

CNAM - Département Informatique

RCP216 Ingénierie de la fouille et de la visualisation de données massives

M. Crucianu, R. Fournier, P. Cubaud

## **Visualisation d'information (1) historique, applications, outils**

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mai 2015

le **cnam**

## Plan de l'exposé

1. Exemples d'applications de la VI
2. Définition du sujet
3. Bertin et Tufte
4. Spence et Ware
5. Le Xerox PARC
6. Le HCI lab
7. "Information is beautiful"
8. Processing

# 1. Exemples

choisir dans une grande masse d'informations

Pub dans Metro, nov 2007

metro | 05  
septembre 2007

Capacité des Français  
à choisir que leur pouvoir  
d'achat est en un an, selon  
l'IS-Sofres citée hier  
par la journaliste Christine Lagarde.

Les laitiers  
re  
4%  
de l'alimentation  
des ménages.

Il prévoit un chiffre  
de hausse de 7 à 8%.  
En fait, la hausse de  
prix a été chez Danone  
de 10%. Les prix prati-  
qués par les distribu-  
teurs sont donc à savoir  
s'ils seront répercutés.  
Chez Danone, cela sera  
le cas, début décem-  
bre. Le groupe Lactalis  
(Président...)  
a décidé d'augmenter ses tarifs  
de 15 et 17%. "Il y a  
un risque de trop de  
hausses dans ce  
secteur", avance François  
Lafont, directeur gé-  
néral de Danone, qui évoque  
la possibilité  
d'une "entente sur les  
prix" entre les groupes.

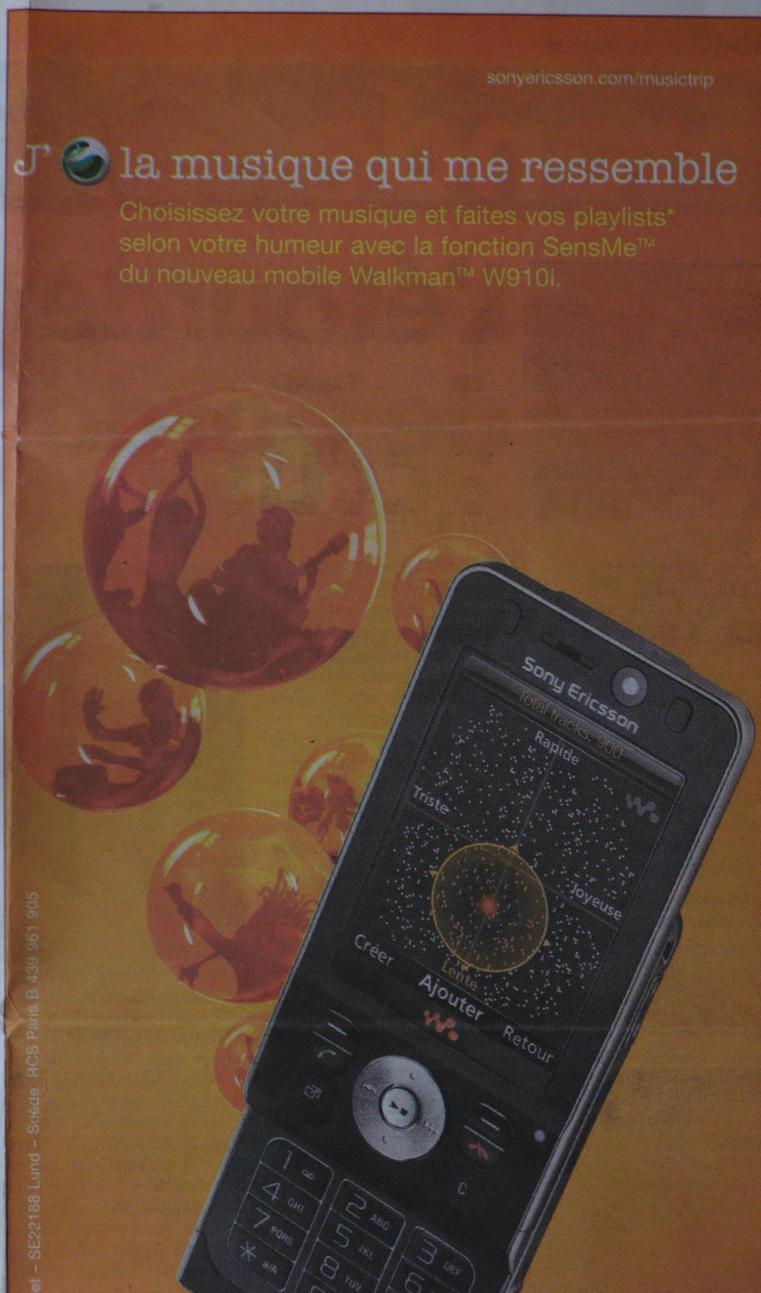
JUDITH KORBER

Le magazine intégral  
est disponible sur  
[metrofrance.com](http://metrofrance.com)

sonyericsson.com/musictrip

J' la musique qui me ressemble

Choisissez votre musique et faites vos playlists\*  
selon votre humeur avec la fonction SensMe™  
du nouveau mobile Walkman™ W910i.

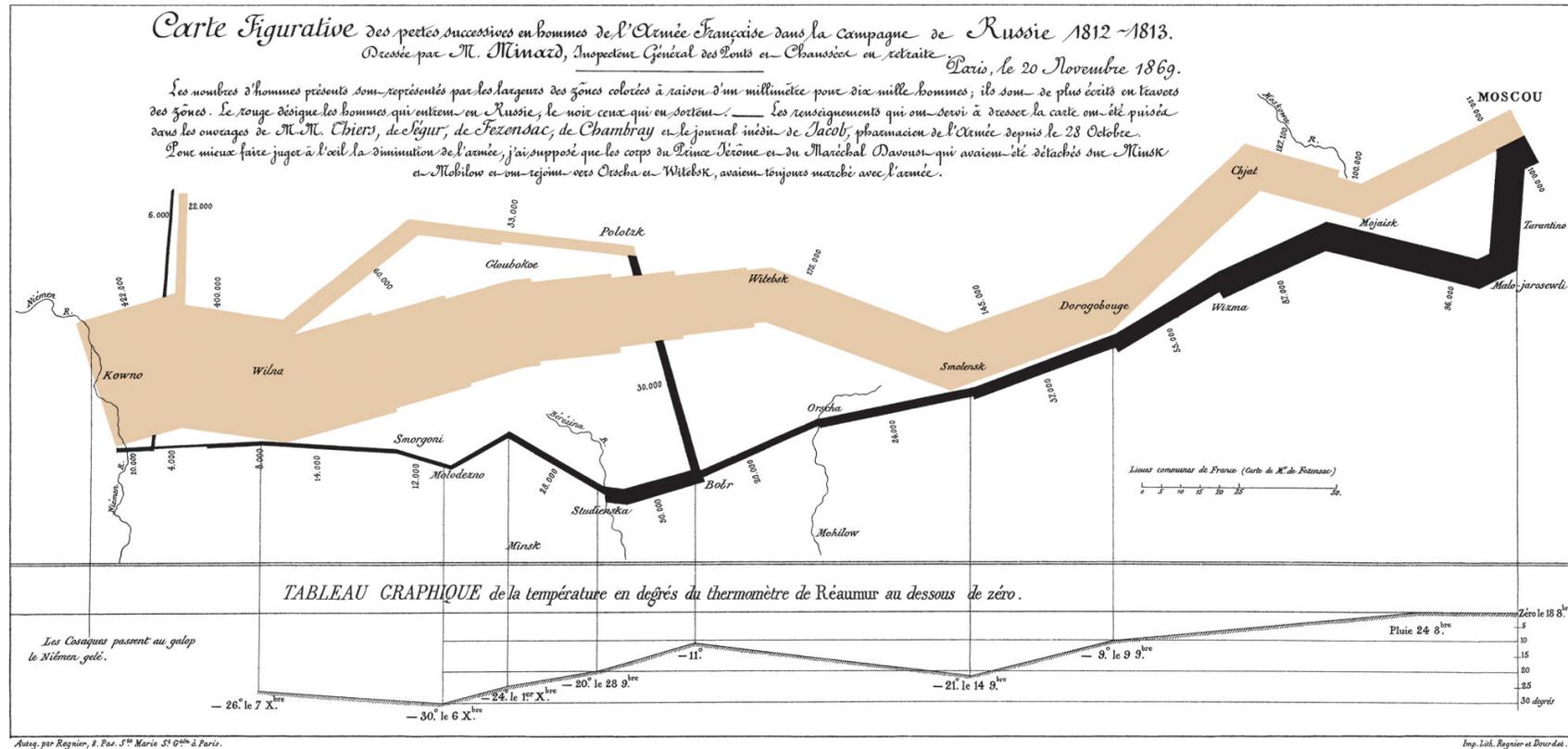


net - SE22188 Lund - Suède - RCS Paris B 439 951 905



« cover flow » Apple Ipod Touch

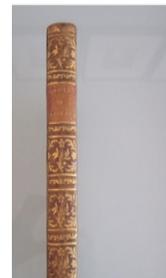
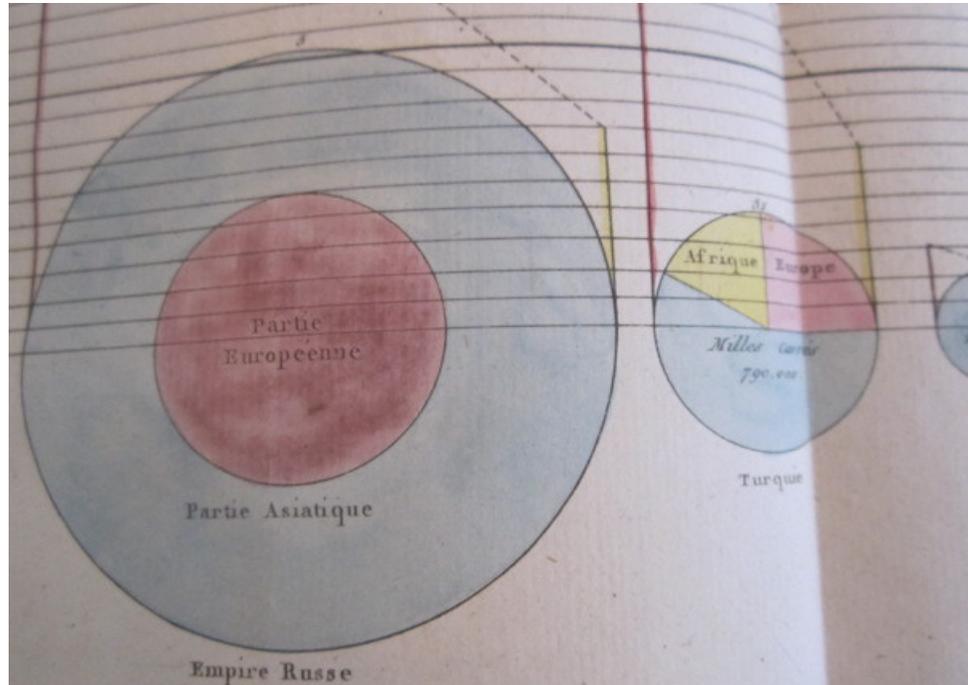
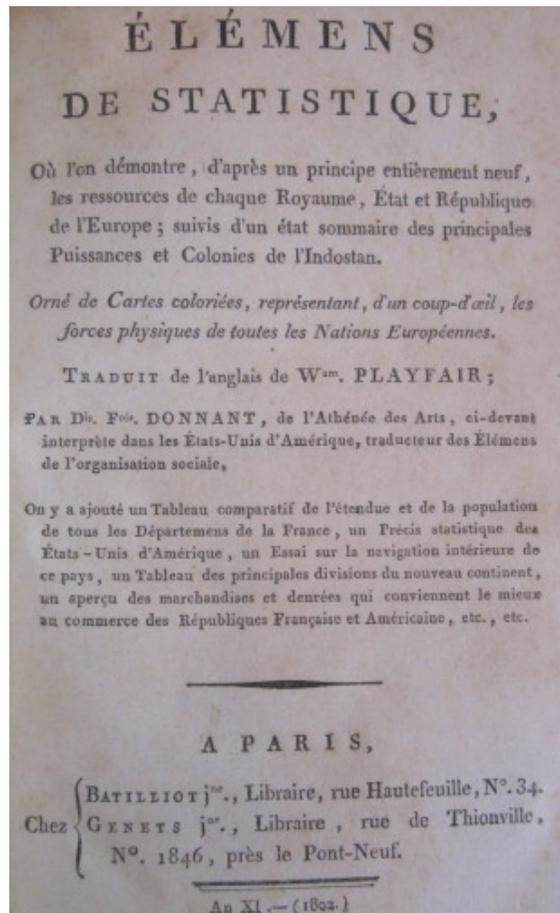
# Autre exemple : comprendre un phénomène



Edward R. Tufte (1992). The Visual Display of Quantitative Information

Minard (1869) : carte augmentée par des flots  
 « graphics reveals data » (Tufte)

# Le fondateur ? W. Playfair (1800)



## Playfair, Elémens de statistique, Economie, EO, Mathématiques, Etats-Unis, les premiers diagrammes !

Etat de l'objet : -

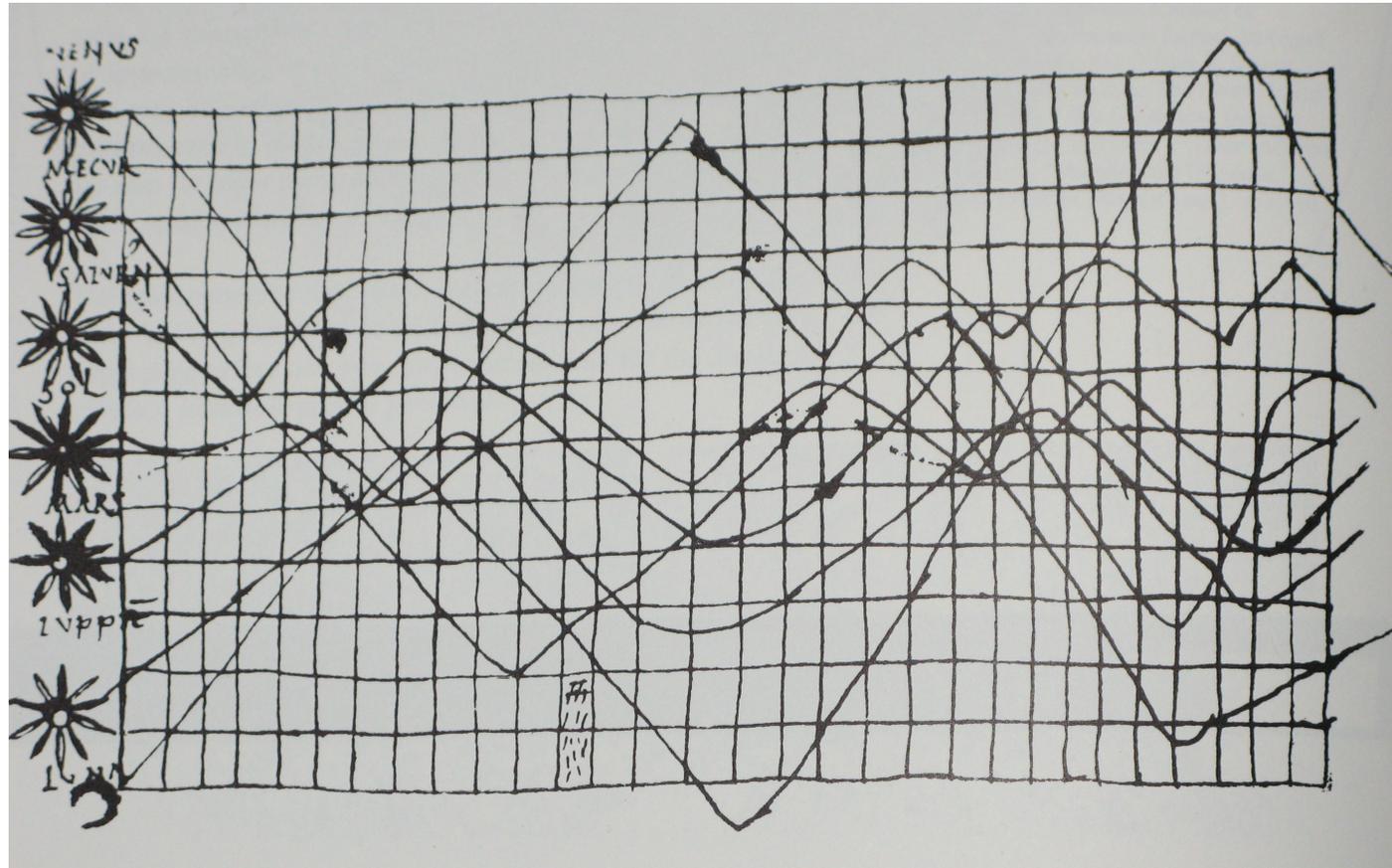
Vente terminée : 24 sept. 2013 21:16:30 Paris

