"A Really Nice Spot": Evaluating Place, Space, and Technology in Academic Libraries

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This article describes a qualitative mixed-method study of students' perceptions of place and space in an academic library. The approach is informed by Scott Bennett's model of library design, which posits a shift from a 'book-centered' to a technology supported 'learning centered' paradigm of library space. Two surveys gathered data on (a) students' perceptions of places in an academic library, and (b) on occupancy rates in the same library. When triangulated, the results identified two distinct and contrasting models of place: a more traditional model based on individual study near stacks of books, and an emergent technologically-supported group study model. The results suggest that academic libraries should develop new metrics to measure library place and space in settings of technologically-supported group work.

Library evaluations are useful sources of data for library administrators and planners. They provide data on how patrons use a library, which services they like, and what kinds of new services could be provided, and this information can then be used to support decision making. Evaluation frameworks and methods are not static; libraries are situated within constantly changing external environments, and evaluation practices have to evolve to account for these. For academic libraries, one significant ongoing change is that of students' adoption of information and communication technologies such as laptops, smartphones, and course management systems. The use of these technologies has been associated with changes in the ways in which students carry out studies and assignments, including an increase in group-based study. While solo modes of study are not disappearing, and many students still prefer to study alone, technologically supported student groups are an increasingly important phenomenon that academic libraries have to respond to and provide services for.[1] In preparing their responses, academic libraries are faced by questions such as: How are student study practices changing with tech-

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nology adoption? How does group work affect the needs and requirements placed on libraries? And: In what ways can library design respond to students' needs in a time of technological change?

This article provides a case study that analyzes an academic library in terms of the relationships between solo work, group work, and perceptions of place and space. The study draws on Scott Bennett's framework of library building paradigms, which describes a shift from a book-centered paradigm, characterized by an architecture that emphasizes the individual study of documents, to a learning-centered paradigm, characterized by spaces that support groups to study and learn in self-motivated ways.[2] To investigate this transition, the study uses a qualitative mixed-method approach, consisting of (a) a face-to-face survey with map annotations and open-ended survey questions, which probed students' perceptions of different areas of a library, and (b) a seating occupancy survey, which recorded where students sat in the library. Triangulation between the surveys provides fine-grained evidence of the need to plan library spaces both to support technologically supported collaborative and group forms of learning, as well as the more traditional services based around stacks of books and serials. The following sections provide a theoretical background to the study; a description of the methodology; the analysis and results; and a discussion of the results in terms of Bennett's model.

Place, Space, and Technology

Although it may not be apparent to freshman students entering universities today, libraries have traditionally been thought of as places for quiet solo study.[3] In an early study, Diane Fishman and Ruth Walitt found that "readers tended to locate themselves in order to avoid others … [and] that the seat selected by the first person affected the choices of those who entered later."[4] Karen Antell and Debra Engel's phenomenological study of doctoral students and faculty found that a sense of "sanctuary" was "conducive to scholarship" and fostered a sense of quiet, concentration, contemplation, and focus for users.[5] More recent studies have contributed additional perspectives on the roles of libraries in general, viewing libraries as anchor points for social networks and citizenship, as venues for "conversation," as collaborative coworking and learning spaces, and as "information commons" and "learning commons."[6] In many library buildings, new models of usage sit side-by-side, sometimes a little uncomfortably, with more traditional uses. Lisa Given and Gloria Leckie's study of two public libraries, for instance, identified the presence of social activities and a need for "areas conducive to talk," although they also note that in one library the group rooms generated enough noise to attract complaints from other patrons.[7] These contrasts are also found in academic libraries. Michael Loder contrasts "what the library preferred to offer in the way of seating (primarily carrels to control noise) and [also] what the users preferred to use (primarily tables so they could spread out their work or study with others)."[8] Rachel Applegate's study of "soft spaces" (library spaces that are neither stacks nor computer labs) found that, in the case of study rooms, "Just because students may prefer the freedom to talk, it does not follow that they prefer to listen to others around them also talking."[9]

This increased demand for social spaces is occurring alongside ongoing student adoption of information technologies.[10] Judi Briden and Ann Marshall observed increases in laptop use in both "traditional" and "hi-tech" areas in an academic library and suggest that students perceived the library to be a supportive environment for group-based laptop use (versus, for example, student dormitories).[11] Students routinely use online catalogs and databases, and digital reference services, as well as e-mail, text messaging, social networks, calendars, and other applications, and these

digital services are increasingly accessed on mobile platforms such as laptops, tablets, and smartphones. Study practices are also changing. Increasingly, students are taking part in group-based assignments, either face-to-face, or supported by course management systems; they are thought to learn more in group-based interactions, and group projects are thought to offer models for post-university work experience, where many students will be employed in contexts that will require them to work in collaborative teams.[12] Compared with traditional solo modes of study, group study is often a social activity, with students learning through conversations and collaborations.[13] These changes are producing a demand for library spaces that are open, configurable, social, and comfortable. The LibQUAL+ instrument, for instance, now includes fields for assessing areas such as "quiet space for individual activities" and "community space for group learning and group study."[14] A number of in-depth and multimethod studies of academic library users have identified wide-ranging requirements for "next generation" library buildings, including a need for open plan and configurable group study spaces.[15]

Understanding the dynamics of these transitions to provide appropriate services and then evaluating those services is useful for libraries. As has been noted, however, library evaluation in general is a moving target that is affected by external factors such as the adoption of new technology. To gain traction with this complexity, therefore, and to analyze further the relationships between place, space, and technology in academic libraries, this article adopts Scott Bennett's model of three paradigms of library space.[16] Bennett argues that the adoption of digital technologies by students is leading to a shift in learning and study practices. He sets this shift in the context by describing it as the latest of three different library design paradigms, which correlate with the past, present, and future of library design. Each paradigm describes a different configuration of information technologies, users, and library architectonics. The first *user-centered* paradigm is associated with the invention of movable type and early printing presses, which supported library buildings designed around the needs of the scholars accessing relatively small numbers of printed documents and collections. The second paradigm is the *book-centered* paradigm, which has its origins in nineteenth-century industrial techniques for paper production and printing, which then led to an explosion in the volume of printed material. This led to the need to house ever more expansive stacks of physical volumes, with study areas increasingly arranged around the perimeter of these stacks. This paradigm perhaps reached its height in the second half of the twentieth century, in the form of multistory library buildings with extensive stacks, perhaps augmented by off-site storage. The architectural legacies of this paradigm are still concretely apparent in many existing academic library buildings.[17] Finally, digital technologies are now supporting a new *learning-centered* paradigm, in which users engage in solo and group learning, often with digital resources. Digital technologies are eliminating many of the spatial and temporal barriers to obtaining information (articles, papers, and the like), thus creating space within libraries for the provision of "good public spaces" alongside their existing information services. Such good public spaces should support learning in ways that are social and immersive in nature. In this paradigm, book stacks are becoming less visible, while spaces for learning and collaboration (tables, chairs, couches, nooks, and so on) are moving to the center (for instance, in the form of information commons and learning commons). According to Bennett, such social spaces support *intentional learning*, in which acquiring learning as a skill and practice becomes part of the student's motivation for engaging in study. In intentional learning, students *want* to learn as a means as well as an end, and especially in groups, engage in metacognitive actions and "tak[e] responsibility for high-level skills normally exercised by the teacher."[18]

