Culturegraphy

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Abstract

Culturegraphy visualizes the exchange of cultural information over time. Treating cultural works as nodes and influences as directed edges the visualization of these cultural networks can provide new insights into the rich interconnections of cultural development such as movie references. All findings were made in a process that involved network scientists, a media theorist, and a sociologist. The role that visualization can play in bridging scientific communities was central to this work. In this sense, the resulting visualizations were process to bring researchers from different disciplines together. Tradionally using different methods, physicists increasingly ask similar questions as media theorists or sociologists as they study the dynamics in networks. Visualization can serve as a common language that brings fields together, shows differences, but also has its own idiosyncratic views.

Introduction

In this work, we investigate how to visually explore the dynamics of memes [2, 5, 6] traveling through cultural history and present the first findings that we were able to make by visualizing this model of culture. We ask ourselves what happens when culture is seen as a superorganism in which knowledge is copied, combined, and transformed from person to person as well as their artifacts over time in a network of interactions. What can we learn from visual representations of such a relational model of culture?

The visualizations are based on movie references from IMDB (Internet Movie Database). We were able to make findings on the macro level of the graphics and on the level of each individual movie through the help of experts in different fields. This paper gives an overview of the process and describes particular findings that we gained.

Related Work

Our work is influenced by several visualization techniques intended to represent network structures in a new light. However, most network visualizations do not utilize the plane efficiently. In linear representations only one axis is used to plot data. In force-directed graphs where the nodes are positioned by physical forces the plane is not used to explicitly represent aspects of the data. In 2006, M. Wattenberg developed a visualization technique called PivotGraph [14]. The technique uses a very simple but also quite restricted approach of placing the nodes on a grid structure by aggregating nodes by attributes. A. Aris and B. Shneiderman created a visualization technique for networks called semantic substrates [1] that used some of the ideas from PivotGraph. It is a spatial template for a network, where nodes are grouped into regions and laid out within each region according to one or more node attributes. The main contribution is the idea of different substrates in which the nodes are placed. Since then multiple projects picked up the idea to display networks in other spatial formations. M. Dörk, S. Carpendale, and C. Williamson used a multidimensional scaling algorithm to calculate implicit similarities between items and map them on the plane in their project EdgeMaps [8]. Jan Willem Tulp created an interactive version of 'The Flavor Connection Network' [13]. Tulp ordered the nodes in the visualization by the number of connections on the y Axis and grouped the network into categories on the x Axis. The approach is similar to semantic substrates but by restricting the regions to the x axis the graphic stays much clearer and easier to read. Throughout these examples we can see a development of new arrangements of nodes on the plane. This project wants to further explore how position can be used to make sense of relational cultural data.

Movie References

For the purpose of this research we chose references among movies from IMDB, an online movie community with 42 million members. People contribute various aspects about movies on IMDB, we were mainly interested in the references between. To give a sense of these references, here an example for the movie Star Wars from 1977: The robot C3PO was modeled after the robot from the movie Metropolis (1927) according to the IMDB community. The dataset contains 119,135 reference connections from 42,571 movies. To be able to responsively visualize the data in a web browser we selected the 3,000 most connected movies by in-degree. Our aim is to map the dynamic structure that is created by the cultural practice of copying, transforming, and combining ideas over time.

Design

Building on visualizations arranging nodes by attribute, we introduce 'culture.graphs', a suite of visualizations that integrate the representation of temporal dynamics with graph-theoretical metrics. Our intent is to conceive a visualization technique that exposes the referential structure of culture over time.

By connectedness

The first version of culture.graphs was an arrangement of the nodes by year and by indegree. Indegree is the number of movies who referenced the selected movie or the connectedness of that movie. In force-directed layouts the highly connected movies are placed in the center of the plane, surrounded

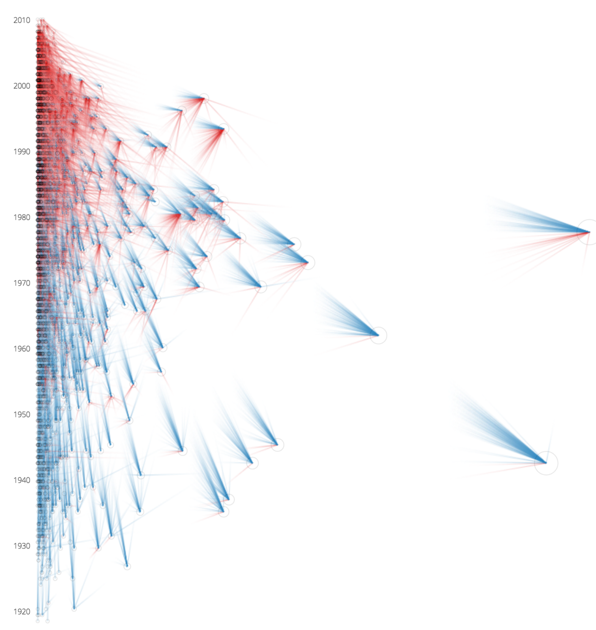

Fig. 1. Culturegraphy visualization 'by connectedness'

