Mapping 16th Century Trade Networks: a GIS Application for Historical Data Sources

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ABSTRACT

This paper presents the results from the GIS application design for a network analysis of historical data sources. The overall research goal is to reveal the mechanisms of cooperation among merchants that tied together the self-organizing commercial networks of the First Global Age (1400-1800). In particular, we have focussed on the network of Simón Ruiz, an important Iberian merchant in the 16th century. In order to achieve that, a new approach was developed for mapping the historical data of commercial networks, having an intrinsic georeferencing component. The GIS application was developed for supporting the spatial visualisation and subsequent exploration of the nodes of such a network, their orientation, extension and intensity. The preliminary results reveal how successfully our proposed approach can be applied to historical data sources, enhancing its analytical potential.

INTRODUCTION

Since the 70's, Fernand Braudel has urged for the integration of space in historical analysis pointing towards to what we call nowadays a "Geographically-Integrated History". For this Historian, the creation of a map as an analytical support was necessary to comprehend men´s evolution, in the belief that change happens in a space-temporal frame (Braudel, 1979). Since then Historians have become more aware of this dichotomy as a crucial paradigm in the historical analysis, and of the need to understand the dynamics between men and space and how they interconnect (Owens, 2007).

Moreover, new perspectives have emerged in historical sciences thanks to the massive databases that have become available. Data bases have been built by Historians in order to gather a large number of data sources and therefore allowing this information to be analysed with new computational tools. Most of these tools have been developed for digitization and georeferencing of historical maps; reconstruction of past boundaries; and georeferencing of historical microdata (such as census or parish records) (Gregory, 2007; Knowles, 2002; Knowles, 2008).

However, there is a gap related to developing approaches for spatio-temporal analysis of social networks. Historians still need to understand how the space plays an important role in understanding human relationships in social networks. The spatial dimension involves mobility, and with this the social spheres are shaped and defined - they expand and evolve. Our main research premise is that GIS could be used as a powerful analytical tool, instead of as only allowing simple visualisations. Therefore, we propose an innovative approach that aims to demonstrate the benefits of carrying on spatio-temporal analysis of historical data sources. The research challenge is twofold: a) develop a spatio-temporal representation for the analysis of the spatial and temporal evolution of a social network; b) develop dynamic spatial visualisations allowing them to be our guide in the exploratory process. In this context the aim of this paper is to present the results obtained from the design of a GIS application for a historical data source. The trade network created by the merchant Simón Ruiz (1553-1589) was used for the application development. The correspondence obtained in Simón Ruiz's

archive counts up to more than 50,000 documents that were collected from a long list of sources during four decades. Remarkably, 1579 is the year with the highest rate of epistolary exchange, with 2,620 letters (Polónia, 2009).

Following this introduction, the next section describes the type of historical data sources we have used in our research. The second section provides the description of the steps undertaken for georeferencing of these data sources. The GIS application developed for supporting the spatial visualisation and subsequent exploration of the nodes of such a network, their orientation, extension and intensity is explained in the third section. In the last section, the conclusions are presented.

SIMÓN RUIZ'S COMPANY AND ITS BILLS OF EXCHANGE

Simon Ruiz was a merchant from Castile, which business expression went beyond Iberian frontiers, reaching all European trade circuits. This can be proved by the extension that his correspondence achieved all over Europe and the establishment of a complex network of agents. His settlement in Medina del Campo made him succeed through an intensive participation in business acting as a representative to other commercial partnerships. He seems to begin the establishment of his network by placing individuals of trust in key points, as well as engaging a network of informants in important trade places. He also began to act as a banker, exchanging foreign currency through the use of bills of exchange. We can find in his archive over 21,000 bills of exchange, reporting a period between 1553 and 1606.

It is important to remind that bills of exchange appeared as a mercantile credit paper in order to solve the risks and difficulties of cash transportation. In the 15th and 16th centuries, bills of exchange became a method of payment, therefore, the most frequent way of loan. The close relationship between these bills - as a financial tool - and Medina del Campo (where Simón Ruiz's company was settled) is based on the fact that, in its well known fairs, their use in trading starts to increase through the acceptance of exchanges, payments and liquidations of other Castilian fairs made with foreign commercial places (Pinto, 2009). Figure 1 is an example of a bill of exchange.

