What will the visualisation of the Gaia catalogue be?

André Moitinho & Alberto Krone-Martins
(SIM - U. Lisbon)
&
VA-4D Collaboration (Uninova; NComVA; King's College)

VA-4D

VA-4D - Visual Analysis of 4-Dimensional Fields, Processes & Dynamics

"Design a conceptual model for an intelligent Visual Analysis tool for large datasets of 4-Dimensional fields "

- 5 scenarios: Space Science; Climate Changes influence in Floods/Habitats/Vector borne diseases; Natural Hazards (for) Disaster Management
- Visual analytics; Computer science

What is Visualisation for?

- Exploring the catalogue
  - Displaying views of the catalogue for querying and selecting objects of interest
    - Analysing the data. What built in functions?
- Presenting results.
  - Professional papers and talks
  - General public

Requirements

- Functional
- Visualisation
- System interface
- Architecture
- Software engineering
- Performance
- Security

Requirement	Key-word requirement examples	Priority
The Visualization Framework (VF) shall provide [flood] monitoring capabilities.	"Monitoring capability" examples = remote sensing, instrumental stations, field observations.	MH
The VF will provide data input functionalities from online archives	"online archives" examples = virtual observatories, atmospheric datacentres.	MH
The VF will provide data input functionalities from offline storage / local archives	"offline storage" = user's data / files	MH
The VF shall provide data integration [of climate, land use, vegetation, basin and flood / flood risk].	"data integration" = maps overlays, time synchronized datasets	MH
The VF shall provide [flood] frequency-size analysis of the probabilities based on past events.		CH
The VF will provide an integration with external statistical analysis tools.		MH
The VF shall provide collaborative environment tools.	"Collaborative environment tools" examples = Defining user workgroups; Workspace sharing for selected workgroups; online communication	MH
The VF shall provide offline working capabilities		MH