While learning-centered technologies and study practices may be new, the physical fabric of libraries often reflects an existing twentieth-century book-centered paradigm. Much library architecture remains influenced by previous design paradigms. Moving from a book-centered to a learning-centered model of library building therefore involves a rethink in many areas of service and space design, including a focus on spaces for learning. This process is hard to initiate and define, not least because libraries are at the beginning of this paradigm shift, and it is hard to foresee the direction of change "from within." There is therefore an ongoing need to understand how new technologies and emerging study practices fit into existing spaces and shape the emergence of new types of spaces. The rest of this article seeks to ground such an understanding by exploring empirically two complementary research questions, aimed at gaining theoretical and practical insights respectively:

- To what extent is a theoretical model of library space paradigms useful in understanding library users' changing needs?
- How do students perceive and use space in the Library, and what might this tell us about library space paradigm change?

Research Setting

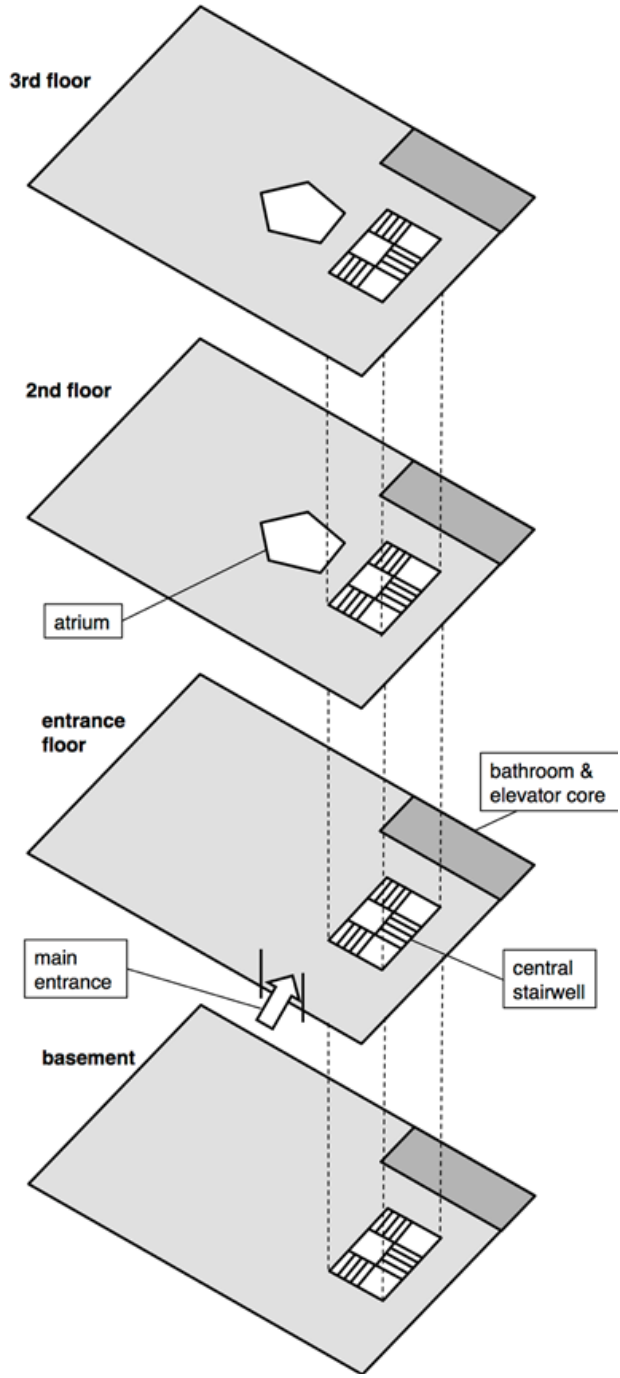
This study was carried out in an academic library ("the Library") of a private not-for-profit university ("the University") located on an urban campus in a large city in the United States. The study is situated within wider evaluation work at the Library that is aimed at understanding how the Library can support patrons to accomplish their goals. The outputs of this work include internal and external reports used to inform a range of stakeholders and to articulate the Library's place and mission within the University's strategic plan. Within this context, the aim of this particular study was to develop a baseline model and framework that could be used to understand, at a granular and empirical level, what was "going on" in the Library. This included understanding how different areas of the Library are occupied and used, and how students perceive the Library; at an early stage, it was decided to take a look at how Bennett's work could inform this understanding.

The Library building occupies a central location on the campus, bounded on two sides by busy streets that provide north-south and east-west axes across the campus. The building was constructed in the 1980s, and the style is modernist. Each of the three floors is expressed as large horizontal brick-clad mass, interspersed with horizontal bands of tinted glass on the lower floors, and vertical window slits on the upper floors. Many of the users of the library are undergraduate students. At the time of the study in 2010 and 2011, the spaces available to patrons (in other words, ignoring administrative, maintenance, and other spaces) included the following:

- A basement with several large "open plan" study areas with large movable tables, desks, chairs, and couches; journals housed in compact storage; classrooms (for instance, for information literacy sessions as well as scheduled classes during the academic term), computer labs, and some small study rooms. There is an uninterrupted view across large sections of this floor. The classrooms and computer labs generate foot traffic through the area during the day.
- An entrance floor with the circulation desk, public computers, reference volumes, DVDs, access to an adjacent fast food café, and assorted tables, chairs, and couches. The entrance itself consists of several doors that provide access from an external terrace. Just inside the doors is a security desk with a computer, a turnstile, and an RFID terminal. Anybody entering the Library is required to swipe his or her University ID card on the RFID terminal, which releases the turnstile. To one side of the turnstile is a book drop.

