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Evaluating Conflicts in the Use and Development of Geographic Information Systems

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EVALUATING CONFLICTS IN THE USE AND DEVELOPMENT OF GEOGRAPHIC INFORMATION SYSTEMS

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Use of geographic information systems is increasing in governments, commercial companies, and by individual users. With such pervasive use of GIS there has been surprisingly little investigation of the values that various parties would support in the development of geographic technologies. There are many parties involved in the use of GIS each with opinions of what are good goals for developing and using such systems. This research seeks to determine differences and similarities among parties in the importance placed on supporting specific societal goals germane to the use of geographic technologies and databases.

Previous research determined six areas where the potential for disagreement between different parties involved in GIS might be high. The first phase of the research involved creating a survey. The survey was designed to determine to what extent conflicts are perceived to exist by those using and creating GIS and those who are subjects of such systems. Those sampled in the survey were asked how much value they would place on various societal goals. Each goal is believed to be a laudable goal by

some parties using GIS. Response options ranged from unimportant societal goal to highly important societal goal. Statistical analysis of the results was performed. This allowed researchers to see if differences exist among the groups sampled for the value they place on supporting the goals.

Various professional organizations with members involved in the use and development of geographic information systems are discussing the development of codes of conduct and recommendations for ethical education. The work done for this project hopes to serve as an initial step for creating ethical learning materials. The research also identifies areas where there is disagreement about what is beneficial for society so further research may be performed.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter 1

INTRODUCTION

Geographic Information Systems (GIS) are gaining widespread use for tasks ranging from environmental protection to land use planning. A GIS is a system used for the capture, storage, retrieval, analysis, and display of spatial data. (Clarke 2001) Spatial data is data related to the space around us; data related to a location. Geographic information typically consists of data about time, space, and at least an attribute. Data are collected about a phenomenon and where it is at a particular time or how a phenomenon in a certain location changes over time. (Chrisman 1997)

The roots of geographic information systems begin with maps, which are being replaced and improved upon by databases and software systems. (Chrisman 1997) Databases offer the ability to amass large quantities of data. GIS offers the ability to integrate many different types of data through the use of common geography such as an address. The use and purpose of the data and the way it is distributed vary according to the beliefs of the groups collecting and using the data. (Clarke 2001)

There has been continuing discussion since the early 1990's of creating a GIS code of ethics to provide consistent guidelines for appropriate practice. (Craig 1993) This has been a daunting task due to the multi-disciplinary nature of GIS. Surveyors, geographers, planners, and many others in various professions utilize GIS. Those using and developing GIS all have opinions on how the technology should be used and directions GIS technology should take in the future.

While debate has been occurring between those utilizing geographic information systems, the public has become aware of some uses of GIS they feel uncomfortable with. The issue of privacy is raised again and again by the general population. They feel that GIS technology is allowing businesses and the government to combine data from so many sources that one system can contain enough data to invade their privacy. (Clarke 2001) Those supporting the use of GIS feel that it is an efficient and inexpensive way to provide the public with access to data collected by the government. (Jain 1999) Liability has become increasingly important to the public with the use of mobile geographic information systems. Those in the GIS industry wonder what methods are in place to insure the integrity of their data and what potential exists for litigation should something go wrong. (Epstein, Hunter et al. 1998) With developments in technology, it is becoming increasingly easy to amass large quantities of data. Libraries of digital geographic data are being amassed but a balance has yet to be reached between public goods aspects and author rights. (Onsrud 1998) Government employees spend a lot of time and money collecting data for government purposes. Debate is growing between keeping existing open access principles or allowing the pricing and selling of government data. (Pluijmers, 2002)

While much literature exists debating the value of various goals for the future of GIS, little study has been performed to determine what various groups believe are truly worthy goals for developing geographic information systems. Knowing the directions in which technology should progress will have a positive effect in guiding day-to-day decision making of moral choices. With clear ideas of what goals benefit society technology can be developed to protect those goals and information can be gathered

when it doesn't violate those goals. Little study has been done to determine how people solve ethical dilemmas that arise while using GIS technology. Gathering people's beliefs about what they feel are important societal goals is a starting point. Creating scenarios of situations that are encountered while utilizing geographic information will allow both ethical theorists and GIS practitioners to think about the ethical impacts of geographic information technology. From the scenarios, tools may be developed to educate those entering the GIS field about ethical situations that might occur in their work. (Onsrud 1997)

1.1 Scope of the Thesis

This research has two objectives: (1) to gather opinions from a wide range of individuals involved in geographic information technology about what they believe are goals worth achieving in GIS and (2) to build the base work for creating scenarios from practice for discussion and education.

This research strives to answer the question; *to what extent do differences exist between and among various parties about the perceived harms and benefits of GI technology?* This question may be answered through a combination of three other questions. Which values or interests are strongly supported by the parties? Which goals present individual conflicts? When are the goals of one group strongly at odds with the goals of another group?

Knowing the goals that are strongly supported or opposed is important for gaining a broad understanding of what parties believe are important issues. Knowing which side of an issue is believed to be the most important overall may aid in the resolution of

conflicts. Conflicts within individuals exist when a person believes two opposing goals are both worth achieving. This type of conflict is very important because it indicates that an individual has a difficult time deciding how to resolve a conflict. Further, disagreements between parties are important to identify because this type of difference indicates that people will resolve the same issue in a different manner.

The opinions of those utilizing GIS for government, commercial, and academic purposes were gathered and compared with each other and with the opinions of students who have little professional interest in supporting one value over another. The process of creating scenarios is begun with the hope it will be carried on in another phase of research. Scenarios create a unique opportunity for discussing resolution of ethical dilemmas that arise in practice.

1.2 Methods Employed

This research is composed of two major segments: the survey and the scenarios. The survey is employed to gain a general understanding of which goals various parties believe are worth supporting for the development of GIS. The results help gage the amount of disagreement that exists between the various parties involved in GIS. The parties sampled in the survey identify themselves as government, commercial, and academic individuals who utilize GIS and those who are subjects of geographic data sets. Those who utilize GIS in their profession were targeted primarily through membership in professional organizations such as the University Consortium for GIS (UCGIS) and the Urban and Regional Information Systems Association (URISA). While everyone can be a subject in a geographic data set, not everyone understands the issues involved in GIS

well enough to coherently answer the questions set forth in the survey. In order to survey subjects with some potential for understanding the issues and who are not professionals using the technology daily, students in university programs associated with GIS and email lists containing casual users of GIS were targeted.

Scenarios were begun as a part of this work. Scenarios are situations drawn from practical experience that present ethical dilemmas. Harlan Onsrud, Will Craig, and Francis Harvey developed several draft scenarios from actual situations they were familiar with. The scenarios focus on the conflict areas and were tested to make sure they present a "right versus right" conflict. These and further scenarios drawn from practice will be developed further and tested in a future phase of the research program.

1.3 Outline of the Thesis

A discussion of ethics is contained in Chapter Two. Areas of concern for the development of GIS technology are discussed in some detail in Chapter Three. These are areas that have been discussed frequently in the GIS literature. A survey was created to measure how various parties in GIS feel about the areas of concern. Chapter Four sets forth a description of the survey instrument while a copy of the actual survey, with questions in random order is contained in Appendix A. Appendix B lists the survey questions in order so the conflicts between questions can be seen. The results for the survey are presented in three chapters. Chapter 5 uses descriptive statistics to determine which goals are important to those surveyed. Chapter 6 determines if individuals in various subject groups are conflicted over competing goals. Conflicts can arise when groups feel differently about the importance of a goal. Potential conflicts among

different groups are discussed in Chapter 7. The final chapter draws the results of these three analysis methods together to provide evidence of those areas in which the greatest potential for conflicts among groups may exist. This chapter also makes recommendations for future research.

Chapter 2

ETHICS

Ethics are an important piece of this research. The goal of the research is to determine if people feel conflicted over which actions might benefit society the most. The survey is an initial pass at determining what are valuable goals for society regarding the use of geographic information systems (GIS). This research will be extended by the creation of scenarios that will give those involved with the use of GIS an opportunity to consider the consequences of their actions. A future step to this research will be the creation of ethical teaching materials to be used in geographic information science education.

2.1 The Importance of Ethics

Ethics are the rules or standards governing the conduct of a person or the members of a profession. The actions people take based on the principles of right and wrong that they believe in reflect their ethical values. Ethical and legal matters are not the same thing. An action can be illegal and ethical at the same time, such as speeding to deliver an injured person to the hospital. Unethical behaviors are not necessarily illegal. Under most circumstances lying is wrong but not illegal. Choosing to avoid unethical behavior is in most instances straightforward. A person chooses between an action they know is right and an action that they know is wrong. Ethical dilemmas are more difficult because they require a person to choose between two "right" actions in which either choice will result in adverse consequences. Rushworth Kidder offers a useful description of the

differences between right-versus-wrong and right-versus-right dilemmas. "The latter reach inward to our most profound and central values, setting one against the other in ways that will never be resolved simply by pretending that one is 'wrong.' Right-versus-wrong choices, by contrast, offer no such depth: The closer you get to them, the more they begin to smell." (Kidder 1995) Right-versus-right choices tend to involve a choice between truth and loyalty, an individual and the community, the short and long-term, or justice and mercy.

Several philosophical theories exist which aid individuals in making ethical decisions. One of these philosophies is ends-based. It is based on teleological theories that argue an action is right if it brings about the desired outcome. Rules-based or deontological theories emphasize duty and consider actions to be intrinsically right or wrong. Right-based theories such as contractarianism also exist. These theories are based on the principle of an implicit social contract that grants everyone certain rights such as life, liberty, and the pursuit of happiness. (Spinello 2000) The Golden Rule is an example of a care-based philosophy. This is when individuals consider what they would like done if the results of the action directly affect them. (Kidder 1995)

In practice ethics are often defined by a code of ethics, which is a document that defines moral behavior for a profession. Some consider such a code to be a contract between a profession and the society they serve. Ethical codes provide a profession with a place to begin discussions about what constitutes unethical behaviors. "Whatever the issue, it will only seem important in proportion as we are willing to recognize and activate the moral values lying at the core of our thinking. Without a clear sense of our core values, we may simply sail on by. With it, we pause and at least try to help."(Kidder

1995) A code of ethics helps us to identify when a decision requires ethical consideration. Although rarely utilized, a code of ethics supported by professional societies also provides the ability to penalize individuals for acting in an unethical manner within that profession. Ethical scenarios are also an important part of preparing members of a profession for making ethical decisions.

Many moral objections have been raised over the use and development of geographic information technology. (Onsrud 1997) Individuals are becoming increasingly wary of giving their telephone numbers to businesses due to the amount of information that may be linked to them. Privacy is important to individuals. Knowing what data government collects (freedom of information) is also important for checking the way government operates. Allowing a government agency to supply information about people to others may intrude upon their personal privacy . creating a conflict of societal objectives. Determining which moral position is stronger is a matter of ethical consideration. Information in a GIS has the potential to dramatically influence the decisions an individual makes and influence his or her behavior. (Man 2000) Concern should be given to the ethical implications of any technology that has the potential to alter a person's behavior.

As discussed in Curry (Curry 1995), some people feel that it is useless to discuss ethics in technological development. The assumption is that the technology is going to develop and individuals will have no real choice in the direction that developments take. There are many ways GIS technology is progressing that raise concerns among individuals. These concerns are discussed in Chapter Three. If society were to take the fatalist view about this technology, then there is no reason to study ethics because the

technology will be created and those in the GIS community will use it as they see fit. However Rushworth Kidder argues that we should be wary of simply accepting technology and not attempting to consider the ethical ramifications of progression. "What's new, then, is not simply our knowledge. It's the sheer scale and power of our systems --- scientific, technological, financial, governmental, educational, and so forth. Widespread, designed for great speed, often decentralized, such systems are increasingly susceptible to misuse or manipulation by a single individual making a single wrong decision. Why is that fact so important? Simply, such systems leverage our ethics so highly. Like megaphones, they amplify small whispers of wrongdoing into vast bellows of amorality. In that megaphone effect, a single moral lapse—a single ethical Chernobyl—can now affect millions for centuries." (Kidder 1995) Technological changes are occurring at an astounding rate and individuals should be prepared to act ethically when faced with new technology.

2.2 Ethics in GIS

While any new technology brings with it ethical concerns, geographic information technology poses several unique problems. One of the biggest difficulties in creating an ethical code for GIS professionals is that the technology brings individuals together from many different professions. Surveyors, planners, geographers, and those in many other areas such as business commonly utilize GIS. With such a large range of backgrounds it is difficult to determine one set of values that encompasses the range of tasks GIS is applied to. Many forms of geographic information systems and spatial technologies are

also available to the public to collect and process data. The general public does not typically feel bound by codes of conduct produced by groups they do not identify with.

GIS as technology has roots in geography. But some (Curry 1995) argue that existing ethical discussions have little applicability to GIS. While understanding ethical matters in a broader context can be beneficial, GIS raises ethical issues in a unique mannermaking it important to consider each issue in its distinctive context. "Here a truly adequate account of the ethical status of GIS needs to move beyond a consideration of the actual practice of automated cartography and GIS, and to consider the relationship of that practice to the contexts within which GIS operates: the field of geography, the broader science establishment, the information marketplace, and various levels of government." (Curry 1995) GIS is utilized in many ways, which should be considered before attempting to define an ethical context for solving dilemmas that arise in practice. Scenarios are a helpful way of studying ethical situations that arise in a variety of different contexts.

2.3 Resolving Ethical Dilemmas

There are many methods for resolving ethical dilemmas. One method developed by Kidder (1995) is discussed here. Kidder's first point is to realize that there is indeed a moral issue. This requires the person to identify which issues need attention and which are simply matters of manners or social conventions. The second step is to determine if the issue is yours to deal with. The person must determine if he or she has the power to do something and if it is his or her responsibility to do something. The next step is to gather as much information as possible. Not knowing leaves voids in understanding,

which can lead to a bad decision. Gathering facts also involves looking at possible results in the future.

The fourth point is to test for right versus wrong issues. Kidder suggests four tests that may be used to do this. The legal test simply asks if the action is legal. The stench test asks how you feel about the issue. Does it feel wrong even if you can't identify the cause? The front-page test has you consider if you would do something if you knew it would be on the front page of the newspaper tomorrow. The mom test has you ask if someone you look up to would perform the action. "If I were my mother, would I do the same thing?" If a choice fails any of the tests, there is no ethical dilemma. You should be able to recognize that the choice is wrong.

The next step is to identify what kind of dilemma it is. Is it a conflict between telling the truth and protecting loyalty? Will one action benefit either an individual or the community and harm the other party? Is it deciding whether the short or long-term benefits are more important? Is it a choice between justice and mercy?

Once you have determined what kind of conflict exists you can apply resolution principles. Kidder discusses three principles drawn from classical ethical theories. Ends-based tries to determine what approach provides the greatest good to the most people. Rule-based methods try to determine what would happen if everyone did the same thing. The care-based method asks how you would want others to act in the same situation if the results affect you directly. The goal of this step is not to arrive at a resolution based on a three-to-nothing or a two-to-one vote but to locate the reasoning that seems most relevant to the issue.

Once you have found a resolution and considered the results of the action it is important to look for compromises or other creative solutions if any exist. Once all options are considered the next step is to make a decision. This requires moral courage. The final point is to reflect on the decision after it is made. After the situation has died down consider what you would have done differently and learn from it.

CHAPTER 3

POTENTIAL CONFLICTS

Onsrud (2001) determined six areas of potential conflict which form the basis for the questionnaire that was created. The six areas to be discussed are: (1) privacy, (2) intellectual property, (3) liability, (4) access to government data, (5) geographic data as a public good, and (6) sales of government data.

3.1 Location Privacy

One of the most frequently raised concerns about the development of geographic information technology is the ability it provides to combine large amounts of data.(Onsrud, Johnson et al. 1994) Massive quantities of data exist and are available for free or for purchase. GIS is commonly used to combine data from many sources. Census data can be combined with voting records and tax parcel data all through the use of a common address. Many people do not realize how easy it is for companies to cross reference information about them. They feel that since they do not give out their social security number it is difficult to identify them individually but every time they fill out an application they include an address. Many feel that privacy becomes threatened with the ability to combine geographic information with personal information through a GIS. (Dobson 1998)

Privacy works on the principle that people will select the data about themselves they wish to make public. It also relies on people forgetting some things allowing for the possibility of redemption. (Curry 1995) Without the fear that information we wish to

keep secret will be exposed, we act as individuals less fettered by the expectations of society. Some theories present the idea that constant surveillance and the fear of punishment for transgressions will alter a person's behavior. (Whitaker 1999) This is why the issue of personal privacy has become a key concern in the development of GIS.

Both the government and commercial companies are realizing the benefits to be gained by using geographic data sets. Government collects data about individuals and uses it to achieve various goals. Government agencies can easily justify the need to collect such data, but with the use of computer technologies and GIS the potential for privacy abuse is worse. Government is required through FOIA to allow the public access to most of the data it collects. Some government agencies are making their data available over the Internet in an attempt to minimize the amount of work required to fulfill information requests. Having information such as tax records available online is disconcerting to many individuals and the public is beginning to question the effectiveness of existing privacy laws. (Onsrud, Johnson et al. 1994)

Companies have access to a variety of data, which allows them to better target potential customers or to better serve current customers. GIS can combine census data, home prices, and purchasing histories to make studies of a household's shopping preferences. Companies aggregate as much information about customers as possible. Some companies use profiles to offer personalized catalogs to families with items they are most likely to buy. (Curry 1995) In 1996, Beverly Dennis sued a company called Metromail because they used prisoners to compile data on individuals and one of those prisoners began harassing her. She found the Metromail had twenty-five pages of information on her including her income, preferences for soap and magazines, and even

when she used hemorrhoid medicine. Dennis felt that her privacy had been severely violated. Metromail can no longer use prisoners to process their data. When prison officials lost the revenue from data processing they moved to creating maps with GIS. One application allows users to access tax information about every home, photographs of the residents, and consumer profiles.(Skyes 1999) Individuals are becoming increasingly wary of providing information to companies so companies offer discounts and benefits through programs such as frequent buyer cards. A standard is being set where individuals must determine how much their privacy is worth and who they are willing to sell it to. Once an individual provides information to a company there is little they can do to prevent the transfer of information to other companies.

