SOCIAL INTERACTION IN STUDENT RESIDENCE HALLS: AN ARCHITECTURAL PERSPECTIVE

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by
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Abstract

The past decade has seen a considerable increase in student enrollment in postsecondary institutions nationwide. This increase has encouraged universities to plan new student housing facilities at the same time that family and student expectations have led to a reconsideration of residence halls and their amenities. Many universities have sought to keep students, especially upperclassmen, in on-campus housing, as a means of generating revenue as well as creating a sense of affiliation with the university community and minimizing student dropout rates.

Facilitating social interaction among students is one of the most salient objectives of new on-campus housing developments. Social interaction aids in student retention, helps students to integrate themselves into broader student communities, increases learning opportunities, helps students adjust to their chosen universities’ educational goals, integrates minority students into universities’ social systems, and cultivates long-term relationships among students.

While university administrators try to promote interactions among students in residence halls by providing meal plans and organizing social events or by manipulating the number and diversity of inhabitants (e.g. separating or mixing underclassmen and upperclassmen), less attention is usually paid to physical design factors. It is these physical factors, however, that are essential for creating stimulating environmental conditions that help students to interact. Despite the past decade’s increased university enrollment, there remains a need for a coherent study of physical design factors in residence halls from an architectural standpoint as they relate to sociability.
This thesis aims to identify the environmental factors pertaining to social interaction in Northeastern and Midwestern residence halls in the United States. Two major steps were taken to identify these factors. First, the physical factors that influence social interactions in student residence halls were synthesized through an analysis of existing literature. A method was identified for categorizing dormitory buildings based on their socio-spatial attributes; these attributes were extracted from previous studies. Three major criteria for residential halls were extracted based on meta-analysis: the average number of bedrooms per auxiliary common space, the average number of bedrooms per service space, and the amount of corridor traffic flow. Using these criteria, 148 residence halls from four campuses in the Northeast and the Midwest were analyzed and five different typologies were developed.

Secondly, a comparison was carried out between the final types in order to evaluate the degree of social interaction and the extent to which environmental factors contributed to this interaction. This resulted in developing activity maps of students’ movement patterns and interactions in these residence halls over multiple observation sessions.

This study concludes that the environmental factors pertaining to social interaction in residence halls can be categorized into two broad groups: factors related to spatial configuration and factors related to the quality of individual spaces. For spatial configuration, three factors were identified: the separation of common spaces and individual spaces, the distribution of common spaces and individual spaces, and the fragmentation of spaces. Three factors pertaining to the quality of individual spaces were likewise identified: the visibility of spaces, the flexibility and functionality of spaces, and the finishing materials and colors. The environmental factors that were identified in this study provide a basis for architects and sociologists for both the design and assessment of the sociability level in various types of residence halls.
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Introduction

According to statistics provided by the National Center for Education, the number of postsecondary students has significantly increased over the last few decades. The number of students enrolled in college in 2011 was 21.6 million, which represents a 40 percent increase since 2000 (National Center for Education Statistics, 2012).

The demand for student housing is directly related to the number of students enrolled in postsecondary institutions (Ong, 2013). Eighty percent of universities in the United States (U.S.) are expected to see 15% growth in student enrollment. This increase is expected to be particularly considerable in Florida, Texas, California, and Arkansas. Many universities in the U.S are incapable of providing sufficient on-campus housing for students. Georgia Institute of Technology, for instance, can only accommodate half of its students in its on-campus housing facilities (Ong, 2013).

While off-campus housing helps address the overflow of students needing housing, there are many reasons that on-campus living remains a better option. Pike (2002) has argued that students who live on-campus are more open to diversity (2002). Likewise, multiple studies have shown that schools that are able to provide students with sufficient on-campus housing have higher retention rates (Fidler & Moore, 1996; Wisely & Jorgensen, 2000; Stephens, 2000; Kuh, 2001; Ong, 2013). Gebhardt (2000) has shown that the lack of regulations typically found in off-campus housing may lead to excessive alcohol consumption among students. On-campus life also reduces students’ need for cars and consequently the need for parking spaces on campus (Stephens, 2000). Ong et al. (2013) have asserted that on-campus
housing is often more affordable for students, especially in large cities; they also note that this issue is an important factor for students in deciding on which college to attend. For all of the aforementioned reasons as well as the fact that on-campus housing remains an important revenue stream for universities (Hill, 2004), postsecondary institutions today are trying to increase the number of students living on-campus.

Despite this renewed interest in student housing, the past three decades have produced relatively little research on the quality of residence halls. This may be due to the temporary nature of student housing, which makes quality seem less important than it is in regular housing (Thomsen, 2008). Another reason might be the modest financial means of students (Devlin et al., 2008). Nevertheless, changes in family expectations as well as the financial and educational advantages that are associated with on-campus housing have encouraged university administrators to promote the high quality of life offered within residence halls (Tibbitts, 2005; Hill, 2004; Devlin et al., 2008).

One of the goals of recent policies put in place by college administrators is to create a positive atmosphere in residence halls by fostering social interactions among students (Biliczky, 2005; McKee, 2005; Miller, 2005). Social interaction can be affected by many different factors. Marmaros and Sacerdote (2006) have suggested that race, proximity, interests, family background, and architecture are those factors most responsible for determining how social interaction develops. Hillier and Hanson (1984) have specifically focused on the role of spatial configurations, exploring how one’s physical environment affects his or her social behavior.
It is important to identify the environmental factors that influence social interaction among students in residence halls. Therefore, this thesis puts forth a method for analyzing, categorizing, and evaluating residence halls from a socio-spatial vantage point. Based on an analysis of existing residence halls and the social patterns observed in the halls’ common areas, this study offers a range of design strategies for architects that will help to further improve the social atmosphere of on-campus student residence halls.

**Literature Review**

**A brief history of student housing in United States**

Student housing is not a recent concept; rather, it emerged two thousand years ago or perhaps even before, when young men travelled long distances to learn from master teachers in Greece. Once the men reached their destination, they lived together and with their teachers. This living arrangement served to increase interactions among the students and teachers, thus fostering the development of knowledge (Lucas, 2006; Palmer et al., 2008).

In North America, the emergence of student housing dates back to 1636, with the founding of Harvard University. The earliest student housing in the U.S. may have been based on English collegiate models because the founders of the first colleges in the U.S. were educated in English residential colleges or still believed, as in ancient Greece, that if teachers and students lived together, the students would have more opportunities to learn from their teachers (Palmer et al., 2008). Accordingly, in the early years of U.S. student housing, students lived alongside faculty members in what were then termed residential-instructional units (AIA, 1956). One of the problems associated with this model was that students were not comfortable being constantly watched by their instructors, and this undermined the
relationship between the students and their teachers (AIA, 1956). Another reason for adopting this method was that college students at that time were younger than they are today (about 14 years old) and the faculty had to take on the responsibility for developing students’ moral character (Palmer et al., 2008). Given the dispersed population of the U.S. at that time and the relatively small number of universities, students were apt to have travelled long distances to pursue their education. Having the students live and study in the same place thus made the most sense (Palmer et al., 2008).

As more and more people moved to the cities and the number of colleges and educational centers grew at the beginning of the nineteenth century, administrators started to consider other European models of residence life. Outbreaks of disease, the negative influence of older misbehaving students on younger students, and the extensive costs of creating libraries in individual living units further weakened the hold of the English collegiate residence hall model on the U.S. educational system (Rudolph, 1990). Instead, the German model became popular. In this model, students’ residences and the college facilities were completely separate from one another, leaving the universities responsible only for educating their students. Yet it did not take long for administrators to realize that not all students were self-sufficient adults who were able to concentrate on their studies. In many cases, students became distracted from studying while living away from their colleges (Rudolph, 1990).

The late 1950s and early 1960s were key moments in the evolution of residence life in the U.S. The large number of veterans who returned from World War II sought to take advantage of their right to free education under the G.I. Bill. Universities were suddenly overwhelmed with enrolling students and faced new challenges in housing these students (Palmer et al., 2008). The Higher Education Facilities Act of 1963 provided universities with considerable financial resources. As a result, universities started to draft low-cost, rapid construction plans.
for more student housing. Many buildings constructed during this time were austere, monotonous, and uninviting, and were planned in such a way as to meet only the most basic needs of their residents. The majority of these buildings consisted of long double-loaded corridors with rooms for multiple students and common bathrooms (Educational Facilities Laboratories, 1972, p. 12).

The unfavorable social climate in the newly built residence halls led to many environmental-behavioral studies in the late 1960s and early 1970s. Indeed, since the 1960s, a large body of literature has focused on many aspects of student housing such as students’ satisfaction, academic achievements, and the facilities within the housing units. These studies have helped administrators and policymakers to recognize the unsatisfactory living conditions in residence halls and to reconsider the quality of life in on-campus housing.

The need to improve the quality of life in residence halls has spawned a variety of trends such as the building of luxurious residence halls (Macintyre, 2003, p. 110), the privatization and minimization of common areas (Angelo, 2003, p. 25), a shift from corridor-style to suite- and apartment-style housing (Agron, 2003, p. 58), and the creation of live-and-learn communities (Angelo, 2003, p. 25). Overall, student housing has shown itself to be a lucrative and growing business for universities. It has also attracted the attention of researchers during the past decade. The exponential growth in the postsecondary population suggests that the need for student housing is likely to increase in the coming years.

**Advantages of social interaction in dormitories**

Social interaction within a community falls within two major categories: passive and active. Passive interaction is about “unintentional encounters” such as greetings, eye contact, shaking hands, or talking in the hallway. This form of communication can increase social support and
one’s feeling of security in a group (Felbinger & Jonuschat, 2006; Bouma et al., 2007). If frequent, passive interaction can also lead to friendship among students (Abu-Ghazaleh, 1999). Conversely, active interaction is about intentional encounters and can be either formal or informal. Informal interaction comprises all interactions bound by personal relationships in a given group, such as playing games and having coffee with friends. Formal interaction is associated with organizational management, such as specific events or meetings that are held by different organizations (Bouma et al., 2007). There are many advantages associated with social interaction, as discussed here:

- **Social interaction increases retention rates:** Freshmen and sophomores who find themselves suddenly detached from their childhood homes naturally try to find their niche in college communities (Tinto, 1988). Studies assert that dropping out of college is most common during the first and second years when students’ support networks tend to be underdeveloped (Wisely & Jorgensen, 2000). College students need to develop a sense of community in order to cope with their new surroundings and succeed in their education. Social interaction is the carrier that helps to build up such local communities (Abu-Ghazaleh, 1999). Failing to build a sense of community may lead to lack of motivation, poor performance and alienation, and a heightened dropout rate (Tinto, 1988; Deci et al., 1991; Osterman, 2000; Hoffman et al., 2002).

