SOCIAL SPACES IN STUDENT HOUSING

A Report Submitted to The Faculty of Graduate Studies and Research in Partial Fulfillment
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ABSTRACT

The history of student housing can be traced back to the emergence of university education. Since then, it was recognized that an active life in student housing can foster interaction, help build social networks and teach valuable lessons about having a home away from home. In recent years, with increasing number of students in universities, especially international ones, the quality of social space in such buildings becomes an important consideration for universities and designers as a means to attract students.

This report investigates how to integrate high-quality social space into student housing, by studying their history, exploring worldwide successful cases using literature review, summarizing design aspects that improve social spaces, and evaluating these aspects in nine cases. Finally, the report suggests design guidelines for high-quality social spaces.

The key findings of this research indicate that to create an active and comfortable social space, student housing could include multiple accessible types of shared spaces, have sufficient natural light and good ventilation system, control noise, use diverse materials and interior design to create engaging environment, link the place with the community at large, and ensure safety. The author concluded that there is no sole design solution, and all these aspects should be considered creatively and equally to achieve comfortable social spaces.

RÉSUMÉ

L'histoire de l'hébergement étudiant remonte à l'émergence de l'enseignement universitaire. Depuis ce temps, il a été démontré qu'une vie active en résidence étudiante peut favoriser les interactions, aide à bâtir des liens sociaux et enseigne des leçons précieuses sur le fait d'avoir un nouveau chez soi, loin du nid familial. Depuis les dernières années, avec l'augmentation du nombre d'étudiants universitaires, surtout d'étudiants internationaux, la qualité des espaces communautaires offerts par les universités devient un point important à considérer pour les designers et les universités lorsque vient le temps d'attirer de nouveaux élèves.

Ce rapport vise à investiguer comment il est possible d'intégrer des espaces communautaires de grande qualité dans l'hébergement étudiant en examinant leur histoire, en explorant par l'analyse documentaire des cas fructueux autour du monde, en résumant certains aspects du design qui améliorent les espaces communautaires et finalement, en évaluant ces aspects à travers neuf différents cas. En somme, ce rapport propose plusieurs lignes directrices de conception pour créer des espaces communautaires de qualité.

Les principaux résultats de cette recherche indiquent que pour créer un espace communautaire actif et confortable, les logements étudiants pourraient inclure plusieurs types d'espaces partagés accessibles, disposer d'une lumière naturelle suffisante et d'un bon système de ventilation, contrôler le bruit, utiliser des matériaux et un design intérieur diversifiés pour créer un environnement attrayant, relier l'espace à la communauté au sens large et assurer la sécurité. L'auteur conclut qu'il n'existe pas de solution unique en matière de conception et que tous ces aspects doivent être pris en compte de manière créative et égale pour obtenir des espaces sociaux confortables.

ACKNOLEDGEMENTS

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CHAPTER 1: INTRODUCTION

1.1 A brief introduction of student housing

Student housing has been developed along the evolution of the education. Historically, education was originally controlled by churches. Later, the first formal educational institution was generated in early medieval Europe at the University of Bologna (Friedman, 2016). Early universities were conceived more as societies rather than a physical place, which emphasizes the important role played by social interaction of university life. A democratic system originated in a university in Paris and was later adapted by most of other universities at the beginning of 20th century (Friedman, 2016). The development of student housing since the 1960s set the foundation of today's form. However, the social circumstance has always been changing; thus, the design of social space in student housing should also be reconsidered according to today's reality and challenges.

To reconsider social space in student housing, one should understand the current situation of university students and their expectations. Nowadays, on a global scale, as formal education's population increases (figure 1.1), so does the number of young adults choosing to go to university and those who opt to live in student housing (MacKay, 2014). In the journal article, "Neoliberalism and postsecondary education: A view from the college", written by Kevin MacKay, a professor of social science at Mohawk College in Hamilton, more than half (54.0%) of Canadians aged 25 to 64 had either college or university qualifications. This rate went up greatly in the past few decades (MacKay, 2014).
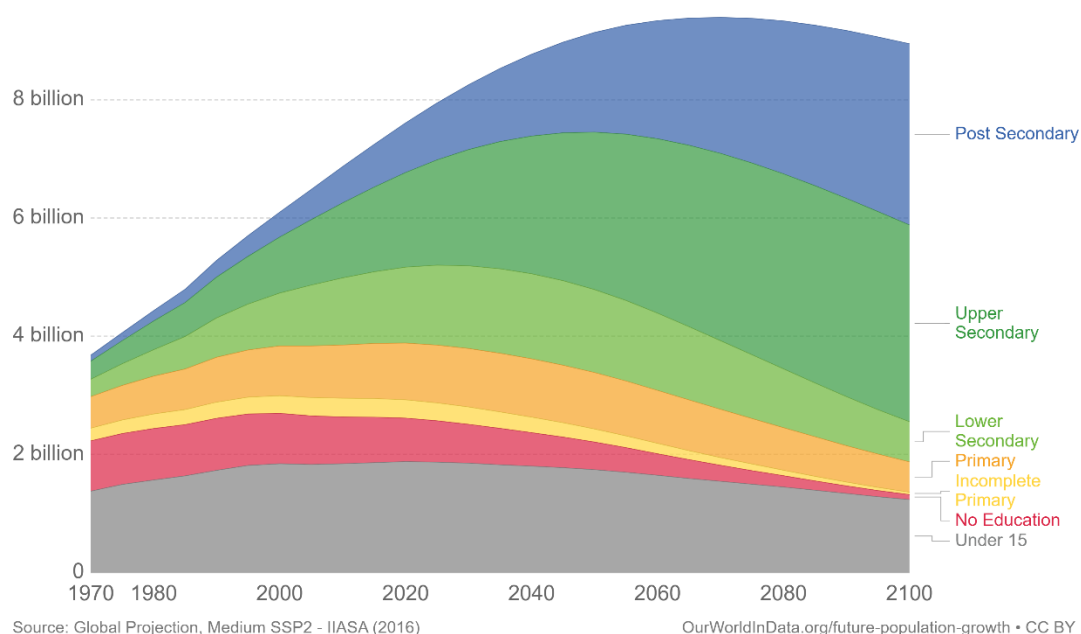
Figure 1.1 Projected world population by level of education. Roser, M., & Ortiz-Ospina, E. (Retrieved from https://ourworldindata.org/global-education)

Along with the increasing need for higher education, the cost of room and board is also increasing (figure 1.2). Part of the reason of increasing boarding cost is the design of apartment-style student residentials. In his meta-analysis of 21 studies that compared residence hall students with those living at home, Blimling (1989) found students living in residence halls seems to perform better academically than students living at home (Rinn, 2004). Apartment-style residential buildings have better amenities and privacy compared to the traditional corridor-style student housing. However, according to the research, living in apartment-style housing has a negative influence on students' academic behavior due to the lack of social spaces within the building. Furthermore, insufficient common space for social activity in student residentials may result in more problems than just poor academic behavior (Brown, 2019).
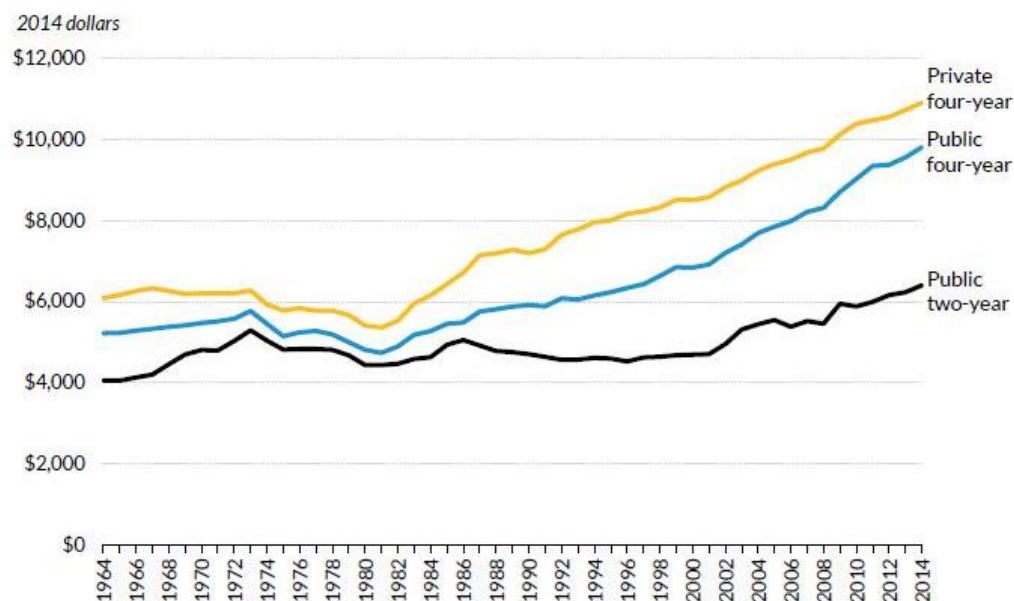
Source: National Center for Education Statistics, *Digest of Education Statistics*, Washington, DC: US Department of Education, 2014.

Figure 1.2 Average room and board, 1964-2014. Marcus, J. (2017, January 30). Study: Fast-rising room and board costs worsen college affordability problem.
(Retrieved from https://hechingerreport.org/study-fast-rising-room-board-costs-worsen-college-affordability-problem)

This paper studies social space in existing student housing. It focuses on what the different options in general use are and how they provide opportunities for social interaction among students.

Most university students are in a phase in their life where their role shifts from a teenager to an adult. Therefore, student housing would be their temporary home and extended classroom, especially for students who have to live on campus and/or universities with a large contingent of international students. "The research shows that the majority of students, both domestic and international, believe it's important to mix across cultural boundaries and develop skills for the globalizing world of work." said Spencer-Oatey (2018), one of the authors of the research project regarding the importance of communal spaces in student housing for social integration of domestic and international students. He also indicated that

offering communal areas in student accommodation enables interaction and encourages community life for both domestic and international residents (Staytoo apartment, 2018).

1.2 Personal experience

As a graduate student, I have already spent more than six years in universities in both Europe and North America. I lived in a student dormitory on campus for more than two years. While my personal experience might not be comprehensive enough for the research subject, I found that the social aspect of student housing deeply influenced my academic behavior and my life choices in the following future.

When I first arrived at Virginia Tech in the United States, my university required all freshmen to live on campus in student housing for their first year. I was assigned to the West Ambler Johnston Hall, which is a traditional, coed style residence hall located in the heart of the residential part of the campus (figure 1.3). I lived with another girl in a typical 2-bedroom in the building (figure 1.4). A laundry room was located on the second floor and served the whole building. The bathrooms and showing rooms were located at the corner of the hallway. Each floor was equipped with more than one study lounge which are called "family rooms". I was confused by the name of the room at the beginning. After spending a year in the building, that common place was a coffee place to me in morning, a group study place where we can work on group projects and sharing ideas, and, more importantly, a place where I met my friends and spent time with them. There was a community kitchen on the top floor, but it was not the best place to cook and eat. However, there is a fully equipped game room with a pool table, TV, and small library with a large, shared collection of books and bord games (figure 1.6). There was even a small film-room in the basement where one can enjoy a movie with

friends just by making an appointment and bringing a laptop and popcorn. Such public spaces greatly enriched my leisure time (figure 1.7). They helped me adapt to the new environment and build my social web in a foreign setting. The positive lifestyle I had in West Ambler Johnston Hall supported me in accomplishing my academic work to the best of my abilities. As well affording me more peer advice, a good attitude, and better output. I would say that I found belongingness in the student housing, and I chose to live one more year in the building after the first mandatory year. However, the relatively higher cost and having to share my private bedroom with another student was the reason I moved to off-campus housing afterwards.

Figure 1.3 (left) Exterior of West Ambler Johnston Hall
(Retrieved from https://www.housing.vt.edu/experience/YourResidenceHall/HallListing/aj-w.html)
Figure 1.4 (right) A private room in West Ambler Johnston Hall
(Retrieved from https://www.housing.vt.edu/experience/YourResidenceHall/HallListing/aj-w.html)

Figure 1.5 A collective kitchen
(Retrieved from https://www.housing.vt.edu/experience/YourResidenceHall/HallListing/aj-w.html)
Figure 1.6 Top floor lounge connecting to the game room and library
(Retrieved from https://www.housing.vt.edu/experience/YourResidenceHall/HallListing/aj-w.html)
Figure 1.7 The screening room
(Retrieved from https://www.housing.vt.edu/experience/YourResidenceHall/HallListing/aj-w.html)

I've had different experience with a student dormitory in Germany. I was an exchange student who studied in TU Brunschweig in Brunschweig, Germany (figure 1.7). I lived in *Studenten Appartement Anlage* which is about a five-minute walk away from my class. The dormitory provided better privacy but without any space for socializing and interacting. Without a common space, there was more space in private rooms (figure 1.8). However, I lived alone instead of with roommate and the size of my room was similar to that of my room at Virginia Tech. My room had a fully equipped kitchen and bathroom (figure 1.9). As convenient as all that was, I longed for more social interaction. I had many questions that can be simply answered by my colleagues. I also had so many thoughts that I would like to share. Yet, most of the time, there was no one in the corridor and it was relatively difficult to interact with my neighbors without common spaces (figure 1.10). I visited another student house in TU Brunschweig that only had one public lounge and a collective kitchen. As such, the feeling of community was very different.

Figure 1.7 (left): Exterior appearance of *Studenten Appartement Anlage*
(Retrieved from https://www.iwb-ingenieure.de/portfolio/studenten-appartementanlage-braunschweig/attachment/apm_bs_ssp6345)
Figure 1.8 (right): A private room in *Studenten Appartement Anlage*
(Retrieved from https://www.iwb-ingenieure.de/portfolio/studenten-appartementanlage-braunschweig/attachment/apm_bs_ssp6345)

Figure 1.9 (left): Private bathroom

(Retrieved from https://www.iwb-ingenieure.de/portfolio/studenten-appartementanlage-braunschweig/attachment/apm_bs_ssp6345)

Figure 1.10 (right): Corridor in *Studenten Appartement Anlage*

(Retrieved from https://www.iwb-ingenieure.de/portfolio/studenten-appartementanlage-braunschweig/attachment/apm_bs_ssp6345)

1.3 Research question

Based on my planned research and personal experience, the research questions in this report are:

Main question: How social spaces can best be integrated in the design of student housing?

Sub question: How the balance between private and public spaces in such buildings can be controlled?

1.4 Challenges and opportunities

Challenges have risen in the design of student residences. Besides keeping the affordable cost, student housing can also provide a satisfying living condition that is comfortable, sustainable, and available for both physical and social activities. For example, an interactive façade in student housing would be able to filter daylight, save energy to heat/cool the building to provide a more comfortable residential place for students. Being a housing, but not a household, the student residence also needs to provide support for those

young adults and find the balance between public private areas in spatial arrangement. A thoughtful design of student housing should also be a space inspiring creative thinking.

The study of problems and solutions in student housing is meaningful. After all, those students are the younger generation of our society, so it is critical to maximize their potential. Furthermore, student accommodations traditionally represent the most reasonably priced form of housing outside of the family home (Mutius and Nussberger, 1994). Nowadays, more people choose to live alone in a more compact and energy efficient way in the city. The research of innovative design of student housing can provide valuable design strategy to be considered in the design of compact mini-units, hotels, low-income communities, and refugee housing.

1.5 Methodology

The method used in this paper includes a literature review of the history and concept of student residential units in both Europe and North America, observation of the existing types of social space in residential buildings, analysis the strengths or feature of each type (Chapter 2), and study of the existing cases (Chapter 3). In chapter 4, this research will provide some design strategies to improve the design of social space in student housing projects.

The work of Avi Friedman and John Wybor (2016) *Innovation Student Residences: New Directions in Sustainable Design*, and the work of Albert von Mutius and Jorg Nussberger (1994) *Bauen Fur Studenten: Wohnanlagen in Deutschland Seit 1990* will be considered as main literature references for this research. These works introduced the

development of student housing from 20th century Europe to modern trends and solutions

adapted through the discussion of numbers of case studies.

1.6 Research outline

In terms of method, this research will start with analyzing the history of student

housing to understand the generation and development of student residence as a building type

in the first chapter. Chapter 2 will focus on why social interaction is important by studying

the existing types of social space in student housing. In other words, how the design can

foster social interactions as theoretical strategies. Chapter 3 will review case studies including

Simoon Hall at MIT designed by Steven Holl. Most of the cases will be from literal

documents. In this chapter, I will discuss different aspects of existing precedents and the

possibilities in them. In Chapter 4, as a conclusion, this research will lead to a summary of

the design principles and guidelines for student housing, and investigate different future

design possibilities.

CHAPTER 2: HISTORY AND DESIGN STRATEGIES OF STUDENT HOUSING

2.1 Introduction

Students commonly use the term "dormitory", or "dorm" to refer to residence halls. These terms derive from the word "dormant", meaning to sleep, however, this term is not relevant, since nowadays the function of contemporary residence halls includes studying, socializing, educational programs, and other activities in addition to sleep (Blimling, 2010). The residence hall "provides not just a place to sleep, but also opportunities for personal and educational growth" (Michigan State University- Housing- Prospective Students, 2007). The different core concepts of student housing, between the sole function of habitation and more diverse use of space, also reflects my personal experience as noted in chapter 1.

