THE ACCESSIBILITY OF PUBLIC LIBRARIES TO USERS: A GIS STUDY

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Introduction and Problem Statement

Accessibility has been conceptualized in many different ways as well as in many different academic fields. Researchers in transport geography focus on spatial relationships, and refer to it as “the proximity of one location to other specified locations” (Kwan & Weber, 2003, p. 341). Web developers generally consider web accessibility in the context of the web access of individuals with disabilities (Slatin & Rush, 2003). Recently, aspects such as the “social norms and the attitudes of a particular social world” (Burnett, Jaeger, & Thompson, 2008, p. 53) have also been examined in the context of information access. Additionally, accessibility has been analyzed from cognitive, economic, intellectual, and political perspectives.

Several factors deriving from these various perspectives are found to either facilitate or constrain access to activities. Physical accessibility, in particular, is a fundamental measure of the equal chance to take part in activities (Weibull, 1980). In spite of the fundamentality of physical accessibility, relatively little research has been carried out to measure the physical accessibility to public libraries. Furthermore, there is very little research on public libraries’ accessibility through analyzing space and time dimensions simultaneously. Space and time are basic elements of human actions and existence. These elements do not exist independently, but are in continuous and simultaneous interaction with each other. Therefore, the integration of these two elements might enable us to better understand social phenomena (Harvey, 1989).
To measure the accessibility of public libraries, LIS researchers typically measure the distance as a unit of measurement for accessibility (Kinikin, 2004; Lee, 2007; Ottensmann, 1997). However, such research overestimates the impact of the spatial perspective and underestimates the role of the temporal perspective in library utilization. Distance-based research has focused on how far individuals travel to get to the library and has measured the distance from their homes to libraries. Even though it may be true that distance is the primary determinant of library access, other factors can more significantly influence access to the library. Also, some research has suggested that the importance of distance as an organizing principle of accessibility is declining (Kwan & Weber, 2003). For example, if a library is located in frequently congested areas, it may not be used, even though it is near the user’s home. Also, problems resulting from long distances can be reduced by efficient travel systems such as the construction of highways or subways. Therefore, the travel time needs to be considered as well.

Another problem of studies on library access and accessibility is a misunderstanding of individual away-from-home activities. Some users, indeed, conduct a single-purpose trip, traveling directly to their destination, then returning home. However, most outdoor travels “are not simple origin-destination trips” (Leu, Crompton, & Fesenmaier, 1993, p. 291). Rather, people make a considerable number of multi-purpose trips, traveling to several destinations. As empirical studies have indicated, between 30% and 50% of all trips are multi-destination trips (Hanson, 1980; O’Kelly, 1982). As a measure of accessibility, limiting consideration to single-purpose trips can underestimate the meaning of accessibility and misinterpret the cost of the entire trip (Loomis, Yorizane, & Larson, 2000).

Additionally, some studies have incorporated a census data set to analyze the accessibility and spatial patterns according to socio-economic characteristics (Adkins & Sturges, 2004;
Kinikin, 2004; Koontz, 1992). Geographic data is often aggregated in order to present the results of a study in a more useful context. Census blocks boundaries are examples of the type of aggregating zones used to show results of some spatial phenomena. Integrating geographical data with socio-economic or human-related data might lead to several problems, even though it allows researchers to better understand social phenomena relative to social space. First, individual differences (e.g., age, gender, income, and education) cannot be easily explained by through the use of aggregated zones. Even though census data include various kinds of socio-economic data, the power of the explanation of individual differences might be limited when analysis uses aggregated census block data instead of individual point data (Guy, 1983). Second, zonal analysis includes the modifiable areal unit problem (MAUP), “in which zones of varying sizes and configurations will yield different results or relationships between accessibility and other characteristics” (Kwan & Weber, 2003, p. 345). When values of socio-economic characteristics are averaged over the process of aggregation, variability in the dataset is lost and the values of statistics computed at the different levels will be different; this change is called the scale effect. One also gets different values of statistics depending on how the spatial aggregation occurs; this variability is called the zoning effect. Finally, zone-based analysis cannot represent and specify the complex influence of distance on individual accessibility. When data analyzed is separately collected by a person, a variety of methods for distance measure can be incorporated in the accessibility analysis (Kwan & Weber, 2003).

**Purpose, Goal, and Research Questions of the Study**

The purpose of this study is to gain a finer-grained picture and better understanding of the travel patterns of library users, and the activities, demographics, and other factors that affect
library access. Previous studies of physical accessibility of public libraries, which have focused on library users’ single-purpose trips and their travel distance, do not provide a full understanding of library use patterns in their full temporal and spatial environment. By analyzing household travel data sets, this study will model library access patterns of users and identify factors which influence library access.