- **Social interaction improves educational performance:** Residence halls can function as an extension of the classroom environment, allowing students to continue the learning process (Palmer et al., 2008). Since learning can be a social activity, an atmosphere that promotes social interaction can play a significant role in improving learning opportunities.
- **Social interaction helps students develop college-specific values:** The existing literature suggests that students with a strong sense of community are more likely to integrate themselves within their campus communities (Berger, 1997). Moreover, positive behaviors (e.g. studying) tend to be developed among students who live alongside and interact with students who already exhibit those positive behaviors (Wisely & Jorgensen, 2000; Hill, 2004). According to Kuh (2001), “[P]roximity is the key factor for getting the students along with school values.”

- **Social interaction helps integrate minorities:** Extensive literature suggests that learning in a diverse community is an important factor for both students and the labor market (Bowen et al., 1998; Bowen & Levin, 2003; Epstein, 2002; Marmaros & Sacerdote, 2006) and that university policymakers try to mix students of various backgrounds through different programs (Richards, 2002; Marmaros & Sacerdone, 2006). Providing student housing in which students of different backgrounds can easily interact with one another can help universities better integrate minorities into their systems.

- **Social interaction helps generate a friendly and favorable campus atmosphere:** Positive social interaction helps students to develop an awareness of their fellow students who live near them and consequently helps them to form social networks while promoting social capital (Pretty & Ward, 2001; Williams, 2005). Several studies have suggested that constant and positive social interaction leads to long-term relationships among students, which partially influence the students’ futures (Marmaros & Sacerdone, 2006).
A review of methods for measuring social interaction

A great deal of literature has attempted to identify accurate methods of examining and quantifying human behavior. Rosenblatt et al. (2009) have assessed different types of social interaction, measuring the “degree of involvement” using both frequency and depth of interaction as indicators. Rosenblatt’s research resulted in the following categorization of behaviors: “talking to neighbors,” “knowing the neighbors,” “socializing with neighbors,” and “being friends with neighbors.” This categorization was then further assessed through interviews. The results indicated that one’s sense of attachment to his or her place in the studied housing community was high, but not all residents chose to involve themselves in common activities. In another study, Berger (1997) used the following categories of behaviors in a questionnaire for college students: “floor neighbors know me,” “have influence on floor,” “floor gets along,” and “recognize people on floor.” Like Rosenblatt et al., Berger examined the frequency and intensity of these activities; Berger’s typology of behaviors, however, is confined to the primary stages of interaction, which center on “knowing” the neighbors.

Some studies have tried to assess the degree of friendship and bonding or neighborliness in residential spaces. Tsai and Sigelman (1982), for instance, have measured the frequency of attending social events with other neighbors as a determining factor in friendship. Kasarda and Janowitz (1974) questioned individuals regarding the number of friends they had in their residential complexes. McGahan (1972) completed a more comprehensive survey, asking about the number of friends students had in their buildings, whether they attended social events with their neighbors, and whether they borrowed items or talked about personal issues with other residents in their buildings.
There are some studies that rely on observation as the main method for assessing social interaction among individuals. Among the earliest of these studies, Hall (1963) created a method for coding the way people interact via observation. Categories that Hall used included those encompassing certain activities such as sitting and walking, as well as those related to the geometric position of individuals while interacting. In his book, *The Social Life of Small Urban Spaces*, Whyte (1980) explores how people behave in the most frequently used urban spaces by recording people’s activities with a time-lapsed camera. Through this study, Whyte reveals which spaces are most likely to be used by pedestrians at certain times of the day. Gehl (1987) has used this method to assess whether urban spaces are socially successful. Through his observations, he determined the number of people in every space and the length and the type of their activities (Gehl, 1987).

Some recent studies have relied on data mining methods for their observations. These studies use computer-aided technologies to examine the geometric positions and movement patterns of individuals in order to conclude who interacts with whom. One study, for instance, analyzed recorded videos of pedestrians’ behaviors in public spaces under the assumption that those pedestrians who moved with the same velocity were more likely to be grouped (French et al., 2007). In another study of this kind, Ge et al. (2012) analyzed and categorized the movement patterns of pedestrians as either deformation, stretching, jittering, or rotation.

The existing literature offers several findings that are necessarily taken into consideration in this study. First, as the literature suggests, in order to capture the overall social atmosphere of each residence hall, observation has to be longitudinal. The behavior of students must be observed at different times of the day and on different days of the week.
Second, an activity map must be developed indicating the location of the students on the floor plan during set periods of time as well as the types of activities in each space in order to represent different levels of interaction.

**A review of typological studies on residence halls**

Typological studies have been employed in architecture from the beginning of the nineteenth century when the Industrial Revolution led to the creation of a large variety of new building types. In 1771, Francois Blondel proposed one of the first studies on building typologies. In 1801, Jean Nicolas Louis Durand developed a morphological typology and introduced a new way of looking at similarities and differences between buildings (Vidler, 1987). Modernist architects were particularly interested in building types inasmuch as they guaranteed certain outcomes upon which the builders could work to improve architecture’s efficiency (Kärrholm, 2013). Since then, typological studies have proven popular for analyzing buildings. Many typological studies have looked at different aspects of buildings. One reason for the popularity of this approach is the straightforward framework that it offers for rather complicated forms and configurations (Doty & Glick, 1994).

Overall, typological studies on buildings fall within two categories according to the distinguishing criteria they employ. The first category classifies buildings based on their formal attributes, including construction, materiality, and tectonics. The second category considers the functions of buildings. An example of this latter category is Nikolaus Pevsner’s typological study of 1976. Despite their popularity, many scholars believe that typological studies cannot explain why different societies employ different types of
buildings to fulfill specific functions (Lawrence, 1994). According to Lawrence, the use of built environments is determined by a number of factors, including the social, economic, and political conditions of the given society. An explicit example of this is the difference between use and design principles in pre- and post- industrialized domestic spaces, which is indicative of a deficiency in functional typologies.

As defined by the Oxford English Dictionary (1989), type is “that by which something is symbolized or figured; anything having a symbolic signification.” Accordingly, typology is “the study of classes with common characteristics; the classification, especially of human products, behavior, characteristics, etc. according to type; the comparative analysis of structural or other characteristics.” In architectural terms, “The birth of a type is conditioned by the fact that a series of buildings share an obvious functional and formal analogy among themselves … Type is depicted as a scheme deduced through a process of distillation from a group of formal variants to a basic form or common scheme” (Petruccioli, 1996, p. 11). The primary purpose of a typological study is to discover the dimensions of a phenomenon by describing the relationship between different types as well as their relationship to typology criteria (Schneekloth & Bruce, 1989).

Type has taken on a number of different meanings, though it is often mistakenly used merely as a term for classification (Francescato, 1994). As Quatramere de Quincy explains, types cannot be reconstructed and therefore they are not simply models (Vidler, 1987). According to Golgonen and Laisney, type is an abstract object referring to a set of entities with certain similarities (1982). Types can be used as tools of analysis due to their simple nature (analytical typology). Types also provide reduced images of a given phenomenon with the exclusion of certain features that might otherwise distract from
discovering certain patterns. A simplified version of entities presented by type reveals the distinguishing dimensions of the phenomenon and clears the way for in-depth analysis (Francescato, 1994).

A number of studies have focused on developing typologies for residence halls. The typologies presented for dormitory buildings differ based on the purpose of the given study. Most of these studies correlate the degree of satisfaction among students with certain types. Amole (2007), for instance, placed 20 dormitory buildings in Nigeria into five categories based on the buildings’ interior spatial configurations. The criteria he used to differentiate among the different types included corridor length, horizontal-access traffic load, the service core, and overall spatial structure. This typology focused on the functional capacities of different types and overlooked other aspects.

Davis and Roizen (1970) have categorized dormitory buildings into the following groups: housing complexes, apartments, tower dormitories, suites, and conventional dormitories (1970). This typology is based upon the dominant architectural feature of the residence halls. This study seeks to find parallels between students’ satisfaction and the overall architectural forms of residence halls. Devlin et al. (2008) has developed a classification system to measure students’ sense of community in different types of dormitories. They focused on a relatively small sample of residence halls (24 buildings) and categorized these residence halls in terms of the buildings’ sizes and their overall spatial organization.

There are a number of studies that compare corridor-style and suite-style residence halls (Baum et al., 1975; Baum & Valins, 1979; Rodger & Johnson, 2006). Corridor-style (also known as dormitory-style or traditional) residence halls are those in which a relatively large
number of students share major common spaces with other students. The rooms are connected by either a single-loaded or double-loaded corridor that leads to the common spaces. On the other hand, suite-style (also known as apartment-style) residence halls offer self-sufficient living units with a small number of bedrooms, often with personal bathrooms. The major criteria for this typology is the size of the groups in which students live together and are more likely to encounter one another and communicate frequently. These studies assume that corridor-style dormitories are more densely occupied and that students live in larger groups as compared to suite-style dormitories.

The criteria used by these studies are mostly obvious environmental features that can be readily detected by looking at floor plans or overall forms of buildings. Yet using diagramming techniques, Hillier and Hanson (1984) have emphasized that not all factors that influence agents’ behavior can be immediately detected by studying floor plans. This study seeks to collect all the contributing factors heretofore identified and propose a new typology of residence halls by studying a broad cross-section of American residence halls.

**General characteristics of selected campuses**

Four campuses were selected as case studies for this research: Boston University (Charles River), The Pennsylvania State University (University Park), Ohio University (Athens), and University of Massachusetts (Amherst). Of these campuses, only Boston University is located in a dense urban environment; the other three campuses are located in college towns. According to Gumprecht (2003), a college town is any city in which the college is the main cultural influence on the local community. Although college towns and large cities offer different lifestyle experiences for students, an analysis of the interior spaces in
these buildings suggest that the dormitories in the three selected college towns and Boston University are relatively similar.