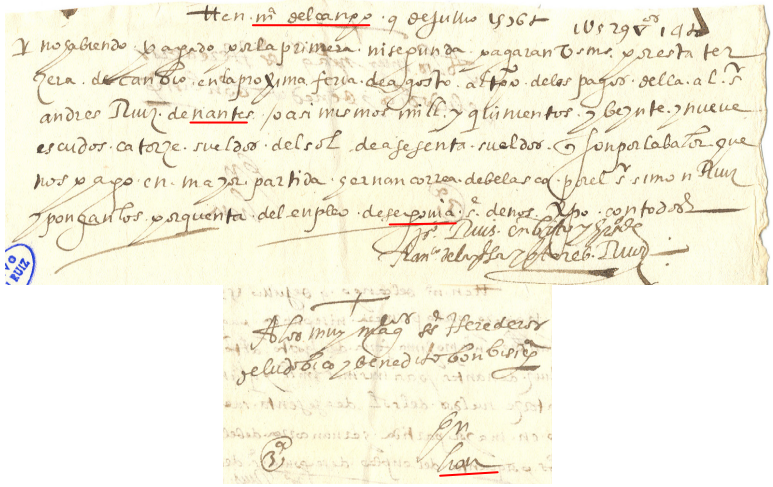

***Figure 1*: Bill of exchange**
Simón Ruiz Archive, Bills of Exchange, caja 1, 1576, nº 52

Its transcription is the following:

"en **medina del campo** a 9 de julho 1576 1529 sos 14 s.

No habiendo pagado por la primera ni segunda pagaran v.m. por esta tercera de canbio en la proxima feria de agosto a tempo de los pagos della al senor Andres ruiz de **nantes** o a si mismos mill y quinentos y beinte y nueve escudos catorze sueldos del sol de asesenta sueldos que son por la balor que nos pago en mayor partida hernan correa de belasco por el sr. Simon ruiz y pongalos por quenta del empleo de **Segovia** sobre de nos. Cristo con todos. jeronimo ruiz embito e herdeiros de francisco de la presa e vitores ruiz"

(In the back)"A los muy magnificos senhores herederos de ludobico y benedito bonbisi en **leon**."

In this bill we can find four georeferences: Medina del Campo (location of the taker); Lyon (where the money is going to be paid); Nantes (location of the beneficiary); and Segovia (taker's connections).

THE GEOREFERENCING APPROACH FOR HISTORICAL DATA SOURCES

For collecting this data source we have used a tool developed at the University of Coimbra, Portugal by Joaquim Carvalho and his team (Figure 2). The tool is based on a micro-historical research support, with a strong emphasis on network analysis and prosopography. Using JEdit text editing software, we have collected the information as close as possible to the textual form of the document. After that, we have translated and imported the information gathered to a common database using the TimeLink software. This system is simple and easy-to-use and has allowed us to browse through complex networks of relations, collecting and processing biographical information scattered in different sources, using structured texts instead of pre-defined forms (Polónia, 2008). However, TimeLink is an agent-based model focusing on people identification. In order to carry on a spatial analysis we have developed a catalogue for providing a spatial location as a human individual (georeferencing). The human have been associated to a place by using functions, attributes, as well as relations. According to our approach, the database supports geographical references as individuals with their own "biography". This means that to a particular place, we can see how frequently it is mentioned in the documentation, in what context it appears, who was located there and which functions were there performed. Most of all, this information is seen through a timeline, allowing the analysis of the spatial and temporal evolution of a social network.

