Online Issue Mapping of International News and Information Design

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Online issue mapping uses interactive network or topic maps to relate information sources to each other and to their respective uses of key terms. This strategy prioritizes the ability of visualization systems to show complex data that change over time. Our research applies combinations of software in a cross-disciplinary technique well suited to the information dynamics of the modern world. In an attempt to combine network maps over time, turning them from snapshots to a chronologically sensitive visualization system, we have undertaken two projects:

1. Mapping of the North Korean English Language New Media Space, available for free through Google News. The North Korean mapping project is part of an effort to study conflict through new media.

2. Mapping of the Information Design Research Community, as it is presented in new media. This second project has examined information design, using network maps over time and textual analysis software to understand the information design and visualization research community as it is presented in new media.

Our research is part of new developments in network mapping that aim to elucidate the operations of academic and professional institutions and organizations, blogs, news media, and the public diplomacy of states. Our mapping is dynamic in two senses: each map is a snapshot of content that is constantly changing, and the SVG or cluster map representations of the maps are interactive, allowing readers to actively study the visualizations by zooming, selecting elements for further information, and following links.

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As automated data analysis methodologies multiply, changes take place in research across disciplinary boundaries. This paper presents and analyzes such convergence in the case of studies related to political science and information design. Below we argue that the broader phenomenon our examples represent – cross platform analysis, evolutionary systems feedback, and publics brought into being (including research communities) – require an expansion of how we define dynamic mapping. The expanded definition that is needed, in our view, must include these major trends as well as reflexivity. Working towards this broader definition of dynamic mapping, we begin with three automated data analysis methods currently being applied within this paper and elsewhere. These are:

1. Internet news coverage visualization/mapping (*news space analysis*). News returns available freely on the Internet are analyzed with software tools. Vast amounts of coverage of important issues (literally tens of thousands of stories), such as the North Korean nuclear issue, or the semantic information politics related to the Israeli–Palestinian separation barrier/apartheid wall are mapped to show common frames, the circulation of content, and permutations over time (Rogers & Ben-David 2005, 16-18).
2. Colink network mapping (*issue network analysis*). Taking the link pages of a group of web sites as a starting point, an Internet "spider" crawls all of the linkages between the starting points and the rest of the network. The resulting Issue Network maps show, for example, the Information Design Research community, or Republican convention protest networks in the U.S. or the genetically modified food debate in Europe (for a current overview see <http://www.issuenetwork.org>).
3. Interactive web based tools (*information politics analysis*). Dynamic web sites and web tools aid Internet research. Examples include

> "elections barometers" that track and compare candidates' effectiveness on specific issues daily during an election, and "civil society issue indexes" which interactively track the web campaigns of a set of specific actors, such as the Seattle WTO meeting protest network, or European Social Forum actor issues (Rogers 2004, 22-33). Furthermore, web tools scrape and harvest data sets from the Internet in accordance with the priorities of different research agendas.

These three techniques are only a small part of general developments that are alike in principle and function (see <http://www.visual complexity.com> for an overview). Various research groups are responding to such developments simultaneously, and hence the language is in flux. The most inclusive term, and one that reflects the strikingly broad interdisciplinary application of these techniques is "virtual method." (Hine 2005). Another research group in this field is international in nature and concentrated around the The Govcom.org Foundation, Amsterdam and Aguidel SA. It is through experiences with this latter group that the authors have come to consider virtual method in relation to dynamic mapping.

The two mapping projects discussed in this paper fall under the first two categories of news space and issue network analysis given above. A network focus is the key element binding together the various visualizations presented in this study. To elucidate the relationship between dynamic mapping and our focus on web based networks, one can turn first to Robert Darnton's efforts to map the communication circuits of pre-revolutionary France, which identify the need for dynamic mapping. As Darnton has stated "There were so many modes of communication, and they intersected and overlapped so intensively that we can hardly picture their operation." (Darnton 2000, 7).

Communications circuitry as related to e-texts and web sites are the focus of our dynamic mapping efforts and analysis. Arguably, the Web presents significant changes from the paper based publishing that is the focus of Darnton's research. Dynamic mapping offers an improvement in our capacity to visualize communications networks. Towards this end, communication circuits should be linked to a *re*-modernist Actor Net-

work Theory definition of a network from Bruno Latour (in relation to Ulrich Beck's definition of risk):

> *As to 'risk', it does not mean that we run more dangers than before, but that we are now entangled, whereas the modernist dream was to disentangle us from the morass of the past. A perfect translation of 'risk' is the word network in the ANT (Actor Network Theory) sense, referring to whatever deviates from the straight path of reason and of control to trace a labyrinth, a maze of unexpected associations between heterogeneous elements, each of which acts as a mediator and no longer as a mere compliant intermediary. For instance, you begin with a T-bone steak on your plate and you end up in the laboratory of a protein specialist showing you the tertiary structure of the now infamous prion, one of the possible causes of the so-called 'made cow' disease. But in the mean time you have visited European Commission bureaucracies, the cattle farmers' unions, quite a few hospitals, and participated in a lot of scientific meetings (Barry, 2001). In brief, you have traced a network – a network, to prevent any objection from people not familiar with our use of the word, being not a thing in the world but the path traced by the researcher equipped with an ANT methodology during his explorations.* (Latour 2003, 36)

The news space and issue network mapping cartography presented in this paper resides, we would argue, at the intersection of the two network concepts given above. The collaborative framework of this research is built upon Vannevar Bush's visionary insight that the path we take to our knowledge would become equally important to the findings themselves (Bush 1945).