Meilleure enchère : **755,00 EUR** [ 21 enchères ]

Livraison : **10,00 EUR Standard** | [Détails](#)

Lieu où se trouve l'objet : Paris, France métropolitaine

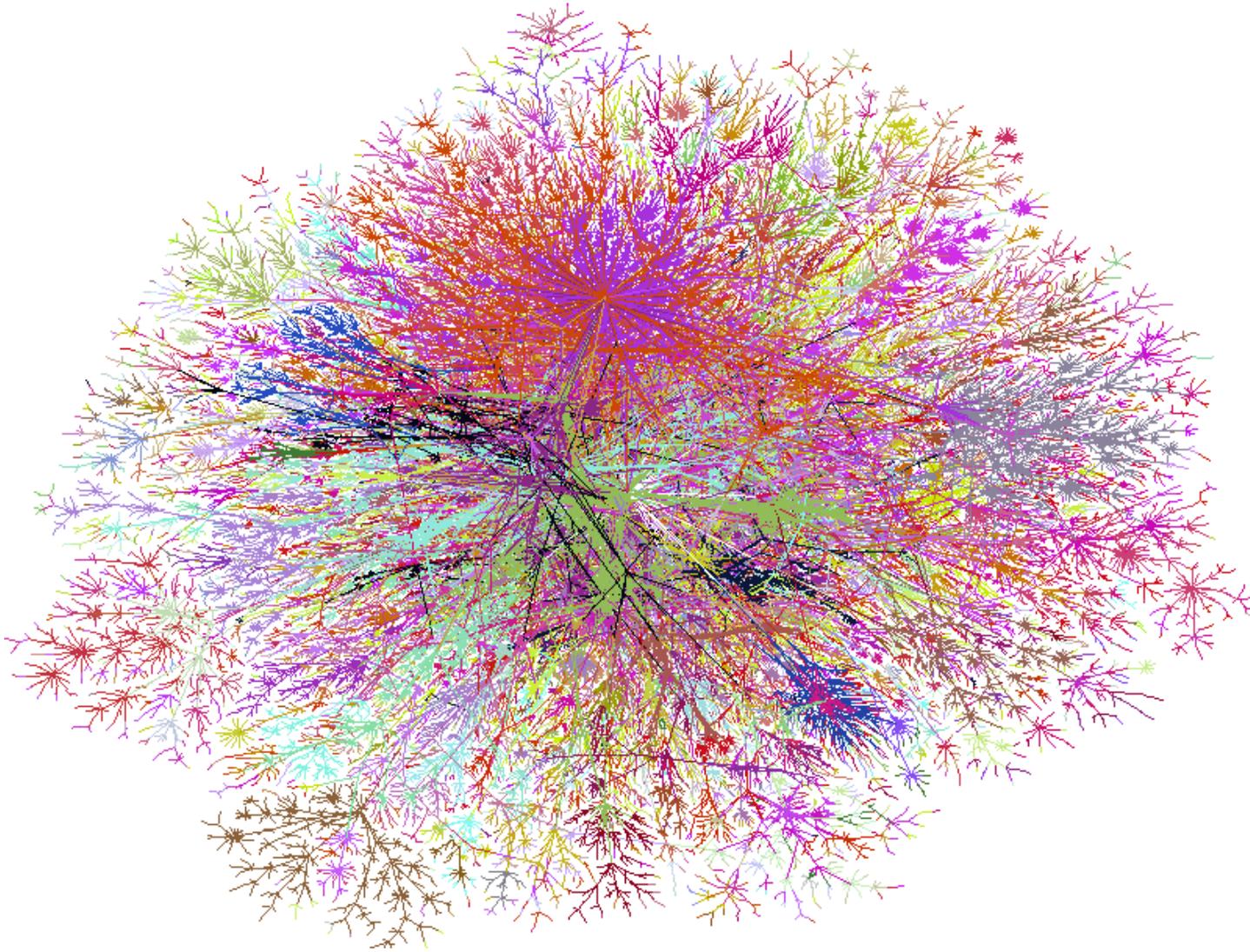
Un exemple au Xème siècle !



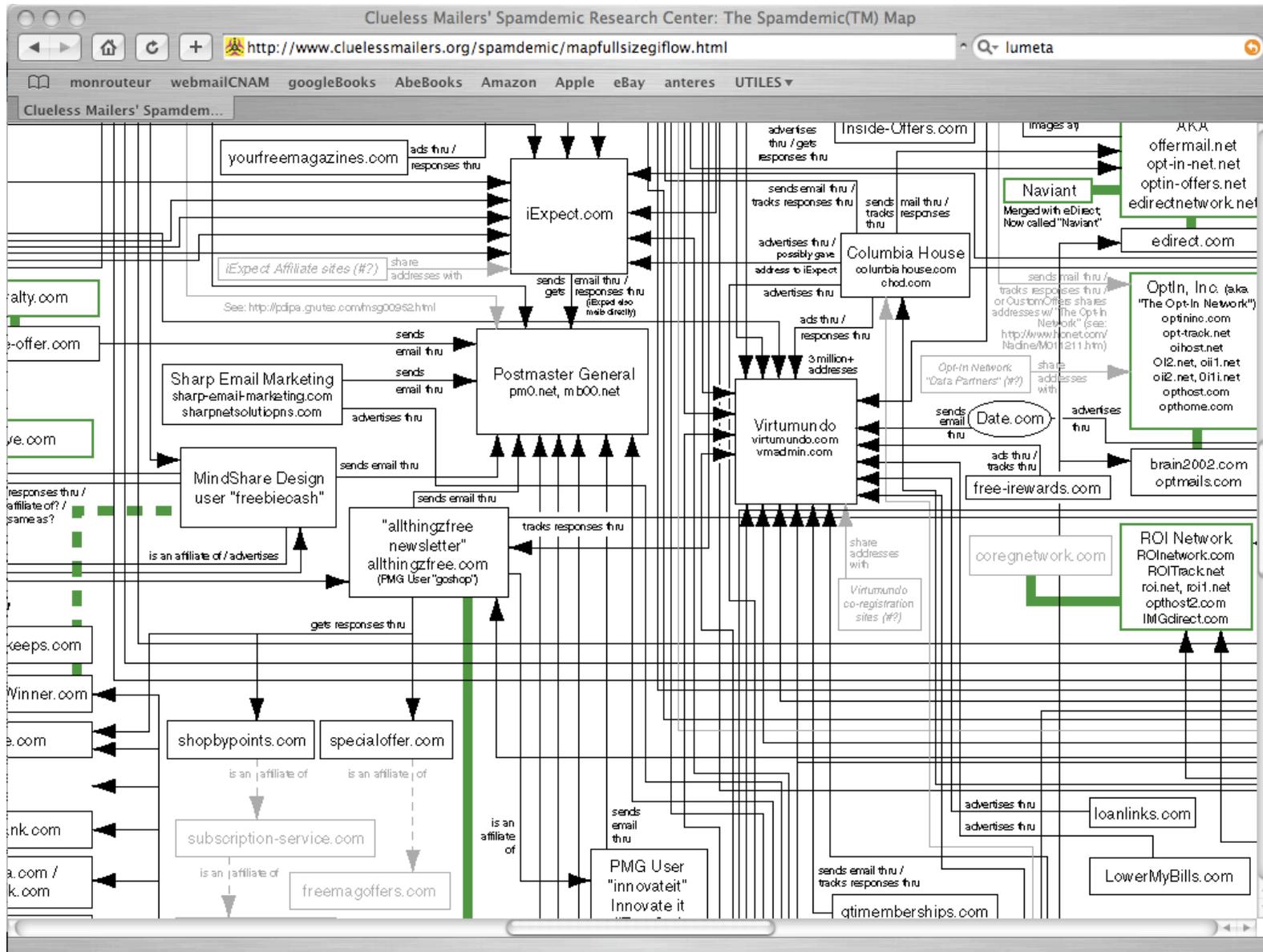
[Tuftte, Visual display ... p. 28, d'après H. Gray Funkhouser, Osiris, Jan 1936, 260-2]

le temps qui passe sur le papier

Aujourd'hui : cybergéographie

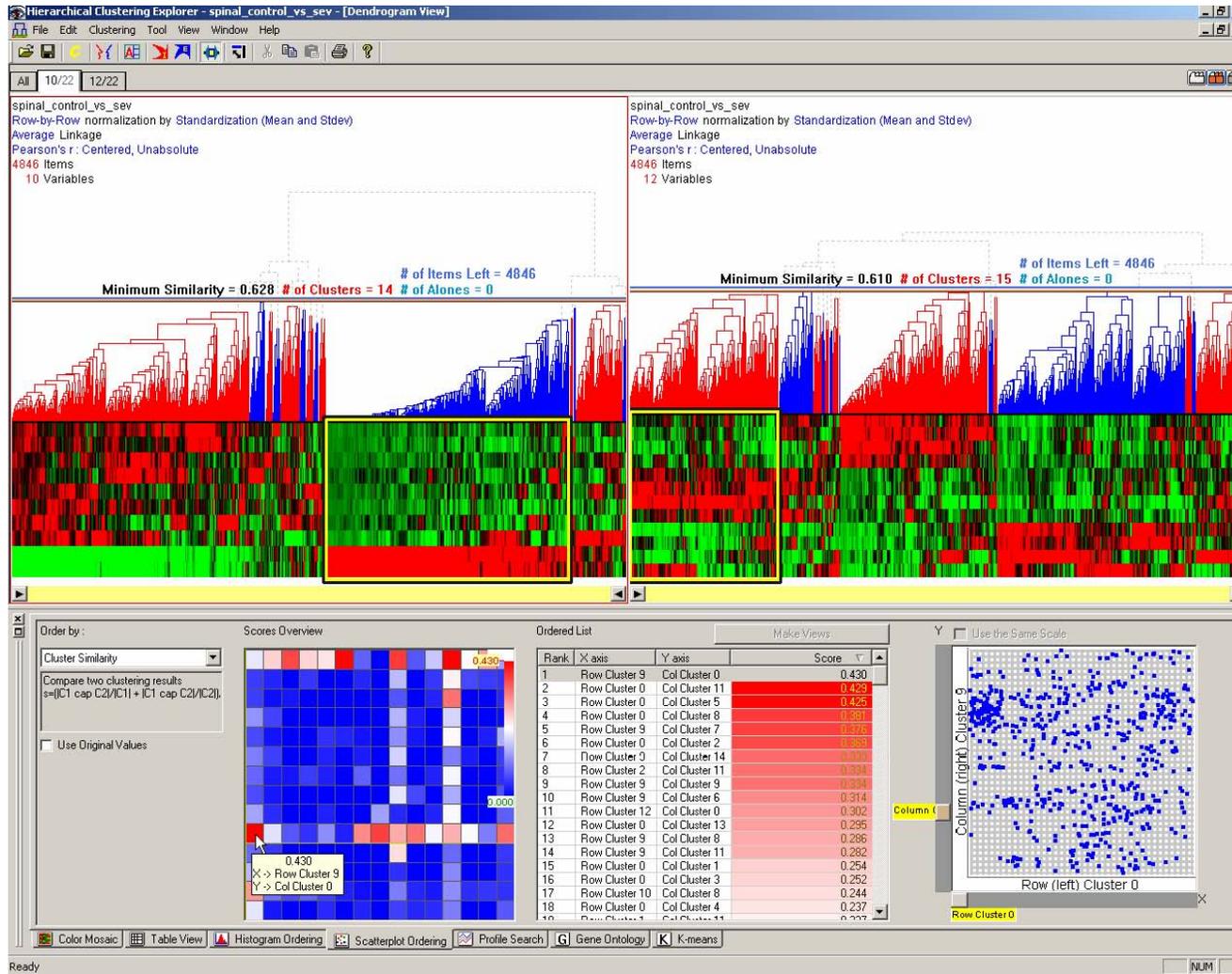


Lumeta (revue Nature)