FIGURE 1
Schematic Representation of the Library Building

(The figure shows the relationship between the floors, and the stairwell as a vertical axis of the building. Not to scale.)



- A second floor that houses the main stacks, study rooms, some small open spaces with tables and seating, and rows of carrels.
- A third floor not generally accessible to Library patrons.

Near the entrance is a large open stairwell, as well as a service core with elevators and bathrooms. The stairs and service core provide a vertical axis connecting all the floors (see figure 1). When going from the entrance floor to the basement or the second floor, most people use the stairs. The entrance, second, and third floor are arranged around and connected by a large asymmetrical central atrium that lets in light, through a glass roof, down to the well-lit entrance floor.

Overall, the Library provides space for both individual and group study with chairs, tables, carrels, and private study rooms. Computer terminals and wireless networks provide Internet access, and students can also borrow laptops.

Methodological Approach

In the studies reviewed so far, the concepts of place and space have often been defined in different ways, with terms and definitions being used interchangeably. From this point on in, this article adopts the following definitions:

- *Library building* will refer to the physical library building;
- *Library place* will refer to users' phenomenological "sense of place" in a library; that is, how users react to and behave in library buildings; and
- *Library space* will refer to how users occupy library buildings, in this case in the form of a detailed seating survey.

In the following analysis, it is assumed that users' qualitative perceptions of library spaces are as important as the physical details and quantitative metrics of those same spaces.

The study follows a mixed-method approach that used qualitative and quantitative instruments to investigate the relationships between place, space, technology, and user experience. A mixed method approach allows for the collection and triangulation of multiple data views on the same phenomenon.[19] As part of the wider evaluation research being carried out at the Library, the study followed (and is still following) an action research approach, which gathers and analyzes data, generates recommendations for intervention, and builds theory, on an ongoing basis.[20] It is a method suitable for complex multivariable field sites with evolving organizational and technological components.[21] The major components of this study were two surveys carried out between June 2010 and June 2011. The first survey—the "space survey"—recorded seat occupancy in the Library. Space surveys can provide information that can support the planning of new library spaces, or the redesign of existing spaces.[22] The second survey—the "place survey"—interviewed students on campus about their perceptions of different places in the Library and about what they liked and did not like about the Library. Both surveys were developed by a team of University faculty, PhD students, an undergraduate student, and a Library employee, and were refined over a number of pilot tests. All survey administrators undertook the required IRB training.

The Space Survey (n = 112)

The space survey collected seat count data to create "heat map" visualizations of Library occupancy. Heat maps are visualizations that use different colors to illustrate the relationships between different sets of data.[23] A color convention often assumed in heat map visualizations is that of a spectrum, in which lower data values are represented by blue (cooler) colors, intermediate values by green and yellow, and higher data values by orange and red (hotter) colors. Heat maps were originally developed to support the visualization of matrix information in the biological sciences, but they can also be used

to map data onto space (for instance, in the case of weather maps), socioeconomic data, and so on. In this case, Library occupancy rates were mapped onto plans of the Library. Detailed plans of the Library basement, entrance, and second floors, were obtained. These plans were subdivided into smaller "zones," defined informally as spaces that felt coherent in terms of use, environment, furniture, and so on. An example of a zone is shown in the photograph and plan in figure 2.

FIGURE 2
An Example of a Zone, Showing a Photograph and a Plan of the Same Zone, in this Case with Three Tables, Each with Four Chairs

(Note: in compliance with IRB protocols not to depict subjects in photographs, the following photographs show a relatively unoccupied Library; in reality, many of areas depicted are often more occupied.)

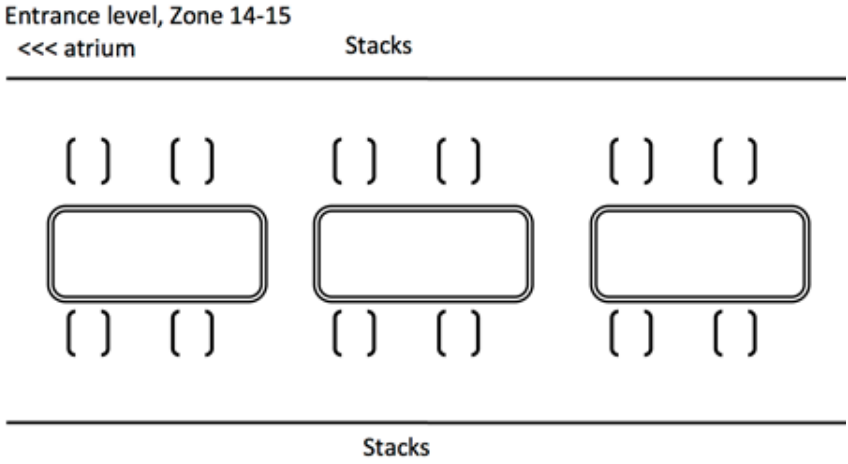


TABLE 1
Summary of Survey Collection Times and Dates

Month of Collection		
	Count	%
October 2010	1	0.9
November 2010	10	8.8
December 2010	3	2.6
January 2011	15	13.2
February 2011	13	11.4
March 2011	5	4.4
April 2011	**34**	**29.8**
May 2011	28	24.6
June 2011	5	4.4
Total	114	100.0
Day of Collection		
	n	%
Sunday	1	0.9
Monday	24	21.1
Tuesday	20	17.5
Wednesday	26	22.8
Thursday	**29**	**25.4**
Friday	14	12.3
Total	114	100.0
Term of Collection		
	n	%
Fall 2010	14	12.3
Winter 2011	33	28.9
Spring 2011	**67**	**58.8**
Total	114	100.0
Time of Day of Collection		
	n	%
10 a.m.–12 p.m.	30	26.3
12 p.m.–3 p.m.	**43**	**37.7**
3 p.m.– 4 p.m.	20	17.5
after 5p	21	18.4
Total	114	100.0

A small zone might consist of a few tables and chairs, while a large zone—such as the open area inside the library entrance—included 7 tables and 35 chairs of different sizes, as well as other furniture. Other zones included study rooms, usually with a table, four to six chairs, a chalkboard, and rows of study carrels. A total of 76 zones were identified, and in each zone, each item of furniture was mapped. The zones on each floor were given sequential numerical identifiers that supported a structured "walkthrough" of the Library. After iterative pilot testing, a survey book was prepared with instructions, plans, and a key (see appendix A). The survey was administered mainly by a Library staff member with IRB training who walked through the Library and marked with an "X" on the plans all the users in the Library. An average walkthrough of the Library took about 45 minutes. It was decided that it was not possible to survey library use randomly over time, for two main reasons. First, there were too many variables to account for (time of day, day of the week, week of the term, and so on) to create a truly random survey. Second, the surveys were carried about by Library staff in addition to their existing duties; thus, they were often carried out in parallel with existing scheduled tasks (such as existing Library walkthroughs). A summary of survey collection times and dates is provided in table 1. Finally, as both Library staff and patrons could, on occasions, rearrange the furniture—an event that with hindsight should have been expected—any permanent rearrangements of the furniture were recorded in revised versions of the survey book.

