Project Proposal

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Introduction

Political district boundaries in Pennsylvania are currently drawn by politicians trying to protect and expand their power. District configurations that favor incumbents have been a result of this. This strategy has resulted in 98% of incumbents retaining their seat in a typical Pennsylvania election (Eich, 2007). The issue of taking redistricting out of the hands of political leaders, and placing it in the hands of a nonpartisan redistricting commission, is one currently promoted by reform candidates (Eich 2007).

This topic has been introduced to a group of twelve non-partisan undergraduate students at the Pennsylvania State University by Centre County Commissioner candidate, Jon Eich. Each student had an understanding of the problem prior to Eich’s introduction, but further research has allowed the students to come to a more complete understanding of this issue. The fields of study for these students include geography, earth science, and entomology. Each student has experience using the mapping program, ArcMap, and knowledge of how to obtain and manipulate data relevant to this problem. Each student has a thorough understanding of exactly what redistricting and gerrymandering are, and why it is necessary to redistrict in a non-partisan manner. As a class, we have split into groups, according to each of our abilities, in order to efficiently undertake the problem.

Problem

An understanding of the Modifiable Areal Unit Problem (MAUP) is key in understanding the drawing of non-partisan political boundaries. If the spatial units in a particular study are specified differently, or modified, the statistical properties may have very different patterns and relationships (O’Sullivan and Unwin, 30). There are two components of the MAUP: the scale effect and the zonation effect. A variation in numerical results due to the number of zones used in an analysis is the scale effect. The variation in numerical results due the grouping of smaller zones into larger ones is termed the zonation effect.

According to O’Sullivan, the effects of the MAUP, “have been well known for many years to politicians concerned with ensuring that the boundaries of electoral districts are defined in the most advantageous way for them” (O’Sullivan and Unwin, 31). For example, Pennsylvania’s 12th Congressional District is a gerrymandered district. The
This district was drawn to protect the incumbent Democrat John Murtha. The district contains regions with mainly Democrat influence, while snaking around more right-wing and conservative areas. It is neither compact nor contiguous, and is most importantly biased.

As a group, we will propose regions that are not biased towards the needs of one party, and create districts that adhere to the “one person, one vote” principal. This will be achieved by drawing boundary lines that do not take into account party registration, and accurately represent a defined geographic area based on the population eligible to vote.

**Project Description**

In an effort to allow for a fair election between all candidates, including incumbents, we will draw new boundaries for the districts of Pennsylvania. 2000 Census data, as well as other important data from Pennsylvania, will be manipulated using mapping software to arrive at a newly configured map displaying the redistricted state of Pennsylvania. Each district will have an equal population. The lines will be drawn in such a way that county, school district, and other municipal boundaries are taken into account in the formation of districts with high geographical cohesion. Geophysical boundaries created by mountains, rivers, or large water bodies will also be taken into consideration during the redistricting process as well.

Our final product will consist of three parts: a website accessible to the public, a set of tool and procedures to achieve a new redistricting, and a printed version of the redistricted map of Pennsylvania. The website will include the current map of the districts in Pennsylvania as well as a map of the possible redistricted state. Along with the two
maps that will serve as a comparison, interested viewers will also be able to access the 
statistics used to create the new boundaries. The print-out version will be a large 
redistricted map of Pennsylvania which the client may make use of as he sees fit.

Objectives

The first objective of the project is to gather the necessary data and research 
various analysis/GIS programs to be used for the problem. The data that will be used is:

- Hydrography
- Present PA senate and congressional boundaries
- Present U.S. Congressional boundaries
- Census 2000 population data
- Projected population data
- Topography
- County boundaries
- Voter registration data
- School district boundaries.

Both PASDA Data and ESRI Census 2000 Tiger/Line Data will be used to create the 
appropriate maps needed for analysis. After the data for the project has been collected 
and redistricting software has been identified, the project can move towards the second 
goal.

The second objective is to design and test the redistricting software. As the class 
learns how the software works, the methodology for completing the project will unveil 
itselves. We will experiment with different constraints using the data, observe the response 
of the software in the resulting political districts, and in turn, determine the best approach 
to achieve neutral political boundaries.

The third objective is to design and produce the new political district maps with 
no political bias. In order to do this no voter registration data will be included in the 
process of drawing the new boundary lines. Analysis will be done in either ArcMap or 
Autobound to start redistricting. At the same time the Cartography/Web Design and Web 
Mapping/Interactive Map groups will begin work on the cartography for the map and 
website design.

The fourth and final objective is produce a related web mapping application for 
public use, and a professional printed map for our client, both showing the final 
redistricted results and related statistics. The web page will be published online and web 
space will be provided by the Department of Geography. The print-out map will be a 
large poster sized map that will be printed on strong a medium. This map can be used as a 
visual during any of the client’s presentations.