by all the movies they are connected to. This has the effect that the most significant nodes are often difficult to discern. In our arrangement the highly connected movies stand out and become the outliers on the right side of the graphic while the less connected movies create a dense area on the left side of the plane. This creates a shift in perspective on what is important in the representation. While force-directed graphs in the best case represent different clusters in the network, the ordering by degree shows temporal and referential patterns among movies.

By communities

The decision to place nodes by their connectedness leads to interesting results and makes it easy to see the highly connected nodes in the network. However, high connectivity is not the only interesting aspect of a network. One thing that force-directed networks are particularly useful for is arranging nodes into groups within the network. They do so by modeling the connections (or lack thereof) between nodes as physical forces that affect the positioning of nodes along both axes of the

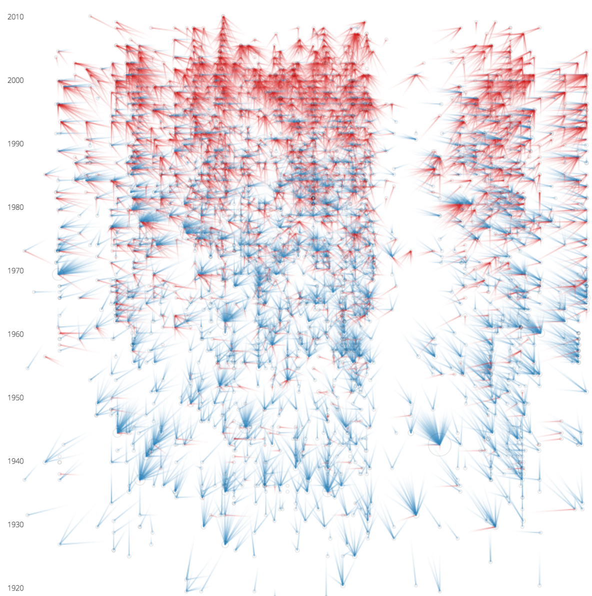

Fig. 2. Culturegraphy visualization 'by communities'

plane. Our aim was to order nodes into groups on one axis only, in order to use the other axis to represent the temporal aspect of the network. For this purpose modularity measurements are useful [4], which take links away from the network until it breaks apart the clusters that come up in this process become the individual groups that this algorithm produces. We used this approach to represent the different modules on the x-axis of the graph, retaining the y-axis for time.

Findings

Until now we can present two initial findings, which were made through interviews with physicists who are specialized in cultural networks, a media theorist and a sociologist. The most dominant patterns are on the macro level the rise of postmodern cinema and on the micro level different reference patterns.

One apparent pattern visible in the culture.graphs is the color gradient from blue at the bottom to red at the top. The red that starts around the 1980s is known in film studies as the postmodern cinema, an era in which movies strongly cite the style, stories, and scenes of past movies The postmodern cinema is studied well [3, 7, 9]. What 'culture.graphs' are contributing is not only a representation of this large-scale phenomenon but also a view onto the underlying movies constituting it.

While the rise of the postmodern cinema is a dynamic process that emerged on the micro level but only exists as a phenomenon on the macro level, there are also patterns that can be found and analyzed on the micro level of each movie. One difference that can be seen between the individual movies is the citation patterns they have. The movie The Wizard of Oz was released in 1939 and for 30 years, until the beginning of the 1970s, the movie received very few references. In comparison, Alfred Hitchcock's Psycho was referenced immediately after its release in 1960. However, despite its delayed uptake, The Wizard of Oz received substantially more references than any other movie, except Star Wars.

Conclusion

Network visualization can function as a language [10, 11] to describe complexity that holds the capability to connect scientific fields that are usually unrelated to each other [12]. Through this language new findings can be made that combine micro with macro patterns of complex relationships in ways math, statistics or written language could not. We hope the presented visualizations inspire interdisciplinary projects that use this new language as a common ground for communication and exploration.

References and Notes

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