> 200 high level reqs - merging underway

Visualisation frameworks

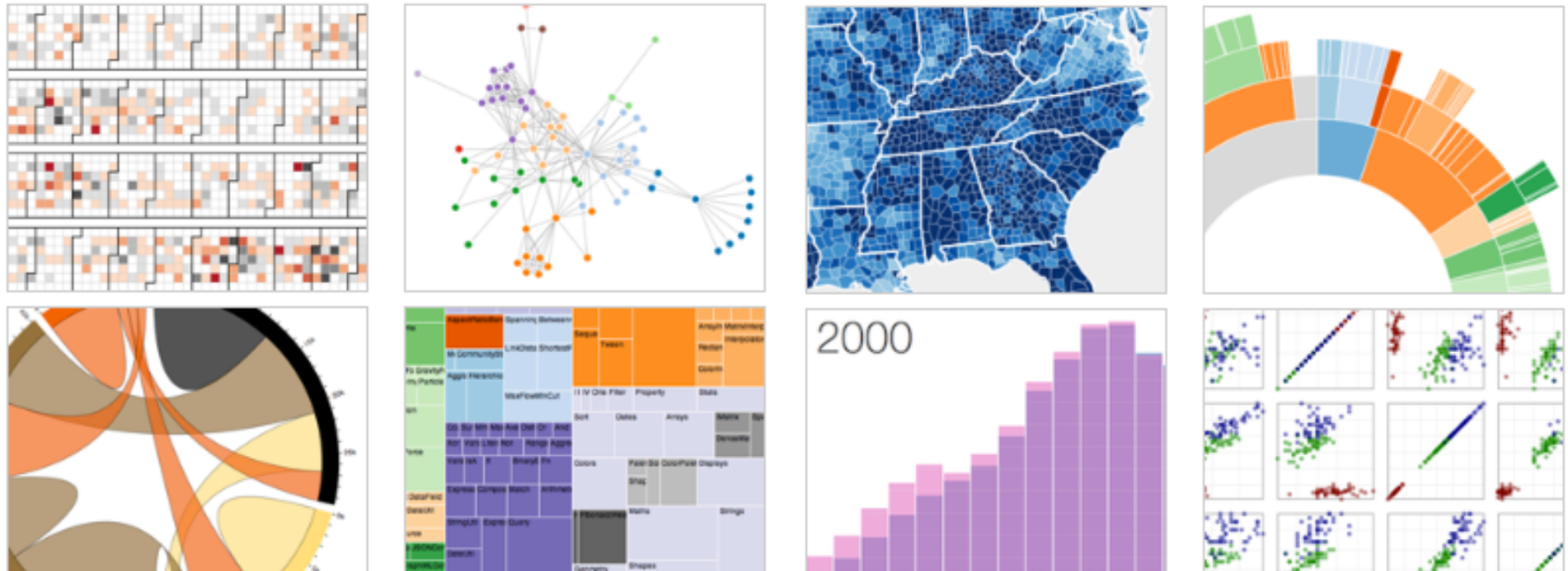
- More than 100 FW identified

	Visualizations	Vis5D and Vis5d+	VisAD	McIDAS-V	The Visualization Toolkit - VTK	Advanced Visual Systems - AVS	NCAR Command Language – NCL	Avizo Green	VAPOR	Vooren
1	3D bar chart									
2	3D scatter plot									
3	Iso-surface	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	Cutting	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	Scalar generation	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	3D hedgehog and glyph	Yes	Yes	Yes	Yes	Yes		Yes		
7	Warping	Yes	Yes	Yes	Yes	Yes		Yes		
8	Streamline	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	Volume rendering	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes
	2D visualizations (will be expanded)			Yes	Yes	Yes	Yes			
1	Interaction support	Yes			Yes	Yes	Yes	Yes	Yes	Yes
2	Time animation support				Yes			Yes		Yes
3	Multiple-linked view support		Yes							
4	Large dataset support	Yes						Yes	Yes	
5	Data analysis support			Yes			Yes		Yes	
6	Collaboration support		Yes							
7	Story publishing support									
8	Web-based visualization support		Yes							
9	Component-based	Yes	Yes	Yes	Yes		Yes	Yes	Yes	Yes
10	Integration into other system support	Yes	Yes			Yes	Yes			
11	Programming environment	C++, OpenGL	Java	Java	C++, Java, Python, Tcl/Tk					C++
12	Parallel processing support				Yes					
13	Cross-platform				Yes	Yes	Yes		Yes	
14	Open source	Yes	Yes		Yes		Yes		Yes	Yes
15	Providing programming library	Yes			Yes	Yes			Yes	Yes
16	Active development				Yes	Yes		Yes		Yes
17	Technical support				Yes	Yes		Yes		
18	License	GNU General Public License	GNU Lesser Public License	GNU Lesser Public License	BSD	Proprietary		Proprietary	BSD	GNU General Public License version
1	Internal format				Yes	Yes	Yes		Yes	
2	Text format (csv, txt)		Yes	Yes		Yes	Yes			
3	Excel format			Yes		Yes				
4	Xml-based format				Yes	Yes	Yes			
5	Database access					Yes				
6	NetCDF format		Yes	Yes			Yes	Yes		
7	Esrishape format					Yes	Yes			
8	Raw format			Yes						Yes
9	Image formats (jpeg, gif, png)		Yes	Yes			Yes			
10	Other formats		Yes	Yes		Yes	Yes			Yes

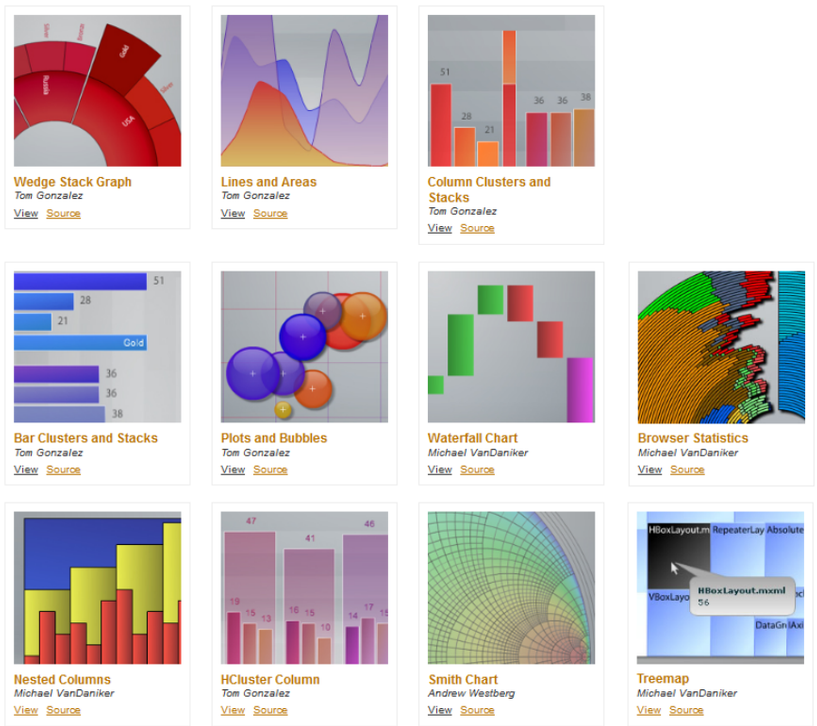
Visualization Frameworks, Toolkits, Systems