The recorded data, including the date and time of each survey, were entered into a spreadsheet. The average occupancy for each zone was calculated by taking the potential occupancy for that zone in terms of seats, calculating the observed occupancy over time, and then calculating the observed occupancy as

a percentage of the potential occupancy. For instance, a zone with four seats and an average recorded occupancy of 2 patrons had a calculated average occupancy of 50 percent. Overall, the average occupancy of the basement (total seats, 312) was 95 seats, or 27.8 percent; the average occupancy of the entrance level (total seats, 377) was 128 seats, or, 39 percent; and the average occupancy of the second floor (total seats, 151) was 67 seats, or 48.2 percent. With the caveat that, due to factors such as the quarter-term system, final exams, holidays, and other calendar-related events, there was no such thing as a "typical" week in the Library, overall, the busiest times for all three floors were earlier in the week, from Monday to Wednesday, while Friday was the least busy day. All levels of the Library are busiest in the late afternoon (3:00 p.m.–5:00 p.m.); and the second floor, which had the least total possible capacity, was the busiest at all times observed.

The percentage occupancy rates were converted to RGB color values, ranging from red (255, 0, 0) to represent 100 percent occupancy, to blue (0, 0, 255) to represent 0 percent occupancy, and used to color the Library floor plans appropriately. In the resulting heat maps, zones occupied at a higher rate appeared as orange or red "islands" in the generally blue and green maps.[24] An example of the heat map for the entrance floor of the Library is presented in figure 3. In this map, an example of a crowded "island" is the reference hub on this entrance level, where average occupancy was recorded at approximately 90 percent. "Hot spots" identified elsewhere in the Library included the second-floor carrels, which were recorded at approximately 79 percent average occupancy, and the desks around the atrium balcony, which were recorded at approximately 83 percent overall occupancy.

FIGURE 3
Example Heat Map: Entrance Floor. Relatively High Occupancy Areas Are In Red, Relatively Low Occupancy Areas In Green/Blue

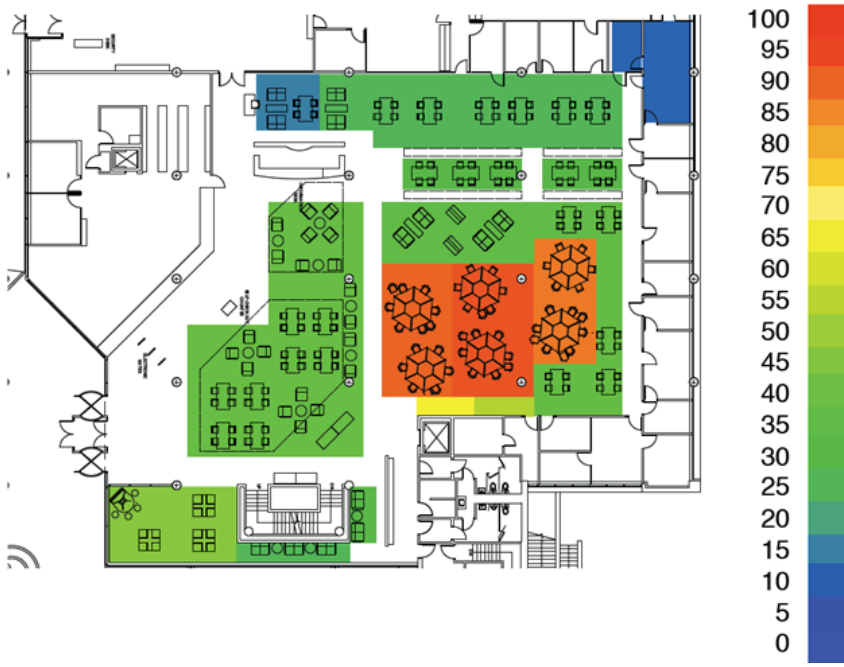


TABLE 2
Summary Demographic Data from the Face-to-face Place Survey (*n* varies slightly with survey completion rates)

Frequency of Library Visits (n=97)		
Never	1	1.0%
Once per quarter/semester	15	15.5%
Monthly	16	16.5%
Weekly	26	26.8%
Several times a week	20	20.6%
Daily	12	12.4%
Several times a day	7	7.2%
Enrollment Level (n=98)		
Undergraduate	84	85.7%
Masters	7	7.1%
Combined BS/MS	7	7.1%
Program Status (n=96)		
Full-time	92	95.8%
Part-time	4	4.2%
Gender (n=98)		
Female	60	61.2%
Male	38	38.8%
Age (n=98)		
18-20	36	36.7%
21-23	48	49.0%
24-26	9	9.2%
27-30	3	3.1%
31-35	2	2.0%
Years at the University (n=93)		
1	29	31.2%
2	13	14.0%
3	22	23.7%
4	18	19.4%
5	9	9.7%
6	2	2.2%
Average: 2.7 years		

The Place Survey (n = 98)

The place survey gathered data on users' perceptions of the various places in the Library and was administered face-to-face. Potential subjects on the University campus were approached and asked if they would like to take part in a survey to help improve Library services. If the subject agreed, the consent form was collected, and a set of floor plans for the Library was shown to the subject (see appendix B for the survey instrument). Respondents were asked to annotate the maps to identify the areas of the Library that they liked or didn't like. Several open-ended questions were also asked about what the respondents did the last time they visited the Library; what they liked about the Library; what didn't they like; and what changes would they implement. Basic demographic data were also collected (see table 2).[25]

To analyze the map annotations, the floor plans from the survey were enlarged to approximately 3 feet by 4 feet and pinned to a bulletin board. The map annotations were transcribed into a word processing document (in the case of written comments) or reproduced as hand-drawn figures. Each individual comment was cut out, and the authors collaboratively pinned each comment or drawing to the appropriate area of the enlarged floor plan (see figure 4). The map annotations and responses to the open-ended survey questions were also added to a spreadsheet and coded to enable sorting by zone and floor. Working as a team, the authors used an inductive coding approach to identify significant recurring themes in the data. These themes were refined in further discussion, as follows: (a) perceptions of Library services; (b) perceptions of the Library building; (c) ambience and affect; and (d) the "character" of each floor.