The goal of this study is to improve the physical accessibility of public libraries. Through analyzing a large data set of a household travel survey, this study will provide meaningful information regarding library use patterns and physical locations of public libraries. The findings from this study will be useful for library planning and optimal location selection.

To accomplish this goal, the following research questions are proposed:

RQ1: How are libraries spatially related to other facilities?
   RQ1-1: What are spatial relationships between libraries and other facilities during single-destination trips?
   RQ1-2: What are spatial relationships between libraries and other facilities during multi-destination trips?

RQ2: What is the impact of distance on library use?

RQ3: Which transportation modes are used to reach libraries, and what are the trip characteristics using these modes?

RQ4: How much time do library users spend for library use?
   RQ4-1: How much time do library users spend to travel to and from the library?
   RQ4-2: How much time do library users spend in the library?

RQ5: When, during the day, do people use public libraries?
Brief Notes of Methodology

To address these research questions, this study employs a mixed method design combining quantitative and qualitative data analysis. Figure 1 shows a visual diagram for the mixed methods study.

![Figure 1. The Procedures of the Study](image_url)

**Quantitative (Secondary) Data Collection.** The data sets for analysis were collected from the Metropolitan Travel Survey Archive (http://www.surveyarchive.org), which stores data sets that from studies that are typically conducted at the national, state, or local level, and are related to household trips in an assigned period. There are seventy nine surveys from forty five metropolitan areas and states, together with data and reports, available on the project website. A travel diary method was generally employed to collect household travel data. In the diaries, participants were asked to report all their away-from-home activities. Then, their activities were sequentially reported along with the arrival time to an activity place, departure time from that place, the purpose of the activity, and transportation mode(s) used.
To collect data sets addressing the research questions, the following criteria were applied. In terms of library visits, first, the activity place name should be indicated in the data set to extract daily activities of individuals who visited public libraries. If no activity place name is provided in the data set, library visits might be indistinguishable from activities that occurred in other places. Second, in order to measure travel distance, addresses for activity places are needed. Each activity location can be mapped through the geocoding process and the distance between activity places might be measured using road networks. Even though there is no address information, if longitude/latitude codes are included in the data set, the data set is collected since the location can be mapped using those codes in geographic information systems. Third, transportation modes used for travels are critical information to address one of the research questions. Finally, in terms of temporal aspects, departure and arrival time should be included in the data set.

Among 79 data sets, only the following four data sets meet the above criteria: Atlanta, GA, California State, Seattle, WA, and Tucson, AZ. Of these only the Seattle study will be used since this study includes a sufficiently large number of library visit activities for analysis. Also, unlike other data sets, the Seattle household travel survey collected more accurate data using Geographic Positioning Systems (GPS) to mitigate underreporting of trips.

To collect data for this study, first of all, daily activities of persons who visited public libraries will be extracted from the Seattle household travel survey data set. The travel data set is composed of several data files, which are connected with each other using an identifier, including household characteristics, personal characteristics, transportation mode, and trip activity. Library-related activities are indicated in the trip activity file, and those will be extracted. Using identifiers, data in other data files will also be collected.
Qualitative Data Collection. Public librarians’ perceptions are keys in the accessibility analysis in that they participate in the development of library service programs for their users. In terms of temporal aspects, for instance, the schedule of library literacy programs might be based on librarians’ perceptions of the times of their users’ visits during the day. Therefore, their perspectives of library usages and patterns will be obtained by interviews with public librarians in the study area using informal and unstructured questions related to the study’s findings of library usages and patterns such as:

1. Where do your users come from?
2. Do you have the impression that they are primarily local or that they travel some distance to come to the library?
3. How does it appear to you that they come to the library (e.g. personal vehicles, public transportation, etc.)?
4. When do they usually use your library during the day?

Also, during the interview, questions to obtain corroboration of conclusions drawn from the secondary analysis will be asked. Even though secondary data analyses allow researchers to analyze social phenomena in inaccessible settings, the interpretations of a secondary analyst can be limited due to the lack of the researcher’s knowledge of the setting. Therefore, interviews with librarians in the study setting will enable the researcher to ensure the credibility of interpretations of secondary analyses. Those questions will include:

5. What are your interpretations of findings from the secondary data analysis? What changes are in patrons’ usages and patterns since 2006?
6. What are implications of the findings for planning library services and facilities?
These questions are tentative and can be revised and more questions might be added after the analysis of the secondary data. The interviews will be audio-recorded and transcribed.

**Data Analysis**

Geographic Information Systems (GIS), which are “a powerful set of tools for storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes” (Burrough, 1986, p. 6), will be employed to manage the collected geographic information. In this study, GIS will be used in several ways to address the research questions above. First, using GIS, the collected addresses, including participants’ home addresses and activity places’ addresses, will be geocoded. Geocoding refers to the process of converting street addresses into x/y coordinates (longitude/latitude) to be displayed as features on a map (Wade & Sommer, 2006). Geocoding will occur at two distinct stages: home address geocoding and trip location geocoding. These displays can show where public library users’ activities occur and where the library is located. Secondly, GIS can be used to measure travel distance between activity places. This study includes road networks to measure travel distance more realistically. This measurement is based on the assumption that people access a location along the road network.