Google

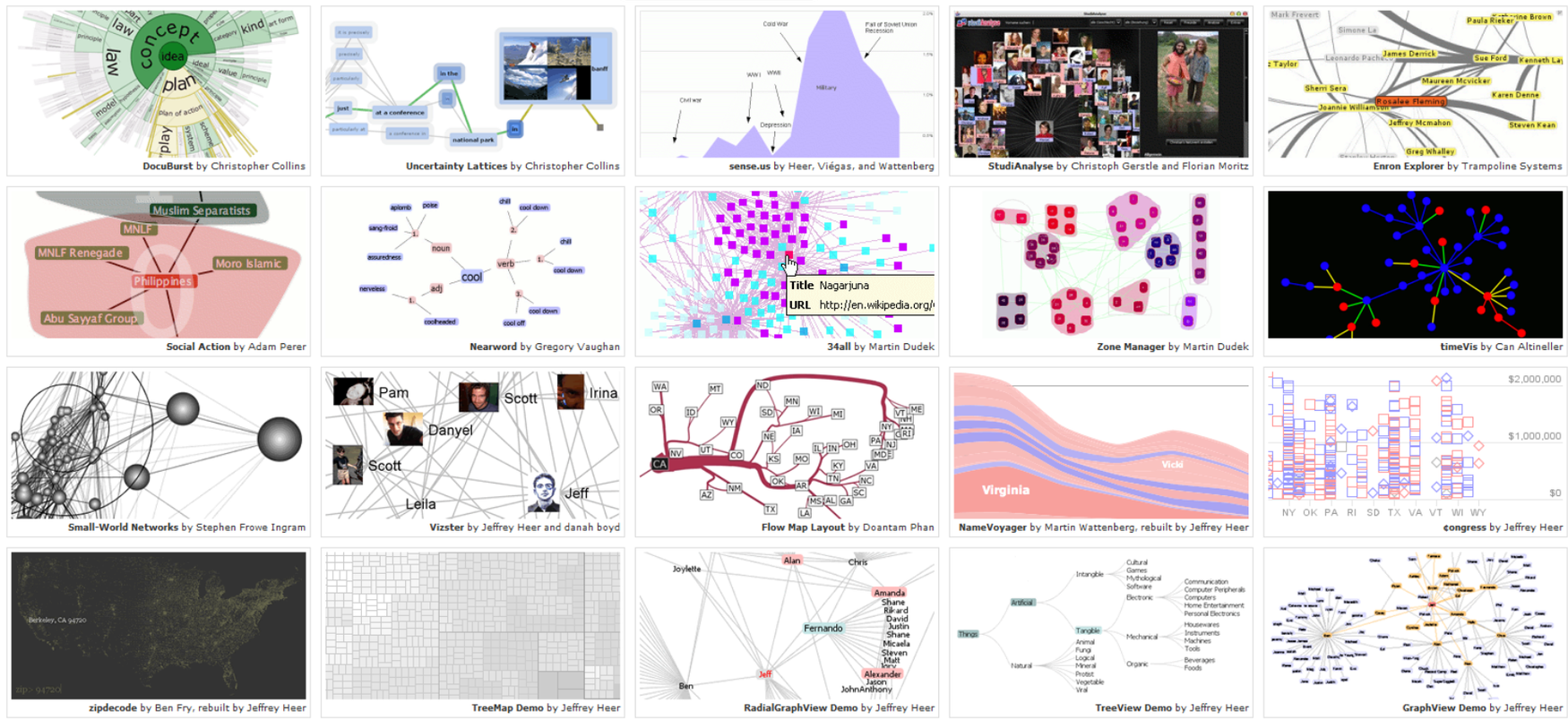
D3.js



Axiis

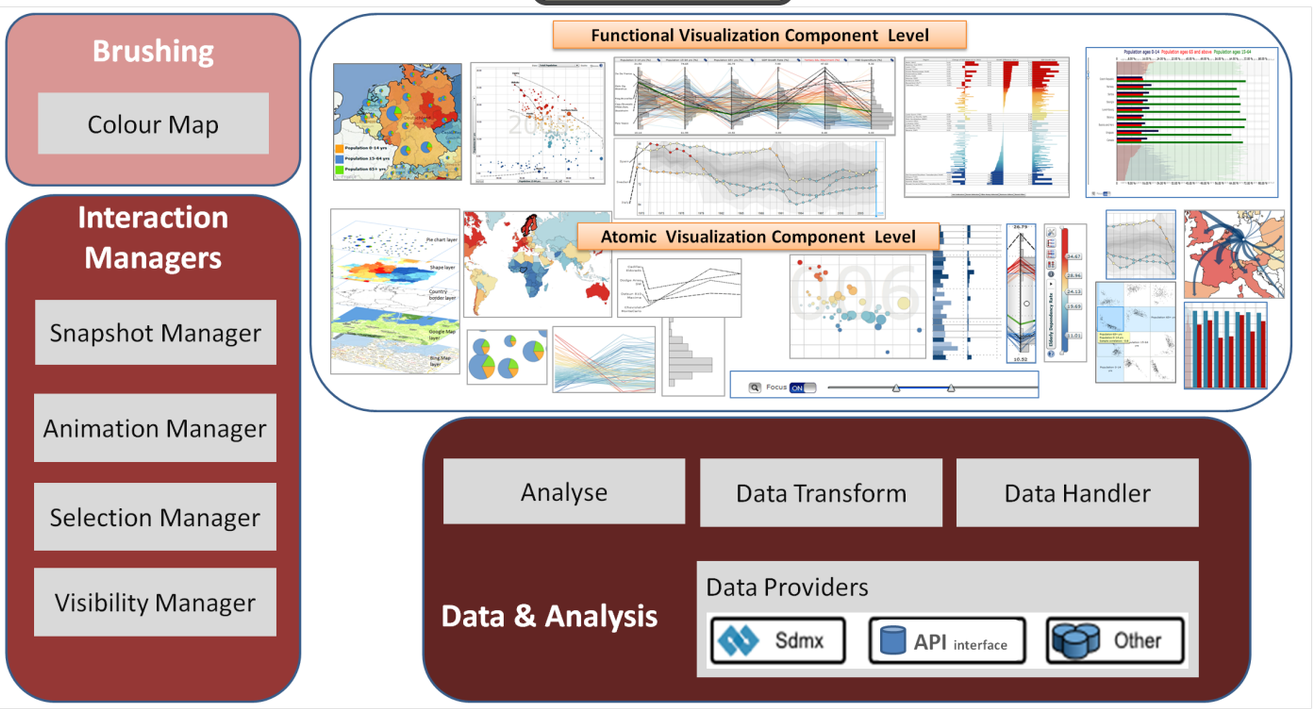