Two concepts of student housing have been developed in Europe. One was the English idea of developing "the collegiate way of living" (figure 2.1). The other concept was the German idea where the university took no responsibility for student housing and paid no attention to student activities outside the classroom (O'Hara, 2011). Though the way of students occupying a dorm has changed (figure 2.2), the difference between my experiences with American and German university student housing can be traced to their histories.

Figure 2.1: A trove of 19th century photographs of students at royal Holloway University gives a rare insight into Victorian accommodation.

(Retrieved from: https://www.bbc.com/news/magazine-21425200)

Figure 2.2: A recreation of the 1890s photo of tea party (left) and another recreation where everyone is occupied with electronic devices (right).

Retrieved from: https://www.bbc.com/news/magazine-21425200

2.2 The beginning of student housing

The first official university, the University of Bologna, was inaugurate in Italy in 1088. Before then, classes were held in various locations around towns (figure 2.3). In a different area of the city center, an early form of residence hall, the Collegio di Spagna, founded by Cardinal Egidio Albornoz in 1364, was used to house Spanish students enrolled at the University of Bologna and has been in operation ever since. The building's architectural design is between the Gothic and Renaissance style and protected by high walls around. Students' rooms face the brick courtyard, connected by a porch. (A stroll around the university of

Bologna, n.d.)

Figure 2.3: The courtyard of Collegio di Spagna, the only foreign college at the University of Bologna in operation since the Middle Ages.
(Retrieved from: https://www.italymagazine.com/featured-story/stroll-around-university-bologna)

2.3 British university student housing model

Many students attending Oxford and Cambridge University in the Middle Ages were poor. In order to assist them, in 1452, Oxford University established *domus pauperrum* (endowed hostels) as charitable institutions (Blimling, 2010). These institutions offered an environment for students to interact and to form a society. Residential accommodation was the essence of this system, and the idea was to combine the intellectual and social environment with the view of educating the students. In the 17th century, the British colonists brought the educational tradition and concept of England to North America. Despite the Philadelphia Academy and the College of William and Mary, graduated from Oxford and Cambridge founded most of the original colonial colleges. Therefore, the concept and model of Oxford and Cambridge have a profound influence on the design of earlier North American colleges (figure 2.4). The initial motivation of residential halls was to help establish students' character and intellect while serving as the practical functioning housing for students as young as thirteen and fourteen years old who traveled far to attend college. Student housing was necessary for

many of them. "Book-learning alone might be got by lectures and reading," observed the

educational historian Samuel Eliot Morison, "but it was only by studying and disrupting, eating

and drinking, playing and praying as members of the same collegiate community, in close and

constant association with each other and with their tutors, that the priceless gift of character

could be imparted to young men." (Morison, 2013).

Figure 2.4: Massachusetts Hall at Harvard University is the oldest dormitory in the U.S. Founded in 1636, it is in
early Georgian in style and has a symmetry, simple construction, and modest accent.（Retrieved from:
https://news.harvard.edu/gazette/story/2011/02/the-art-of-architecture)

2.4 Germanic university student housing model

In the 1500s, German universities established a system of private residential halls called

"*Bursen*" which were organized and run by monks (Student Accommodation, n.d.). Clerics

who followed Martin Luther worried that this type of student housing facility resembled the

Monkish Order of the Catholic monasteries, therefore, the Germans abandoned this form of

residence halls.

In the late 1800s, the British system of colleges started to disappear in continental

Europe, and the Germanic university tradition was introduced to American higher education.

The Germanic university model, which focuses on technical scholarship and research instead

of the comprehensive development of student's intellect and character, was on-trend of the

twentieth century.

However, the renewal of the older decentralized British collegiate model comes after that. The core concept of the British collegiate model is to provide a few hundred students each a small but comfortable and home-like living environment, which is managed by administration office and faculties. This environment seeks to counteract the impersonal alienated studying and living experience one often finds in large Germanic-style universities.

2.5 Student community in residence halls

The early U.S. colleges were intended to separate students from the corrupting influence of the city. This isolation allowed the institution to "imprint its specific morality upon its followers". The residence housing facility became necessary to provide accommodation to students in these rural locations or small towns. In the 1800s administrators indicated the importance of a moral education as well as an academic one, thus higher education took on a semi-monastic aura. The concept of "Ivory tower" was first introduced (Martin, 2019).

Student groups and communities started to form in these isolated residence colleges. Some of the students, including Benjamin Franklin, were interested more in socializing with other members instead of seeking the moral benefits. College life introduced men to other men like themselves (Martin, 2019). Socializing became a critical part of residential life, and it was emphasized by the rise of the fraternity houses.

While the residence housing system provided an opportunity for students to socialize with their colleagues, universities tended to allocate students in separate housing when they were not white Protestant members. This situation continued in the mid-19th century when white women of middle to upper class started attending college for undergraduate degree.

Student housing for women was separated from those for men and were built as "cottages" to cultivate women's future roles as homemakers, wives, and mothers (figure 2.5). This educational philosophy impacted the layout of residence buildings.

Figure 2.5: Victorian students had the luxury of a study and a bedroom.
(Retrieved from: https://www.bbc.com/news/magazine-21425200)

2.6 High-rise residential halls

Residential facilities on college campuses expanded greatly following World War II with the enrollment of veterans, and in the mid-1960s, when the baby boomers began arriving on campuses (figure 2.6). The number of undergraduate students nearly doubled (Yanni, 2019). In 1953, it became necessary to increase funding to provide housing facilities for students (figure 2.7). Hotels, trailers, and parks were also converted into student housing (College and University Residence Halls- Purpose of Residence Halls, n.d.).

TABLE I: INSTITUTIONS PROVIDING HOUSING FACILITIES FOR SINGLE STUDENTS, 1951 AND 1952

	Institutions Reporting Usable Information	Per Cent of Total Number of Institutions [a]	Per Cent of Institutions Reporting	Per Cent of Institutions with Facilities
With facilities	844	44.4	82.3	
For men only	186			22.0
For women only	122			14.5
For men and for women	536			63.5
Without facilities	181	9.5	17.7	
TOTAL	1,025	53.9		

[a] The total number of higher education institutions reported by the United States Office of Education as of November 1952, less institutions in Alaska, the Canal Zone, Hawaii, and Puerto Rico, was 1,900. It should be noted that this number had been reduced, by the fall of 1954, to 1,849.

Figure 2.6: Chart of Institutions Providing Housing Facilities for Single Students, 1951 and 1952. (Retrieved from: https://prezi.com/scg46fnxd1eb/the-history-of-student-housing-facilities)

TABLE IV: ESTIMATED GROWTH OF HOUSING FACILITIES FOR SINGLE STUDENTS, 1951–54

	Number of Institutions	Total Number Student Spaces Permanent and Temporary	Per Cent of Gross Increase [a]	Total Square Feet Floor Space Permanent	Per Cent of Net Increase
Reported available, 1951–52:					
Total	844	489,445		82,252,656	
Men		293,469			
Women		195,976			
Reported new construction, 1951–54:					
Total	292	68,162	13.9	13,465,862	16.4
Men		44,884	15.3		
Women		18,726	9.6		
Estimated new construction, [b] 1951–54:					
Total		95,428	19.5	20,986,390	25.5
Estimated Totals—1954		584,873		103,239,046	

[a] These percentages are gross rather than net because of the inclusion of temporary-type space in the 1951–52 figures.
[b] Total reported new construction costs were used as the basis for estimated totals of student spaces and of square feet of floor space See text.

Figure 2.7: Chart of Estimated Growth of Housing Facility for Single Students, 1951 and 1954. The number of students and housing facilities greatly increased.
(Retrieved from: https://prezi.com/scg46fnxd1eb/the-history-of-student-housing-facilities)

Because of the GI Bill of Rights after World War II, the insufficient space for students to live led to the growth of modern high-rise type of student residence building (figure 2.8). The economy expanded after war, Americans place their faith in education to resist communism, as a result of the Cold War political environment. More and more mid-class families expected to send their children to college. American valued higher education as never before. The calls for radical change in the 1960s influenced students' living arrangements. Integrated residential

area and projects, such as Kresge College at the University of California, were built around the

site's redwoods, including cafe, launderettes, meeting spaces, and classrooms, other than just

dormitories. In these residential areas, space was divided up upon communal agreement instead
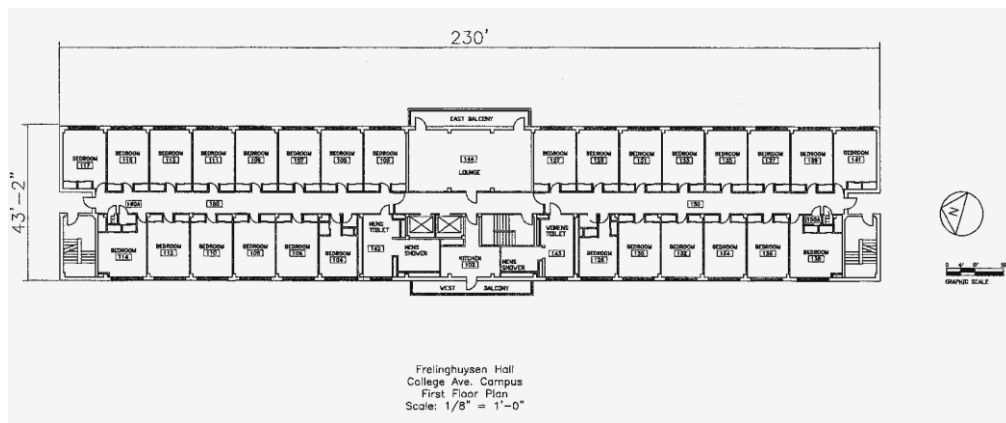
of built-in interior walls (figure 2.9).

Figure 2.8: Typical layout of the high-rise residential hall of rooms and corridor during the 1960s.
Source: Yanni, C. (2019). *Living on campus: an architectural history of the American dormitory*. Minneapolis: University of Minnesota Press.

Figure 2.9: Interior of the high-rise residential hall of rooms and how students occupied them.
(Source: Yanni, C. (2019). *Living on campus: an architectural history of the American dormitory*. Minneapolis: University of Minnesota Press.)

However, the high-rise residence halls did not last long as the dominant mode of student

housing. Fire safety was a large issue in the design of skyscraper residence halls. Also, as

indicated by Gifford in a review of thirty years of research on the effects of high-rise living in 2007, "social relations are more impersonal and helping behavior is less than in other housing forms" and "crime and fear of crime are greater", as a conclusion, the form of high-rise building does not encourage people to help on another (Yanni, 2019). Later, the alternative schemes, the hill town and quadrangle became the main design of student housing as a rejection of high-rise living.

2.7 Adjustment and development of student housing

The rigidness and repetitive of modernist architecture became a metaphor for the misery that student residents living in the skyscrapers felt about their lives as living in the impersonal units. The functional division of space was copied as a mainstream of zoning principle on thousands of campuses. In a lecture in 1958 given by Clark Kerr in the University of California, Berkeley, he announced that the world has changed from an emphasis on tradition to an emphasis on progress. The universities have also changed, albeit at first reluctantly, to become the architects of progress instead of the protectors of tradition (Yanni, 2019). Many progressive adjustment and development were made in student housing design in the 1970s. The anonymous, auto-oriented, disingenuous university of modernism was expected to be replaced by architecture that would balance the need for communality and the desire individuality. In 1972, Gradually colleges began to allow co-ed dorms to fit the need of merging student communities (figure 2.10). Brown University, Stanford University, and the University of Pennsylvania started offering unisex rooms and bathrooms.

Figure 2.10: A Photograph of unisex residence building.
(Retrieved from: https://prezi.com/scg46fnxd1eb/the-history-of-student-housing-facilities)

Later, in the 1980s, computers became a popular equipment to have for university students (figure 2.11). However, the cinder-block residential units from the previous era were ill equipped to handle the computer revolution. New residential buildings were built partially because it was expansive and difficult to rewire old buildings.

Figure 2.11: University Residence halls started to be equipped with computers.
(Retrieved from: https://prezi.com/scg46fnxd1eb/the-history-of-student-housing-facilities)

In the 1990s, despite the increasing demand for college residential units, State and federal funding decreased.

A new rise of sustainability emerged in the early 2000s.Universities responded to the trend by choosing environmentally friendly materials and encouraging residents to use resources in a more efficient way.

The student society is way too diverse to characterize today. Some of their families are wealthy and willing to spend a fortune for education, however, because equal rights and open opportunities for students, some of them may have an insufficient financial fund to cover the cost. Many aspects need to be considered, including cost, sustainability, and most important, the balance between dwellers' individuality and social interaction as the main core idea of student housing.

Universities, developers, and architects today need to carefully considerate who needs the dormitory and that role do they play in the future of higher education. A concept of "environmental determinism" was mentioned in Yanni's book, that the design of student housing and living environment will shape students' personal character. It means that a purposefully built and well-designed building is essential to cultivate undergraduate students into ideal citizens. It's ideal for students to experience on-campus living to be fully benefitted from the collegiate life.

Different types of modern student housing facility will be introduced in the following chapter. The existing types of social space in residence halls and how the design can foster social interaction will be discussed.

2.8 Design considerations of student housing

A survey conducted by the insurance company Cigna showed that young adults, 18-22 years old, were the loneliest among a pool of more than 20,000 people (Rao, 2018). Near half of the young adults are enrolled in college (figure 2.12). For those young college students who are experiencing loneliness, the intention of living collaboratively is helpful (Kim, 2017). Loneliness is a function of how socially connected a person to the people around him. It's the

result of false connections and an increase of social isolation. Several architecture design strategies can be adapted to student housing to foster social interactions. The strategies will be demonstrated with different types of active space and various aspects of space quality.
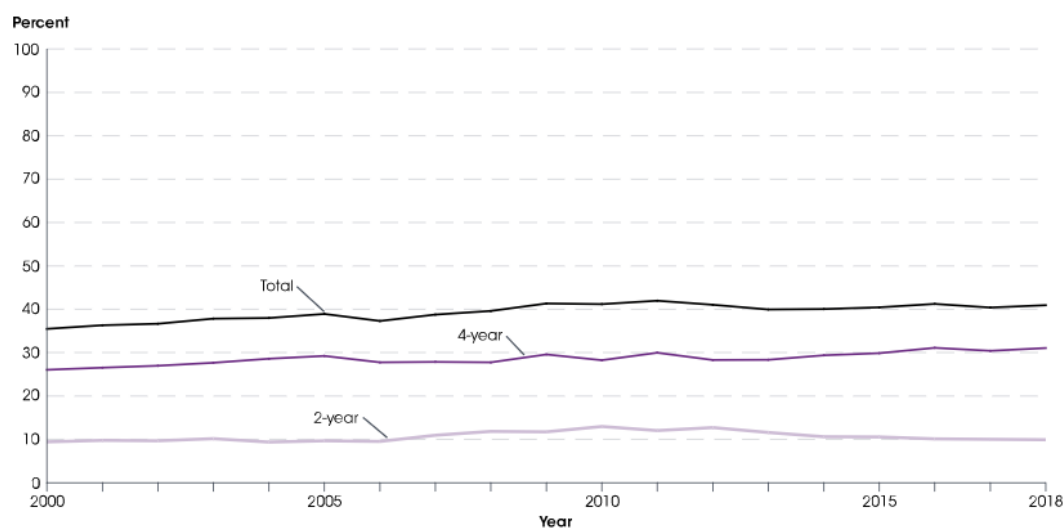
Figure 2.12: College enrollment rates of 18- to 24-year-olds, by level of institution: 2000 through 2018 SOURCE: U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October Supplement, 2000 through 2018. See *Digest of Education Statistics 2019*, table 302.60.

2.9 Typology of interactive space

There are three different types of social interactive space in a university; formal space, semi-formal space, and informal space. Formal spaces are places for people to have formal social interactions, such as classroom, library, gym, and event hall. They have the capacity of large groups of students, while they are bonded with lots of rules and usually do not encouraging small talks, which helps to build personal relationships.