The maps presented in this paper are unified by their focus on the Web and networks as an object of study and a call by the researchers to expand the definition of dynamic mapping in a more reflexive direction. They are further connected to one another at the level of the tools used to accomplish the maps. The cluster mapping performed in each case was based upon a ReseauLu (or "NetworkReader") visualization software backbone developed by Aguidel, while web harvesting techniques developed by the Govcom.org Foundation provided the data sets used in each case. The third category given above, information politics, is the meta-

level which addresses the digital and reflexively communal nature of both issue network analysis and news space analysis. Information politics makes clear that researchers using virtual methods must: a) make decisions that engage them in the politics of the object of study and b) actually feed results back into the virtual environment being studied. Thus web tools unify researchers and form communities even as these communities influence the future direction of web tool development and research networks. The reinsertion of maps created via virtual method into the trajectory of an issue being studied online can also influence the trajectory of the issue. Therefore, dynamic mapping shows a strong propensity towards reflexive understanding. The Information Design Research findings and North Korean news space findings presented in this paper were fed back to the appropriate expert communities during their production, along with insight gained into the utility of methodologies and tools. As this process is continuous in digital media, and a core facet of issue network research, it constitutes a basic level of information politics which is certainly dynamic and open to influencing the object of study. Interestingly, in both cases the study of networks through dynamic mapping elucidated the presence of the political. Having broached the overall framework of the paper, we turn now to a more detailed explanation of methods. The new economy is a world of work in progress shaping system dynamics, public policy and events on the ground. In short, the social dimension of communications theory can be improved by a reflexive definition of dynamic mapping.

News Spaces

A news space is created in new media by freely available news coverage related to a specific issue that can be accessed by any individual with an Internet connection. Since this coverage is ephemeral, we identify a space rather than a discourse in order to emphasize the dynamic nature of the content. News coverage ebbs and flows constantly, and freely available news spaces, such as those that can be found through GoogleNews, are dependent upon factors that are chronological as well as national, linguistic and geographic.

The chronological window when dealing with GoogleNews spaces is defined by the fact that the data set is created in thirty day units. Thus

the last thirty days of news are accessible, while older news leaves the data window in a manner characteristic of just-in-time e-texts. A news space is dynamic not only in the momentary production of news content, which is continual on account of the distributed nature of the system, but it is additionally dynamic in terms of its existence as a temporally determinate feedback system. News spaces need not be limited to freely available GoogleNews, as any news database can constitute a valid data set for the study of news spaces, such as LexisNexis or subscription based archives of e-texts.

The national and linguistic parameters of news spaces come about as news content is tailored to different national identities, with the individual news providers residing physically in a given state. The dynamics of the linguistic parameter are evident insofar as a single language may represent several groups, such as French in relation to France and Quebec, or Chinese in relation to Hong Kong, mainland China, and Taiwan. News spaces thus exist physically, as an articulation of the geographically determinate location of the news provider and simultaneously virtually as networks within the operational closure of the Internet as a communications system. Therefore news output from vastly different (and distant) news providers form networks in a news space.

An example of this kind of dynamic news space is the one surrounding North Korea (Figure 1). The dynamic map of the news space from Google News was created using the cluster mapping technology developed by Aguidel SA, Paris.[1] The search terms used to cluster the sites were: "North Korea" plus "axis of evil," "regime change," "human rights," "war," "reunification," "nuclear," and "famine."

Analysis of the resulting map yielded several insights about the online coverage of issues in North Korea:

1. There are significant differences between the terms used to discuss North Korea in the various media.
2. Several of the sites on the map coupled the terms "Regime Change" and "Human Rights," based on an initial press release from the Whitehouse.org. One of the sites that picked up the terminology was Frontpagemag.com, which is a news outlet from the extreme right.

3. Three major news sites connected "Regime Change" with "War." These sites were Fox News, Newsweek, and Asia Times Online.
4. The terms "Regime Change" and "Reunification" are not coupled by western media, although they are in Asian news outlets. Reunification is thus identifiable as a regional rather than global issue.
5. Only CNN links "Regime Change" with "Famine," which marks a difference between their coverage and the coverage provided by other American media outlets. Since this linkage is both practical and meaningful, it is an instance of a site taking a more balanced approach to the North Korean issues.
6. Aljazeerha.info links Axis of Evil to War, as does Stuff.co.nz
7. In terms of communications-based public diplomacy, Radio Free Asia is present, linking North Korea to Human Rights. Meanwhile Voice of America links North Korea to Human Rights and Nuclear. Radio Free Asia was established originally by the Central Intelligence Agency (CIA) of the United States of America, and Voice of America is a long-standing public diplomacy tool of the United States dating from World War Two (Ungar 2005, 8).