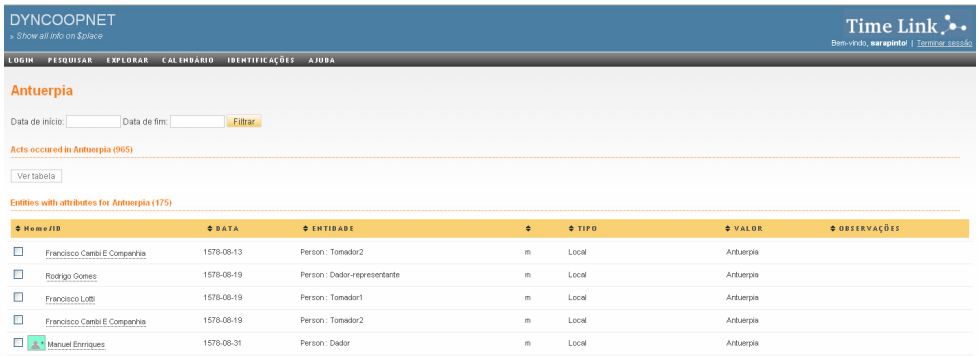

Figure 2: TimeLink
http://timelink.fl.uc.pt/mhk/

THE SPATIO-TEMPORAL ANALYSIS THROUGH A GIS APPLICATION

"Networks happen not only in socially, economically and historically defined spheres, but also in geographically determined areas" (Beerbühl, 2004). In order to achieve our goal, a spatial representation is needed for the study of the dynamic complexity of commercial networks. In fact, "some disciplines, such as geography and landscape ecology, emphasize the spatial dimension of world knowledge, and other disciplines, such as history and climatology, we take timecentric approaches to organize evidences of reality. However, it is the space-time integration that provides the explanatory power to understand and predict reality. Dynamics is by definition an integration of space and time." (Yuan, 2008). Being defined as the time of the "world economies" (Braudel, 1979) or of the "world systems"(Wallerstein, 1990), or even as the "First Global Age", the 16th century is consensually seen as a time of growing interconnectivity between several world spaces, being in a geographical, social, or even in a cultural and mental meaning. Therefore, it's crucial to understand how merchants, self-organised in cooperation networks, moved in space, apparently ignoring political boundaries. In doing so, they were, somehow, creators of their own geography.

Some European families became merchant dynasties that sent their youngest members to the most important cities in order to achieve new markets, products and clients (Bratchel, 1996). As they settled, they started engaging the local networks acting by the rules of reputation, trust and credibility (Beerbühl, 2004). As we can easily understand, these long-distance trade relations forced the merchants to rely on their commercial partners. Very often they had to trust that they would receive their goods or their money several months after the business contract. The most usual response to these need of trust was based on familiar bounds, so we can say that before the joint stock companies, family was the foundation of the commercial and financial entrepreneurship (Lapeyre, 1955). These companies were supported by a family banking system, stores and warehouses settled in the main European cities, and credit relations (Fontaine, 2004). A family network, based on blood and kinship, could more easily operate within a large spatial framework.

Our GIS appplication design builds upon the familiar node-link network visualization techniques for exploring connectivity in graph structures, supporting visual search and analysis, and automatically identifying and visualizing familiy structures. In the database, where each agent is associated to a geographic location, we have selected some of the most important merchant families. According to the historical context of the Simón Ruiz company, we found bills exchanged among members of different European families such as Balbani, Bonvisi, Spinola, Ximenes and Évora. By selecting these names[1] we have collected the number of agents and their georeferencing, creating a map of their spatial distribution. The spatial position, color, size, and shape have been used to encode historical information in such a way a family has been arranged on a map to represent its geographic distribution and intensity (i.e. the number of merchants belonging to a family of the network). Moreover, we have used the force-directed visualisation technique for achieving an effective visualisation of the spatially grouping connected families, rather than using the traditional radial visualization which intuitively portrays network distances from a central member of a family. Color, size, and shape have been used to encode both topological and non-topological properties such as centrality and family group.

[1] Data collected concerning the years of 1553, 1558 to 1582, and 1588 to 1589.

