ORGANIZING THE NEO-GEOGRAPHY COLLECTIONS WITH ANNOTATED SPACE-TIME PATHS

Menno-Jan Kraak & Nannan He
ITC
POBox 6, 7500 AA Enschede, the Netherlands
kraak@itc.nl

1. Introduction

In combination with other Web 2.0 facilities such as wiki's, blogs, photosharing, podcasting, social software like facebook, folksonomy and (geo)tagging, as well as rss feeds many people contribute to the collection of geo-referenced materials. The data are made available via the web using mash-ups on top of Google Earth / Google Maps and alike. This trend has been 'classified' as neo-geography, and has resulted in a tremendous increase in the availability of geo-related data. This has a major impact on maps on the web. Again we can witness an increase in web map use, but the problem is that for certain areas of interest all available geo-tagged information is plotted together resulting in chaotic and overloaded maps. If it is assumed those maps have to be made more readable what can be the strategy?

Often these items, such as photographs and video's are collected during trips. More and more those trips are registered with a GPS and as such available as trajectory or Space-Time Paths (STP). To create some clarity in the large and chaotic information displays the objective is to link geo-tagged information items to the STP. This results in so-called Annotated STP's which can be displayed either on a map or in the Space-Time-Cube.

This will not immediately solve the map overload problem. However, with a specific visualization strategy the clarity might be improved. The functionality of the Space-Time-Cube environment will be couple with Shneiderman's visual information seeking mantra (1996): 'overview first, zoom/filter and details on demand'. The design of the graphic representation of the annotation will be made dependable on manta's three levels. The specific user task (questions) will guide one through the levels and will make selected functionality available.

As annotations, static images (photo's, drawings, diagrams and maps), text, and dynamic displays (video, animation, sound) are considered. They are linked to the STP based on the time stamp or geo-tag, and in some cased their geographical names.

2. Neogeography

According Turner (2006) "*Neogeography is about people using and creating their own maps, on their own terms and by combing elements of an existing toolset. Neogeography is about sharing location information with friends and visitors, helping shape context, and conveying understanding through knowledge of place*". Not every one is using the term Neogeography because this fast developing 'trend' still has to mature. Elwood (2008) describes the emerging options for research and practice in this field. Other terms found are user generated content, collaboratively geographic data, volunteered geographic information (Goodchild, 2007). There is also the debate between what could be described the formal en informal worlds. One could argue that the formal world makes use of rules and the spatial data infrastructure, while the informal world behave as described in Turner's definition above. People collect based on individual or community rules, if rules are involved at all. 'Collecting' photographs during a trip is an example. Everything of interest is 'stored' by an individual and later put on website like flickr or in blogs. This with the purpose to share the

experiences during the trip. In the formal world similar operations take place, but often following some rules. For instance fieldwork by a geologist or soil scientist is also characterized by trips during with location and their attributes are stored. To bring these to worlds together is an interesting challenge since data from informal world - what could be called neogeography collections - contain lots of useful information. However, there is an ongoing debate on the credibility of this informal data (Flanagin & Metzger, 2008).

From a cartographic perspective the maps created in a neogeography world look chaotic (see Figure 1). They do so because maps are effective only when they present a selection from reality via a well design symbolization, and neogeography-maps tend not to be based on specific design rules. A question to ask is if this is problematic? From a traditional cartographic perspective the answer is likely to be yes, but what do we know of the 'multi-tasking' young generation. However, even in our formal word one has to deal with chaotic information and displays, and here cartographers work with other disciplines on geovisual analytics techniques to make sense of the chaos which is just like neogeography collections often incomplete and uncertain. Both worlds want to make sense of their data. The difference might by the in the informal world individuals collecting the data use the maps to exhibit their 'adventures', and community looks at collective adventures, while the data collections in the formal world are used to make 'serious' decisions. But it would be wrong to neglect the neogeography collections for serious use.

Figure 1. Maps with neogeography collections (based on google layers)

In this paper a visual representation is presented that can deal with neogeography collections and tries to bring order in an organized chaos. Here it is assumed the information collected is linked to a trajectory followed by an individual. As such the collected information is seen as annotation of this path. Annotations can be classified according their nature in static and dynamic annotations. Examples of static annotations are photographs and sketches, while video and sound are examples of dynamic annotations. Of course it would be possible to map those tracks with their annotation in a map (see Figure 2) but in this paper the Space-Time-cube was selected because this is considered useful for visualization of trajectories (Kraak, 2003).