The total number of residence halls on the four campuses included in this study is 306. This number includes a large variety of buildings of different sizes and types. Some of these buildings use the exact same spatial configuration since they belong to the same residential complex with typical buildings. Of all of the buildings studied, only 148 buildings have unique plans. This study focuses on these 148 buildings. This section provides an overview of student living at the four campuses studied in this thesis. The following chart provides a preliminary analysis of these 148 buildings.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Number (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-rise Buildings (3 or less than 3 stories)</td>
<td>37 (25%)</td>
</tr>
<tr>
<td>Mid-rise and High-rise buildings (More than 3 stories)</td>
<td>111 (75%)</td>
</tr>
<tr>
<td>Buildings in which service spaces are shared between 5 or less bedrooms</td>
<td>39 (26%)</td>
</tr>
<tr>
<td>Buildings in which service spaces are shared between 5 to 10 bedrooms</td>
<td>33 (22%)</td>
</tr>
<tr>
<td>Buildings in which service spaces are shared between more than 10</td>
<td>76 (52%)</td>
</tr>
<tr>
<td>Buildings that have no auxiliary common space</td>
<td>59 (40%)</td>
</tr>
<tr>
<td>Buildings in which auxiliary common spaces are shared between 8 or</td>
<td>27 (18%)</td>
</tr>
<tr>
<td>Buildings in which auxiliary common spaces are shared between more than 8</td>
<td>62 (42%)</td>
</tr>
<tr>
<td>Buildings in which corridors are shared between less than 10 bedrooms</td>
<td>57 (38%)</td>
</tr>
<tr>
<td>Buildings in which corridors are shared between 10 or more bedrooms</td>
<td>91 (62%)</td>
</tr>
</tbody>
</table>

**Figure 1. A preliminary analysis of the 148 buildings.**

**University of Massachusetts (Amherst)**

The University of Massachusetts at Amherst is located in a college town in Massachusetts and has an undergraduate enrollment of 22,134 students. This university benefits from seven on-campus residential areas with a total of 52 residence halls. Sixty-four percent of students live on campus. Nearly 51 percent of the student population is male, and the freshman retention rate is approximately 80 percent (U.S. News and World Report, 2015).
The University of Massachusetts at Amherst offers a variety of student housing facilities, including high-rise buildings, suites, and corridor-style residence halls. Each residence hall offers a combination of different services, including recreational and social centers, kitchens, study areas, and television rooms, among other amenities. There are both co-ed and single-sex residence halls (“UMASS Amherst Residence Life,” 2015).

Ohio University at Athens

Ohio University is located in the college town of Athens, Ohio, and has an undergraduate enrollment of 23,504 students. There are three major residential areas on campus, which
include a total of 42 residence halls housing about 8,000 students. At this college, 44 percent of the students live on-campus, nearly 60 percent of the students are female, and as at The University of Massachusetts at Amherst, the freshmen retention rate is approximately 80 percent (U.S. News and World Report, 2015). All of the residence halls, except for the female-only Voigt Hall, are co-ed (“Ohio University Residential Housing,” 2015).

![Ohio University's campus map and residence halls' locations.](image)

**Figure 3.** *Ohio University's campus map and residence halls' locations.*

**Boston University (Charles River)**

Boston University is located in Boston along the Charles River. This college has an undergraduate enrollment of 18,165, of which nearly 60 percent are female students.
There are six on-campus residential areas at the Charles River campus, which includes 81 residence halls in different sizes and types as well as 60 apartments that are affiliated with the university. Most residence halls on this campus are co-ed; there are, however, some dormitories that are exclusively reserved for male or female students. Seventy-six percent of students at this college live on campus, and the freshmen retention rate is 92 percent (U.S. News and World Report, 2015; “Boston University Residence Life,” 2015).

![Campus Map and Residence Halls’ Locations](image)

**Figure 4.** Boston University's campus map and residence halls' locations.

**The Pennsylvania State University (University Park)**

The Pennsylvania State University (University Park) is located in State College, Pennsylvania. This college has an undergraduate enrollment of 40,085. The freshmen retention rate for this school is 92.4 percent, and 46.3 percent of the students are female.

There are seven residential areas on-campus that house approximately 37 percent of the student population (U.S. News and World Report, 2015).
With its high retention rate, Penn State is known as a particularly successful school among the Big Ten schools in terms of student satisfaction ("Penn State Budget Office," 2014). In addition to long-term plans for improving its residence halls’ conditions, since 1999, Penn State has upgraded security and counselling services as well as its meal plans available to students (Hill, 2004).

Penn State benefits from seven residence hall complexes distributed throughout campus. About 37 percent of students live on-campus at University Park, a number that is just slightly below the nationwide average (38.6 percent) (U.S. News and World Report, 2015). Penn State requires undergraduate students to live on campus during their first year. Forty-three percent of residence halls’ capacity is allocated to first-year students who constitute twenty percent of the student body (U.S. News and World Report, 2015).

Figure 5. *The Pennsylvania State University’s campus map and residence halls’ locations*
Environmental predictors of social interaction in student residence halls

While college policymakers try to promote formal interactions in residence halls by offering meal plans and organizing various social events or by manipulating the number and diversity of inhabitants (e.g. separating or mixing underclassmen and upperclassmen or increasing the diversity of residents), environmental factors play an important role in creating appropriate spaces for students to interact. In this section, the predictors of social interaction in residence halls are distilled through an analysis of the existing literature in this area.

Researchers have found that several architectural design elements generally affect passive interaction, with most literature suggesting that proximity is a key factor (Abu-Ghazze, 1999; McPherson et al., 2001; Williams, 2005; Marmaros & Sacerdone, 2006; Tsai, 2006; Wineman et al., 2009; Sailer & McCulloh, 2012; Preciado et al., 2012). It is important to note that both physical and functional distance are inherent to the concept of proximity. While physical distance refers to the measurable distance between two points, functional distance encompasses many design factors such as site design and the geometry of corridors (Abu-Ghazze, 1999; Sailer & McCulloh, 2012).

While researchers tend to accept the importance of proximity in stimulating passive interaction, some assert that too much density (crowdedness) in residence halls has destructive psychological consequences and lowers social interaction and sense of belonging within a given community (Valins & Baum, 1973; Coldeman, 1990; Evans et al., 1996). Studies of spatial arrangements in residence halls have mostly investigated the effects of crowdedness by comparing suite-style and corridor-style dormitories. Most of
these studies assert that suite-style dormitories provide better social climates, since this type of dormitory divides students into smaller groups and thus helps students to develop stronger senses of community (Harpin & Valins, 1975; Baum & Valins, 1979; Rodger & Johnson, 2006). Yet other studies have shown the opposite—that students living in suite-style dormitories are affected by the greater depth of space (the number of steps one needs to take to move from one space to another), and in comparison to students in traditional corridor-style dormitories, are less likely to interact with other students (Hill et al., 1999; Devlin et al., 2008). One explanation for these conflicting results is that the spatial typology that these studies use does not take all influential spatial factors into consideration.

It is crucial to identify and categorize different environmental factors pertinent to the social climates of residence halls. In general, the literature suggests that there are five main spatial factors that affect social interaction in dormitories:

1. **Spatial scale and group size:** The literature suggests that the size of a community influences social interaction and the creation of friendships (Baum & Valins, 1977; Fischer et al., 1977; Birchall, 1988; Coleman, 1990; Fromm, 1991). Williams (2005) has suggested that social ties in larger communities are weaker because residents are less likely to know one another. Brown and Devlin (2003) have argued that large dormitories’ increased susceptibility to vandalism indicates a decreased sense of belonging in large communities. Likewise, extremely large communities are prone to problems with privacy (Williams, 2005).
It is important to note that the size of community is not necessarily related to the size of building. A residence hall can be divided into a number of self-sufficient spatial packages according to how the shared activity sites are distributed throughout the building. These spatial packages may have their own vertical and horizontal access points and common areas that eliminate students’ need to move from one area to another or to interact with other students in other parts of the building.

2. Organization of common and private spaces: Typically residence halls have three major types of spaces: common spaces, rooms, and corridors. The ability of residents to observe others using common spaces greatly influences whether the residents meet and interact with each other (Williams, 2005; Fromm, 1991; McCamant & Durrett, 1994; Abu-Gazzeh, 1999). In discussing the arrangement of common and private spaces, some studies assert that common spaces should be central and easily accessible, located on shared pathways where residents are more likely to interact (Fromm, 1991, McCamant & Durrett, 1994, Abu-Ghazzez, 1999). Helamaa (2013) has suggested that common spaces can be either centralized or decentralized. Decentralized common spaces aid in a range of common activities, provided that the common spaces are large or numerous. Common spaces can be used as buffer zones between public areas (outdoor spaces in the case of student housing) and private spaces (Helamaa, 2013).

The organization of spaces can also affect the privacy and noise levels of residence halls. Some studies have shown that residence halls that are organized into smaller groups of bedrooms provide quieter, more private spaces than dormitories that do not adhere to this arrangement. Providing smaller groups of bedrooms increases students’ control over their
environments and makes dormitories more suitable for activities such as studying (Devlin et al., 2008).

One important factor affecting the relationship between outdoor and indoor spaces is the number of floors in residence halls. Some studies have found that indoor spaces provide a more intimate atmosphere since they are not as affected by inclement weather (Helamaa, 2013). Other studies have suggested that low-rise buildings function better for social interaction due to their stronger connectivity with the surrounding outdoor spaces. This factor, however, is closely related to climate conditions (Williams, 2005; Abu-Ghazneh, 1999).

3. Geometry of shared pathways (corridors): Much literature suggests that shared pathways can play a significant role in increasing opportunities for interaction (Cooper & Sarkissian, 1986; Gehl, 1987; Fromm, 1991; McCamant & Durrett, 1994; Abu-Ghazneh, 1999). Overall, the literature suggests that physical distance is extremely influential in the formation of networks. “Natural movement” is the term used by Hillier et al. to indicate the relationship between the flow of movement and interaction in the built environment (Hillier et al., 1973). In the case of residence halls, corridors are the spaces through which such natural movement is most likely to occur. Natural movement has been recognized as an important factor in fostering social interaction (Heilweil, 1973). The perceived crowdedness of corridors is also a significant factor. Some studies have shown that long double-loaded corridors in residence halls increase the perceived crowdedness of space (Baum & Davis, 1980; Heilweil, 1973), while other studies (Hill et al., 1999) have demonstrated that such corridors do not account for a higher degree of perceived crowdedness. More recent studies have found that corridors’ angular attributes, axial and
segment steps, and metric distance all contribute to the creation of social networks (Sailer & MaCulloh, 2012).