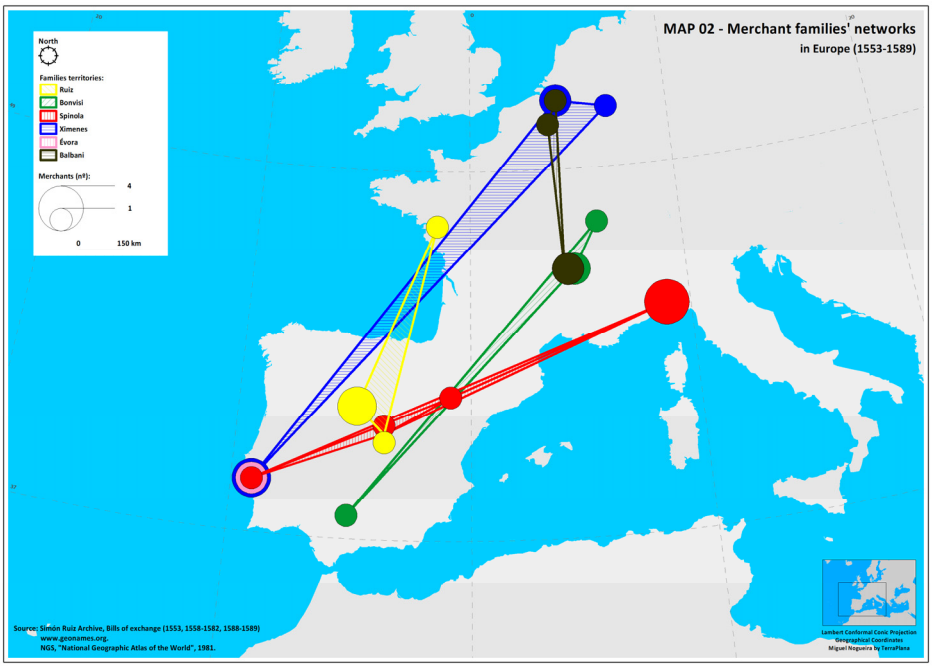

Figure 3: Merchant families' networks in Europe (1553-1589)
Simón Ruiz Archive, Bills of Exchange

This unique map (Figure 3) has revealed two strategic locations of Simón Ruiz's, besides his establishment in Medina del Campo. They are his nephew in Madrid, near the crown and his brother in Nantes, one of the key points in the textile trade. From his office Simón Ruiz acted as a downer giving credit money and then recovering it in the exchange fairs of Lyon and Besançon, where his brother acted as its beneficiary. If his brother could not perform as his agent he used his partners Antonio and Ludovico Bonvisi, instead (González, 2000). Originally from Lucques, the Bonvisi family settled their office in Lyon since the 16th century with agents in Antwerp and in the main financial fairs as Besançon (Lapeyre, 1955). Also the Balbani family developed an affiliated company having independent firms in Plaisance and Lyon. The Genovese Spinola used two different networks: the first one to obtain money and credit in Europe, and the other to settle their accounts in Spain, with agents located in Madrid and Saragoza, and transfer precious metals to different creditors in other countries. The New Christian family Ximenes owned two companies: "Tomas & Andrea Ximenes" based in Lisbon and "Fernão Ximenes e herdeiros de Rui Nunes" that did most of the operative work in the Netherlands. Due to the war, its headquarters moved from Antwerp to Hamburg and Cologne from time to time. Ximenes and Rodrigues d'Évora were related by kinship (Almeida, 1997). The company was managed by Lopo Rodrigues and Rodrigo Lopes in Lisbon while the brothers Simão and Nicolau were based in Antwerp - and were also forced to move in the 80's to Cologne (Silva, 1956).

The map also portrays the behaviour that has been related to the big families of merchants in the 16th century. The Early Modern Age is the time for the commercial trade expansion at a global scale. One of the most important factors of this phenomenon is information circulation, meaning the good and fast reception and transmission of news that sustain decisions. For that it was essential the spread of commercial and financial agents that worked as correspondents for the big companies. A network

is based in relationships between individuals following informal rules that are crucial to its success. The maintenance of these rules is achieved by a feeling of group belonging, like being of the same family, culture, or religion. These mechanisms define the network with commercial consequences, but also with very important social consequences. In fact, they are so tied together that we are not able to determinate if it is the family that begins an intense economic relationship between its members or if they become family because they already have a common commercial background (Álvarez, 2005).

However, to outline this georeferences and depict this mobility in our minds demands outstanding efforts, mainly for those who are not so secure with Europe's geography or do not consider space in a regular base through their (historical) research. Maps can, in fact, contribute to a comprehensible spatial projection of these phenomena. But we strongly believe that these spatial games, strategically played by merchants and their teams - not a random upshot - generated spatial patterns that claim the thoughtfulness of an countless collection of other spatial attributes allocated to these places in order to be interpreted; or even to other spaces that our historical sources do not mention or reveal. Why were our merchants operating there, in that specific location and not elsewhere? What Europe remain apart their interests? We've just mention war reasons to explain spatial adjustments but… wouldn't demographics, politics, finance, accessibility, even natural aspects (in addition to the obvious economical) enhance and consolidate our frame analysis? Unquestionably would.