Organization

Each step of the process will be documented carefully in order to ensure the 
project is moving forward. The class will be divided into different sub-groups according 
to skill and familiarity with specific components that will be necessary to the construction 
and implementation of the final product. Each group will have a sub-group leader who 
will work closely with the other sub-group leaders to ensure that each component leading 
up to the final product is met in an efficient and timely manner. Each of the members of 
the class will be assigned to a county (or counties) for which they will serve as the
contact person for information regarding townships, cities, and boroughs within a county that may impact the drawing of boundary lines.

The first overall goal for the class is to begin documentation of the project. Understanding that every aspect of this project must be documented is important for the whole class especially because of the short amount of time to devote to the project and the number of people working. This documentation should include the steps we have taken whether they have led us forward or not. By documenting the progress made each day everyone involved will be kept informed throughout the process. This includes communication regarding individual group progress, as the whole class will be informed of the daily progress made in each group.

Our second goal is to divide the class into groups to allow for more efficient group work and to play on each person’s strengths. We have determined that there will be four groups:

- Data collection/Programming/GIS Analysis
- Documentation
- Cartography/Web Design
- Web Mapping/Interactive Map

Some people may be in more than one group depending on their abilities. We have also determined a need to assign specific people as permanent communicators with the client so we can direct any questions to him and to avoid confusion.

The third overall goal will be to assign each member of the class to specific counties in order to gather information about the townships, cities, and boroughs within, which could affect the redistricted boundaries. The shared drive to which we will all have access will allow us to easily upload and download files.

**Product Design Overview**

To create the appropriate maps we will use data from: [www.pasda.psu.edu](http://www.pasda.psu.edu), and also from the ESRI Census 2000 Tiger/Line Data download site at [http://arcdata.esri.com/data/tiger2000/tiger_download.cfm](http://arcdata.esri.com/data/tiger2000/tiger_download.cfm). At these websites we will locate the current District Lines, School Districts, Area Codes, Hydrography, Physiology, County Lines, Township Lines, and finally the census information which come in the form on blocks, tracks, and block groups. All of this data will allow us to compare with the current District lines across the state and also to produce our own set of lines following the guidelines set by the client.

In order to use data we are going to use an ArcMap extension called *Districting* which is downloaded from esri.com/downloads. This extension allows us to create unified polygons which can be modified and changed to create a
more unbiased district plan for the state. The extension provides us with real time charts and tables with the information for each polygon or district we create. This will allow us to load all of the different data layers such as Rivers, School Boundaries, etc and try to follow them as much as we can while keeping the population counts equal.

After the set of maps are posted online and running, the ability to manipulate the data with the ArcMap extension Districting will allow us to interactively see the effects of different parameters on the District lines. At this point the specific details are not clear regarding the form of this program; however, it will include different options for the number of Districts displayed, the sensitivity of the variance of population between Districts, as well as radio buttons for different data layers. These radio buttons will allow the user to choose the layers that he or she wants the District lines to follow while also ranking the importance each of these layers.

The first half of the final product will be an online collection of PA District maps that will have some sort of interaction possibility. These maps will show us the statistics of each District such as Population Count. For this we will most likely be using one of the GeoVISTA programs such as Improvise, to display these maps online at a soon to be determined URL.

To produce these maps we will follow these guidelines pre-determined by the client (Eich, 2007):
1.) Each district must contain approximately the same number of “qualified electors.”
2.) Party registration must not be a factor in drawing district boundaries.
3.) Keep political units in the same legislative district (a priority, wherever feasible).
4.) Account for barriers between travel and communications posed by physical features.
5.) Consider the contiguousness and shape of legislative districts.

The second half of the final output is a large print out of the newly determined lines for the state of Pennsylvania. This will be printed on thick display board and will be able to be used at different presentations. This map can be carried and displayed when needed and be used as proof that these new lines can be created.

Constraints

Software

Because of the lack of inputs into the ArcMap extension Districting, we will need to either code to provide us with these inputs, or to find another program that will allow us to do this. For the coding we are going to do it in house, or with the help of PSU Geography faculty. It has also not yet been determined if we want to have the ‘behind the scenes’ interactive redistricting program online and useable by anyone, or rather have it in a place that only a select number of people can use it.