Prefuse

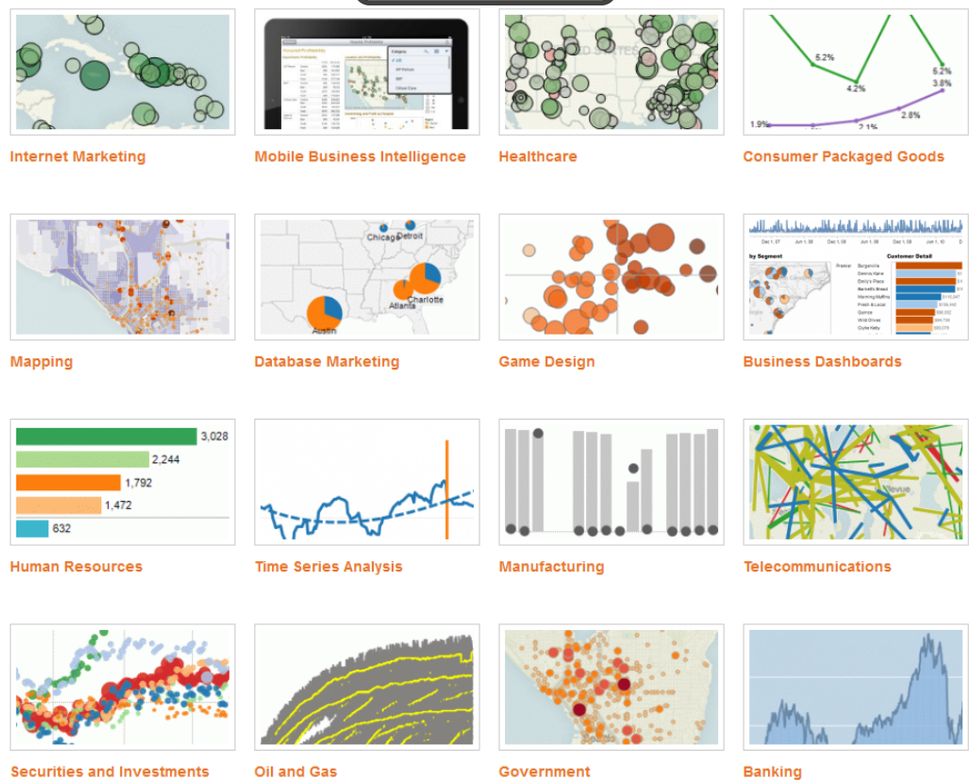


Visualization Frameworks, Toolkits, Systems (cont.)

