

Web-Based GIS to Explore Media Influence and Election Processes

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Abstract

The Mapping the Media in the Americas Project is a three-year collaboration between the University of Calgary, the Carter Center in Atlanta and the Ottawa-based Canadian Foundation for the Americas (FOCAL). An interactive web-based GIS tool has been developed to graphically illustrate and analyze where the media are located and which electoral districts they reach. Using ArcIMS, we have mapped socio-economic data, electoral results and the locations of the media (TV, Radio Stations and Newspapers) for Canada and eleven South and Central American countries. The aim of this project is to help untangle the complex web of media ownership in the Americas and to allow political parties and non-governmental organizations involved in monitoring the democratic process to determine the influence of the media on the electoral process. This paper explores the results of our comparative analyses with Canada, Peru, Guatemala, Costa Rica, and Mexico to date.

Introduction to the Mapping the Media in the Americas Project

The Mapping the Media in the Americas (MMA) Project was launched in September 2004 as a collaborative undertaking between The University of Calgary, Alberta, the Carter Center in Atlanta and the Canadian Foundation for the Americas (FOCAL) in Ottawa, Canada. The goal of the project was to map the location of the media in eleven Latin American countries and in Canada. For the purposes of this project the media was defined as the print media, specifically newspapers, and the broadcast media comprised of TV and radio stations. The aim of the research was to map the location of the media together with the results of recent federal elections in order to show potential correlations of the media's influence on the electoral process. In addition, the results of recent census surveys have also been mapped and all the data sets have been entered into an ArcGIS geodatabase and then into the ArcIMS Map Server to create an interactive, web-based GIS that can be used by all those individuals and organizations that are interested in supporting the democratic process.

That the future of democracy is not assured, that it is not a given that all groups support throughout the various countries of Latin America has been suggested by Peter Smith (2005, p.285) in his recent text on "Democracy in Latin America":

What do the people of Latin America think of their democracy?Especially in times of difficulty, might the citizens of Latin America be willing to accept authoritarian regimes? These are issues of major concern.....Most democracies throughout the region are of recent origin, dating from the 1980s or 1990s. Many are novel experiments rather than time-tested traditions.....There is no reason to take democracy for granted.

The glass of democracy may be seen as half full, as the Economist suggested in an article on August 12th, 2004, when they argued that their annual Latinobarometro Poll showed that:

Contrary to much punditry suggesting that the region risks a return to authoritarianism, roughly half of Latin Americans continue to support democracy, though few think it is working well.

Alternatively, the glass of democracy may be regarded as half empty, as the Economist argued paradoxically a year later on October 27th, 2005, when they stated, based on the results of the subsequent Latinobarometro Poll that:

If anyone ever imagined that building strong democracies in Latin America would be a swift and easy task, this year's Latinobarómetro poll should disabuse them.... the poll—taken in 18 countriessuggests that only about half of Latin Americans are convinced democrats and only one in three is satisfied with the way their democracy works in practice. Those figures have remained almost identical for three years in a row—and are down on those of a decade ago....

Methodology

The MMA Project is concerned with enhancing the democratic process in those countries of Central and South America that support free elections. Eleven countries in Central and South America were selected. These included: Argentina, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Guatemala, Mexico, Peru, Trinidad and Tobago, and Uruguay. At the time of writing all but Brazil, Colombia and Trinidad and Tobago have been mounted on the website which is located at www.mediamap.info . At an early stage in the Project the Technical Director (Nigel Waters) made a decision to map the media, election and census data in Canada. It was felt that since the Technical Team (Chantal Hansen and Heng Sun) were all located in Canada at the University of Calgary the researchers' familiarity with their home country would allow the problems of mapping the data to be resolved for the Canadian data and then these solutions could be applied subsequently to the other countries.

This initial, rather simplistic view was not always valid. The twelve countries differed extensively in their social, cultural, economic and physical geographies. Geography really did matter to a very great extent. Some of the countries such as Canada and Brazil are of continental size while others such as the Dominican Republic are parts of relatively small islands. In Canada there are two official languages, French and English, and so the website is provided in both those languages. In most of the Latin American countries the official language is Spanish but in Brazil it is Portuguese. So the website has all four official languages as appropriate.