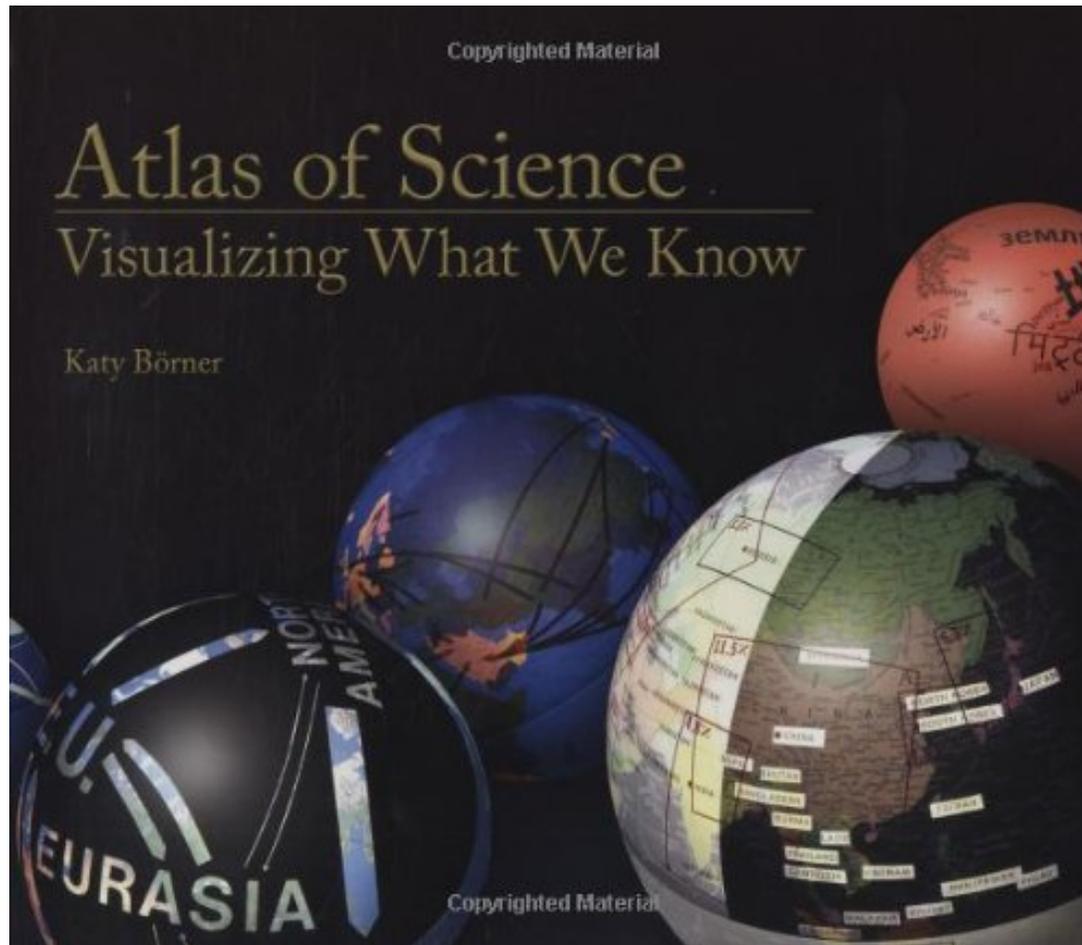


propagation d'un virus informatique

# Génétique :



# cartographie de la connaissance

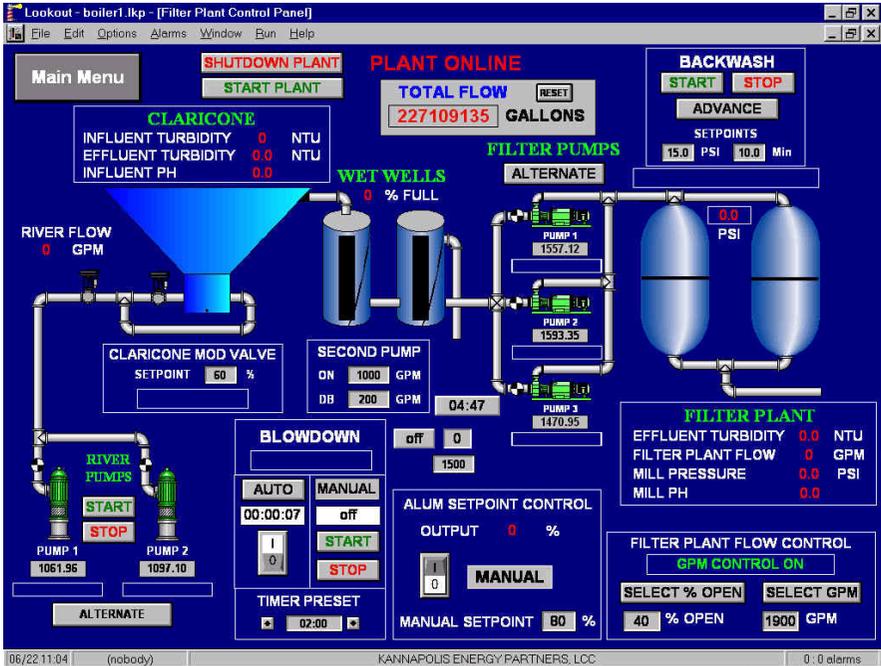


livre magnifique (gd format) et pas trop cher (30€)



<http://geography.sdsu.edu/People/Pages/skupin/>

# Autre exemple : piloter un processus complexe





cockpit airbus A380 (wikipedia)

# Traders



<http://www.stocktradingtogo.com/2007/09/25/are-20-monitors-enough-for-one-trader-you-decide/>

# Grands instruments scientifiques : exemple d'ALMA Chili (Atacama, 5000m)



**interféromètre : 66 antennes (12m + 7m) et 2145 lignes de bases (<16 km)**



**corrélateur : 170 TFlops, 8200 FPGA, 180 KW**



**ex de freq : 714 GHz !**



Salle de contrôle  
en 2010-11

Java+Corba (avant 2000 !)

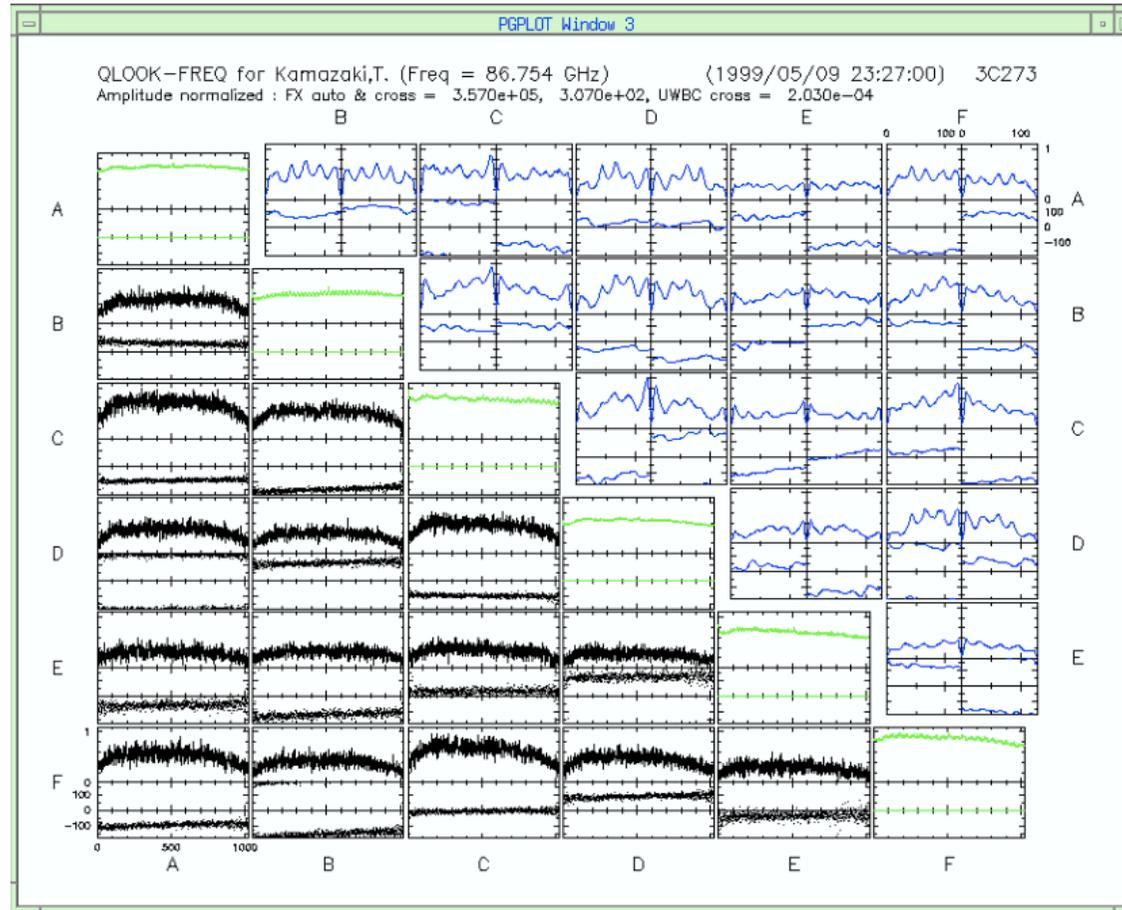
débit de capture : 1 Go/s

débit d'archivage : 180 To/an



[http://www.eso.org/public/images/max\\_a129560s/](http://www.eso.org/public/images/max_a129560s/)

# Problème du passage à l'échelle des interfaces



Exemple d'écran du VLA (Arizona) : 6 antennes =>  $6 \cdot 5/2$  lignes de base

Comment faire avec 2145 ?? A VOIR PLUS TARD

## 2. Définition du sujet

Compact graphical presentation and user interface for

- manipulating large numbers of items
- possibly extracted from far larger datasets

Enables users to make

- discoveries,
- decisions, or
- explanations

about

- patterns (trend, cluster, gap, outlier...),
- groups of items, or
- individual items.

[Plaisant, 2001]

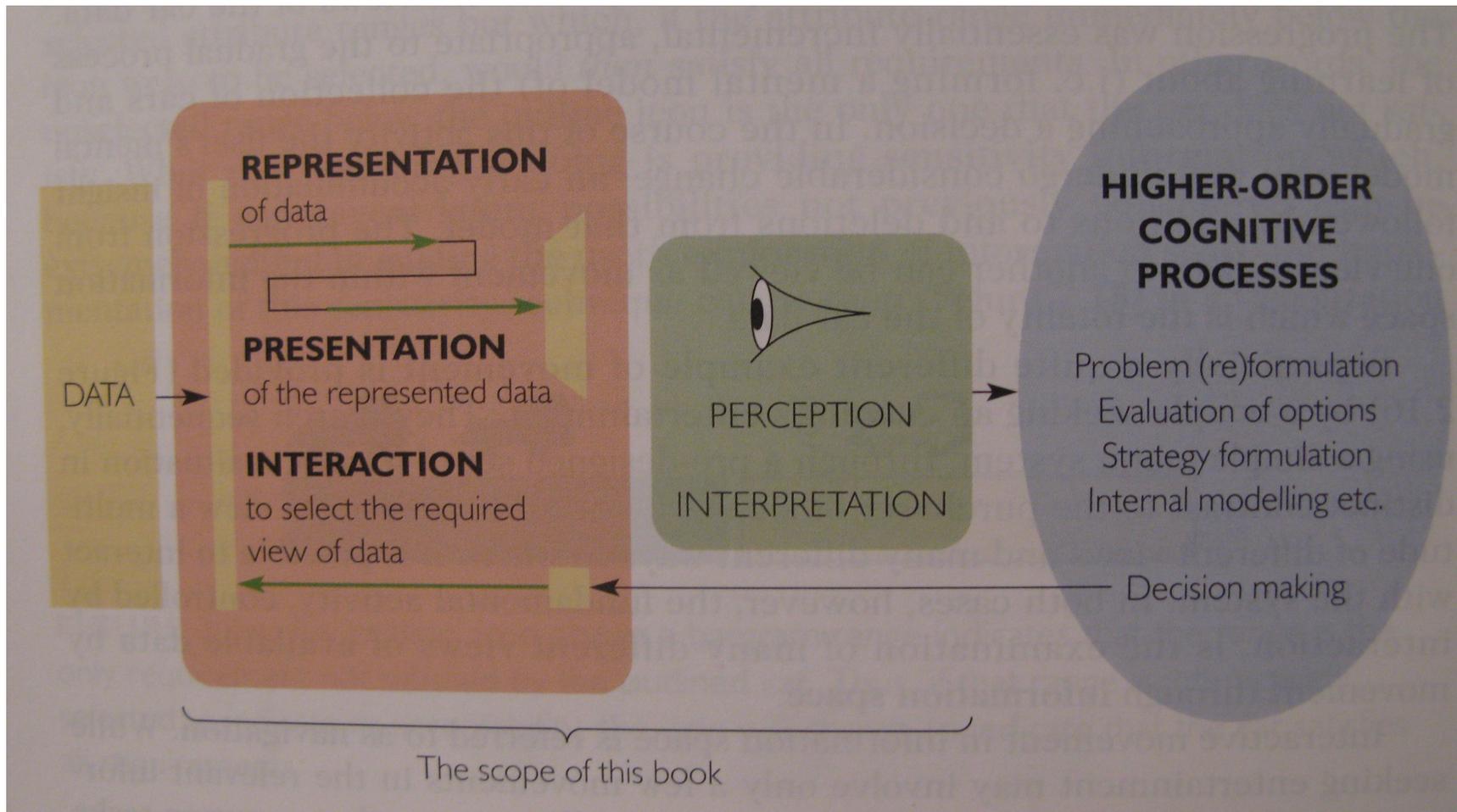
Visual representations of the semantics, or meaning, of information. In contrast to scientific visualization, information visualization typically deals with nonnumeric, nonspatial, and high-dimensional data.

[Chen, 2005]

Information visualization (InfoVis) produces (interactive) visual representations of abstract data to reinforce human cognition and perception; thus enabling the viewer to gain knowledge about the internal structure of the data and causal relationships in it.

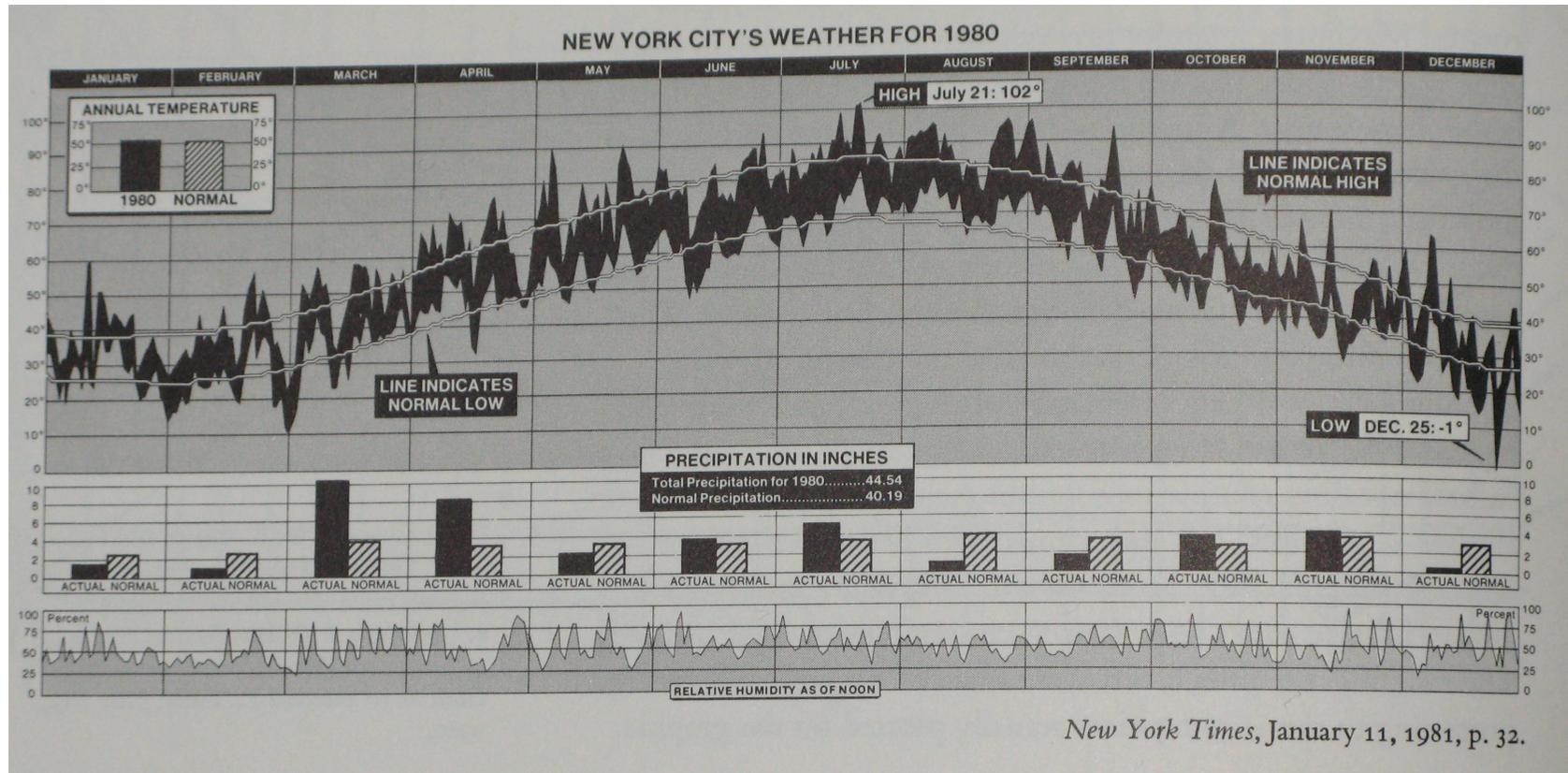
[http://www.infovis-wiki.net/index.php/Information\\_Visualization](http://www.infovis-wiki.net/index.php/Information_Visualization)

"using vision to think" (Card et al.)



