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Using GIS to identify clusters of potential donors to colleges and universities

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USING GIS TO IDENTIFY CLUSTERS OF POTENTIAL DONORS TO COLLEGES AND UNIVERSITIES

As tuition at colleges and universities continues to rise, many development offices face increased pressure to raise additional funds from alumni and friends. This pressure has intensified, in part due to costs associated with the investment in the latest computer technology. But these costly computer tools also can be used by schools to increase philanthropic giving.

This paper explores ways in which development offices can use one computer-based research tool, Geographic Information Systems, to better identify potential donors. GIS allows a researcher to overlay data on a map and then search for patterns that might not be otherwise apparent. The paper offers a brief history of GIS and explores its diverse uses. The paper focuses on several current uses of GIS at colleges and universities and explores initial efforts by schools to use the technology in philanthropic giving. Finally, the paper demonstrates how GIS can work in a university capital campaign. Using data from one school, the paper shows how geocoding can help a development office focus on such questions as 1) whether alumni and friends who currently contribute are geographically “clustered” in identifiable neighborhoods; 2) what the wealth of these neighborhoods is and whether the wealth correlates with the level of giving; and 3) for alumni and potential donors who are not contributors, what their giving potential is.

History of GIS

GIS has been broadly defined as a "computer system capable of assembling, storing, manipulating and displaying geographically referenced information, i.e. data identified according to their locations." [1] The technique -- part of the broader field of Computer Aided Design -- has been used at least since the early 1960s, when development of the Canada Geographic Information Systems began as a way to address growing competition for potential uses of land.[2] In 1964, Howard Fisher established the Harvard Lab for Computer Graphics and Spatial Analysis, which created pioneering software for spatial data handling.[3] While the U.S. Geographic Survey has been a leader in promoting the use of GIS, the technique is increasingly used in both the public and private sectors, here and abroad. Estimates of the size of the global market of GIS range from $700 million[4] to as high as $2 billion. [5]

Abstracts of papers prepared for the 14th annual Conference on Geographic Information Systems in Toronto in March 2000 underscore both the varied applications and the international scope of GIS usage. To explore the concept of "environmental justice," one University of Pennsylvania researcher used GIS to analyze demographic patterns in neighborhoods adjacent to Superfund sites to see if there was any bias toward any segment of the population (Un Ban, 2000). [6] Another researcher described the growing use of GIS data on the World Wide Web as a way to increase public participation in city planning in China.[7] A representative from the Technical Teachers Training Institute in Chennai, India, described how GIS improved the siting of sanitary landfills.[8] Another paper described the difficulties of managing an overwhelming amount of municipal data for cities in Saudi Arabia and the ability of GIS to provide a framework to ease municipal decision-making.[9]

When a GIS database is placed online, it can sometimes be too effective at informing the public, as authorities in Dakota County MN found when law enforcement agents discovered that their home addresses were suddenly available to anyone who searched for their names (Thornburg, 1999).[10]

College and university applications

College and university administrators often need to examine multiple datasets in decision-making, and GIS can be a useful tool in this regard. One 1998 study[11] highlighted some of the many campus uses of GIS, including strategic planning for institutional goals; recruiting students and monitoring student progress; alumni contacts and development; integrating databases for personnel, facilities and budgeting; facilities planning, operations and management; and community outreach. The authors also identified stages in the adoption and use of GIS in the academic world. Initial applications may involve GIS for individual projects and activities, followed by a larger number of individuals and academic units getting involved in continuing projects or activities. A third stage involves essential applications at the highest organizational levels, often resulting in new or reallocated resources and staff. The authors reviewed the evolution of GIS use at their institution, Arizona State University, and concluded that diffusion of GIS via the Internet could be especially useful to institutions seeking to manage scare resources.

Reviewing the varied use of GIS at the University of Arizona, McCormick and Wissler[12] entitled their paper: "THAT'S NOT HOW YOU'RE SUPPOSED TO USE GIS! Rethinking GIS as an administrative tool at a major university." While UA's internal GIS effort started as a campus-wide aerial survey and mapping project, the school encouraged interdepartmental collaboration and the development of instructional technology tools, such as a "virtual world" 3D campus map that was based on GIS basemaps. The authors stressed the advantages of GIS-generated graphics that depict and sell proposals for new facilities, rather than conventional maps that might better explain existing conditions.