4. Quality of common spaces: One of the most challenging aspects of residence halls is their inherently contradictory nature: they encompass both institutionalism and hominess (Robinson, 2004). Student residence halls are technically institutions that are governed by rules and regulations for the purpose of creating social order. At the same time, successful residence halls should be able to substitute for regular houses and fulfill students’ inevitable wish to live in places where they can feel at home. If designed appropriately, common spaces can help to bridge the gap between common and personal spaces and inspire an atmosphere that is more akin to the atmosphere in students’ own homes.

Identifying positive characteristics of common spaces in residence halls is rather difficult due to the characteristics’ subjective nature. The literature suggests that students’ preferences for interior spaces as they relate to color, finishing materials, and lighting, among other characteristics, differ (Nasar 1994). Nevertheless, there are some qualities associated with interior spaces that are commonly accepted by everyone.

Visibility is recognized as an important factor in creating social interaction in many studies (Williams, 2005; Abu-Ghazze, 1999). The primary rule is that watching a group of residents interacting motivates others to take part in social activities (Gehl, 1987, p. 75). While the location of common spaces plays an important role in the way the spaces are perceived by students, the spaces need a certain level of transparency to best serve their function. In addition, it is vital for common spaces in residence halls to be multi-
purpose, fostering recreational, social, and academic activities, among other types of activities (Godshall, 2000, p. 153).

The literature suggests that colors and materials can also play an influential role in attracting students. A well-chosen set of colors and materials can help to create a pleasant space in which students enjoy spending time (Richter et al., 2008). One way to refrain from creating an overly institutional atmosphere in residence halls is by differentiating among different spaces that have different functions by carefully selecting both the materials and colors. Certain materials are associated with certain meanings. Lower-quality and inexpensive materials such as vinyl, with its polished and easy-to-clean surface, are likely to provoke feelings of oppression in students or suggest to them that they are not important to the administration (Thomsen, 2008). On the other hand, materials such as wood stimulate a sense of hominess (Nylander, 2002).

5. The ratio of common spaces to private spaces: It seems logical that having more common spaces in residence halls leads to more social interaction among students. The literature suggests that in general, limiting the number of private spaces in housing increases residents’ chances to interact (Fromm, 1991; Marcus & Dovey, 1991; McCamant & Durrett, 1994). Studies on residence halls have also emphasized the importance of having adequate common spaces for facilitating student interaction (Fondacaro et al., 1984).

The factors that affect students’ social interaction go beyond housing, and thus, beyond the scope of this study. Students are, of course, apt to interact in all campus spaces. This study, however, looks only at residence halls, categorizing them based on the
configuration of their interior spaces. In doing so, it explores how the morphology of interior spaces influences interaction among students.

The case studies used here are all drawn from universities in the Northeast and Midwest where the climate is rather cold during most of the academic year. While the literature suggests that the number of floors in a residence hall is directly related to the linkage of interior and exterior spaces (Williams, 2005; Abu-Ghazneh, 1999), this study argues that the spaces surrounding dormitories play a secondary role as spaces of interaction. In the Northeast and Midwest, these spaces are too cold for much of the year to allow for prolonged outdoor activities such as lounging or studying. Therefore, this study assumes that the number of floors is not a determining factor in the way that students interact.

In order to best understand the important factors suggested by literature, one should consider the specific spatial structure of residence halls. Dormitory buildings consist of a set of bedrooms (individual or shared) and service spaces that are connected by means of corridors. Service spaces are those spaces such as bathrooms, laundry rooms, kitchens, and vertical access spaces that meet basic housing needs for students. These spaces are used by almost all students and can be either private or shared by a number of students. Some residence halls also provide auxiliary common spaces such as study rooms, lounges, game rooms, and lobbies. These rooms are not as essential as the service spaces, and students may or may not use them. Sometimes these spaces are designed to increase social interaction among students, as in the case of lobbies and lounges. The distribution of these spaces is important in determining who meets whom and how frequently, as the spaces’ locations may divide a building into self-sufficient spatial packages that leave students with no reason to move from one self-contained area to another. In this system,
each area has its own common and service spaces as well as an independent vertical access point. For example, Harris Hall, a residence hall at Penn State, is comprised of three self-sufficient spatial packages as a result of certain relationships among component parts: bedrooms, service spaces, corridors, and auxiliary common spaces, as illustrated below (Figure 6).

![Figure 6. Harris Hall, a dormitory at The Pennsylvania State University, consists of three independent spatial packages.](image)

The underlying concept in all the factors described above (spatial scale and group size, organization of common and private spaces, ratio of common spaces to private spaces, geometry of shared pathways, and quality of common spaces) is the way in which different environmental factors may promote the co-presence of actors in a given space. Put differently, environmental factors may foster social interaction if they help a certain number of students see and feel the physical presence of one another. As the literature
suggests, over time, this co-presence may lead to social interaction (Abu-Gazzeh, 1995). Given the rather simple spatial structure of residence halls and the fact that only four major spatial categories exist in residence halls (individual rooms, service spaces, auxiliary common spaces, and corridors), the environmental factors pertaining to social interaction are necessarily limited to the characteristics and relationships of these four spatial categories. In other words, the group size, the ratio of common spaces to private spaces and their organization, the quality and geometry of corridors and the quality of common spaces are rendered as the following three factors in this study: the average number of students per auxiliary common space, the average number of students per service space, and corridor traffic flow.
Methodology

In the previous section, it was concluded that three factors affect social interaction in student residence halls: the average number of students per auxiliary common space, the average number of students per service space, and corridor traffic flow. The number of students per service space, auxiliary common space, and corridor was calculated for the 148 residence halls previously introduced. Given the tabulation of data for the 148 residence halls according to these criteria, the halls were organized into five distinct typologies. A narrative of the calculation procedure is provided in the results section.

All five typologies were found at Penn State, and thus building samples were taken from this campus. This study ultimately draws a comparison among these residence halls as representatives of the five typologies. To do so, this study first makes a number of observations regarding the five selected case studies, thereby providing activity maps of movement patterns and social interaction patterns in different common spaces. It then identifies the environmental factors that lead to these patterns of movements and interactions via various manually produced diagrams illustrating the depth of different spaces, as well as spatial diagrams including AVG graphs and axial maps created using Depthmap4.

After determining the five spatial typologies of the dormitory buildings, a number of observations were made in the common spaces of the dormitory buildings in order to assess the ways these dormitory buildings function from a socio-spatial point of view. These common spaces included all the spaces of each identified self-sufficient package previously discussed in detail, with the exception of students’ rooms.
The observation procedure was carried out in two stages. The first stage aimed at identifying those hours and days of the week that students were more likely to interact with one another. The actual observations were made on Monday, Thursday, Saturday, and Sunday. When selecting days for observation, those days on which specific student events were scheduled to occur were avoided since the events would skew the results. This study hypothesized that Monday would be representative of a general weekday, with the exception of Thursday and Friday. Thursday was considered an anomaly since it is close to weekend and most of the recreational and social centers are open on Thursdays. Friday was assumed to be similar to Thursday in the morning and afternoon and similar to Saturday in the afternoon and evening in terms of students’ social activities. The students’ activities were observed three times a day for each residence hall: in the morning between 8:30 am and 10 am in order to determine what time students left for classes, in the afternoon between 1:30 pm and 3 pm to determine if there was activity around the lunch period, and in the evening between 6:30 pm and 8 pm to observe whether students were engaging in or on their way to evening activities. Each observation session lasted for 10 minutes, during which time students’ activities and movement patterns in the dormitory were recorded. The five residence halls were observed in a sequential manner, meaning that after finishing an observation session in one residence hall, the observer moved to the next residence hall for another observation session.

Early observation results indicated that both the variety and frequency of activities was most noticeable on Saturday evening between 6:30 pm and 8 pm. One explanation for this is that most students consider Saturday evening as leisure time and typically spend time with friends then.
The second step of the observation procedure was carried out on Saturday, November 15 2015, from 6 pm to 10 pm, which was as identified as the busiest time of the week. Each observation session lasted for 30 minutes. During this time, students’ movement patterns and interactions were recorded. Over the course of the 30 minutes, the observer frequently changed positions in order to observe all activities and movements in different spaces. The movement patterns were recorded by determining students’ starting and ending points as well as the paths they took to get to their destinations. The students’ behavior was recorded according to whether they interacted by talking, shaking hands, nodding, smiling, or making eye contact, or whether they refrained from interacting with one another (by focusing on their laptops or cell phones in the presence of others, for example).

During this second stage, five dormitory buildings were observed in a sequential manner, starting at Bigler Hall and ending at Watts Hall. One limitation to this observation stage was that different residence halls were observed at different times of the day. For example, Bigler Hall was observed at 6 pm, while Watts Hall was observed at 9:30 pm. This affected the results since the students’ behavior might not have remained constant during this time period. To help correct for these errors, another observation session was conducted on Saturday, December 6, but this time the observation sequence was reversed: the observer started at Watts Hall and ended at Bigler Hall.

Activity maps that were produced from the first observation stage were superimposed on activity maps produced from the second observation stage. This resulted in a single map of students’ movement and interaction patterns considered to be best representative of students’ behavior in the selected residence halls.
Results

Criteria used for determining residence hall typologies

This section explains the procedure by which the environmental factors pertaining to social interaction in residence halls (the average number of students per auxiliary common space, the average number of students per service space, and corridor traffic flow) were calculated. These factors were used as the criteria for categorizing different residence halls. In the following discussion, Harris Hall is used as an example of the calculation procedure.

1. Average number of bedrooms per service space (SS): This number indicates the average number of bedrooms that share a given service space (bathroom, laundry room, kitchen, and vertical access point). The value was calculated for each self-sufficient spatial package in a typical floor plan, with the final value being the average among all self-sufficient packages in a given floor plan. As seen in Figure 7, the number associated with each service space is the number of bedrooms that share that specific service space. If one adds these numbers (in the case of Harris Hall, this number is 75) and divides it by the number of bedrooms (15 in Harris Hall), the resultant number is the average number of bedrooms that share a particular service space. Accordingly, as illustrated below, the average number of bedrooms per service space in Harris Hall is 3.94. This means that every 3.94 bedrooms in Harris Hall share one service space.
2. **Average number of bedrooms per auxiliary common space (ACS):** This indicator refers to the number of bedrooms that share a common space such as a lounge or study room. To simplify this calculation, all common spaces (e.g., study rooms, game rooms, living rooms) were considered equivalent common spaces. The method used was exactly the same as the method used for the calculation of service spaces. Figure 8 indicates the distribution pattern of auxiliary common spaces in one of the spatial packages in Harris Hall. As illustrated in this figure, there are two auxiliary common spaces with different functions in Harris Hall. Both of these common spaces are shared among 15 bedrooms. On average, auxiliary common spaces are shared among 15 bedrooms in Harris Hall.
Given that in the case of Harris Hall all three spatial packages have the exact same spatial arrangement, the values for the floor plan remained constant. Accordingly, on average, every 3.94 bedrooms in Harris Hall share one service space, while every 15 bedrooms share one auxiliary common space.