Student residence buildings can present students with social opportunity by providing both semi-formal spaces and informal spaces. These spaces are critical to turn a cold living space to a vibrant student community. Ray Oldenburg explains in his book *The Great Good Place* that these spaces are not associated with dwelling or work, as "third places" (1999). Semi-formal spaces are 'third places'. They are small meeting spaces for group activities,

including cafeteria, lobby, common room for group meeting, small theater/ movie room, and game room. People intentionally visit these places to participate in social activities. However, it is not the priority to worry about people who realized the importance of social interaction and are seeking opportunities to participate. The design of space should considerate more about those people who pay less attention to social need. Informal spaces in the building are places where users do not intend to interact but where built environment is designed in such a way that fosters conversation and are known as 'fourth places' (Friedman, 2016). Informal spaces are more open and encourage interaction among a diverse group of students. Furthermore, flexible group of user makes the place more socially open and can adapt a variety of uses (Simões Aelbrecht 2016). These spaces include laundry room, public kitchen, bathroom, corridor, stairs, and garden and terraces.
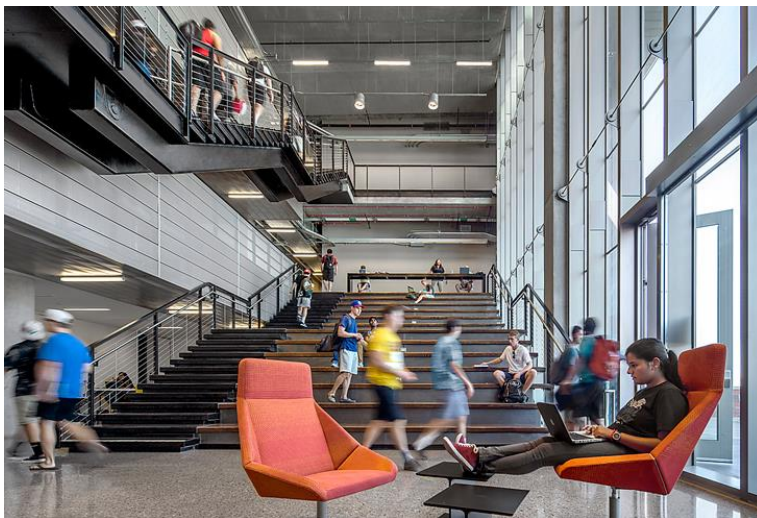

Figure 2.13: 'Forth place', as grand stairs with rest area in Arizona State University, fosters spontaneous social activity between daily users.
(Retrieved from: http://www.gensleron.com/cities/2015/1/30/a-closer-look-at-student-housing.html)

2.10 Quality of active space

The architectural design of those spaces should follow some basic principle to achieve good space quality and become successful interactive spaces.

2.10.1 Location

The location of active space and the distribution of social gathering nodes should be carefully planned around and inside the student housing. The location of active space to a student residential building is similar to the location of a public square to a small town. The location of active space will influence the light condition, accessibility, noise control, and safety aspects.

Public space should be able to gather people into the space for group activity or social interaction to happen. The population density within a reachable distance in the surrounding area is essential to provide several students who are potentially possible to use the public space. After attracting people to come, public spaces should be able to make users willing to spend time. When public space is located near the exterior facade or under a skylight, natural light will shine in the space. Furthermore, public space near the courtyard will have both the natural light and a relatively quiet atmosphere. Those public spaces on the same or different floors near the courtyard establish a visual connection between each other. It helps to build familiarity within the student community, enriches layers of social interaction, while also increase the safe level by open eyesight in the space. Students should be able to gather and stay for hours in some public space. It is also important that it shall not disturb the other students' normal use of the residential building. Keep group activity space distance from students' dorms helps sound insulation and contributes to good sleep quality. When students want to stop and talk in corridors and stairs, the location of informal space provides the space for them to seat or have a quick conversation without interrupting the regular circulation (figure 2.14).

Figure 2.14: Small interactive space with seating in the corridor

2.10.2 Light condition

A study found that people interact more with their surroundings in light settings with a high light ratio, where objects with social connotations are the main focal point. In contrast, people interact more with each other in low-level lighting (Evensen, 2014, a study on the effects of lighting on social interaction). Bringing natural light into space always associated with an open view, natural ventilation, and eyesight connection between inside and outside (figure 2.15). The active space becomes more dynamic. Furthermore, the results of several studies show that both natural and artificial bright light particularly in the morning can significantly improve health outcomes such as depression, agitation, sleep, circadian rest-activity, and seasonal affective disorder (J Clin Sleep Med, 2014). Sufficient artificial light also helps to improve the safety issues in the outdoor activity areas.

Figure 2.15: Rest area locates next to exterior façade with outside view and natural light

2.10.3 Material

Sufficient light source is important to the public space and light color also helps to make the space brighter. Colors are fundamental elements of our visual perception and environmental experience; they are the substance of how we experience the environment (Meerwein, 2016) Our environment is perceived mainly by colors that surround us which make a signal to emotions. Different materials and different colors of the space will subtly influence the social interaction in those common rooms. Dark colors might make us feel calm or sad (figure 2.16). Bright colors can render a delightful atmosphere to encourage social interaction (figure 2.17). Glass and steel might convey the sense of technology and rational, while wood might render a friendly and cozy atmosphere. Blackboard paint or washable wall surface are easy to clean and encourage students to share their ideas and inspirations.

Figure 2.16 (left): Lounge in dark color

Figure 2.17 (right): Lounge in bright color

Sound insulation material helps keep group activity's noise from rest area of the student residential building. Durable and recyclable material supports the sustainability of student residences.

2.10.4 Sound insulation

A quiet atmosphere makes it easier for people to concentrate. However, people might feel socially isolated and lonely if they always stay in a very quiet place for a long time. Noise sometimes disturbs student's study and rests in student housing. Sound insulation is a very common problem in cohousing projects. Within the student housing, the group activity area should be separated from the sleeping and quiet area and apply sound insulation measures in some cases, including the sound insulation wall material, acoustic ceiling, floor carpet to absorb vibration, and rules to regulate students' use of the public space. So that the noise is under control and users can choose different surrounding atmosphere according to their needs.

2.10.5 Ventilation

In student housing, people are living together in a relatively dense way. Therefore, ventilation is an important aspect of space quality. Ventilation helps with the smell problem in a high-density residential building. Good air quality improves mental health. Furthermore, ventilation also prevents mitigate airborne transmission of the virus and lowers the risk of

disease. Students can study and socialize more efficiently under a healthy condition.

2.10.6 Accessibility

For active space in student residential buildings to serve students' social needs properly, students need to have easy access to those places. The "forth places" on the circulation route form social gathering nodes, where people can sit down and have a conversation (figure 2.18). For gathering purposes, one needs to ensure that paths are wide to allow the opportunity for the space to be retrofitted (Simões Aelbrecht 2016). A wide path provides ample space and minimize conflict while completing activities. Easy access to the places also makes it an ideal spot for small group activities. Smaller seating places on the side of the corridor became a "social pocket" (figure 2.19). People can stop at those spots when passing through the paths. These pockets have many possibilities by providing a rest area near circulation. The flow of people passing by provide many opportunities for social interaction to happen. The accessibility also includes reachable amenities, such as water fountains, to make the area user-friendly and let students stay and linger comfortably.

Active space in student residential has the advantage of accessibility. Students with disabilities might have difficulties to go to formal active space on or off-campus. However, they need social interaction, just as much as other students if not even more. The active space within student residence can be very helpful in this situation.

Figure 2.18: Social node highly connected with surrounding area

Figure 2.19: "Social pocket" by the side of wide circulation path

2.10.7 Safety

College crime and safety is an important concern for every student. Safety is the basic human right and requirement. Young adults in university may be away from home for the first time or could be in a very different environment than in high school. They could be vulnerable and lack of experience to properly protect themselves. Fortunately, the record shows that the rate of on-campus crime has dropped tremendously in recent decades. However, the rate of sexual assault increased (figure 2.20). Also, the number of reported crimes might be different from the number of actual crimes.

Number of on-campus crimes per 10,000 FTE students
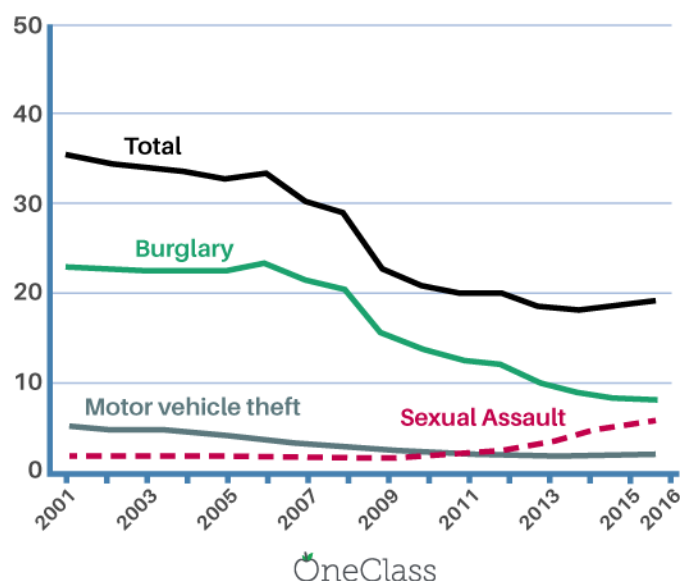
Figure 2.20: Number of on-campus crime per 10,000 FTE students
(Retrieved from: https://nces.ed.gov/programs/coe/indicator/a21)

Student safety is also a main consideration in student residential buildings. Despite the regular measure of security and door locks, the design of public space also provides protection to students (figure 2.21). First, public spaces attract students to come out of their own dorms. In *The Death and Life of Great American* Cities, Jane Jacobs pointed out that a place or street is safer when it's more frequently used. Furthermore, people who hang out in the public area accidentally became observers of this public area. These observers could be a good prevention of sexual assault and other crimes. Even when there is no crime, students may still need help by accident, it is easier for them to find help if the public areas are populated. Last but not least, public space contributes to building a student community with social networks and less social isolation. A healthy community and a healthy mental condition also lower the crime rate.
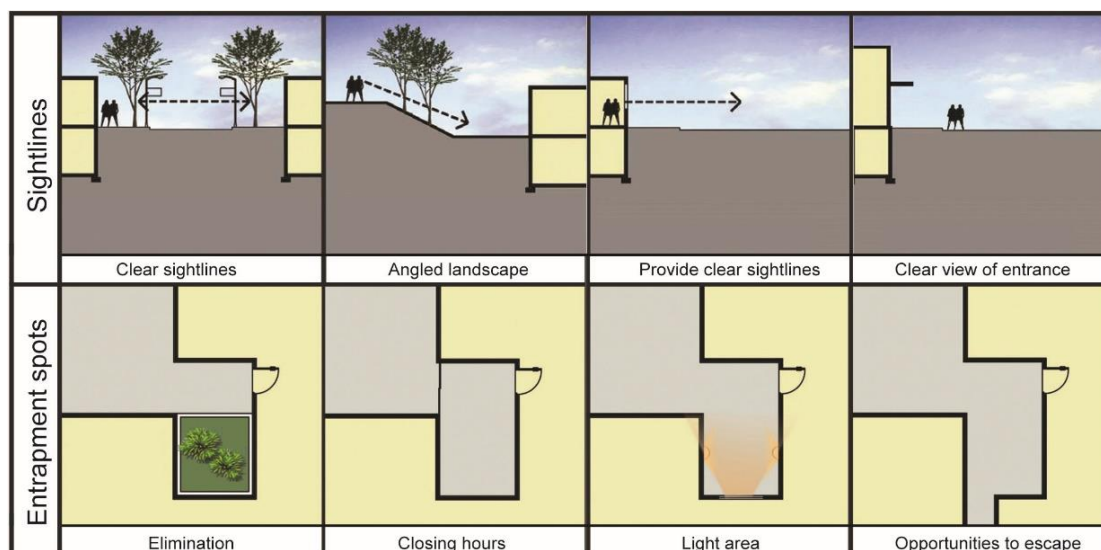
Figure 2.21: Design principles of safe public space (Friedman 2014)

(Source: Friedman, A., Planning Small and Mid-Sized Towns; Designing and Retrofitting for Sustainability. Routledge: London, UK, 2014)

2.10.8 Interior decoration and furnish

A tasteful environment can encourage students' creativity. The decoration and furniture are also important in public areas in student housing. The interactive area should use interior design, outdoor view, art piece, or decoration to draw users in (figure 2.22). For example, lounge with flower and vase, hearth, wall art, or television provides the area with a focal point. These focal points also stimulate discussion and gathering.

Figure 2.22: Common room with decorations

Students deserve the opportunity to interact with their friends and learn to build their

own social networks. They can take a rest in the common room with their friends and watch new episodes of a show, meet someone new in the roof garden, have a meal together with their neighbor or friends and discuss the schedule for mountain climbing during weekends, and chat with classmates they walk into on the way in corridor. The next chapter will cover more specific case studies of social space in student housing. With design strategies and good space quality, public interactive spaces in student housing foster social interaction among students, form student communities, and contribute to a healthy way of student life.

CHAPTER 3: CASE STUDIES

3.1 Introduction

This chapter investigates social space in nine student housings and analyzes how they utilize public space to foster social interaction. The analysis is based on the factors investigated and listed in Chapter 2. This chapter lists international cases, including Europe, Asia, and Australia, to discuss the diversified options to design public space in student housing. These case studies were chosen in accordance with the following parameters:

- Shared facilities in the building (including study area, kitchen, and bathroom)

- The number of units in the building

- The public space in and around the building

These case studies focus on the space quality of common area, including location, light condition, material, sound, ventilation, accessibility, safety, and interior decoration. The goal is to make observations on the contemporary pattern of common space in student housing, find the strengthens, problems, and possible solutions in the design which will be presented in chapter 4.

3.2 Methodology

The cases were selected among those which were found by the author to be the most interesting based on their floor plans and location of common space on each floor. This chapter will create a list of criteria and attempt to find the design principles of public space in student housing.

As mentioned, in Chapter 1 and due to the travel restriction as result of COVID-19, the

method of this research will mainly consist of literature reviews, visual illustrations, and observation of the physical environment on local site visit.

Pictures of interior and exterior will also illustrate the use of public space in each case study.

3.3 Case studies

3.3.1 Case Study 1: "MySpace" Trondheim Student Housing

Figure 3.1: street view of Trondheim student housing
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

- Design: Murado & Elvria Architects

- Location: Trondheim, Norway

- Year of construction: 2012

- Number of beds:116

3.3.1.1 Location

MySpace contains small individual units as student dorms to provide space for resting and privacy. Small chatrooms are interspersed on each floor to foster social interaction by providing space for students to meet their neighbors and have small discussion. In order to achieve a group living style, students share a lounge and a self-managed 'ultrakitchen' on the

second floor. A shared open terrace is located on the second floor providing a gathering space between interior and exterior (figure 3.2).

Students' rooms
Communications
Common facilities (for all residents)
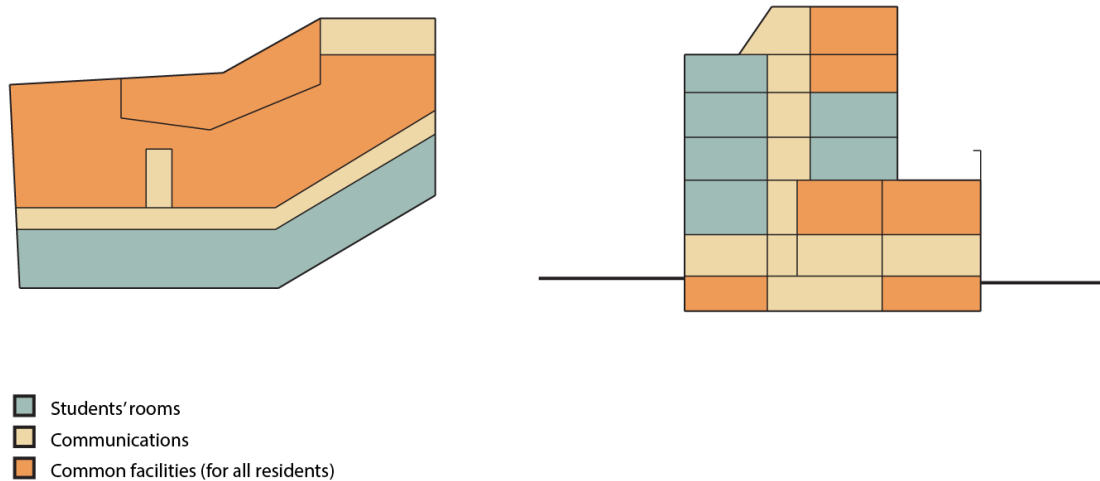
Figure 3.2: Location of the collective space
(Created by the author with Adobe Illustrator)

3.3.1.2 Light condition

The building is an independent volume shaped in an angle to gain more views and natural sunlight (figure 3.3). While physically detached from the surrounding buildings, the student housing is still connected to the existing urban fabric via the city view on the second-floor open terrace (figure 3.4).

Figure 3.3: The volume is shaped to gain better view and sunlight
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)
Figure 3.4: open-air terrace on the second floor
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

3.3.1.3 Material

The design chooses to apply traditional technics in a creative way instead of using newly developed material and technology. Trondheim is one of six "Early Adopter Cities" of the Build-in-Wood project (Build-in-Wood, 2021),, so, as a large building, the student housing uses pine wood planks as exterior cladding with weather treatment. The openings on the façade have a modern geometric layout. With warm tuned interior artificial light, the grey wood cladding renders a welcoming atmosphere that encourages social activities between students.