The technique can be useful at smaller schools like community colleges, at regional institutions and at larger schools like state universities and national selective institutions. For smaller schools, it provides a cost effective way of providing a local market analysis. Current students can be geocoded by neighborhood; the proximity of these neighborhoods and their demographic profile can be used to identify similar neighborhoods that can then be targets of an enrollment campaign. Likewise, larger schools looking to plan a satellite campus can use Census data to build a demographic profile of an area, look at such variables as the percentage of residents without a bachelor's degree, and gauge the area's potential as a market.

One problem faced by colleges and universities is a scarcity of trained personnel to administer GIS-based research programs. In the mid-1990s, 10 community colleges and 350 four-year schools in the U.S. offered courses in GIS; today the tachnique is taught in an estimated 475 community colleges and 1,100 four-year schools.[13] Recognizing the need for better trained academics in this field, the National Science Foundation awarded a $800,000 grant in 1999 for the training of faculty members at schools across the country.[14] An estimated 50,000 to 75,000 people now use GIS on a regular basis.[15] Many schools strugge with the age-old issue of whether to educate students in the theoretical or practical aspects of the technique.[16]

To launch a GIS campaign, some schools have enlisted faculty members from departments like Geography, Urban Studies and Sociology who use GIS in their research. The faculty members, paid with a stipend or through course relief, already have access to much of the needed software. Schools that have to bring in a GIS specialist face a startup cost of about $1,000 for a software base system (available through such vendors as ESRI and Mapinfo), plus digitized maps of their area that can range from $500 for a community college to $15,000 for a national profile. While there is always a learning curve, the software is user friendly (compared, say, to SPSS), features pull-down menus in a desktop environment, and also can be used in the classroom by students with minimal training

Philanthropic applications

One major challenge to all involved in philanthropy in higher education is the need to classify alumni and friends by their potential to provide support. Some alumni may respond to surveys and voluntarily provide information about their income and wealth. However, in most cases, even alumni and potential donors who are committed to an institution may not voluntarily disclose their giving potential. A second challenge for any development office, especially during a capital campaign, is to organize networks of campaign volunteers who are willing to be involved in fund raising efforts. An effective strategy might tap into the social networks where clusters of alumni live in physical proximity to one another.

Both of the challenges identified above can be addressed by employing a GIS system to organize alumni and donors by the neighborhoods where they live. Once alumni and donors records are geocoded, street addresses can be matched to their geographical location. Once neighborhoods are identified, the Census data for the area can be added to the individual records of alumni and friends. With this neighborhood data, the level of current and potential giving can be analyzed by the relative wealth of areas where the individuals reside.

Yet while GIS can be used as a cutting edge technology in many areas, an examination of on-line materials offered by Philanthropy Journal, Philanthropy News Digest and the Chronicle of Philanthropy in March 2000 found little is being written about the potential use of GIS in fund raising and development activities. One of the few studies focused on a Lebanon-based philanthropic association (Makassed). It described how GIS could serve as a decision-making tool for budgeting and scheduling, as well as providing a platform for mapping on-line information about the organization. [17] A more ambitious marriage of GIS tools and fund raising was used by Notre Dame Church in Denver.[18] Instead of using traditional maps and pushpins to track families in the parish, church leaders used GIS to geocode church families by street address. The map allowed the church to identify groups of 10 families living near one another, and a church volunteer was assigned to each group to better ensure a successful fund raising campaign. The map allowed the leaders of the fund raising campaign to track and validate the success of the campaign. (The authors called the result: “G.I.S. for G.O.D.”)

Understanding GIS: Social geography

The underlying premise of GIS draws upon a long tradition in American social science, especially in sociology, which considers space to be an important component of social reality. People inhabit social and physical space, and the shared characteristics of neighbors have strong influences on behavior and attitudes. Communities where people live and carry out their daily lives are characterized by a social geography. In order to fully understand any social phenomenon, including charitable giving, the influence of this social geography must be examined. GIS provides a powerful tool in the study of the social geography of American communities.