3. **Corridor traffic flow:** Corridors play an important role in determining who meets whom as well as the frequency with which they encounter one another. In order to calculate the traffic flow in each corridor, it was necessary to identify visually independent corridors in each spatial package. The Isovist Analysis conducted using Depthmap 4 software\(^1\) showed the visual domain of each corridor. As seen in Figure 9.

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\(^1\)“UCL Depthmap is an Open Source application to perform visibility analysis of architectural and urban systems. It takes input in the form of a plan of the system, and is able to construct a map of ‘visually integrated’ locations within it” (Space Syntax Network, 2015).
Corridors A, B, and C are visually independent, meaning that a person passing through any one of these corridors is not be able to see people in the other two corridors.

After identifying visually independent corridors, it was important to determine the paths that students take to travel between their bedrooms and shared activity sites. In considering all possible paths, it became obvious that Corridors A and B were likely to be used only by the residents of the adjacent rooms, while Corridor C was likely to be used by the residents of all 15 rooms because of its adjacency to service spaces. Accordingly, the average traffic flow for this spatial package can be calculated as follows: \( (4+6+15) \div 3 = 8 \).

![Figure 9. Isovist Analysis for three points in the middle of each corridor indicates that there are three visually independent corridors in this spatial package (left) and three major corridors that connect groups of rooms to shared spaces (right).](image-url)
In analyzing all 148 buildings, it became clear that in some buildings the self-sufficient spatial packages’ domains are limited to the floors on which they are located. In other words, students do not need to use vertical access points in order to fulfill their basic needs (except for entering and exiting from the building). Most of these buildings have

Figure 10. Three major paths that connect groups of rooms to shared spaces.

Figure 11. After considering the paths that students take to get from their bedrooms to shared activity sites, the traffic flow for each corridor can be calculated.
typical floor plans that are self-sufficient and therefore independent from other floors. This type can be further categorized according to the characteristics of their typical floor plans using the criteria discussed in the previous section.

In contrast, other buildings do require that students use staircases and move vertically within the buildings in order to fulfill their basic needs. All of the buildings that fall into this category are between one to three stories high with relatively small occupied areas that are essentially based on townhouse typology. These buildings usually have their kitchens, living rooms, and other major common spaces on the ground floor, meaning that students have to move between floors to fulfill their basic needs. Thus, the vertical domain of self-sufficient spatial packages should be also considered in order to empirically capture how spatial configuration affects the way students encounter one another.

Figure 12. The bedrooms on the second floor and the common spaces on the first floor, all of which are connected by a staircase, together define a self-sufficient package. Lovejoy Hall at White Course Apartments, The Pennsylvania State University.
Typology results

All 148 residence halls were analyzed according to the typology criteria previously explained. Of the studied buildings, 106 had at least one common space in their self-sufficient spatial packages. These spatial packages were categorized according to the three criteria identified earlier: the average number of bedrooms per service space, the average number of bedrooms per auxiliary common space, and corridor traffic flow. Figure 13 illustrates the distribution of buildings according to these three criteria.

Figure 13. 106 buildings of 148 case studies have common spaces in their self-sufficient spatial packages; this diagram shows the 3D scattered chart for these buildings, as produced by Matlab 2012a.
<table>
<thead>
<tr>
<th>Residence hall</th>
<th>Average number of bedrooms per SS</th>
<th>Average number of bedrooms per ACS</th>
<th>Corridor traffic flow</th>
</tr>
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<td>1.2</td>
<td>4</td>
<td>2</td>
</tr>
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<td>4</td>
<td>4</td>
</tr>
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<td>4</td>
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<td>Average number of bedrooms per ACS</td>
<td>Corridor Traffic Flow</td>
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<td>John Adams Hall</td>
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<td>18</td>
<td>9</td>
</tr>
<tr>
<td>John Quincy Adams Hall</td>
<td>18</td>
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<td>9</td>
</tr>
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<td>Kennedy Hall</td>
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<td>9</td>
</tr>
<tr>
<td>Washington Hall</td>
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<td>18</td>
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<td>Nelson Hall</td>
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<td>Hartranft Hall</td>
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</tr>
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<td>Curtin Hall</td>
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</tr>
<tr>
<td>Geary Hall</td>
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<td>10</td>
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<td>McKeen Hall</td>
<td>16</td>
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<td>10</td>
</tr>
<tr>
<td>Packer Hall</td>
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</tr>
<tr>
<td>Pennypacker Hall</td>
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</tr>
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<td>Snyder Hall</td>
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<td>10</td>
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<tr>
<td>Wolf Hall</td>
<td>16</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Chace Hall</td>
<td>13</td>
<td>24</td>
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<td>Moore Hall</td>
<td>16</td>
<td>24</td>
<td>17</td>
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<tr>
<td>Cance Hall</td>
<td>31.2</td>
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</tr>
<tr>
<td>Sycamore Hall</td>
<td>12.3</td>
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</tr>
<tr>
<td>Stone Hall</td>
<td>14</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td>Baker Hall</td>
<td>15.33</td>
<td>46</td>
<td>15.33</td>
</tr>
<tr>
<td>Prince Hall</td>
<td>13</td>
<td>50</td>
<td>15</td>
</tr>
</tbody>
</table>

**Figure 14.** 106 cases had at least one auxiliary common space in their self-sufficient spatial packages.
The resultant analysis suggests that there are four major types within the 106 dormitory buildings that include auxiliary common spaces within their self-sufficient spatial packages. The following section provides an overview of each type:

**Type I:** In these residence halls, service spaces are shared among 1 to 4.71 bedrooms on average. Each common auxiliary space is shared by 1 to 17 bedrooms, while fewer than 15 bedrooms share the corridors. Twenty-six percent of the dormitories examined fall within this category (Figure 15).

![Figure 15. Type I diagram. Each person in this diagram represents one bedroom.](image)

**Type II:** Service spaces in these buildings are shared among 5 to 20 bedrooms on average. Fewer than 20 bedrooms on average share one common auxiliary space, while corridors are shared among 5 to 10 bedrooms. Twenty-two percent of the analyzed dormitories fall within this category. The following floor plan is an example of this type (Figure 16).
Type III: Service spaces in these buildings are shared among 5 to 15 bedrooms on average. Common auxiliary spaces are shared among 10 to 16 bedrooms, and corridors are shared among 11 to 20 bedrooms. Eleven percent of the studied residence halls fall within this category. The following floor plan is an example of this type (Figure 17).

Type IV: The only difference between Type III and Type IV is that in Type IV, the auxiliary common spaces are shared among more than 20 bedrooms, which is a relatively high number of bedrooms per auxiliary common space (Figure 18).
Forty-two buildings among the selected residence halls include no auxiliary common spaces in their self-sufficient spatial packages. In these buildings, students’ opportunities to interact with one another are limited to corridors and service areas. Figure 19 provides a list of these buildings. Figure 20 shows the distribution of these 42 buildings according to “average number of bedrooms per service space” and “corridor traffic flow.”

Figure 18. Type IV diagram. Each person in this diagram represents one bedroom.
<table>
<thead>
<tr>
<th>Residence hall</th>
<th>Average number of bedrooms per SS</th>
<th>Corridor traffic flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>1019 Commonwealth Avenue</td>
<td>7.25</td>
<td>27</td>
</tr>
<tr>
<td>Jordan Hall</td>
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<td>12</td>
</tr>
<tr>
<td>Wheeler Hall</td>
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<td>24</td>
</tr>
<tr>
<td>Jefferson Hall</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>Voigt Hall</td>
<td>9.2</td>
<td>14</td>
</tr>
<tr>
<td>Butterfield Hall</td>
<td>9.33</td>
<td>20</td>
</tr>
<tr>
<td>Lewis Hall</td>
<td>9.4</td>
<td>23</td>
</tr>
<tr>
<td>Biddle Hall</td>
<td>9.6</td>
<td>10.33</td>
</tr>
<tr>
<td>Greenough Hall</td>
<td>9.6</td>
<td>24</td>
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<tr>
<td>Crabtree Hall</td>
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<td>15</td>
</tr>
<tr>
<td>Lyons Hall</td>
<td>11.33</td>
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<tr>
<td>Lyon Hall</td>
<td>11.33</td>
<td>17</td>
</tr>
<tr>
<td>Mackinnon Hall</td>
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<td>12</td>
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<tr>
<td>Pickering Hall</td>
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<td>12</td>
</tr>
<tr>
<td>Dwight Hall</td>
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<td>16</td>
</tr>
<tr>
<td>Johnson Hall</td>
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</tr>
<tr>
<td>Van Meter Hall</td>
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</tr>
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<td>Brown Hall</td>
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<td>Brown Hall</td>
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<td>13</td>
</tr>
<tr>
<td>Washington Hall</td>
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<td>15.75</td>
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<td>Gamertsfelder</td>
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<td>16</td>
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<td>Knowlton Hall</td>
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<td>Tiffin Hall</td>
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<tr>
<td>Bryan Hall</td>
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<td>Thompson Hall</td>
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<tr>
<td>Crawford</td>
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<tr>
<td>Hamilton Hall</td>
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<tr>
<td>Cooper Hall</td>
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<td>Cross Hall</td>
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<td>Ewing Hall</td>
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<td>Hoyt Hall</td>
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<td>Stephens Hall</td>
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<td>McElwain Hall</td>
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<td>Mifflin Hall</td>
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</tr>
<tr>
<td>Brett Hall</td>
<td>10.5</td>
<td>15.5</td>
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</table>

**Figure 19.** 42 cases had no auxiliary common spaces in their self-sufficient spatial packages.
As illustrated in Figure 20, the majority of buildings (more than 80 percent of the total number marked by the red rectangle) can be identified as a single type.

**Figure 20.** Forty-two buildings of all 108 case studies had no auxiliary common spaces in their self-sufficient spatial packages. This diagram shows the scattered chart for these buildings. The red line indicates where the majority (more than 80 percent) of floor plan types fall.