Data

A type of constraint or limitation to our data is its abilities and usefulness. For example, we are limited to Census 2000 with the smallest divisions being census blocks, which are the smallest of the census boundary shapefiles. With census blocks we will be able to easily draw our congressional boundary line down to some of the smallest communities with accurate population spread. This will allow us to correctly allocate the required population count per congressional district. The constraint with Census 2000 data is how old it is in relation to the current year.
Additionally, new residential and commercial developments throughout the counties of Pennsylvania since the seven year old 2000 census was collected will have a reasonable impact on data accuracy. Communities represent social boundaries which we believe are important to mapping congressional districts. Although community boundary lines are unattainable at the moment, using student’s local knowledge and a combination of research and other readily available data like school districts we will attempt to approximate these county polygons. Our data will be primarily obtained through PASDA and the 2000 Census, so there will be no restrictions on our access.

Timeline

Our first major deadline following the proposal is the design document. By November 6th, our project design will be finalized. At this point we should know exactly what has been accomplished, through documentation, and also know how the project will conclude. The redistricting should be well on its way and perhaps a prototype should be included with the document.

Following the design document deadline, the redistricting work will continue and be completed in this last stage before the end of the semester. When finished, we will apply the proper cartography to the maps for both the print out and the web page. We then have to compare the final district results to voter registration data to see what the impact would be on a mock election. Once the redistricting is complete, the maps will be printed as well as uploaded to our project webpage.

When the project is complete, the group will give an oral presentation to our instructor and our client on December 6th. Finally, an Implementation and Evaluation Report will be completed by Thursday, December 13th. This report will include all of our other deliverables, the maps and website.

Attached are a timeline and flowchart both of which detail the project from start to finish. The project will be completed by December the 13th.

Conclusion

It is impossible to draw non-partisan legislative district boundaries when redistricting is in the hand of incumbent political leaders. The problem surrounding the restoration of the “one person, one vote” principle can be solved by placing the task of redistricting in the hands of this non-partisan group of students. We have the necessary resources and are committed to delivering a usable product. Our expertise is applicable to this issue and comes without cost to the client.

Cost Justification

Costs incurred by the class:

Personnel:

Students 865.2 hours (51912 min)

(Time spent on project by each student. Class two times a week for 75 minuets, plus one hour after class work, plus 7 hours (outside of class) work, multiplied by 7 weeks per person. 72.1 hours per week multiplied by 12
students.)

<table>
<thead>
<tr>
<th>Personnel Total:</th>
<th>865.2 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Travel:</td>
<td></td>
</tr>
<tr>
<td><strong>Travel</strong></td>
<td>10.5 hours</td>
</tr>
<tr>
<td><em>(Student’s walk to and from Walker building.</em></td>
<td>(630 min)*</td>
</tr>
<tr>
<td>Average student’s walk to Walker building is 15 minutes. 15 minutes multiplied by 2, multiplied by 3 (two class periods a week + one outside of class meeting a week), multiplied by number of weeks (7) (starting from 10/21/07 and ending 12/13/07) excluding Thanksgiving break.)*</td>
<td></td>
</tr>
<tr>
<td>Travel Total:</td>
<td>10.5 hours</td>
</tr>
<tr>
<td>Equipment:</td>
<td></td>
</tr>
<tr>
<td><strong>Lab Computers</strong></td>
<td>$0</td>
</tr>
<tr>
<td><em>(Lab costs included in PSU tuition)</em></td>
<td></td>
</tr>
<tr>
<td>Equipment Total:</td>
<td>$0</td>
</tr>
<tr>
<td>Supplies:</td>
<td></td>
</tr>
<tr>
<td><strong>Voter Registration CD</strong></td>
<td>$10</td>
</tr>
<tr>
<td><em>(The CD of Voter Registration data will be purchased in order to perform an analysis of the final map once all boundary lines have been drawn.)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Office Supplies</strong></td>
<td>$84</td>
</tr>
<tr>
<td><em>(This is an over-all estimate for pens, paper, paperclips, stapler, staples, and any other office supplies that will be necessary throughout the time spent working on the project ($42.00). It was estimated that each person in the class has one notebook ($3.50).)</em></td>
<td></td>
</tr>
<tr>
<td><strong>Printing Fees</strong></td>
<td>$40</td>
</tr>
<tr>
<td><em>(One large poster that includes the final redistricted version of the PA map will be printed at the culmination of the project. This may also include smaller inset maps highlighting areas of greatest change or a map displaying the current district lines for comparison.)</em></td>
<td></td>
</tr>
</tbody>
</table>
**ESRI ArcGIS Software Package**  
$0

(Lab computers equipped with ESRI ArcGIS for use in the Walker Building. The software is covered by the Department of Geography. Cost to students is included in PSU tuition.)

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**Supplies Total:**  
$134

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**Contractual:**

*PSU GIS Faculty*  
20 hours

(Skilled PSU faculty may be contracted to provide assistance in the programming and other areas of need where higher expertise is deemed necessary in completing the project to the level of the standards stated in the proposal.)