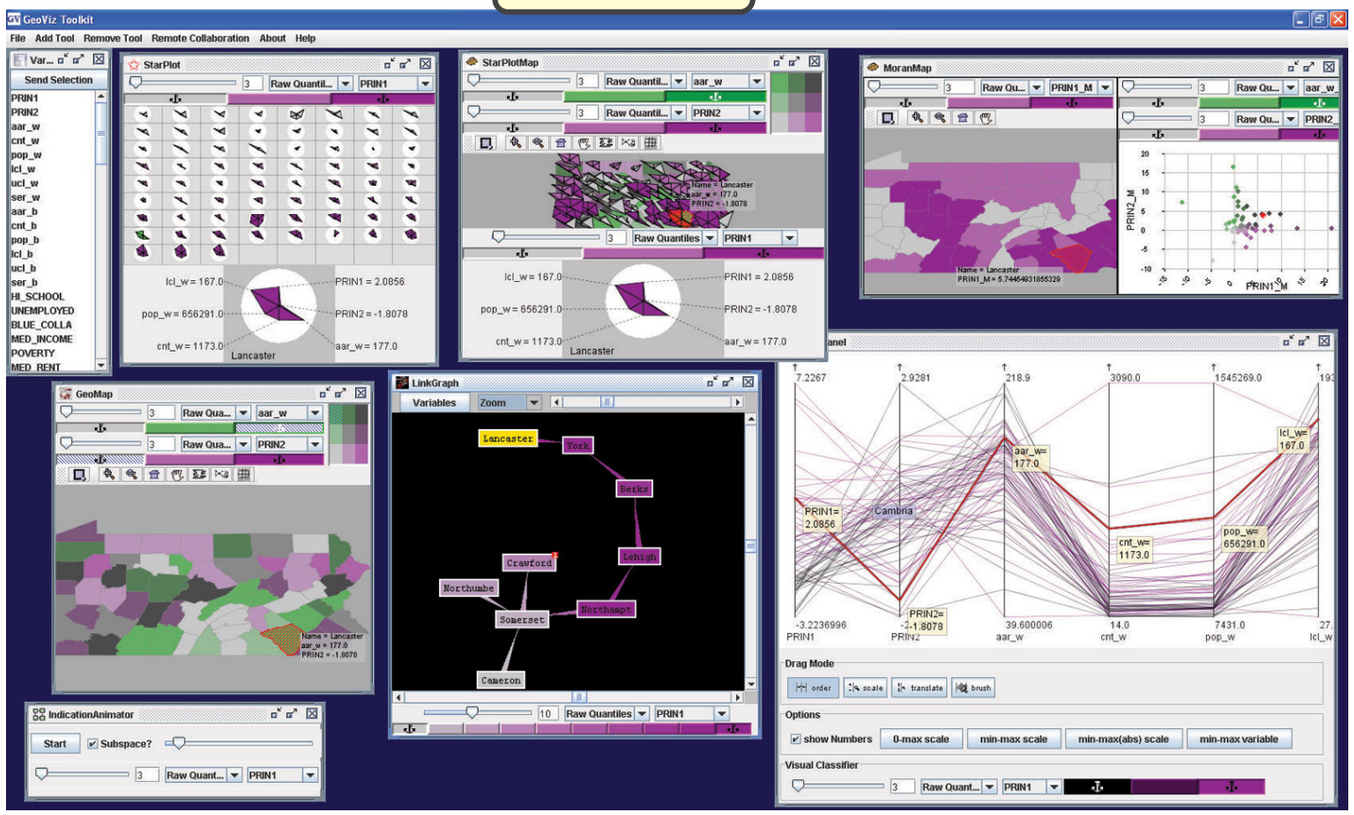
GAV



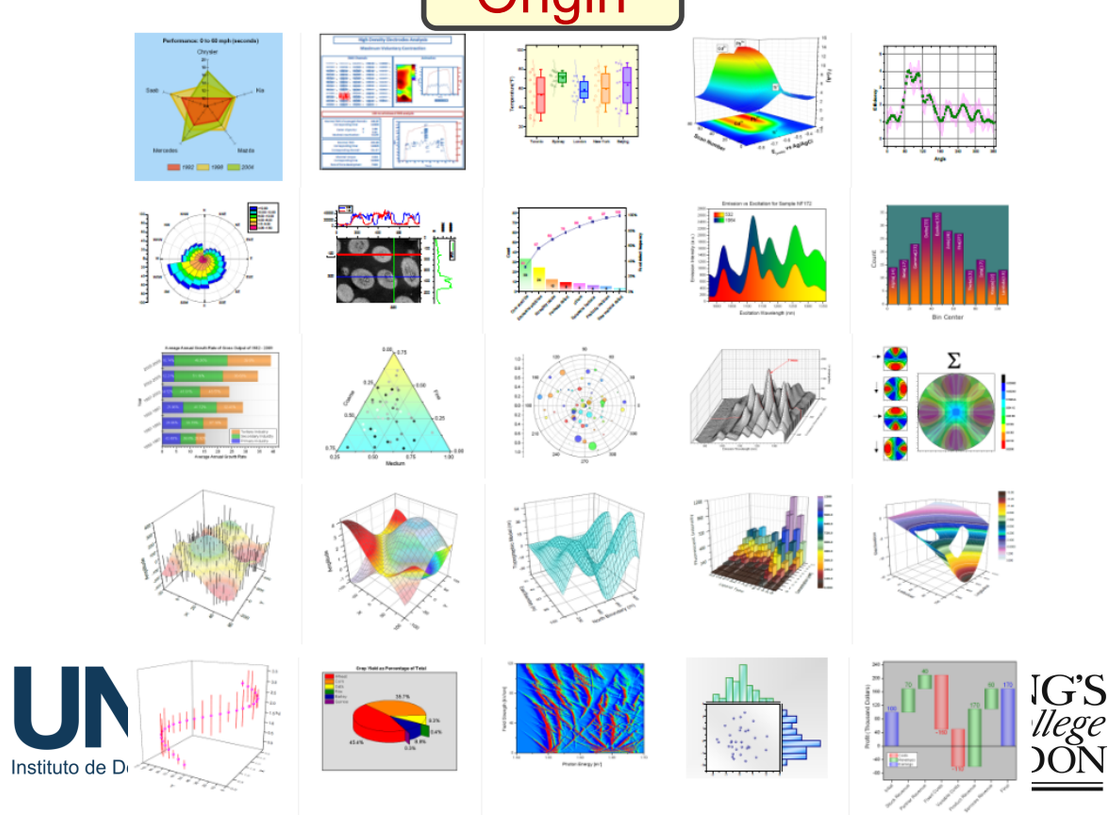
Tableau



GeoVista