As an example, in the following map (see figure 4) we combine information extracted from our database – the location of merchants - and information given by specialized literature – the location of the exchange fairs (Lapeyre, 1955). The resulting map allows to understand the relevance of the spatial attributes (the presence of a fair endorses a certain value to the space) to the comprehension of the merchants behaviour, especially how they organized their networks.

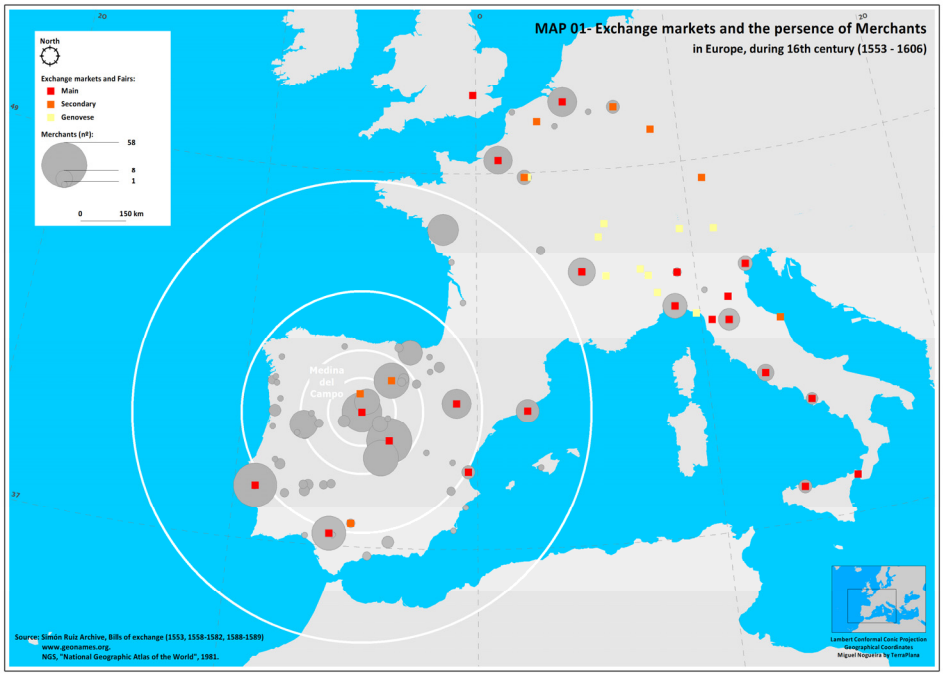

Figure 4: Exchange markets and the presence of merchants in Europe (1553-1589)
Simón Ruiz Archive, Bills of Exchange
Lapeyre, 1955

CONCLUSIONS

By using an analytical map as our main spatiotemporal representation of the commercial network of Simon Ruiz, we were able to visually explore the different variables that otherwise would have not been possible. Our new approach allows the analysis of:

- Each agent's spatial action range;

- Spatial concentration /dispersal of the agents of the same family;

- Spatial behaviour of the networks based in family;

- Motivation for mobility inside a network; and finally

- Merchant's strategies to enhance commercial and financial profits.

As a result, a GIS application has been developed that is capable of registering and integrating a large scale of georeferenced information provided by the empirical data of the Simon Ruiz's archive. The spatial visualisations depicting the Simon Ruiz's network in Europe has provided a new way of mapping the scattered reference points and features, each accumulating a widespread range of attributes. The results already show the strength of carrying on a spatio-temporal the analysis in order to explain our merchants business's resolutions and strategies, whether they were sensitive to a particular place over time.

However, some interesting questions still remain to be answered. Where did Simon Ruiz and their fellow merchants operate: at the fringes of main markets or at the core of Europe's commerce? Did they follow on the footprints of others, coming into markets already dried of opportunities? And ultimately, were these 16th century merchants' activities the result of momentary geographical circumstances or were they produced by the interactions of agents and place?...Possible answers to these questions depend on following a synergetic approach in cross referencing history and geography. Therefore, our further research work will focus on modeling the interactions between human agents and space as well as the interactions between space and time.

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