**Type V:** Type V is the only type of building that does not offer auxiliary common spaces.

Type V buildings have traffic flows ranging from 11 to 25 bedrooms per corridor, which is rather high. The average number of bedrooms per service space is between 9 and 16, which is also high. About one-fourth of the 148 case studies fall within this category (Figure 21).
Unique Cases: Seven percent of dormitory buildings analyzed in this study do not fall into any of above-mentioned categories.

<table>
<thead>
<tr>
<th>Self-sufficient spatial package type</th>
<th>Average number of bedrooms per SS</th>
<th>Average number of bedrooms per ACS</th>
<th>Corridor traffic flow</th>
<th>Number of residence halls</th>
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<tbody>
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<td>TYPE 1</td>
<td>1-4.71</td>
<td>1-17</td>
<td>1-15</td>
<td>38 (26%)</td>
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<tr>
<td>TYPE 2</td>
<td>5-20</td>
<td>1-20</td>
<td>5-10</td>
<td>33 (22%)</td>
</tr>
<tr>
<td>TYPE 3</td>
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<td>10-16</td>
<td>11-20</td>
<td>16 (11%)</td>
</tr>
<tr>
<td>TYPE 4</td>
<td>5-15</td>
<td>MORE THAN 20</td>
<td>11-20</td>
<td>12 (8%)</td>
</tr>
<tr>
<td>TYPE 5</td>
<td>9-18</td>
<td>NO AUXILIARY COMMON SPACE</td>
<td>11-25</td>
<td>36 (24%)</td>
</tr>
</tbody>
</table>

Figure 22. The final typology chart of self-sufficient spatial packages in 148 dorms. Of these dorms, 93 percent fall within these categories.

Figure 23 shows the median number for each domain in the above chart. Calculating the median numbers enables us to draw a logical comparison between the final types. The median numbers are represented by circles, with the size of each corresponding to its median number.
The larger the circle for each type of space, the greater the number of students who use that particular space.

Figure 23. A diagram of the final typologies. The size of the circles is proportionate to the number of bedrooms that use each space.
A brief description of selected residence halls

The last section identified five types of residence halls and analyzed their overall spatial characteristics. In order to draw a comparison between the final types, one residence hall from each type was selected for observation. Penn State’s University Park campus offers a large number of residence halls, with multiple examples of all five types. The following examples were thus chosen for analysis: Nittany Apartment #60 (Type I), Watts Hall (Type II), Bigler Hall (Type III), Chace Hall (Type IV), and Atherton Hall (Type IV). In this section, detailed descriptions of each of these buildings, considered the final case studies, are provided. These descriptions serve to further illuminate the specificities of each type.

Type I: Nittany Hall

Nittany Hall is one of the numerous apartment buildings located within the Nittany Apartments complex that was constructed in the 1950s. These apartment buildings are two-story buildings with two or four bedrooms per suite-style apartment. Each bedroom has a closet, two chests of drawers, two beds, two desks, a refrigerator, and a microwave. The apartments are designated for upperclassmen and, since they are located away from crowded areas, provide a rather quiet atmosphere. The building provides the residents of the apartments with exclusive use of its television and game rooms as well as laundry facilities. The building also features a basement consisting of mechanical, utility and storage rooms.

Nittany Hall is categorized as a Type I building. In this type of building, the corridor traffic flow, as well as the number of bedrooms that share service spaces and auxiliary common spaces, is relatively low.
Nittany Hall’s spatial organization is symmetrical, with a core of auxiliary common spaces separating two clusters of suites. The core consists of two meeting rooms, a study room, a lounge, and a storage room, with a corridor bisecting and bounded by two staircases on opposite sides. Each cluster of suites consists of 16 suites that are in turn subdivided into two groups of 8 suites symmetrically divided by another corridor.

**Type II: Watts Hall**

Located in the heart of the West Halls complex, Watts Hall is flanked by large, open common spaces on each side. The building was constructed sometime between 1922 and 1937 and has three stories and a basement where the mechanical and storage spaces, as well as the residence hall’s laundry room, recreation room, and study lounge, are located. The top three floors are relatively similar in terms of spatial structure and features. The building has two
staircases on each end and an elevator in the center that is rarely used by students. This residence hall is co-ed with double rooms shared by students of the same gender. Each floor features sex-segregated bathrooms and a study room that is the same size as the bedrooms and looks nearly indistinguishable from outside.

Watts Hall is an example of a Type II building. In this type of building, service spaces are shared among a relatively large number of students, while corridors and auxiliary common spaces remain comparatively uncrowded.

![Figure 25. Watts Hall’s typical room layout (top left); Watts Hall’s location within the West Halls complex (top right); second-floor floor plan (below).](image)

**Type III: Bigler Hall**

Bigler Hall represents an example of a Type III building. As previously discussed, in this type of building, service spaces are shared among 5 to 15 bedrooms and common auxiliary spaces are shared among 10 to 16 bedrooms, which is a relatively low number of bedrooms for auxiliary common space. Corridor traffic flow is generated by 10 to 20 bedrooms, which is
comparatively high. In Bigler Hall, each auxiliary common space and service space is shared among 14 bedrooms.

Bigler Hall, constructed in 1961, is a five-story building located on the southwestern side of the East Halls complex. The East Halls complex is the largest residential area on campus entirely inhabited by first-year students, and it houses half the population of first-year students. The complex consists of 14 co-ed residence halls with shared double rooms. Findlay/Johnston Commons is located in the center of the complex and offers residents a range of services such as a commons desk, food services, a computer lab, a cultural lounge, a bookstore, and study rooms. The East Halls complex is close to the Bryce Jordan Center and Beaver Stadium but is rather far from downtown State College and its main thoroughfare of College Avenue. The complex’s buildings each have four floors; a ground floor including a lobby, recreation room, and a few suites and bedrooms; and a basement for mechanical and storage facilities.

The spatial organization of this building is symmetrical. Two rows of 14 rooms are stretched along the length of the building on the eastern and western sides, while another row of corridors, service areas, and auxiliary common spaces are bounded by individual rooms on both sides. Each floor features a study room, two locker rooms, two elevators, and two staircases. There are two sex-segregated bathrooms on every floor. Each room is shared between two students of same gender and features two single beds, two desks, two closets, a refrigerator, and a microwave.
Type IV: Chace Hall

Chace Hall is an example of a Type IV building. As explained earlier, this type is similar to Type III, the most explicit example of which is Bigler Hall. The only difference is that here the auxiliary common spaces are shared among a relatively large number of students (more than 20 bedrooms’ worth). This building is located in the South Halls complex adjacent to Shortlidge Road and within walking distance from College Avenue. Chace Hall has four stories and a basement, and all stories, including the basement, have double rooms inhabited by students of the same gender. This residence hall is co-ed with designated bathrooms for each gender on each floor. The basement is slightly different from other stories; this story also includes the mechanical and storage spaces as well as a kitchen that is occupied by a number of students most times.

The South Halls complex rests on the edge of downtown, which in turn affects the intensity and variety of activities in the open spaces around its halls. These halls offer co-ed and sorority housing for upperclassmen. Like other residential areas on campus, this complex
benefits from a commons desk, computer labs, and food services offered in Redifer Commons.

The typical spatial organization of its floors consists of two clusters that are separated by a group of common spaces that in turn are divided into two separate units of auxiliary common spaces and service spaces. Each cluster of bedrooms is bisected by a corridor that connects the bedrooms to the common spaces and the elevator. Each bedroom features two desks, two single beds, two wardrobes, a refrigerator, and a microwave.

Figure 27. Typical room layout (top left); Chace Hall’s location within the South Halls complex (top right); Chace Hall’s fourth-floor floor plan (below).
Type V: Atherton Hall

Atherton Hall is a Type V building. Type V buildings do not typically benefit from auxiliary common spaces. In other words, these buildings are sets of rooms and essential service spaces connected by long corridors. The number of bedrooms that share service spaces and corridors are relatively high. Each room is occupied by two students of the same gender, and there are multiple sex-segregated bathrooms. Atherton Hall has a relatively large number of self-sufficient spatial packages in different sizes. The building has multiple entrances and vertical access points, and the spatial organization resembles a complex of five buildings connected to one another by means of a network of corridors.

Constructed in 1957, Atherton Hall is one of the largest buildings in the South Halls complex. Atherton Hall is completely separated from the rest of South Hall buildings that face College Avenue on one side and the White Building, one of Penn State’s fitness and athletic centers, on the other side. This co-ed residence hall is reserved for both first-year and upperclass Schreyer’s Honors College students. Simmons Hall, also located in the South Halls complex, houses the remainder of the Honors College’s students.

Atherton Hall has four stories. The ground floor features a variety of spaces including multiple lounges, office spaces, a study room, and students’ rooms. The rest of the floors are very similar, though the number of bedrooms is smaller on the upper floors of the building. In this study, the second floor’s floor plan is considered most representative of this building, since it includes all the features found on the other floors while also housing the largest number of students among the four floors.
Observation results for final types

In this section, brief descriptions of the rules, and physical characteristics for each residence hall are provided. The observation results for each building as well as a preliminary analysis of the contributing factors pertaining to social interaction are also included in this section.

Observation results for Nittany Hall (Type I)

The second-floor students’ activities were observed on Saturday, November 15, beginning at 6:40 pm and Saturday, December 6, beginning at 7:57 pm. Each session lasted 30 minutes. The observer frequently changed position in order to observe all spaces and comprehensively record movements and interactions. The following activity map indicates the movement patterns as well as the social interaction locations.
Overall this residence hall was quieter than the other studied dormitories. Only a few movements and interactions occurred during the observation process. Most of the paths taken were from one room to another room, with a few brief conversations occurring in the corridors in front of the doors to the rooms.

The low level of interaction and movement can be explained by a number of factors. First, the fact that every room has its own service space makes it less necessary for students of this building to leave their units on a regular basis. Moreover, this residence hall offers four separate vertical access points, one for every 8 bedrooms, which leads to low levels of foot traffic in the staircases. The distribution of common spaces suggests a purposeful design aimed at both reducing crowdedness in interior spaces and increasing students' privacy.