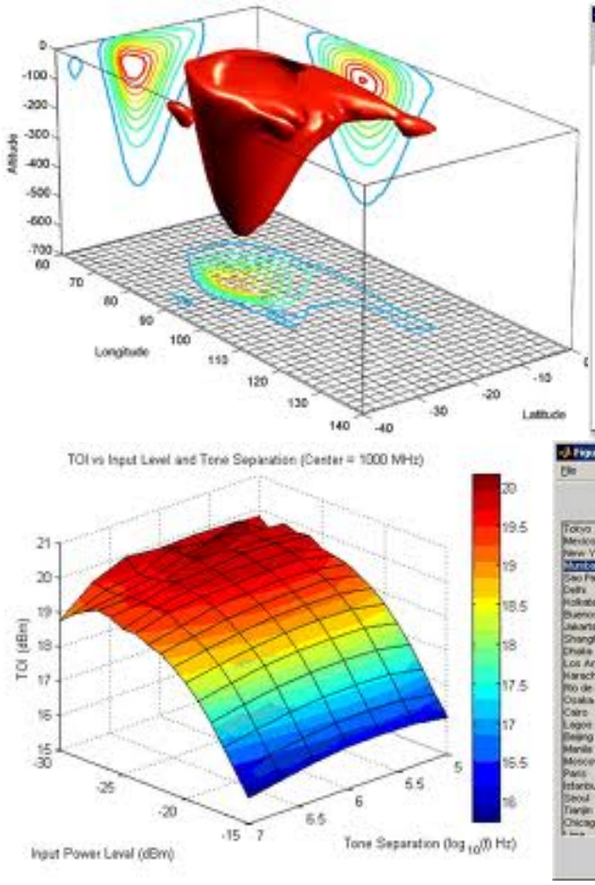


Origin

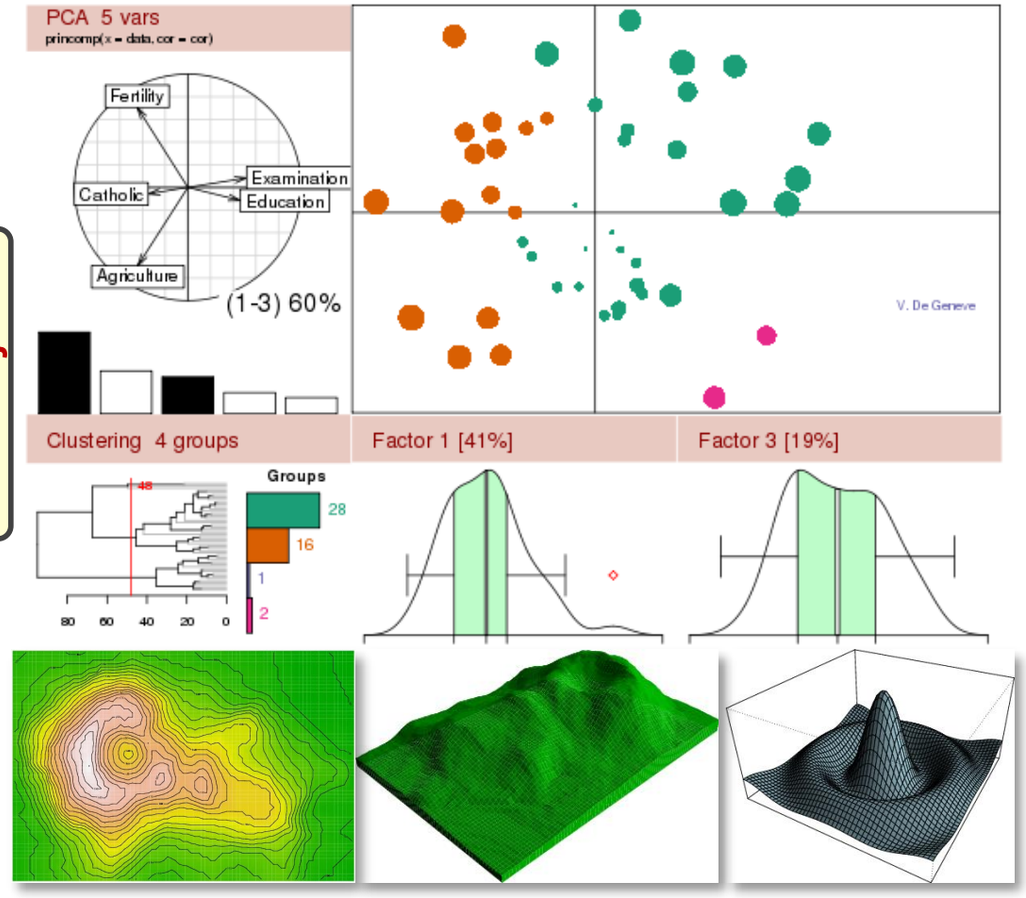


Visualization Frameworks, Toolkits, Systems (cont.)