The rapid rate of development of location tracking devices gives way to a variety of highly intrusive applications. (Clarke 1999) These technologies present the risk of monitoring individuals' behavior patterns. GPS (global position systems) are being placed in more and more technology. Cell phones contain GPS so that calls to 911 can be traced to a location. Systems are being created so the cell phones can be continuously tracked while the phone is on. These systems could potentially track if a person is walking beside another cell phone owner. Cell phone tracking offers businesses the opportunity to distribute advertisements over cell phones to people as they walk past a business.(Hoofnagle 2002) Cars contain GPS in order to accurately track the location of any vehicle and to assist the driver with navigation instructions. Whenever a GPS is turned on it collects information on the position of the unit. When an individual carries around a GPS, others can know where that individual is and sometimes what they are doing. A recent case involving a car rental company shows that GPS can be used for

more than what the user intended. James T. Fleming rented a car from Acme Car Rental that contained a GPS system. The contract stated that if the driver exceeds the speed limit he or she could be fined $150. The car company determined from the GPS unit that the driver went over the speed limit 3 times. The company withdrew $450 from his account before he even returned the car. In the end the Connecticut Department of Consumer Protection ruled this was in violation of state law. (Hoofnagle 2002) This case and others illustrate the potential of geographic technologies for invading personal privacy. Societies place limits on the amount of privacy invasion they are willing to permit. (Clarke 1999) Efforts should be made to determine how to protect individual privacy in geographic information systems so these limits are not exceeded.

3.2 Intellectual Property Rights

Intellectual property rights involve the ownership of ideas and control over the tangible or virtual representation of those ideas. Control is given to the creator through such legal rights as copyright, patent, trademarks, and trade secrets. *Copyright* is the most common device used within the GIS community to determine rights to intellectual property. Copyright laws are based on the principle that neither the creator nor the general public should be able to gain all the benefits from the creation of a new work of authorship. (Litman 2001) Copyright works to restrict some uses of creative works as an incentive for authors to create while still allowing appropriate access to such material by the public. Copyright exists automatically in a work as soon as it is fixed in a tangible medium; no copyright marks are required.

Copyright grants the author the right to make and distribute copies, create adaptations, and to perform or display the work publicly. (17 U.S.C. sec. 106) These rights are subject to some restrictions, most notably the first sale doctrine and the fair use doctrine. The *first sale doctrine* removes the author's control over the distribution of a copy once the author has sold the copy. The *fair use* doctrine allows the work to be used for purposes such as criticism, comment, news reporting, teaching, scholarship, or research without infringing on the author's copyright.

Copyright protects "original works of authorship" that are fixed in a tangible form of expression. The fixation need not be directly perceptible so long as it may be communicated with the aid of a machine or device. Copyrightable works include the following categories: literary works; musical works; dramatic works; pantomimes and choreographic works; pictorial, graphic, and sculptural works; motion pictures and other audiovisual works; sound recordings; and architectural works. These categories should be viewed broadly. For example, databases and most "compilations" may be registered as "literary works"; maps and architectural plans may be registered as "pictorial, graphic, and sculptural works." (Office 2002)

The *Copyright Act* protects maps as pictorial works but the facts presented in a map are not protected. This can make the issue rather confusing. The Copyright Act categorizes maps not as factual compilations, but as "pictoral, graphic, and sculptural works." Copyright only protects originality, meaning only the part of the work that is independently created by the author (as opposed to copied from other works). Yet in the 1997 case of *Alexandria Drafting Co. v. Amsterdam* the judge decided that despite overwhelming evidence, Franklin copied portions of ADC's maps, they did not violate

copyright. In this case Alexandria Drafting Company (ADC) noticed Amsterdam and Franklin Maps were copying maps that they had produced. Franklin was caught because they copied many of the so-called "copyright traps" in its maps -- fictitious names, streets, or dead-ends. Previously, the originality in the way the facts underlying the map were presented was far less important than the compilation of facts, due to the sweat-of-the-brow doctrine. With this doctrine's demise due to *Feist Publications v. Rural Telephone Service*, the court's analysis had to turn to the originality present in the map. The court decided that if they upheld copyright because Franklin copied the copyright traps then no one could ever copy actual facts in a map without fear of copying the traps and violating copyright. This case decided that just as facts themselves are non-copyrightable, copyright traps are non-copyrightable. Generally, the map as a whole is protected by copyright but the elements in the map are facts and unprotected. An entire map may be copied under the fair use doctrine in order to extract non-copyrightable information.

A compilation is "formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship." (17 U.S.C., Sec 101) GIS databases involve selection, presentation, and arrangement of the data in a particular way. For this reason a database can be considered a copyrightable work as long as some creativity goes into the arrangement of the data instead of using a standard format. The copyright only extends to the creativity not the facts. So for a GIS database the non-standard structure of the database may be copyrightable but not the data contained in the database.

The case of *Feist Publications v. Rural Telephone Service* is helpful for showing why the data in a database is not copyrightable. This case involved the copying of telephone directories produced by Feist. The courts decided that Feist did not hold copyright over the names, towns, and telephone numbers listed in the white pages as these are all facts. Feist held that "the facts contained in existing works may be freely copied because copyright protects only the elements that owe their origin to the compiler – the selection, coordination, and arrangement of facts." (Feist, p.1295) This ruling abolished the "sweat of the brow" theory, which is based on the idea that a compiler of facts must go to the original sources to gather data and not depend on the work of others. In the Feist case, Rural Telephone was allowed to copy the white pages because there is little creativity in the arrangement of names in a phone book as everyone expects them to be in alphabetical order. With a GIS database some creativity is involved in determining what elements should be in the data set and the way they should be represented. The creativity in arrangement of a database prevents anyone from copying the entire database. Everything in a typical database may be considered a fact so a person can take information in such a database and arrange it differently without violating copyright. It is important for the interests of both producers and users of data to achieve a workable balance among their interests to protect all legitimate rights. (Council 1999)

3.3 Liability

Liability is a legal responsibility for a possible or actual loss or a duty to perform in an appropriate manner. (Black, Nolan et al. 1990) Decisions and action are made based on geographic data and products. Geographic data are subject to error or

uncertainty. If wrong decisions are made or someone is harmed by the use of data, the issue of who is liable for the mistake often arises. (Onsrud 1999) GIS and geographic data are being used in technologies such as vehicle navigation where the potential for harm is greater than ever before.

The legal system attempts to protect consumers from harm by requiring producers of products or services to provide some level of competence in their product. The law also acknowledges that blunders are inevitable, so it only requires producers to be liable for damages that could be reasonably foreseen or that they have a duty to prevent. (Onsrud 1999) *Tort* laws exist to protect consumers from wrong or injury whether a contract exists or not. (Black, Nolan et al. 1990) Types of tort law are fraud, negligence, and misrepresentation. Contracts are an agreement between two or more parties that set out obligations for each party. (Black, Nolan et al. 1990)

Negligence can be defined as failure to use such care as a reasonably prudent and careful person would under the circumstances or doing something such a person would not do. (Black, Nolan et al. 1990) Negligence can result in accidents causing physical and/or property damage, but can also include business errors and miscalculation, such as sloppy data collection.

Fraud in the inducement involves misleading or concealing facts so a person will act in a manner that causes them some injury.(Black, Nolan et al. 1990) This action often involves trying to convince the court that the defendant misled the plaintiff into believing something, which lead them to sign a contract. In this case the contract should be thrown out because of the defendant's actions. *Misrepresentation* is similar to fraud in the inducement. It can be defined as "an intentional or sometimes negligently false

representation made verbally, by conduct, or sometimes by nondisclosure or concealment and often for the purpose of deceiving, defrauding, or causing another to rely on it detrimentally."(Merriam-Webster 1996) Misrepresentation allows the injured party to collect losses caused by their reliance upon information supplied to them.

The purpose of *strict product liability* is to "provide an incentive to manufacturers to keep unsafe, defective products off the market." (Onsrud 1999) Strict product liability requires the plaintiff to show the product is in a "defective condition unreasonably dangerous to the user or consumer" (§402A(1) Restatement of the Law (Second) Torts) and that this defect caused physical harm. Defects could be the results of manufacturing or design. Manufacturing defects occur when the product is not in the condition the manufacturer intends it to be in when it is produced. Design defects are problems inherent to the product that can injure the user.

Contracts are a legal document used to convey goods or services. The *Uniform Commercial Code* applies to goods and, in the absence of a written contract that states otherwise, imposes warranties of merchantability and fitness for a purpose. Contained in contracts are warranties both expressed and implied. One type of *implied warranty* is the *warranty of merchantability*. For goods to be merchantable they must be acceptable in their line of trade, be adequately packaged, and conform to the promises made on the packaging. A *warranty of fitness* is also implied. In this case a seller must know the purpose for which the goods are bought and the buyer must rely on the seller's skill or judgment.

Those using GIS technologies are becoming more aware of the potential for harm that can occur while using geographic data. Companies provide data for navigation purposes

where the potential for an accident is high if the data is wrong. Many wonder who should be ultimately responsible when such accidents occur.

3.4 Access to Government Data

Access to government data is typically an issue of how much information the public can receive from the government. The United States is a democratic society that is governed by the people. The concept of informing the people of what the government is doing is a fundamental piece in that democracy. (Branscomb 1994) Deciding what information is available to the public is traditionally handled through *freedom of information acts (FOIA)*. FOIA requires federal government agencies to provide copies of "*public records*" free of charge or at the marginal cost of duplication in order to assure open and democratic government. This section will discuss issues surrounding what geographic data is considered "public record". Section 3.6 deals with issues that arise when government agencies charge for their data.

The freedom of information act (FOIA) and its subsequent revisions are the rules by which the federal government distributes information. FOIA states that each federal agency shall make available for public inspection copies of all records, which have been released to any person and which because of their subject matter might become the subject of subsequent requests. (U.S.C. Sec. 552 (a)(2)(D)) Federal agencies must make their data used for decision making available to the public. State and local governments are allowed to make their own laws for distributing information. State and local governments have the choice to charge or to make data available for free.

The government can more easily collect certain types of data than commercial companies, census data being the most common example. The principle of having access to government data is to ensure that they are using correct data. By allowing the public to have access to government records the public can test the data to make sure it is correct. Whether it is a person gathering information on himself or herself or an individual asking the local government what properties he is being taxed for, public access gives a person the ability to make sure that the government is using taxpayer money appropriately. (Litman 1994)

Technology, such as the Internet, allows fast and easy access to various forms of data. In a traditional setting, those requesting information would have to communicate with staff in the appropriate government office and the staff person would have to take time to process the request. Many government agencies are moving to place their data on the Internet to allow use and copying of data with little involvement from staff. This increases the efficiency of government agencies and offers incentive to agencies to provide open access to their data. (Onsrud, Johnson et al. 1996) Yet individuals in the public might feel their privacy is being violated with easy access to data about them such as tax records. (Jain 1999) A balance has yet to be found between efficient access and protecting privacy.

Often local governments will hold on to the information they collect in the hope that charging for the information will produce a profit. The dissemination policies of government agencies determine the benefits that the public can gain from the data and can promote economic activity. Study has shown that there is little consistency between open-access and revenue generation approaches among government agencies. (Onsrud,

Johnson et al. 1996) Consensus has yet to be found between open access and selling government data so many conflicts arise between parties supporting different approaches.

3.5 Geographic Data as a Public Good

A public good is an object intended for use by the general public. It is created by allowing the greatest access possible to that good. The creator or copyright holder decides how much access to allow for his or her work. *Copyright* and *intellectual property* rights govern the rights of the copyright holder. The goal of copyright is to promote progress by securing certain rights for the creator. Copyright laws attempt to strike a balance between rights for the author and access for the public. (Council, 2000)

As discussed in Section 3.2 on Intellectual Property, various forms of geographic works are copyrightable. Many believe that it is important for the public to be able to access and utilize this information. Others believe that the data and products they produce should be protected. Copyright laws attempt to create a balance between these two positions. However, the issue is becoming controversial once again with the advent of digital technologies. In a digital environment the balance of rights is no longer balanced. Many of the issues that were resolved in a paper environment must now be readdressed for the digital environment.

One key area where these issues arise is in the creation of geolibraries. A geolibrary is designed to permit users to access all existing information about a place of interest. A geolibrary is a digital library that contains information associated with a distinct area of the world. Libraries store intellectual works so the community can have access to them. A geolibrary has this goal but differs from a traditional library in that the

information and users are distributed. They do not have to be in the same location and a person is not limited to a specific location to gain access to the information. Libraries exist to acquire, give access to, and safeguard knowledge and information and to assist users in accessing that information. An effective geolibrary will provide access to geographic knowledge and the ability to process data. (Council 1999)

In a traditional library, only one patron may borrow a book at any time. The *First Sale Doctrine* allows borrowing. A patron must be in the physical location of the book and only one person can use the book at any given time. Access in a digital environment requires that a copy be made, allows for the user to be located anywhere, and can potentially allow many people to access a document at the same time. Many of these benefits of a digital library are not allowed under current copyright regulations. This means a digital library is only able to use works that are not copyrighted or are licensed under open access principles. A geolibrary could gather data on the web that authors have given up their copyright to or that due to lack of creativity are not copyrightable. However, a great deal of valuable information is stored in commercial datasets. Commercial companies are not likely to give up their ownership rights if they can make a profit. Those who provide data for public access worry about others being able to take that data. Incentives need to be found to encourage data collectors to allow geolibraries to purchase their data and distribute them. Conflict will continue to occur as attempts are made to find the right balance between access to data sets in a digital environment and protection of author rights.

3.6 Ownership and Sales of Government Data

There are two philosophies concerning the ownership of government data. Some believe that data should be distributed at marginal cost, in other words the cost of producing the data should not enter into the pricing. The other side feels that GIS data are a commodity that should be protected and sold for a profit. (Clarke 2001) Gathering geographic data for government purposes is an enormous and costly task. As discussed briefly in section 3.4 there is much debate over whether local government data should be supplied to the public at the cost of dissemination or if local government agencies can assert ownership rights and charge for their data. The *Freedom of Information Act (FOIA)* states specific regulations for the Federal government. State governments often have similar open access policies but state governments are not banned from claiming copyright of their data. In the past state governments have typically provided copies of records free or for the cost of dissemination.

The information contained in government data sets is a valuable commodity. Agencies are coming to realize the value of the data they collect and must decide what to do with the data. Many local agencies are turning to cost recovery techniques in an attempt to offset the cost of producing the data, to fund maintenance, or to improve their technology.

The purpose of *open records* laws is for citizens to be informed of the actions of the government and hold them accountable. Some argue that charging for government information will interfere with democracy. Those in the government argue that the data sets most often requested have little to do with maintaining democracy. Records are often requested by commercial companies that do not want to collect the data themselves

or pay for the data from another company. Many feel it is appropriate to place the burden on those who stand to gain the most, often the company requesting the information. (Dando 1993) Yet charging for information may limit the number of people who request the information and might reduce innovation that comes from having access to information. (Matsunaga and Dangermond 1994) Laudable arguments can be made for either side of the debate.

Data in government data sets is collected from public funds. Many feel that they have already paid for data through taxes and should not be charged again to access the data. Others argue that by charging those who use the data, funds can be raised to offset the cost of producing the data. Many believe that this can lead to a reduction of the tax burden placed on individuals. Study of cost recovery approaches in European governments tends to show otherwise. "The consensus of recent research is that charging marginal cost of dissemination for public sector information will lead to optimal economic growth in society and will far outweigh the immediate perceived benefits of aggressive cost recovery. Open government information policies foster significant, but not easily quantifiable, economic benefits to society."(Weiss 2002) Studies are being performed to determine whether open access or cost recovery techniques hold the greatest benefit to society. Studies are showing the open access techniques appear to be more beneficial but these arguments are not convincing all government agencies to abandon cost recovery methods.(Pluijmers 2002) Conflict continues to exist between those supporting the sale of government data and those supporting open access to government data.

Chapter 4

QUESTIONNAIRE

The objective of this research was to identify what people believe are laudable goals for the development of geographic information technology and if different parties have the same goals (Onsrud 2001). A survey was created to gather people's opinions. The survey was available online and in a paper version. The URL address for the online version was emailed to most of the subjects. A paper version of the questionnaire was distributed to students in classes dealing with GIS or geography at the University of Minnesota and the University of Maine.

The questionnaire was created in digital format for distribution online because it was believed that the ease of completing the questionnaire would encourage greater participation. With a paper questionnaire, the possible respondents would be required to fill out the questionnaire and return it by mail. With an online questionnaire, the subject simply has to click a few buttons for their responses to be recorded. This greatly decreases response time. Using a digital questionnaire also increases accuracy because results do not have to be entered in by hand before the results can be analyzed by statistical software. The digital questionnaire eliminated many printing and distribution costs.

Creation and distribution of the questionnaire were done in a software package called Perseus Survey Solutions. This software was chosen because it offers the ability to create, distribute, receive results, and perform some basic statistical analysis. Creating a questionnaire in this software was similar to using word processing software. Questions

are simply typed in or can be imported from a Microsoft Word file. Form actions such as radio buttons and text boxes can be added with a click of the mouse. Once the questionnaire is created, the software allows the user to chose how he or she wants the results reported. The software also offers an easy way to upload the questionnaire to a website. Once the submit button of the questionnaire is clicked, the results are processed by the company's servers and the results are returned via email. The email messages can be uploaded straight into an Access database. The software will also supply basic statistics such as number of valid responses, mean, and variance.

A paper questionnaire was created for students to ensure a higher return rate. Since a relatively small sample of university students was targeted, a high return rate was essential. By creating a paper questionnaire, the survey could be handed out in class and returned in class. Students are more likely to return a paper form that can count for some grade than to fill out an online questionnaire where the teacher has no way to verify that they actually completed the questionnaire. Results from the paper questionnaire had to be entered by hand before the results could be processed.

