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# Using Archival Texts to Create Network Graphs of Musicians in Early Modern Venice

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## Introduction

This project uses network graphs to depict musicians' careers in late seventeenth-century Venice. The current network graph, viewable on the [Musicians in Venice web page](#), demonstrates relationships between musicians and the institutions that employed them. The graph is bimodal, with nodes representing musicians ("people" nodes) and institutions ("place" nodes). Archival texts are incorporated into the visualization, with transcriptions of records that indicate musicians' activity included in the node attributes. The entire project is text-based, with data derived from XML transcriptions of archival records in addition to assigned metadata. The current website is a proof of concept for a larger project that would demonstrate ways of displaying text as part of the network graph and using texts in creating network visualizations.

The current graph focuses on the career of the composer Giovanni Legrenzi. Legrenzi worked for several prominent Venetian institutions from the early 1670s

to his death in 1690 and ultimately was appointed to the most prestigious musical posts in the city. The musicians he worked with also served multiple institutions, either simultaneously or in succession, and their relationships with other musicians, patrons, and administrators often facilitated their movement between institutions. Legrenzi's Venetian career presents an excellent case study of these musical connections in late seventeenth-century Venice, and studying these connections demonstrates how networks of musicians functioned in this time period. This study also provides a representative sample of how network visualization effectively demonstrates patterns in musicians' careers in Venice.

The texts in the network graph include transcribed administrative documents, mostly unpublished, from the Venetian institutions where Legrenzi was active between 1670 and 1690. These are primarily payment, hiring, and termination records, which document the activity of the musicians employed by or affiliated with these institutions. Several generations of musicologists have used these documents to identify where different musicians were working, when they were employed, and in what capacity (Bonta, 1964; Moore, 1981; Termini, 1981; and Selfridge-Field, 1994). In this sense, this treatment of the documents is standard to the field, but applies DH methodology and processes to create visual representations of the data. This provides a new perspective on the sources. For instance, grouping the "person" nodes by centrality results in multiple sub-groups, and proximity among these nodes demonstrates shared institutions and implied communities. (Hanneman and Riddle, 2005: Chapter 10) (Mary Russell Mitford's text-based network analysis of Robert Southey's *Thalaba the Destroyer* provides an excellent example of this. In addition to demonstrating the behavior of agile, well-connected nodes, the graph displays modules of nodes as units of analysis (Wasserman and Faust, 1994: 4).

## Methodology

The transcriptions of the original documents were encoded in XML with tags and attributes determined by the Text Encoding Initiative (TEI). I used the XML markup to tag the information I wanted to include in my data while retaining the complete original text. In general, I tagged the name of the musician, the name of the institution with which they were connected, and the date and location of the connection.

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9307
9308 <div type="entry" xml:id="L00_17" n="17">
9309 <dateline>
9310 <date when="1677-02-04">Adi 4 Feb[ra]ro 1677 Cong[regazione]
9311 Gent[il]e</date>
9312 </dateline>
9313 <p><note place="margin">Legrenzi</note> Intesi li sentimenti del Sig[no]r
9314 Maestro <name type="person" ref="#GioLeg">Legrenzi</name>; che accettò di
9315 continuar a far gli Oratorj secondo il solito; fu eletto di nuovo il
9316 Pre[te] D. <name type="person" ref="#BarGri">Bartol[omeo]
9317 Gritti</name>; acciò passasse l'istesso uffizio col Sig[no]r
9318 <name type="person" ref="#GioPes">Giovanni da Pesaro</name>; con
9319 q[ue]sto però; ch' egli averse solo da ingerirsi nelle funzioni
9320 di <name type="place" ref="#fava">Chiesa</name> solam[ent]e; e fu
9321 preso con tutti li voti.</p>
9322 </div>
9323