Figure 3.5: Exterior façade with pine wood
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

3.3.1.4 Sound control

MySpace is managed by a student-run association named SIT that seeks to explore student housing's availability (NTNU, 2021). The budget was tight in this project and a new layout with extra 40% rooms was fitted within the volume. The high density of the residence provided potential for group activities and building social connections. However, it also makes the noise in public area a potential problem in the building. The multipurpose lounge became a place to attract students and foster social interactions. The lounge is a stage for spontaneous social interactions with minimum restrictions. The public area, separated from the high density

residential units on the upper floors, is located on the lower floors to isolate noise (figure 3.6).
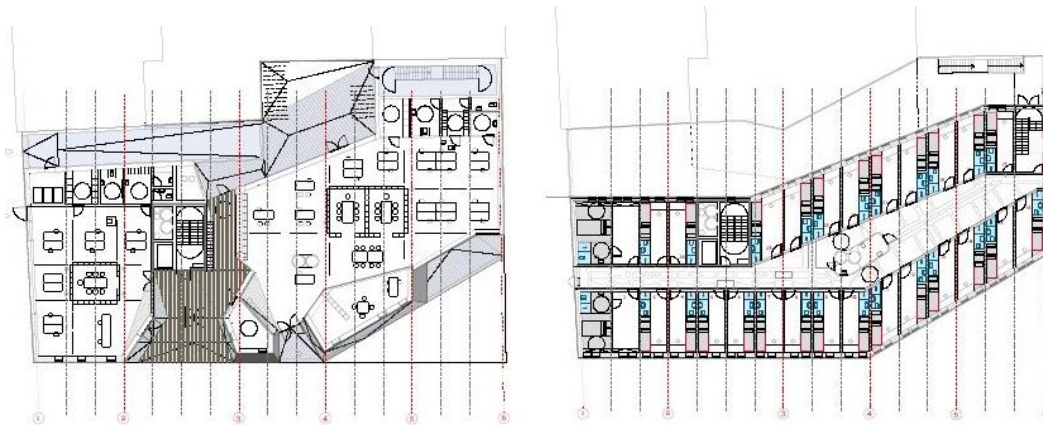
Figure 3.6: Public space on the ground floor (left) and typical high density small individual units on the upper floors (right).
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

3.3.1.5 Relationship between the building and the local context

The MEK Architects consider this project as a design which improves the way students living and relating to each other. The entrance cutting through the lobby on the ground floor provides easy access to both students and visitors. The setback of entrance connects the building with the small front plaza. There is also a garage on the underground level. The wooden façade blends the building into the surrounding urban texture thus enhancing visual connection to the site. As a result, the exterior appearance, view terrace, and accessibility counterbalances the isolated feeling of the building and creates belongingness to the site.

3.3.1.6 Interior decoration and furnishing

Because the density of the student population in this building is relatively high, the interior walls in the communal area are painted white to reflect light. So that the space looks large and bright. The doors and floors are painted yellow to light up a vibrant and warm atmosphere and balance the clod feeling of white wall. With this color combination, ceiling is painted black to let the exposed ceiling and ventilation ducts fade away visually. Modern

simplistic style furniture is used for efficiency in the relatively tight space and to meet aesthetic

value of the young adults.

Figure 3.7: Widened corridor forms communal space for small group activities
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

3.3.1.7 Collective facility- 'Ultra Kitchen'

The building can be looked upon as unfinished because it calls for more satisfying

community life (ArchDaily, 2012). All 116 residents and guests in the building shares the large

'ultrakitchen' (figure 3.8). This design considers residents as participants in building the

architectural environment, thus enhances the connection between dwellers and building and

among dwellers themselves. The collective space is designed for students to use creatively

(figure 3.9). Students have the option to cook dinner together, eat together, and talk to their

friends and neighbors. Research showed that those who eat together more frequently, exhibit a

higher level of collective community's bond (Kim, 2017)

Figure 3.8: Self-managed 'Ultrakitchen'
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

Figure 3.9: detail of individual owned minifridge in 'Ultrakitchen'
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects)

3.3.1.8 Conclusion

The student housing blends in well with existing buildings, some built as far back as the 1700s, on the exterior by using neutral color wood façade and lowering building height when touching the adjacent building (Build-in-Wood, 2021). While the interior of the building uses bold and colorful design creating a bold and energized environment for young users to express their personalities.   The design of collective space puts students in responsibility and strengthens the bonds within the newly established community (ArchDaily, 2012).

3.3.2 Case Study 2: Student Housing in University of Southern Denmark

Figure 3.10: Street view of the student housing in SDU
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

- Design: C.F. Møller

- Location: Odense, Denmark

- Year of construction: 2015

- Number of beds: 250

3.3.2.1 Location

The student housing is designed with a strong community concept. The building is composed of three towers. Each tower is a small unit containing seven bedrooms and a shared common space towards the center of the building. A triangular central common space connects the three parts, provides common area on each floor, and serves as vertical circulation (figure 3.11). The rotational symmetrical shape of the building's layout has no back side or front side, attracts crowds coming from different directions, and provides a board view (figure 3.12). The distinctive shape advocates its residential community content, provides inspiration for the student residence, and makes the building a landmark in the university.
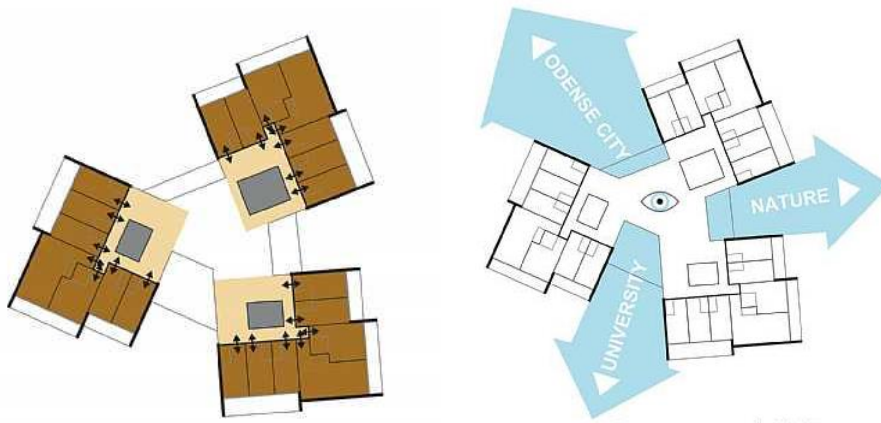
Figure 3.11 (left): Bedrooms are clustered into three small-scale units
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)
Figure 3.12 (right): sightlines
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

3.3.2.2 Light condition

The three towers are rotated in angle to receive natural sunlight during different time in the day (figure 3.13). Each room has balcony which provides both sunlight and view towards landscape (figure 3.14). Students can enjoy natural light and breeze and relate with the surrounding landscape context without overlooking neighbors' rooms on those balconies. The balcony encourages student residents' active living style while also helps solar gain to save energy (archello, 2021). Common area with a shared kitchen at the center of the building has a generous portion of glazed façade to guarantee light and views in all directions (figure 3.15).
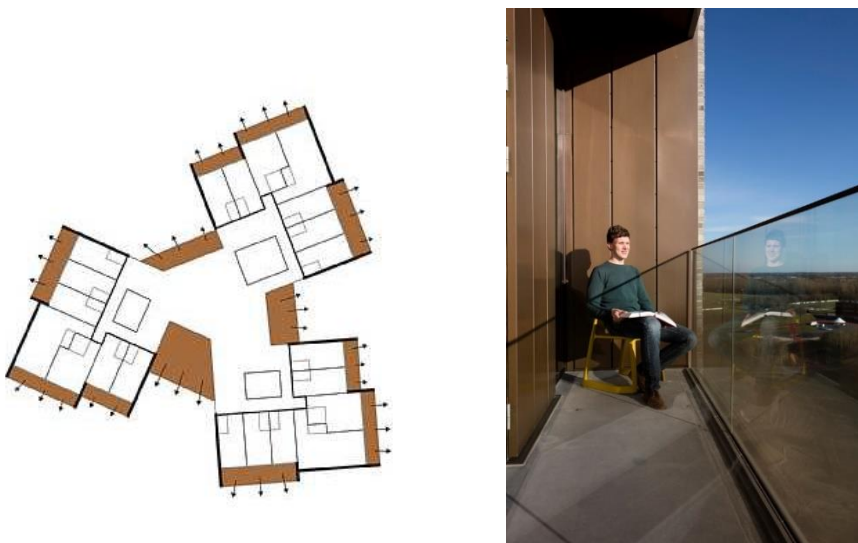
Figure 3.13 (left): Plan of the three rotated towers and balconies
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)
Figure 3.14 (right): Photo of balcony with natural light and view
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

Figure 3.15: Common area with glazing wall on different directions
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

3.3.2.3 Materials

The residential building is a low-energy construction made from quality material that meets the strict Danish codes for low-energy class 2020 (Design Build Network, 2016). The exterior façade of the building is warm-toned greyish brick with slightly extruded joints (figure 3.16). The glass on balcony is surrounded by hardwood panels (figure 3.17). Hardwood veneer is also applied in private dorms (figure 3.18). The natural, warm-toned material provides a friendly atmosphere for the student's community. It also responds to the surrounding natural forest landscape and the small lake.
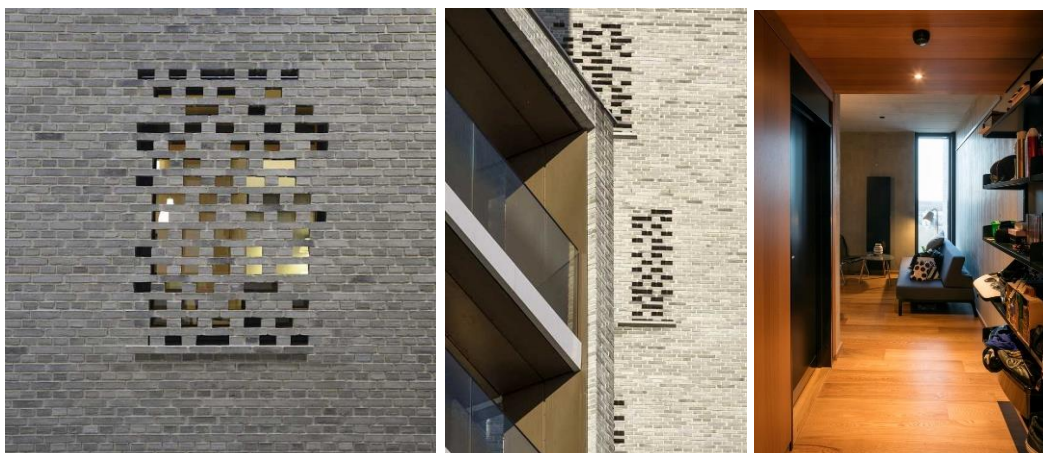
Figure 3.16: Grey brick and extruded joint on exterior wall

(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

Figure 3.17: Balcony surrounded by wood panels

(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

Figure 3.18: Hardwood veneer in private bedroom

(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

3.3.2.4 Sound control

The living room in between the shared kitchen and bedrooms in each tower separates is also available for small social meetings to increase chance of social interaction among the neighbors who live in the same tower on the same floor (figure 3.19). This semi-private living room space connects public and private space and separates group activities' noise from private resting area (figure 3.20).

Furthermore, group rooms, study area, and party space are located on the top floor to minimize the disturbance of noise on the other residential floors. Open-air terrace on roof top also provides exterior space for public gathering (figure 3.22)

Figure 3.19: Photo of the living room

(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

Figure 3.20: Semi-private living room separate private bedrooms from public kitchen

(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html; edited with Adobe Illustrator by the author)
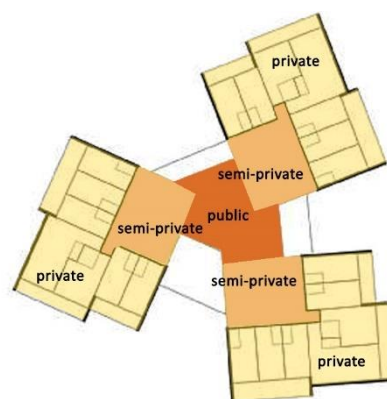
Figure 3.21: Roof terrace
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

3.3.2.5 Ventilation

The building envelop is highly insulated and airtight to save energy. The building use natural cross-ventilation and extensive heat recovery from exhaust air, wastewater, and showers (ArchDaily, 2016).

3.3.2.6 Accessibility

The private rooms are located on the outer perimeter of the three towers, facing the quite countryside environment. Moving inwards from these private unites towards the center communal kitchen, space gradually become more and more public (figure 3.22) (cfmoller, 2021).

The three towers of student housing are rotated to have accessibility from different sides. The building is surrounded by multifunctional gardens, volleyball courts, and sitting terrace. The development plan of a light rail in the future will contribute to the building's connection to the city (figure 3.23). The bicycle garage is located on the ground floor and a bike is provided to each student resident in the building to encourage a healthier active life style (archello, 2021) Biking becomes a convenient and environmental-friendly way of access to the building.
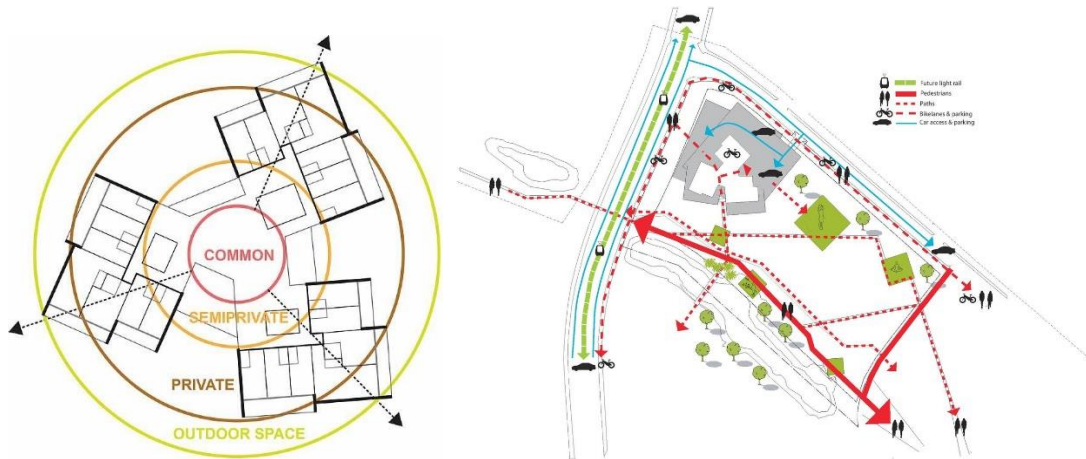
Figure 3.22: space gradually becomes more public when moving inwards
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)
Figure 3.23: Map of future light rail, pedestrian path, bicycle lane, and car access to the building
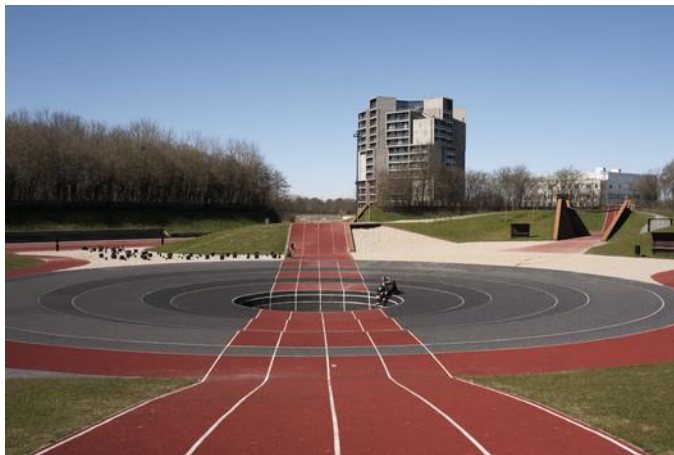(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

3.3.2.7 Safety

Public plaza and sitting steps are linked to the building with a main walking path (figure 3.24). Multifunctional plots attract more pedestrians near the student housing. More people and open eyesight can help increasing the sense of safety in the student housing area. Sufficient artificial light resource at night is also important to keep students safe (figure 3.25).

Figure 3.24: Main walking path to the building
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

Figure 3.25: Artificial light at night
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)

3.3.2.8 Interior decoration and furnishing

This student housing is also equipped with modern style furniture as the previous study case. Television is installed to attract and entertain students. Students can sit in the resting area while cooking in the kitchen to increase social interaction. Pendant lights over table renders a positive atmosphere for gathering (figure 3.26)

Living room is decorated with orange wall painting and plants to light up the plain grey wall and bring vitality to the space (figure 3.27). Natural light coming into the building through the patterns on the exterior façade makes the space more dynamic (figure 3.28)

Figure 3.26: Pendant light for group dinning in the kitchen
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

Figure 3.27 (left): Plants and wall painting in the living room
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)
Figure 3.28 (right): Natural light shows the brick wall's pattern in bedroom
(Retrieved from: https://www.cfmoller.com/p/Campus-Hall-University-of-Southern-Denmark-i2971.html)

3.3.2.9 Conclusion

The collective space in student housing in the University of Southern Denmark is carefully planned in different scales, including both small rooms for intimate communities and large area for big events. A balance between private and public is well established to foster social interaction in the student residents' community.

3.3.3 Case Study 3: Tietgen Dormitory

- Design: Lundgaard & Transberg Architects

- Location: Copenhagen, Denmark

- Year of construction: 2005

- Number of beds: 400 students

3.3.3.1 Types of functions and spaces

The Tietgen Dormitory is shaped in a simple circular form surrounding the central courtyard (figure 3.29). By locating private bedrooms on the perimeter and moving communal function towards the central courtyard, the design concept reflects the nature of dormitory as type of residential building: The combination of the individual and collective (ltarkitekter, 2021) (figure 3.30).