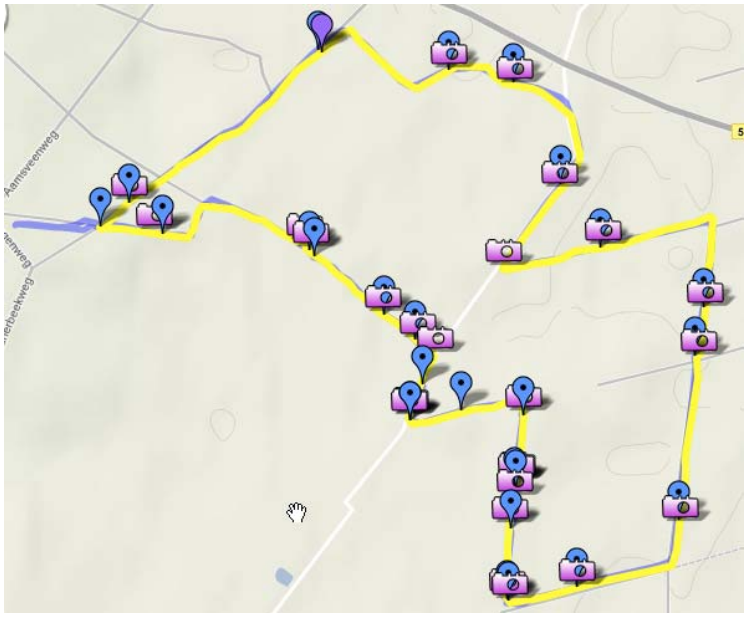
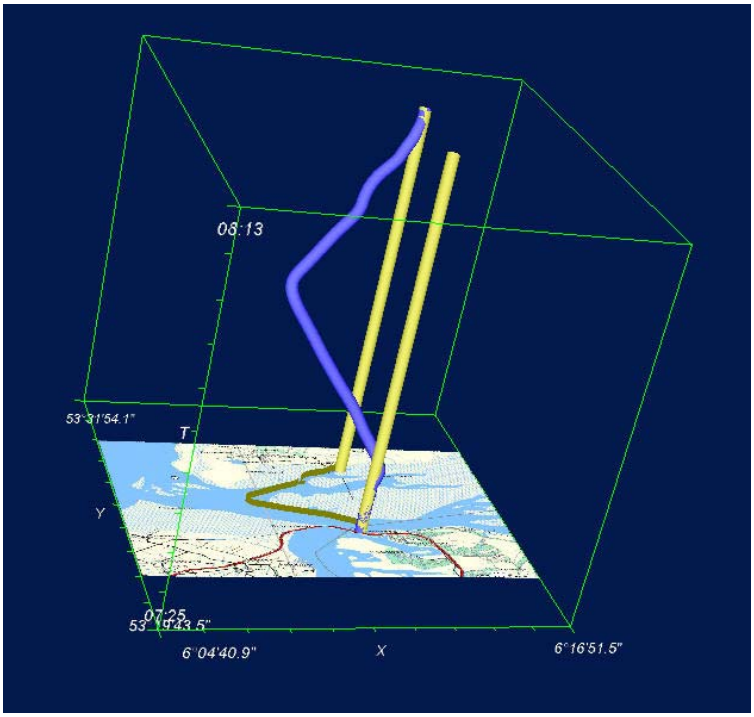


Figure 2. Map with annotated paths

3. Space-Time-Cube

Time-geography studies the space-time behaviour of human individuals. In their daily life each individual follows a trajectory through space and time. Hägerstand's time geography (1970) sees both space and time as inseparable, and this becomes clear if one studies the graphic representation of his ideas, the Space-Time-Cube as displayed in for instance Figure 3. The cubes x and y axes represent space, and the z axis represents time. This allows the display of trajectories, better known as Space-Time-Paths (STP). In practice these paths are influenced by constraints. The vertical lines



indicate a stay at the particular location which are called 'stations'.
Figure 3. Space-time-path: path, stations and path's footprint

The time people meet at a station creates so-called ‘bundles’. The near horizontal lines indicate movements. The STP can be projected on the map in the cube, resulting in the path’s footprint. Hence, it provides a behavior view for the spatio-temporal process, and can represent the movement of any kind of object.

4. Paths and annotations

In many early applications of the STC the path is only a single line and the complaint was that the STC concept was unable to deal with attribute data. This is not true. It is possible to add qualitative and quantitative characteristics to a path’s appearance. For instance the bus lines of a city’s public transport network could be distinguished by a different colour and the amount of passengers by the thickness of the line. A similar approach can be applied to stations.