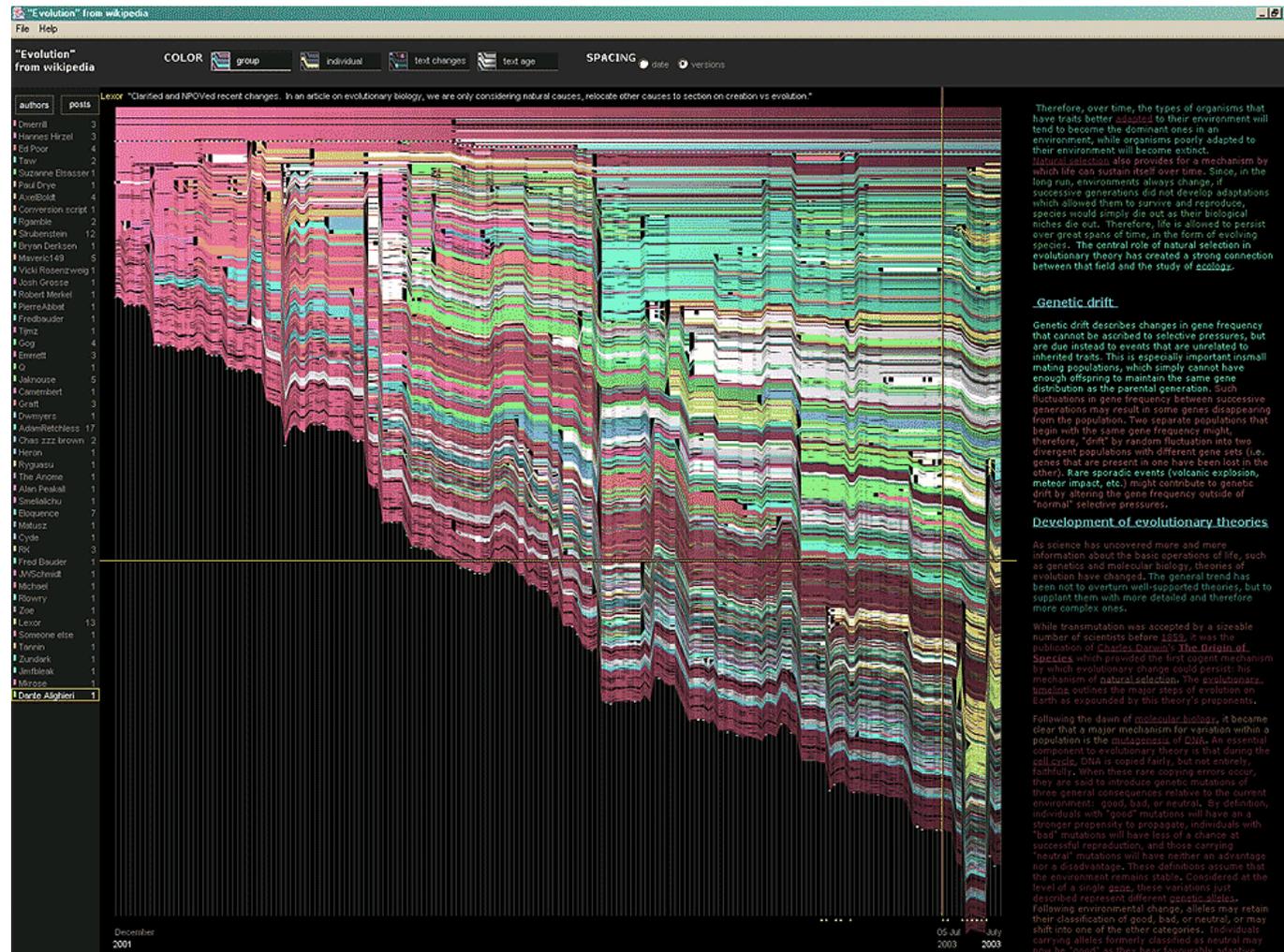
[Spence] p.26

# Un schéma pour 1888 nombres



The graphics (...) tells a story [Tufte, Visual display ... p.30]

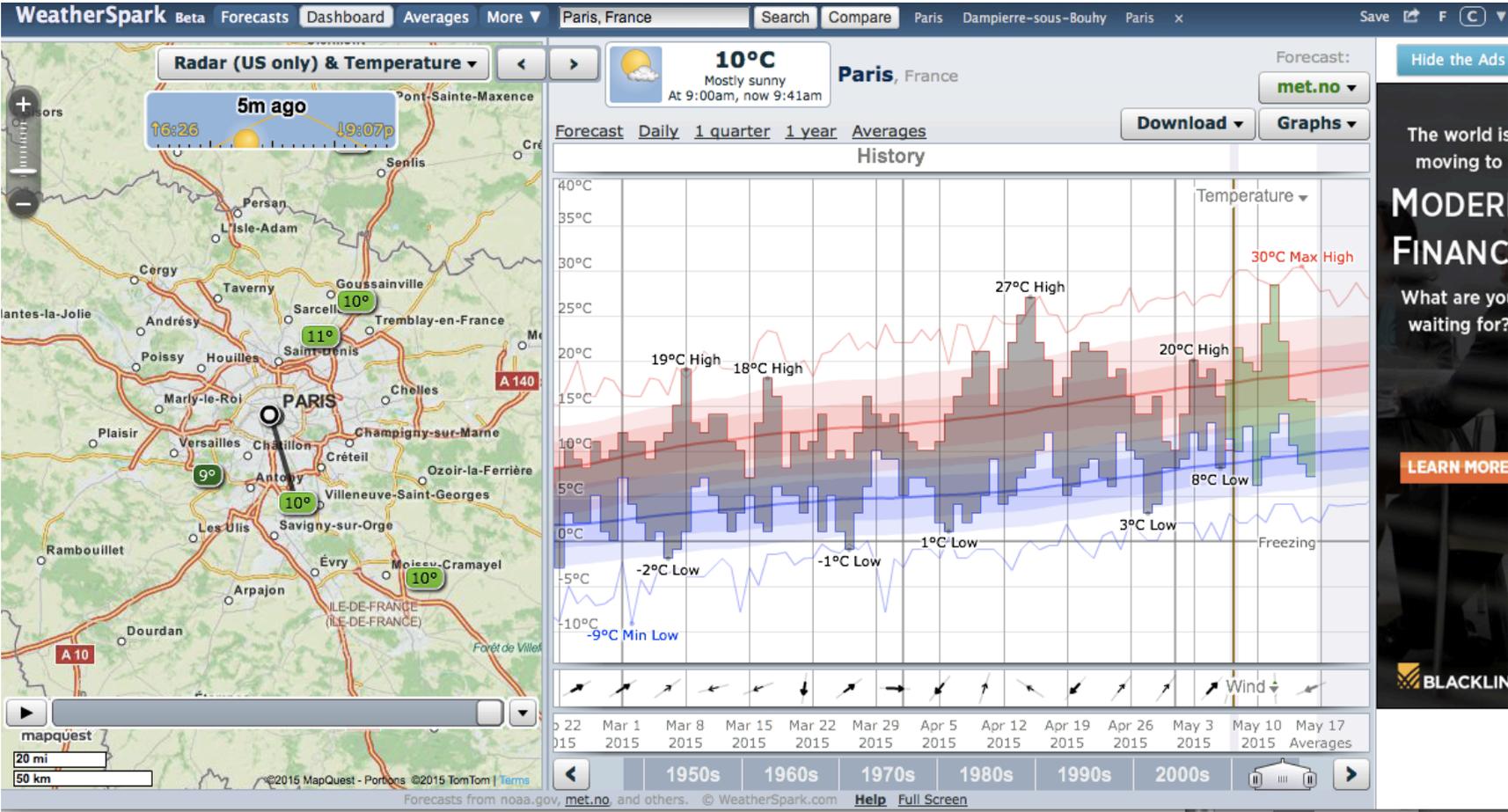
Si + de données, une interaction indispensable (zoom, etc.)



versions de l'article "evolution" sur Wikipedia

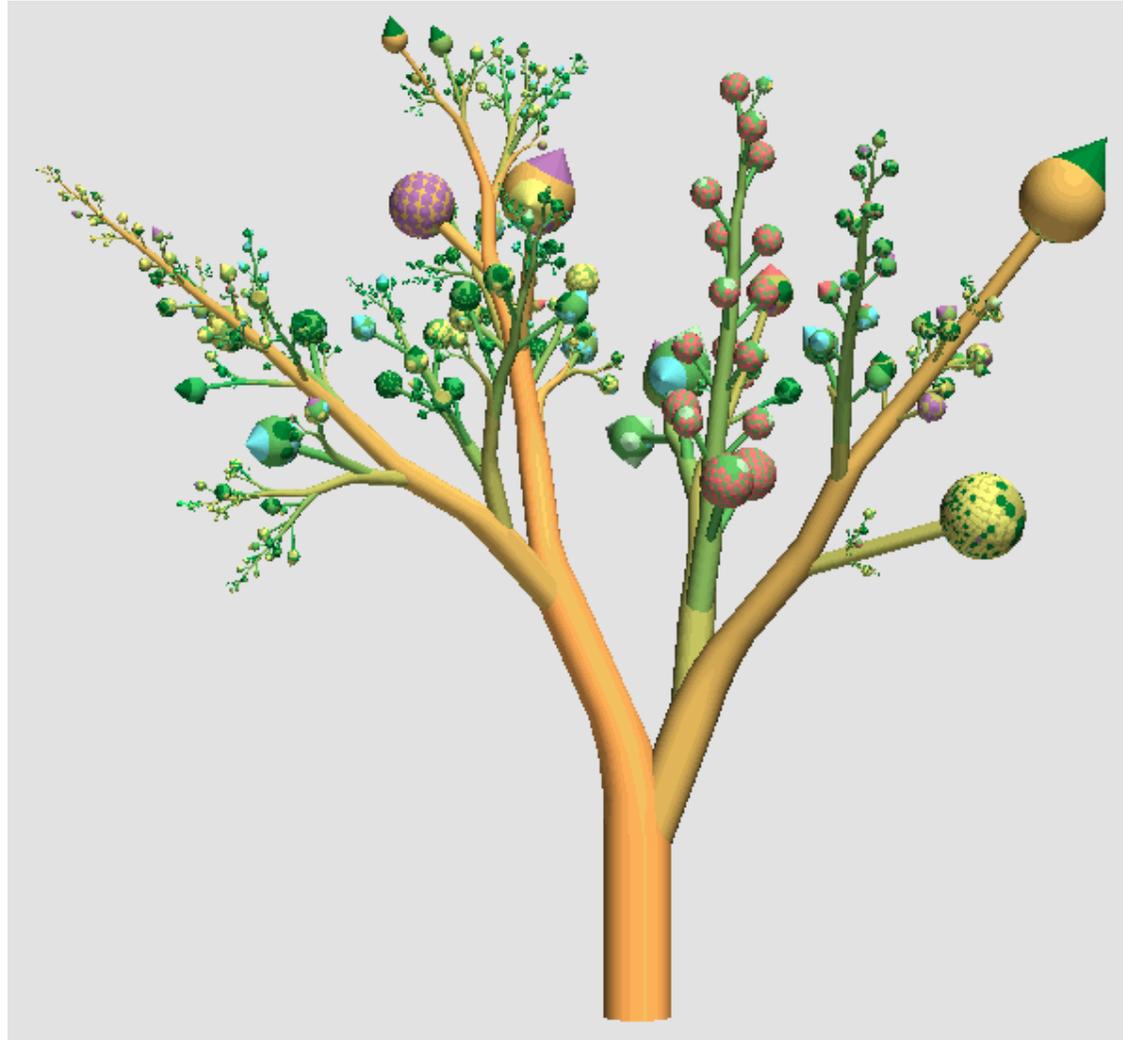
[http://www.research.ibm.com/visual/projects/history\\_flow/](http://www.research.ibm.com/visual/projects/history_flow/)

# Autre exemple avec la météo



<http://weatherspark.com/>

Représenter l'abstrait ? une usabilité à évaluer...



<http://www.infovis-wiki.net/index.php?title=Image:Boom.gif>

# Infovis : une discipline scientifique



25-30 October 2015  
CHICAGO, ILLINOIS, USA

VAST • INFOVIS • SCIVIS

**Welcome**  
IEEE VIS 2015 is the premier forum for advances in scientific and information visualization. This weeklong event convenes an international community of researchers and practitioners from academia, government, and industry to explore their shared interests in tools, techniques, and technology.

A full complement of research presentations, tutorials, workshops, panels, demonstrations, posters, and exhibitions make this conference one of the largest and most important gatherings of researchers and professionals who specialize in the visual analysis of data.

We invite you to participate in **IEEE Visual Analytics Science and Technology (VAST)**, **IEEE Information Visualization (InfoVis)**, and **IEEE Scientific Visualization (SciVis)**, by sharing your research, insights, experience, and enthusiasm.

The conference venue, the **Palmer House Hilton**, is a historic hotel located in the heart of downtown Chicago, the third largest city in the United States and home to world-class architecture, museums, parks, and restaurants.

**VIS 2015 General Chairs**  
Michael E. Papka, *Argonne National Laboratory and Northern Illinois University*  
Maxine Brown, *University of Illinois at Chicago*

Follow @ieevis to keep up with conference activities and announcements.  
Questions? E-mail info(at)ieevis.org

**Important Dates**  
**Thursday April 30th** Tutorials Submission Deadline  
**Thursday April 30th** Workshops Submission Deadline  
**Sunday May 10th** Doctoral Colloquium Deadline  
**Monday June 15th** Panels Submission Deadline  
**Friday June 26th** Posters Submission Deadline  
**Friday July 3rd** Visualization in Practice Posters

**Supporters (Become One)**  
**Bronze**  
plotly

**Call for Participation**  
Papers  
VAST • InfoVis • SciVis  
Posters  
Contests & Challenge  
SciVis • VAST  
Tutorials  
Workshops  
Panels  
Visualization in Practice  
Doctoral Colloquium  
Arts Program (VISAP)

**Co-located Events**  
IEEE LDAV 2015  
IEEE VizSec 2015  
VDS 2015

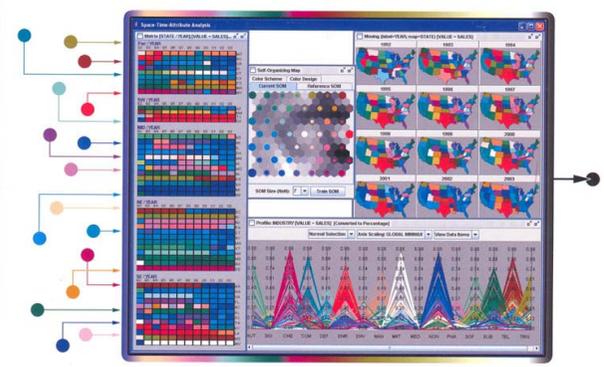
**Committees**  
VIS Conference Committee  
VIS Executive Committee  
VGTC Executive Committee  
Program Committees  
VAST • InfoVis • SciVis  
Steering Committees  
VAST • InfoVis • SciVis

**Previous Years**  
2014 • 2013 • 2012 • 2011  
2010 • 2009 • 2008

conférence VIS

IEEE TRANSACTIONS ON  
**VISUALIZATION AND COMPUTER GRAPHICS**  
A publication of the IEEE Computer Society  
Indexed in ISI

NOVEMBER/DECEMBER 2006 VOLUME 12 NUMBER 6 ITVGEA (ISSN 1077-2626)



**SPECIAL SECTION ON VISUAL ANALYTICS**  
Guest Editorial: *Special Section on Visual Analytics*  
D.A. Keim, G.G. Robertson, J.J. Thomas, J.J. van Wijk ..... 1361  
*High-Dimensional Visual Analytics: Interactive Exploration Guided by Pairwise Views of Point Distributions*  
L. Wilkinson, A. Anand, and R. Grossman ..... 1363  
*Interactive Visual Analysis of Families of Function Graphs*  
Z. Konyha, K. Matković, D. Gračanin, M. Jelović, and H. Hauser ..... 1373

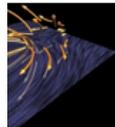
(Contents continued on back cover)

IEEE computer society  
60th anniversary  
www.computer.org  
tvcg@computer.org

revue TVCG

à la croisée de plusieurs autres (info, psycho, ergo, design, ...)