4.1 Sample Group

One of the hypotheses of this work is that people who utilize GIS technology may have different goals than those who are subjects in geographic data sets. In order to obtain appropriate responses we needed to create two sample groups, one of GIS professionals and one of those who are subjects in data sets. The purpose of sampling is to find a group that is enough like the population under investigation that valid generalizations can be made about the population based on the sample. In other words,

the results received from the sample group would be identical to the results received should everyone in a population be surveyed. (Sapsford 1999)

There are many factors that affect the return rate of a survey. Studies performed to determine if paper or e-mail surveys had a higher response rate are inconclusive. (Sheehan 2001) Survey length, follow-up and issue salience were also identified as factors that can contribute to response rate. The issue of survey length is discussed in section 4.2 below. Research has indicated that a follow-up email can increase response rates by as much as 25%. For this survey, a follow-up email was sent to respondents approximately one week after the initial request.

The importance and timeliness of an issue has a positive effect on the return rate for a survey no matter what form it comes in. (Sheehan 2001) For this reason we tried to target as many organizations and mailing lists as we thought would have an interest in societal issues in GIS. To target professionals working in the GIS community we contacted professional organizations for the email addresses of their members. The organizations agreeing to supply email addresses were Urban and Regional Information Systems Association (URISA), University Consortium for GIS (UCGIS), and American Society for Photogrammetry and Remote Sensing (ASPRS). An online search was also performed to identify potential mailing lists whose members would have an interest in the survey. We also wanted to target subjects of data sets. Many of those who are subjects of geographic data sets would not have enough background to coherently answer the questions in the survey. So to address this group we wanted students whose work introduces them to the principles of GIS. Students should have some interest in the topic and knowledge of the issues but not work in the field. Students won't be able to address

the issues from the perspective of specific applications but in general terms. Students were targeted with paper questionnaires distributed in courses at the University of Minnesota and the University of Maine. Business people who use the technology on occasion were targeted through a mailing list specifically for discussing GIS use for business applications. Those in other application fields such as agriculture, education, and transportation were targeted through mailing lists as well.

4.2 Survey Design

The survey contained twenty-three statements of goals that at least some parties utilizing geographic information technology believe are laudable for the development of GIS. A background question was created to identify a subject's relation to geographic data. Survey respondents were asked also to supply any comments and contact information if they wished. An introduction section was added to the questionnaire to make sure those taking the survey understood the rating scale. This survey was designed to ask what individuals believe are important goals for society in developing GI technology. Society is key to the rating because we were not as interested in what goals people believe are best for their profession as we were in determining what is best for society.

It is important to design a questionnaire so that reading questions, following instructions, and recording answers is as easy as possible for respondents. (Fowler 1995) The total questionnaire was designed to be as self-explanatory as possible. The questions were subject to much discussion and revision. Time was spent removing ambiguous terms and clarifying what each question was asking. The instructions were presented at

the beginning of the survey to explain exactly how we wished individuals to answer questions. Labels for the scale were as clear as possible. Key points in the instructions were underlined. An attempt was made to create a consistent questionnaire.

Four versions of the questionnaire were created. The order of questions in a questionnaire has been found to significantly affect the overall study. (Rea and Parker 1992) The questions in this survey were designed in pairs yet the subjects were not supposed to readily recognize that the paired questions support conflicting goals. In order to reduce the chance of subjects realizing the repetitive nature of the questions, the questions were randomized on the questionnaire. One example of the randomized questionnaire is contained in Appendix A. Appendix B contains a list of the questions in pairs. Multiple forms with different random orders were created to help reduce the chance of the subject recognizing the pattern of questions. While no comments were received about the questions containing opposing goals, many subjects indicated they felt the questions were redundant.

4.2.1 The Questions

Questions were created in each of the six potential conflict areas explored in Chapter 3. Twenty-three statements of positive goals were created in total. Questions were set in conflicting pairs. This means that a statement was written stating what one party believes is a laudable goal and a statement was created reflecting the opposite of that goal, which other parties might believe is just as commendable. (See Appendix B) Each statement is a positive goal so simple negation of the original statement did not produce the opposing goal. Eleven goals were created and Harlan Onsrud, Will Craig,

and Francis Harvey determined a positive action to contradict each goal. Respondents were asked to rate each of these statements on the same scale, which is discussed in some detail in section 4.2.2.

A background question was created to identify which portion of the subject group and individual falls into. Those utilizing GIS technology on a daily basis were asked to indicate if they worked in the government, academic, or commercial sector and whether the performed mostly managerial, production, or user tasks. Members of the general public were asked if they were a student and if they use GIS.

Space was provided in the survey for subjects to supply their comments. Space was also provided for individuals to provide contact information. This information was held in confidence as discussed in section 4.5.

4.2.2 The Scale

Each of the twenty-three statements was rated on a scale of 1 to 5. Scales are used to put measurable labels on a continuum of feelings. Respondents are asked to decide which of the choices provided best matched their feelings about the question. (Fowler 1993) Values for the numbers are as follows: (1) unimportant societal goal, (2) minor goal, (3) moderate goal, (4) important goal, (5) highly important societal goal. The choice of scales met with much criticism from those taking the survey. An agree/disagree scale was purposely rejected since a critical piece to the assessment was to measure the extent of agreement between parties. The comment section was often filled with subjects asking for a positive to negative scale or simply a yes/no scale. These are some of the comments that were received. "Answers were not sufficient for expressing

opinion on these questions." "For many of the questions you asked, my answer would be dependent on the content of the data." "I cannot answer these questions as posed because I do not comprehend the significance of a societal goal. I could do 'Strongly agree' to 'Strongly disagree' but I can't correlate that with your phrasing." These comments show that many respondents wanted to respond in the context of specific situations rather than in a broader societal setting, which was the goal of this stage of research.

"Good questionnaires maximize the relationship between the answers recorded and what the researcher is trying to measure." (Fowler 1993) The importance scale was chosen because there are at least some parties involved in the use of GIS that believe each statement is worth achieving so each goal is indicated to have some degree of merit. We wished to determine how important individuals felt each goal is to society, not whether or not they felt it is important to themselves as individuals, so the term societal goal was specifically chosen.

4.3 Pre-Testing

An important step in performing a survey is to pretest the survey. Pretests are used to determine how a survey really works. Pretesting is critical to gather information about how respondents understand and answer questions to determine if changes need to be made. Making sure the questions are accurate measures before sending the survey to the entire sample will reduce errors. (Fowler 1993) Will Craig at the University of Minnesota coordinated the pretest of this survey. He asked members of the GIS/LIS board to take the survey. Participants in the survey were asked to have one window open with the survey and an email message open to make comments about the questions as

they arose. Some students at the University of Maine were also asked to take a few moments to fill out the survey.

Overall the pretest results indicated two patterns that we expected to see. Participants indicated that they wished to be presented with a different scale. After much consideration we decided to keep the scale the same. Subjects also indicated that for most of the questions their answers would depend on various circumstances. This was also expected. While results might depend on the situation, the questions ask the subject to take a step back and to state the level of importance goal has to society under most circumstances. The purpose of this part of the research was to identify conflicts in general terms; specific situations are addressed in the scenarios. The pretest led to slight rewording and clarification of some questions and a more explicit description of what we were asking the participants to think about in the introduction.

4.4 Subject Solicitation

Subjects were sent emails to ask for their participation in this survey. This was performed in two rounds for the majority of participants. The majority of email addresses for those considered to be GIS professionals were acquired from professional organizations. Urban and Regional Information Systems Association (URISA), University Consortium for GIS (UCGIS), and American Society for Photogrammetry and Remote Sensing (ASPRS) were willing to share email addresses of their members for the purpose of this research. UCGIS and URISA supplied us with their membership lists while ASPRS agreed to forward our messages on to their members. Copies of the emails sent to potential subjects are in Appendices B and C.

Members of the general public with some knowledge of GIS were targeted through online email lists. We attempted to target software vendor lists and lists for business. Will Craig and Francis Harvey chose courses related to GIS at the University of Minnesota and had students fill out the paper version of this survey. Appropriate courses were also chosen at the University of Maine.

4.5 Survey Ethics

The Belmont Report lays out three principles for ethical research involving human subjects. (Report 1979) The three principles are autonomy, beneficence, and justice. Respect for persons is carried out though informed consent. Participants should have the opportunity to choose whether or not to be involved in the research. Beneficence involves studying the risks and benefits of a project and determining the most beneficial method for obtaining the desired results. Justice involves creating a fair procedure for the selection of subjects.

The solicitation letter and introductory page to the survey inform the potential subjects of the nature of the survey and how the results will be used. Participation is voluntary; they do not have to fill out the survey if they do not wish to. Other than the time and inconvenience of taking a survey there is no risk to the participant. Attempts were made to contact as many people as possible that utilize GIS technology and have an understanding of the issues. There was no purposeful exclusion of subjects as long as they had a basic understanding of the issues.

Attempts were made to reduce intrusiveness by only sending two email requests and by removing from the mailing lists those who requested removal. Harm to subjects

can occur through violation of privacy or confidentiality. (Frankel and Siang 1999) To reduce the risk of privacy invasion only summary aggregate information will be released. Comments included in reports will never be associated with individuals. Supplying contact information was optional and access to the information was limited to the principal investigator, Harlan Onsrud, and one graduate student, Amber Bethell. If subjects did not provide contact information the survey was completely anonymous.

Chapter 5

SURVEY RESULTS

This chapter presents the results of the survey. Results received for each individual question are discussed and compared in general terms with the opposing question. The purpose of this chapter is not to discuss conflicts between parties or within individuals. This chapter shows the distribution of the results and makes general inferences about which goals all of respondents felt were worthy of societal concern. Basic statistics such as count and mean were performed automatically in the Perseus Survey Solutions product. This chapter begins with a discussion of the subject distribution. Starting in section 5.2, the results from each of the potential conflict areas will be discussed.

5.1 Sample Group

Question 24 in the survey allowed subjects to indicate one classification which best describes their relation to geographic data. A total of 858 responses were received. While it is difficult to determine exactly how many subjects received solicitation messages, it would be reasonable to assume the survey was distributed to over 2000 people. Difficulty in determining the number of subjects contacted is due in part to not knowing how many members belong to mailing lists. Another reason is that potential subjects may be members of multiple lists or their email address might be invalid. No method was employed to determine if those who received the solicitation read the message. The sample distribution is shown below.

Table 5.1: Distribution of Sample Group by Societal Sector

Choice	Count	Percentage
Government		
1. Producer of geographic data	130	15.2%
2. Geographic information system manager	175	20.4%
3. User of geographic data	72	8.4%
Subtotal	377	44.2%
Commercial		
4. Producer of geographic data	107	12.5%
5. Geographic information system manager	57	6.6%
6. User of geographic data	69	8.0%
Subtotal	233	27.1%
Academic		
7. Producer of geographic data	26	3.0%
8. Geographic information system manager	25	2.9%
9. User of geographic data	47	5.5%
Subtotal	98	11.4%
General		
10. Student who typically does not use digital geographic data	49	5.7%
11. Student who does use digital geographic data	47	5.5%
12. Member of the general public who typically does not use digital geographic data	12	1.4%
13. Member of the general public who does use digital geographic data	23	2.7%
Subtotal	131	15.3%
Unanswered	19	2.2%
Total	858	

Respondents for this survey are slightly skewed. Ideally, there would be the same number of respondents for each subject category and no unanswered questions. Traditionally it has been found that those with the most interest in a survey will be most likely to fill it out. (Sheehan 2001) Those in the government, commercial, and academic sectors often use geographic technologies on a daily basis and have a high interest in the issue. It was difficult to acquire survey results from members of the general public because they have little knowledge of the subject matter and it presents little relevance to them. While the term general public is used, the results in this population are mostly

students with a small degree of familiarity with the issues. Students were asked to fill out surveys as part of their classes. Those who returned the surveys commonly wrote in the comments section that they didn't feel they understood what the questions were asking. On respondent wrote, "I don't know that this survey is best for the general public because I didn't feel I knew enough about certain subjects." This was also indicated by a tendency for students to mark most answers with a three. Questions that were easier to understand, such as those about privacy, tended to have answers that diverged from this pattern. There was a very low return rate for student surveys. Courses with 50 students would typically have 5 to 7 surveys returned. Courses with greater relevance to the topic had higher return rates.

Taking all the survey responses into consideration allows some general conclusions to be drawn about what are considered to be valuable goals for developing geographic information technology. These results do not appear to be affected by the disproportionate results in the sample group. This can be seen as the results do not appear to overly favor the government sector. Other tests performed on the data take the size of each group into account. Table 5.2, presents a different view of the sample group. In this table the responses are sorted by the subject's relation to geographic data. Instead of being first classified as Government, Commercial, Academic, or General Public, the respondents are classified as Producer, Manager, User, and Non-user and then divided by profession.

Table 5.2: Distribution of Sample Group by Relation to Geographic Data

Choice	Count	Percentage
Producer		
1. Government	130	15.2%
4. Commercial	107	12.5%
7. Academic	26	3.0%
Subtotal	263	30.7%
Manager		
2. Government	175	20.4%
5. Commercial	57	6.6%
8. Academic	25	2.9%
Subtotal	257	29.9%
User		
3. Government	72	8.4%
6. Commercial	69	8.0%
9. Academic	47	5.5%
11. Student	47	5.5%
13. Member of general public	23	2.7%
Subtotal	258	30.1%
Non-User		
10. Student who typically does not use digital geographic data	49	5.7%
12. Member of the general public who typically does not use digital geographic data	12	1.4%
Subtotal	61	7.1%
Total	839	

5.2 Privacy

The questions on privacy deal with the increasing ability of both government and commercial entities to more accurately combine individual's activities and locations. Question 1 through 4 on the ordered questionnaire deal with the issue of privacy. Two of these questions deal with the issue of government utilizing information about individuals. The other questions deal with commercial uses of information about individuals.

5.2.1 Privacy in the Government Sector

Question 1) Information contained in government data sets about the locations of an individual's activities should be kept private.

Questions 2) Government agencies should be allowed to cross-match data about the past and present locations of individuals in order to accomplish government objectives.

A general look at the results from the questions dealing with privacy in the government sector would tend to indicate that keeping government data private is a more important goal than allowing government to cross-match data about individuals. The majority of respondents (54.6%) indicated that it was highly important for government to keep information about people's location and activities private. Allowing government to cross-match data about individuals had mostly moderate support with only 10.6% highly in favor of cross matching.

Table 5.3: Government Privacy

Societal Importance	Q1 Count	Q1 Percentage	Q2 Count	Q2 Percentage
1 unimportant societal goal	44	5.3%	165	20.0%
2 minor goal	40	4.8%	164	19.8%
3 moderate goal	104	12.6%	232	28.1%
4 important goal	187	22.6%	178	21.5%
5 highly important societal goal	451	54.6%	88	10.6%
Total	826		827	
Mean	4.16		2.83	

Difference of Means 1.33

5.2.2 Privacy in the Commercial Sector

Questions 3) Information contained in commercial data sets about the locations of an individual's activities should be kept private.

Question 4) Private companies should be allowed to exchange information about the locations of an individual's activities to accomplish commercial objectives.

As with government data, those surveyed felt that commercial data sets about individuals should be kept private. Most (54.5%) responded that it was highly important for commercial data sets containing information about an individual's activities to remain private. Unlike government data, which was more dispersed, the majority of those surveyed (56%) felt it was unimportant for commercial companies to be allowed to exchange data about individuals.

Table 5.4: Commercial Privacy

Societal Importance	Q3 Count	Q3 Percentage	Q4 Count	Q4 Percentage
1 unimportant societal goal	36	4.3%	459	56.0%
2 minor goal	36	4.3%	173	21.1%
3 moderate goal	105	12.5%	121	14.8%
4 important goal	205	24.4%	45	5.5%
5 highly important societal goal	458	54.5%	22	2.7%
Total	840		820	
Mean	4.21		1.78	

Difference of Means 2.43

5.3 Intellectual Property Rights

Intellectual property rights attempt to strike a balance between the amount of control an author has over his or her work and providing access of the work to the public. The issue of intellectual property rights is raised in questions 5 though 8. Questions 5 and 6 deal with intellectual property rights for individuals creating data sets while questions 7 and 8 deal with commercial rights.

5.3.1 Citizen Sector

Question 5) Individuals should have freedom to create new products from geographic data sets and digital maps produced by commercial companies.

Question 6) A person purchases geographic data sets and digital maps from a commercial company. Others should not be able to obtain and use the data from this person without permission of the company.

Those responding to the survey appear to place similar amounts of importance on both these goals. Results show that an individual not being able to obtain commercial data from another without company permission is slightly more important than an individual having freedom to use any data. This is indicated by question 6 having a slightly higher mean (3.45) than question 5 (3.26). Few of those surveyed felt that intellectual property rights in the citizen sector is a highly important issue; only 27.2% for question 6 and 18.6% for question 5.

Table 5.5: Citizen IP

Societal Importance	Q5 Count	Q5 Percentage	Q6 Count	Q6 Percentage
1 unimportant societal goal	108	12.9%	106	12.8%
2 minor goal	113	13.5%	98	11.9%
3 moderate goal	224	26.8%	162	19.6%
4 important goal	236	28.2%	236	28.5%
5 highly important societal goal	156	18.6%	225	27.2%
Total	837		827	
Mean	3.26		3.45	

Difference of Means 0.19

5.3.2 Commercial Sector

Question 7) Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by their commercial competitors.

Question 8) The geographic data sets and digital maps produced by commercial companies should be protected from use by commercial competitors who purchase such data products but do not have explicit permission to use the data extracted from such products in a competing product.

The results indicate that those surveyed place greater importance on commercial companies being protected from other companies using their data without permission. This is indicated by over half of the population (55.7%) indicating that goal number 8 is either important or highly important. Only 20.7% of the population felt that allowing commercial companies the freedom to build on their competitor's work was an important or highly important goal.

Table 5.6: Commercial IP

Societal Importance	Q7 Count	Q7 Percentage	Q8 Count	Q8 Percentage
1 unimportant societal goal	231	28.2%	88	10.6%
2 minor goal	194	23.7%	86	10.4%
3 moderate goal	225	27.5%	192	23.2%
4 important goal	125	15.3%	260	31.4%
5 highly important societal goal	44	5.4%	201	24.3%
Total	819		827	
Mean	2.46		3.48	

Difference of Means 1.02

5.4 Ownership and Sales of Government Data

The questions about ownership of government data ask if it is more beneficial for government agencies to have control over their data and to be able to charge for it or to allow individuals and companies to do as they wish with the data. Question 9 and 10 examine the public's right to utilize government data while questions 11 and 12 look at commercial use of government data.