The items of the neogeography collections are geo-tagged to be able to map them. They can be linked to the path based on their coordinates (finding a match between the item’s geo-tag and the path’s coordinates). A match could also be made based on the time-stamp of both the item and the path, but only if one is sure the element have a location near the path. Alternatively a link could be made based on geographical names. The annotations linked to the STP (often GPS tracks) can be considered a kind of stations. I

5. Implementation

The design of the symbols representing the items in the space-time-cube and the their paths has been done based in the level of detail one gets applying Shneiderman’s visual information seeking mantra.

On the overview level the annotations are linked to the path represented by different geometric symbols, changing in shape and colour depending on the category. With many paths and annotation the view remains overloaded. The zoom/filter takes place based on questions such as which?, where?, what? and when? (see figure 4). Filtering is attribute based. One can filter based on paths or on a particular annotation (e.g. photo’s only). The zoom operation is based on geometry and time. On can select an single location or and area, or a moment in time or a time interval. At this level of detail the annotation will be displayed as icons or geometric symbols. On the detail on demand level the full annotation will be displayed. The photographs and video’s will pup-up in a separate window. See figure 4

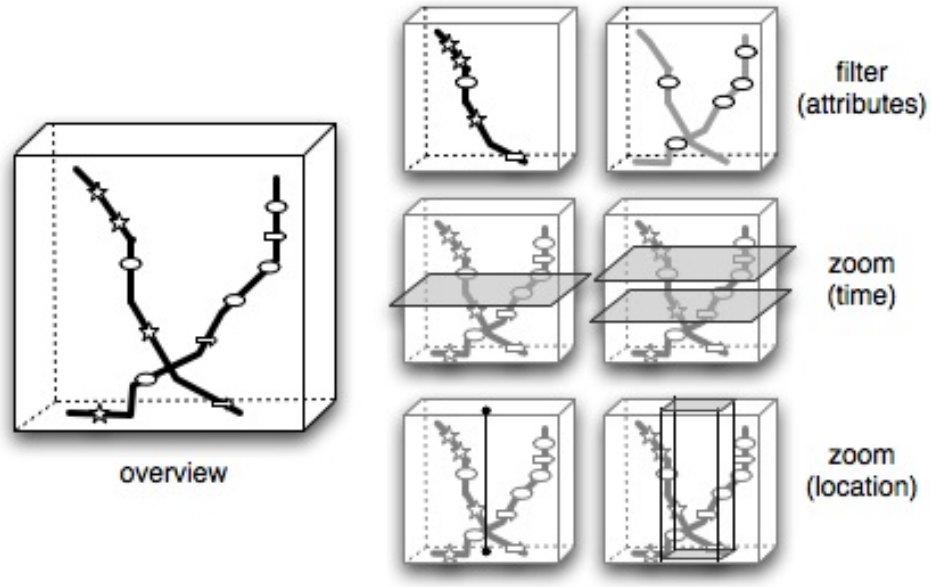


Figure 4. Applying the visual information seeking mantra. From overview, via zoom and filter to details on demand.

Based on these conceptual ideas a prototype has been created in a coordinated multiple view environment. The base for the software has been the open source uDig GIS with a plug-in for the space-time-cube software. To demonstrate the functionality a case study has been developed based on a gps track and waypoint representing a trail trough the nature area Aamsveen on the Dutch-German border near Enschede. During the creation of the track other data (photo's, video's etc) have been collected. Figure 5 shows several snapshot of the three-dimensional interactive space-time-cube with the case study data.

6. Discussion and conclusion

A limited usability test has been conducted to judge the effects of this approach. Questions such as (1) Is the proposed STC environment able to visualize annotated space time paths successfully? (2) How is the accomplishment of Shneiderman's Visual Information-Seeking Mantra? (3) Is the proposed space-time-cube visualization environment capable to answer the spatio-temporal question by incorporating the exploratory functionalities? (4) What are the participants' preferences regarding to the available tools and options? The outcome was positive, but more usability testing is required to be able to give a serious report.