Library services were generally well thought of and frequently used. Respondents appreciated the Library

staff who performed the reference, circulation, and related functions and remarked positively about the range of materials available in the Library, and technologies such as computer workstations, laptops on loan, and WiFi. They requested additional electrical outlets, printers, computers, copiers, and scanners, and better WiFi connections. Ethernet ports are located on the walls in certain areas, and the Library does offer Ethernet cables for checkout, but users often were unaware of this service. Respondents appreciated the entrance-level "Reference Hubs," an area with six hexagonal workstations, each with six computers, often used for quick tasks such as checking e-mail and social networks, accessing Library catalogs and databases, as well as nonacademic Web

FIGURE 4
Aggregating and Coding the Map Annotations

surfing. These were seen as useful for printing and other "quick activities," although many respondents mentioned the difficulty in finding available machines as well as the general congestion of this area. The Hub could be filled to capacity, with users standing around the seated users of the workstations. This assessment of the Hub as crowded was confirmed by place survey responses such as "Normally filled with students," and "Convenient to access, but often loud and crowded. Hard to find a computer."

The *Library building* was another important theme for respondents. For students on this campus, the Library is "one of the only places to go to study." Respondents found it convenient to meet at the Library for group work; as one respondent put it, "there are enough places where I can talk without getting stares," and they suggested lounge-style arrangements in areas conducive to group work. In contrast, other respondents requested more areas for independent work and suggested segmenting the collaborative workspaces into smaller areas. As one respondent explained, "I'd like more traditional library study space, where I can sit and be around books and the other resources I need (without tons of people)." Finally, many respondents affirmed the Library's role in supporting leisure needs. Centrally located on the campus, the Library is used as a place to go between classes during the day to unwind: "I like the solidarity that can be found in some spots here." Several respondents referred to the library as a place to hang out and "get socialized" with their peers. The standing computer workstations on the entrance level are within reach of the entryway for users to check e-mail or browse the Web without needing to find a seat. Respondents overwhelmingly complimented the magazine and DVD collections, and, when asked for improvements to enhance their Library experience, one respondent suggested: "I would make pleasure reading a more important aspect."

Comments that described *ambience* described various atmospheric and environmental factors such as sound, temperature, and scent. Different places in the Library have different and contrasting ambiences, such as cozy/open, quiet/loud, private/public, crowded/spacious, and secluded/high traffic. One user observed that the Library provided a "nice mix of environments (quiet/social/dark/lit/casual seating/tables & chairs)." Individual quiet areas and computer carrels were in high demand. Users also commented on the desire for lighter and brighter environments; this could include more sunlight, better lighting, and more windows, as well as a need to provide more seating environments next to windows. Another identified need was for clearer signage and more directional awareness; user comments indicated that they had experienced difficulty finding a certain item or area or did not know something existed before looking at the map during the interview.

Noise was a frequent topic of discussion. Many students commented on the noise and congestion in the basement. The group study area, while popular with some students, also drew criticism from others: "too many people," "don't use because of congestion," "Avoid. Noisy. Kids playing around," and "too loud and dirty" were a few comments about this space. The ground level was also noted for its high noise level and traffic where people are entering, accessing services, and exiting. Sample plan annotations for this area include: "they are normally filled with students," [it's] way too loud because too many undergrads," "Congested," "Not enough printers/computers," "People take up computers when they aren't using them. Are way too loud. Is there a time limit? If so, no one follows it," and "It is convenient to access, but often loud and crowded. Hard to find a computer." The adjacent café was viewed both positively and negatively. Some respondents enjoyed the nontraditional library space as somewhere to study as well as "be loud and eat," while others found it prohibitive for either work or relaxation. The area on the ground floor under the atrium is heavily trafficked: one respondent referred to it as a "watering hole" while another remarked

the area was "Good for people watching, BAD for any kind of work. People are SO LOUD." Several survey respondents remarked that the ground floor was too loud and distracting to be a place for any serious study.

Survey responses for the second floor were notable for a theme not found in the rest of the Library: quiet work and solitude. The study carrels, installed mainly along the perimeter of the second floor between the stacks and the windows, and with individual power outlets built into the carrel frame, were particularly valued. They were noted for being quiet and relaxing places for concentrated study. Sample comments from the place survey include: "Some of the quietest and most relaxing spots," "These areas are usually quiet, if I can find a seat this is my go-to spot," "Nice place for quiet study and get books to read," and "Use when CANNOT be distracted. This is my hiding area," and "The place I prefer most to study when by myself. It is actually quiet, kind of secluded without actually truly being secluded physically." The second floor also has a series of desks around the atrium balcony. Users liked these desks because they were individual spaces that afforded a view over the floor below for people watching, but others also disliked them because of the noise from the atrium.

Affect refers to the emotions that places in the Library can produce. Positive emotions included "comfortable," "relaxing," "less stressful," "homey," "private," "energetic," and "engaging." Spaces that were noted as "comfortable," "relaxing," and "less stressful" often contained softer seating like couches and armchairs. "Energetic" and "engaging" emotions were brought forth in large group work areas where the sound of other users filled the air. Less favorable emotions triggered include "creepy," "confined," "intense," and "crowded." Interestingly, some users felt that the reading room felt "creepy," "confined," and "intense"—most likely due to the quiet policy and the individual work cubicles.

Discussion

Both the space and place surveys generated useful findings regarding how patrons used and perceived the Library. In this section, these findings are aggregated into two related themes: (a) correlations between quiet, noisy, and busy spaces in the library, and (b) different characteristics identified for each floor of the Library. Both themes are interpreted in terms of library paradigms.

The first theme is associated with perceptions of occupancy and noise. It might be expected that more-occupied spaces in the Library would also be described as noisier, while less-occupied spaces would be described as quiet. This correlation was indeed observed in some zones, such as the Reference Hub on the entrance level, which was used for quick computer access and which was described as both crowded and noisy. In other areas of the Library, however, more-occupied zones could be perceived as quiet, while less-occupied zones could be perceived as noisy and crowded. For example, the rows of back-to-back carrels on the second floor around the edges of the stacks (see figure 5), which were recorded as high occupancy, were also perceived as quiet.