One key to understanding and mapping these networks is to appreciate that news spaces are driven by issues. A given issue results in dynamic news coverage, and the cartographer must react dynamically as a result.

The means of finding news content is to query the dataset, using a set of distinct terms related to a particular issue, what is colloquially referred to as "Googling." Through launching queries we obtain the dataset that constitutes a news space; a news space is therefore the intersection of an anchor issue and a physical news production network in a virtual space. The analysis of news spaces is carried out through a combination of web tools which constitute a new media cartographer's toolbox.

Zelman's *Media Analysis Toolbox* (Figure 2) serves as an excellent example of these dynamics (Zelman 2002, 144). Cartography is unified in the assertion *that there are a plethora of subjects worthy of mapping* and as the scope of these subjects expands while the means of mapping concentrate, our ability to define the cartographer's task and the consequences of dynamic mapping will inevitably become more refined.

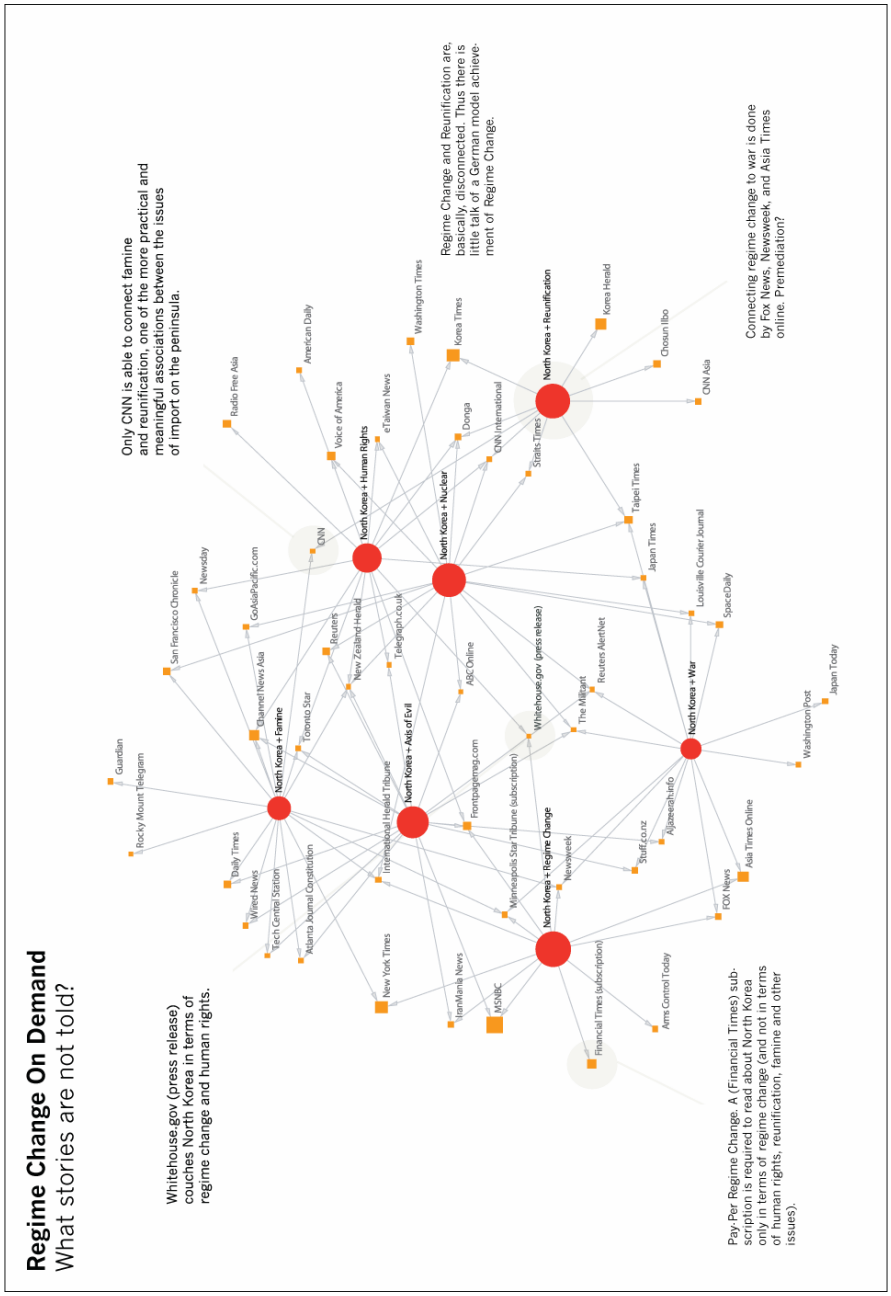

Regime Change On Demand
What stories are not told?
Whitehouse.gov (press release) couches North Korea in terms of regime change and human rights.
Only CNN is able to connect famine and reunification, one of the more practical and meaningful associations between the issues of import on the peninsula.
Regime Change and Reunification are basically disconnected. Thus there is little talk of a German model achievement of Regime Change.
Connecting regime change to war is done by Fox News, Newsweek, and Asia Times online. Premediation?
Pay-Per Regime Change. A (Financial Times) subscription is required to read about North Korea only in terms of regime change (and not in terms of human rights, reunification, famine and other issues).
North Korea + Human Rights
North Korea + Nuclear
North Korea + Reunification
North Korea + Famine
North Korea + Axis of Evil
North Korea + Regime Change
North Korea + War
Guardian
Rocky Mount Telegram
San Francisco Chronicle
Newsday
GoAsiaPacific.com
Channel News Asia
Daily Times
Wired News
Tech Central Station
Atlanta Journal Constitution
Toronto Star
New York Times
IranMania News
MSNBC
Financial Times (subscription)
Arms Control Today
Reuters
New Zealand Herald
Telegraph.co.uk
International Herald Tribune
Minneapolis Star Tribune (subscription)
Frontpagemag.com
ABC Online
Whitehouse.gov (press release)
Newsweek
Stuff.co.nz
Aljazeerah.info
FOX News
Asia Times Online
The Militant
Reuters AlertNet
Washington Times
American Daily
Radio Free Asia
Voice of America
eTaiwan News
CNN
Korea Times
Donga
CNN International
Straits Times
Taipei Times
Japan Times
Louisville Courier Journal
SpaceDaily
Washington Post
Japan Today
Korea Herald
Chosun Ilbo
CNN Asia