The census data that has been mapped reveals vast economic and cultural differences. Some countries, such as Canada, have a high per capita income while others, such as Peru, are much poorer. In Peru a useful indicator of this poverty is the number of houses with dirt floors while in Canada such a variable would be meaningless. In all countries the inhabitants exhibit vast differences in wealth and this is important because, at present

Creation of the Website

The final step in the research process was the creation of a website. This involved designing an attractive layout and then importing the geodatabase into ArcIMS. The various ArcIMS tools that were implemented were kept to a minimum for ease of use. Since it was expected that many of those accessing the website would have had little or no GIS training, usability and user friendliness of the website was held to be of paramount importance in the design process.

Figure 2 below shows the use of the Identify tool on the website toolbar. A radio station has been located and information relating to that radio station is presented in the lower left corner of this screenshot taken from the website. The information shown includes the ownership of the station and data on the height of the tower, its power, and whether it broadcasts as AM or FM. If political parties want to target their advertising monies they can find out information about those radio and TV stations that broadcast in districts where they want to focus their advertising.



Figure 2 The Use of the Identity Tool to Extract Information About a Radio Station from the Website

Visualization of Relationships

There are many barriers to completely transparent and effective democracies in Canada and also in the eleven Central and South America countries included in the MMA Project. Some of these have been noted by (Sieder et al., 2002) for Guatemala. These researchers note the following electoral impediments to the democratic process in Guatemala:

Democracy and elections are not the same thing. While elections are a necessary ingredient, the notion of procedural democracy requires the right of citizens to participate in an equitable manner in leadership choice, in policy formation and implementation. It requires the rule of law and an institutional structure to support these processes. More ample conceptions of democracy, pertinent to Guatemala, take into account social inequality among class and ethnic groups, and poverty levels, conditions which can only undermine democracy by preventing the real practice of democracy regardless of the formal rule structure.

Figure 3 below shows a comparison of federal election results from the 2004 and 2006 Canadian elections. This is straightforward approach to envision the changes that occurred in the voting patterns over the two years.