This example is relatively easy to understand. The survey comments for the carrels echoed descriptions dating back hundreds of years, as well as the norms governing whether or not someone may sit at a carrel. Originally designated as areas for individual contemplation in religious houses (and, as such, first paradigm in nature), the *Oxford English Dictionary* records one of the first usages as dating back to the late sixteenth century: "In every wyndowe three Pewes or Carrells, where every one of the old monks had his carrell, severall by himselfe, that when they had dyned they dyd resorte to that place of Cloister, and there studyed upon there books, every one in his carrell all the after nonne."[26] Such a description would not be out of place in a description of carrels in the present day, testifying to the longevity and stability of

FIGURE 5
Top: An Individual Carrel
Bottom: Carrels Lining an External Wall

the social norms and practices governing carrel use. One consequence is that making a decision on whether to use a carrel is—perceptually, cognitively, and culturally—a relatively simple exercise. It is easy to see whether a carrel is occupied or not, and an empty carrel is common space, until someone sits in it, at which point it then becomes a private space. Given that there is a limited supply of carrels, and these are occupied on a regular basis, and there are established conventions regarding quiet behavior while using a carrel, it is also relatively easy to see how a carrel area might be fully occupied and also quiet.

In contrast, the group study areas in the Library basement (see figure 6), which were, according to the space survey, occupied at a lower average rate of 25 to 40 percent, also drew comments such as "Too many people," "Don't use because of congestion," and "Avoid. Noisy. Kids playing around." These latter comments are unambiguous and correspond with anecdotal impressions of the Library staff. In

FIGURE 6
A Section of the Basement Open Area

view of the reports of noise and crowds, the relatively low levels of occupancy in the basement were initially puzzling. One way to understand this apparent contradiction is in terms of the social norms and behaviors in this space. In contrast to the carrels, in the basement it is permissible to sit in groups, talking is not condemned, and it is acceptable to move around and through this space and also to move the furniture. The norms associated with finding a seat appear to be loosely defined. Compared with an individual carrel, which is either occupied or not, a large study table can be an ambiguous and partly occupied space. Studies of individuals entering common spaces show that they tend to situate themselves away from other people in that space (for instance, in subway cars[27]). In the case of student study tables, Susan Gibbons and Nancy Fried Foster note that an eight-seat table can be considered full by students if there are four or five students sitting there, with laptops, notebooks, textbooks, cell phones, beverages, and so on.[28] Such a table may indeed be "full" in terms of available surface area, and to have eight students studying around a table would involve overcrowding. While a colleague of a group of students sitting at a large table may join that group by occupying an empty seat, a stranger probably would not. One consequence is that, while there may be unoccupied seats at a table, these seats may also be unavailable to most students. Thus, while seating availability is initially evidenced by an empty table, this availability is reduced incrementally and ambiguously, depending on group dynamics, social familiarity, and other factors. In agreement with Gibbons and Foster, this study suggests that tables may be perceived to be "full" when only approximately 50 percent of the seats at each table are occupied. This suggests in turn that in a change from a book-centered to a learning-centered paradigm, the social norms that guide the use and occupation of space may be different in the new paradigm. In the case of the basement, for instance, deciding when a table is full involves a different set of judgments to deciding when a carrel is full, both for students and also for evaluators.

A second major theme identified in the data is that of different themes associated with each floor in the Library. The basement was often associated with group work and noise; the entrance floor was spoken of in terms of social activity, public computers, library services, and noise and congestion; and the second floor was seen as a place for quiet work and secluded seating. These perceptions were not associated with specific value judgments. Some students liked noisy and disliked quiet areas, while other students expressed reverse preferences; some students liked being in the midst of hubbub and activity, while others preferred areas with as few distractions as possible; some liked to work in groups, while others preferred to work solo, or to meet friends, or to check e-mail at terminals, or to "people watch"; some students appreciated common areas with public computers, while others preferred areas where they could plug in personal laptops. In terms of library paradigms, the second floor, associated with quiet solo work, is an example of second paradigm book-centered space. In contrast, the basement can be seen as an example of a third paradigm learning-oriented space. The entrance floor is an interesting case; it has some aspects of a third paradigm space, but at the same time it is not focused specifically on learning. It is also an arrival space, a social space, a service space, and a crossroads and a connection between the second floor and the basement. It has a social or marketplace function as a kind of "walk through" area where patrons access Library services ranging from reference services, to terminals for checking social networks, to the latest DVD movie releases. This appears to be an emergent characteristic, and perhaps a further feature of third paradigm spaces: that is, a place where users meet to coordinate their lives, their academic activities, and their social and academic groups and networks.

Outcomes of the Study

The project provided empirical baseline data for understanding Library use. It has provided data for internal and external Library reports, and other outreach activities, such as the Library blog. A specific outcome has been to provide data for a plan to provide more access to exterior light. This and other Library surveys showed that students wished to have more naturally lighted seating environments and that dark areas were often negatively perceived (note here that the carrels around the atrium balconies, which receive a lot of light through the Library roof, are among the most heavily occupied areas of the Library). Part of the second floor is therefore being remodeled to increase access to windows, to provide more seating in these areas, and to generally open up this space to the street outside; and this new space will be evaluated with the theoretical and methodological approach developed in this article. A final practical outcome has been to use the lessons learned as the basis for a new research study looking at the relationships between the physical construction of learning spaces, the use of those spaces by student groups, and learning practices.[29]

Theoretically, the library paradigm framework brought into focus the complex relationships in the triangulated data between crowded/uncrowded and noisy/quiet areas, and the different themes for each floor. This conceptual coherence supported the assessment of space usage. While a second paradigm interpretation of the basement might prompt consideration of what other services might be provided in the same area, a third paradigm perspective suggests that the practical occupancy limits for open-plan group study spaces could be lower than the theoretical maximum seating. As a thought experiment, if the group work areas in the Library basement are perceived by users to be fully occupied when only 50 percent of seats are physically taken, then the average occupancy rate of the basement would double from between 25 and 40 percent to between 50 and 80 percent, and the group study areas of the basement would be colored green/yellow/orange rather than blue/green in the heat maps.

The study generated further questions and directions for thinking about the relationships between group and solo work in third paradigm spaces, such as the use of group spaces for solo study. Some students indicated that they liked the activity of busy group spaces, even when studying alone. To what extent therefore could the framework account for third-paradigm solo work? What might third-paradigm solo spaces look like? Would they be mixed in with group spaces, or separate? Would third-paradigm solo studiers also want to be in a suitably provisioned group study space? A second interesting set of questions concerns understanding further students' perceptions of place and space when approaching already occupied study tables. What norms govern decision making in these cases? How are judgments made regarding whether a table is available or not?

