The *GeoSocialApp*: A Visual Exploratory Data Analysis Tool For Spatial-Social Network

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Introduction

A growing number of researchers realize the potential application of social network analysis to geographically embedded networks and flows such as population migration and international trade. Although either statistical methods or visualizations has been used to explore this area, discovering previously hidden patterns in complex datasets with spatial and social components remains a challenge. Our strategy designs a novel geovisual analytics tool, the *GeoSocialApp*, with a tight integration of statistics and visualization to facilitate insight gain.
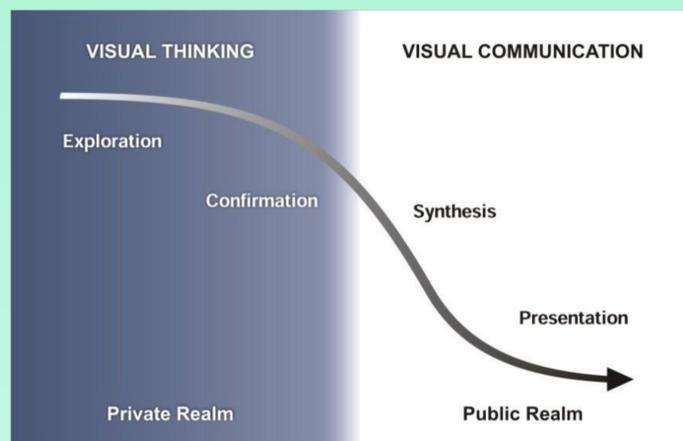

Figure 1: Scientific research process using geovisualization after DiBiase [1].

Methods and Data

The tool presented here consists of three linked components: (1) network space, (2) geographical space [3], and (3) attribute space [3]. Each of these performs a specific task, and can coordinate with other components to facilitate the insight gaining process.

We use the import and export data in current U.S. dollars among 192 countries in 2005 as a case study test of this tool. These data were extracted from the CorrelatesOfWar Database [2]. Countries are the nodes of the network and a link between two countries represents a trading relationship with monetary values more than 0 dollar.
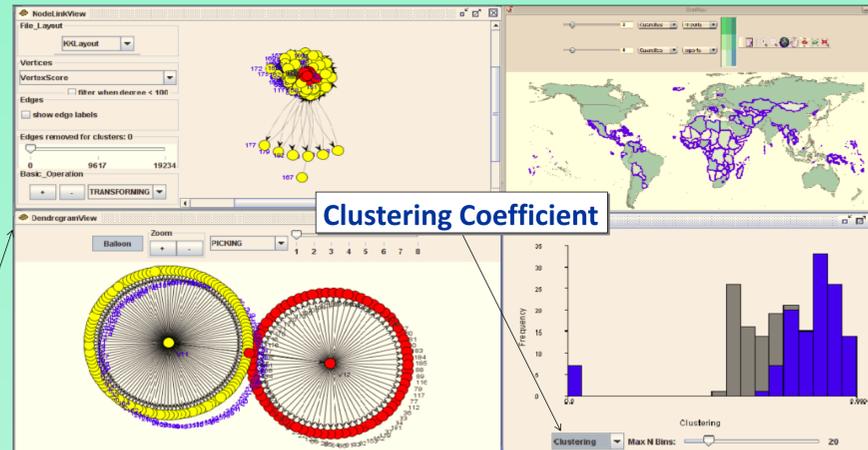

Figure 2: Exploring process and hypothesis development: node-link, dendrogram, bivariate choropleth map and histrogram views. More details: http://www.geovista.psu.edu/GeoSoicalApp.
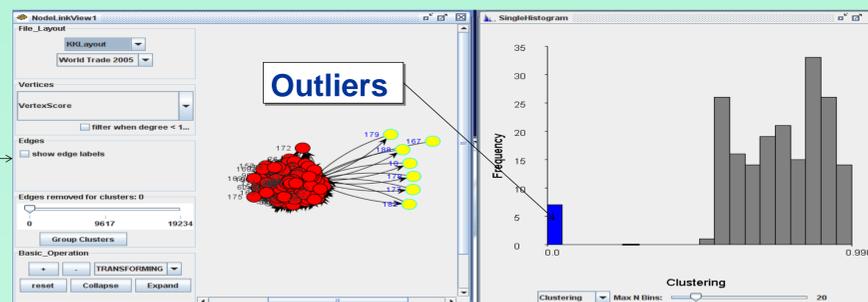

Figure 3: Outliers identification and hypothesis support

Figure 4: Hypothesis support (star plot view with six variables: imports, exports, in-degree, out-degree, betweenness, and clustering coefficient)

Results

• The combination of dendrogram, node-link, and choropleth map views in Figure 2 indicates that global trade is hierarchical with a core-periphery structure at higher levels of trade.

• The histrogram view in Figure 2 indicates that periphery countries tend to have international trade among each other, whereas more developed countries tend to have more trade partners than less developed countries.

• Figure 3 confirms that those outliers of countries that do not violate the above result, because they only have one trade partner.

• The negative relationship between five parameters and clustering coefficient in Figure 4 further supports the hypothesis developed in the second result.

Conclusion

GeoSocialApp supports exploration of spatial-social networks among multiple spaces: geographical, network, and attribute spaces. It also supports the exploration of network attributes from community-level (positional clustering) to individual-level (network node measures). The brief case study presented illustrates that this tool can facilitate an insight gaining process about spatial-social networks underlying international trade.

References:

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