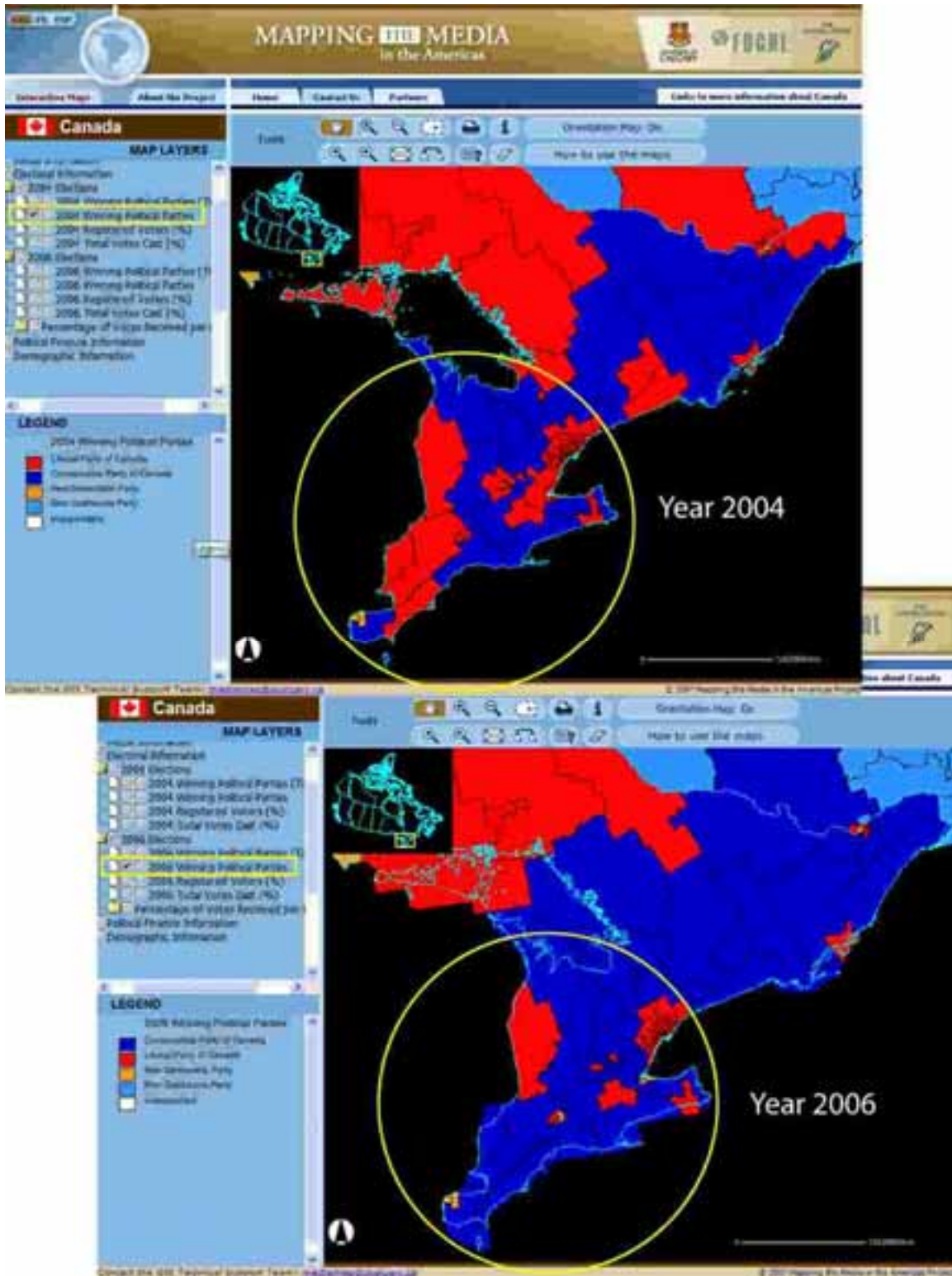


Figure 3 Results of the Canadian Federal Elections in South-western Ontario in the 2004 and 2006 Federal Elections

Statistical Analysis

An important use of the website will be to conduct statistical analysis that can show relationships between variables. One common method is to relate the pattern of variation in a dependent variable, such as the percentage of voters that voted for a political party, with various independent variables such as education, income, and language spoken. Examples of such models for the MMA Project were provided in a recent paper (Waters et al., 2006).

There are a vast number of other types of statistical analyses that can be conducted on the datasets located on the website and this is indeed one of the attractions of the website as a resource for further research. It is hoped that the website will enhance *empirical* political science research which has had a relatively short history since it is commonly asserted that this type of research dates back only to the 1960s (Smith, 2005, p. 287). Much statistical analysis can be carried out within the GIS using tools that are found within ESRI's Spatial Analyst module. Certain types of analysis are better conducted by extracting the data from the GIS and performing the statistical operations in a stand-alone statistics package such as the Statistical Package for the Social Sciences (SPSS: www.spss.com).

In Figure 4 below an online calculator has been used to calculate an index of concentration known as the Gini coefficient. The Gini coefficient is a measure of the inequality of a distribution. It is defined as a ratio with values between 0 and 1: the numerator is the area between the Lorenz curve of the distribution and the uniform (perfect) distribution line; the denominator is the area under the uniform distribution line. A value of 0 thus indicates perfect equality while a value of 1 indicates perfect inequality.

Cleavages between rich and poor, between Spanish and indigenous speaking populations and between the literate and the illiterate exist in most countries in Latin America but the Gini coefficient can provide a quantitative measure of these disparities. If the disparities are seen to be increasing and if this occurs when a country's economy is growing then this can be a source of great dissatisfaction in the electorate. It can be especially disconcerting if these divisions manifest themselves geographically. Our website can help to show whether these spatial cleavages exist. The Gini coefficient can be used to indicate their magnitude and, where time series data exists, trends can be discerned.