360 bedrooms, dividing into thirty groups of twelve units, are located on the six upper levels. Each group has a shared kitchen, a common room and utility room (figure 3.31). Public facilities including administration, meeting and study rooms, workshops, laundry, mail room, and function room are placed on the ground level for easy access to users in the entire building (figure 3.32).
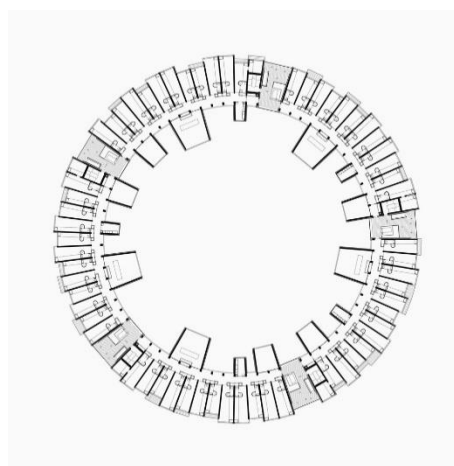
Figure 3.29 (left): Circular shaped building surrounding the central courtyard
(Retrieved from: https://housingfoundation.dk/the-tietgen-dormitory)

Figure 3.30 (right): Private rooms on the perimeter
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)

Figure 3.31: Shared kitchen in each group
(Retrieved from: https://housingfoundation.dk/the-tietgen-dormitory)
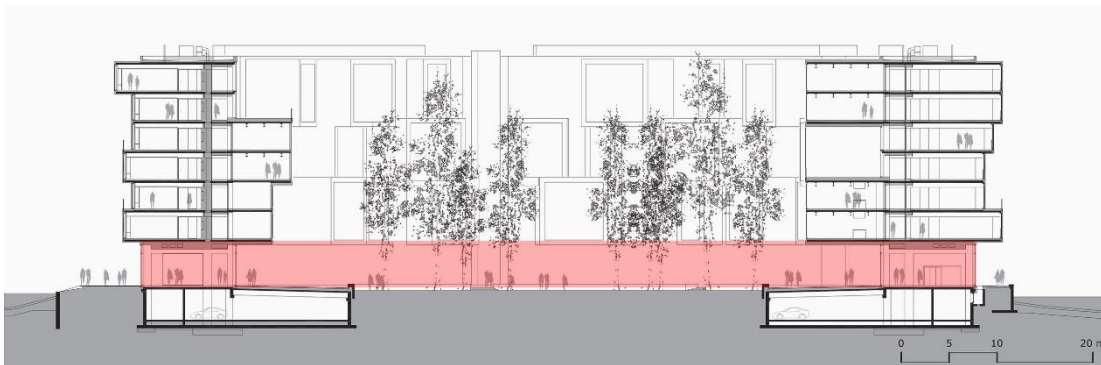
Figure 3.32: Group facilities at ground floor
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0; edited with Adobe Photoshop by the author)

3.3.3.2 Accessibility to the common space

The circular shape, as a centrosymmetric geometry, has an equality feature which means it can be approached from different directions (figure 3.33). The building mass is separated into five sections vertically. These gaps between each section link the courtyard to the street at ground level (figure 3.34). The volumes of each section projecting into central courtyard contrasts the building's monumental circular shape and presents the uniqueness of individual personality (e-architect, 2008). Garage is located on the underground level for automobile access.
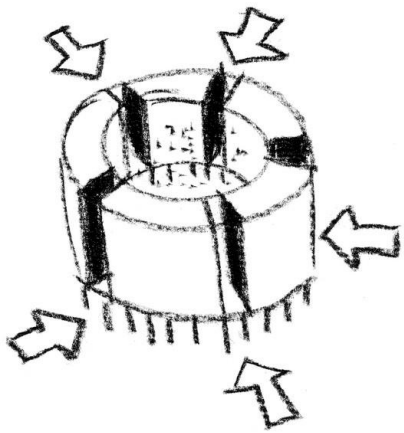
Figure 3.33: Diagram of access from different directions
(Retrieved from: https://www.archdaily.com/474237/tietgen-dormitory-lundgaard-and-tranberg-architects)
Figure 3.34: Overview of the path connecting courtyard to street
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)

3.3.3.3 Light condition

The volumes are pushed and pulled to create balconies with great view and sufficient natural light in private bedrooms (figure 3.35). The full-height glass partition with sliding American oak screen panel allows user to adjust the amount of daylight entering the room according to their need. The major part of the façade facing the central garden is glass (figure 3.36). The transparency of glazing wall not only provides visual connection between interior public spaces and the exterior courtyard, but also maximizes daily sunlight gain in these activity rooms.
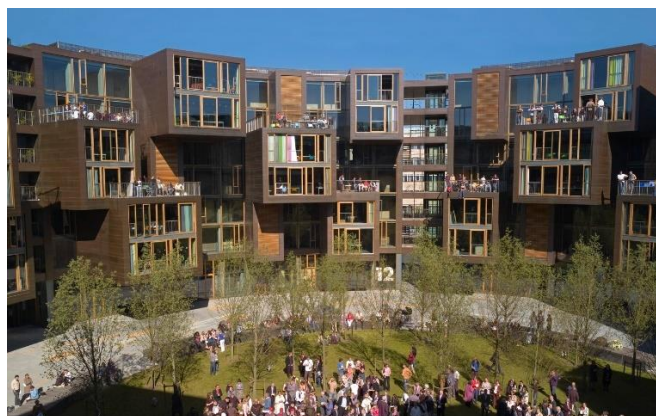
Figure 3.35: Balconies of private bedrooms gains daylight
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)
Figure 3.36: Natural light in the courtyard
(Retrieved from: https://www.archdaily.com/474237/tietgen-dormitory-lundgaard-and-tranberg-architects)

3.3.3.4 Material

The construction combines both inventive and conventional building technology with prefabrication and duplication to achieve high quality within restricted time and limited budget. The building's façade uses cooper alloy cladding (figure 3.37). The floor and ceiling system use porous magnesia flooring and expanded metal acoustic ceiling for noise control (ltarkitekter, 2021).
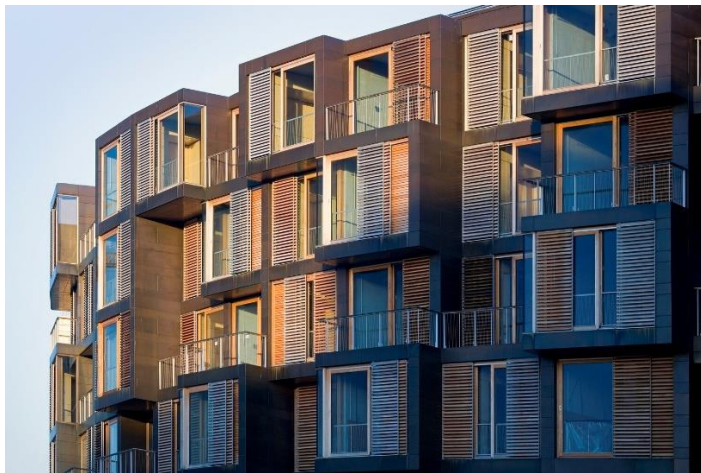
Figure 3.37: Cooper alloy cladding facade
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)

3.3.3.5 Interior decoration and furnishing

Entering from doorway into private room, each bedroom has a narrow layout with a full-height window, a single bed, a bookshelf, a desk, and a small toilet for user's convenience (figure 3.38). The interior has an exposed concrete structure and plywood finishing panels. The texture of interior plywood partitions renders a warm-tone atmosphere and provides an austere finish with detail (figure 3.39).
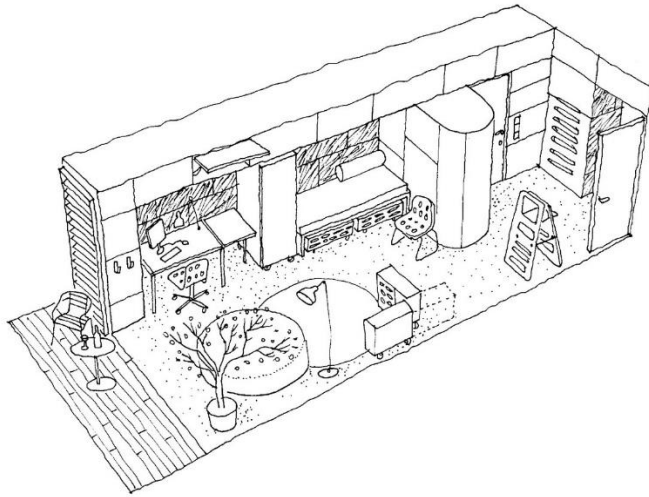
Figure 3.38: Sketch of the bedroom

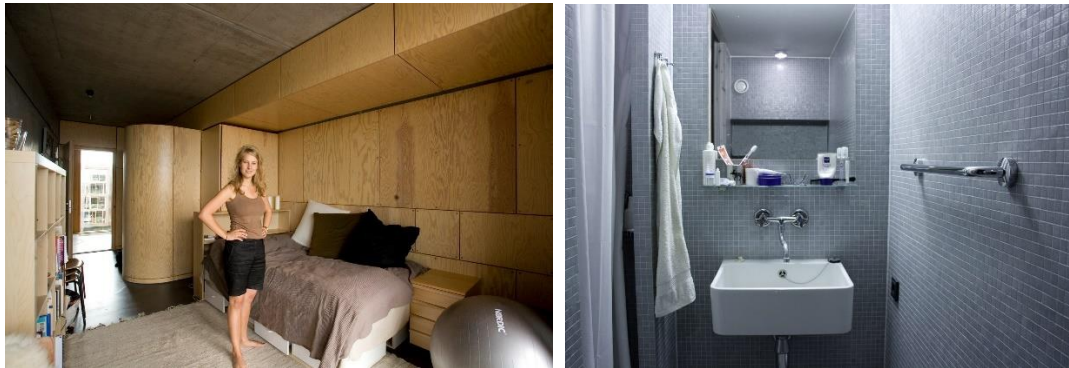(Retrieved from: https://www.archdaily.com/474237/tietgen-dormitory-lundgaard-and-tranberg-architects)

Figure 3.39: Photo inside bedroom (left) and small toilet (right)

(Retrieved from (left): https://www.ltarkitekter.dk/tietgen-en-0; (right): https://housingfoundation.dk/the-tietgen-dormitory)

3.3.3.6 Relationship between the building and the local context

The round shape of Tietgen Dormitory provides city view of the adjacent open landscape of Amager Common on the west side and the waterfront of Islands Brygge on the east (Danish Architecture Center, 2021). The design boldly stands out from the Ørestad North's rigid local urban pattern in the newly planted area, instead of blend in (figure 3.40).
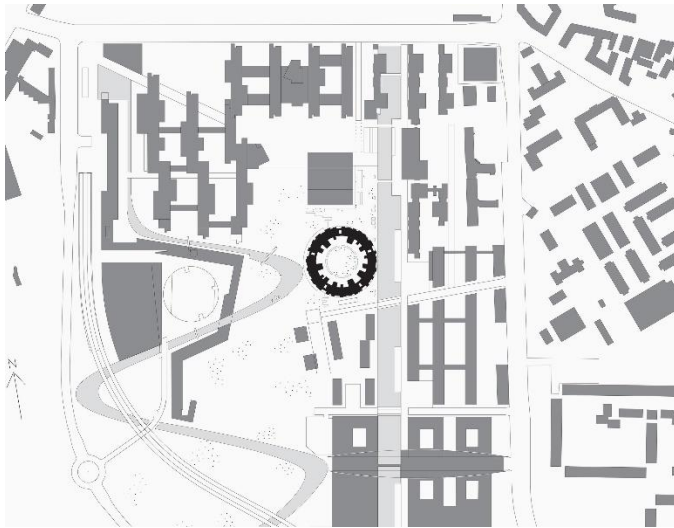
Figure 3.40: Circular building and the orthogonal structure of the site plan.
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)

3.3.3.7 Safety

The courtyard provide space for students to meet people and spend time with friends under the tall willow trees. The communal space is overlooked by eyesight in the public rooms projecting into the courtyard and the hallways on different levels surrounding it (figure 3.41). The open-air staircase in between the vertical sections has natural ventilation and brings pedestrians to the communal space as both observers and observees (figure 3.42). Group activities in these public areas are subconsciously being witnessed (figure 3.43). Research indicates that there is sufficient evidence of 'watching eyes' can reduce crime (Dear et al., 2019). The visibility in public space not only encourages spontaneous social interaction, but also provides a safer atmosphere

Figure 3.41 (left): Hallway surrounds the courtyard
(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)
Figure 3.42 (right): Open-air staircase
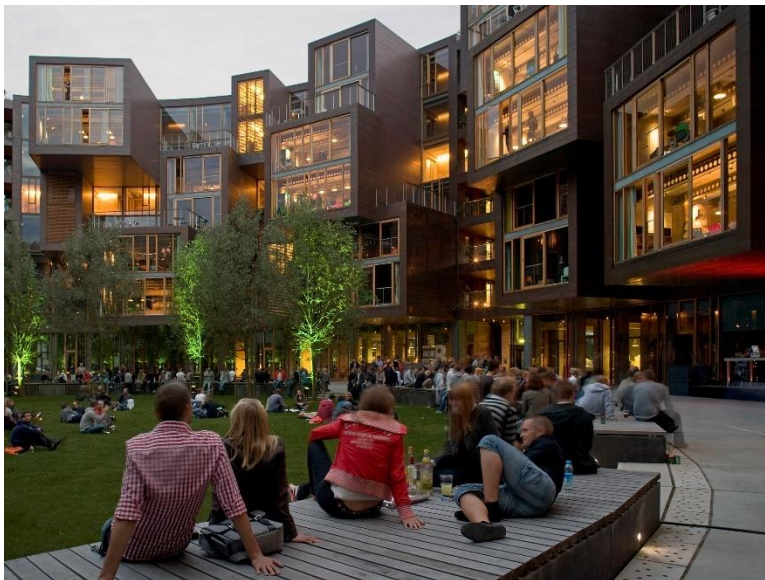(Retrieved from: https://www.ltarkitekter.dk/tietgen-en-0)

Figure 3.43: Group activity in courtyard surrounded by 'watching eyes'
(Retrieved from: https://www.archdaily.com/474237/tietgen-dormitory-lundgaard-and-tranberg-architects)

3.3.3.8 Conclusion

The hierarchy of exterior-building-interior-garden in Tietgen Dormitory is a successful case respond to local urban context. The inner garden, the courtyard, serves as a core for pedestrian circulation and public activities. It provides a visual center and a physical gathering ground to encourage social interactions and forming bonds within the student community.

3.3.4 Smarties, Uithof

Figure 3.44: Street view of Smarties Student Housing
(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

- Design: Architectenbureau Marlies Rohmer

- Location: Utrecht, The Netherlands

- Year of construction: 2008

- Number of beds: 380

3.3.4.1 Location

The student housing, 'Smarties', is located on the Utrecht University site, which used to be a monotonous cluster of university buildings on the city margins of Utrecht (Archdaily, 2011). The overall site plan of De Uithof is a 'strip of objects' designed by OMA. The 'Smarties' is a tall, thin rectangular box as one of the elements on this strip along the 'green alley' (figure 3.45). This project provides 380 individual and shared units to solve the existing problem of housing shortage for students and complete the function of the campus.
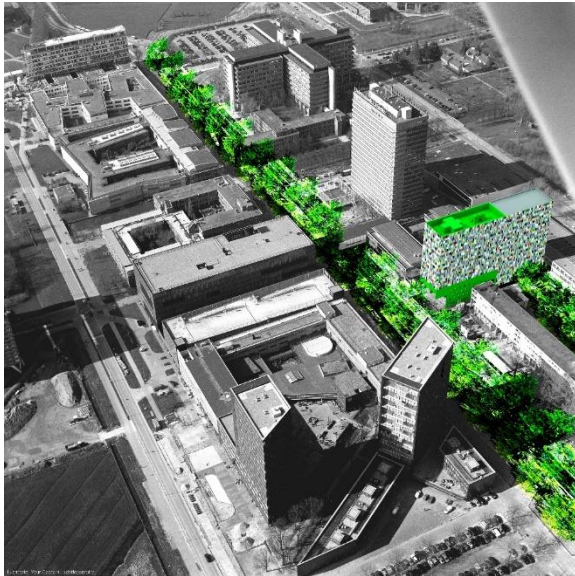
Figure 3.45: Smarties on the strip along 'Green Alley'
(Retrieved from: https://cdn.archilovers.com/projects/aaee775e-0235-4d40-bf1e-43c7c999f9b4.pdf)

3.3.4.2 Façade

The first impression 'Smarties' gives people is its colorful, scaly skin (figure 3.46). The skin sublimes 1,200 small windows with hundreds of multi-colored aluminum panels to create an image of student group which is more than the sum of the parts. The colorful panels break the appearance pattern of a rigid multi-story residential building and transform the building into a single entity as a colorful honeycomb for vibrant young adults (figure 3.46). With the visually dynamic pattern of the colorful panels, windows magically blend in and fade away (figure 3.47).
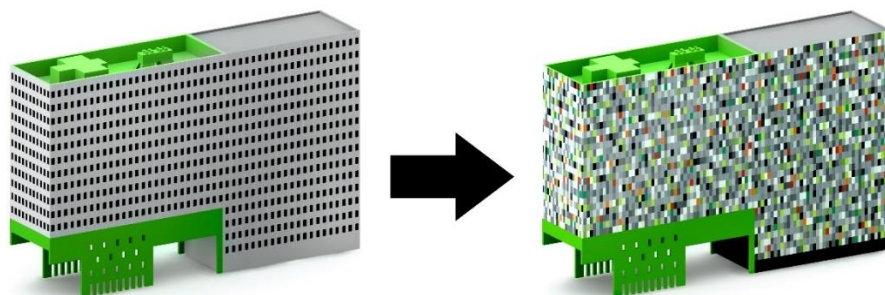
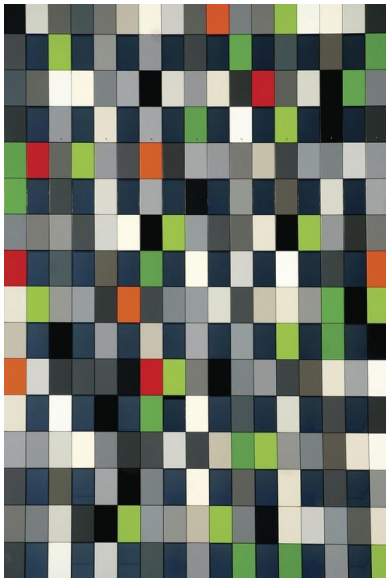Figure 3.46: Add colourful panels to break appearance pattern
(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

Figure 3.47: Windows blend in and fade away
(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

3.3.4.3 Light condition

The floor plan layout is a thin rectangle to make sure the room depth is appropriate to receive natural light. The dorms locate on both side along the corridor in the center (figure 3.48). so that the windows on the east and west façades can bring natural light source into each room.

