Visual Analytics meets Political Science: Visualizing Patterns and Changes in States' Policies toward Religion

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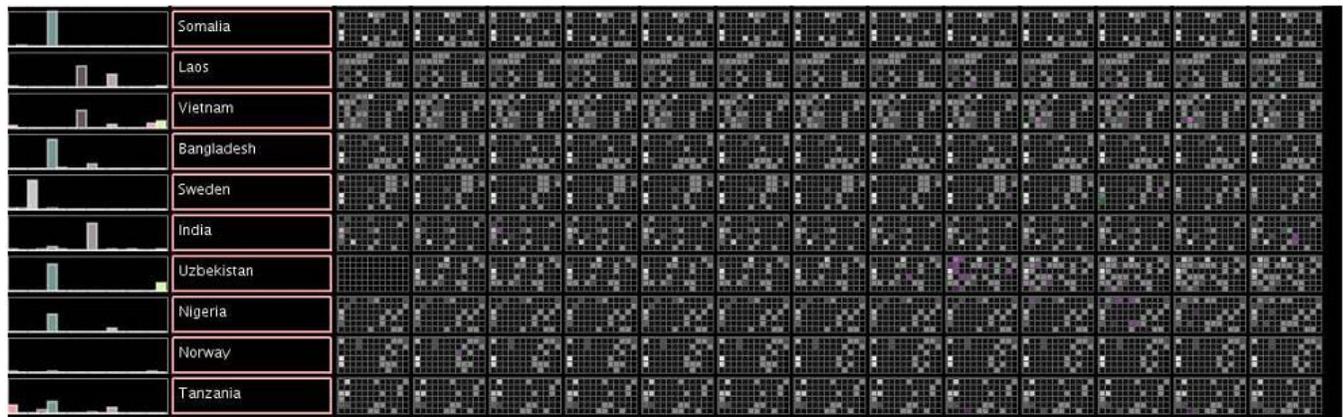
Figure 1. Part of the "Pattern View" Visualization. The religious policies are visualized using 6 x 12 cell color icons for each country-year.

ABSTRACT

This paper shows how visualization has helped a political scientist to make sense of an important topic: states' policies toward religion. Dissatisfied with the current techniques of data analysis in the field he asked for a visual tool that would enable him to directly see and interact with the data and come up with answers for his substantive research problems. We therefore designed a customized visualization tool that enabled the political scientist a) to find patterns in states' regulations and policies toward religion, b) to connect these patterns to religious differences, and c) to study the dynamics of state-church relations over time. Our collaborative enterprise turned out to be a great success which impacted on the political scientist's work by generating unexpected findings concerning real-world political problems that may well have been missed using more traditional approaches.

KEYWORDS: Visualization, Visual Analytics, Comparative Politics, Religion and Politics, State-Church Relations.

1 INTRODUCTION

This paper shows how visualization can help political scientists make sense of an important topic: states' policies toward religion. Contemporary discussions on the ban of headscarves in European countries, government funding of faith-based welfare organizations in the US, and blasphemy laws in Islamic contexts provide ample evidence for the relevance of understanding the complex interplay between religion and politics. While in the past these themes have mostly been the domain of historians, legal experts, and political philosophers, recent years have seen an increase in empirical efforts from analytically and quantitatively minded comparative political scientists. Along with this trend comes an immense growth of new data that need to be explored and analyzed. It is here that Visual Analytics can play an important role and impact on the advancement of our knowledge concerning real-world political problems.

In our particular case a political scientist – one of the authors – approached a visual analytics researcher and two students of information engineering to help him visualize a complex data set on church-state relations. Dissatisfied with the current techniques of data analysis in the field – they seemed too restrictive and not very well suited for the exploration and discovery of the unexpected – he asked for a visual tool that would enable him to directly see and interact with the data. He wanted to let the data speak for themselves and - while retaining their full complexity - come up with answers for his substantive research problems. In particular, the following challenges were among the major tasks which the political scientist wanted to address with the help of data visualization: a) finding patterns in states' regulations and policies toward religion, i.e. identifying different regime types, b) connecting these patterns to denominational and religious differences, and c) studying the dynamics and changes of these patterns of state-church relations over time.