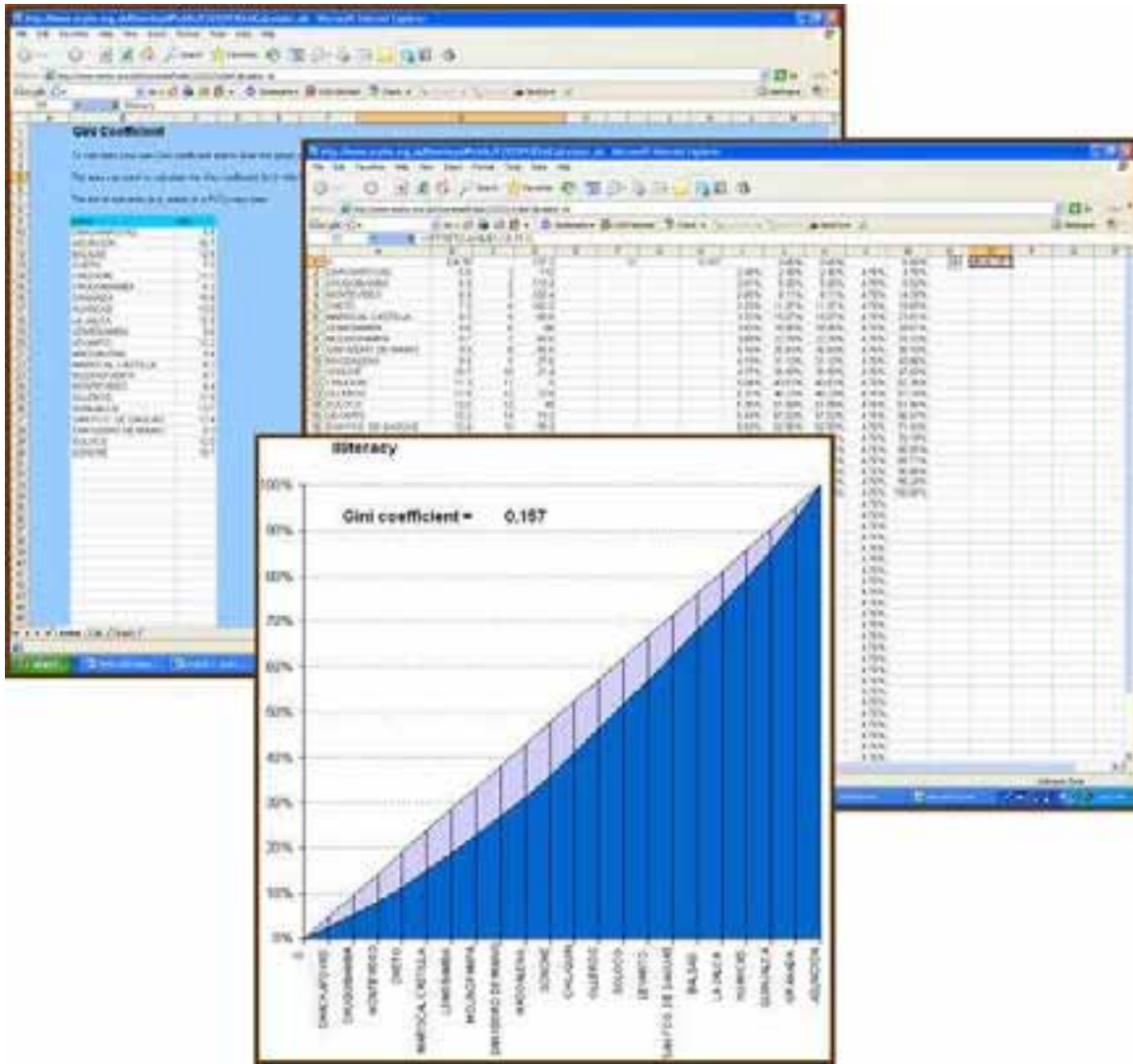


Figure 4 The Gini Coefficient Calculated for Illiteracy Rates in Chachapoyas Region of Peru

Spatial Analysis

There are many forms of spatial analysis that can be conducted on the data in the MMA Project website. Two forms of spatial analysis involve the use of buffers, wave propagation models and digital elevation models to estimate the reach of broadcast media and the use of geographically weighted regression models to assess the spatial variation in those dependent variables that are used to explain voting patterns in federal elections (Waters, et al., 2006).