Limitations of the Study

There are a number of limitations to the study. In the case of the seating survey, a larger sample would have informed understanding of how use of the Library fluctuates over time (for instance, over a week, or over a quarter). The survey also did not record people standing in crowded areas (such as at the Reference Hub); this, it was realized, could be a contribution to crowding. A better understanding of traffic flow patterns in the Library would also be useful. The face-to-face survey relied on voluntary participation and recall data by respondents. There are issues with the accuracy of self-reported anecdotal data, and the differences between what people say they do and what they actually do. Future research will address this with ethnographic interviews with users *in situ* in the Library (although there is a tradeoff here in terms of the resource-intensive nature of ethnographic research). Finally, in the case of the face-to-face survey, while

the instrument, including the maps (see appendix B), may have been familiar to the researchers, it may also, despite iterative pilot testing, have been unfamiliar or hard to interpret for the respondents, thereby affecting the data that were collected.

A more general objection might be that the study provides nothing new beyond this particular case study and that librarians already know about the different characteristics of solo and group study and of the crowded nature of study tables. Many readers, especially in the academic library world, are indeed aware of these phenomena, informally or anecdotally. However, there has been a lack of formal study of these issues, either quantitatively or qualitatively, and it is possible that these nuanced understandings of academic library usage may not be so widespread among higher-level university administrators (for example), who may take it at face value that a group space that is recorded as being occupied at (say) 40 percent on average is in fact underused. One important contribution of this article is therefore to provide a detailed empirical analysis of why the occupancy characteristics of group spaces need to be considered in new ways, not just by libraries, but by those who fund them.

Another objection could be that, while useful information was obtained to support decision making about spaces and services, it is questionable how much of this is more widely useful. Here, we would like to distinguish between generalizable results that are of relevance to academic libraries and transferable results that can be used to inform further case studies. As this is a case study that is exploring a complex theoretical framework, the overall results fall into both categories. The findings regarding the different characteristics of floors in the Library, as well as the differences between carrel spaces and group study spaces, are transferable to other case studies at the moment, although with further research they may become more generalizable. In terms of wider relevance, the study generated novel results that are generalizable to wider library settings. The methods, including the heat map visualizations, are generalizable to different library settings, with the caveat that as different libraries (as physical buildings and social institutions) vary greatly in character, they may have to be adapted to local conditions. Also generalizable is the theoretical framework that informed the survey, although again in different settings the framework may support different framings and interpretations of data.

Conclusion

Student use of libraries is changing as the result of the adoption of new information technologies. To understand these changes, a multifaceted and mixed method research approach was used to study students' use and perceptions of space and place in an academic library. The study was guided by Bennett's model of library space paradigms. Data were collected in two surveys, and the analysis pursued multiple paths to understand the relationships between place, space, and technology. Triangulation of the data built a wider picture than that obtainable from each individual survey. On a practical level, the findings provided concrete evidence and descriptions of distinct user groups, based on solo and collaborative study. Both groups have specific requirements and used the Library in different ways. Notably, the characteristics and needs of neither group were revealed fully by just one of the survey methods. Theoretically, the library paradigm model was informative, usefully framing the results to demonstrate the existence of both second and third paradigm spaces in the Library, with the dynamics between recorded occupancy and users' perceptions of these paradigm spaces varying in complex ways. The findings show that library building paradigm shifts are complex phenomena, which include changes in social and pedagogical practices, and that there is a continuing need for library evaluation practices to evolve accordingly. Overall, the study contributes to a broader understanding of the library place and space.

The analysis highlights the ways users' preferences and perceptions regarding library space inform their behaviors, raising intriguing issues for academic library planners to consider (and these issues are being explored in further research). The study also illustrates the utility of a multimethod approach and provides detailed descriptions of the methodology to encourage replication.

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APPENDIX A. The Space Instrument

1. Introduction

This survey is part of wider research on Hagerty Library users, which is investigating the following questions:

- What are users working on?
- How do users describe the space they are working in?
- Why are users working where they are?
- What are the advantages of the space?
- What are the problems with the space?
- Are there any ways in which the space could be improved?

This survey is designed to gather data on the use of different spaces in the library.

2. Survey Procedure

- Print out the accompanying survey.
- Record the date and time you are surveying each level on the map page for that level.
- The numbered zones on the map are arranged in an approximate "tour" of this level.
- Each zone can be identified in two ways:
  - ◊ From the index map of the level
  - ◊ From the individual plans of each of the zones
- For an explanation of the symbols in the zone plans, please see the key overleaf.
- For each zone mark each person present (including those standing, sitting on floor, and so on) with an **X**.
- Mark anyone sleeping with an **S**.
- Some of the zones contain movable furniture. The map of the zone may not match what you observe. Please try and record at least the number of people present. If you have time to sketch a different layout of furniture, please try and do so, but it is not necessary.
- Please respect peoples' privacy, especially in study rooms and other private areas.

3. Data entry

- Data will be entered by the researchers. Please contact the following with completed surveys:
  - ◊ [Researcher A, name and e-mail address]
  - ◊ [Researcher B, name and e-mail address]

If you have any questions about this survey, please contact [Researcher A, name and e-mail address].

APPENDIX B. The Place Instrument

Instructions for Survey Takers

This survey is designed to gather data on users' ratings of the different places in the library:

— What places do they like, and what places do they avoid?
— What are their reasons for using and avoiding particular places?
— Do they use different places for different tasks?

Suggested Survey Procedure

- Print out the survey sheets and two consent forms. Each copy of this document contains materials for one survey.
- Sign and date the consent forms.
- Select the research subject.
- Introduce yourself to the research subject:
  - ◊ *Hello. Would you like to take part in a survey on _____ University library services?*
- If the answer is yes, hand subject 2 copies of the informed consent form.
- Instruct the subject to
  - ◊ read the consent form
  - ◊ initial and sign the two copies
  - ◊ return one copy to the researcher
- Read the following introduction to the subject.

Hello. My name is _____. I am:

— *a faculty member at the university*
— *a student research assistant at the university*
— *a staff member of the library*

I am conducting research with the library into how users use the library. The aim is to improve services in the library.

I would like you to look at a series of maps of each floor in the library, and mark and describe the areas that are important to you. This should take approximately 10 minutes.