A GIS system starts with digitized, street-level maps. The maps are created as a series of lines (vectors) connecting nodes that map each street intersection. The nodes are located as points on a GIS map defined in units of longitude and latitude. Additional units of geography such as zip code boundaries, city and town boundaries, and county delineations can be added as layers.

The Census Bureau also has developed geographical units, Census tracts and block groups, that map the boundaries of neighborhoods within cities and towns across the United States. Census tracts are small geographic entities within cities, towns, or counties that have 2,500 to 8,000 residents and boundaries that follow visible features. The goal is to define spatial areas that are as homogeneous as possible with respect to population characteristics, economic status, and living conditions. For the 1990 Census, there were 50,690 Census tracts across the United States. Block groups (BGs) are the next level below the Census tract, and they serve as subdivisions of Census tracts. A BG is the smallest geographic entity for which the decennial Census tabulates and publishes sample data. The data includes detailed social and economic characteristics of interest to GIS users. The total number of BGs delineated for the 1990 decennial Census was 229,466.

Both Census tracts and block groups can be utilized to illuminate the social geography of local communities across the country. The social geography of local communities is often complicated. Neighborhoods may vary significantly in socio-economic makeup even within geographical proximity. There may be areas of high wealth and, in the exact same community, neighborhoods of more modest make-up. For example, Greenwich, Connecticut, is usually identified as among the most affluent communities in the United States. Recently, the Board of Realtors in Greenwich reported that the average sales price for single family homes exceeded $1 million, with the median at almost $800,000. Yet within Greenwich, there are neighborhoods with lower income and corresponding home prices far below the town average. This variation in social geography becomes crucial when using a GIS system to identify the potential to contribute.

Geocoding

A GIS analysis of alumni and friends of colleges and universities begins by identifying the Census tract and block group where each targeted individual lives. Geocoding is the technical term for matching individual address records against reference files and locating the address to its exact geographical position on a street map. If an exact match is not possible, the address can be matched to its zip +4, zip +2, or zip code boundary. Once address records are successfully geocoded, the neighborhood boundaries can be added to the GIS map, and the identifying tract and block group codes can be appended to individual records.

Successful geocoding depends on two factors: the quality of the address records maintained by the college or university and the degree to which the street spellings and street numbers match those in the GIS reference file. GIS researchers refer to the match rate to indicate the percentage of address records successfully located to their geographical location. Getting this match rate as high as possible can pose a technical challenge; the school's address list and the GIS reference files need to be as up to date as possible. But with some efforts, match rates can exceed ninety or ninety-five percent. The higher the match rate, the more comprehensive the GIS analysis.

The availability of updated, 2000 Census data starting in summer 2001 provides an added opportunity for GIS users. Due to the tendency of alumni and donors to routinely relocate, the Census data can result in a lower match rate as it gets older. The updated 2000 data will increase the usefulness of the GIS technique.

Once address records have been successfully geocoded, the Census tract and block group numbers become a permanent part of the individual level records. The next step is to add the social and economic characteristics of the neighborhood to the individual records. After every decennial Census, the Census Bureau provides a wealth of data for Census tracts and block groups. Starting with the 1990 Census, this data became available in electronic form. Private vendors reorganize the data and sell the available data for the entire country on CD. Vendors also provide updated Census tract and block group data each year with projections for the future. GIS systems include utilities which attach variables for boundary layers such as Census tract and block groups to the geocoded records within (see Table 1).

Application to development and fund raising

Once alumni and friends files are successfully geocoded, development offices have a powerful tool to organize fund raising efforts and to identify the giving potential of individuals. Fund raising efforts often involve recruiting volunteers from among alumni and friends to contact potential donors and solicit funds. One strategy is to organize fund raisers into networks and have them solicit individuals they personally know, have social contact with, or live near. When the university president or senior development officers travel to meet with potential donors, these social networks can be the focus of a fund-raising trip. However, it is a time consuming task to organize these networks and to determine who lives in proximity to one another. Often, harried staff members study paper maps, consult city directories, and use push-pins to identify clusters of donors.

With a GIS system, geocoded records can be displayed on a digital map. Starting with a selected reference point, a radius of any diameter can be drawn and all of the alumni and friends within the radius captured. Once the radius is established, all of the records within can be written to a spreadsheet or database file for preparing contact lists and direct mail. The digitized maps can also be printed.

