Pathfinder: a system for data exploration, analysis, and visualization of art catalogs and exhibitions

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Abstract

The growing consolidation of art exhibition studies as a research field has been accompanied by the emergence of numerous projects devoted to the construction of databases and archives, as well as the development of digital platforms for consultation and analysis. The Exhibitium Project (www.exhibitium.com) falls within this research framework. Coordinated by the iArtHis_Lab research group of the University of Málaga (Spain) since 2015, in collaboration with various international partners, one of the objectives pursued by this project is to design and develop technological infrastructures with the aim of enhancing research on art exhibitions as well as opening new critical inquiries (Rodríguez-Ortega, N. and Cruces Rodríguez, A., "Development of Technological Ecosystems for Cultural Analysis: The Case of Expofinder System and Art Exhibitions", Digital *Scholarship in the Humanities,* fqy018, Oxford University Press, 2018).
One of the devices developed within the Exhibitium Project is Pathfinder (https://hdplus.es/pathfinder/). Pathfinder is a system for exploring, analyzing and visualizing data about art exhibitions previously recorded in the Expofinder system (www.expofinder.es), a multi-relational database that is semantically enriched with fine-grained metadata. This design is based on the main theoretical framework that underlies the Exhibitium Project: network and complex system theories. At the same time it also fits in with our concept of the art-exhibition domain as an ecosystem (or cultural network structure) built through the different types of relationships that heterogeneous actors (institutions, artists, curators, collectors, critics, etc.) dynamically establish with one another. Figure 1 shows the Expofinder conceptual model represented in a graph.

In general terms, Pathfinder was designed following four essential principles:

1. Flexibility and high precision in the search function. Together with the traditional search functionalities, Pathfinder includes a powerful filter system based on combinations of multiple queries that makes it possible to gather specific subsets of data using as many conditions as needed. Complementarily, the Expofinder multi-relational data model on which Pathfinder operates exponentially increases both the direct and indirect connections established among data. For example, we could retrieve a list of exhibitions held in Madrid, between 2010 and 2015, curated by non-Spanish curators, funded by private entities, where 25–35-year-old female artists participated with pictorial works. Once the search has been run, the list is displayed on the screen with the option of expanding the complete metadata information associated to each exhibition.

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2. Optimization of analytical engines for knowledge extraction based on quantitative processes by exploring statistical concepts potentially significant for humanistic research. For this reason, advanced descriptive statistics functionalities have been implemented, thereby making it possible to incorporate previously unexplored categories in the analysis of the art exhibition ecosystems, such as those of 'entropy' and 'outlier'. These categories help us in discovering atypical results that do not respond to the dynamics usually observed. These values are usually an inconvenience when analyzing large data series, but they are an opportunity for the humanist researcher, because they allow us to detect elements outside the limits of 'normality', those that are not exactly the most homogenous with the rest of the group, but rather the ones that stand out among the others (fig. 2).

3. Visualizations as crucial hermeneutic and interpretative tools. According to this idea, a broad array of visualization tools that can be configured by users have also been implemented in Pathfinder with the aim of making the information as insightful as possible. Together with the traditional maps, histograms and networks, others have been designed ad hoc for Pathfinder, such as those that we have called 'geograms' and 'taxograms' (fig. 3). The geoanalytical section is made up of maps which, in addition to the usual georeferenced information and flow paths between connected actors, include a convex envelope calculation based on Delaunay triangulation and Thiessen polygons, which helps us to detect possible areas of influence based on the proximity between different groups of elements.

4. Wide-range usability and interoperability. Finally, Pathfinder can operate with any dataset –whether extracted from Expofinder or not – that matches up with the JSON structure available at https://github.com/antoniocruces/pathfinder. This means that Pathfinder can be used by any researcher or research group interested in making use of the data exploration, analysis and visualization opportunities that Pathfinder offers. At the same time, any subdataset obtained with Pathfinder can be exported in standard formats to be processed using other platforms and software.

Founding: Pathfinder has been made possible thanks to funding provided by the Ministerio de Economía y Competitividad of the Spanish Government (HAR2014-51915-P) and the Centro de Estudios Andaluces of the Junta de Andalucía (PRY128-17).

Keywords: data infrastructures, art exhibitions, data analysis and visualization, digital art history