Figure 5 illustrates the use of the ArcIMS query tool to investigate illiteracy rates in different parts of Argentina. An important concern here is that if political parties use the print media as their primary tool to reach the electorate then high illiteracy rates will

effectively disenfranchise large portions of the population. Moreover those segments of the population that suffer the most from limited access to information will be the poor and the old. The precise nature of this relationship and those regions of the country where it is of most concern can be determined using our web-based GIS.

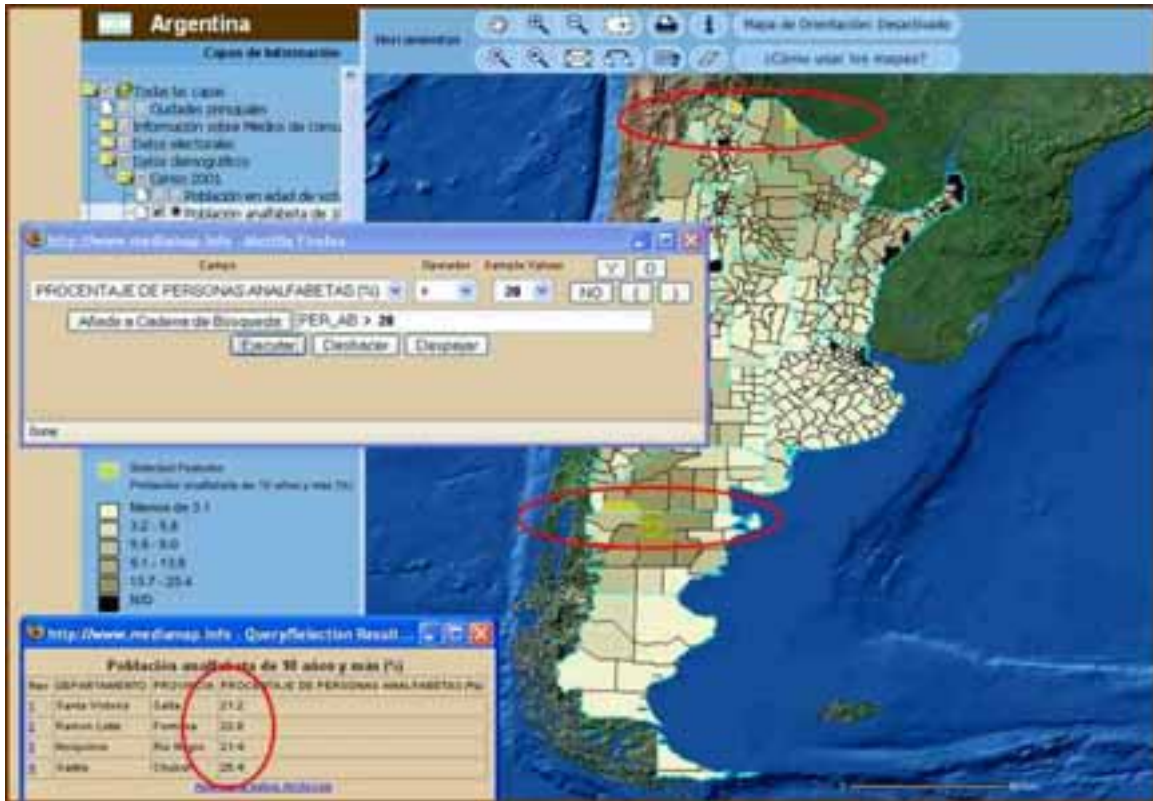


Figure 5 An Illustration of the Map Query Tool to Examine Rates of Illiteracy in Argentina

Spatial autocorrelation statistics such as Moran's I and Geary's C can be calculated to determine the degree of spatial concentration in the datasets that appear on our website. It is especially important to determine if the voting patterns exhibit positive spatial autocorrelation. A clustering of voters' preferences for a particular political party can indicate regional differences and disparities. In federated states this may lead to separatist and secessionist tendencies.