In many hours of discussion and several rounds of trial and error, we - the visualization team and the political scientist – finally came up with a custom-tailored visualization tool that seemed well-suited for the challenge at hand and allowed the political scientist to pursue his research questions by visually and interactively analyzing the data. This analytic process in turn fed back to the development and improvement of the visualization tool. In sum this collaborative enterprise turned out to be a great success which impacted on the political scientist's work by helping him find answers to his research questions and generating unexpected findings.

In the remainder of this paper we will shortly introduce the data set used and the visualization tool that was developed to extract information from the data. We then present how our Visual Analytics approach served to come up with new and interesting

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findings and thus impact on knowledge generation in political science.

2 THE DATA

The data we used come from *Religion and the State Project* initiated by Jonathan Fox [1]. The data set provides data on state policies toward religion in a total of 175 countries and for the time span 1990-2002. Besides several constructed scales the data are available in disaggregated form, i.e. there are about 16 items covering different aspects of religious discrimination of minorities by the state, 11 items covering regulatory policies toward the majority religion (or all religions) as well as 33 items on different favorable policies toward religion (e.g. funding of clergy of religious schools, etc.). Taken together there are a total of 68 variables in the data set which are either on a binary or ordinal scale.

Analyzing the *Religion and the State* is no easy task because it features multiple dimensions: spatial, temporal, multivariate. But instead of simplifying the data by focusing on single variables, one year or a selected group of countries location only, we decided to use all of it.

3 VISUALIZATION TOOL

Based on Schneidermann's mantra "Overview first, zoom and filter, then details on demand," we developed a visualization system that provides different views of two aspects of the data – religious policy patterns and changes over time. In this sense the visualization tool was custom tailored for the specific political scientific research questions at hand.

3.1 Overview first

The first visualization – the "Patterns View" – shows the 68 religious policy variables in a 6x12 color icon using a gray scale varying in intensity to represent the value (see Figure 1). Because of the different ranges for the values assigned to the features, we used interpolated values for the intensity. For example, for a feature that has range of 0 to 9, these would be evenly matched to intensities between the ranges with 0 using none (black) and 9 as maximum intensity (white). Similarly, for a feature with a range from 0 to 4, 0 would be none (black) and 4 would be the maximum (white). Slight color variations for features that showed a change with respect to the previous year are represented using a divergent scale with the same interpolated value of intensity, as if there had been no change with respect to the previous year. (See the ninth, tenth, and eleventh columns in Figure 1 for the countries Uzbekistan and Nigeria.) This is not necessarily an effort to represent changes, per se, but is rather intended to draw attention to changes in the overall view for further investigation. The ordering of the countries for this view was performed using a hierarchical clustering algorithm measuring similarities in policies between the countries.

The second large overview visualization – the "Changes View" – is specifically intended to show only those religious policies that were changed with respect to the previous year (see Figure 2). The first year/column shows the data as in the Patterns View, but all values are colored black for the subsequent years which are unchanged compared to the respective previous year. Changes, both increases and decreases, are represented with a divergent color scale with varying intensity representing the amount of change.

Both visualizations have three long vertical divisions. The leftmost column shows a bar chart representing the population percentages for each religion, with each of the four primary divisions shown in a different color (Christian – red, Muslim – green, Other – blue, None – yellow). The second column shows

the country name. The third, wide column shows the thirteen year series of the color icons.

3.2 Zoom and Filter

Both of the overview visualizations can be zoomed-in to look at the relationships between neighboring countries (in terms of the clustering algorithm). Close relationships between countries are easy to detect, as are juxtaposed countries which may not appear to be related due to artifacts of the clustering algorithm (see Figure 3).