5.4.1 Ownership against Citizen Uses

Question 9) Individuals should have freedom to create new products from geographic data sets and digital maps produced by government agencies.

Question 10) Government agencies should protect the geographic data and digital maps they produce from use by citizens unless citizens have permission from the government to use the data.

The survey results indicate people feel government agencies should not prevent individuals from utilizing data they provide. Results show that 71.9% of respondents feel it is important or highly important for individuals to have freedom to use government data. 63.8% indicate that it is unimportant or a minor goal to allow government to protect their data from individual use.

Table 5.7: Government Ownership vs. Citizen Use

Societal Importance	Q9 Count	Q9 Percentage	Q10 Count	Q10 Percentage
1 unimportant societal goal	27	3.2%	386	46.3%
2 minor goal	52	6.2%	146	17.5%
3 moderate goal	158	18.8%	129	15.5%
4 important goal	273	32.5%	94	11.3%
5 highly important societal goal	330	39.3%	78	9.4%
Total	840		833	
Mean	3.98		2.20	

Difference of Means 1.78

5.4.2 Ownership against Commercial Uses

Question 11) Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by government agencies.

Question 12) Government agencies should protect the geographic data and digital maps they produce from use by commercial companies unless such companies have permission from the government to use the data.

While the results for commercial use of government data are not as clear as that of citizen use of government data, the responses tend to indicate the same result. The mean response to question 11 is 3.61 while the mean of question 12 is 2.87. This indicates that

those surveyed feel it is more important for government data to be utilized than for agencies to be able to protect their data. While the mean to question 12 is 2.87, slightly less than a moderate response, it is interesting to note that approximately the same number of responses was received for each answer.

Table 5.8: Government Ownership vs. Commercial Use

Societal Importance	Q11 Count	Q11 Percentage	Q12 Count	Q12 Percentage
1 unimportant societal goal	52	6.2%	210	25.2%
2 minor goal	83	10.0%	151	18.1%
3 moderate goal	206	24.7%	156	18.7%
4 important goal	292	35.0%	173	20.7%
5 highly important societal goal	201	24.1%	144	17.3%
Total	834		834	
Mean	3.61		2.87	

Difference of Means 0.74

5.5 Liability

Liability is used to determine who is ultimately at fault if someone is harmed or injured while using data or a product supplied by another. The issue of liability for products using geographic information is raised in questions 13 through 18. Liability between companies and consumers, between two companies, and within the government are all considered.

5.5.1 Commercial vs. Consumer

Question 13) Those who provide consumer products and services utilizing geographic information or spatial technologies should protect consumers from economic and physical harm in the use of such products and services.

Question 14) Individuals using geographic information or spatial technologies should take responsibility for using such information and technologies wisely.

Those surveyed feel that it is at least moderately important for both parties, commercial companies and consumers, to take responsibility for utilizing spatial technologies wisely. This is indicated by both question 13 and 14 having means over 3, 3.33 and 4.27 respectively. Respondents indicating that both goals are important would not necessarily indicate a conflict because both parties could foreseeably take measures to limit harm that can occur through use of geographic data. While those surveyed might wish both parties to be responsible, results indicate that it is more important for individuals to use technologies wisely than it is for companies to protect consumers from potential harm. This is evident with 49.3% of those surveyed indicating question 14 is highly important while only 24.9% said the goal in question 13 is highly important.

Table 5.9: Commercial vs. Consumer Liability

Societal Importance	Q13 Count	Q13 Percentage	Q14 Count	Q14 Percentage
1 unimportant societal goal	107	12.9%	26	3.1%
2 minor goal	128	15.5%	17	2.0%
3 moderate goal	187	22.6%	76	9.1%
4 important goal	200	24.2%	303	36.4%
5 highly important societal goal	206	24.9%	411	49.3%
Total	828		833	
Mean	3.33		4.27	

Difference of Means 0.94

5.5.2 Commercial vs. Commercial

Question 15) Commercial companies using geographic information that was supplied by a government agency or another company should take responsibility for ensuring the information is suitable for the private uses they intend for the data.

Question 16) Commercial companies supplying geographic information to another private company should take responsibility for ensuring the information is suitable for the private purposes intended.

The results to the question of who should show more care, the commercial producers or commercial users of data, are less clear than the results of consumer and commercial liability. The means seem to indicate that more importance is placed on commercial companies using data ensuring the data is used for the correct purposes (3.98) than for companies supplying the data to assure it is accurate (3.54). 74.7% of those surveyed ranked question 15 as important or highly important. 59.2% ranked question 16 as an important or highly important goal. This shows that both goals are believed to be important.

Table 5.10: Commercial vs. Commercial Liability

Societal Importance	Q15 Count	Q15 Percentage	Q16 Count	Q16 Percentage
1 unimportant societal goal	39	4.7%	87	10.5%
2 minor goal	41	4.9%	90	10.9%
3 moderate goal	132	15.7%	161	19.4%
4 important goal	315	37.5%	267	32.2%
5 highly important societal goal	312	37.2%	224	27.0%
Total	839		829	
Mean	3.98		3.54	

Difference of Means 0.44

5.5.3 Government

Question 17) A government agency using geographic information that was supplied by another government agency or a private company should take responsibility for ensuring the information is suitable for the public purpose intended.

Question 18) Commercial companies supplying geographic information to a government agency should take responsibility for ensuring the information is suitable for the public purpose intended.

The results for liability for government are very similar to those of commercial suppliers and users. The means for the conflicting goals are fairly close. Question 17 has

a mean of 4.04 and question 18 has a mean of 3.82. Of those responding, 77.3% indicated that it was important or highly important for government agencies to make sure data from other agencies is properly used. Companies supplying data to government agencies ensuring the data is valid was indicated by 69.7% of those surveyed as being important or highly important.

Table 5.11: Government Liability

Societal Importance	Q17 Count	Q17 Percentage	Q18 Count	Q18 Percentage
1 unimportant societal goal	31	3.7%	65	7.8%
2 minor goal	40	4.8%	71	8.5%
3 moderate goal	119	14.2%	116	13.9%
4 important goal	318	38.0%	281	33.7%
5 highly important societal goal	329	39.3%	300	36.0%
Total	837		833	
Mean	4.04		3.82	

Difference of Means 0.22

5.6 Access to Government Data

Questions 19 and 20 discuss the right of citizens and companies to access government data.

Question 19) Individuals and commercial companies should have freedom to view and copy geographic data sets and digital maps used by government agencies in decision making.

Question 20) Government agencies should protect the geographic data and digital maps they use in decision making against inappropriate uses by citizens and commercial companies.

Those surveyed expressed that allowing freedom to copy data from government agencies was slightly more important than government agencies protecting their data. Question 19 has a mean of 3.6 and 59.4% marked it as an important or highly important

societal goal. The mean for question 20 was less than that of question 19 at only 3.35. Those choosing government protection of data sets as an important or highly important goal were only 49.8% of the respondents.

Table 5.12: Access to Government Data

Societal Importance	Q19 Count	Q19 Percentage	Q20 Count	Q20 Percentage
1 unimportant societal goal	58	7.0%	114	13.7%
2 minor goal	103	12.5%	125	15.0%
3 moderate goal	175	21.2%	179	21.5%
4 important goal	266	32.2%	188	22.5%
5 highly important societal goal	225	27.2%	228	27.3%
Total	827		834	
Mean	3.60		3.35	

Difference of Means 0.25

5.7 Geographic Data as a Public Good

The issue of geographic data as a public good is studied in three questions; 21, 22, and 23. This is an issue over determining the proper balance between intellectual property rights and public access to geographic data in the context of distributed geolibraries. For the purpose of analyzing opposing goals, questions 22 and 23 are grouped together.

Question 21) Commercial creators of geographic data sets and digital maps should be able to impose any contractual or licensing restrictions they see fit on the use of such data sets and digital maps.

Question 22) Some uses of geographic data sets and digital maps should not require users to acquire permission from the creators of such data sets and digital maps.

Question 23) Substantial geographic information and digital maps should exist for use and sharing by anyone as a public good.

The results to these three questions would indicate that having a large quantity of data available for public use is the most important goal. This is indicated by 45.3% of respondents choosing the goal as highly important. Only 19.3% felt it was highly important for creators of data sets to issue any restrictions they feel necessary. A relatively scant 17.2% said they felt some uses of data should be allowed without explicit consent of the creator.

Table 5.13: Geographic Data as a Public Good

Societal Importance	Q21 Count	Q21 Percent	Q22 Count	Q22 Percent	Q23 Count	Q23 Percent
1 unimportant societal goal	109	13.2%	111	13.4%	44	5.3%
2 minor goal	115	13.9%	128	15.4%	45	5.4%
3 moderate goal	232	28.1%	209	25.2%	150	18.1%
4 important goal	211	25.5%	240	28.9%	216	26.0%
5 highly important societal goal	159	19.3%	143	17.2%	376	45.3%
Total	826		831		831	
Mean	3.24		3.21		4.00	

Difference of Means 0.37

Table 5.14 below indicates the average values of questions 22 and 23 compared with question 21. Questions 22 and 23 were created together as a pair to be the opposite of the goal stated in question 21. The values of question 22 and 23 are averaged to give one response for the position of creating a geolibrary containing data freely available for use. Results of comparing question 21 with the average show that respondents feel it is more important to create geolibraries than to allow creators to place restrictions on data. This is evidenced by the mean for the questions 22 and 23 being 3.61, which is greater than the mean of question 21, 3.24.

Table 5.14: Geographic Data as a Public Good II

Societal Importance	Q21 Count	Q21 Percent	Q22/23 Average Count	Q22/23 Average Percent
1 unimportant societal goal	109	13.2%	77.5	9.3%
2 minor goal	115	13.9%	86.5	10.4%
3 moderate goal	232	28.1%	179.5	21.6%
4 important goal	211	25.5%	228	27.4%
5 highly important societal goal	159	19.3%	259.5	31.2%
Total	826		831	
Mean	3.24		3.61	

Difference of Means 0.37

5.8 Measure of Conflict from Means

A general measure of the amount of conflict the entire population has over different issues can be found be comparing the difference of means. Two questions with very similar means show that as a whole those surveyed place almost equal support on both goals. While this may not be the most accurate measure of the conflict that exists over support of two opposing questions, the test presents an initial pass at determining where conflicts could exist. Table 5.15 below shows the difference in the means of two conflicting questions. The left column states the topic of the conflict and the table where the means are presented and the difference of means is calculated.

Table 5.15: Summary of Conflict from Difference of Means

Conflict	Difference of Means
Table 5.4 Commercial Privacy	2.43
Table 5.7 Government Ownership of Data vs. Citizen Use	1.78
Table 5.3 Government Privacy	1.33
Table 5.6 Commercial Intellectual Property Rights	1.02
Table 5.9 Commercial vs. Consumer Liability	0.94
Table 5.8 Government Ownership of Data vs. Commercial Use	0.74
Table 5.10 Commercial vs. Commercial Liability	0.44
Table 5.13 Geographic Data as a Public Good	0.37
Table 5.12 Access to Government Data	0.25
Table 5.11 Government Liability	0.22
Table 5.5 Citizen Intellectual Property Rights	0.19

The table above shows the amount of difference that exists between the means of all respondents to two opposing questions. When two means are close together, this indicates that the respondents on average had a difficult time determining which of the goals is more important to society. This means there is some conflict between the importance of supporting these goals. Following this logic, the most conflict exists over the issue of intellectual property rights between the producer of a work and an individual using the work. The difference between the means of these goals was .19. It is difficult to determine the magnitude of the conflict from simply using the difference of means. The most conflict arises by ranking both conflicting questions as highly important (5). Simply using the difference of means it is impossible to tell if the difference of .19 is between 2.00 and 2.19 or 4.71 and 5. Also conflict is greatest for an individual if he or she ranks both questions as highly important. With the measure there is no way of knowing how an individual ranked both questions. This is why the conflict matrix was created as discussed in Chapter 6.

Chapter 6

CONFLICT WITHIN INDIVIDUALS

This survey was created with questions set in pairs, which reflect opposing values. (See Appendix B.) By considering how an individual ranks both questions in a pair the amount of conflict that individual has about a goal can be measured. If an individual believes that two opposing goals are both very important, this indicates that the individual has a conflict within himself or herself. This chapter begins with the methods used to determine the degree of conflict. Values for the amount of conflict within each subject group were determined. The conflict values will be compared to see if there are conflicts that exist within every group. Finally areas that present internal conflict will be discussed.

6.1 Conflict Matrices

To study the extent to which an individual is conflicted an individual conflict matrix was created. (See Figure 6.1.) The matrix is created with all possible responses to one question down the left side and all possible responses for the opposing question across the top. A person's responses to both questions are considered and the count is increased for the appropriate element in the matrix. For example, if a person marked question 1 with a 5 and question 2 with a 1 then the count in the top right element of the matrix would be increased to reflect this. Each element in the matrix contains the number of individuals in a subject group who responded with the values on the top and left of the matrix. If a person did not answer both questions in a question pair then his or her

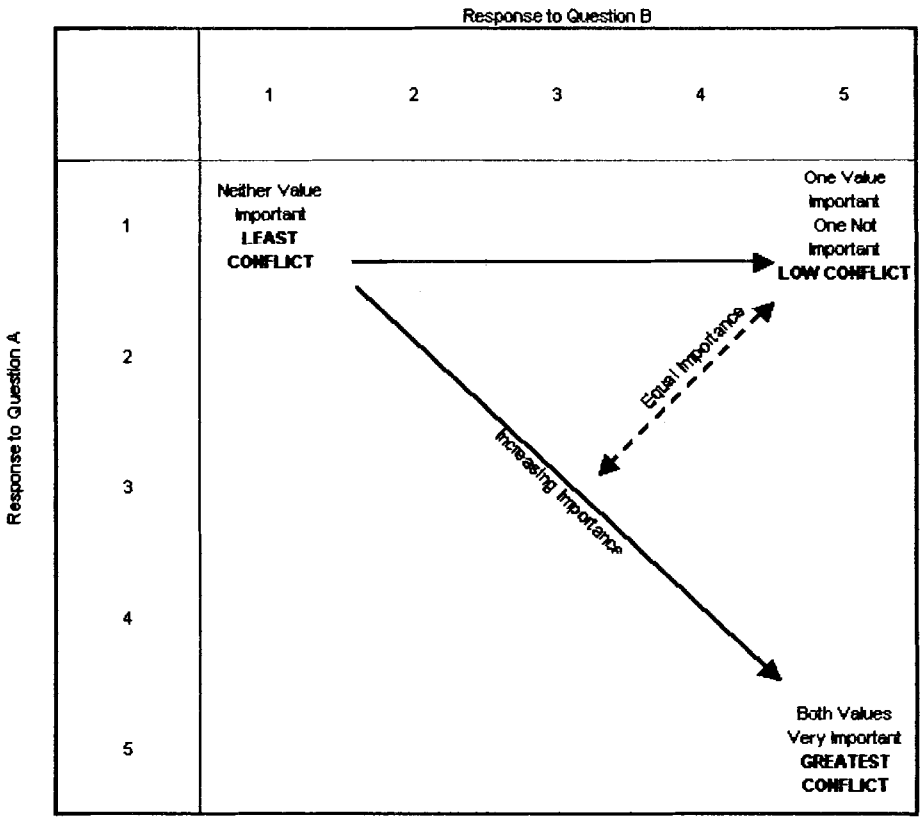
answers were discarded only for that pair of questions. In the sample matrix, (Figure 6.1) four people ranked both question 1 and question 2 with a 1.

Figure 6.1: Sample Conflict Matrix

		Question 2				
		1	2	3	4	5
Question 1	1	4	1	3	6	3
	2	0	3	2	4	2
	3	4	6	17	12	5
	4	8	14	25	18	7
	5	45	32	45	34	21

Conflict within individuals arises when the individual ranks both questions in a pair highly. In the matrix, question pairs with considerable conflict would have a large number of responses in the bottom right corner, where the individual ranked both with a five. Matrices with responses clustered in the upper left corner have the least amount of conflict because the respondents did not feel that either goal in important. More conflict becomes present as respondents add importance to one of the questions. This would result in responses being clustered in the upper right or lower left corners. Responses clustered in this area have one question respondents feel is unimportant and one question respondents feel is important. In these corners respondents have a clear idea of which of the two goals they feel is most important so there is still little conflict. The diagonal connecting these two corners present a line of equal conflict. This logic is shown in Figure 6.2 below.

Figure 6.2: Weighting Logic for Reflecting Extent of Conflict



While we could show the conflict matrix for each question pair, this would be lengthy and quite redundant. A method was created to weight the conflicts to show where the most conflict exists. The method utilized was to create a mean value, which follows the weighting logic in Figure 6.2. Creating the mean involves multiplying the value in a cell by the average of the two response values. For example, the respondents who ranked one question as a 4 and the other as 2 will have their responses multiplied by 3. Each cell is added and divided by the total number of responses for the question pair. This would produce a 1 to 5 scale. The means are ranked as shown in Figure 6.3.

Figure 6.3: Explanation of Mean Conflict for Matrix

5 to 4.2 Very high conflict
4.1 to 3.4 High conflict
3.3 to 2.6 Moderate conflict
2.5 to 1.8 Little Conflict
1.7 to 1 Very little conflict

6.2 Identifying Conflict Areas

The discussion of the results begins with identifying which question pairs present conflict for individual in various groups. It is very interesting to note that issues presenting conflict within individuals are fairly consistent between subject groups. See Table 6.1. Questions 13-18 create conflicted individuals for every subject group. These questions deal with the issue of liability. Questions 19 and 20 present a conflict for most groups over the issue of access to government data. Individual privacy in government data sets, questions 1 and 2, also present relatively high conflicts for individuals. The issues of intellectual property rights between individuals and companies and public goods in geolibraries also present some conflict. Each of these conflicts is analyzed in detail in this chapter.