Figure 1. Product of Workshop: Social Life of Issues 8, The News About Networks. Nov. 03. Analysis by Andrei Mougotov and Zachary Devereaux with ReseauLu. Data from Google News Sept. 15 – Nov. 15, 2003. Design by Anderemedia.nl, see <http://www.issuenetwork.org> (Devereaux & Jiang 2004, 117-125).

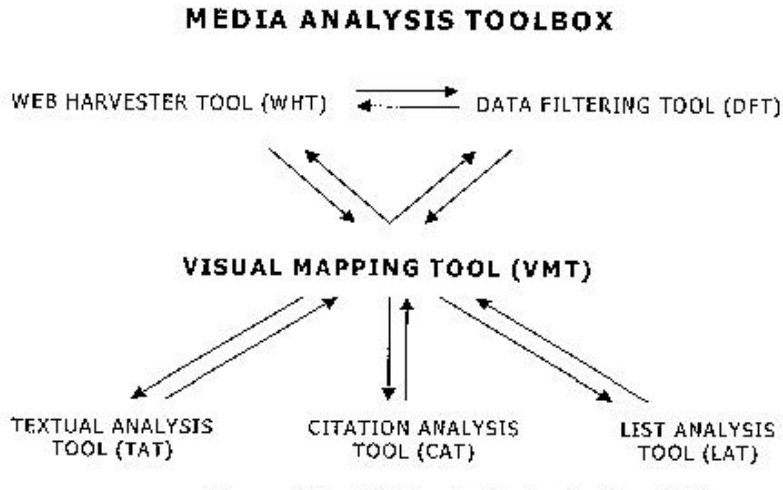


Figure 2. Zelman's Media Analysis Toolbox.

Issue Networks

As Noortje Marres has commented, "Issues call a public into being, and public involvement in politics stands in the service of these issues." (Marres 2005, 216). The attempt to study these communities has been motivated by a focus on networks as the object of study. Research using the cartographic tools profiled in this paper treats issue networks on the Internet existing in relation to a host of themes. Such issue networks are often articulated by mapping the co-linkage behavior of different actors on the Internet, but they can also be found in other ways such as news space mapping or information politics.

The basic idea of mapping networks as they are presented on the Internet applies to both news spaces and issue networks, as it is the exist-

ence of the Internet, with both its physical and social architecture, that supports cartography related to the subject. As explained above, news spaces involve networks similar to Darnton's communications circuit, in the form of the news gathering apparatus and readerships. However, it is an effort to understand the ever-changing nature of international civil society as presented through the Internet that motivates issue network co-linkage analysis mapping.

What should be emphasized is that rigorous cartography can lead to insights involving complex and puzzling cultural constructs. Our example of an issue network map is a component of a larger project studying the online presence of the information design and visualization research communities. For this phase, we used the IssueCrawler software from The Govcom.org Foundation, which allows the user to input several starting sites. The crawler then automatically follows the links provided by the sites, in order to determine which sites are linked to by the starting points, and which sites are linked to by the second order URLs. To simplify the visualization, the starting points can be omitted from the display.

Our starting points involved nine sites, which can be divided logically into groups of three. The first three represent research centres: the Communication Research Institute of Australia, the Human-Computer Interaction Lab at the University of Maryland, and MIT's Media Lab. The next three are sites of professional organizations: the International Institute of Information Design (IIID), SIGGRAPH, and the Graphic Designers of Canada. The third set are research organizations in industry: HP, IBM and Nokia.

Clearly delineated in Figure 3, the first information design research issue network, we find a nexus of the US-led military-industrial complex (lower right-hand quadrant).