3.3 Details on Demand

Each of the color icons, regardless of "Patterns View" or "Changes View" can be clicked on to open an "Exploded Icon View" dialog window that shows the icon in a large format. Furthermore, each of the colored squares can be clicked on showing the exact feature code, i.e. the specific religious policy and the value for that year (see Figure 5).

Similarly, the bar chart for the demographic data can be clicked to open a bar chart dialog where the details of the demographic data can be queried.
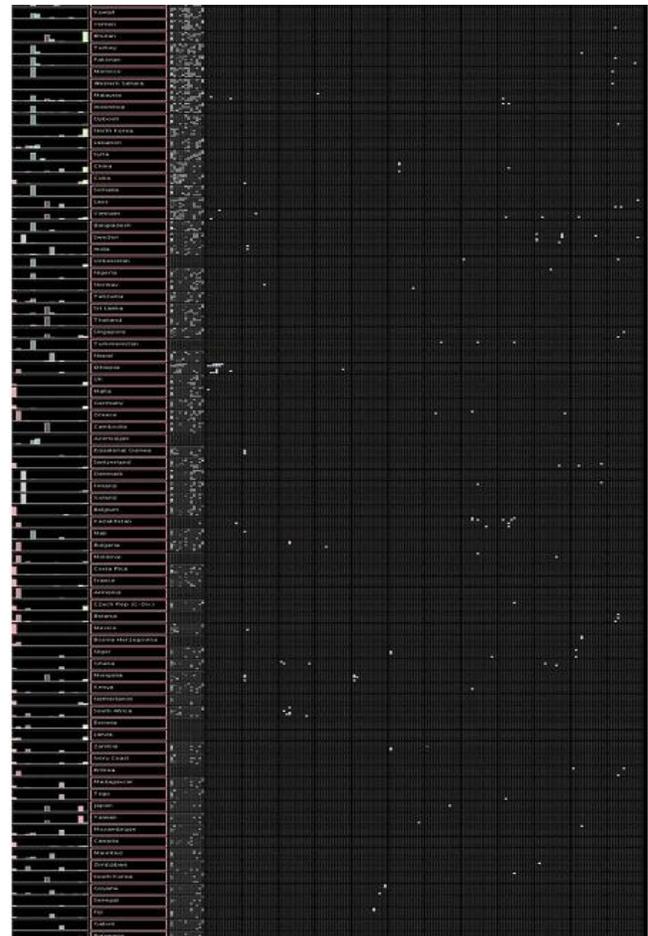

Figure 2. Part of the "Changes View" visualization. Only policy changes with regard to the previous year are highlighted.

4 FINDINGS

What did we learn about religion and politics from visualizing the data? Following the initial research problems we first present our results on the empirical patterns of state-church relations and then focus on policy change in a second step.

4.1 Patterns of Religious Policies

Concerning the identification of patterns of religious policies and regime types, the overall "Patterns View" visualization revealed an immense diversity of different religious policy arrangements around the world (see Figure 1). Indeed, this bewildering variety - and in this sense the very *absence* of obvious similarities between states with regards to their policies toward religion - is the most striking visual feature of the data. No country seems like the other. This finding seriously calls into question the all too common legal classifications and typologies that divide countries in one of three systems - "State Church", "Cooperation", or "Separation". Rather, the political reality is much more complex. A Visual Analytics approach clearly establishes this empirical complexity and gives an intuitive impression of its scope.