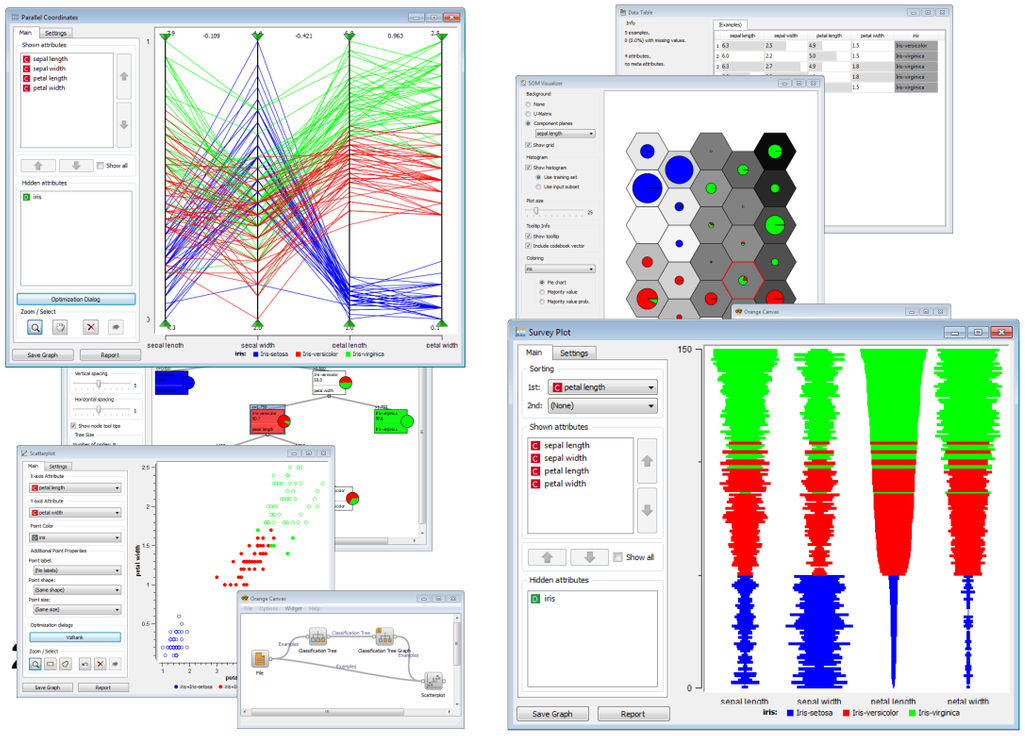
Matlab



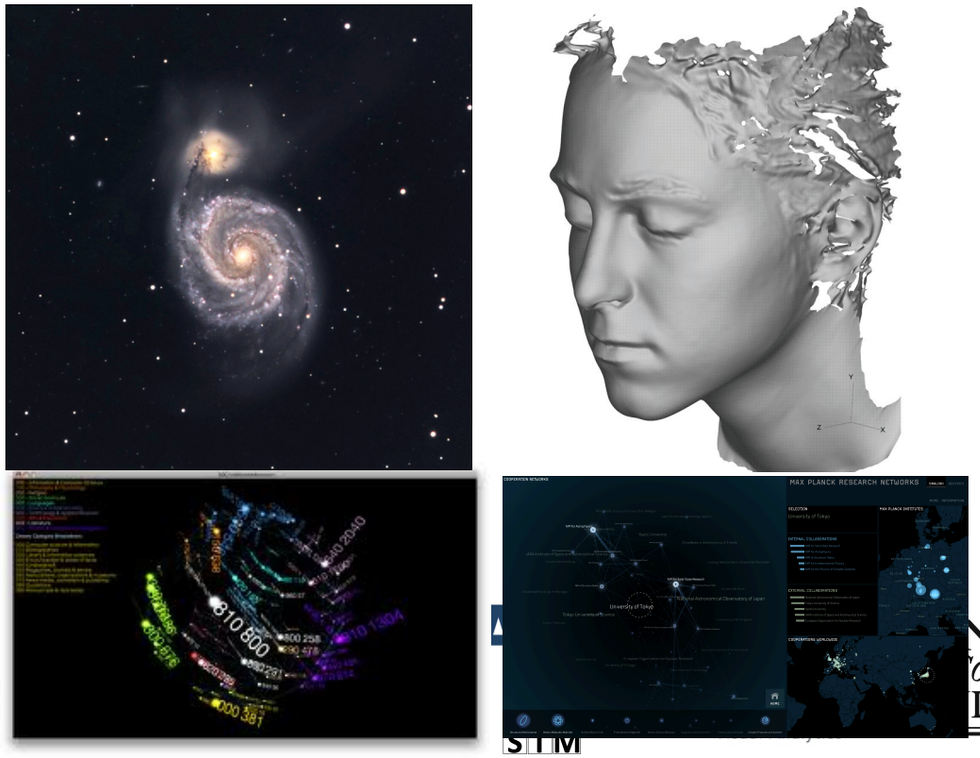
R Project



Orange



Processing



- Gap assessment underway. Some highlights:
  - Adequate representation of the errors: Propagation. Clutter even in moderate sets
  - Large datasets: What to plot and what to render. Performance
  - Limited mathematical tools. Interoperability (python, java,VO, ..) preferred.
  - 3D interactivity: Measuring and selecting. Interfaces.
  - Collaborative environment. Story telling and publishing.