Somewhat surprisingly, NASA is also present, through its connections to Macromedia. The constituents of the military-industrial nexus are interesting in their own right, including organizations such as the National Science Foundation, the White House, DARPA and Defenselink. For background on NASA amongst this expanding and evolving cluster we can turn to Mosco:

> *In 1958 Eisenhower gave primary responsibility for manned space exploration to an ostensibly civilian agency, the National Aeronautics and Space Administration (NASA). Amendments to the NASA act subsequently subordinated the civilian programs to military requirements.* (Mosco 1989, 144)

In order to see how the network changed over time, we ran the same crawl twice: first in July 2004, then again in October the same year. The results, shown in Figures 3 and 4, were strikingly different. Whereas the first map shows only a single university site, the second has a large cluster of universities. We can only speculate about the reason for this variation. It may be that the summer is a time of web site revision, and some crucial linking site was not up and running. It may be that the crawler itself met with some unresolvable condition in the earlier crawl but not in the later one. It may be that the links on the sites were modified in the interim. However, the latter map suggests that the ".com - .org - .gov" network was more articulate in the information design research issue network.

What the two crawls share is a clear subset of sites that might be characterized as belonging to the military-industrial complex. Since none of these kinds of sites were included in the starting points, it seems reasonable to assume that they are present as contributors to the research carried out by the other institutions. The other sites on the maps are highly interconnected, and represent a balance of NGOs and corporations, as indicated respectively by the extensions ".org" and ".com." Importantly, the sites acting as gateways between the military-industrial complex and the information design research community were not static but changed over time. Thus the dynamic nature of the colinkage network is rendered visible, shedding light on the interface between the military-industrial complex and the corporate/educational research community.

Dynamic Mapping

When considering news space and issue network maps, important dynamic features can be found in the algorithmic visualization backbone and the formatting processes related to the maps themselves.[2] The maps

are digital, like GIS maps, and as such are scalable, artifacts that can be explored through zooming, scrolling, projection and the like. Variables in the maps can be selected or deselected, for example in colinkage maps each node is a dynamic link to a web site, while nodes are colour coded by suffix, and linkage networks of a specific suffix can be activated or deactivated to reveal the inner constitution of the network image.

It is also important, at this point, to emphasize the chronological component of dynamic mapping. The news space and issue maps in this paper are snapshots in time, and we have discussed the "chronological window" of the data sets we are committed to, following Susan Hockey's advice to "invest in the data" which may be extended to an understanding of freely available online news as a public good on the global scale (Hockey 1999, 17-36). That said, news space data sets and their accompanying maps have been constructed with an eye to viewing issue network changes over time. The same is the case with regularly scheduling issue network maps. In this way, several snapshots of a network instantiation can be compared in an evolutionary perspective.

Figure 3. There is only a single university site on our first issue crawl visualization for information design and visualization research (July 2004). The military-industrial complex, on the other hand, was present (lower right), even though there were three university sites in the crawl starting points, and no military sites.

Figure 4. In our second crawl using the same starting points, produced three months after the first (October 2004), the universities reappear in force (top and top right).

In addition, it should be noted that maps of this kind emphasize flows. Greg Elmer's work on profiling and feedback in the personal information economy shows how our behaviors are continually mapped in a social sense (Elmer 2004, 49). Thus dynamic mapping is not only an issue within a given digital map, but between maps in a series. Requests to increase the speed of news mapping technology have been made by many groups: political parties, researchers, and journalists. Therefore

timeliness and capacity to map change over time are key elements of the definition of dynamic mapping.

That socioeconomic networks and power relations are irreversibly involved in quantification is made clear by Bruce Curtis, who shows that the enumeration of reality is intertwined with control of the social (Curtis 1994, 418). What could be more linked to the health of the state than its capacity to map and enumerate?

Expanding the capacity to map and the real achievement of dynamic mapping is a valid goal compelled by the evolutionary trajectory of cartography as a system (or more accurately *systems*), regardless of whether one is compelled to advance the growth of cartographic philosophy or simply the positivist accuracy of maps. Dynamic mapping, then, also includes the development of conceptual frameworks for cartography that can be considered as part of a turn past the social, and beyond the postmodern (Latour 1992, 277).

And here we turn again to the work of Andres Zelman, concerned with mapping the Self Organization of the European Information Society (SOEIS) initiative. Zelman's work is important for identifying the scientific community, their communications, and citation patterns as an object of study in and of themselves. Zelman states an expectation that has animated this paper throughout:

> *Information and Communication Technologies (ICT) affect the ways that scientists communicate, perform their research, and contribute to the production of knowledge.* (Zelman 2002, 51)