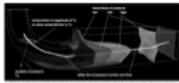
# A voir : une chronologie des 25 ans de la conference sur la visualisation



Representation of ds  
J. van Wijk



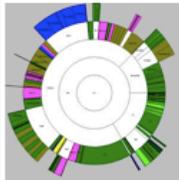
Parallel Parallel is for Exploration datasets.  
M. O. Ward, E. A. Vander Zanden



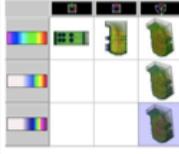
The "Parallel Vectors" Operator: A Vector Field Visualization Primitive  
R. Peikert, M. Roth



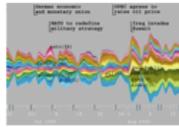
Salt Lake City, UT  
2000  
+ Add Visualization



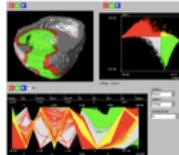
Focus+Context Display and Navigation Techniques for Enhancing Radial, Space-Filling Hierarchy Visualizations  
J. Stasko, E. Zhang



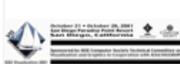
A spreadsheet interface for visualization exploration  
T. J. Jankun-Kelly, K-L. Ma



ThemeRiver: visualizing theme changes over time  
S. Havre, B. Hetzler, L. Nowell



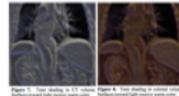
WEAVE: A System for Visually Linking 3D and Statistical Visualizations, Applied to Cardiac Simulation and Measurement Data  
D.L. Gresh, B.E. Rogowitz, R.L. Winslow, D.F. Scollan, C.K. Yung



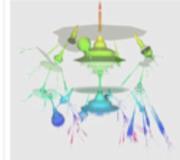
San Diego, CA  
2001  
+ Add Visualization



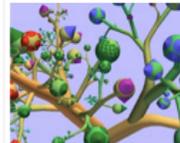
Polaris: A System for Query, Analysis and Visualization of Multi-Dimensional Relational Databases  
C. Stolte, P. Hanrahan



Volume Illustration: Non-Photorealistic Rendering of Volume Models  
D. S. Ebert, P. Rheingans



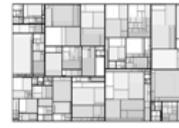
Visualization of State Transition Graphs  
F. van Ham, H. van de Wetering



Botanical Visualization of Huge Hierarchies  
E. Kleiberg, H. van de Wetering, J.J. van Wijk



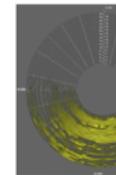
Technical Note: Visually Encoding Program Test Information to Find Faults in Software  
J. Eagan, M. J. Harrold, J. A. Jones, J. Stasko



Ordered treemap layouts  
B. Schneiderman, M. Wattenberg



Interactive Volume Rendering Using Multi-dimensional Transfer Functions and Direct Manipulation Widgets  
J. Kniss, G. Kindmann, C. Hansen

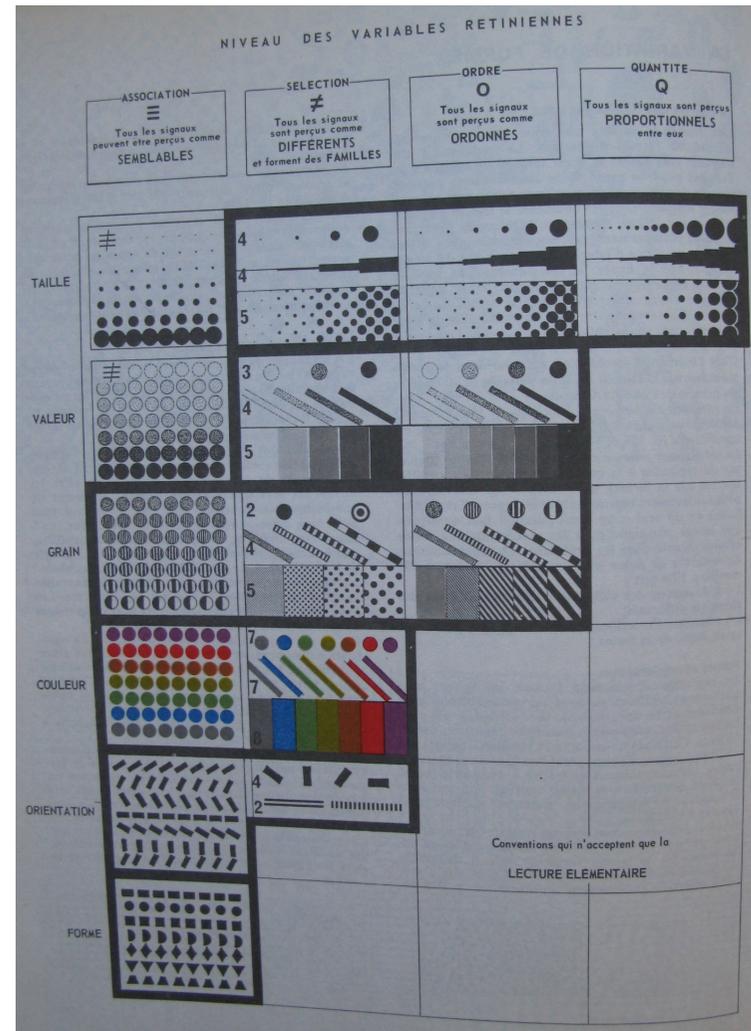
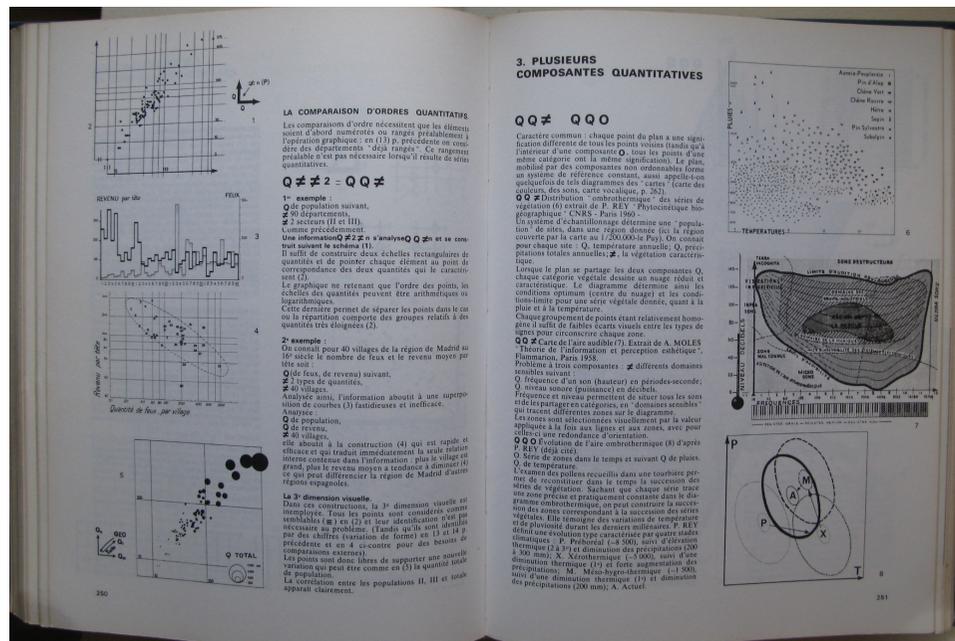


Visualizing Time Spirals  
M. Weber, M. Ale Muller

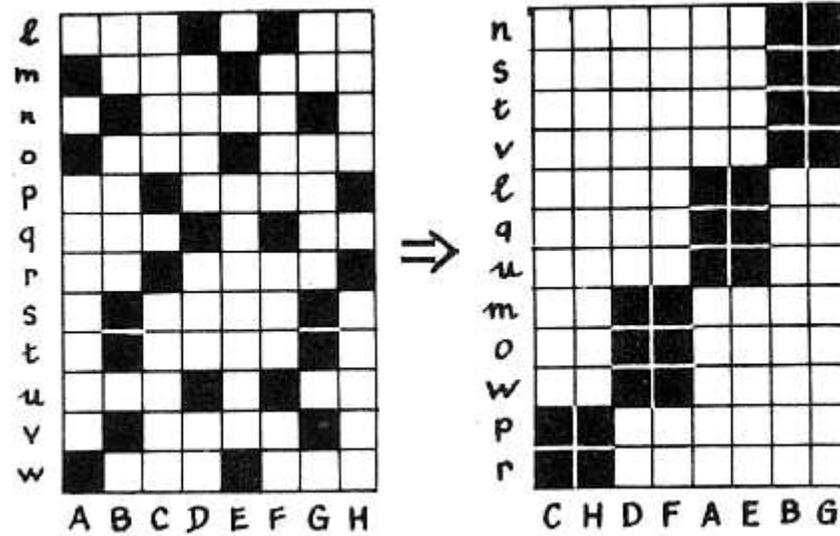
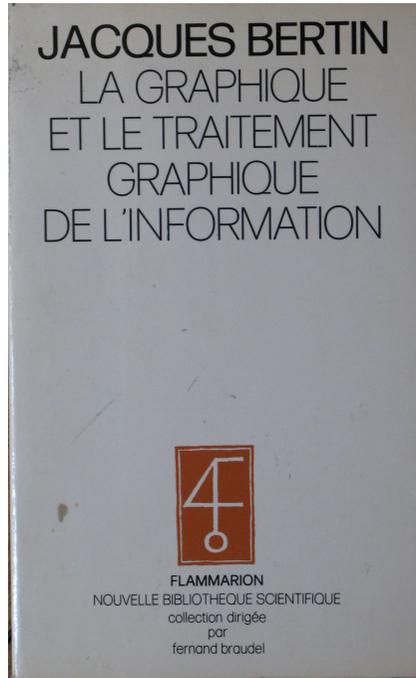
<http://www.aviz.fr/~bbach/vis25timeline/>

# 3. Travaux de Bertin et Tufte

J. Bertin  
*Sémiologie graphique*  
 Mouton & Gauthier-Villars, 1967

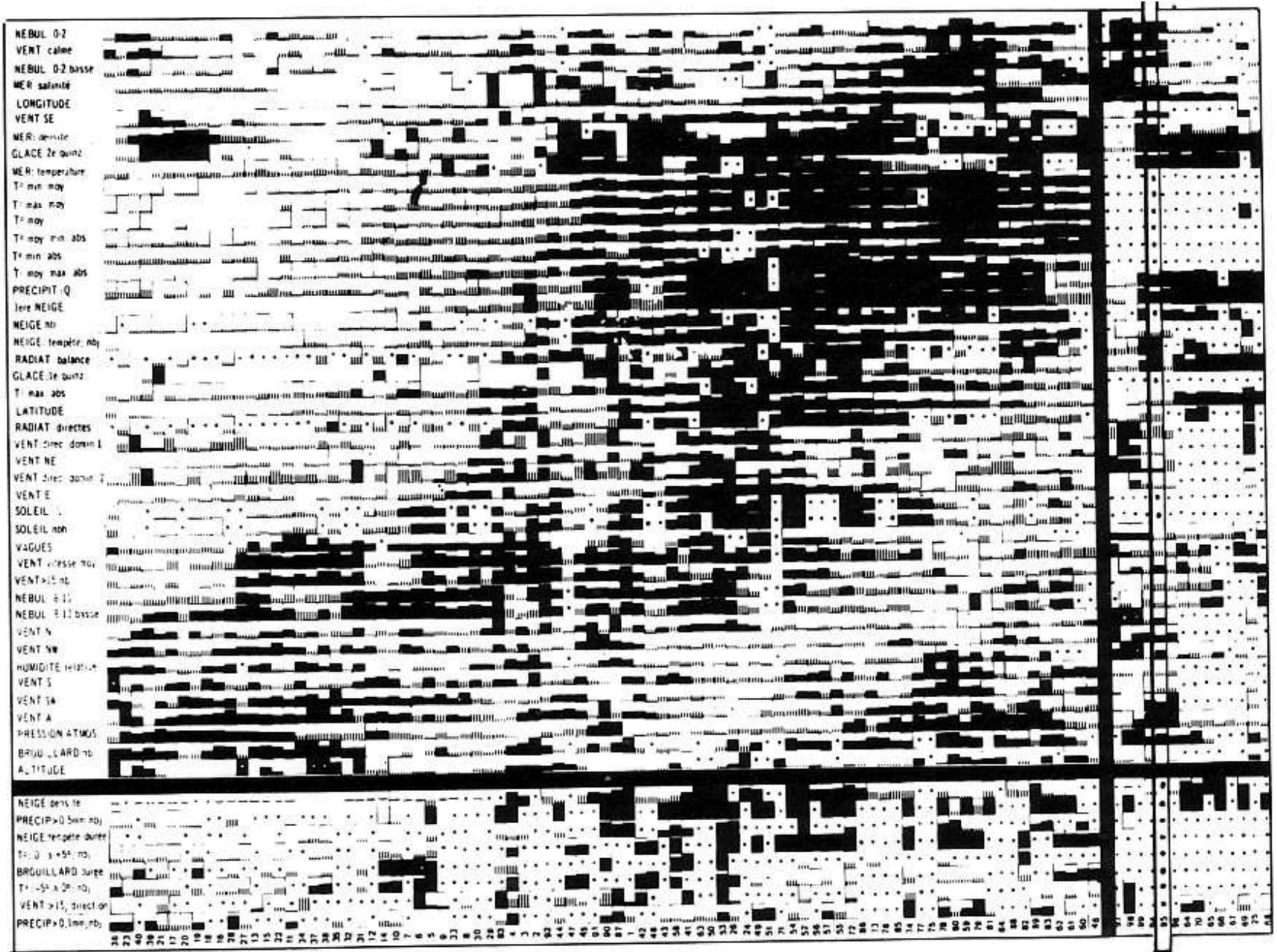


propriétés des "variables rétiennes" => cours #2



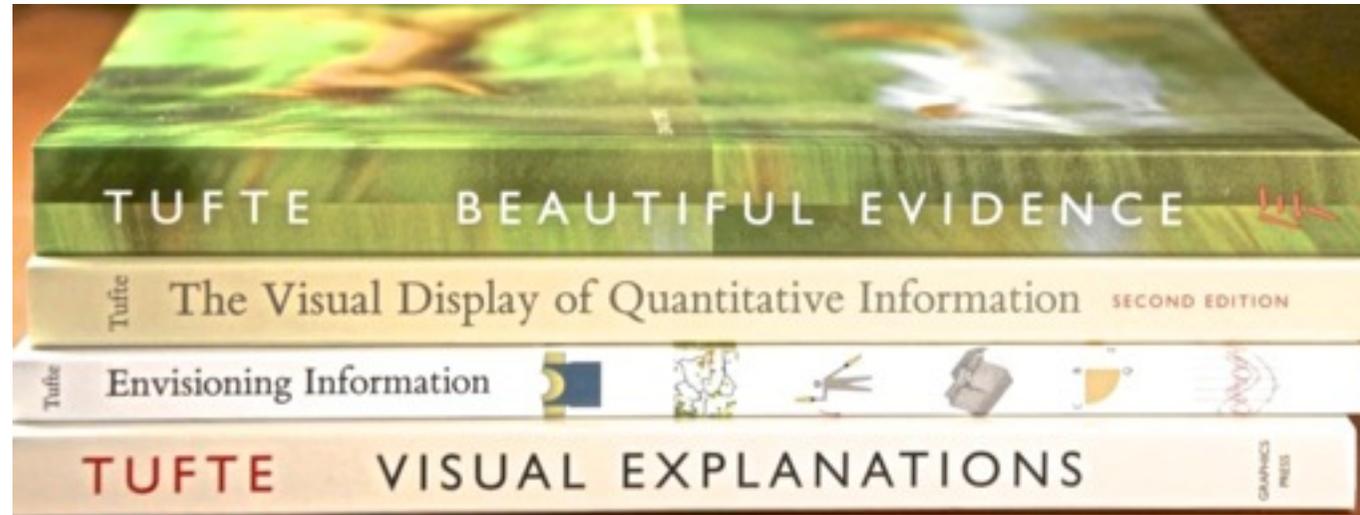
2ème livre : 1977

Matrices de permutation  
et système "Domino"