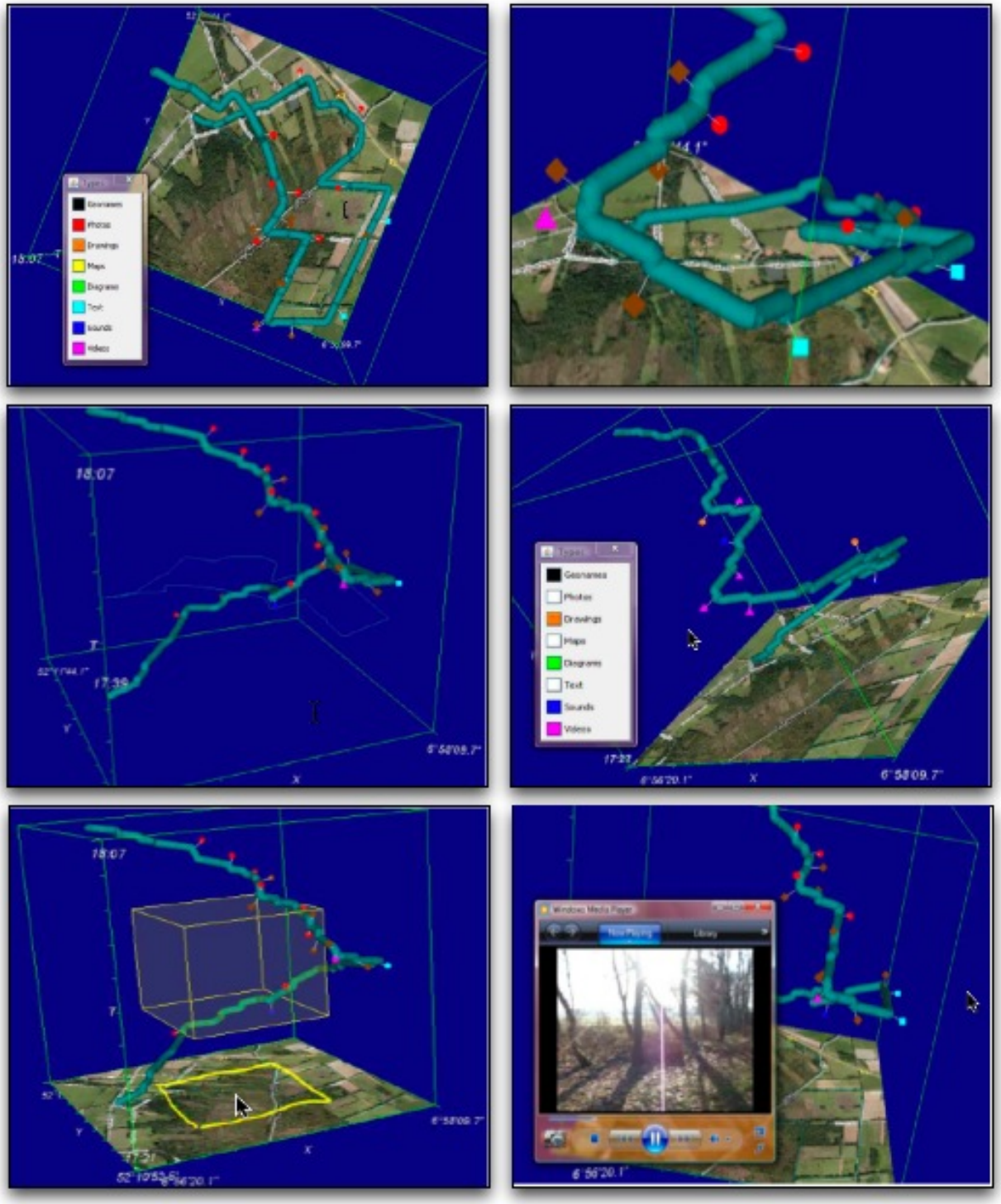


Figure 5. The annotated space-time-cube at work: a) view from the top; b) details; c) slected path; d) select according attribute; e) select by time (vertical) and space (horizontal); f) details: playing a video.

References

Elwood, S. (2008). Volunteered geographic information: key questions, concepts and methods to guide emerging research and practice. GeoJournal vol. 72, no 3/4, pp.133–135

Flanagin, A.J. & M.J. Metzger (2008). The credibility of volunteered geographic information GeoJournal GeoJournal vol. 72, no 3/4, pp. 137–148

Hägerstrand, T. (1970). "What about people in Regional Science? ." Papers in Regional Science vol .24, no 1, pp. 7-24.

Goodchild, M. (2007). Citizens as sensors: The world of volunteered geography. GeoJournal, vol 69, 211–221.

Kraak, M. J. (2003). "The space-time cube revisited from a geovisualization perspective." 21st International Cartographic Conference: 1988-1995.

Shneiderman, B. (1996). The eyes have it: A task by data type taxonomy for information visualization. Proceedings IEEE Symposium on Visual Languages, Boulder, Colorado, IEEE Computer society.

Turner, A. (2006). An introduction to neogeography. Sebastapol, CA: O'Reilly Media.

(this paper should be considered an extended abstract; due to a harddisk failure in the week of the submission deadline the authors regret this was all what could be composed)