Figure 6 below shows that the spatial autocorrelation of voting patterns for the Grand National Alliance Party in the Second Round of the Presidential Elections in 2003 is relatively high and is thus a cause for concern. Time series data that portray the results of a sequence of federal elections can be examined to determine if this trend is increasing or moderating.

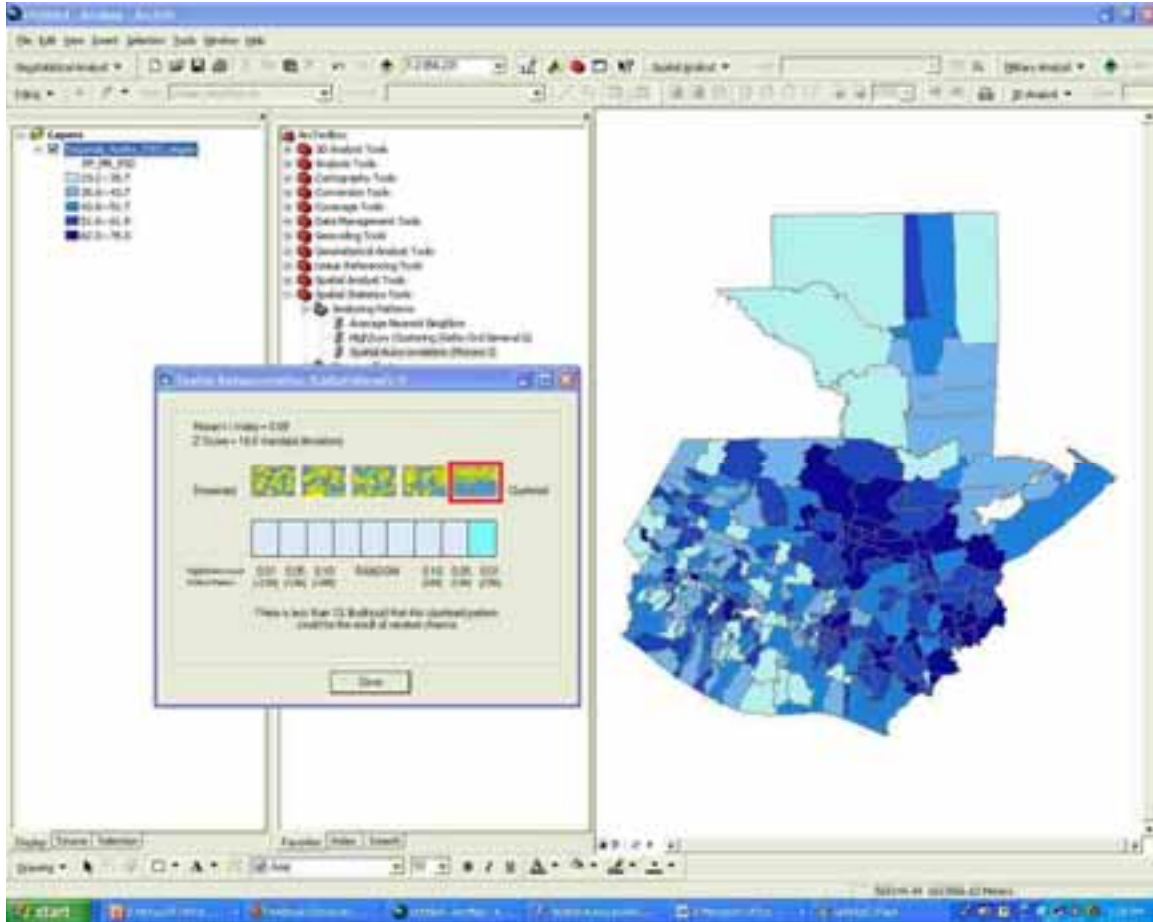


Figure 6 Spatial Autocorrelation: Votes for the Grand National Alliance Party in the Second Round of the Presidential Elections in Guatemala in 2003.