However, it would be premature to conclude that no meaningful patterns arise from the data at all. In fact, at the very bottom of the "Patterns View" visualization we detected a cluster of closely grouped countries that differ markedly from the rest (see Figure 3). Judging from the bright coloring of the icons, it is immediately obvious that this group of countries exhibits extremely high levels of state regulation of religion, including religious discrimination of religious minorities, regulations and favorable policies targeted at the majority religion as well as other forms of religious legislation.
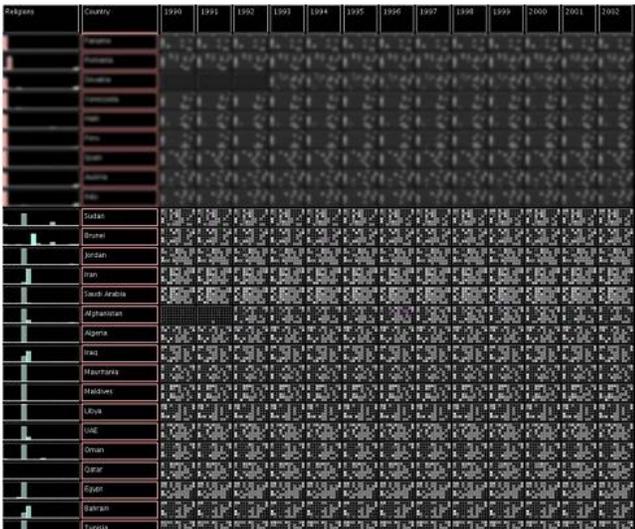

Figure 3. Zoomed in view on the policy patterns, showing the Muslim cluster with extremely high levels of religious regulation by the state.

Zooming in on this interesting part of the visualization allowed us to identify the countries within the group. In total, this cluster comprises of 17 mostly Arabic and North African and thus geographically close countries, including amongst others Egypt, Iran, Iraq, Jordan, Sudan, or Saudi Arabia. One single geographic outlier in the cluster is the state of Brunei which is located in South East Asia.

A look at the bar charts in the left column of the visualization further reveals that all of the countries have predominantly Muslim populations, enabling us to tentatively connect specific policy patterns with differences between world religions: While there are many more Muslim countries around the world with markedly lower degrees of interpenetration of religion and politics, there are no Non-Muslim countries that show similar high levels of religion-state entanglement as the 17 Arabic and North-African states.

4.2 Changes over the time

What are the dynamics of states' policies toward religion? By highlighting the policies that changed with regard to the previous year, the "Changes View" visualization makes it easy to spot the introduction of new regulations concerning religion and the abolishing of old ones (see Figure 2). While we did not expect to find many or even drastic changes in church-state relations in the period from 1990 to 2002 and stability indeed seems to be the rule, in a first overview the visualization nonetheless revealed a considerable amount of policy shifts. They are scattered all around the world and happen across the whole time period under investigation. Most of them are minor and concern single or a very few policies, laws or regulations only, suggesting that the reconfiguration of church-state relations typically happens through cautious and often tacit reinterpretation of the existing rules.

However, the visualization also reveals some instances of revolutionary changes, i.e. icons with a large number of highlighted cells. Two of them show particularly striking changes and thus indicate rapid shifts in state-church relations. The first of these disruptions happened in the year 1991, the other ten years later in 2001.

Zooming in on these two cases allowed us to identify the states where those revolutionary changes in state policies toward religion took place and add more context information not contained in the data per se (see Figure 4). The first is Ethiopia, where in the year 1991 the former socialist dictatorship was overthrown by rebel groups in the wake of civil war. The second country is Afghanistan, where in the year 2001 the radical Islamic Taliban regime was removed by the US-lead military intervention in the course of the "War on Terror".

What were the results of these two violent regime changes and how did they affect the two states' religious policies? The "Exploding Icon View" allowed us to further compare Ethiopia and Afghanistan and access many details by clicking on the cells within the icons (see Figure 5). In Ethiopia for instance, the socialist regime had in general been hostile to religion and some religions were even considered illegal. With the new government, a state-church system of cooperation was installed and while there still exist some practical limitations for certain religious groups, none of them are illegal anymore.