## 4. Edward Tufte

4 livres :



<http://www.edwardtufte.com/tufte/>

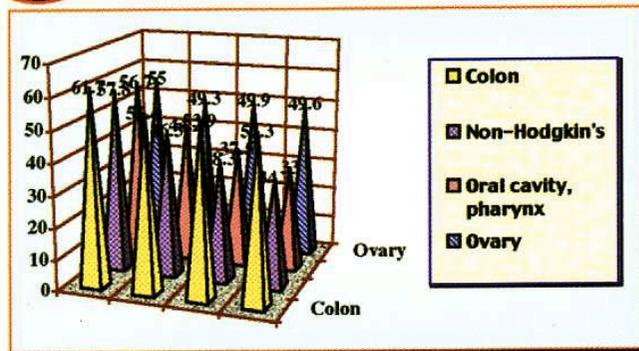
- concept du data/ink ratio
- "maximize data density (within reason)"  
densité= dim matrice données / surface du graphique
- "The graphics (...) tells a story"

# Critique du style PowerPoint (PP)

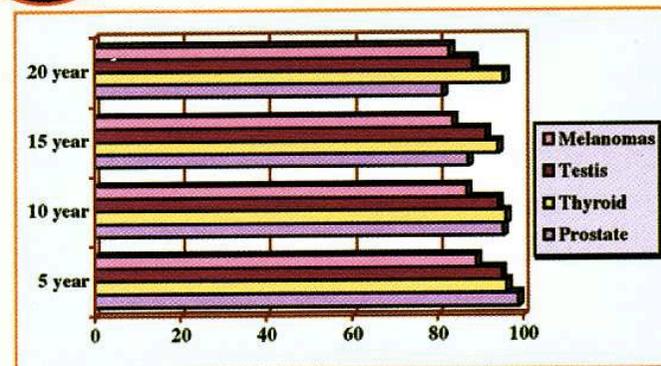
Applying the PowerPoint templates for statistical graphics to this nice straightforward table yields the analytical disasters on the facing page. These PP default-designs cause the data to explode into 6 separate chaotic slides, consuming 2.9 times the area of the table. *Everything* is wrong with these smarmy, incoherent graphs: uncomparative, thin data-density, chartjunk, encoded legends, meaningless color, logotype branding, indifference to content and evidence. Chartjunk is a clear sign of statistical stupidity; use these designs in your presentation, and your audience will quickly and correctly conclude that you don't know much about data and evidence.<sup>20</sup> Poking a finger into the eye of thought, these data graphics would turn into a nasty travesty if used for



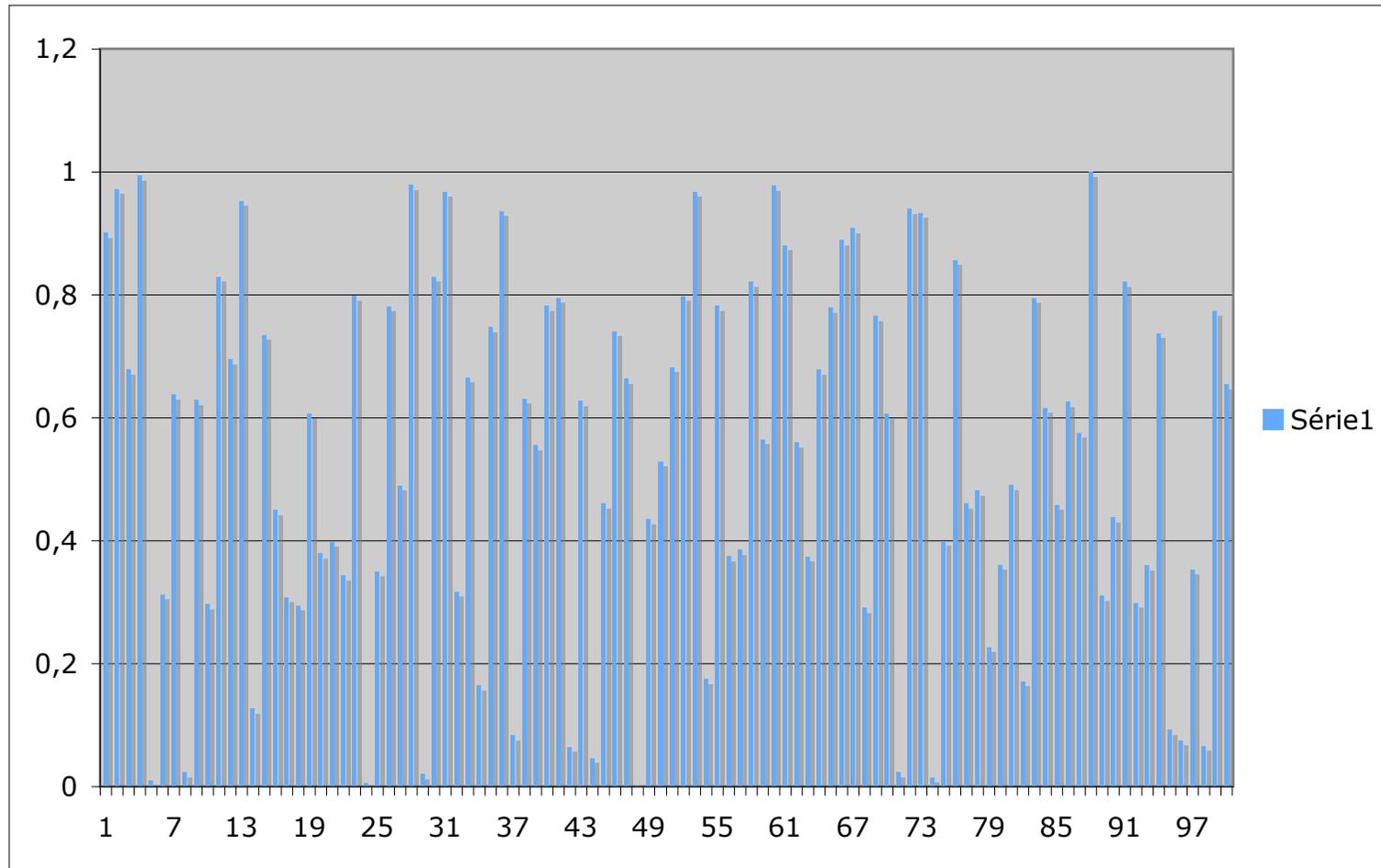
## IV. Cancer Survival Rates



## I. Cancer Survival Rates

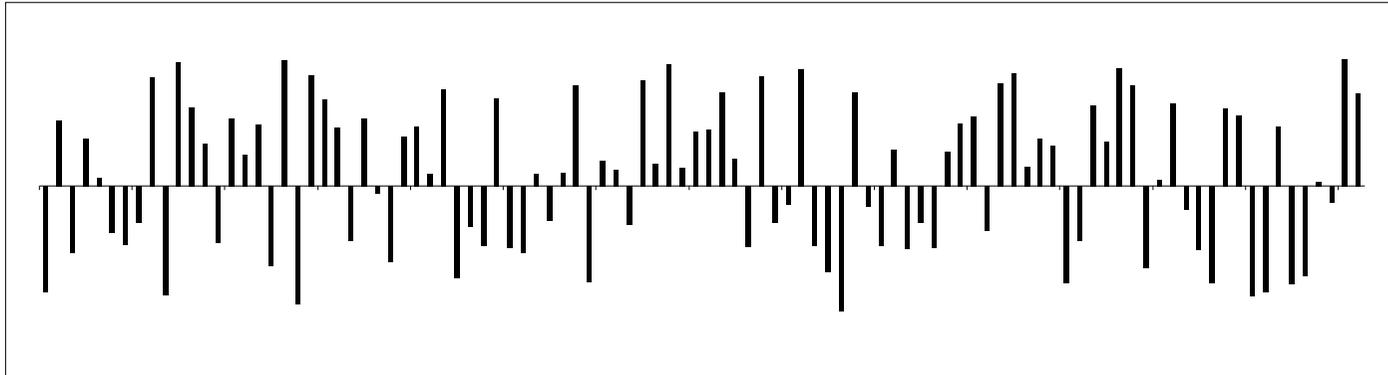


Exemple du grapheur d'Excel :

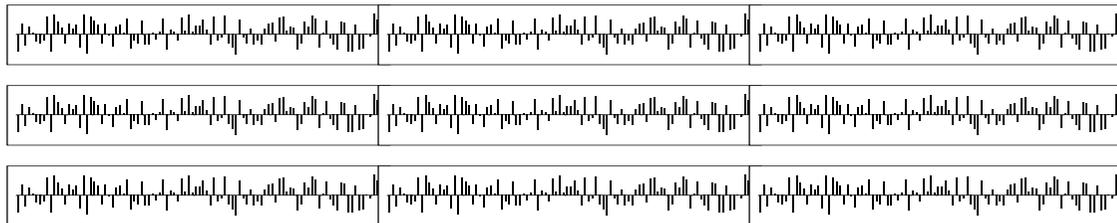
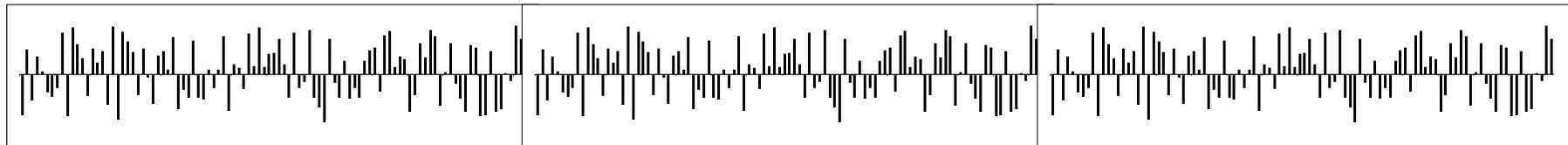


100 valeurs aléatoire entre 0 et 1, graphe par défaut

# Après application des principes de Tufte (et Bertin)

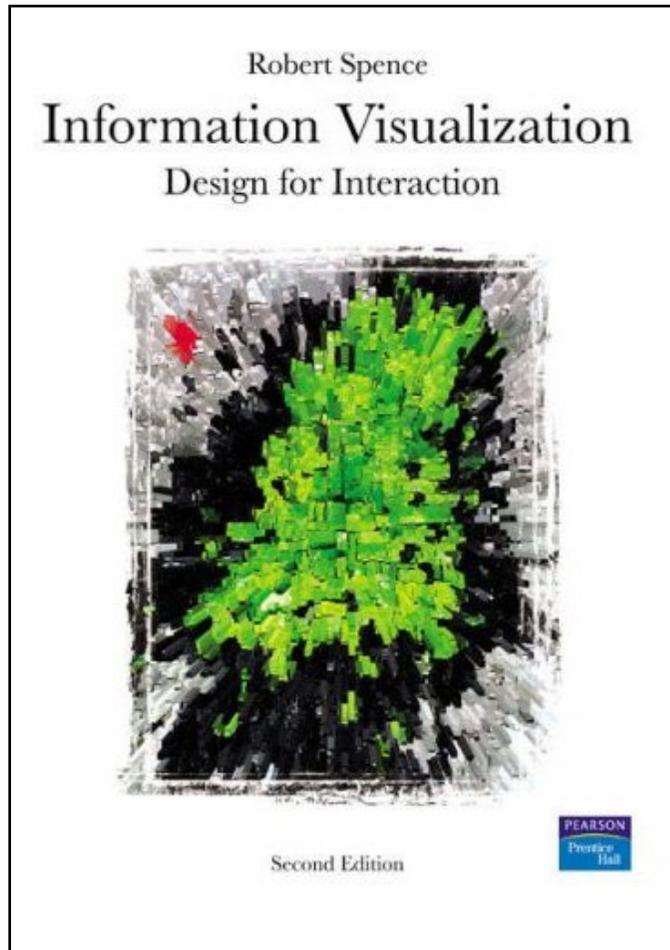


## Passage à l'échelle ?

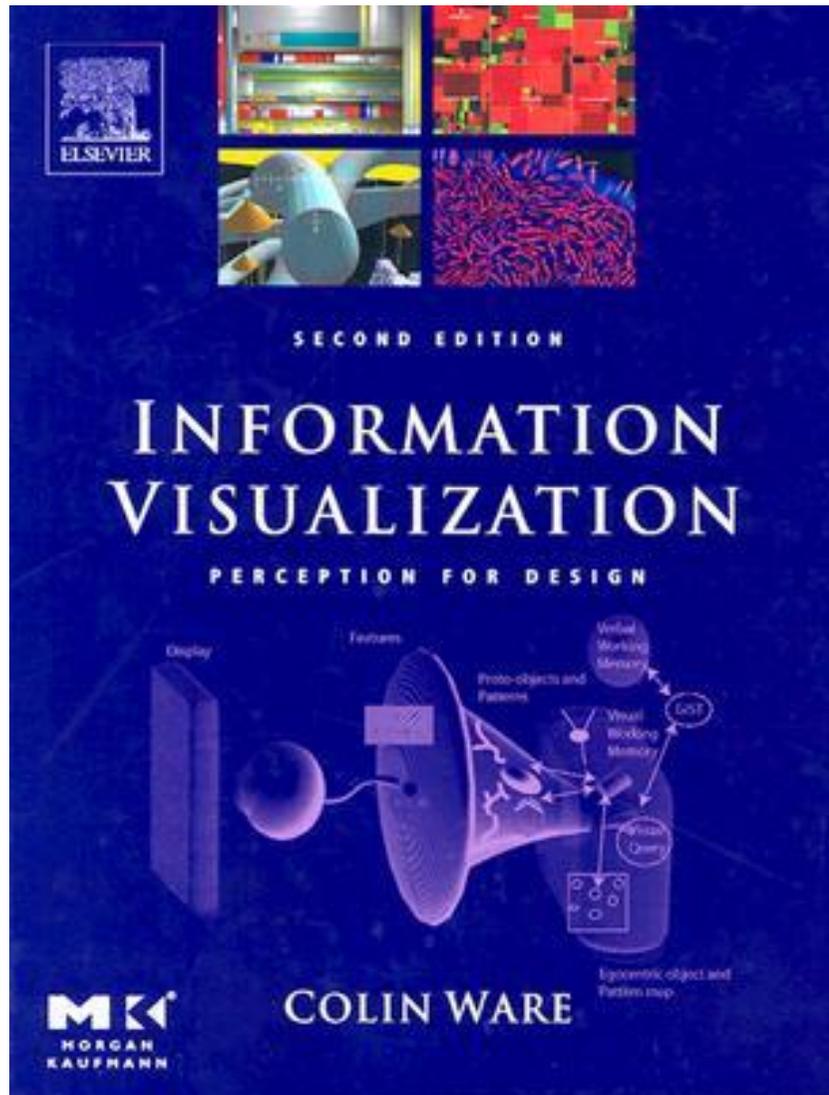


## 4. Spence et Ware

### Video #12



Bifocal display  
(Spence et al., 1980-2)



## C. WARE

Cartographie océans

Complète Bertin  
(animation, textures)

Evaluations expérimentales  
- sur l'utilisation des couleurs  
- sur l'utilisation de la 3D

Pas bcp d'interaction ...