Table 6.1 Mean Conflict for Individuals by Subject Group

Questions	Overall Conflict	Government	Commercial	Academic	Producer	Manager	User	Subject
1 & 2	3.5	3.55	3.43	3.39	3.58	3.42	3.45	3.52
3 & 4	2.99	2.94	3	3.02	3.03	2.91	2.97	3.06
5 & 6	3.36	3.36	3.34	3.56	3.38	3.32	3.48	3.23
7 & 8	2.97	2.94	3.04	2.87	3.06	2.89	2.92	3.01
9 & 10	3.09	3.06	3.13	3.15	3.18	3.03	3.07	3.02
11 & 12	3.23	3.27	3.22	3.16	3.3	3.17	3.25	3.18
13 & 14	3.8	3.82	3.69	3.93	3.83	3.77	3.76	3.84
15 & 16	3.76	3.82	3.73	3.69	3.85	3.82	3.6	3.67
17 & 18	3.93	3.94	3.91	4.02	4.01	3.97	3.82	3.85
19 & 20	3.47	3.47	3.47	3.63	3.56	3.42	3.5	3.34
21, 22 & 23	3.31	3.28	3.45	3.41	3.42	3.31	3.32	3.08

6.3 Liability

The issue of liability is ranked as a high conflict by all subgroups. Upon further consideration of the goals for responsible parties in the use of GIS, questions were raised as to whether conflict really exists if both questions are ranked highly. One goal in the question pair states that those supplying data for use should make it appropriate for the intended uses. The opposing goal states that those using data should make sure it is the appropriate data for that use.

The questions are opposing because one goal is for the supplier to make sure the data is appropriate and the other goal is for the user to make sure the data is appropriate. But a major conflict doesn't exist if the position of respondents is that everyone should take reasonable precautions to assure that data is being used suitably. The purpose of these questions was to determine who should be liable if the technology and data were used appropriately and some harm still occurred. The results from Section 5.5 show that subjects believe that it is an important goal for all parties to show responsibility for their actions. They are conflicted over who should ultimately be liable.

Tables 6.2, 6.3, and 6.4 show conflict within many respondents over the issue of liability. Table 6.2 looks at liability between commercial companies and consumers. Question 13 holds companies ultimately responsible should something happen and question 14 makes consumers responsible for their actions. Most of the responses for question 14 appear to be a 4 or 5. While results for 13 appear much more distributed. While there is much indecision it appears that if forced to pick, those surveyed would on average hold consumers liable.

Table 6.2: Individual Conflict Matrix for Commercial vs. Consumer Liability

		Question 14				
		1	2	3	4	5
	1	12	0	7	34	52
	2	1	7	13	44	62
Question 13	3	3	6	17	83	78
	4	4	3	20	83	88
	5	6	1	18	57	124

3.8 Mean extent of conflict

Question 15 holds the commercial user ultimately responsible and question 16 holds the commercial supplier liable. It is more difficult to pick out a pattern in this data. In general terms it looks like question 15 was marked with mostly 4 and 5 with a few results at 3. Results for question 16 appear to be much more dispersed. However the most people ranked 5 or 4 for both questions.

Table 6.3: Individual Conflict Matrix for Commercial vs. Commercial Liability

		Question 16				
		1	2	3	4	5
	1	15	2	7	5	8
	2	6	9	13	10	2
Question 15	3	10	18	35	49	18
	4	29	31	58	136	54
	5	27	30	47	64	140

3.76 Mean extent of conflict

The results for the issue of government users and commercial suppliers appear to be very similar to the results for commercial users and commercial suppliers. Question 17 holds the government user liable while question 18 seeks to ensure that commercial suppliers take every care possible. The matrix shows that most people marked both conflicting questions with either a 4 or a 5. As with commercial versus commercial

liability, it appears the results for holding the user liable are mostly 4 and 5 while the results for holding the supplier ultimately liable are more distributed.

Table 6.4: Individual Conflict Matrix for Commercial vs. Government Liability

		Question 18				
		1	2	3	4	5
Question 17	1	9	4	6	4	8
	2	2	4	8	16	9
	3	3	12	35	47	21
	4	16	30	45	138	86
	5	35	19	21	75	174

3.93 Mean extent of conflict

The comments from one participant seem to sum up the beliefs of all those taking the survey. "I think that in all cases of use of GIS data, the producer AND the user, no matter who each one is (government, commercial, or individual) should be held equally accountable for the reliability of the data. The producer should be responsible for supplying accurate data and the user should be responsible for its appropriate use." The results from this test show that those taking the survey want all parties to act responsibly when using geographic information technologies.

6.4 Government Privacy

Questions 1 and 2 indicate a high conflict. These questions deal with privacy issues arising from government data. Supporting question one means that the respondent believes that information about the locations of individuals that is contained in government data sets should remain private. Support of question two would allow government to use data about individuals to accomplish government objectives. Many of those surveyed appear to be conflicted over which they feel is more important, retaining

individual privacy or accomplishing government objectives. Question one supports individual privacy while question 2 supports fulfilling government purposes. The conflict matrix (Table 6.5) shows that most of the respondents answered 5 for question one. Results for question two are much more dispersed and focused in the lower end. This indicates that respondents feel strongly that privacy should be protected but have trouble deciding how important accomplishing government objectives are.

Table 6.5: Individual Conflict Matrix for Government Privacy

		Question 2				
		1	2	3	4	5
Question 1	1	9	3	10	11	10
	2	3	9	7	14	5
	3	6	17	43	28	8
	4	15	50	60	44	15
	5	130	83	107	81	44

3.5 Mean extent of conflict

It is interesting to note that conflict is presented over privacy of government data sets but not commercial data sets. Most people tend to believe strongly that privacy should be protected. They believe commercial companies should not use their data but can see some benefit to government collecting individual data. This presents the conflict. As one subject said, "While I do not believe in government tracking of citizens, where do you draw the line. Does this prohibit police from 'tailing a suspect' or documenting 'known whereabouts'? Would it prohibit access to property records from the assessor's office, title searches, etc.?"

6.5 Access to Government Data

Access to government data is raised in question 19 and 20. The Freedom of Information Acts grant the right to the public to access data used to accomplish government objectives. Those who spend time and effort gathering data that is given away free or for the cost of dissemination do not always agree with FOIA. FOIA laws only apply to federal agencies so government agencies at the state and local level do not have such clear laws governing the distribution of their data. Many of these agencies are turning toward cost recovery methods in order to defer costs. As one government manager said, "It is unfortunate, but we have a business need to hold our data closely and sell subscriptions for updates. If funding were not an issue, I would support the open sharing of all data as long as security is not compromised." Another respondent wrote, "I'm very concerned about the impact of proprietary data on public access, the types of data that are collected and data sharing among government agencies. Government is not a business. It is the function of government to collect basic data needed to develop and implement public policy and to create a level playing field by making this data available to the public." It appears that many people have a difficult time deciding whether it is more important to allow access to data or to protect that data. This is shown in the conflict matrix. It appears that most respondents answered 4 or 5 for both questions.

Table 6.6: Individual Conflict Matrix for Access to Government Data

		Question 20				
		1	2	3	4	5
Question 19	1	8	6	5	11	28
	2	3	9	22	31	37
	3	17	18	41	47	51
	4	29	60	66	56	52
	5	57	31	42	40	54

3.47 Mean extent of conflict

6.6 Public Goods Aspects of Geographic Data

This issue is about finding the right balance between creator rights and greater access to data. Both are valuable goals so individual conflict is high when subjects must pick between them. One respondent said, "I always appreciate the availability of free data, however the originator of such data must have the option to maintain some level of ownership of their data." It is very difficult to detect any patterns in this conflict matrix that could lead to determining which is the more important goal.

Table 6.7: Individual Conflict Matrix for Public Goods of Geographic Data

		Question 21				
		1	2	3	4	5
Question 22/23	1	5	5	4	5	28
	2	2	14	25	26	26
	3	30	38	88	77	35
	4	48	41	84	86	39
	5	23	17	30	13	26

3.31 Mean extent of conflict

6.7 Intellectual Property Rights between Individuals and Commercial Companies

Intellectual property laws are designed to promote science and knowledge. They provide rights to creators of works and promote access to the work. Many appear to be conflicted over the extent to which individuals should have freedom to use and build upon commercial data. Most strongly agree that it is wrong for a commercial company to take another company's product and use it without permission. While laws exist to the contrary, individuals will often take or "borrow" data or products from friends. This, somehow, seems a lesser offense that raises some individual conflicts. It is interesting to note that academics and users are the only groups conflicted over this issue, as they

would be the 'individuals' most likely to use a company's product without explicit permission.

Table 6.8: Individual Conflict Matrix for IP between Companies and Individuals

		Question 6				
		1	2	3	4	5
Question 5	1	8	1	10	29	58
	2	4	15	15	42	36
	3	23	23	61	70	42
	4	32	38	55	69	38
	5	39	19	21	25	49

3.36 Mean extent of conflict

Chapter 7

DIFFERENCES BETWEEN GROUPS

One goal of the research was to identify if differences exist between various parties involved in the use of GIS, specifically between those using the technology and those that are subjects in data sets. The survey allowed the participants to rate how important various goals are to the development of GIS. Statistical analysis will help determine if a person's relation to geographic data affects the importance he or she places on achieving various goals. The tests, used to determine if conflicts exist, are the chi-squared test and the t-test or analysis of variance, ANOVA.

The comparisons are made between professional and subjects; government, commercial and academic employees; and producers, managers, and users. Results of each comparison will be presented in a summary table. Those questions where both the chi-square and t-test or ANOVA are significant indicate that there is a difference in importance placed on that goal. These questions will be studied in detail.

7.1 Level of Significance and Degrees of Freedom

When performing statistical tests a hypothesis is formed. A hypothesis consists of two complementary statements about the state of nature. H_0 is called the null hypothesis and H_1 is called the alternative hypothesis. For our chi-square test we are looking at the following hypotheses.

H_0: The distributions of responses for the groups compared are the same.

H_1: The distributions of responses for the groups compared are <u>not</u> the same.

The hypotheses for the t-test are similar only the t-test looks at mean values and not the distribution of the results. When two groups do not have the same distribution or mean for their results it can be said that the groups differ in the amount of importance they place on a goal. The level of significance is used to determine the probability of rejecting the null hypothesis when it is true. (Kiemele, Schmidt et al. 1997) While it is important not to reject the null hypothesis when it is true, it is also important not to accept the hypothesis when it is false. Typically the level of significance is .05. This means that there is a 5% chance of rejecting the null hypothesis when it is true. In other words the results are said to be correct with 95% confidence.

The level of significance and degrees of freedom need to be known in order to determine the critical value. A critical value is the largest number a result should be before the null hypothesis is rejected. The degrees of freedom refer to the number of unknowns in an equation that are free to vary.

The degrees of freedom for the t-test are calculated by:

DF= (number of results for group 1) + (number of results for group 2) –2

The ANOVA test uses two degrees of freedom calculated by:

DF1 = (number of different samples compared) –1 and

DF2 = Σ (each sample size –1)

The Chi-square test uses the following equation for calculating the degrees of freedom.

DF = (number of rows –1) * (number of columns –1)

When comparing two groups the chi-square is significant with 95% confidence if it is greater than 9.49 and the t-test is significant if it is greater than 1.96. When

comparing 3 groups, chi-square is significant with 95% confidence when it is greater than 15.51 and the ANOVA is significant if greater than 3.69.

7.2 Chi-Squared Test

One method for comparing groups is to compare the distribution of the results. Distributions show how many people responded with a particular answer. This can be done with a chi-squared (χ^2) or goodness-of-fit test. The chi-squared test asks if two variables are independent (not related) or dependent (related). Two variables are independent if one variable gives no information about the other variable. In the context of this survey, if two groups are independent then how one group feels about a question will not help us determine what another groups feels. This means they do not place the same amount of importance on each goal.

In order to test the hypothesis a contingency table is created. This table shows how one variable is contingent or reliant on another. For this survey, the groups to be compared and the importance they placed on a goal are contingent. See the sample chi-squared table (Figure 7.1) below. Once the contingency table is created, column and row sums are calculated. The chi-squared test works by comparing the observed frequencies with the expected frequencies. The observed frequencies are present in the contingency table. The expected frequencies can be calculated for each cell by multiplying the row sum and column sum for the cell and dividing by the total number of responses. For the sample table the expected value for government employees responding with 1 would be (39*379/711) or 20.8. The expected value is subtracted from the observed value and then

squared. The squares are then divided again by the expected frequencies and all of these values are summed together to get the chi-squared value. (Kiemele, Schmidt et al. 1997)

Table 7.1: Sample χ^2 Table

Question 1

Response	Producers Counts	Managers Counts	Users Counts	Row Sum
1	14	17	12	43
2	11	14	12	37
3	33	34	25	92
4	50	67	44	161
5	158	129	131	418
Column Sum	266	261	224	751

Chi-Square 7.5

The chi-squared test has rules for when the results will be valid. The chi-squared test should be performed on nominal or ordinal values. Results on a scale of 1 to 5 are considered to be ordinal values. It is also assumed that the results are from a random sample of an infinite population. The sample size should be large. Large is defined by the expected frequencies. A rule of thumb is that at least 80% of the expected frequencies should be greater than 5. (Rea and Parker 1992)

7.3 T-Test and ANOVA

A t-test is used to determine whether two sample means are equal. There is always a chance that the results obtained are a product of chance. If the probability received by the t-test is small enough we can reject the likelihood of the result being a product of chance. (Sapsford 1999) The t-test works only for two independent samples so the analysis of variance (ANOVA) test is used to compare more than two groups. When comparing two samples the ANOVA approach is equivalent to the two-sample t test. (Kiemele, Schmidt et al. 1997)

The results are measured on an ordinal scale. The normal method for determining central tendency for ordinal data is the median. However, when the data is on a scale similar to the one utilized for this research the researcher is permitted to calculate the arithmetic mean. (Rea and Parker 1992)

Table 7.2 below shows how the results for the t-test are presented in this chapter. The ANOVA results are presented in a similar manner only with three variables. The counts indicate the number of valid results to the question received by each group being compared. The mean is the mean value of the results on the 1 (unimportant societal goal) to 5 (highly important societal goal) scale. Variance indicates how the responses for each group deviate from the mean. DF is the degree of freedom, which is calculated by the total number of data sets minus two. The critical t-value at the 95% confidence level is 1.960 for large sample sizes. The t-value for the table below is 2.344 so we can conclude that group 1 feels the goal presented in the question is more important than group 2 as indicated by the means (3.28 vs. 2.84)

Table 7.2: Sample T-test Table
Question #

	Group1	Group 2
count	611	51
mean	3.28	2.84
var	1.61	2.25
DF	660	
t-value	2.344	

7.4 Professionals and Subjects

Determining where professional responses differ from subject responses was an important piece of this research. The results for the statistical tests performed are statistically significant according to the rules mentioned above. However there were very few responses from the general public compared with the professional population.

Professionals were considered to be producers, managers, or users of GIS technology in the government, commercial or academic field. Subjects were those who considered themselves to be members of the general public. Out of 858 respondents, 131 were subjects of data sets, 708 were professionals using geographic information technology, and 19 did not choose a relationship to geographic data. While the conditions for statistically significant tests were met it seems inappropriate to compare a group of 708 with a group of 131. Statistically significant differences are highlighted in Table 7.3 below. For the purposes of analysis, only those questions where both the chi-squared test and the t-test are significant will be discussed in detail.

Table 7.3: Summary of Chi Square and T-test for Professionals and Subjects

Question	T-Value	Chi	Question	T-Value	Chi
1	-0.61	1.29	13	-2.59	8.9
2	0.12	1.36	14	2.54	8.49
3	0.11	0.25	15	3.44	20.04
4	-1.86	14.71	16	-1.01	6.81
5	1.03	3.7	17	1.89	9.75
6	1.39	16.26	18	0.2	9.65
7	-1.4	5.12	19	3.71	15.77
8	0.55	12.48	20	-0.8	3.01
9	6.04	36.59	21	2.05	13.7
10	-3.58	15.52	22	1.95	10.05
11	4.27	22.96	23	3.85	20.72
12	-2.39	9.25			

7.4.1 Ownership and Sales of Government Data

Professionals and subjects differ significantly over what they believe are beneficial goals over the issue of ownership and sales of government data. These issues are raised in questions 9 through 12. Professionals and subjects disagree on questions 9, 10, and 11. Question 9 asks if individuals should have freedom to create products from government data and question 10 supports government agencies protecting their data from citizens. The means show that professionals place more importance on allowing

individual use of government data than subjects place on this goal. Subjects on average ranked supporting individual access to government data lower than professionals (3.49 to 4.08 means) and ranked protecting government data higher (2.58 to 2.12). Table 7.5 compares the results for questions 9 and 10 from the subject population and government employees. The t-test for both of these questions is significant. It is interesting to see that members of the general public support protecting government data more than those in the government.

Table 7.4: Professionals and Subjects T-test for questions 9 and 10

Question 9

	Professionals	Subjects
count	701	124
mean	4.08	3.49
var	1.02	1.28
DF	825	
T-value	5.86	

Question 10

	Professionals	Subjects
count	698	121
mean	2.12	2.58
var	1.81	1.96
DF	819	
T-value	-3.42	

Table 7.5: Government and Subjects T-test for questions 9 and 10

Question 9

	Government	Subjects
count	375	124
mean	3.91	3.49
var	1.16	1.28
DF	505	
T-value	3.8	

Question 10

	Government	Subjects
count	374	121
mean	2.22	2.58
var	1.92	1.96
DF	501	
T-value	-2.58	

Professionals and subjects also disagree on the importance of questions 11. The goal stated in this question is allowing commercial companies the freedom to create products from geographic data sets. Professionals believe that it is more important for companies to be able to build upon government data sets than subjects believe it is.

Table 7.6: Professionals and Subjects T-test for question 11

Question 11

	Professionals	Subjects
count	696	124
mean	3.68	3.23
var	1.25	1.37
DF	820	
t-value	4.02	

The results for these questions were unexpected. Traditionally it is government employees that believe government data sets should be protected and the public who believe in access to data. Those surveyed in the general public often wrote comments that they did not understand some of the issues. This may have been one of the issues that was unclear but it is interesting to see that the general public, represented primarily by students, is not strongly opposed to sales or ownership of government data.