In Afghanistan, too, several discriminatory policies toward religious minorities have been abolished. But in contrast to Ethiopia, Afghanistan under Taliban rule exhibited high levels of religious legislation (i.e. the state sanctioned religious requirements, bans and rules) and a deep interpenetration of religion and politics. Several of these aspects are no longer in place. For instance as of 2001 religious officials are no longer automatically afforded government positions.

Of course, many more details could be queried from the "Exploded Icon View" to further investigate the policy changes in the domain of religion and politics.

5 CONCLUSIONS

We used a Visual Analytics approach to extract information from a complex multidimensional chronological data set on states' policies toward religion. The visualization of religious policies played an important role in the generation of interesting findings and new knowledge concerning the patterns as well as the dynamics of church-state relations – a topic of great concern to comparative political scientists - by presenting data in a manner atypical to the standard tools used in comparative political research, i.e. large tables of descriptive statistics and regression models.

By designing a customized visualization tool the visualization team enabled the political scientist to freely explore and interact

with the data. This flexible and fast mode of analyzing the empirical material led to immediate insights that would have been much harder to discover or may well have been missed using more traditional approaches.

Obviously, the present results are merely the tip of the iceberg and much more could be discovered by a deeper immersion in the data. But even these first steps give evidence of the great potential that data visualization methods bring to the comparative political research toolbox and of the future possibilities to be explored.

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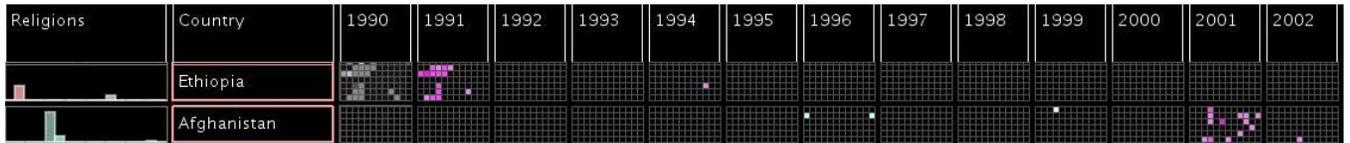
Figure 4. Zooming in on the rapid policy changes in Ethiopia and Afghanistan, in both cases induced by a violent removal of repressive former regimes.
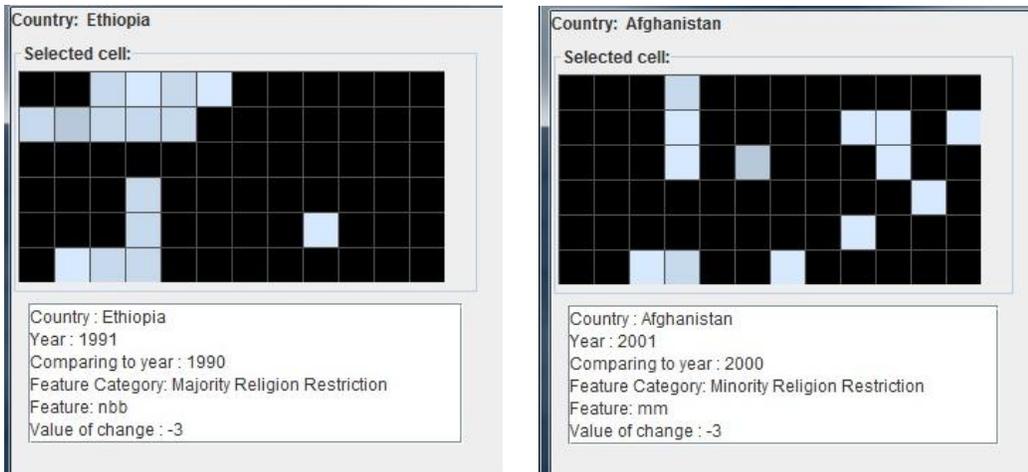

Figure 5. "Exploded Icon View" providing country details on individual policies and their change compared to the previous year.