
Appendix 4

Spring maps: self-organizing network visualization

Background

This note explains the applet-based visualization experiments used as interfaces to the databases of the Union of International Associations, including that on international organizations. The applet itself was developed, in cooperation with the UIA, by Gerald de Jong (BeautifulCode BV, see <http://www.beautifulcode.nl>)

For explanations concerning the other visualization experiments, see **Appendix 3** (and <http://www.uia.org/altermedia/>). It is from these displays that many of the visualizations in this volume have been generated. **The URLs on the visualizations in this volume offer access to the dynamic online version in colour.**

The purposes of these self-organizing displays are to create a visual index to show the complexity of relationships between (data) profiles and reveal the data rich domains. The maps are generated online from the data in direct response to user requests. Each display is dynamic and continues to organize itself in response to user constraints applied via the mouse. Further improvements to the display are under development in order to offer new insights into the data.

Spring maps are characterized by their dynamic self-organising properties. Instead of having to pre-allocate elements of the map over the screen surface, the network is randomly distributed over the surface and then reorganises itself according to the length (strength) of the relationships between individual nodes (based on spring mechanics). In addition, users are then free to manipulate portions of the map, configuring it according to preferences, colouring its parts, and freezing the result progressively.

This note first describes how the maps are generated and manipulated via the web, before discussing some of the technical issues relating to their presentation in this volume.

Map generation via the web

The maps are generated under user control via <http://www.uia.org/data.htm>. There are several pages from which a map may be (re)generated:

- Using pre-selected map examples (<http://db.uia.org/scripts/sweb.dll/examples>).
- From the search screen, after specifying a keyword (for example "forests" for the database World Problems), and clicking on the "map" link against display choice.
- From an index listing, after running a search (for example "forests" for the database World Problems), and clicking on the "map" link at the top of the listing.
- From a text profile, after running a search and selecting a profile for display (for example "forests" for the database World Problems, then click on "deforestation"), and then click on the "map" link against any of the lists of cross-references of different types.

Reconfiguring a displayed map

Some of the displays are exceptionally elegant – irrespective of the content. The display can be manipulated in a variety of ways using the mouse or keystrokes prior to printing (discussed below):

- **Navigation:** The mouse may be used to drag nodes of the map. The arrow keys can be used to move the map along the x and y axes. Key C will re-centre the map.

- **Temporary label display:** Moving the cursor over any node ensures that the profile names of all immediately connected nodes will appear temporarily. If too many are displayed to see a central node label, putting the cursor over any node that is only connected to that central node will ensure display of a single label.
- **Permanent label display:** Moving the cursor over a selected node and using Key T, will toggle the label on (or off) permanently. The size of labels can be increased by using Key B, or decreased by using Key S.
- **Fixing a node in a new position:** After dragging any node in the network to a new position, use a right-click to fix the node position. The node should change colour. Release it from that position by repeating the procedure (right-click on the node). All parts can be moved into a meaningful new configuration in this way. A screen shot could then be copied for use elsewhere (notably in PowerPoint type displays). These operations may be easier after first freezing the dynamics of the display by toggling with Key F.
- **Select maximum number of items displayed:** Simpler or more complex maps (if there is data to display) can be displayed by reselecting the number of nodes within the size limit (according to user access rights).
- **Zooming:** The scale of the map can be increased, effectively moving in, using the Page Up / Page Down keys.
- **Line colour / length:** The line colours and length can be changed using the pull down menus. Both these features are associated with "steps". The first step includes the nodes directly connected to the source node (or node cluster). The second step includes those linked to the first ring, etc. When exploring hierarchical relationships, each step may be one step down the hierarchy (in the case of "narrower" type relationships) or up the hierarchy (in the case of "broader" type relationships)
- **Profile display:** Profile text corresponding to any node can be displayed by holding down the CTRL key and clicking on the node.
- **Map exploration:** Displaying other maps centred on any of the nodes in the display can be triggered by holding down the CTRL key and right-clicking on the node.
- **Map background:** A range of colours can be selected. Selecting a line colour to match can be used to hide certain lines.
- **Sounds:** These can be set to play or not (see **Appendix 5**)
- **Selecting other relationship types:** There are three possibilities:
 - Same database / Same starting point: The map to be regenerated using a different set of relationships (if there are any in the data). Check the corresponding profile if unsure whether the starting point will be fruitful.
 - Different database / Same starting point: If the map was generated directly from a keyword search, it can be switched to generation from another database using the same keywords.
- **Other features:** These include hiding or showing directional arrows, icons, or link labels, etc. More controls and information available via map display page.

Exporting / Printing maps

This restricted feature was used to export any map generated over the web into an XML-formatted file that was then converted to the SVG (scalable vector graphics) format.

The SVG file could then be imported into a graphics editor to enable several operations to produce images for this volume:

- further modification of fonts
- ensuring that the labels do not overlap
- further repositioning (or exclusion) of nodes and links
- modification of colours (recognizing that only grayscale variants were to appear in print)
- selective addition of meaning by experimental aesthetic design choices

The new possibilities of SVG are of particular value in enabling an image to be scaled up to much larger size (eg poster or larger) – exposing much greater detail – and without loss of quality. The UIA provides such high-definition maps as a service, on demand.

Selection of maps

The intention has been to produce a selection of visually interesting images that suggest new ways of exploring networks of:

- international organizations,
- world problems they recognize,
- strategies advocated in response to these and other problems,
- human values guiding the detection of problems and the implementation of strategies,
- forms of human development implicit in the strategies and values.

both from a substantive perspective and as a trigger for the imagination in promoting attention to a particular network (eg for a conference or in promotional material).

The maps selected cover a wide variety of organizations, problems or strategies. The selection was not made so as to provide any systematic coverage. The purpose was primarily indicative of possibilities for the future, or for particular program initiatives (conferences, education, presentations, etc).

In several cases greater emphasis was given to the aesthetic properties of the image as a whole, rather than to maximizing the visibility of the network details.

The online facility enables thousands of maps of this type to be generated and manipulated over the web – varying colour, detail (up to several thousand nodes), layout, etc – according to the preferences of the user. However the dynamic nature of the maps requires that a significant amount of time be spent in laying them out in the ways presented in this volume.

The great merit of this approach is that it enables users with minimal experience or software facilities (other than a Java-enabled web browser) to explore highly complex spring maps according to their personal preferences. No special software needs to be acquired or downloaded.

The intention, in the printed form in this volume, has **not** been to achieve visibility of all detail associated with a complex image. Such detail could be explored – notably in the online SVG variants by using zoom (right-click on the SVG image in your browser and select zoom in / out).

Images on CD-ROM

The CD-ROM accompanying this volume includes:

- a selection of rasterized variants of the network visualizations in grayscale. These may be viewed using a normal web browser or any image viewer.
- a selection of the same network visualizations in colour in high quality Scalable Vector Graphic (SVG) format. These may be viewed using a browser plug-in provided on the CD-ROM or downloadable from <http://www.adobe.com/svg/> or manipulated in common (but recent) graphics packages.
- a three-minute Ecolynx movie demonstrating the possibilities of the spring map technique in relation to the UIA databases. This movie has been prepared as part of UIA's project funded by the European Commission's Info2000 Programme (1997-2000). It is available in two formats: QuickTime (highest quality) and RealAudio. Free players for both formats are available on the CD-ROM or downloadable from <http://www.apple.com/quicktime/> and <http://www.real.com/player/> respectively.

Other resources

Other UIA products (posters, etc), based on the use of spring maps, are described at <http://www.uia.org/altermedia/pub.php>