Your participation is voluntary; you can answer as many or as few of the questions as you wish, and you can stop at any time without penalty. Participating in this survey signifies your understanding that the data may be used for research purposes.

Do you have any questions before we begin?

- If the answer is "Yes," answer the questions.
- If the answer is "No," begin the survey.
- Hand the subject the maps of the Library, one by one. Provide a general introduction, something like:

I am going to show you some maps of the library. I would like you to circle all the areas that are important to you: favorite areas, areas to avoid, useful areas, etc. Please add notes to the maps explaining what makes a space make it appealing, unappealing, useful, etc. Feel free to add whatever you want to the maps.

- You can explain the maps further if you want, pointing out significant features such as the entrance, the stairs, etc.
- Answer any questions they may have. You may have to explain the maps in further detail.
- Once the subject has finished, collect the maps.
- Ask the subject if they would like to answer some further survey questions.

Would you be able to answer some further survey questions?

- If the answer is "No," thank the subject.
- If the answer is "Yes," introduce part 2 of the survey.

Please answer the following questions about yourself, and about what you think of Library services. If you are interested in possibly being contacted in the future about your replies, please supply a contact name and email. Thank you.

- Carry out the survey.
- Collect the survey.
- Thank the subject.

If you have any questions, please contact _____ _____, _____@_____.edu

Survey Questions

Please answer as many questions as you have time for.

---

1. □ Undergrad □ Combined BS/MS □ Masters □ Doctoral

Department/College: _____
Program or Major (if declared): _____
□ Full-time □ Part-time

How many years have you been at University? □ 1 □ 2 □ 3 □ 4 □ 5 □ 6
More than 6:

---

2. Gender □ Male □ Female □ I'd prefer not to say

---

3. Age □ 18-20 □ 21-23 □ 24-26 □ 27-30 □ 31-35 Over 35:
□ I'd prefer not to say

---

4. On average, during a typical quarter/semester, how often did you physically visit Hagerty Library?
□ never (go to Q 6) □ once per quarter/semester □ monthly
□ weekly □ several times a week □ daily

---

5. To the best of your memory, the last time you visited the Library to study/work, did you choose a particular place or places to use?
□ Yes, I chose a place
□ I did not choose a place, but someone I was with had already chosen a place
□ No, I did not choose a place – it was not important

If yes: Where was the place? What were you doing there? Why was the place chosen?

6. What do you like most about the library?

What do you like least about the library?

7. Is there anything you really want to change in library facilities, technology, resources, services, etc., that would help to improve what you do in the library or make your visit more enjoyable?

8. Would you be interested to take part in a further study of users' behavior in the library?
□ Yes □ No

If yes, please provide your contact information, in case we have any further questions.

Name:_____
E-mail: _____

Thank you for your participation. Please return this survey to the survey taker.

Survey taker:_____
Day _____
Time _____
Location_____

□ Inside the library □ Outside the library

Survey taker's comments:

FIGURE B1
Example of Space Survey Data Sheet

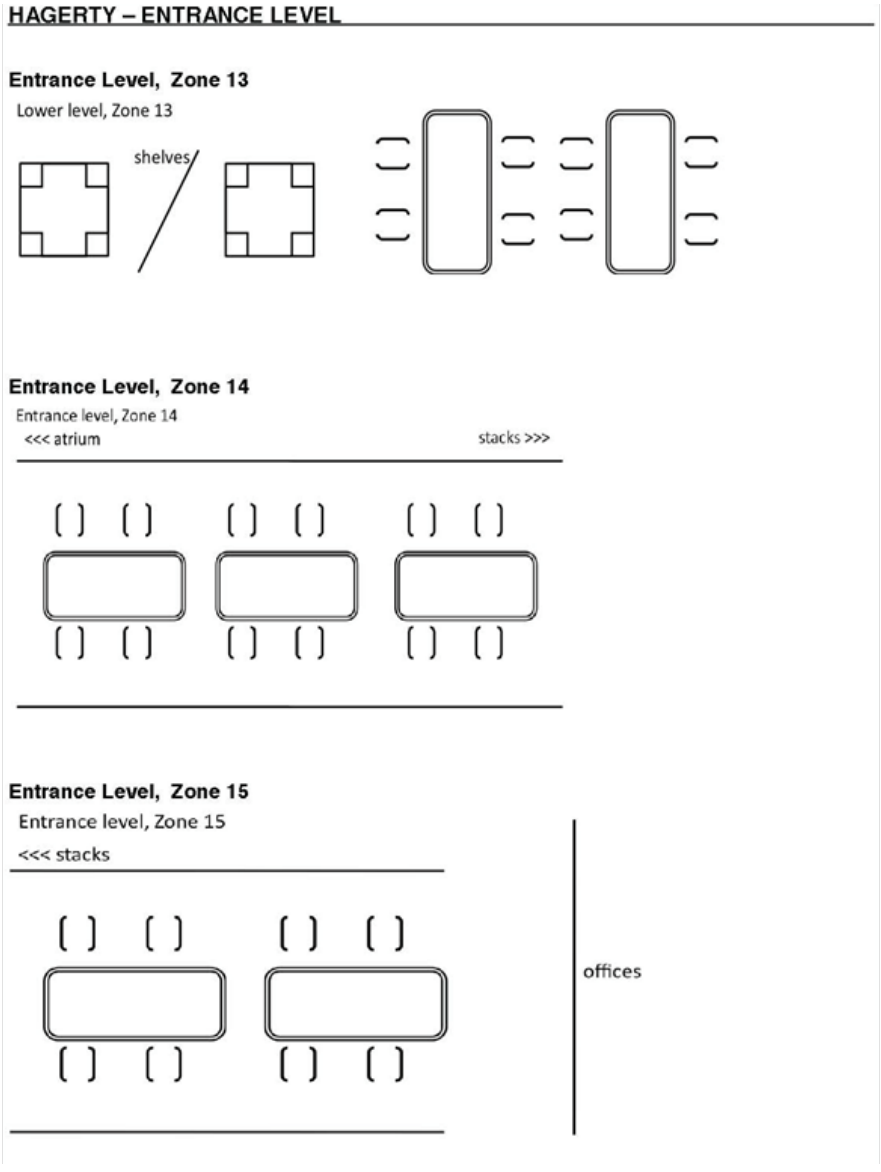

FIGURE B2
Example of a Library Floor Plan, with Zones Arranged in Order
In this case, the 'sweep' would follow a roughly anti-clockwise direction from the front entrance