7.4.2 Liability

The issue of liability, who is obliged to pay for a mistake, is raised in question 13 through 18. Support for question 15 indicates that the survey taker believes it is important for commercial users to ensure the information they receive from others is suitable for their purposes. Professionals believe that this is an important goal as indicated by the mean of 4.03. Subjects do not believe that the goal is quite so important. Their mean response was only 3.68.

Table 7.7: Professionals and Subjects T-test for question 15

Question 15

	Professionals	Subjects
count	703	129
mean	4.03	3.68
var	1.1	1.24
DF	832	
t-value	3.44	

The goal in question 17 is to hold government agencies responsible for appropriate use of data they receive from others. As with the other liability questions, those in the general public believe that this is an important goal. Subjects on average place less importance on holding the government responsible for appropriate use than the professional population.

Table 7.8: Professionals and Subjects T-test for question 17

Question 17

	Professionals	Subjects
count	700	123
mean	4.07	3.87
var	1.06	1.09
DF	823	
t-value	1.98	

Chapter 5 showed that, if forced to choose, those responding would place ultimate responsibility for appropriate use on the user rather than on the supplier. By comparing the professional and subject populations we see that subjects disagree with how much importance is placed on user responsibility. They feel that less liability should be placed on the user.

7.4.3 Access to Government Data

Access to government data allows individuals and companies the freedom to view and copy government data. Question 19 supports access to data sets. As with the issue of ownership and sales of government data it is interesting to see that subjects of data sets believe this goal is less valuable than professionals. Again this might be attributed to the general public's lack of knowledge over the issue.

Table 7.9: Professionals and Subjects T-test for question 19

Question 19

	Professionals	Subjects
count	692	122
mean	3.67	3.27
var	1.43	1.39
DF	814	
t-value	3.4	

7.4.4 Geographic Data as a Public Good

Making geographic data a public good involves making compromises between the amount of control an author has over his or her work and making a substantial amount of work available for public consumption. Question 21 supports allowing authors to make as many restrictions as they wish. Those who use geographic data professionally feel that licensing and other restrictions are more important than those in the public. Professionals also place more importance on the availability of data as a public good than the public does. Typically if one group believes that a goal is more important than another group and the groups disagree over the opposing goal as well, then the disagreement will be the other way for the opposing goal. In other words, since professionals believe question 21 is more important than the public, the public should believe that question 23 is more important than professionals. This is not the case.

Table 7.10: Professionals and Subjects T-test for questions 21 and 23

Question 21

	Professionals	Subjects
count	694	121
mean	3.27	3
var	1.69	1.24
DF	815	
T-value	2.14	

Question 23

	Professionals	Subjects
count	698	122
mean	4.07	3.68
var	1.27	1.41
DF	820	
T-value	3.49	

7.5 Government, Commercial, and Academic

Survey respondents were asked to think of how important various goals are to society. While the same societal goals should be important to everyone, there are often differences depending on the respondent's profession. For this reason, responses from the government, commercial, and academic sectors were compared. Issues with high conflict are highlighted in table 7.11

Table 7.11: Summary of Chi Square and ANOVA for Government, Commercial, and Academic Employees

Question	ANOVA	Chi	Question	ANOVA	Chi
1	0.31	2.6	13	2.11	9.18
2	3.57	10.27	14	1.56	12.78
3	1.78	12	15	3.18	10.52
4	5.16	19.01	16	0.27	4.7
5	8.74	28.74	17	0.91	4.02
6	3.88	15.16	18	0.27	8.35
7	0.68	10.93	19	19.45	39.11
8	6.15	21.37	20	8.16	27.61
9	14.71	32.43	21	11.22	29.22
10	3.02	20.99	22	2.98	14.43
11	25.36	52.53	23	8.67	25.81
12	21.30	44.61			

7.5.1 Commercial Privacy

Question 4 asked if commercial companies should be allowed to gather data about an individual and his or her location for commercial purposes. Most believe this is not an important goal as indicated by the means in the ANOVA table below. However there is significant difference between how important those in the commercial, government, and academic fields feel the goal is. Those in the commercial sector feel that being able to collect data on individuals is more important than those in the government or academic sectors. Individuals do not want to have their privacy compromised by commercial companies.

Table7.12: Government, Commercial, and Academic ANOVA for Question 4

Question 4

	Government	Commercial	Academics
count	365	228	94
mean	1.63	1.91	1.80
var	0.87	1.28	1.46
DF	687		
F-value	5.16		

7.5.2 Intellectual Property Rights

The issue of intellectual property rights for individuals is addressed in questions 5 and 8. Support of the goal in question 5 allows individuals to create products from commercial data sets and products. Question 6, the opposing goal, limits the ability of individuals to use commercial data that they have not purchased themselves. Those in the academic sector place more importance on allowing others to create products from commercial data sets than either government or commercial employees place on this goal.

Table 7.13: Government, Commercial, and Academic ANOVA for Question 5

Question 5

	Government	Commercial	Academics
count	373	232	93
mean	3.37	3.03	3.60
var	1.40	1.81	1.74
DF	698		
F-value	8.74		

Question 8 asks how important it is to protect commercial data from commercial competitors. Those in the commercial field believe it is more important to protect that data than those in the government and academic fields believe it is. Academics can see the benefit of commercial competition while commercial companies are worried about not receiving profit from their products.

Table 7.14: Government, Commercial, and Academic ANOVA test for Question 8

Question 8

	Government	Commercial	Academics
count	368	231	94
mean	3.41	3.72	3.24
var	1.66	1.60	1.50
DF	693		
F-value	6.15		

7.5.3 Ownership and Sales of Government Data

Questions 9, 11, and 12 address the issue of ownership and sales of government data. Question 9 addresses ownership against individuals while questions 11 and 12 seek to protect government data from commercial uses. The opinion of government employees differs strongly from the opinion of academics on the issue of individuals creating products from government data sets. This is indicated in the means for the two groups, 3.91 for government employees and 4.47 for the academics. Government agencies put a lot of work into gathering data for geographic information systems the means show that government employees place less importance on allowing individuals the right to create new products form their data sets. Academics believe that it is very important for individuals to have the right to create new products from government data sets.

Table 7.15: Government, Commercial, and Academic ANOVA test for Question 9

Question 9

	Government	Commercial	Academics
count	375	232	94
mean	3.91	4.20	4.47
var	1.16	0.87	0.57
DF	701		
F-value	14.71		

Commercial companies and government employees are strongly at odds over the importance of allowing commercial companies access to government data. Commercial companies want to be able to produce products from government data without having to pay for the data. Government agencies want to protect their data from some uses. Some government agencies would rather produce the products that use their data than allow commercial companies to create products. Question 11 supports commercial companies' use of government data, which commercial employees believe is more important than government. This is indicated by the means of 4.07 from commercial respondents and 3.42 from the government. Commercial support for question 12 is much lower than government support, 2.38 versus 3.13. Question 12 asks the importance of allowing government agencies to protect their data.

Table 7.16: Government, Commercial, and Academic ANOVA for Question 11 & 12

Question 11

	Government	Commercial	Academics
count	370	232	94
mean	3.42	4.07	3.69
var	1.34	0.93	1.09
DF	696		
F-value	25.36		

Question 12

	Government	Commercial	Academics
count	372	232	95
mean	3.13	2.38	2.66
var	2.02	1.77	2.31
DF	699		
F-value	21.30		

7.5.4 Access to Government Data

Access to government data allows individuals and companies the freedom to view and copy government data. Question 19 supports access to data sets while question 20 would allow government agencies to protect their data from inappropriate use. The commercial and academic sectors show much greater support for accessing government data than the government does. The government respondents had a mean of 3.45 while academics averaged 4.24 on the importance scale. The positions were reversed for the opposing question.

Table 7.17: Government, Commercial, and Academic ANOVA for Question 19 & 20

Question 19

	Government	Commercial	Academics
count	366	231	95
mean	3.45	3.79	4.24
var	1.55	1.27	0.82
DF	692		
F-value	19.45		

Question 20

	Government	Commercial	Academics
count	371	233	95
mean	3.52	3.15	3.02
var	1.85	1.88	2.04
DF	699		
F-value	8.16		

7.5.5 Geographic Data as a Public Good

Making geographic data a public good involves making compromises between the amount of control an author has over his or her work and making a substantial amount of work available for public consumption. Question 21 supports allowing authors to make as many restrictions as they wish. Commercial producers believe very strongly about protecting their rights to data. Companies make a profit by charging for access to their data. But having access to commercial data sets is an important piece for creating an effective geolibrary.

Table 7.18: Government, Commercial, and Academic ANOVA for Question 21 & 23

Question 21

	Government	Commercial	Academics
count	367	233	94
mean	3.14	3.58	2.99
var	1.6	1.57	1.93
DF	694		
F-value	11.22		

Question 23

	Government	Commercial	Academics
count	371	232	95
mean	4.03	3.96	4.51
var	1.24	1.44	0.8
DF	698		
F-value	8.67		

7.6 Managers, Producers, and Users

Many differences exist between those in the government, commercial, and academic fields. Some differences also exist depending on what the subject does with geographic data. The next analysis compares producers, managers, and users of geographic data. Table 7.19 is a summary of the conflicts that exist between these three groups. Differences exist over the issues of access to government data, question 20, and

ownership and sales of government data questions, 9 and 11. For a test to be statistically significant with 95% confidence the ANOVA must be greater than 3.69 and the Chi-squared greater than 15.51. Only those issues where both tests are significant are explored in detail.

Table 7.19: Summary of Chi Square and ANOVA for Producers, Managers, and Users

Question	ANOVA	Chi	Question	ANOVA	Chi
1	1.76	7.26	13	0.51	5.19
2	2.92	10.19	14	1.21	4.54
3	0.61	6.61	15	2.27	8.89
4	1.17	12.31	16	3.29	16.53
5	2.31	7.26	17	0.48	9.08
6	0.80	10.59	18	2.56	12.11
7	0.14	7.51	19	4.77	14.53
8	3.90	12.8	20	4.59	16.46
9	4.10	15.88	21	3.36	17.09
10	3.59	18.89	22	0.19	6.75
11	7.95	18.89	23	2.10	14.06
12	1.29	11.94			

7.6.1 Ownership and Sales of Government Data

Ownership and sales of government data creates conflicts between all of the groups compared in this chapter. Between producers, managers, and users of geographic data conflicts exist over questions 9 and 11. The goal stated in question 9 is that individuals should have freedom to create products from government data. Users show the strongest support for this goal.

Table 7.20: Producer, Manager, and User ANOVA for Question 9

Question 9

	Producers	Managers	Users
count	260	256	185
mean	4.11	3.95	4.22
var	1.07	1.13	0.76
DF	701		
F-value	4.10		

Question 11 states that commercial companies should have the freedom to create new products from government data. The results are similar to the results from question 9 in that users place the most importance on this goal. However, the means are lower than question 9 so there is less importance placed on this goal overall.

Table 7.21: Producer, Manager, and User ANOVA for Question 11

Question 11

	Producers	Managers	Users
count	259	254	183
mean	3.78	3.46	3.84
var	1.17	1.41	1.06
DF	696		
F-value	7.95		

7.6.2 Access to Government Data

Each group compared also raises concerns over access to government data. Question 20 says that government agencies should protect their data from inappropriate uses. Users rank this goal with the least importance and producers place the most importance on this goal.

7.22: Producer, Manager, and User ANOVA for Question 20

Question 20

	Producers	Managers	Users
count	258	255	186
mean	3.51	3.30	3.11
var	1.89	1.85	2.00
DF	699		
F-value	4.59		

Chapter 8

CONCLUSIONS AND RECOMMENDATAIONS

This thesis has explored conflicts that arise from supporting various goals for the development of GIS. A survey was created and the results analyzed with three different methods. The central question of this research has been: *to what extent do differences exist between and among various parties about the perceived harms and benefits of geographic information technology?* A broad population of individuals using GIS for government, commercial, and academic purposes was surveyed. Those who are subjects of data sets were sampled mostly as first or second year college students with some knowledge of GIS. The results of the survey should be indicative of results that would be received from the entire population.

To analyze the central question of this research, three questions were developed that were easier to answer and the results combined to answer the initial question. One of the questions attempts to determine which goals are considered important for society. It tries to determine which goal would be supported if the subject were faced with two conflicting goals. The other two questions attempt to determine when conflicts or differences exist. Conflicts can exist for individuals if they feel two opposing goals are both worth achieving. Disagreements between groups exist if they place different amounts of importance on achieving the same goal. The answers to these questions are explored in detail in chapters 5, 6, and 7. The summary of results section of this chapter attempts to draw the answers to the individual questions together to answer the main question of this research.

8.1 Summary of Results

This section will summarize the conclusions that can be drawn from chapters 5, 6, and 7. Those chapters discuss respectively what goals have societal importance in the development of GIS, which goals present conflicts for individuals, and which goals cause conflicts between groups.

8.1.1 Important Goals

Chapter 5 compares the questions by pairs to determine which of the goals the national pool of respondents feel are most important for society. Those surveyed tended to support protecting privacy when asked to choose between information contained in government or commercial data sets about the location on an individual's action remaining private and government or commercial entities being allowed to use such data to fulfill their objectives. (Section 5.2) The results showed that those surveyed placed more importance on protecting individual privacy in a commercial setting than in government data sets.

Two sets of questions were created to address intellectual property rights. Rights between individual users and commercial producers and between commercial users and commercial producers were addressed. One side of these questions supported users having the freedom to create new products from the producer's data sets. The opposing goal was to allow producers to protect their data from those without explicit permission to use the data. The results to both sets of questions showed more support for allowing producers to protect their data than for users to have access to the data. (See Section 5.3)

Questions were created to determine if it is important for government agencies to have ownership rights to their data and to be able to sell that data. Section 5.4.1 addresses the issue of allowing individuals the freedom to create new products from government data. Those surveyed showed much more support for allowing individuals to access data than for allowing government agencies to protect their data from use without permission. Section 5.4.2 shows that there is also more importance placed on allowing commercial companies to have access to government data than allowing government to protect their data. However, the support for commercial companies having access to government geographic data is lower than support for allowing individuals access to the data.

Questions about liability were created to help determine who should be held responsible when someone is harmed using geographic information technologies or data. One set of goals supported the provider of products protecting consumers from economic and physical harm when using their products. The opposing goals supported users taking responsibility for using products wisely. Questions were written to ask who should be liable when the situation involves commercial producers and individual consumers (Section 5.5.1), commercial producers and commercial users (Section 5.5.2), and between government users and commercial suppliers (Section 5.5.3). Support for both the user and supplier operating with every care was very high. If forced to choose between the supplier and user, those responding would lean towards the user holding ultimate responsibility in each of the three cases.

Questions addressing access to government data sets were created. One side of the potential conflict supports individuals and companies having the freedom to view and

copy government data. Others support allowing government agencies to protect their data against inappropriate use. Analysis of the results in Section 5.6 show that access to view and copy government data is more important than government agencies protecting their data.

In order to create a geolibrary, a balance must be struck between allowing data creators to impose restrictions on their data and providing substantial amount of geographic data for public use that might not require gaining the creator's permission for use. Those surveyed felt it is was very important for substantial amounts of geographic information to be available to the public. (Section 5.7) Support for allowing commercial creators of data to impose restrictions for using their works was also relatively high.

Section 5.8 uses the difference between the means of opposing questions as a first pass at determining where conflicts might exist. Having two means that are approximately the same indicates that overall those surveyed place similar importance on the two goals. The issues of intellectual property rights between commercial producers and individuals, liability in government data sets, and access to government data presented the smallest difference in means (See Table 8.1).

Table 8.1 Difference of Means (also Table 5.15)

Conflict	Difference of Means
Table 5.4 Commercial Privacy	2.43
Table 5.7 Government Ownership of Data vs. Citizen Use	1.78
Table 5.3 Government Privacy	1.33
Table 5.6 Commercial Intellectual Property Rights	1.02
Table 5.9 Commercial vs. Consumer Liability	0.94
Table 5.8 Government Ownership of Data vs. Commercial Use	0.74
Table 5.10 Commercial vs. Commercial Liability	0.44
Table 5.13 Geographic Data as a Public Good	0.37
Table 5.12 Access to Government Data	0.25
Table 5.11 Government Liability	0.22
Table 5.5 Citizen Intellectual Property Rights	0.19

8.1.2 Conflict Within Individuals

Individuals in most groups are conflicted over questions dealing with privacy, liability, and access to government data. Table 8.2 below shows the average amount of conflict on a 1 to 5 scale. As indicated in Chapter 6, conflicts with a value greater than 3.4 were deemed to be significant. Questions 13-18 deal with the issue of liability, questions 1 and 2 deal with the struggle over protecting personal privacy versus allowing government to use data sets however they feel is appropriate, and questions 19 and 20 raise issues between allowing access to government data sets and government agencies protecting their geographic data against inappropriate use. Conflict also exists for the issue of protecting copyright in commercial data sets versus allowing individuals the freedom to create new products from commercial data sets (questions 5 and 6). Determining when an individual should be able to create products from data produced by commercial companies (questions 21, 22, and 23) also presents some conflict. The conflicts arising from access to and privacy in government data sets are important to note. People want to be able to protect their privacy but they see the need for government to have and use data that includes individual locations. Location privacy in commercial data sets did not present individual conflicts, indicating that individuals do not see any need for commercial companies to monitor their actions.

Table 8.2 Mean Individual Conflicts (extracted from Table 6.1)

Questions	Overall Conflict	Questions	Overall Conflict
1 & 2	3.5	13 & 14	3.8
3 & 4	2.99	15 & 16	3.76
5 & 6	3.36	17 & 18	3.93
7 & 8	2.97	19 & 20	3.47
9 & 10	3.09	21, 22 & 23	3.31
11 & 12	3.23		

8.1.3 Differences Between Groups

Differences exist for all the groups over the issues of access to government data, questions 19 and 20, and the issue of ownership and sales of government data, questions 9 through 12. A fair amount of disagreement also exists over the public goods aspects of geographic data. An X is placed in Table 8.3 for each question the compared groups differed over. Comparisons were made between professionals and subjects (Section 7.4); government, commercial, and academic employees (Section 7.5); and those who produce, manage, and use geographic data (Section 7.6). The chi-squared test was performed to see if the distribution of the results were independent. The t-test was performed between professionals and subjects while the analysis of variance (ANOVA) was performed between the other groups to see if the means for the groups compared were statistically similar. Conflict was determined to exist for a question if the groups compared had statistically significant results for both statistical tests.