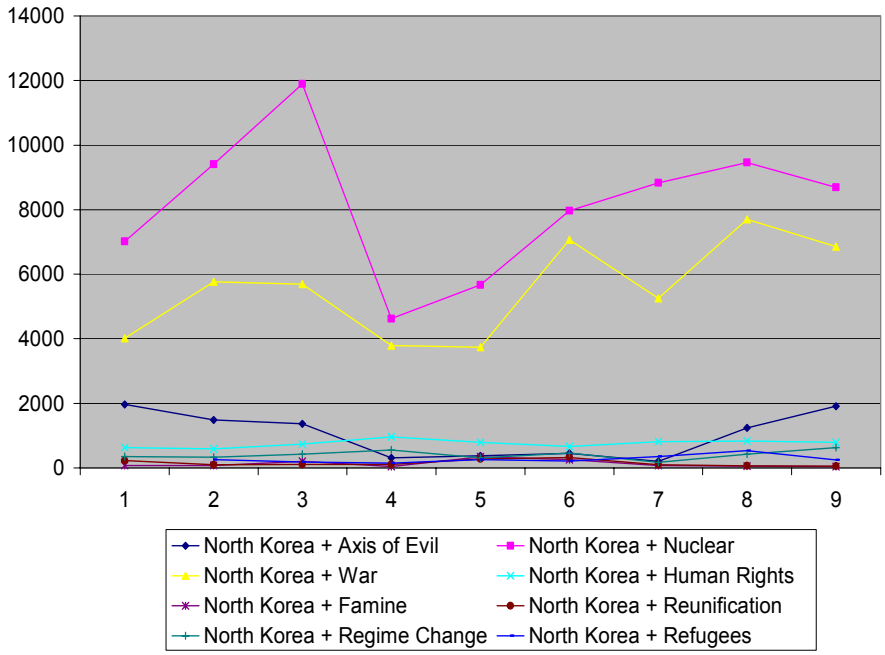
What Zelman makes clear as a feedback dynamic between ICTs and researchers is being experienced by greater numbers of researchers day by day. As virtual methods and research groups become increasingly distributed in nature, certain reflexive patterns occur and should be addressed. The insight giving momentum to the process is that dynamic mapping may be applied to multiple subjects by multiple disciplines. As a result, methods are widely disseminated. However, a bifurcation process is part and parcel of this spread and forms part of research output being fed back into the developmental trajectory. In this over-simplified account, we see researchers sharing findings arrived at with web tools,

but not only findings. Software knowledge, problem issue identification and innovation concepts are also continually shared. Arguing for a reflexive turn in the definition of dynamic mapping simply means allowing for such processes in conceptions of what modern cartography is all about.

This assertion holds for the information design research community. The North Korea news space mapping project has been witness both to the automation of steps in the cartographic system, and has additionally involved efforts to visualize the flow over time of news content related to the central queries. The initial "Regime Change on Demand" map with its central seven queries is shown above (Figure 1), and this map has been followed by data collection and visualizations over time. This type of cartography is also dynamic in that the cartographer is actively engaged in the construction of automated processes as well as the combination of various web tools provided by different sources. Thus the originally manual act of collecting Google News returns related to North Korea based queries became an automated process in the form of the Google News Scraper. Modification and advance of the cartographic instruments is itself dynamic, and involves visualizations performed in several software platforms.

For example, the original Google News Scraper did not give the total number of returns related to a query, the "meta-returns," and therefore this data was collected and visualized over time in relation to the central North Korea queries. Figure 5 is a line graph articulation of the North Korea meta-return data.

Through such visualizations, we have query-related information important to the mapping of the news space over time that is not yet incorporated into the cluster map visualization. This data comes from a central step in the cartographic technique of our maps and approaches the queries mapped in a relevant chronological manner. The depiction is a graph rather than a map, but has important reference to the map set.



North Korea + Axis of Evil	1970	1480	1370	311	373	445	202	1240	1910
North Korea + Nuclear	7020	9410	11900	4620	5670	7970	8830	9460	8690
North Korea + War	4020	5770	5690	3790	3740	7070	5250	7700	6860
North Korea + Human Rights	632	590	737	956	795	664	811	835	794
North Korea + Famine	78	76	199	38	340	256	79	50	46
North Korea + Reunification	221	100	103	107	279	323	100	69	56
North Korea + Regime Change	348	331	432	555	309	455	169	424	633
North Korea + Refugees		254	181	147	255	214	348	529	250

Figure 5. North Korea New Media News Space Meta-Return Graph. The left axis of the graph shows total numbers of returns for the queries listed below over the course of several months depicted on the bottom axis.