A GIS system also allows for the creation of customized geographical units that may suit the particular needs of a development office. Customized geographical units are created by grouping Census tracts or block groups into districts; the newly created combinations can be saved for later use. A school may decide to organize fund raising at the county level and, in turn, would create customized districts as combinations of counties. Allowing segmentation of the potential market can allow development offices to be selective and targeted in their appeals, reducing the need for a broader effort and increasing the quality of contact.

GIS and the potential to give

One of the most vexing challenges in fund raising is to properly identify the potential to give among alumni and friends. Soliciting a $100 donation from someone with the potential to give substantially more represents an opportunity missed. On the other hand, asking an alumnus to contribute a multi-thousand dollar gift they cannot afford wastes scarce time and resources. Most development offices know their top prospects, especially those with the potential to make substantial financial commitments to the institution. However, any successful fund raising campaign has to move beyond the relatively short lists of top prospects. GIS can be helpful in this regard.

Once alumni and friends lists have been geocoded, neighborhood income and wealth data can be added to the individual records. Alumni and friends can be classified by the income and wealth of the neighborhoods (Census tract or block group) they live in. Data for the neighborhoods where alumni are clustered can be used to create a typology, placing alumni into categories based on an estimate of their income and wealth. An analysis of alumni living in the home county of one Connecticut university found that the 1997 income categories ran from under

$56,000 (4% of alumni) to over $168,000 (15% of alumni). Eight categories spanned the income range between $56,000 and $168,000 (see Table 2). Even in the most affluent communities, there are alumni living in neighborhoods with more moderate income levels.

With a GIS system, the same methodology can be used to categorize alumni, friends, and potential donors across the entire country. While income levels in other parts of the country vary from those in discussed in this study, the rank order remains of paramount importance. Placing alumni and friends in these categories identifies individuals with the greatest potential to contribute (defined by the highest income category for the area) and those living in areas with more modest incomes. Once alumni are categorized by neighborhood income and wealth estimates, fund raising efforts can be directed to specific targeted groups. For example, a visit from the president can be organized among alumni clustered in neighborhoods selected on the basis of their estimated income.

GIS and current giving assessment

Another use of a GIS analysis is to compare the current level of contributions from alumni and friends with an estimate of their income or wealth to determine if a strong correlation exist between the two. Does income predict the level of giving? Do alumni living in neighborhood clusters contribute at the same level? Do other variables beyond income predict the level of contributions?

An analysis of contribution patterns of undergraduate alumni at a Connecticut university produced surprising results. First, neighborhood income did not predict whether alumni contributed or not; the correlation was very low ($r=.107$, $p > .05$). The reason: all institutions have large numbers of alumni who do not contribute. Explaining this has proven to be a vexing challenge, and this GIS analysis did not shed any significant light on the decision not to give among these alumni.

Among alumni who did contribute, there was a moderately strong correlation between current contributions and the income of neighborhood where the alumni live ($r = .462$, $p < .05$). The correlation increased once graduation year was controlled for. Among older alumni who contribute, the higher the income of the neighborhood they live in, the higher the level of contribution.

Finally, when examining alumni who give the highest amounts on a yearly basis (> $1,000), the correlation between neighborhood income and contribution increased ($r = .667$, $p < .01$). Once they had made the decision to contribute, alumni living in the most affluent areas were most likely to give significant amounts. As far as the most generous contributors are concerned, social geography matters.

Once this pattern is identified, a development office could target, on an individual basis, alumni living in affluent areas who are not current contributors. If they could be persuaded to give, the model predicts that they would contribute at a high level.

Limitations of GIS

Researchers using GIS need to be wary of the “ecological fallacy” that can occur when assigning the overall characteristics of a neighborhood to all of the individuals who live within it. All Census data at the tract and block group levels consist of aggregate numbers that characterize the geographical area as a whole. Given a relatively homogeneous area, median or mean income may typify most of the people who reside there. The opposite is also possible. An average may mask people at two extremes: one group may have income substantially below the average, while the other could stand far above the average. As a practical matter, it makes sense to include both median and mean data for heterogeneous neighborhoods.