Study shows that natural lighting both emotionally and physically benefits students who live there. PhD fellow Brenda McMahon, MD, of the Neurobiology Research Unit at the Copenhagen University Hospital in Denmark indicated that people become better at coping with anxiety-provoking experiences when they are exposed to light in the morning that mimics the wavelengths of daylight (Christensen, 2014). Because the light simply improves the communication between the regions of the brain that are central to our handling of emotions such as stress and anxiety. Study also shows that people performed 10 to 25% better on tests of mental function and memory recall when they worked in a room with daylight and a view, compared to those without (Sorensen, 2021) Not to mention that natural light is a vital source

of Vitamin D which is essential to young adults' health. Sufficient natural light gain is especially critical for north countries like Netherland, where the campus locates.
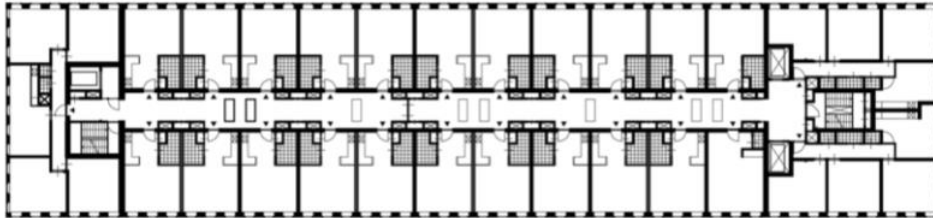

Figure 3.48: Floorplan of standard floor with bedrooms on both sides of the corridor
(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

3.3.4.4 Accessibility to the common space

Designer lifted the bulk of the structure off the ground, supporting it by four four-story tall concrete 'legs' (figure 3.49). These 'legs' project by eight meters providing the structural support for the building, created space for a basketball court on ground level and allowed people to gather under the cantilever space and try the six-people swing hanging in front of the entrance (figure 3.50). The cut-through walkway also connects the student housing with other buildings on campus with a continuous circulation at ground level.
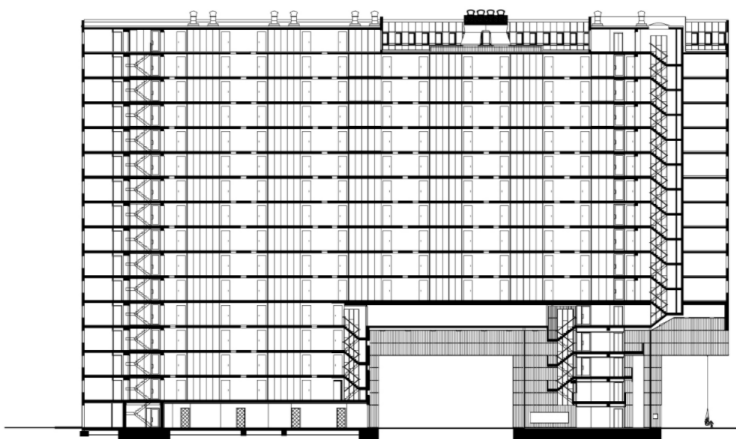

Figure 3.49: Section of the building with 'leg'
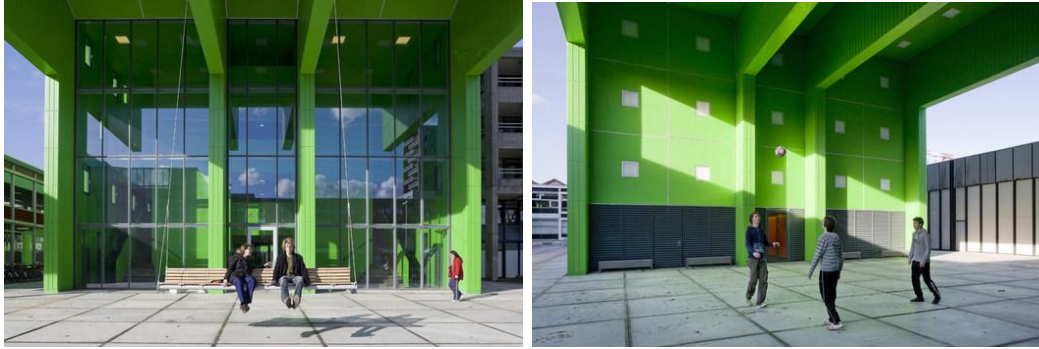(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

Figure 3.50: Space under the cantilever for grand swing (left) and basketball court (right).
(Retrieved from: https://www.archdaily.com/120265/380-student-units-and-public-space-design-architectenbureau-marlies-rohmer)

3.3.4.5 Sound control

The four-story tall exterior playground provides space for sport and gathering outside of the building which helps to reduce the influence of noise. The elevated tall structure also keeps most of the units away from the noise from ground level.

3.3.4.6 Interior decoration & furnishing

The vibrant colors are not only used on exterior envelop panels, but also on the interior wall paintings to render a dynamic and vibrant atmosphere for students who live there. Elevator lobby on each floor has a different color to make each floor more distinguishable (figure 3.51)
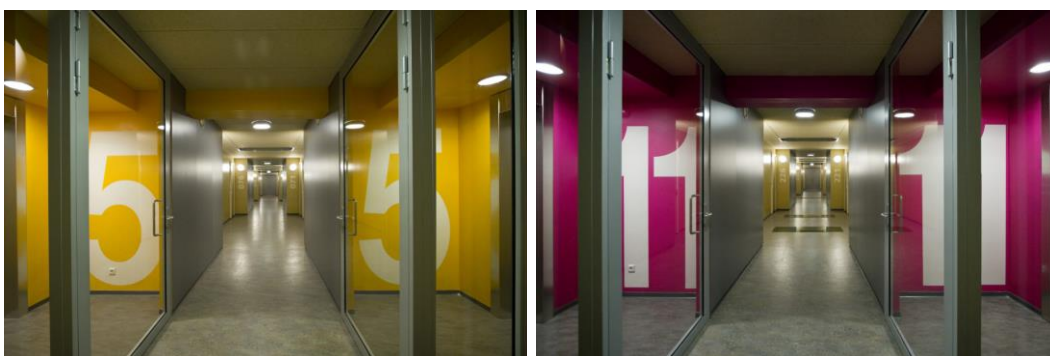

Figure 3.51: Vibrant colours painted in elevator lobby to distinguish different floors
(Retrieved from: https://rohmer.nl/en/projects/smarties-student-housing-uithof-utrecht-nl)

3.3.4.7 Conclusion

'Smarties' is a successful attempt to provide housing and socialization possibilities for students. The colorful façade is attractive. Underneath the vivid envelop, group rooms along

the staircases and corridors encourages encounters and interaction. The cantilever space in the front creates a free and playful space for people to gather spontaneously. It meets users' requirements as an affordable residential building while enhancing urban interaction and eliminating the feeling of an urban desert as a landmark on campus.

3.3.5 MIT Baker House Dormitory

Figure 3.52: Over-looking MIT Baker House Dormitory
(Retrieved from: https://listart.mit.edu/public-art-map/baker-house)

- Design: Alvar Aalto

- Location: Cambridge, Massachusetts, United States

- Year of construction: 1948

- Number of beds: 353

3.3.5.1 Location

The Baker House is located at the Massachusetts Institute of Technology (figure 3.53). The architect Alvar Aalto was a professor at the university by that time. The dormitory is on the north bank of the Charles River. The building is designed in a 'W'-shape, to provide a

unique view of the river to each room (figure 3.54). However, a one-side slab with clusters of rooms facing south is not able to accommodate enough students. Parallel blocks in echelon, fan-shaped ends, and the "giant gentle polygon" were added onto the initial sketch to increase density of the building. (ArchDaily, 2010) Alvar Aalto's creative design promotes communication and interaction among all residents on six floors by having open study areas and lounges, as well as a luminous dining hall overlooking the Charles River. His design strategy makes the dormitory both a place for the residences to live and a case to study.
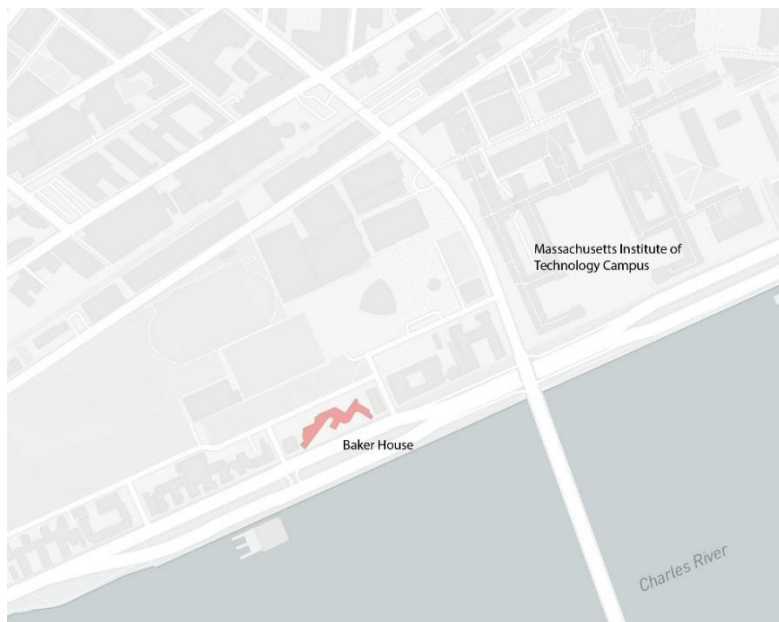

Figure 3.53: Location of Baker House in MIT campus site
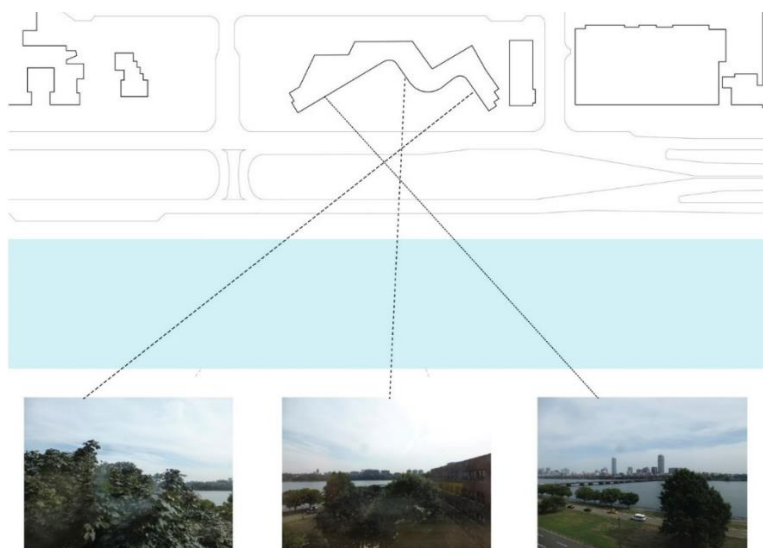(Made with adobe illustrator and mapbox by the author)

Figure 3.54: Views of the river in each dorm
(Retrieved from: https://www.souheilbm.com/housing-complex; Edited with Adobe Photoshop)

3.3.5.2 Accessibility to the common space

There are a lot of public areas with different functions in Baker House for students' diverse activities. These areas including lounges on each floor, a gym, a dance room, a laundry room, a music room, a group study room, a quite study space with natural light, and printing room encourage students to communicate and bond (figure 3.55 and figure 3.56) To link these spots, hanging staircases serves as the vertical access, providing an increasingly dramatic view of MIT as one ascends (figure 3.57).

Figure 3.55: lounge (upper left), gym (upper right), dance room (lower left), laundry room (lower right).
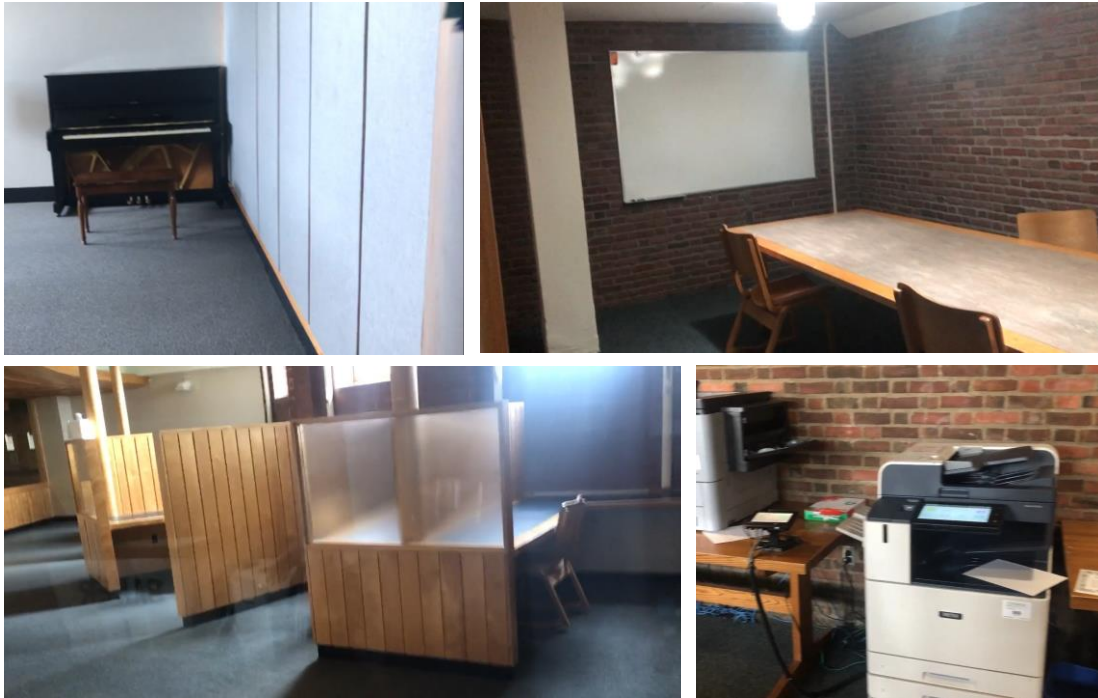(Retrieved from a video in: https://mitguidetoresidences.mit.edu/map/baker-house)

Figure 3.56: music room (upper left), group study room (upper right), quite study space (lower left), printing room (lower right).

(Retrieved from a video in: https://mitguidetoresidences.mit.edu/map/baker-house)

Figure 3.57: ascending staircase form exterior (left) and interior (right)

(Retrieved from a video in: https://www.archdaily.com/61752/ad-classics-mit-baker-house-dormitory-alvar-aalto?ad_medium=gallery)

3.3.5.3 Material

The façade is built with dark rustic bricks, the modular pieces come together to create curve-shaped building outline. However, Aalto was unsatisfied with the consistency of American bricks and hired the worst brick maker in Boston instead (Nicas, 2021). The wood

kiln scorches brick surface so that the architect could take advantage of the maximum variability of product and create a façade with unique texture (figure 3.58). The rectangular dining hall attaching to the dormitory is built with solid limestone to exaggerate the contrast between dynamic and static (figure 3.59). Structural columns covered in plaster on the lower floor are cladded with timber on the upper floor to reflect the trees in the view.

Figure 3.58: warped brick on Baker House's façade
(Retrieved from: https://www.spillmanfarmer.com/blog/human-industry-aalto)

Figure 3.59: the contrast between brick curve and straight limestone walls
(Retrieved from: https://baker.mit.edu/about/)

3.3.5.4 Light condition

With the ingenious wave-shaped building, these south facing dormitory unites are not only provided with beautiful view of Charles River but also sufficient natural light exposure (figure 3.60). When sunny southern daylight disturbing student's study and resting, a blind and be pulled down to block the extra light (figure 3.61). Natural light fills the dining pavilion from

a grid of overhead skylights and corridor is lit with circular lights (figure 3.62 and 3.63).