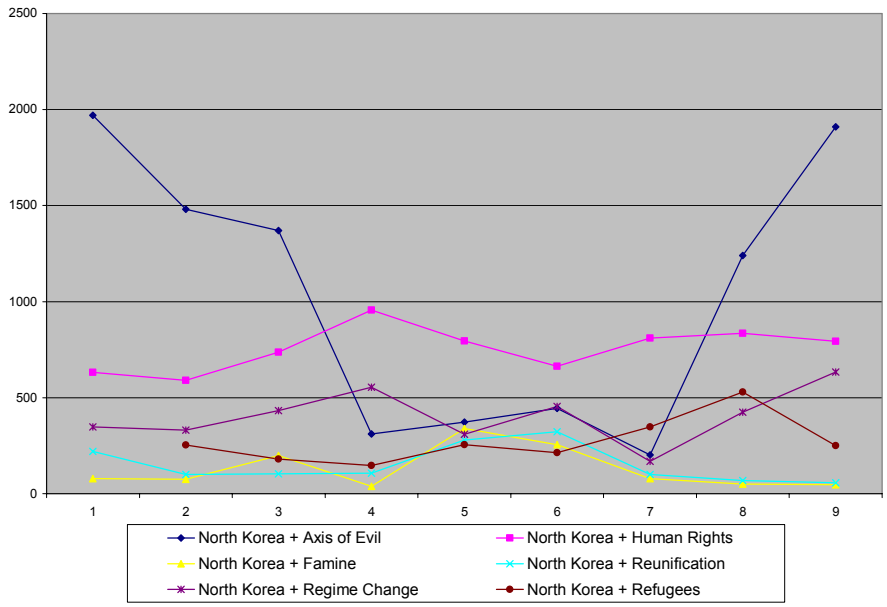


Figure 6. This graph shows the same data at a higher level of granularity, minus the queries "War" and "Nuclear" which are seen to dominate in Figure 5. Notice the decline in the resonance of "Axis of Evil" which, we suggest, was a factor leading to the recent replacement of the term with "Outposts of Tyranny."

If Figure 1 could be endowed with the capacity to translate the fluxuations present in Figure 5 and Figure 6, the visualization techniques would be more dynamic in nature.

The point is that dynamic mapping involves the development of cartographic instruments that are applied by a map-making community to different issues. This process forms an evolutionary feedback loop which has social as well as technical consequences. This holds for the issue

network and news space cartography community, as maps are generated in a communal archive, and can be viewed and analyzed by any individual in the research community. Thus, mapping is "going on before your eyes" and logging into the colinkage mapping engine itself entails being aware of other cartographic efforts.

Finally, the digital nature of the objects, links and words being mapped means that different types of maps created with different tools are a continually developing aspect of research. Thanks to an impromptu, brief and dynamic cross-platform collaboration between two research teams, Figure 7 came into being through analysis of blogstreet output.[3] At first glance it may be difficult to think of the fixed phrase graph as a map, but the argument can be made that it is one. In the first case Figure 7 represents semantic networks, and as such the graphic interface presents "…the network of "familiar paths" that constitute a person's language." (Shawver & Kennedy 2004, 112) Considering this word map from a technical standpoint sheds some insight on this claim. Issue network colinkage maps are made in the same digital tool suite as this word map–they are both Scalable Vector Graphics (SVG). Since they use the SVG format, both Fixedphrase maps and IssueCrawler colinkage maps can be navigated and explored, which means that paths are not only identified within networks, but that they can also be followed by the researcher. This results in both applications of interactivity technology in an (at least) dual knowledge production function of dynamic mapping: a) the researcher derives orientation and graphic meaning of information from the map (Bertin 2001, 5) and b) the researcher enacts a dynamic exploratory component, familiar in the colloquial as "surfing" or "exploring" that occupies an increasingly significant role in knowledge production. Thus we see the digital as a common unifying factor across various visualizations and maps presented here with an eye to dynamic mapping. In terms of more concrete findings, Figure 7 reveals meanings of the term "information" in our data sample associated with, in decreasing significance, the international institute of information design, the resonance in the network of a particular blog "nathannewman.org," some benign product information regarding functionality, portable mobile management, and privacy concerns.

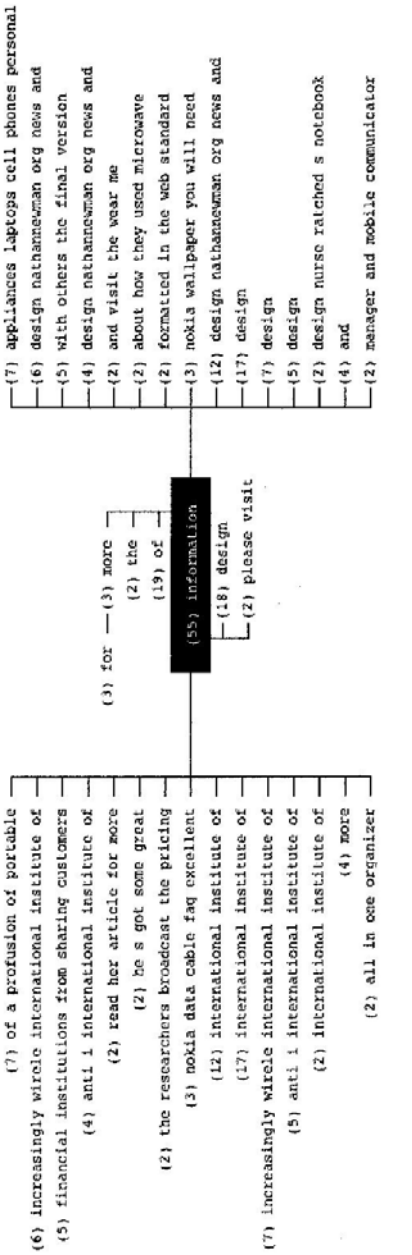


Figure 7. Fixed Phrase Graph of the term "Information" with data from <http://www.blogstreet.com> – 'Information Design Research' returns, summer, 2004. By Gary W. Shawver, Oliver Kennedy (New York University), Stan Ruecker and Zachary Devereaux.