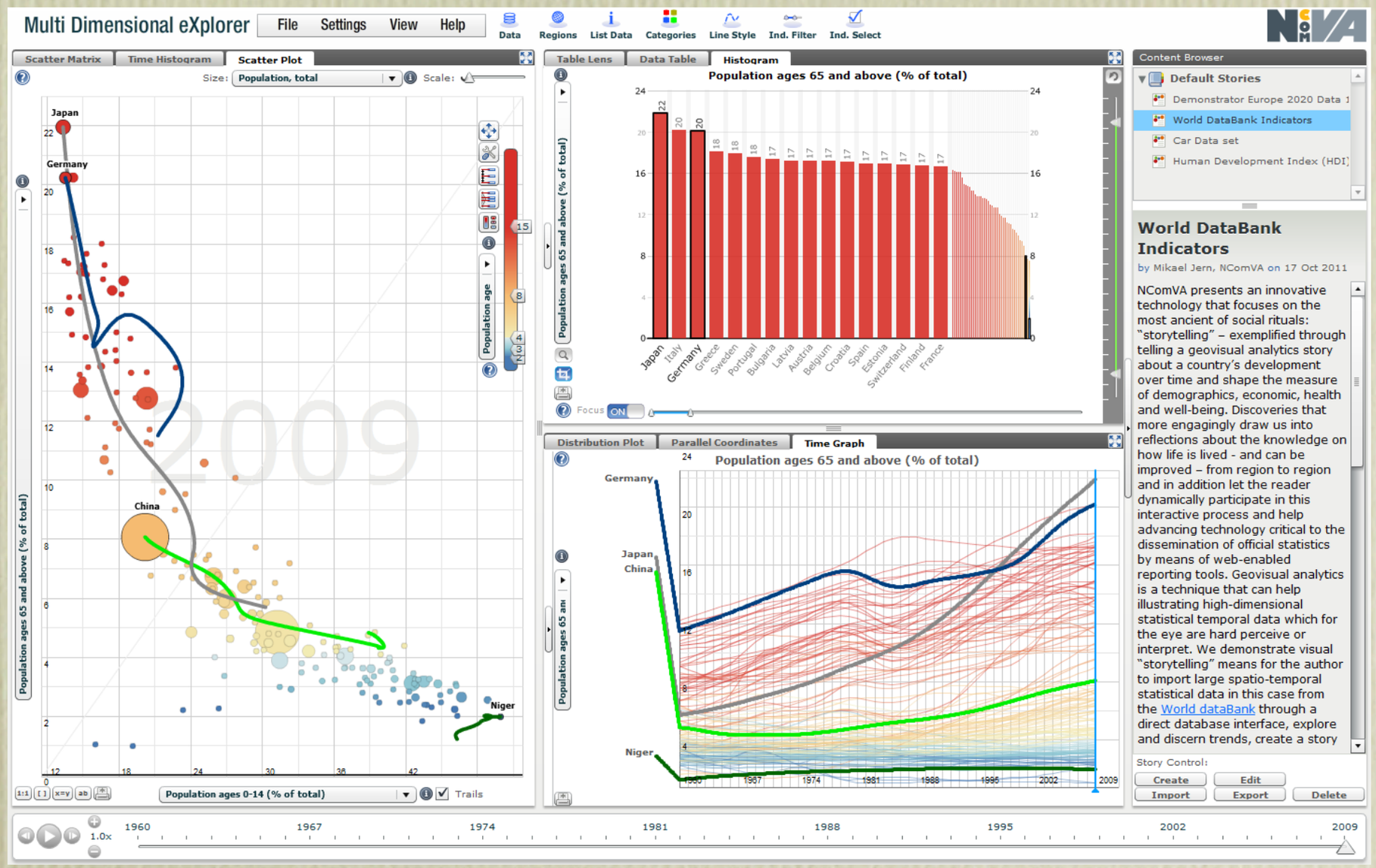
Some out of the box FWs

but (still) not Gaia-ready:

- World Wide Telescope (only worth considering the Windows version). Excellent 3D interactivity through Kinect.
- UNIVIEW (very impressive, expensive. For planetariums. Requires super computing)
- Celestia (multi-platform, expandable, free)

Collaborative visualisation

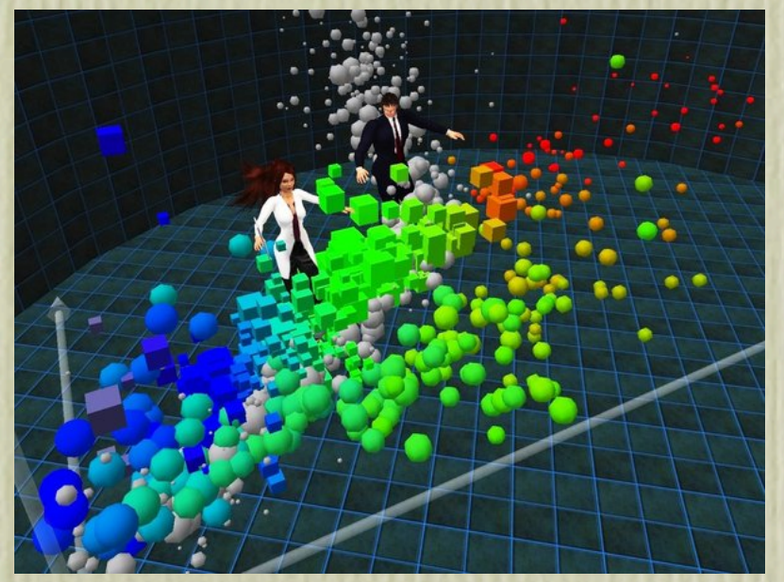
GAV Flash - Story telling



Visualise, analyse, collaborate, annotate, click-to-publish on the web

Collaborative visualisation

MICA - Meta Institute for Computational Astrophysics (SL/OpenSim)



Immersive data exploration and interaction

Seminars.

(With the family tree of variable astronomical sources by our DPAC CU7 Eyer & Molawi !)