=> cours #2

## 5. Le Xerox PARC : S. Card, J. MacLinlay, R. Robertson

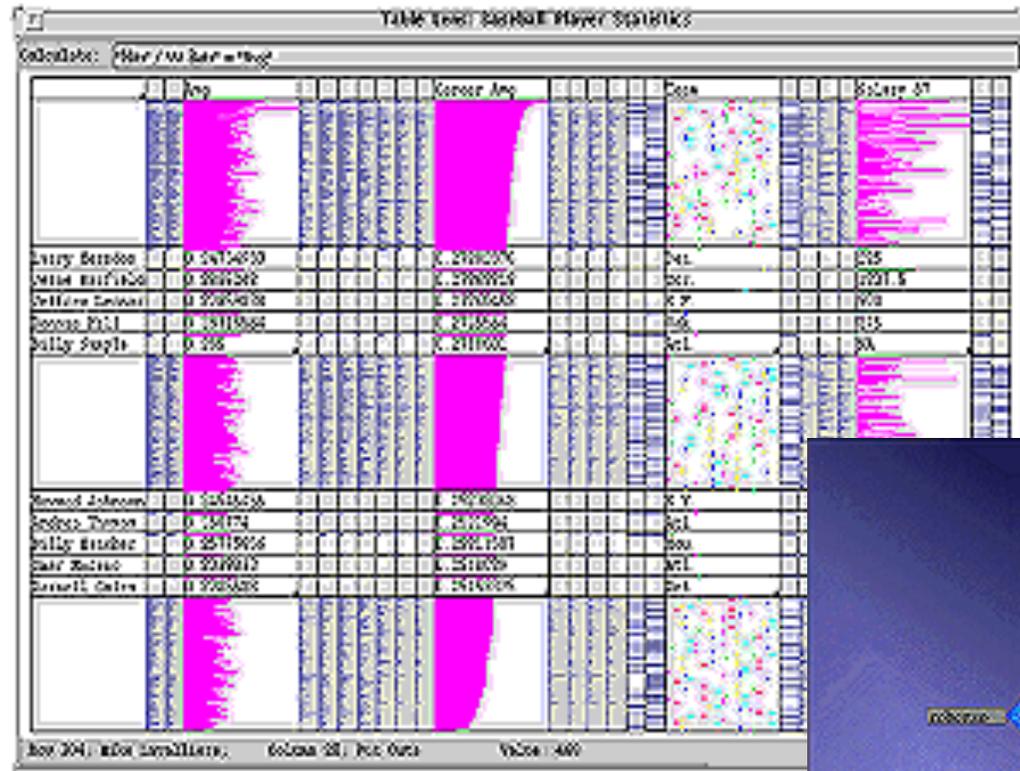
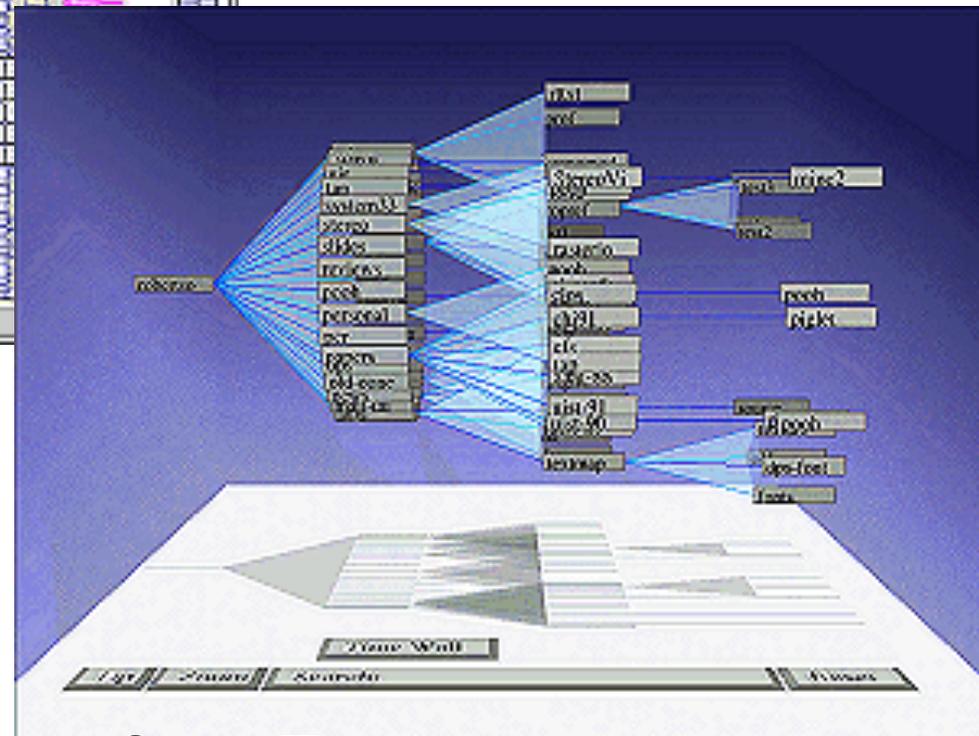
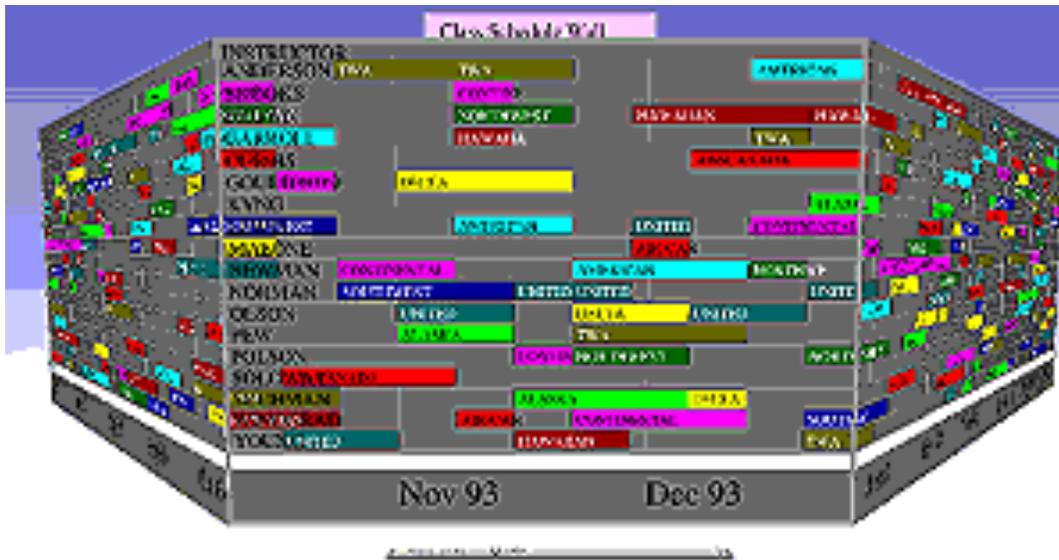


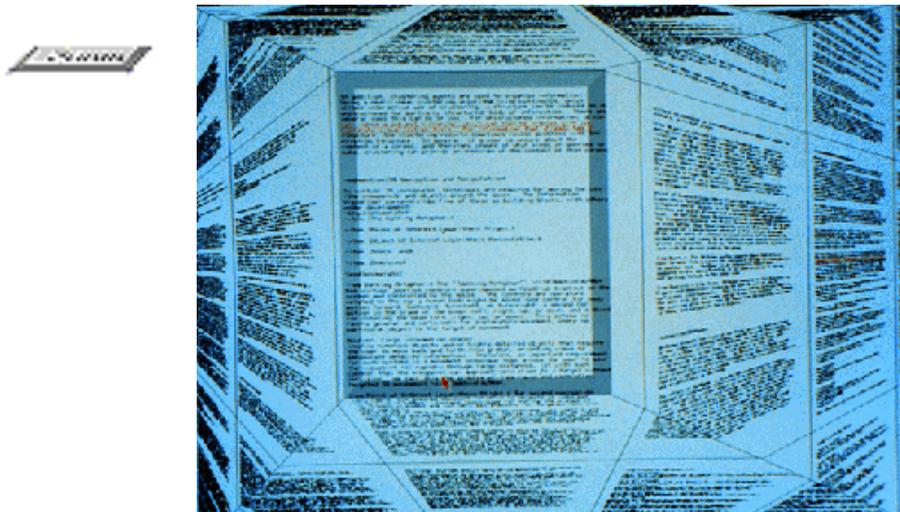
Table lens



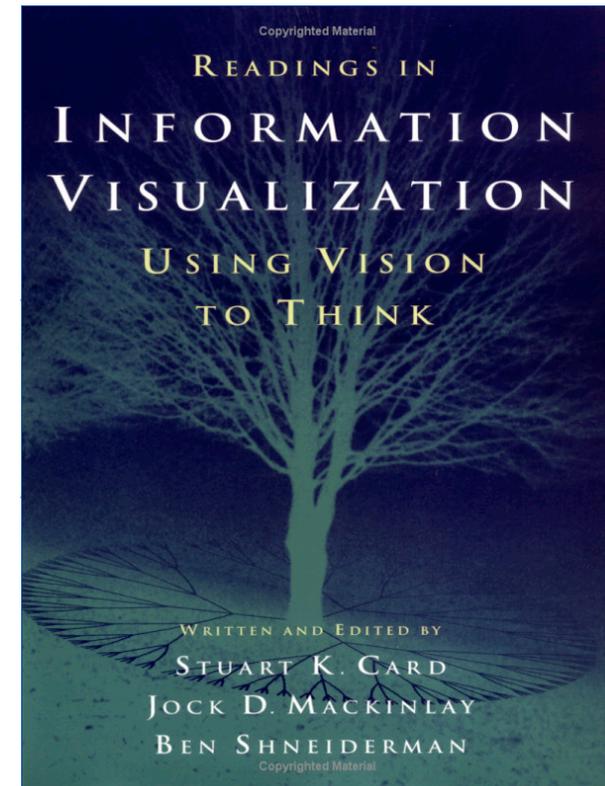
Cone Tree



Perspective Wall



Data lens

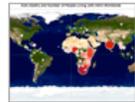


(niveau recherche)

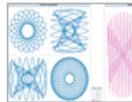


## visual examples | entire gallery

seeing is learning



AIDS in Perspective



Tricked Out Trochoids



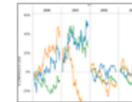
Economic Davids vs Goliaths



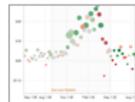
Per Capita Energy Use



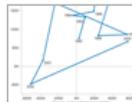
"Blue-Hairing"



Hard Crash Tech Stocks



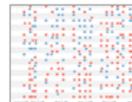
Dot.com Bubble Burst



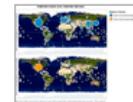
Skittish Investors?



Buying Condos in FL?



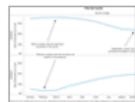
English League Soccer



Who's Online



Hurricane Tracks



Monthly Ice Cycle



Sales Pipeline



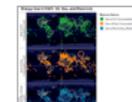
Hurricane Influences



Tropical Storm Tracks



Hot Enough Yet?

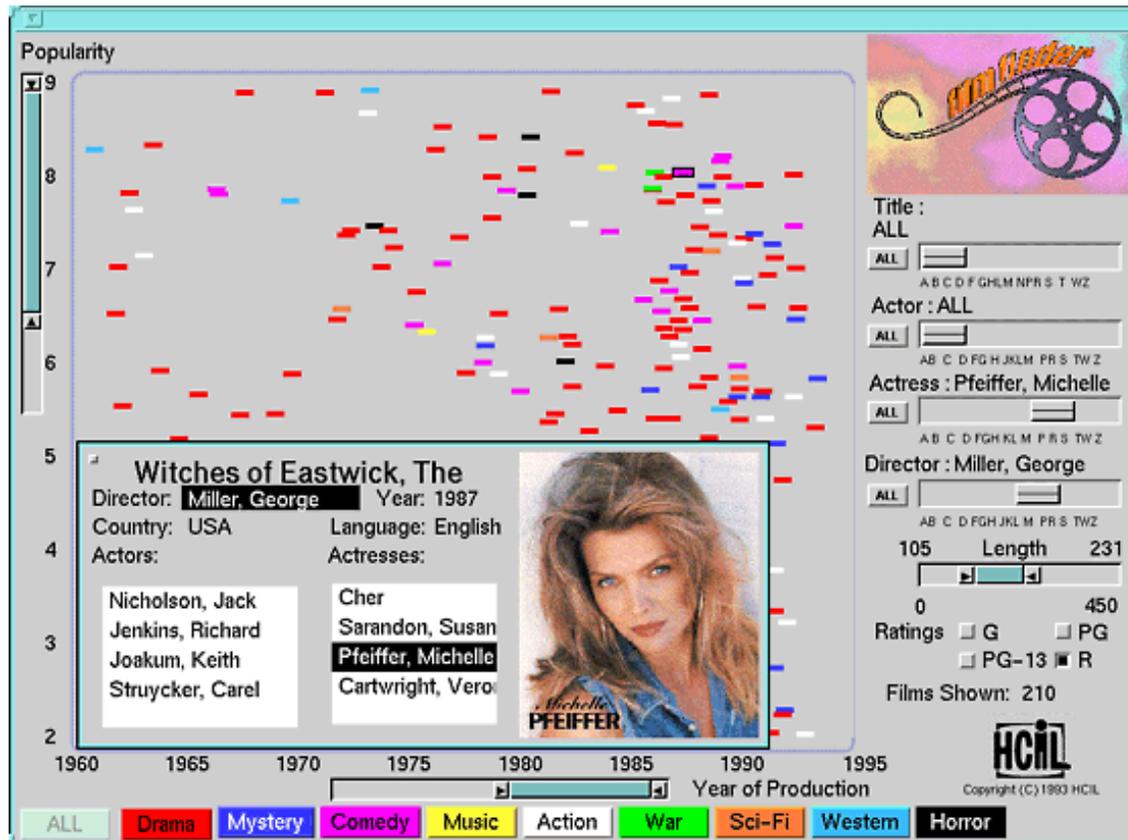


Worldwide Energy Use

# Tableau (Jock Mackinlay)

## 6. Le HCI lab, univ. Maryland

### Dynamic queries (1993)



the FilmFinder comprised 1,838 film titles, 5,468 actors and 1,463 directors.  
Shneiderman and Ahlberg (CHI, 1994)



# Infovis mantra (1996)

Overall, the bandwidth of information presentation is potentially higher in the visual domain than for media reaching any of the other senses. Humans have remarkable perceptual abilities that are greatly under-utilized in current designs. Users can scan, recognize, and recall images rapidly, and can detect changes in size, color, shape, movement, or texture. They can point to a single pixel, even in a megapixel display, and can drag one object to another to perform an action. User interfaces have been largely text-oriented, so as visual approaches are explored, appealing new opportunities are emerging.