Conclusion

Leydesdorff comments insightfully regarding the utility of dynamic visualization:

> *Spatial representations provide us either with static pictures of the multivariate complex (like snapshots) or they depict the historical trajectory of a system using a geometrical metaphor (e.g. Shinn 1987; Haraway 1988). One cannot represent change in the data and in the relevant dimensions for organizing the data without changing one's reflexive position, and this leads to confusion unless the representation itself can be made dynamic (as in a movie).* (Leydesdorff 2003, 28)

In the case of the information design research community maps in particular, dynamic qualities in cartographic interactivity have been demonstrated by this study. Our information research design maps are an example of a larger engagement of interactive maps by researchers, who are brought together by web based tools. Thus developing trajectories of different natures compel an expansion of the definition of dynamic mapping and have characterized the researchers' experience with dynamic mapping.

Firstly, the "movie" component that Leydesdorff identifies is perhaps the most prevalent conception of what dynamic mapping will be. There is no doubt that such interactivity and flexibility of visualization is a goal in many quarters. But dynamic mapping is not limited to an imitation of motion photography. Indeed, the motion photography parallel often overshadows other aspects of interactivity and dynamic mapping evolution. Animated cartographic visualization is eminently foreseeable, and this compels an examination of what dynamic mapping means.[4]

A second dynamic tendency is found in the evolution of dynamic mapping tools. This is to say that the development of dynamic mapping technology is strongly linked to feedback processes. Hence tools both come together and are applied to diverse subjects by researchers in a manner that is well described by actor network theory. This paper is an example of such interaction, and the analytical focus of the network traced by the researchers could range from social networks to the software tools themselves. This aspect of dynamic mapping should be

understood as a fruitful and interdisciplinary process of cross-pollination, one that compels interactivity and dynamism in both tools and methodology. Such an understanding of dynamic mapping is made even more compelling by digital concentration, as evidenced by our capacity to apply tools developed independently of one another to data sets obtained in the pursuit of various research agendas. Such was the case with our fixed phrase graph, and the dynamic nature of both the data set establishment and its reorganization is apparent along the parallel researcher and visualization dimensions.

Dynamic mapping is coming online both popularly and in academia. The literal depth of information promised by such developments is encouraging. But a reflexive understanding of dynamic mapping as a research model with unique characteristics is necessary and worthwhile. This essay has argued that a definition of dynamic mapping should be expansive, including the characteristics of approaching information in flux through varying new cartographic methodologies. As cybermetrics and epistemology develop apace with multiple visualization and mapping techniques, the conception of digital systems, communal authorship, and a theory of place in the virtual environment form an increasingly relevant heuristic (Viégas, Wattenberg & Kushal 2004, 582 ; Zook & Graham 2005). Mapping networks is a task that can be considered dynamic cartography, and should be understood as a central part of modern mapping. The parallels across disciplines and the potential of digital cartography should not be underestimated, and maps as artifacts and quantifications of networks will continue to play an increasingly important role in academic research. When hidden data relations are made visible through automation, and opportunities for action in the virtual landscape are created, dynamic mapping is a success. Such is the nature of our expanding capacity to treat in a cartographic manner *information politics* (Rogers 2004, 22).

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Notes

1. <http://64.246.22.134/aguidel/english/admin/index.php?count=10> [2006-01-22].
2. "The ReseauLu algorithm (e.g. www.aguidel.com) optimises the positioning of objects in a two dimensional space focusing on the existence of "strong" statistically relevant ties. The initial binary matrix of links (or matrices of co-occurrences) can be represented without deformation only in a multidimensional space. To minimize the deformation of the final map in a two dimensional space, the software uses a dynamic positioning simulating the interaction between objects. It does so through a three step optimisation process:
   (i) global initial positioning of the object vis-à-vis all the other objects in the space;
   (ii) micro-optimisation of the positioning of the object vis-à-vis the other objects to which it is directly connected ("network neighbours"); and
   (iii) meta-optimisation of groups of highly connected objects ("clusters").
   The optimization process depends on explicit rules defining symmetry properties, structural equivalence of points inside the structure, centrality and "between-ness" of objects." (Dr Andrei Mogoutov, personal communication.)
   The final map has no axes. The orientation of the map is determined by the three most connected or largest objects (in our examples the largest). It provides a triangular vision of the space with the first on the left side, the second on the right, and the third largest on the top.
3. At the "Face of the Text" conference in November of 2004, blog scrape research by Stan Ruecker and Zachary Devereaux from the University of Alberta was analyzed and articulated by the fixed phrase graph generation software of Gary W. Shawver and Oliver Kennedy at New York University. The social consequences of web archivism for cartographers as an online community constitutes a good point of departure for future research into the wave of digitization in the North (or above the digital divide).
4. With Google's recent inclusion of satellite imagery in its GoogleMaps service, once again the political nature of design became apparent, and was recognized by members of the Dutch Parliament, as imagery and distance calculations that could be performed with the system raised fears of a security threat that could be taken advantage of by terrorists. (Sterling 2005)

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