The diaries that were used to collect travel activities in the Seattle case should provide data to explain library access patterns according to transportation modes. Also, the collected diaries provide both departure and arrival times for activity places, from which the travel duration between one activity place and next place can be calculated. That is to say, travel diaries can help to assist in measuring how much time library users spend traveling to get to libraries as well as how much time they spend in the library. In addition, based on the diaries, the time of
travel to the library during the day can be identified. Analyzing the pattern of a library access will be conducted under various demographic characteristics.

To triangulate findings from the secondary data analysis, the researcher will employ an interview method. The data collected through interviews will be analyzed using qualitative data analysis software NVivo 8 to store, sort, retrieve, and code the data. The software allows researchers to manage interviews transcribed and to store memos developing ideas about the study. Specific findings from secondary data and interviews will be compared and verified. Synthesizing and comparing findings from these two different methods will enable the researcher to better understand library usages and patterns.

**Significance of the Study**

The spatial contexts within which public libraries exist contribute to their physical accessibility. While it is true that people can access many of the resources provided by public libraries via the Internet without actually setting foot in them, Bertot, McClure, Jaeger, and Ryan (2006) point out that individuals in poverty visit libraries to gain knowledge through the Internet; in other words, they require physical accessibility in order to use non-physical resources. Thus, in the Information age, physical access to public libraries is a major issue for information access and alleviation of the information divide.

The spatial location of the library also is key in accomplishing its role as a meeting place, and of supporting and extending democracy and social engagement. According to Buschmann (2003), the library “preserves and promotes rational discourse through the organization of collections coupled with the principle of unfettered information access” (p. 47). Buschmann’s definition emphasizes the social and political role of the public library and focuses on the
interactions between the people served by the library. A public library as a social and physical meeting place promotes “a sense of social cohesion, sustaining local identities and communities, and by facilitating the use of new information and communication technology” (Aabø, 2005, p. 209). Based on these social interactions, political participation and involvement of community people can be strengthened. Therefore, to better understand the public library’s roles in their communities, it is vital to examine the physical context of libraries.

In addition, measuring accessibility contributes to a wider understanding of the performance of policies related to the public library and gives way to clear implications for improving that performance. Problems uncovered through research into physical accessibility can be addressed by government interventions such as relocation of public libraries and redesign of public transportation routes (Weber, 2006). Physical issues are also related to analyzing library use and facility planning since they can indicate to the facility planner or policy maker the “good” and “bad” areas for placing facilities (Miller, 1999). Knowing the locations and characteristics of library users, and their reasons for visiting the library, helps planners and policy makers determine where to locate a new library, what materials to select, what programs to offer, and what hours the library should be open (Kinikin, 2004). Therefore, accessibility research has the potential to provide a valuable real-world contribution to issues of public library access, as well as in offering improved understanding.
## Schedule for Completion

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<th>2010</th>
<th>2011</th>
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<td><strong>Prospectus</strong></td>
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<td><strong>Data Collection and Preparation</strong></td>
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<td>Secondary data</td>
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<td>Interviews with librarians in Seattle</td>
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<td><strong>Data Analysis</strong></td>
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<td>Descriptive analysis of secondary data</td>
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<td>GIS analysis</td>
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<td>Interview analysis</td>
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<td><strong>Graduation</strong></td>
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## Detailed Budget

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<tr>
<td>iConference at Seattle (Feb 8-11, 2011)</td>
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<tr>
<td>Site visits and interviews with librarians in the Seattle Public Library system</td>
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Other support

Teaching assistantship from the School of Library and Information Studies at Florida State University

Name of the dissertation advisor endorsing this proposal

Dr. Gary Burnett

Associate Professor, School of Library and Information Studies
College of Communication and Information
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**Education**

Florida State University, College of Information, Tallahassee, Florida
Ph.D. Candidate, Library and Information Science, May 2011

Yonsei University, College of Humanity, Seoul, Korea

Yonsei University, College of Humanity, Seoul, Korea

**Research Experience**

**Principle Investigator**
Yonsei University, Seoul, Korea, February 2005
Master’s Thesis: *A study on the site selection of public libraries in urban areas*
Chair: JeeYeon Lee, Ph.D.