There are many visual design guidelines but the basic principle might be summarized as the Visual Information Seeking Mantra:

Overview first, zoom and filter, then details-on-demand  
Overview first, zoom and filter, then details-on-demand

Each line represents one project in which I found myself rediscovering this principle and therefore wrote it down it as a reminder. It proved to be only a starting point

actions that users wish to perform.

The seven tasks are at a high level of abstraction. More tasks and refinements of these tasks would be natural next steps in expanding this table. The seven tasks are:

**Overview:** Gain an overview of the entire collection.

**Zoom :** Zoom in on items of interest

**Filter:** filter out uninteresting items.

**Details-on-demand:** Select an item or group and get details when needed.

**Relate:** View relationships among items.

**History:** Keep a history of actions to support undo, replay, and progressive refinement.

**Extract:** Allow extraction of sub-collections and of the query parameters.

Further discussion of the tasks follows the descriptions of the seven data types:

**1-dimensional:** linear data types include textual documents, program source code, and alphabetical lists of names which are all organized in a sequential manner. Each item in the collection is a line of text containing a string of characters. Additional line attributes might be the date of last update or author name. Interface design issues include what fonts, color, size to use and what overview, scrolling, or selection methods can be used. User problems might be to find the number of items, see items having

Shneiderman "The eyes have it : a task by data type taxonomy for information visualizations"







Aaron Koblin "Flight patterns" 2009

# Manuel Lima

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visual complexity

Search the VC database:

Are you Writing a Book? Learn How to Publish Your Book. Sign up and Get a Publishing

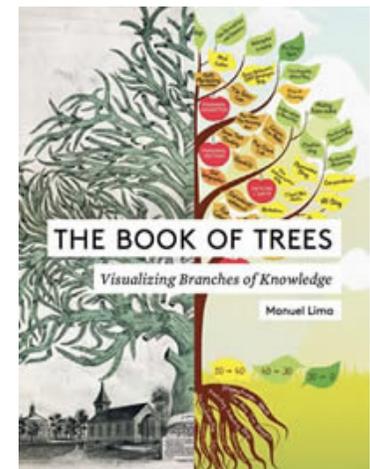
Latest Projects:   Indexing **900** projects

Filter by:

- Art (69)
- Biology (55)
- Business Networks (42)
- Computer Systems (34)
- Food Webs (8)
- Internet (31)
- Knowledge Networks (128)
- Multi-Domain Representation (66)
- Music (41)
- Others (69)
- Pattern Recognition (46)
- Political Networks (32)
- Semantic Networks (44)
- Social Networks (123)
- Transportation Networks (57)
- World Wide Web (55)

See All (900)

 visual complexity Mapping Patterns of Information



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

# Explosion de sites et de logiciels !

Log In / create account

Page Discussion Read View source

Search Go Search

Main Page

wiki

Main Page  
News  
Glossary  
VizPatterns  
Events  
Web Resources  
Publications  
Research & Education  
People  
Companies  
Jobs  
Techniques  
Software  
Coffee Room  
Help  
Sitemap

Share

Toolbox

welcome to the *InfoVis:Wiki*, the **Information Visualization** community platform

**News**  
How to enter news?

- News: 2015-05-04: 2nd CIP: 4th International Workshop on Theory and Application of Visualizations and Human-centric Aspects in Processes (TAProViz'15) at BPM 2015 (Deadline: 29 May 2015)
- News: 2015-04-22: Job: Research Assistant (PhD Position) in InfoVis / Visual Analytics, Johannes Kepler University Linz, Austria
- News: 2015-04-20: Job: Postdoc position in InfoVis/HCI, visualizing image construction in astrophysics, Nantes & Paris Saclay, France (Fall 2015)
- News: 2015-03-18: Job: Instructor needed for Information Visualization, School of Information, San Jose State University (Fall 2015)
- News: 2015-03-18: Job: PhD position in Visual Analytics, University of Montpellier, France (Deadline 1 May 2015)
- News: 2015-03-17: Job: PhD position in Interactive Visualization of Biological

The **InfoVis:Wiki** project is developments and news on all areas and aspects of Information Visualization. Using editable-by-anyone Wiki technology turned out to be the only way of keeping the presented information up to date and knowledge exchange vivid. **Check out our top contributors list ...**

<http://www.infovis-wiki.net/>

visualizing.org Login or Register

Home Visualizations Data Challenges Community Upload Your Work

Urbanization in East Asia between 2000 and 2010

Visualizing Challenge

Congratulations to the winner of our Visualizing Urban Expansion Challenge.

visualizing.org

A community of creative people making sense of complex issues through data and design — join us

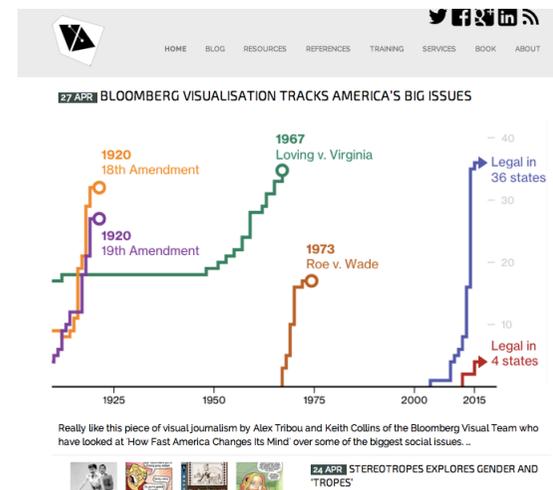
Share Your Work Find Visualizations

Open Data Challenges

Featured Visualizations

News and Announcements

<http://visualizing.org/>



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

<http://d3js.org/>

[Overview](#) [Examples](#) [Documentation](#) [Source](#)

# Data-Driven Documents

Fork me on GitHub

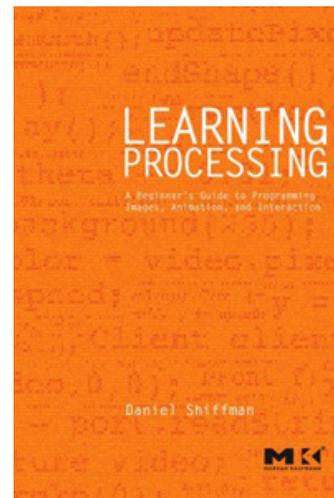
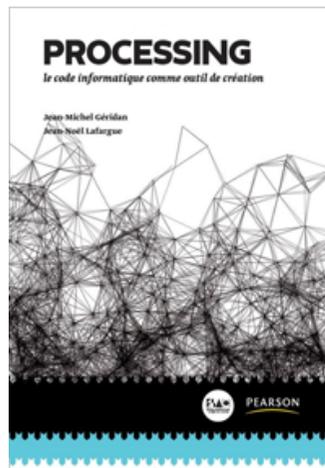
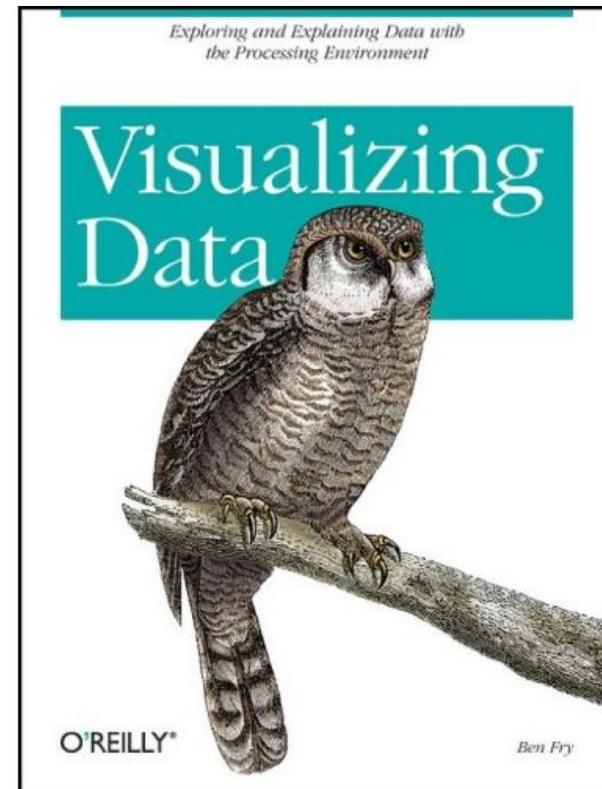
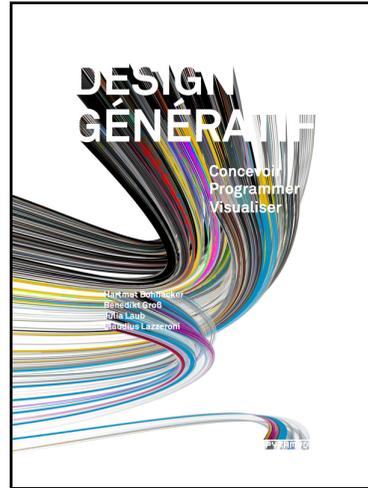
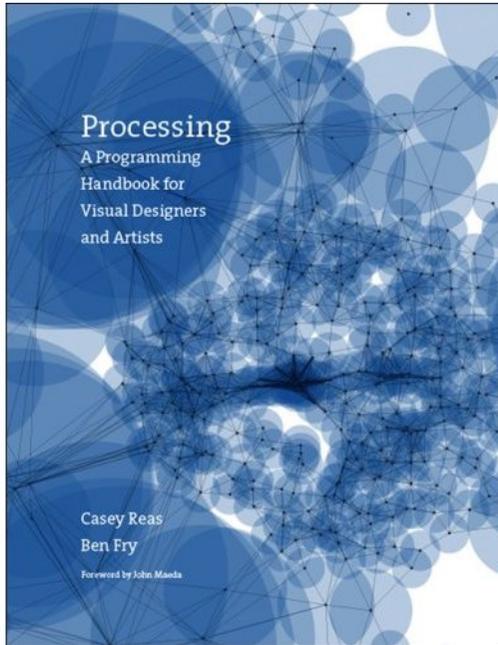


**D3.js** is a JavaScript library for manipulating documents based on data. **D3** helps you bring data to life using HTML, SVG, and CSS. D3's emphasis on web standards gives you the full capabilities of modern browsers without tying yourself to a proprietary framework, combining powerful visualization components and a data-driven approach to DOM manipulation.

[See more examples.](#)

Download the latest version (3.5.5) [here](#):

# 8. Présentation de Processing



B. FRY

"we stand by our mission statement :



Processing seek to ruin the careers of talented designers by tempting them away from their usual tools and into the world of programming and computation.

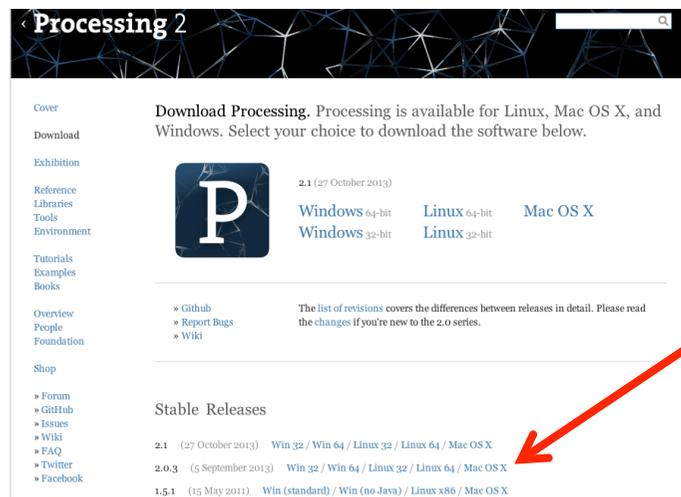
Similarly, the project is designed to turn engineers and computer scientists to less gainfull emplyment as artists and designers."

<http://processing.org/overview/>

- créé en 2001 par Ben Fry (MIT) et Chris Reas (UCLA)
- basé sur le langage Java - et ses bibliothèques multimédia
- multiplateforme (windows, macos, linux)
- version 1.0 en 2008
- 2.0 en 2013 : android javascript etc
- une grande communauté

# étape #1 : installer le logiciel

# http://processing.org



The screenshot shows the Processing 2 website. The main content area is titled "Download Processing. Processing is available for Linux, Mac OS X, and Windows. Select your choice to download the software below." Below this text is a large blue square with a white letter 'P' inside. To the right of the 'P' is the version number "2.1 (27 October 2013)". Below the 'P' are four links: "Windows 64-bit", "Linux 64-bit", "Mac OS X", and "Windows 32-bit". Below these links is a section titled "Stable Releases" with a list of versions: "2.1 (27 October 2013) Win 32 / Win 64 / Linux 32 / Linux 64 / Mac OS X", "2.0.3 (5 September 2013) Win 32 / Win 64 / Linux 32 / Linux 64 / Mac OS X", and "1.5.1 (15 May 2011) Win (standard) / Win (no Java) / Linux x86 / Mac OS X". A red arrow points from the text box on the right to the "2.1" version link in the "Stable Releases" list.

Processing 2

Download Processing. Processing is available for Linux, Mac OS X, and Windows. Select your choice to download the software below.

2.1 (27 October 2013)

Windows 64-bit Linux 64-bit Mac OS X  
Windows 32-bit Linux 32-bit

» Github  
» Report Bugs  
» Wiki

The list of revisions covers the differences between releases in detail. Please read the changes if you're new to the 2.0 series.

Stable Releases

2.1 (27 October 2013) Win 32 / Win 64 / Linux 32 / Linux 64 / Mac OS X  
2.0.3 (5 September 2013) Win 32 / Win 64 / Linux 32 / Linux 64 / Mac OS X  
1.5.1 (15 May 2011) Win (standard) / Win (no Java) / Linux x86 / Mac OS X

prendre de  
préférence  
la 2.2.1

## étape #2 : écrire un premier programme

souris

```
void setup(){
  size(400,400);
  smooth();
  background(0);
  noCursor();
}

void draw(){
  int x = mouseX;
  int y = mouseY;
  ellipse(x,y,20,20);
}
```

## la même chose avec Java et Swing :

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;

class GestionEvt implements MouseMotionListener {
    public void mouseDragged(MouseEvent e) {
        Container c = (Container) e.getSource();
        Graphics g = c.getGraphics();
        g.fillOval(e.getX() - 10, e.getY() - 10, 20, 20);
    }
    public void mouseMoved(MouseEvent e){}
}

class DessinSouris {
    public static void main(String[] args) {
        JFrame frame = new JFrame("dessin souris");
        Container cpane = frame.getContentPane();
        GestionEvt listener = new GestionEvt();
        cpane.addMouseMotionListener(listener);
        cpane.setPreferredSize(new Dimension(600,600));
        frame.pack();
        frame.setVisible(true);
    }
}
```



## étape #3 : tester quelques exemples



ici : AsciiVidéo

démo



Xu Bing - Une histoire sans mot - Grasset, 2013