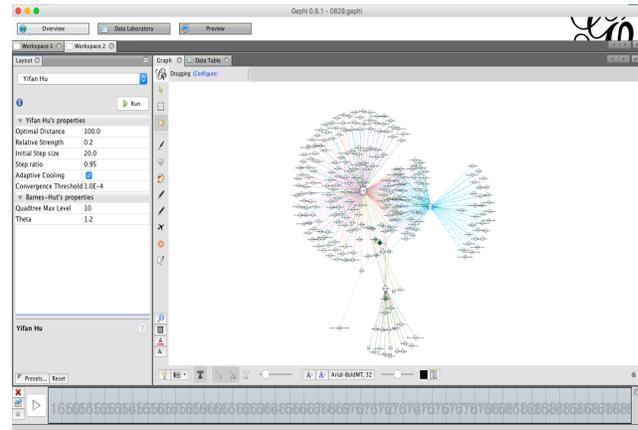
```

### XML markup of primary document text

I then extracted the information for the network from the XML document using an XSLT. For this project, the stylesheet extracted the data assembled in the person index of the XML document and combined it with the entire text that documented each event. The resultant document was a CSV file of raw data that had to be separated into sets of nodes and edges to be read by the visualization platform. The data visualization for this project was generated using Gephi, which is an open-source platform for exploratory data analysis. For this project, I generated the network graph in Gephi by importing two CSV files: one with the nodes and their attributes and ID numbers, and one with the edges and the source and target data. The online version of the network graph includes all the text associated with a “person” node in the network as a node attribute. When the user selects a person node in the online version, it displays the transcriptions for every document mentioning that person in the Information Pane. (I exported the data using the SigmaExporter plugin for Gephi. Version 0.9.0 from Gephi Thirdparty Plugins. The code is available on [Github](#).)

Displaying all the text associated with a person node presented a challenge as the XSLT exported each connection between a musician and an institution as a new line in the CSV. For instance, if a musician was hired by a church in 1674, received a raise in 1678, and retired in 1686, there would be three lines in the CSV. When imported into Gephi, this would create three connecting edges between the person node and the place node. This created a misleading network graph, as the number of documented connections between people and places depended on the nature and availability of the records. To combine all the texts associated with the events for each person in the index, I concatenated the raw data using a PHP script and saved the results as a TSV file that could be imported into Gephi. As a result, the entire context of the decrees and decisions surrounding that musician's activity appears in the Information Pane, which also displays and links to the institutions associated with that musician. The

PHP script also included HTML formatting to better distinguish the entries from one another in the visualization. Once my nodes and edges were imported into Gephi, I used a layout that grouped the nodes by degree of centrality (Algorithm in Gephi based on Blondel, Guillaume, Lambiotte, and Lefebvre, 2008. Resolution in Gephi based Lambiotte, Delvenne, and Barahona, 2009).



Network graph in Gephi

### Next steps

The current graph is the foundation of a more extensive project that uses musicians and musical activity in Early Modern Venice to benefit scholars working with TEI in similar for-hire environments. In these environments, hubs of activity define the relationship between individual practitioners in the historical equivalent of a sharing economy. In the long-term, I propose an online data repository and network graph of musicians working in seventeenth-century Venice that would eventually provide a roadmap for scholars embedded in the TEI transcription model, but with an interest in an automated process for applying TEI text analysis to network analysis.

In addition to the bimodal graph that highlights relationships between musicians and their employing institutions, I also hope to create a unimodal graph documenting relationships among the musicians. Creating the unimodal network and a supporting web application will be a challenge as relationships between individuals can be complicated and dynamic. This will take considerable work in effectively diagramming entity relationships and building web applications that go beyond the “out of the box” functionality of the Gephi export plugin. The website for the [Six Degrees of Francis Bacon](#) project provides an excellent example of a unimodal graph; here the relationships are de-

defined by circumstances (such as “father to” or “colleague of”) or actions (such as “met” or “wrote to”). [Linked Jazz](#), which uses documents as node attributes to demonstrate relationships and meaningful connections between jazz musicians in an interactive network graph, is also an excellent example. Both sites feature custom-designed entity relationships and interactive features in their web design that I want to emulate in my own network graph.

For the unimodal version, I would expand the data beyond Legrenzi’s Venetian career, increasing the time frame and the number of institutions represented in the graph, and include different kinds of sources, such as periodicals, correspondence, and notarial records. Developing relationship typologies is such a crucial component to the project. This will require creating custom node metadata based on the information from the primary sources and agile development as the number and variety documents expand. The result will be a project that can better serve other scholars of Venetian music and culture.

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