Completing Phase I

The above examples of queries to the database, visualization of the variables stored there as maps, and the various statistical and spatial analyses that we have described above indicate the wide variety of uses for the MMA website.

Phase I of the MMA Project will be completed in July 2007. By then all twelve countries will have geodatabases that include social, economic and demographic data from the most recent censuses, the results of result federal election(s) mapped at the finest spatial resolution for which they data is available and the locations of TV and radio stations and the publishers of all major newspapers. All of this data will have also been entered into the ArcIMS website and will be readily available to any individual or organization that has a computer and a web browser.

During the week of May 14-18, 2007, representatives from the Technical Team at the University of Calgary (Chantal Hansen and Heng Sun) travelled to Lima along with Laurie Cole from FOCAL to provide training to our partners from Peru, Mexico, Argentina and Guatemala. This training involved hands on experience in using the website for visualization, and statistical and spatial analysis to see the influence of the media on the electoral process. Our partners were shown how to maintain the website and how to enhance the datasets by adding new census data, electoral results and media information as this becomes available. All data sets associated with a partner's country were then transferred to that partner.

Future Work in Phase II

FOCAL and the University of Calgary are proposing a second phase for the MMA Project. Phase II is planned to last from August 2007 to July 2009. This goal of Phase II will be to promote and sustain the interactive, web-based tool as an election monitoring device. It is envisaged that many different groups and individuals will want to use the website in various ways.

Most countries have government and non-government organizations that are concerned with monitoring elections. In Peru, for example this includes Oficina Nacional de Procesos Electorales (ONPE) and Transparencia, respectively. Other users would include candidates for election and those working for the various political parties who might use the website to maximize their potential for electoral success by focusing their media advertising campaigns in those areas where success had eluded them by the narrowest of margins. The media themselves might use the websites to attract advertising funds during election campaigns.

Phase II will seek to encourage our partner organizations within Peru, Mexico, Argentina and Guatemala to experiment with new, innovative forms of analysis. Thus it might be possible to use ESRI's Network Analyst to design optimal campaign tours that would maximize a candidate's ability to visit marginal seats and to plan an advertising campaign to coincide with such a tour.

Conclusion

The MMA Project interactive GIS-based website provides a tool for enhancing and sustaining the democratic process in the twelve countries studied. A process for sustaining and maintaining the geographic data sets in four of the countries, Peru, Mexico, Argentina and Guatemala, has been established with partner organizations in those countries. The remaining datasets will be housed and updated by researchers working at the Latin America Research Centre at the University of Calgary. The social, economic, cultural, electoral and media landscapes of these twelve countries are changing rapidly. As Ostry (2004) notes the story of this new and changing geography has just begun and "its evolution is fraught with uncertainty." If the democratic process in these

countries is to be sustained and enhanced it is important that these landscapes and geographies are transparent, accessible, and comprehensible. The MMA Project website at www.mediamap.info will contribute to these objectives.

Acknowledgments

The Mapping the Media in the Americas Project has received generous funding and support from the Open Society Institute (OSI); the Canadian International Development Agency (CIDA); the University of Calgary's Faculty of Social Sciences, Latin America Research Centre and Geography Department; Environmental Systems Research Institute (ESRI); the Social Sciences and Humanities Research Council and others.

A partial list of individuals that have worked on the Mapping the Media in the Americas Project and listed alphabetically by family name include Gretchen Bretz, Ben Brewer, Coral Burns, Laurie Cole, Lucila Crena, Jillian Dowding, Jing Gao, Patricia Garcia, Chantal Hansen, Jill Harvie, Tessa Jackson, Coby Jansen, Jennifer Kotler, Caroline Lavoie, Shelley McConnell, Jane Nandy, Maria Palacios, Chris Peters, Stephen Randall, Carmen ReMartinez, Priscilla Revis, Timmy Stuparyk, Heng Sun, Nigel Waters, Brett Wiens, Shuqun Zheng and others.

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