The shifting geometry of the corridors plays a significant role in fostering increased privacy. Only 8 bedrooms use each corridor, and an observer who stands in one of these corridors is unable to see movements in the other corridors. In terms of spatial configuration and depth, the common spaces are clearly separated from the residential sections of the building by

**Figure 29. Activity map for Nittany Hall after superimposition.**
means of two staircases. The interactions and activities in the common spaces, however, were more frequent than our expectations. The interactions that occurred in small groups typically involved students studying together or engaged in conversations in the meeting rooms. Unlike the study and meeting rooms, other common spaces such as the lounge and the corridors remained rather empty. One explanation for this may be the well-appointed nature of the common spaces, including the spaces’ appropriate lighting, quiet atmospheres, and the glass walls in meeting rooms.

![Visibility Graph Analysis](image)

**Figure 30.** Visibility Graph Analysis produced using Depthmap 4. The locations with the highest visibility are denoted by yellow and red markings (top); spatial configuration (below).
Observation results for Watts Hall

The observation process in this building was accomplished for the first time on Saturday, November 15, beginning at 8:31 pm and for the second time on Saturday, December 6, at 6 pm. During these half-hour observation sessions, the second-floor residents’ movement patterns and interactions were recorded. These observations revealed relatively high levels of activity and interactions in this residence hall.

![Figure 31. Activity map for Watts Hall after superimposition.](image)

It is striking in analyzing the activity maps and the spatial configuration of this building that there is a complete separation of the two self-sufficient spatial packages. In fact, each spatial
package is completely independent of the other, with no path taken by students crossing the border between them. The major reason for this is the elevator and the adjacent common space of the lobby. This residence hall is a two-story building, and therefore the elevator is barely used by students. This elevator, moreover, completely obstructs the continuity of the corridors, dividing them into two isolated spaces. The lobby, on the other hand, is attached to the elevator in a recessed area in which it is hardly visible. The low visibility of the lobby space is also reflected in the AVG analysis map. Low visibility may be the main reason for the lack of spatial integration seen in Watts Hall.

The second common space, the study room, is aligned with the bedrooms on the western side of the building. As shown in the activity map, there was no activity detected in this space during the two observation sessions. This may be due to one of two reasons: on the one hand, Pattee Library is located within walking distance from Watts Hall, offering large and convenient study rooms that students may find more inviting; on the other hand, this study room is small and has opaque walls, making it virtually indistinguishable from the bedrooms.

Figure 32. Visibility Graph Analysis produced using Depthmap 4. The locations with the highest visibility are denoted by yellow and red markings (below); spatial configuration (top).
Observation results for Bigler Hall

Students’ activities were observed on the third floor of this building for the first time on Saturday, November 15, starting at 6:03 pm and for the second time on Saturday, December 6, starting at 8:38 pm, with each session lasting 30 minutes. The activity map below was produced by superimposing the activity maps from the first and second observations.

These observations reveal that students exit their rooms for specific purposes (e.g. going to the bathroom, exiting the building, and doing laundry). By and large, the corridors are not destinations for the students; rather, they serve as venues by which the students move from one space to another. In other words, in Bigler Hall’s case, the corridors do not appear to be spaces in which students interact; instead, they are thoroughfares for facilitating movements between spaces.

Figure 33. Activity map for Bigler Hall after superimposition.
One explanation for the alienating feeling of the corridors is that the corridors’ monotonous and overly protracted design leads to a high degree of visibility, and as a result, all corridor activity is able to be observed by others. The AVG analysis graph highlights the visibility of the corridors in relation to other spaces. The high visibility in the corridors makes it so that while using the corridors, students are exposed to a large number of people, many of whom they do not necessarily recognize. The straight corridors that run the length of the building and allow one to see all the rooms and common spaces at once may add to students’ feelings of being in an overloaded social environment. Valins and Baum (1973) argue that such environments can cause stress among students.

![Visibility Graph Analysis](image)

**Figure 34.** Visibility Graph Analysis produced using Depthmap 4. The locations with the highest visibility are denoted by yellow and red markings.

It seems logical to have more movement and encounters around the most frequently used spaces. In Bigler Hall, these spaces are the bathrooms and elevators. An elevator may play a particularly important role in aggregating students in a relatively small place, thereby creating opportunities for unintentional encounters. More specifically, the observations for this study took place on the third floor, a floor on which students typically no longer use the staircase as their vertical access point and instead rely more on elevators. Furthermore, observations
indicated that the waiting area next to the elevators may foster casual conversations or other types of interactions.

The spatial configuration of Bigler Hall creates two completely separate and self-sufficient spatial packages. With all the service spaces in the middle, there is no reason for students to move from one self-sufficient package to another. This is evident in Bigler Hall’s activity maps. Of course, in some cases, students did move across the self-sufficient packages to go to other students’ rooms. The middle service spaces are neither transparent nor impervious, which weakens the connection between the two self-sufficient packages. Auxiliary common spaces are surrounded by solid walls with opaque doors, and one needs to enter the spaces to see others. The detachment from one’s environment fostered by the opacity of the auxiliary common spaces may be another explanation for students’ feelings of alienation.

Figure 35. Spatial configuration in Bigler Hall.
Observation results for Chace Hall (Type IV)

The fourth-floor residents’ activities were observed and recorded in two sessions, the first of which took place on Saturday, November 15, beginning at 7:15 pm and the second of which occurred on December 6, starting at 7:20 pm. Each observation session lasted 30 minutes.

Figure 36. Activity map for Chace Hall after superimposition.

The observations showed a relatively high level of activity and interactions in this residence hall. This may be partially due to the specificities of Type IV residence halls in which auxiliary common spaces, corridors, and bathrooms are shared by a large number of students. In addition, the observations indicated that in this residence hall, students tend to move from one room to another room more frequently. These room-to-room paths, however, are mostly confined within each self-sufficient spatial package, indicating that friendship ties are stronger in adjacent rooms.
The activity maps indicate that there is a significantly high level of activity and interactions in the living space, given that it is the only auxiliary common space on a floor shared by 24 bedrooms (48 students). A variety of activities and interactions occurred in the auxiliary common space at the time of observation; such activities included watching television, chatting, and talking on the phone. The common space is well-integrated. It links the sole vertical access point on the floor to 13 bedrooms. In other words, students have to pass through this common space in order to access their rooms. Due to its transparent walls on two sides, this space is also highly visible, thereby enabling students to see and be seen. In contrast, the service spaces’ access corridor is completely independent and is used only when students go to the bathroom.

![Visibility Graph Analysis](image)

**Figure 37.** Visibility Graph Analysis produced using Depthmap 4. The locations with the highest visibility are denoted by yellow and red markings (left); spatial configuration (right).

**Observation results for Atherton Hall (Type V)**

The observation process for Atherton Hall included two sessions of 30 minutes each, with the first session occurring on Saturday, November 15, beginning at 7:48 pm and the second on December 6, starting at 6:45 pm. During the observation process, the observer was located in the corridors but frequently changed position in order to observe all the common spaces.
used by students. Given the symmetrical spatial structure of Atherton Hall, the observation sessions were accomplished by observing the eastern half of the building so as to be able to cover all spaces simultaneously. The observations were conducted on the second floor, which is the floor of the building that best represents Type V’s typical attributes.

As expected, most of the paths taken by students were within each self-sufficient spatial package. Unlike the building itself, the spatial packages are not entirely symmetrical, as shown in the spatial configuration diagram (Figure 27). The central part of the dormitory benefits from a number of service spaces allocated to each residential unit, and this affects the frequency of movement in the corresponding corridor. The two lower wings of the building have a number of large storage spaces that likewise highly affect levels of movement and interaction. These storage spaces result in the formation of quiet, long corridors with few doors.

**Figure 38. Activity map for Atherton Hall after superimposition.**
This residence hall provides an insufficient number of optional activities, inasmuch as it lacks the auxiliary common spaces necessary to foster social interaction among its large number of residents. Due to this lack of common spaces, students are forced to use their own rooms to interact with one another. Activity maps indicate that most students do not come out of their rooms unless they are going to the bathroom, and furthermore, that they do not tend to linger in the corridors.

Atherton Hall is perhaps the best example of the relationship between common-space visibility and social interaction. The majority of the corridors are narrow and have multiple breaks and junctures that significantly decrease visibility. The central corridor maintains an anomalously high level of visibility due to its width and appropriate lighting, creating a better quality of space. As a result of this, scattered social interactions in form of brief conversations occurred in this corridor from time to time.

Figure 39. Spatial configuration for Atherton Hall.
Discussion of results

Despite the fact that most studies adopt the terminology of suite-style and corridor-style dormitories, this study suggests that the architectural characteristics of dormitories cannot be simplified to that extent. Rather, this study’s findings indicate that a number of environmental factors beyond a residence hall’s organization into corridor-style bedrooms or suites come into play when considering the social atmosphere of the hall. These environmental factors may be associated with either the configuration of the hall’s spaces or the quality of the individual spaces. Spatial configuration plays an important role in determining who meets whom as well as with what frequency. Quality of space, on the other hand, takes into account the usability of spaces. An aptly chosen design may encourage students to use a certain space more frequently, thereby significantly increasing opportunities for social interaction.

Systematic observations revealed the frequency and direction of students’ movement patterns within five dormitories at Penn State. These patterns provide valuable information regarding

Figure 40. Visibility Graph Analysis produced using Depthmap 4. The locations with the highest visibility are denoted by yellow and red markings.
the efficacy of certain spaces and configurations. These patterns also help to identify those places in which there is a higher probability of social interaction. This section discusses in detail those environmental factors that help foster social interaction.

**Factors related to spatial configuration**

1. **Separation of common spaces and individual bedrooms**: One of the most complex and challenging issues in designing residence halls is the separation of common spaces and individual bedrooms. The degree of separation determines the level of privacy that students have. Spatial configuration can play a role in strengthening or attenuating the sense of separation through depth of spaces. Intermediate spaces function as barriers that increase privacy by not only helping to prevent the transmission of sound from bedrooms to the corridors, but also by restricting visual access to the bedrooms. Narrow views and multiple doors play a similar role in increasing privacy. One example of this is the intermediate space separating bedrooms from corridors in Nittany Hall. In contrast, the location of doors and overall spatial configuration in Watts Hall enables a large proportion of rooms to be seen from the corridors if the doors are open.

   If applied to common spaces, spatial depth may lead to a lack of integration among spaces or a sense of seclusion. In Chace Hall, for example, the only space that mediates between the auxiliary common space and students’ rooms is the corridor. The configuration of the auxiliary common space in Chace Hall requires students living in the upper aisle of the building to pass through the common space in order to access the elevator, thereby increasing the chance for unintentional encounters (Figure 43).
Figure 41. Isovist analysis produced using Depthmap 4 for a typical bedroom in Watts Hall (left) and a typical bedroom in Nittany Hall (right). As shown above, the extent to which bedrooms are visible from corridors is greater in Watts Hall than in Nittany Hall.