The broad Census tract data highlighted through use of GIS also may serve more as a wholesale, initial approach to identify promising neighborhoods where alumni and friends have the ability to contribute. Development offices then may want to use more of a "retail" approach by using credit reports or other individualized information to better tailor a fund-raising appeal to a promising prospect. Researchers also could overlay psychographic data, available from vendors such as Claritas, on the targeted neighborhoods to better identify and understand potential donors.

Any manipulation of sensitive financial data calls for careful thought on protecting the confidentiality of givers and potential givers. Many of the GIS examples presented here deal with aggregate data on comparison block groups, where precise financial information on named individuals is not at issue. But care should be taken if a school uses lists of current givers as the basis for targeting similar individuals with corresponding demographic backgrounds – especially if faculty members are used to assist in the research. It is easy to remove an individual's name, address, and other identifying characteristics.

There is a related ethical issue. The same GIS tools used in identifying potential contributors can be used in identifying potential students. Schools will gain detailed knowledge of the neighborhoods of potential students or donors, allowing them to target areas of opportunity – or to "red line" and ignore areas that are less promising. GIS is so powerful that it might be used to allow schools to abandon any commitment to be need-blind, raising an ethical dilemma that can only be addressed at the local level.

Finally, the lack of case studies in the use of GIS in academic fund raising suggests a need for additional research in this area. The technique has demonstrated potential for development officers to identify and locate major donors in an efficient and effective manner. It has the potential to allow development officers to focus their time, energy and resources for the greatest benefit of the institution. In today's environment, this is increasingly necessary. But additional case studies would demonstrate whether the potential of GIS in this area is being fully realized.

Summary statement

A GIS system can be a powerful tool in collegiate fund raising.   Alumni, friends, and potential contributors can be categorized by the income and wealth of the neighborhoods where they live. Once contributors are located by neighborhood, a fund raising campaign can be organized around clusters of alumni and friends. In addition, the pattern of giving (and non-giving) can be analyzed to explore whether neighborhood income and wealth predict contribution patterns. Development efforts, in turn, can be targeted to individuals and neighborhoods with the highest potential. The availability of updated, 2000 Census data starting in summer 2001 should increase the match rate and the usefulness of the GIS technique.

Given the relatively lost cost of implementing a GIS system (initial hardware outlay of under $2,000 for a community college) and the unlimited potential to greatly increase giving (as seen in the case study), the approach may be an important methodology for development officers, researchers and higher education institutions in general. By allowing development offices to be selective and targeted in their appeals, it reduces the need for a broader effort and increases the quality of contact. In addition to its attractiveness on a cost-benefit basis, the technology is user-friendly and features pull-down menus in a desktop environment..

Yet the absence of previous academic research on the specific use of GIS in fund raising suggests that the technique is not being widely used by college or university development offices. Given the explosion of interest in GIS in academic departments, development offices may have faculty and staff on campus with expertise in GIS who could be enlisted to assist in efforts to integrate GIS into development efforts.

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Table 1. Sample alumni data, single town, geocoded with block group data appended

Alumni ID #	Street Address	Census Tract	Block Group	Average Income Block Group
100173	Redding Rd.	604	9	$155,659
101396	Burr St.	604	1	$141,155
100391	Merwins Lane	604	4	$124,436
100622	Samp Mortar Dr.	602	4	$65,213
101304	N. Cedar Rd.	605	1	$111,437
100722	Pepperidge Cir.	609	1	$57,246
101494	Centerbrook Rd.	609	1	$57,246
101497	Maple Dr.	607	4	$79,244
100029	Brookbend Rd.	607	2	$69,703
101010	Fairfield Beach Rd.	616	2	$48,442

Exact house number on given street omitted due to privacy concerns.

Table 2. Income distribution, geocoded undergraduate alumni, college town and college county (1997 projections).

	College Town	College County
< $56,000	1%	4%
$56,000 -- $63,999	7%	9%
$64,000 -- $71,999	11%	7%
$72,000 -- $81,999	6%	6%
$82,000 -- $91,999	5%	9%
$92,000 -- $100,999	13%	12%
$101,000 -- $114,999	10%	10%
$115,000 -- $134,999	19%	13%
$135,000 -- $167,999	9%	15%
> $168,000	19%	15%
Total	100%	100%
(n)	2,512	11.224