Figure 3.60: students' dorm with sufficient natural light
(Retrieved from: https://baker.mit.edu/about/rooms/617/)

Figure 3.61: adjustable blinds control light exposure in the room
(Retrieved from: https://baker.mit.edu/about/rooms/617/)

Figure 3.62 (left): dining room with overhead skylight

(Retrieved from: http://perrydean.com/mit-baker-house)

Figure 3.63 (right): corridor with circular lights

(Retrieved from: https://www.archdaily.com/61752/ad-classics-mit-baker-house-dormitory-alvar-aalto?ad_medium=gallery)

3.3.5.5 Renovation in 2002

The renovation by Perry Dean Rogers Partners Architects in 2002 upgraded existing facilities and added a new roof terrace as outdoor interactive space for students living in the building (figure 3.64). New glazing system was installed to improve light condition and allowed original illuminate features to operate more efficiently. These changes accommodated contemporary needs while retaining the original design.

Figure 3.64: roof terrace

(Retrieved from: http://perrydean.com/mit-baker-house)

3.3.5.6 Interior decoration and furnishing

The dorms were designed into different shapes, including single bedrooms and double bedrooms, to fit the curve of "W" shape (figure 3.65). Every bedroom is equipped with a sink for students' convenience. All rooms have the same theme as exposed rustic brick walls and wood furniture (figure 3.66). And some room have a column inside as load bearing structure (figure 3.67).
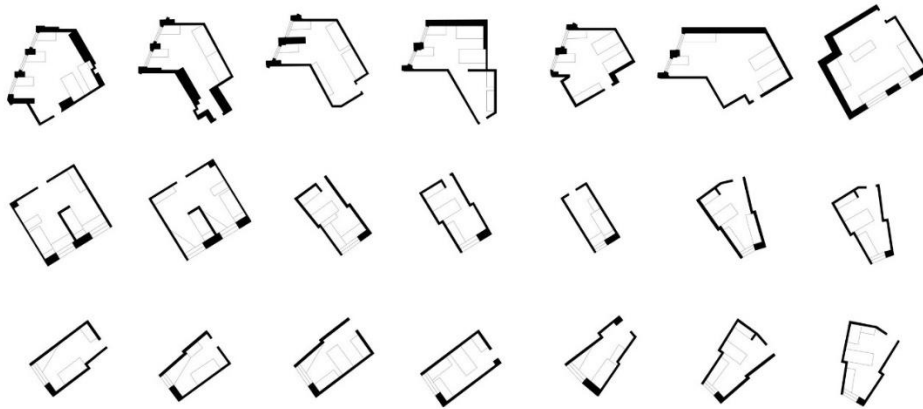
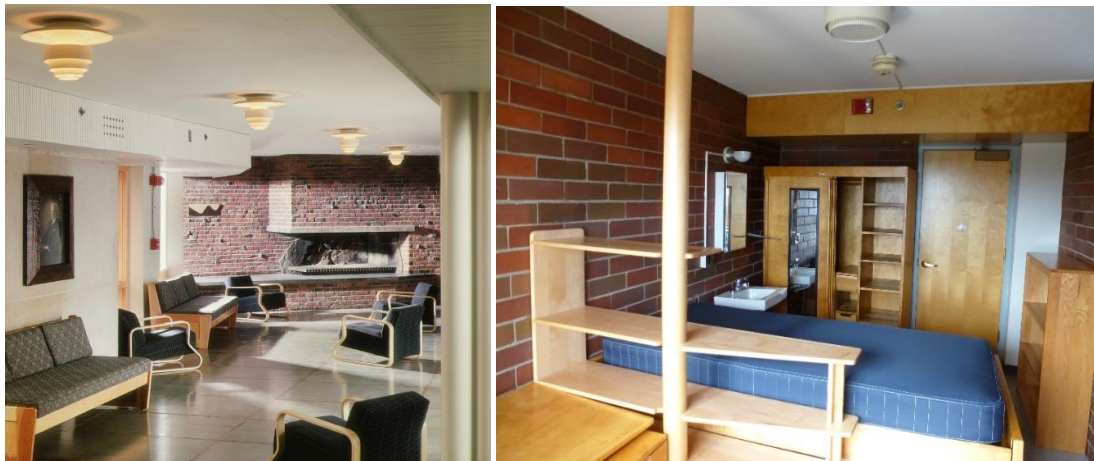Figure 3.65: Different shapes of bedrooms.

(Retrieved from: https://www.souheilbm.com/housing-complex; Edited with Adobe Photoshop)

Figure 3.66 (left): rustic brick wall and wood furniture
(Retrieved from: http://perrydean.com/mit-baker-house)
Figure 3.67 (right): wood cladding column
(Retrieved from: https://baker.mit.edu/about/)

3.3.5.7 Conclusion

According to MIT's guide to residence website, students refer to Baker House as a great place to live on the water with excellent proximity to campus and great people. The introduction emphasized that Baker is a place where everyone becomes comfortable with everyone. The public zone provides opportunities for students to congregate on the weekends to hang out, or on weekdays to work in the lounges. The Baker residences forms a very social and friendly community. The dining hall also attracts students from other dorms to come and eat. The private

zone guarantees nice quality of living with sinks, which approves incredibly useful by residents, and nice furniture including couches. Overall, Baker House is successful case to encourages student's social interaction as a building and establishes a great community where residents can meet great people, make great friends, and have a ton of fun while making their way through an awesome time at MIT (*The guide to Residences*).

3.3.6 Simmons Hall at MIT

Figure 3.68: Simmons Hall dormitory in MIT
(Retrieved from:
https://en.wikipedia.org/wiki/Housing_at_the_Massachusetts_Institute_of_Technology#/media/File:Simmons
_Hall,_MIT,_Cambridge,_Massachusetts.JPG)

- Design: Steven Holl Architects

- Location: Cambridge, Massachusetts, United States

- Year of construction: 1999-2002

- Number of beds: 350

3.3.6.1 Location

Simmons Hall in Massachusetts Institute of Technology campus is a ten-story tall, 382 feet long vertical slice of a city on the Vassar Street edge along the Briggs Athletic Field (Figure

3.69). MIT asked Steven Holl to design a residence hall that fosters social interaction among students. The architect developed several proposals and the "sponge", a monolithic box interspersed with curved open spaces, became the final design. This design attempted to balance between client's demand of function and architect's aesthetic desire of an artistic and memorable architecture. It also balances between architectural elements, such as solids and void and opaqueness and transparency.
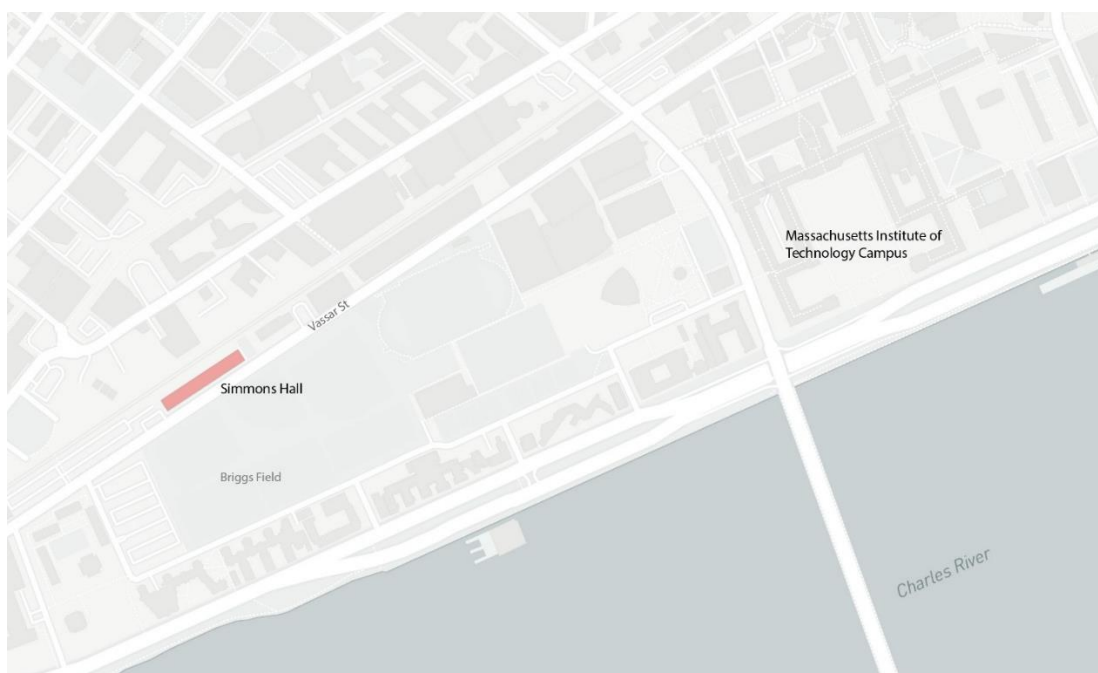

Figure 3.69: Location of Simmons Hall in MIT campus site
(Made with adobe illustrator and mapbox by the author)

3.3.6.2 Structure

Because of the building has a free-standing position in urban fabric and is a "living front" for the residential area to be built to the north of it, it's important for Simmons Hall to not visually block the view and be light and "permeable".

The system "PerfCon" was applied to achieve a transparent skin of the building. The system is invented by engineer Guy Nordenson and consists of a series of precast reinforced concrete panels (Architect, 2012). The structural model of Simmons Hall generated by

computer shows areas that are critically over stressed due to long spans and bent spans over open corners (figure 3.70). To relieve the stress, this system created a gridded façade structure which is perforated with more than 3,000 windows in the size of 2' x2' (Architect, 2012).

During construction, the bedrock was found to be too deep to reach and the soil was incompetent to support friction piles. An amount of soil of weight equals to the building above was excavated to equal the pressure of building and the soil that had been removed. A thick solid concrete matt foundation evenly distributes the building load to ground (Architect, 2012).
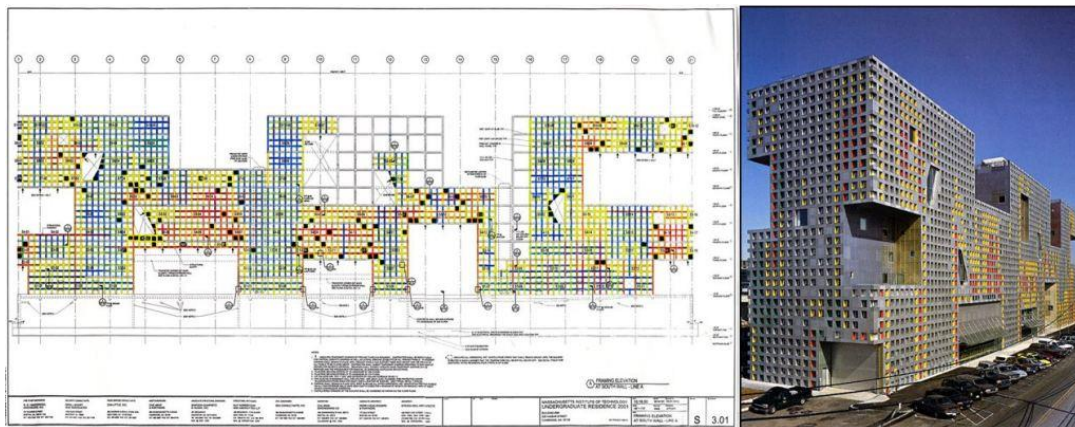

Figure 3.70: Structural model by computer and façade with PerCon system
(Retrieved from: https://understandingstructures.wordpress.com/2012/01/08/frame-example-2-of-2-simmons-hall/simmons-2/)

3.3.6.3 Material

The concrete-coated aluminum panels as exterior wall is reinforced with metal bars. The diameter of the bars varies according to the force applied on them (Architizer, 2016). Color on the head and jamb of the windows reveals the size of the reinforcing steel bars behind them (figure 3.71). Thus, the red bar is the largest diameter with highest resistance, then it goes to orange, yellow, green, and blue with diameter of bars getting smaller, until the aluminum panels without painting, which receive lowest load (WikiArquitectura, 2020).
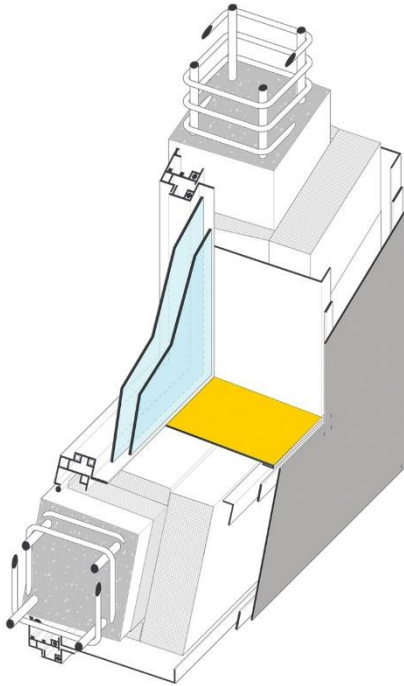
Figure 3.71: Detail of structure and material
(Retrieved from: https://architizer-prod.imgix.net/mediadata/projects/022010/46b9a2cc.jpge)

3.3.6.4 Light condition

The building has a famous porous structure therefore has been referred as a "sponge" by both architect and students. In original drawing, a set of wide-open curved atrium space cutting deep into the building performs as cavity in a sponge by soaking natural light down into the building (figure 3.72). These dynamic interior atrium space contrasts with the rigid rectilinear exterior and serve as focal point for students to interactive and promote flow throughout the entire building (figure 3.73).

The eighteen-inch setback of windows on the wall, as a large parasol, shades room against direct sunlight to keep cool during summer, while allows low-angled winter sun to warm up the space in winter months (StevenHoll, 2021).

Light patterns form the windows at night resemble a rhythmic and magical city skylight (figure 3.74).

Figure 3.72 (left): skylight in the atrium
(Retrieved from: https://architizer.com/idea/131087/)
Figure 3.73 (right): social space under the skylight
(Retrieved from: https://architizer.com/idea/131087/)

Figure 3.74: night view simulates rhythmic skyline
(Retrieved from: https://www.archute.com/mit-simmons-hall-steven-holls-sea-sponge-in-mit/)

3.3.6.5 Ventilation

There are nice operable windows in each cell. When opening both top and bottom windows, warm air rising and circulating out from top window and fresh air breezing in from the bottom (Architect, 2012). So that resident could enjoy natural ventilation within the high-

ceiling room (figure 3.75).

The original design of the vertical atriums would circular air up through the section (figure 3.76). However, these atriums, defining as smoke chimney in fire safety regulation, are reduced in size and closed from hallways (Roberts, 2004).
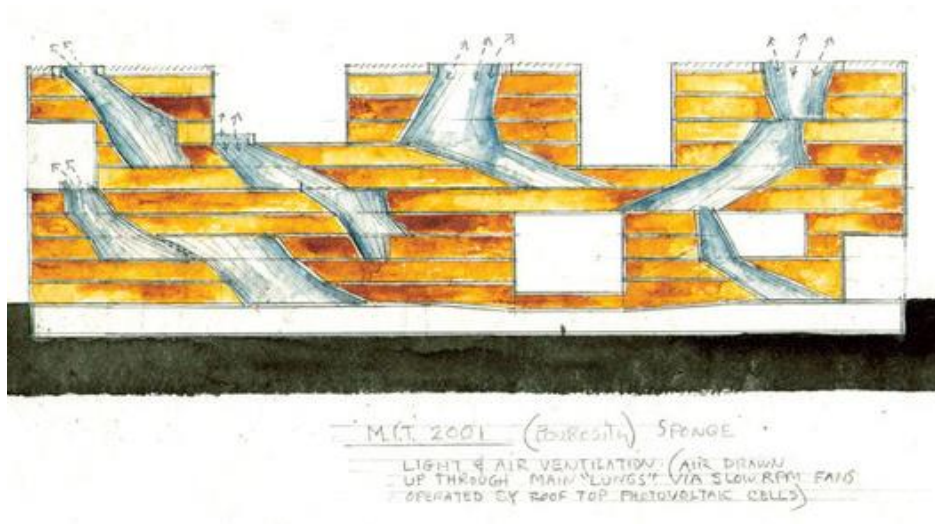

Figure 3.75: original drawing of light and air ventilation atrium
(Retrieved from: https://www.architectmagazine.com/project-gallery/simmons-hall-massachusetts-institute-of-technology)

Figure 3.76: operable window
(Retrieved from: https://architizer.com/projects/mit-simmons-hall/)

3.3.6.6 Accessibility to the common space

The architectural discontinuous feature in Simmons develops unique way to foster

friendship and community among residents. There are various types of public shared amenities, including a 125-seat theater, a night café, a street level dining room with a special awning and outdoor tables (figure 3.77), a lot of lounges with curvy chalk walls (figure 3.78), and even a ball pit room (figure 3.79). These public spaces enrich students after class activities and make Simmons Hall a "slice of city" instead of simply a place to stay and sleep. To further enhance the urban conditions, the interior corridors connecting room are 11 feet wide as the width of streets (figure 3.80). As in the previous case study of Alvar Aalto's Baker House, the hallway provides opportunities to meet new people and have small talks and activities beyond its circulation function.