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**Contractual Total:**  
20 hours

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**Other:**

*PSU Fall 2007 Tuition*  
$84,000

(12 students multiplied by PSU tuition for Fall 2007 (7,000) for each full time student.)

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**Other Total:**  
$84,000

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**Total Direct Costs:**

(The total direct costs were calculated by summing the totals listed above.)

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**Total Direct Costs Total:**  
895.7 hours + $84,124

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**Indirect Costs:**

(These costs will included electricity, heating, lights, the school’s lab computers, internet, and space. All of which are included in PSU tuition.)

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**Indirect Costs Total:**  
$0

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**Total Costs:**  
895.7 hours + $84,134

Costs incurred by the client:
Personnel:

Client                                    9.15 hours
(Time spent in class to present the issue to be addressed in the project (75 min). Time spent in e-mail or telephone correspondence with the class representatives (3 hours). Time spent reviewing documents (2) submitted regarding the progress of the project (5 hours). Also time spent in Walker for in-class presentation of the final product (75 min).)

Personnel Total:                        9.15 hours

Travel:

Travel                     .33 hours (20 min) + $7.68
(Client’s drive to campus (time) plus gas money ($2.88/gallon at 15 miles per gallon, driving 10 miles one way, for two visits to campus. 40 miles/15 miles = 2.66 2.66 x $2.88 = $7.68)

Travel Total:              .33 hours + $7.68

Equipment:

No costs incurred.                  $0

Equipment Total:                   $0

Supplies:

No costs incurred.                  $0

Supplies Total:                    $0

Contractual:

PSU Geog 468 class $0
(Skilled PSU GIS students work without monetary cost to client.)

Contractual Total:                $0

Other:

No costs incurred.                  $0
Other Total: $0

**Total Direct Costs:**
(The total direct costs were calculated by summing the totals listed above.)

| Total Direct Costs Total: | 9.48 hours + $7.68 |

**Indirect Costs:**
No costs incurred. $0

| Indirect Costs Total: | $0 |

**Total Costs:** 19.65 hours + $7.68

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**Cost Benefit Analysis**

*Class*

The total costs incurred by the class will be about 895.7 hours and $84,134. Over the seven weeks the costs consist mainly of hours spent researching, planning, constructing, and implementing the web site and print-out map of the redistricted Pennsylvania. Along with this computing and software fees and classroom space are included in each student’s tuition.

However, even with these costs the students will be receiving compensation in the form of real world experience. Such experience will help strengthen each student’s resume and benefit the student in future job advancement.

*Client*

The total costs to the client will be around 19.65 hours and $7.68. These costs will be minimized by the fact that the service provided by the class will not be compensated with money. It can be expected that 19.65 hours will be spent by the client reviewing documents regarding the progress of the project and answering questions that the class may have. Gas money spent to drive to and from campus on two trips will also be a cost incurred by the client.

However in light of these costs the benefit that the client will receive will be the final product which will have been completed free of charge. It would not be necessary for the client to learn how to use the GIS software or buy necessary equipment; rather the clients will be provided a large map displaying a newly districted Pennsylvania which has been produced by a non-partisan group of skilled who have researched the issue of gerrymandering and have used 2000 Census data to create a map. This map which will have been carefully contrasted will serve as a tangible example of what a redistricted state of PA may look like if districts were drawn without party bias.
Sources


Flow Chart and Timeline
Redistricting problem presented to class by client

Goal: to create district boundaries so that each district for a legislative body has the "same" number of "qualified electors."

Document process until we reach final results

Discern a basic plan of action (what we will need, how to solve problem)

Divide class into groups based on what we need to complete the project/assign group roles

Assign students to communicate with client

Gather data

Hydrography

Present state/senate/congressional/house boundaries

Find redistricting program to use: ArcMap extension? Autobound software?

Join data so shapes/layer have attributes we need

Data group

Programming/analysis/redistricting group

Document group

Cartography/web design

Interactive map/web mapping group

Census population data

Topography

County boundaries

Voter registration data

2000 Census

School district boundaries

Project Proposal/Terms of Reference Document DUE OCT. 23

Assign students to research counties/Gather information about counties/through/selected towns/that could affect redistricting

Access a Google drive for class project materials

Redistrict lines to meet requirements using the program found. Begin thinking about design changes and website. Decide about interactive map.

Design Document DUE NOV. 6

Finish redistricting

Apply proper cartography to online maps and printed map

Compare voter registration data to redistricted map

Final products

Possibility: an interactive map on the webpage

Webpage of four maps and results for the public

Produced website

Oral Presentation and Demonstration of Project in Class DEC. 6

Report/portfolio

Implementation and Evaluation Report/All Previous Deliverables stored into a portfolio DEC. 13