Figure 42. This diagram delineates the number of spatial steps one needs to take to move from her personal room to the auxiliary common space in Chace Hall.
Unlike in Chace Hall, in Nittany Hall, one has to come through an entryway, access the corridor, pass through the staircase, and enter another corridor, in order to finally find herself in an auxiliary common space. As seen below, the number of spatial steps one needs to take in Nittany Hall is noticeably more than the number required in Chace Hall. This leads to a complete separation of these auxiliary spaces from the bedrooms. The red dashed line shows a spatial sequence that a student might take to get from his or her room to an auxiliary common space. The spatial depth in Nittany Hall separates the common spaces and the students’ rooms. This study’s observations indicate that the common spaces in Nittany Hall are not as frequently used as those in Chace Hall.

Figure 43. This map indicates those paths taken by students that cross the auxiliary common space (delineated by the red dashed line) in order to access the elevator. These paths considerably increase unintentional encounters among students on this floor.
Distribution of common spaces and individual spaces: One of the criteria on which the typology was based was the general distribution of common spaces. The distribution of service and common spaces determines the size of the self-sufficient spatial packages and the number of residents who are likely to meet each other on a regular basis. The observations indicate that students do not usually leave their rooms unless they need to go to the bathroom, do laundry, or leave the building. This fact highlights the importance of service and common spaces. These spaces can play a significant role in encouraging students to come out of their rooms and consequently increase the frequency of unintentional encounters and social interaction among students (Abu-Ghazze, 1999; McPherson et al., 2001; Williams, 2005;
Marmaros & Sacerdone, 2006; Tsai, 2006; Wineman et al., 2009; Sailer & McCulloh, 2012; Preciado et al., 2012). The way these common spaces and rooms are configured can likewise exert an influence on the frequency and the time elapsed in these spaces.

It makes logical sense to conclude that the more numerous the service spaces, the fewer opportunities for unintentional encounters and passive interactions in these spaces since the population of students that uses these spaces is accordingly more dispersed. This study’s observations indicate that students tend to use those service spaces that are closer to their own rooms (Figure 47). As one of the most frequently used service spaces in residence halls, bathrooms play a significant role in generating passive interactions. Regardless of how far service spaces are situated from the rooms, these spaces are used most frequently. It can thus be concluded that the farther these spaces are from the students’ rooms, the greater the probability for unintentional encounters in the corridors (Figure 46). A comparison between Chace Hall and Nittany Hall highlights this. Bathrooms in Nittany Hall are shared between two bedrooms (4 students), and every 8 bedrooms are provided with a separate vertical access to the floors. In Chace Hall, however, all 24 bedrooms (48 students) use a single set of service spaces within a single area as well as one elevator to access different floors.

![Figure 45. Configuration of service spaces and pathways in Chace Hall (left); configuration of service spaces and pathways in Nittany Hall (right).]
Figure 46. Common bathrooms in Chace Hall promote social interaction by increasing the frequency of unintentional encounters.

Figure 47. Students tend to use the bathrooms closest to their bedrooms. The students who live in the bedrooms denoted by the yellow color use the bathroom on the left, while those who live in the bedrooms denoted by the green color use the bathroom on the right.
The distribution of spaces in Nittany Hall means smaller self-sufficient packages that are responsible for the hall’s comparatively quiet atmosphere. However, although observations suggest that there is a better chance of unintentional encounters in residence halls with shared bathrooms, one might argue that shared bathrooms are not as convenient as private ones. In such cases, the administrators and designers need to use other design components in order to come to a middle ground between the conflicting needs for convenience and sociability.

3. **Fragmentation of spaces**: A great deal of literature highlights the significance of spaces’ geometry and overall form on movement patterns and visibility (Cooper & Sarkissian, 1986; Gehl, 1987; Fromm, 1991; McCamant & Durrett, 1994; Abu-Gazzeh, 1999). In the case of residence halls, most spaces are similar in terms of dimensions and form. Corridors, however, come in a variety of configurations. Keeping in mind that a large proportion of every floor is allocated to students’ rooms and only a few spaces are considered to be common, corridors can be said to play a fundamental role in fostering students’ social interaction.

The form that corridors take may determine the number of people who are capable of seeing each other at one time. This is evident in Bigler Hall and Nittany Hall. In Nittany Hall, the corridors are divided into multiple smaller corridors that are completely separated from other spaces. As a result, a person who stands in one of these corridors does not have a sense of how many people are walking through the other corridors. In Bigler Hall, however, the corridors are long and straight, allowing every activity taking place in the corridors to be seen (Figure 49). Axial maps are used to provide information on the way spaces are connected. The red and yellow colors represent those spaces that are more integrated (Figure 48).
Factors related to the quality of individual spaces

Sound spatial structures cannot guarantee the occurrence of social interaction unless there is also good spatial quality. Common spaces that are well-appointed can serve as focal points attracting students from all corners of the building and fostering chances for interaction. This is particularly important for auxiliary common spaces, since other spaces (i.e. corridors,
bedrooms, and service spaces) are not designed for recreational use and are typically used regardless of their qualities. Auxiliary common spaces such as lounges and television rooms, however, provide space in which students can spend their leisure time. Although unrelated to leisure time, study rooms also need to be well-appointed, since these spaces need to stand out from the other numerous study areas on campus if they are to be used at all.

1. Visibility: This study’s observations indicate that those common spaces employing transparent walls are those that are more frequently used by students. This finding is consistent with those of previous studies (Williams, 2005; Abu-Ghazalah, 1999; Gehl, 1987). In Nittany Hall, for instance, despite the fact that the building’s configuration separates common spaces and bedrooms, the common spaces were used to an acceptable extent. This usefulness can be partially explained by the transparent walls, which means that the students in these spaces can be seen and can see other students’ activities. Chace Hall also benefits from a fairly transparent living room that may offer an explanation for its success. Watts Hall, by contrast, provides two common spaces that are not used as frequently by students despite the hall’s relatively large number of residents. This is not surprising, since the walls of these common spaces, and particularly the study room, are opaque or the rooms are not sufficiently visible from other common spaces.

![Figure 50. Transparent walls in Chace Hall’s living room.](image)
2. **Flexibility and functionality:** If not frequently used, spaces may negatively affect the social climate of residence halls. In some cases such as that of the large storage spaces in Atherton Hall, spaces decrease proximity among students by building up walls and rarely used corridors. Proximity is known to be an essential factor in stimulating social interaction.

Spaces that allow for a variety of activities such as studying, watching television, and playing games may attract students with different interests and consequently lead to social interaction. Furniture is an immediate means of addressing the need for flexibility. Chace Hall, for instance, offers a variety of furniture that can be used for most common activities. One can dine, watch television, lie down, study, or sip coffee with friends without interfering with others. In Nittany Hall’s lounge, on the other hand, the furniture is less versatile, thus providing fewer incentives for students to spend time in the space. As a result, this space is oftentimes empty. These findings align with those of Godshall (2000)’s study on the importance of the flexibility of spaces in residence halls.

![Figure 50](image)

**Figure 50.** *The variety of furniture in Chace Hall’s lounge fosters a broad range of activities.*

It stands to reason that the dimensions of spaces can also influence their functionality. Undersized spaces do not allow for multiple concurrent activities. Watts Hall’s lobby may be
underused not only because of its lack of visibility but because of its small size, which limits students’ opportunities to participate in various activities such as studying and spending time with friends. Oversized spaces such as those in Bigler Hall and Atherton Hall, however, are equally problematic. With too many repetitive elements such as numerous doors and long corridors, oversized spaces feel institutional rather than residential or homey (Thomsen, 2008).

Figure 51. Watts Hall’s lobby is too small to allow for students to gather together (left), while the overly long corridors in Atherton Hall promote an institutional, rather than homey, feeling (right).

Concluding Remarks

This thesis aimed to identify the environmental factors that influence social interaction in student residence halls. The focus was on Midwestern and Northeastern residence halls in the United States, and the hypothesis was that residence halls’ environmental factors had a considerable impact on the way students interact.

This study first developed a typology of residence halls by drawing on previous studies. The literature review elucidated the factors pertaining to social interaction in buildings in general and residence halls in particular. It identified three factors that were then used to derive five
different typologies. These factors were: the average number of bedrooms per auxiliary common space, the average number of bedrooms per service space, and corridor traffic flow. This study used these criteria as distinguishing factors for residence halls. Through an analysis of 148 residence halls located at 4 different campuses including The Pennsylvania State University (University Park), The University of Massachusetts (Amherst), Ohio University (Athens), and Boston University (Charles River), examples of each of the five typologies of residence halls were found among the studied residence halls. All of the examples were located at Penn State.

The second phase of the study involved investigating the representative examples of the typologies. Students’ behavior was observed and recorded over multiple sessions. These observations were then translated into activity maps that revealed movement patterns and interactions of the students in these residence halls.

This study concludes that the factors influencing the ability of spaces to promote social interaction can be broadly categorized as follows. The first category includes those factors that relate to the configuration of spaces. These factors are responsible for creating conditions in which students are more likely to see one another and co-exist. The distribution of common and individual spaces can increase the possibility of unintentional encounters among students. Hierarchy and spatial depth, which have to do with the number of spatial steps that are required to move from one space to another, also contribute to creating social interaction because the deeper a space is, the less accessible it is. Common spaces function best when they are easily accessible. The geometry of spaces is another contributing factor since it affects the visibility of the spaces and consequently the likelihood of unintentional encounters. Spaces with minimal fragmentation enable students to see one another and feel their fellow residents’ presence, which can result in further interactions.
The second category includes those factors that have to do with the quality of individual spaces. A well-chosen design for the common spaces, aptly selected colors and finishing materials, and appropriate lighting all encourage students to use these spaces more frequently and thus interact with one another. In addition, appropriate lighting and translucent walls in common spaces may increase visibility, enabling students to easily see one another. If suitable for different activities, common spaces increase the chance of unintentional encounters since they attract students who are participating in different activities.

Given the growing need for student housing in the United States in years to come, it is important to upgrade the quality of residence halls that are going to be built in the near future so as to enable them to promote social interaction via well-chosen design strategies. This study puts forth a set of design strategies that help designers and developers to create more sociable spaces in residence halls.
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