**Research Proposal Drafter**
2010 ALISE Research Grant Competition, January 2010 – December 2010
Title: *Online collaborative learning in the web 2.0 era*
Prepared and submitted a grant proposal with Kyungwon Koh and Kathy Burnett.
Funded by the Association of Library and Information Science Education (ALISE). Total award ($5,000)

Yonsei University, Seoul, Korea, September 2006 – December 2006
Title: *A Study on collaboration between school, academic, and public library.*
Prepared and submitted a grant proposal with Jee Yeon Lee. The proposal was accepted.

Yonsei University, Seoul, Korea, Submitted for consideration
Title: *Collaborative problem solving using e-Learning technologies.*
Prepared and submitted a grant proposal.
Research Assistant
Yonsei University, Seoul, Korea, March 2006 – August 2006
Title: Understanding science and technology information behavior and user needs of industry, academics, and research communities
Together with Jee Yeon Lee (Principle investigator), we submitted a research proposal to understand scientists/engineers’ information needs and behavior. Using interviews as the primary method, coded and compiled about 100 interviews, and then prepared a comprehensive report.

Yonsei University, Seoul, Korea, September 2004 – August 2006
Title: Designing of web-based nursing information system project
Interviewed five nurses to obtain requirements for nursing information system and then, manually coded and compiled the interviews.

Yonsei University, Seoul, Korea, November 2005 – December 2005
Title: Consulting of retrieval system of the Korean Intellectual Property Office
Managed the environment of information retrieval system. Designed and conducted an experiment measuring the efficiency and effectiveness of information retrieval systems, and then analyzed results retrieved from three information retrieval systems using search terms and prepared a comprehensive report with Jee Yeon Lee.

Teaching Experience

Instructor
Anyang University, Anyang, Korea, August 2005 – December 2005
Course: Library and Information Searching
This face-to-face course is for undergraduate students and focuses on information searching skills using both library OPAC and online, information organization, academic writings using the information, and citation styles.

Dealim College, Anyang, Korea, August 2005 – December 2005
Course: Practice of Computer Graphic
This face-to-face course is for undergraduate students and introduces students to basic graphic theories, various imaging techniques using Photoshop®, and applications in library program.

Teaching Assistant
Florida State University, Tallahassee, FL, August 2007 – present
Undergraduate: Usability and Use of Information Systems and Information, Technology Project, and IT Leadership – face-to-face.
Graduate, Online: *Advanced Online Searching, Database Management Systems, Management of Information Organization, Marketing of Library and Information Services, Metadata - Online*

As a teaching assistant, reviewed and graded assignments, assisted students with course material, and lead class discussions.

**Publications**

**Refereed Journal Articles**


**Non-Refereed Journal Articles**


**Presentations**

**Invited Presentation at Conference**

**Poster Presentations**


**Other Work Experience**

**Supervisor – Department Office of Library and Information Science**
Yonsei University, Seoul, Korea, January 2003 – February 2004
Coordinated undergraduate and graduate programs with department director, Dr. Taesu Kim and supervised five staffs.

**Website Planner & Webmaster**
Yonsei University, Seoul, Korea, November 2005 – August 2006
Designed the website for the Center for New Humanities at Yonsei University.
Interviewed the staff of the center and analyzed the staff’s needs, analyzed the external and internal environment of the center, designed and developed the site and maintained the website.

**Services**

**Editorships**

**Student Association**
*Founder and Former Chair*, Yonsei Library Volunteer Association
Led members of the association to the Cheolam Children Library, Cheolam, Korea to computerize the library management. Arranged a fund raising activity.

*Vice President*, Tallahassee Korean Student Association (TKSA), August 2008 – July 2009
Registered TKSA to the Recognized Student Organizations (RSOs) at Florida State University and managed the TKSA Website (http://www.fsu.co.kr).
Member, The Graduate Student Council of Yonsei University, Seoul, Korea, March 2003 – February 2005
Planned various events (Film Festival, Athletic Meeting, etc.) for graduate students, collected and analyzed graduate student’s needs, and took part in the project for building a day-care center for graduate students.

Volunteer
Library Staff, Yongsan Public Library, Seoul, Korea
Acquired and classified books and printed materials, and input material information into the library management system using KOR-MARC.

Professional Associations
- American Library Association (ALA), February 2008 – present
- Association for Library and Information Science Education (ALISE), December 2008 – present
- Florida Library Association (FLA), February 2008 – present
- Korean Library Association (KLA), January 2003 – present
- Palm Beach County Library Association (PBCLA), June 2010 – present

Honors
- 2010 ALISE Research Grant Competition Award winner
- 2008-2009 Esther Maglathlin Foundation Scholarship
- 2003 Yonsei LIS Alumni Scholarship
- Scholarship for Academic Excellence in Yonsei University, February 2001
- Fellowships and Scholarships in the Graduate School of Yonsei University, September 2002 – August 2005

Skills
Extensive knowledge of SPSS, professional skills of Adobe Photoshop, SQL, Python programming, Webpage editing tools such as HTML and Flex, DIALOG searching