Table 8.3 Presence of Conflict Between Groups

Question	Professionals and Subjects	Government, Commercial, and Academic	Producers, Managers, and Users	Question	Professionals and Subjects	Government, Commercial, and Academic	Producers, Managers, and Users
1				13			
2				14			
3				15	X		
4		X		16			
5		X		17			
6				18			
7				19	X	X	
8		X		20		X	X
9	X	X	X	21	X	X	
10	X			22			
11	X	X	X	23	X	X	
12		X					

8.2 Conclusions

This section will draw the conclusions from section 8.1 together in an attempt to answer the central question of this research. *To what extent do differences exist between and among various parties about the perceived harms and benefits of geographic information technology?* The purpose of this work was not to draw conclusions on how to resolve conflicts that exist in the use of geographic technologies but to identify which of the potential conflict areas truly present a conflict. Drawing together the results from the three tests performed in this thesis aids us in answering that question.

Most of the issues that raised conflicts for individuals do not present differences between groups. Questions 1 & 2 about privacy and questions 13 through 18 about liability all had significant individual conflicts. Differnces between groups do not arise for these questions. The topic of access to government data, questions 19 & 20, present both an individual conflict and disagreement between groups.

8.2.1 Access to Government Data and Ownership and Sales of Government Data

Studying the amount of conflict raised over these issues shows that many individuals are conflicted over how much control government agencies should have over government produced geographic data. Comparing subject groups shows that the government sector wants more control over government data and commercial companies and academics would like greater access to the data. However it is interesting to see that the general population supports the government's position. While the general public is most likely unaware of the complexities of the issues surrounding sales and access to

government data they do not seem to think that limiting access to some data is of substantial importance.

Access to government data is an important issue especially for those producing the data. Government data is collected at the expense of the taxpayer and many argue that they should not have to pay a second time to access data. But companies often take data that is disseminated for little cost and use it in products to make a profit. Some government agencies would rather gain the profit from the data they collect than give the data away for the cost of dissemination.(Dando 1992) These issues pose important disparities in opinions that will need further study.

While the comments collected with this survey are not discussed in detail, one of the issues raised most frequently is that of access to government data. Comments ranged from strong support of cost-recovery to strong support of free information. Two comments that seem typical of respondents are shared here. "I feel very strongly that the run-of-the mill geographic data (and paper maps) produced by governments have been paid for by taxpayers, and therefore the work product is owned by taxpayers separately and collectively. Taxpayers include commercial companies." "Government agencies that spend millions of tax payer's dollars to collect very expensive GIS datasets should be able to pass laws that allow those government agencies to collect money from the private sector companies who desire to use those GIS datasets to make money."

8.2.2 Location Privacy

The issue of privacy is considered to be very important for most parties. This is indicated by the means for both questions supporting individual privacy being larger than

four, as shown in Chapter 5, Tables 5.2 and 5.3. Those surveyed very strongly support protecting privacy over allowing commercial companies or the government to do what they wish with information about individuals. However, some conflict exists within individuals when determining how much right the government should have to fulfill their objectives (Section 6.4). Disagreement also exists between commercial, government, and academic employees over the issue of privacy in commercial data sets (Section 7.5.1). Commercial companies support this goal more than the other groups. This is reasonable and expected since commercial companies profit from the data they collect about individuals. Those in the commercial sector would push harder than other groups to ensure that gathering data about individuals for commercial purposes remains a valid pursuit.

8.2.3 Liability

The issue of liability seeks to determine who holds the ultimate responsibility when accidents occur using geographic data or technologies. Three sets of opposing goals were created and all were marked as important goals. The lowest mean for any of these questions was 3.33. Simply looking at the means shows that those surveyed would hold the user more accountable than the supplier of data (Section 5.5). However, significant internal conflict existed within most individuals over the importance of supporting these goals (Section 6.3). This indicates that both are important goals and individuals would have a difficult time choosing who might be most at fault. Some differences over the issue also existed between the general public and those who use the

technology (Section 7.4.2). Those in the general public typically place less importance on the user being responsible for appropriate use.

8.2.4 Public Goods of Geographic Data

Geographic data needs to be a public good to create effective geolibraries. Data from government, from commercial companies, and from other sources need to be considered. Current copyright laws make this a difficult proposition. Those taking the survey believe very strongly that considerable amounts of data should exist in the public domain. They also felt strongly about ensuring that copyright holders retain some power over their works. (Section 5.7) Striking a compromise is a difficult proposition. Strong conflict about this issue exists within those in the commercial and academic fields (Section 7.5.5). Commercial employees see the benefit of having large amounts of data available for use, but they see themselves losing profit should their data enter the public domain. Academics understand the importance of copyright rights to the development of science but would also like data available so they can make contributions too. Commercial employees and academics see the value of both sides, which causes internal conflict (Section 6.6), but in this survey they favored different goals leading to conflict between the two groups as well. This is another issue that will require further study.

8.2.5 Intellectual Property

Of all the potential conflicts studied, the issue of intellectual property rights caused the least conflict. Some conflict existed within individuals in the academic sector over whether or not individuals should have rights to use commercial data sets (Section

6.7). Some differences also exist between government, commercial, and academics over the issue of individuals gaining access to commercial data (Section 7.5.2). Academics desire to progress science, which can occur with more data that is available and more products created from the data. Commercial employees support limited uses of commercial data because companies make money when individuals purchase their products not when they share products with friends. Overall there is little perceived difference of opinion over the issue.

8.3 Recommendations

This section focuses on the shortcomings of the survey process and presents recommendations should similar work be performed in the future. The largest difficulty arose from attempting to survey the general public. One concern is the relatively few responses that were received. Comparing a population of 131 with a population of 708 presented results that were barely statistically significant. It is difficult to target a group for a survey that has little interest in the subject matter of the questionnaire. People are most likely to fill out a survey if they are interested in the subject. Attempting to target a population with knowledge of geographic information technology that is not directly involved in its use is a difficult task. Sending survey requests to professional organizations produced about 5 responses from the general public. Attempts to target the general population through students were made for this survey. Students in courses related to geographic information were targeted because they are being introduced to some of these issues but do not use the technology on a daily basis. It might have been beneficial to target more universities than just the University of Minnesota and the

University of Maine. Very few other ideas were found for targeting the general population. One idea was to target casual users of GPS systems such as fishermen and hikers. However, this group is also difficult to contact.

Also many of those in the general student population felt they did not have a grasp of what the questions were asking and the issues behind the questions even though they were enrolled in a course dealing with geography, surveying, or land use. Providing the general population with more knowledge about the issues would have been relatively easy but could have biased results. Since most of the general population results came from students in classes a moment or two could have been taken before the survey was handed out to explain the issues. Details about the issues could also have been added to the instructions although it is unlikely that students would have read the directions completely. One of the purposes of this survey was to determine if those surveyed felt the goals were important in a very broad context. The general population's lack of knowledge about these issues is beneficial toward this goal. If the subject doesn't understand the issue in the context of geographic information they would most likely apply the issue to a broader context. While the general population's lack of knowledge made the survey frustrating for the survey taker, their opinions on the issues offer a valuable view. The best way to improve comprehension for the general public would be to simplify the questions.

8.4 Future Work

Other work

This thesis attempts to determine in which of the potential conflict areas conflicts truly exist, whether within individuals or between groups. This work was performed in a

very general context. Some study for resolving conflicts in areas determined to have high conflict might be a beneficial activity. The issues of access to government data and the rights of government to sell their data presented many conflicts. Simply discussing the issue with those in the government sector raises many concerns. This is an issue that deserves some study. Study towards finding an appropriate balance between proprietary rights and open access to data in a geolibrary setting might also be valuable.

This survey was performed in the United States. With technology allowing sharing of data across the globe many of these issues are important in a global context and not just to Americans. Goals that Americans feel are important to society might differ from what those in other countries believe are important. It might be beneficial to perform a similar survey and see what conflicts exist between people in different countries.

Creating some method for making those who use geographic data and technologies aware of the issues would also be a valuable undertaking. Many of those taking the survey commented that the questions made them think about issues and question their actions. Some commented that they had to re-evaluate how they felt about some issues. There does not appear to be resolution for many of these issues in the near future. Without that resolution it will be important for those using geographic technologies to be aware of the issues and the potential impacts on both sides. Being able to handle these issues in an ethical manner as they arise is important. Creating scenarios and other materials for people to learn from will be useful.

In order to help understand the ethical considerations of the issues discussed in Chapter 3 and to focus on the areas of greatest concern identified in Chapters 6 and 7,

some initial scenarios were drafted. Scenarios compliment the survey. As one survey taker remarked, "Depending upon differing circumstances and scenarios, most all of the items above could be graded anywhere from 1 to 5. Hence, results of this survey could support practically anything. Therefore, in my opinion, you need to zero in on particular cases, circumstances, and scenarios for each item."

The purpose of the survey was to determine, in general terms, which areas of potential conflict those involved with GIS felt were issues of greatest importance to be addressed by society. The purpose of scenarios is to focus in on particular cases within these conflict areas. Scenarios allow people to study a situation and examine the ethical ramifications of potential actions without the stress involved with making the decision in a work setting. They allow people time to decide which practices should or should not be permitted. For those inexperienced with making ethical decisions, scenarios allow people to develop a method for resolving ethical dilemmas before they are faced with a tough choice. "As many professional engineers can testify, ethical lessons are often learned only after something has been overlooked or has gone wrong. There is no wholly adequate substitute for actual engineering experience. However, having students reflect on realistic case studies can provide some helpful preparation for dealing with ethical issues they are likely to face once they do enter engineering practice."(Pritchard 1992)

Harlan Onsrud, Will Craig, and Francis Harvey created the scenarios contained in Appendix E. The scenarios were drawn from situations that actually arose in practice that they were familiar with. Names and locations of those involved and slight details were changed in order to protect the privacy of those involved. Scenarios are presented in the following format. First a situation is described in detail. After reading the scenario

parties are asked to examine the actions of various parties. Those studying the scenario are asked to consider if the conduct is beneficial for society, legal, not unethical, unethical, should be illegal, or is illegal. Participants will also be asked to specify what factors helped them to make a decision. Scenarios were discussed among the developers in detail to determine if they truly presented ethical dilemmas for at least some potential respondents or merely value choices.

While the process of creating scenarios began as part of this work, more time is needed to complete the process of studying scenarios. More scenarios need to be created to offer a variety of situations that arise in the various areas addressed in this research (see Chapter 3). Time needs to be spent to make sure the scenarios truly present a right-versus-right dilemma and that they do not show bias. Responses to the scenarios should be collected to see how people would resolve the conflicts.

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APPENDIX A:

Questionnaire

Survey of Values in the Use and Development of Geographic Databases and Technologies

Project Background:
The survey contains statements that are viewed as laudable or positive statements by at least some parties currently using or developing geographic databases and spatial technologies. Values reflected by some statements may be in conflict with values reflected in other statements.

Instructions:
This questionnaire is designed to obtain your personal views as opposed to those of an organization. However, being a member of an organization or employed by an organization may of course influence your personal perspectives.

By filling out the survey you have the opportunity to express what you believe are important societal goals in the development and use of geographic information. Societal goals are reflected ultimately in codes of conduct, government agency and private company policies, case law and legislation that may affect you personally. If you do not believe that a stated goal is a worthy goal or you disagree with the goal, you should mark it as unimportant.

The questionnaire takes less than 10 minutes to complete. You may skip questions you do not wish to answer. You must be at least 18 years of age to fill out the survey.

I respect your privacy and will keep all identities confidential. Only summary aggregate information will be reported. Anonymous quotes may be used in research publications.

Please circle the response best reflecting your personal view. Return the survey to your instructor when completed.

THANK YOU FOR YOUR HELP!

Questions and Comments can be addressed to:

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	unimportant societal goal	**minor** societal goal	**moderate** societal goal	**important** societal goal	**highly important** societal goal
1. Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by their commercial competitors.	1	2	3	4	5
2. Private companies should be allowed to exchange information about the locations of an individual's activities to accomplish commercial objectives.	1	2	3	4	5
3. Government agencies should protect the geographic data and digital maps they produce from use by citizens unless citizens have permission from the government to use the data.	1	2	3	4	5
4. Commercial companies supplying geographic information to another private company should take responsibility for ensuring the information is suitable for the private purposes intended.	1	2	3	4	5
5. Commercial creators of geographic data sets and digital maps should be able to impose any contractual or licensing restrictions they see fit on the use of such data sets and digital maps.	1	2	3	4	5
6. Commercial companies supplying geographic information to a government agency should take responsibility for ensuring the information is suitable for the public purpose intended.	1	2	3	4	5
7. The geographic data sets and digital maps produced by commercial companies should be protected from use by commercial competitors who purchase such data products but do not have explicit permission to use the data extracted from such products in a competing product.	1	2	3	4	5
8. Those who provide consumer products and services utilizing geographic information or spatial technologies should protect consumers from economic and physical harm in the use of such products and services.	1	2	3	4	5

	unimportant societal goal	**minor** societal goal	**moderate** societal goal	**important** societal goal	**highly important** societal goal
9. Substantial geographic information and digital maps should exist for use and sharing by anyone as a public good.	1	2	3	4	5
10. Individuals should have freedom to create new products from geographic data sets and digital maps produced by commercial companies.	1	2	3	4	5
11. Government agencies should protect the geographic data and digital maps they use in decision making against inappropriate uses by citizens and commercial companies.	1	2	3	4	5
12. Individuals using geographic information or spatial technologies should take responsibility for using such information and technologies wisely.	1	2	3	4	5
13. Government agencies should be allowed to cross-match data about the past and present locations of individuals in order to accomplish government objectives.	1	2	3	4	5
14. Some uses of geographic data sets and digital maps should <u>not</u> require users to acquire permission from the creators of such data sets and digital maps.	1	2	3	4	5
15. Government agencies should protect the geographic data and digital maps they produce from use by commercial companies unless such companies have permission from the government to use the data.	1	2	3	4	5
16. A government agency using geographic information that was supplied by another government agency or a private company should take responsibility for ensuring the information is suitable for the public purpose intended.	1	2	3	4	5

	unimportant societal goal	**minor** societal goal	**moderate** societal goal	**important** societal goal	**highly important** societal goal
17. Information contained in commercial data sets about the locations of an individual's activities should be kept private.	1	2	3	4	5
18. A person purchases geographic data sets and digital maps from a commercial company. Others should not be able to obtain and use the data from this person without permission of the company.	1	2	3	4	5
19. Individuals and commercial companies should have freedom to view and copy geographic data sets and digital maps used by government agencies in decision making.	1	2	3	4	5
20. Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by government agencies..	1	2	3	4	5
21. Information contained in government data sets about the locations of an individual's activities should be kept private.	1	2	3	4	5
22. Commercial companies using geographic information that was supplied by a government agency or another company should take responsibility for ensuring the information is suitable for the private uses they intend for the data.	1	2	3	4	5
23. Individuals should have freedom to create new products from geographic data sets and digital maps produced by government agencies.	1	2	3	4	5

Background Questions

24. Which of the following best describes you as an individual in the context of your employment or relation to geographic data? Pick only one response.

Government Sector:

- O **producer** of geographic data
- O geographic information **system manager**
- O **user** of geographic data

Commercial Sector:

- O **producer** of geographic data
- O geographic information **system manager**
- O **user** of geographic data

Academic Sector (Faculty & Staff)**:**

- O **producer** of geographic data
- O geographic information **system manager**
- O **user** of geographic data

General Public:

- O **student** who typically does not use digital geographic data
- O **student** who does use digital geographic data
- O **member of the general public** who typically does not use digital geographic data
- O **member of the general public** who does use digital geographic data

25. Would you be willing to be interviewed by phone regarding your opinions relative to one or more explicit geographic data conflict scenarios similar to conflicts observed in actual practice? The interview would take less than 30 minutes.

- O No
- O Yes

If yes, please provide your name, e-mail address, and phone number. These will be kept confidential in any and all publications arising from the work.

Name _____
E-mail Address _____
Phone Number _____

26. Feel free to make any comments you wish.

Thank you very much for your time and cooperation!

APPENDIX B:

Ordered Survey Questions

1. Personal Information Privacy

A. Privacy in the Government Sector

1) Information contained in government data sets about the locations of an individual's activities should be kept private.

2) Government agencies should be allowed to cross-match data about the past and present locations of individuals in order to accomplish government objectives.

B. Privacy in the Commercial Sector

3) Information contained in commercial data sets about the locations of an individual's activities should be kept private.

4) Private companies should be allowed to exchange information about the locations of an individual's activities to accomplish commercial objectives.

2. Intellectual Property Rights in Geographic Information

A. IP in the Citizen Sector

5) Individuals should have freedom to create new products from geographic data sets and digital maps produced by commercial companies.

6) A person purchases geographic data sets and digital maps from a commercial company. Others should not be able to obtain and use the data from this person without permission of the company.

B. IP in the Commercial Sector

7) Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by their commercial competitors.

8) The geographic data sets and digital maps produced by commercial companies should be protected from use by commercial competitors who purchase such data products but do not have explicit permission to use the data extracted from such products in a competing product.

3. Claims of Ownership and Sale of Geographic Information by Government Agencies

A. Claims of Ownership against Citizen Uses

9) Individuals should have freedom to create new products from geographic data sets and digital maps produced by government agencies.

10) Government agencies should protect the geographic data and digital maps they produce from use by citizens unless citizens have permission from the government to use the data.

B. Claims of Ownership against Commercial Uses

11) Commercial companies should have freedom to create new products from geographic data sets and digital maps produced by government agencies.

12) Government agencies should protect the geographic data and digital maps they produce from use by commercial companies unless such companies have permission from the government to use the data.

4. Liability in the Use of Geographic Data Sets

A. Responsibility: Commercial vs Consumer

13) Those who provide consumer products and services utilizing geographic information or spatial technologies should protect consumers from economic and physical harm in the use of such products and services.

14) Individuals using geographic information or spatial technologies should take responsibility for using such information and technologies wisely.

B. Responsibility: Commercial User versus Commercial Supplier

15) Commercial companies using geographic information that was supplied by a government agency or another company should take responsibility for ensuring the information is suitable for the private uses they intend for the data.

16) Commercial companies supplying geographic information to another private company should take responsibility for ensuring the information is suitable for the private purposes intended.

C. Responsibility: Government

17) A government agency using geographic information that was supplied by another government agency or a private company should take responsibility for ensuring the information is suitable for the public purpose intended.

18) Commercial companies supplying geographic information to a government agency should take responsibility for ensuring the information is suitable for the public purpose intended.

5. Public Access to Government Geographic Data Sets

19) Individuals and commercial companies should have freedom to view and copy geographic data sets and digital maps used by government agencies in decision making.

20) Government agencies should protect the geographic data and digital maps they use in decision making against inappropriate uses by citizens and commercial companies.

6. Public Goods Aspects of Networked Geolibraries

A. Freedom to Contract versus Support of Important Social Goals

21) Commercial creators of geographic data sets and digital maps should be able to impose any contractual or licensing restrictions they see fit on the use of such data sets and digital maps.

22) Some uses of geographic data sets and digital maps should not require users to acquire permission from the creators of such data sets and digital maps.
and
23) Substantial geographic information and digital maps should exist for use and sharing by anyone as a public good.

APPENDIX C:

Initial Solicitation Email

Subject: Conflicts in the Use and Development of Geographic Databases

Dear ASPRS Member,

As you know, the use of geographic information technologies is pervasive through out business, government, industry and the scientific community in the United States. Conflicts are arising on a daily basis in its use.

My research in this area involves gathering the opinion of individuals about perceived conflicts. By filling out the survey you have the opportunity to express what you believe are important societal goals in the development and use of geographic information.

Societal goals are of course reflected ultimately in codes of conduct, government agency and private company policies, case law and legislations that may affect you personally. The questionnaire takes less than 10 minutes to complete.

Click here to begin:
http://www.spatial.maine.edu/~abethell/survey/SurvIntro.htm
If the link is not highlighted, copy and paste it into the address bar of your browser's window.

I am attempting to sample a broad population of geographic data users, managers, producers and those that are subjects of data sets. Therefore, please forgive any cross listings. This survey is but one segment of a more extensive research methodology.

I respect your privacy and will keep all identities confidential. Only summary aggregate information will be reported.

Thank you in advance for your participation.

Sincerely,

Amber Bethell
Graduate Student
University of Maine
Department of Spatial Information Science and Engineering
anbethell@hotmail.com

P.S. Please address any comments, questions or complaints directly to me rather than to ASPRS.

APPENDIX D:

Follow Up Email

Subject: Conflicts in the Use and Development of Geographic Databases

Dear ASPRS Member,

I wish to thank all of you who have taken the time to fill out my survey. If you haven't, I encourage you to take the survey because it allows you to express what you believe are important societal goals in the development and use of geographic information. Societal goals are of course reflected ultimately in codes of conduct, government agency and private company policies, case law and legislations that may affect you personally. The questionnaire takes less than 10 minutes to complete.

Click here to begin:
http://www.spatial.maine.edu/~abethell/survey/SurvIntro.htm
If the link is not highlighted, copy and paste it into the address bar of your browser's window.

I am attempting to sample a broad population of geographic data users, managers, producers and those that are subjects of data sets. Therefore, please forgive any cross listings. This survey is but one segment of a more extensive research methodology.

I respect your privacy and will keep all identities confidential. Only summary aggregate information will be reported.

Thank you for your help.

Sincerely,

Amber Bethell
Graduate Student
University of Maine
Department of Spatial Information Science and Engineering
anbethell@hotmail.com

P.S. Please address any comments, questions or complaints directly to me rather than to ASPRS.

APPENDIX E:

Scenarios

Will Craig, Francis Harvey, and Harlan Onsrud developed these scenarios as part of this research project. The scenarios will hopefully be developed fully in another phase of the project.

Access to Government Databases

Jeremiah is an alliance of churches and temples working to provide safe, affordable housing for families. Variability in the economy has placed many marginal families at risk. Changes in tax laws regarding rental housing and demolition of public housing projects (to reduce concentrated poverty) have led to a reduction in the supply of low-income housing over the years. Larger families have a particularly difficult time finding rental units to meet their needs.

Jeremiah decided to document the nature of the problems by looking at the counts of three bedroom and larger rental units in one inner-city neighborhood, the Washington neighborhood. They knew the City Assessor had this information on the number of bedrooms in its database, so they made a formal request for these counts. State law defines this data as public information, which must be delivered when requested, viewing data is free, but cost recovery is allowed for photocopies and programming effort required to create summaries.

The Assessor wanted to cooperate, but the request could not be handled by their old DBMS, developed and maintained by the city MIS department – lacking the ability to produce *ad hoc* summaries. The city estimated that 3 days of programmer time would be required to meet the request. The programmer was committed to a high priority city project and the Assessor decided to leave the programmer working on that project. The city could give Jeremiah its full dataset, but Jeremiah didn't have the GIS resources to do the analysis. The cheapest alternative seemed to be sitting a volunteer at a publicr terminal in the Assessor's office and viewing the Washington neighborhood parcel data one at a time, counting the number of 3+ bedroom units.

Please check <u>all items</u> that apply to the actions of the individual indicated and provide your beliefs, opinions, or reasons in the provided spaces.

Party: Jeremiah
Conduct: Seeking data to document rental housing shortages.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: City Assessor
Conduct: Willing to let outside groups have access to their data, but unwilling to adjust resources for a major request.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Party: State Government
Conduct: Guaranteeing citizen access to public data.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Statements, General Guidelines, or Principles you can suggest that might be useful in dealing with this or similar conflicts in the future:

Sale of Government Data by Government Agencies

Adams County has developed a very powerful GIS, with parcel data at its core and a dozen more layers of data. It is used by most departments in the county for mapping and decision support, as well as by cities across the county. Analysis has shown significant benefits to the county and its cities for addressing everyday issues and solving unique problems like locating new libraries.

The county's original investment in the system was over $2 million. This was a huge item in the county budget and Board members were convinced to approve the planned system only because of promises that the system would be self-supporting through sales of data. State law, though normally prohibiting sales of government data, allows cost recovery on efforts that go beyond the normal operational efforts of government units.

The county is willing to support the operating costs of the GIS department, because of the benefits it has delivered to the county. This amounts to nearly $500,000 per year, but provides valuable service to over a dozen departments. Data sales yield another $35,000 per year; about $20,000 that money goes into administering those sales and $15,000 is available for data upgrades – like newer orthophotos and higher resolution elevation data. The county has been unable to budget money for these significant capital data expenses, but willing to let the GIS department put sale revenues into a development fund to support data enhancements.

Several issues are bothering the GIS department. Some reputable citizen groups have been unable to pay for data that would help support their community improvement agendas. Data sales have decreased in recent years as some purchasers have cut their costs by building parallel systems. The department worries that the parallel system is lower quality and could yield inferior decisions. Users continue to demand new and improved data.

Please check <u>all items</u> that apply to the actions of the individual indicated and provide your beliefs, opinions, or reasons in the provided spaces.

Party: GIS Department
Conduct: Providing top class GIS data and services to county and city offices.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: County Board

Conduct: Trying to minimize taxpayer burden.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Private sector users
Conduct: Trying to cut costs through use of parallel systems.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Party: State government
Conduct: Encouraging cost recovery on extraordinary efforts.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Party: County government users
Conduct: Benefiting from GIS data and services at no cost.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Statements, General Guidelines, or Principles you can suggest that might be useful in dealing with this or similar conflicts in the future:

Personal Information Privacy

A group of six order suburban communities decided to work together to create a common redevelopment plan. GIS was a core component of this effort and significant work went into standardizing databases across municipal lines and developing mechanisms to keep data current. Having everyone on a common information base has led to common productive conversations and creative programs.

Demographic data has been the hardest to obtain. The Census of Population is taken once a decade and planners were looking at six-year-old data when the project began with no prospect of an update for another 4-5 years. The cities needed to know ages of householders and whether children were at home so they could make estimates of the number of homes that might be sold as people downsized. City departments wanted this information so they could plan programs to meet community interests and needs.

A local entrepreneur provided a solution. He knew that state and local public records contained much of the necessary information, but needed to be manipulated to be of value in this discussion. Local utility records (e.g. water) had ratepayer name. Local tax records contained similar information for the owner, who may or may not be same person. Voter registration helped verify the names of individuals living at an address, whether or not they are owners, and added the names of other people over age 18 years. Driver's license data added information on ages of individuals. All this data had to be merged, verified to ensure consistency of data at each address, and decisions made when inconsistencies arose. The cities were excited by his proposal and hired him to do the work. The cities were concerned about invading privacy and received only summary information at the block level. The entrepreneur had information about individuals by name, but kept this confidential as specified in the contract. (With no other customers for this data, he necessarily keeps his fees fairly high).

The local school district became interested in this project, because they needed household data to help them make projections about school enrollment. The cities welcomed the school, because it provided a source of information about the age and gender of children, data that was not available elsewhere. Data about minors is protected under state law, but the school thinks it is on safe ground if it treats the entrepreneur as a contractor and shares only summary data with the cities. The partners seem willing to trust the entrepreneur with protecting the confidentiality of data about individuals in the household.

The cities know that the school has data on family income, collected to determine eligibility for the federally-supported free-or-reduced lunch program. They ask the school to add this data to the pooled database. The school is uncomfortable with this request.

Please check <u>all items</u> that apply to the actions of the individual indicated and provide your beliefs, opinions, or reasons in the provided spaces.

Party: 6 cities
Conduct: Getting any data they can to help with redevelopment efforts.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Public Agencies
Conduct: Providing their public data.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: School districts
Conduct: Willing to share some data, worrying about invasion of the privacy of their families.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Entrepreneur
Conduct: Cross-matching files to create a database contain demographic data about individuals at the household level. Promises to keep information confidential.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be

illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Statements, General Guidelines, or Principles you can suggest that might be useful in dealing with this or similar conflicts in the future:

Geolibraries

Ralph Jones is an eminent historian of the physical development of American cities. The city of Metropolis has a GIS map showing the location and land use of buildings in downtown today and Jones accepts this as the current state. He interested in the original settlement and how it evolved over time to become what it is today. He has information about trends in the national economy, in building technology, and in urban planning philosophies. He wants to see how the forces have played out on the developing landscape of the city of Metropolis.

The city has no electronic data about earlier land uses, but Jones learns that insurance companies created detailed land use maps in the early 1900s. The Insurance Company, for example, published maps showing individuals buildings, complete with lists of tenants and construction material – things that would help estimate fire risk. Those maps are available for 1880, 1910, and 1930.

He scans the maps and edits them for his own use, keeping 90 percent of the original. He changes legends and adds a credit to the old Insurance Company. He makes some attempts to contact the company to get permission, but can find no record of them. This presents little difficult, because fair-use laws permit him to use the maps in articles he publishes in profession journals.

The project is so popular that he decides to write a book about the history of urban development using Metropolis as his major example and it sells quite well. Students and planners from around the country ask him for electronic copies of the old maps and he sends these out freely, hoping that others can benefit from this work. He ignores the fact that a firm or person may own the copyright to these maps and they have not yet given him permission to reproduce it.

Please check <u>all items</u> that apply to the actions of the individual indicated and provide your beliefs, opinions, or reasons in the provided spaces.

Party: Professor Jones
Conduct: Using historical data for academic research.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Libra ry
Conduct: Providing customers with historical documents.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Congress
Conduct: Extending copyright to ancient parties who may or may not have an interest in protection.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Party: Students & planners
Conduct: Using data collected by Prof. Jones

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Statements, General Guidelines, or Principles you can suggest that might be useful in dealing with this or similar conflicts in the future:

Web Security

In a move toward better government, Jefferson County put its parcel data on the Internet. This move allowed citizens and professionals 24 hours access to county data, seven days a week. The county has high quality parcel maps, created from the coordinate geometry of the original surveys. Users can type in an address or zoom into a county map to view the parcels of interest to them. Thematic maps show estimated market value or sales dates of recently sold properties. Text information on each parcel includes address, value of land and buildings, lot dimensions, date and price of most recent sale. Such information is very popular with homeowners and Realtors, helping them understand turnover rates and the current housing market in specific locations. Before the Internet service was launched, interested individuals had to travel to view public kiosks in county offices during business hours.

When the site was first launched, it also included information on owner name. A user could search the site by name. Owner names were provided as part of the text information for every parcel. This feature was quite useful. People could use it to find the house of a friend or relative. Homeowners could document the names of their neighbors and use this information to create social networks. People living adjacent to a problem property could alert the landlord about problem tenants.

Complaints about providing owner name came to the County Board. Those leading the list of complaints were teachers, judges, police officers, and counselors who feared a personal attack from a member of the public they had offended. The Board was sympathetic to these public officials, and instructed the GIS department to remove all personal names from the Internet website.

Upon removal of all property owner names from the website, numerous complaints were received from citizens and a wide range of large and small companies that want the property owner names restored.

Please check <u>all items</u> that apply to the actions of the individual indicated and provide your beliefs, opinions, or reasons in the provided spaces.

Party: Teachers & other public employees
Conduct: Demanding that their names be removed from the website.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: Citizens

Conduct: Demanding that public records about property owners be destroyed.

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal

Factors or reasoning relevant to your beliefs or opinion:

Party: County Board
Conduct: Removing public data from the Internet

This conduct is:
___ Beneficial for society; ___ Legal; ___Not unethical; ___Unethical; __Should be illegal; ___ Is illegal
Factors or reasoning relevant to your beliefs or opinion:

Statements, General Guidelines, or Principles you can suggest that might be useful in dealing with this or similar conflicts in the future:

APPENDIX F:

Glossary of Legal Terms

Contracts – an agreement between two or more parties that creates in each party a duty to do or not do something and a right to performance of the other's duty or a remedy for the breach of the other's duty.

Copyright – a person's exclusive right to reproduce, publish, or sell his or her original work of authorship (as a literary, musical, dramatic, artistic, or architectural work).

Copyright Act – document containing the rules of copyright. U.S.C. Title 17.

Fair Use - a use of copyrighted material that does not constitute an infringement of the copyright provided the use is fair and reasonable and does not substantially impair the value of the work or the profits expected from it by its owner.

First Sale Doctrine – the right to resell (distribute) a purchased copy of a work.

Fraud – any act, expression, omission, or concealment calculated to deceive another to his or her disadvantage.

Fraud in the inducement – fraud in which the deception leads the other party to engage in a transaction the nature of which he or she understands.

Freedom of Information Act (FOIA) –requirement for federal agencies to disclose records requested in writing by any person. However, agencies may withhold information pursuant to nine exemptions and three exclusions contained in the statute. The FOIA applies only to federal agencies. Each state has its own public access laws that should be consulted for access to state and local records. 5 U.S.C. § 552, As Amended By Public Law No. 104-231, 110 Stat. 3048

Intellectual property – property that derives from the work of the mind or intellect.

Liability – the quality or state of being bound or obligated according to law or fairness

Strict Product Liability – liability imposed on a manufacturer or seller for a defective and unreasonably dangerous product without a finding of fault. Strict liability for a defective product that does not require the plaintiff to have privity of contract with the seller or manufacturer

Misrepresentation – an intentionally or sometimes negligently false representation made verbally, by conduct, or sometimes by nondisclosure or concealment and often for the purpose of deceiving, defrauding, or causing another to rely on it detrimentally

Negligence – failure to exercise the degree of care expected of a person of ordinary prudence in like circumstances in protecting others from a foreseeable and unreasonable risk of harm in a particular situation

Privacy- freedom from unauthorized intrusion: state of being let alone and able to keep personal matters to oneself.

Property - something (as an interest, money, or land) that is owned or possessed.

Public Access - accessible to or shared by all members of the community.

Public Domain – the realm or status of property rights that belong to the community at large, are unprotected by copyright or patent, and are subject to appropriation by anyone.

Public Records– a record made by a public officer or a government agency in the course of the performance of a duty. Public records are subject to inspection, examination, and copying by any member of the public.

Tort - a wrongful act other than a breach of contract that injures another and for which the law imposes civil liability: a violation of a duty (as to exercise due care) imposed by

law as distinguished from contract for which damages or declaratory relief (as an injunction) may be obtained.

Uniform Commercial Code (U.C.C.) - a set of uniform laws governing commercial transactions. The Code covers the sales of goods, commercial paper, bank deposits and collections, letters of credit, bulk transfers, warehouse receipts, bills of lading, investment securities and secured transactions.

Warranty - a promise in a contract (as for a sale or lease) which states that the subject of the contract is as represented (as in being free from defective workmanship) and which gives the warrantee recourse against the warrantor

Express – a warranty that is created in a contract by a statement of fact (as a description) which is made about the object of the contract and which forms a basis of the bargain

Implied - a warranty that is not expressly stated but that is recognized or imposed by the law based on the nature of the transaction

Warranty of Fitness – an implied warranty that the property being sold is fit for the purpose for which the buyer is purchasing it

Warranty of Merchantability – an implied warranty that the property being sold is merchantable (as by being of a quality that is generally acceptable in that line of trade)

Many definitions are from Merriam-Webster's Dictionary of Law (1996)

http://dictionary.lp.findlaw.com/

BIOGRAPHY OF THE AUTHOR

Amber Bethell was born in San Diego, California on April 30, 1979. She graduated from St. Johnsbury Academy in 1997. She attended the University of Maine and graduated summa cum laude with a Bachelor's degree in Spatial Information Engineering in 2001. She entered the Master's program in Spatial Information Science and Engineering in the Fall of 2001.

After receiving her degree, Amber has no real idea what she would like to do. She is currently searching for a job. Amber is a candidate for the Master of Science degree in Spatial Information Science and Engineering from The University of Maine in December, 2002.