Figure 3.77: Street level dining room
(Retrieved from: https://www.stevenholl.com/project/mit-simmons-hall)

Figure 3.78: small lounge with curvy chalk wall

(Retrieved from: https://mitguidetoresidences.mit.edu/map/simmons-hall)
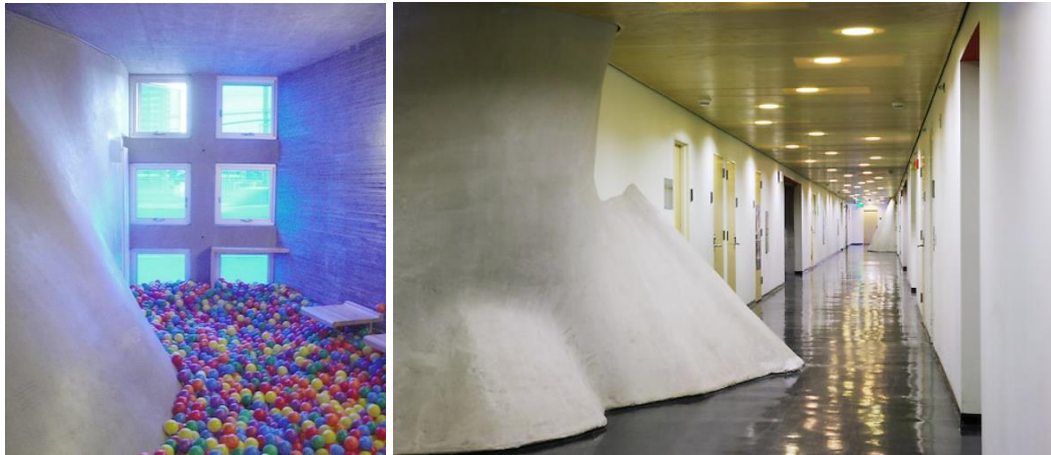
Figure 3.79 (left): Ball pit room

(Retrieved from: https://twitter.com/artsatmit/status/870297951419158528)

Figure 3.80 (right): interior "Street"

(Retrieved from: https://adamlaipson.photoshelter.com/image/I000077coTuxLUzc)

3.3.6.7 Interior decoration and furnishing

Steven Holl also custom-designed room furniture for Simmons Hall to match the aesthetic quality of the building (Ratti &Dorsey, 2008). The furniture is a series of modular components made of wood that allows students to assemble and rearrange (figure 3.81). Even detail installations are also carefully designed (figure 3.82).
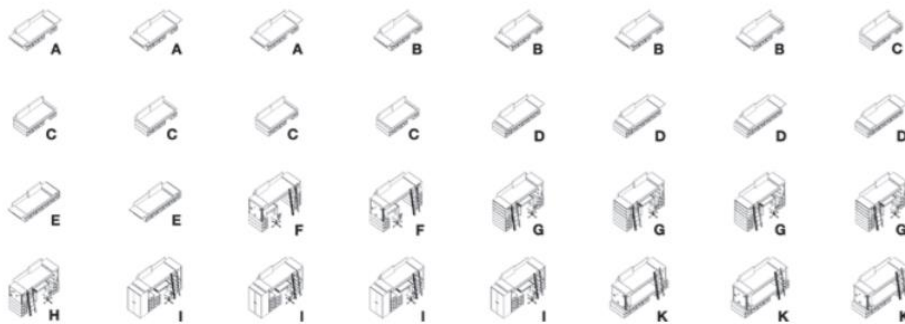

Figure 3.81: different configuration of furniture in dorm

(Retrieved from: https://www.cca.qc.ca/cca.media/files/3223/2990/Inside_the_Sponge_int.pdf)

Figure 3.82: door handle with perforated engraving detail
(Retrieved from: https://architizer-prod.imgix.net/mediadata/projects/252010/2e07592a.jpg)

3.3.6.8 Conclusion

The original design of Simmons Hall was compromised several times. The ideal atrium which could break the separation between floors becomes small and enclosed from hallways due to fire code. Student access to outdoor terraces which could be a perfect space for students to hang out is restrained because of safety concerns. Jeff Roberts, a former resident in Baker House and a member of Simmons Hall's design Founder Group insists that Simmons Hall failed to provide an environment for students to form an interactive community as the Baker House. He claims that architect would rather compromise the use and function of building instead of aesthetic feature (Roberts, 2004). However, the architectural design also inspired residents in Simmons Hall.

A competition organized by resident visiting scholar, architect Carlo Ratti in 2005 collected many creative proposals from students for new and innovative uses of the building and entered an exhibition in Montreal. Sometimes, an architecture provides more than a comfortable living condition but stimulates user's thinking about living, especially when the

users are young adults in college. The fact that Simmons Hall has consistently ranked at the top of MIT student preferences since its opening in 2002 also proves students' appreciation of the building (Ratti &Dorsey, 2008). Even not idealistic, Simmons Hall is still both "rational and intuitive" and creates a lively, well-lit urban condition in a completely enclosed structure.

3.3.7 RMIT Bundoora West Student Accommodation

Figure 3.83: Walert House
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

- Design: RMA

- Location: Bundoora, Australia

- Year of construction: 2016

- Number of beds: 372

3.3.7.1 Location

RMIT Bundoora West Student Accommodation (BWSA) also known as Walert House is the first student housing on Bundoora campus RMIT. It locates in the Northwest sector of the Bundoora campus along McKimmies Road with a two-minutes' walk to Bundoora West campus and a 14-minute walk to Bundoora East campus or take the courtesy bus (RMIT, 2021).

3.3.7.2 History

The site is along Aboriginal heritage named after a clan ancestor, who was present at the signing of a treaty marking European colonists' arrival. This culturally significant site of the building is surrounded by ancient redgums (Arch2o, 2021). The trees bear original scar dating back to the cultural origin and scars caused by fire later (figure 3.84). The building keeps an appropriate distance from these trees to protect them (figure 3.85).

The land use to have a diversified and unique bio-environment. It was once covered by red gums and wattles, with a layer of kangaroo grass and yam daisy, whose tubes were an Aboriginal dish. Among these plants, there were kangaroos, goannas, snakes, birds of prey, ground dwelling birds, beetles, ants, and grasshoppers (ArchDaily, 2016). Local group is working to restore the area ecological environment and species diversity.

The architectural design of BWSA responds to the historic site and dedicates to use wood as main material and to develop a sustainable building. The hub is lifted from ground floor with timber beams to imitate the trees surrounding it (figure 3.86).

Figure 3.84: Ancient red gums
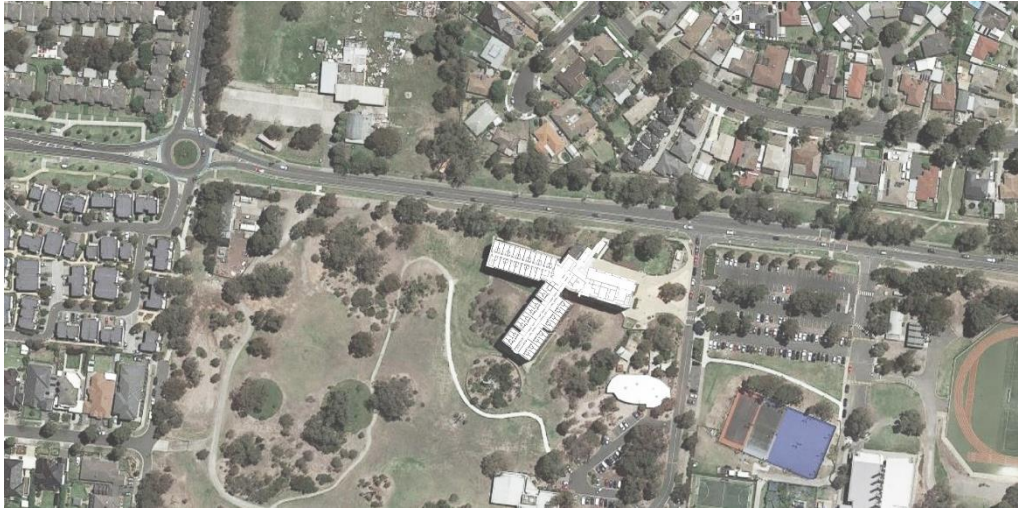(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

Figure 3.85: Skewed cross plan to avoid trees on site

(Retrieved from google map and edited with Adobe Photoshop)

Figure 3.86: Timber beams on ground floor

(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

3.3.7.3 Accessibility to the common space

The plan of BWSA building is a skewed cross with three wings intersecting at the multipurpose hub as the educational central core (figure 3.87). This central hub is a double-height space with different zones from large gathering spaces on the lower levels to quitter space on upper level.

Unlike the previous cases, BWSA is managed by a specialist operator, UniLodge company, instead of self-managed by students. The professional pastoral care provided by the company helps maintaining public facilities (Arch2o, 2021).

There are common rooms, shared kitchen for group cooking (figure 3.88), TED Talk zone with study and relaxing area in the central hub (figure 3.89). The Den and Deck area is dedicated game zone. For those who need a quite space to study, there is a learning area with project room and meeting room (figure 3.90). Students can also find a paid laundry room and car parking space at their convenience.
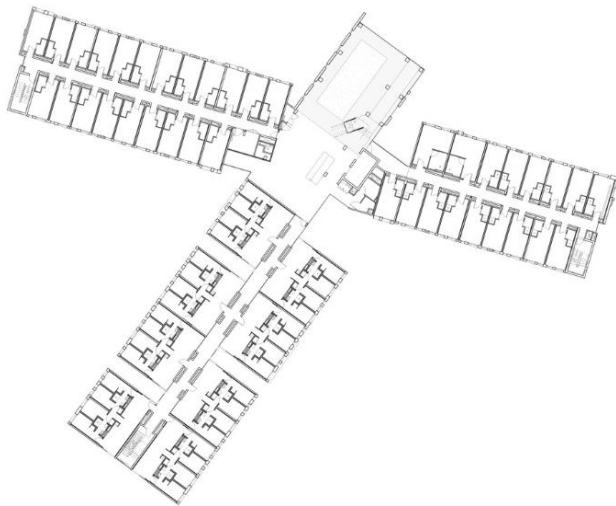

Figure 3.87: Accommodation wings intersecting at central hub
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

Figure 3.88: shared kitchen
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)

Figure 3.89: studying and relaxing area in central hub
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)

Figure 3.90: project room
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)

3.3.7.4 Materials

The central hub has a timber structure and exposed wooden beams with laminated veneer lumber (LVL), contrasting with the black zinc and powder coated aluminum on accommodation wings (figure 3.91) (Arch2o, 2021). Acoustic insulate material is installed to control noise between public activity area and private resting accommodations (figure 3.92).

There is a large outdoor wooden deck and timber seats on large, grassed forecourt for students to gather and enjoy.

Figure 3.91: contrast between materials in central hub and accommodation wing
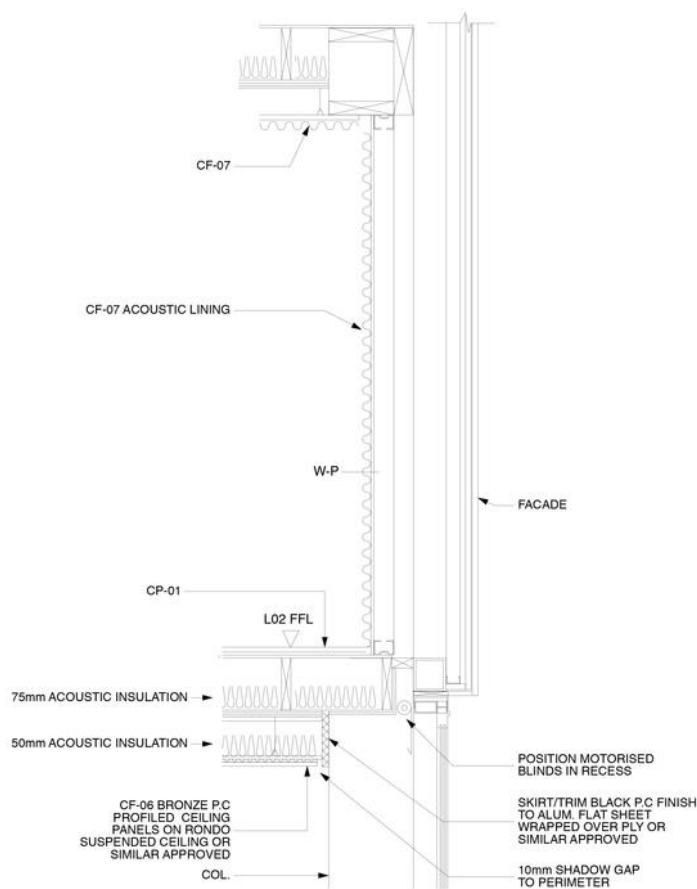
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

Figure 3.92: Detail section drawing of acoustic insulation

(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

3.3.7.5 Relationship between the building and the local context

The building meets the requirement of green design by using thermal chimneys, window actuators, and solar hot water systems. Furthermore, it possesses advanced environmental features, such as underground storm water retention tank and separate rainwater

storage and reuse to flush toilet and irrigate landscape, a large landscape swale- a water harvesting channel built on the contour of the landscape for passive water management, motion detector-controlled lighting/air conditioning in common area, and an allowance for future connectivity to RMIT Sustainable Urban Precincts Program (ArchDaily, 2016).

3.3.7.6 Interior decoration and furnishing

Wood is used as the main theme in interior public space, such as staircases and corridors, to create a welcoming and inviting atmosphere for residents. Tasmanian oak flooring is adapted in the hub and main staircase (figure 3.93). Exposed plywood has been used in the hub's ceiling as kitchen ceiling, in private apartments as interior walls, and in common areas to line all corridor walls throughout the building (figure 3.94). The interior wood furnish can also be seen from the street through the full-height glazing (figure 3.95).

Figure 3.93: wood flooring in main staircase
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)

Figure 3.94: Plywood veneer in corridor (left) and private apartment (right)
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)
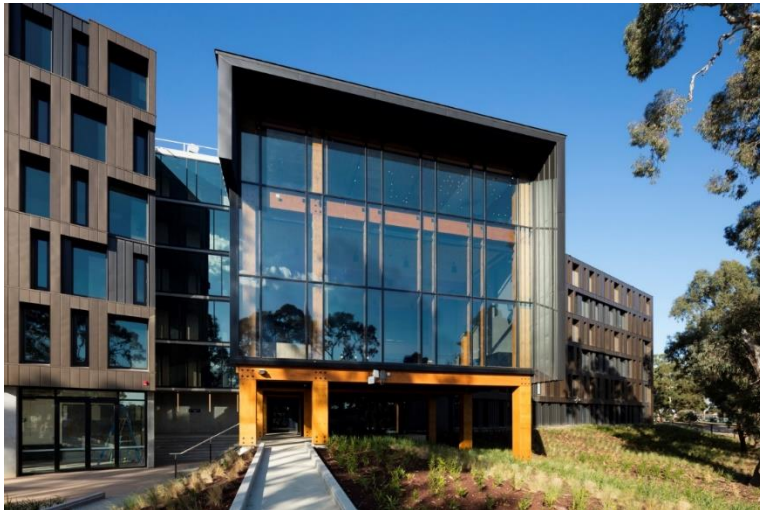
Figure 3.95: full height glazing reveals interior finish
(Retrieved from: https://www.arch2o.com/walert-house-richard-middleton-architects/)

3.3.7.7 Conclusion

RMIT Bundoora West Student Accommodation provides a slightly different yet successful approach to foster student's social interactions. Instead of interspersing public space in the residential building, BWSA combined a public building for activities with a building for private accommodation to form a comfortable and convenient complex for student community. Furthermore, locating on the special historic site, the building focus on environmentally friendly building techniques becoming a great model case to study and learn from.

3.3.8 La Trobe University Student Accommodation

Figure 3.96: La Trobe University Student Accommodation
(Retrieved from: https://www.latrobe.edu.au/accommodation/locations/melbourne/north-and-south)

- Design: Jackson Clements Burrows Architects

- Location: Melbourne, Australia

- Year of construction: 2020

- Number of beds: 624

3.3.8.1 Location

La Trobe University student accommodation also locates in Bundoora, Australia as the previous case. The master plan is consisted of two towers in sweeping arc shape along the site's northeastern and southwestern corners (figure 3.97). The overall layout, as a set of offset brackets, defines a strong edge to the campus context, links to the campus streets with winding path, and forms a semi-private courtyard in the center (figure 3.98). With sight and noise been blocked by towers, the center yard provides a visual focal point of the building and forms a inner garden for students to meet new people and hang out. This residence hall is part of a master plan to construct the campus into a University City in the future (JCBA, 2021).

Figure 3.97: Master plan of the building

(Retrieved from: https://www.archdaily.com/959330/la-trobe-university-student-accomodations-jackson-clements-burrows-architects?ad_source=search&ad_medium=projects_tab)

Figure 3.98: center courtyard

(Retrieved from: https://www.archdaily.com/959330/la-trobe-university-student-accomodations-jackson-clements-burrows-architects?ad_source=search&ad_medium=projects_tab)

3.3.8.2 Facade

The building's façade consists of thousands of prefabricated Aluminum panels (figure 3.99). Those panels on the outside of the brackets are painted in white and grey to present a regular and neutral outlook to fit in with other buildings and trees in the area (figure 3.100) (Abdel, 2021). Wandering along the path to the center courtyard, the façade's colour becomes bright and vibrant to light up student's mood and encourage social interactions (figure 3.101).

The colour spectrum is applied to the façade with consideration. It indicates a progression from whites, silver and grey of eucalyptus trunks to the vibrant colours found in the details - greens, pinks and reds in the gum leaves, and burnt oranges in the bark fissures (JCBA, 2021).
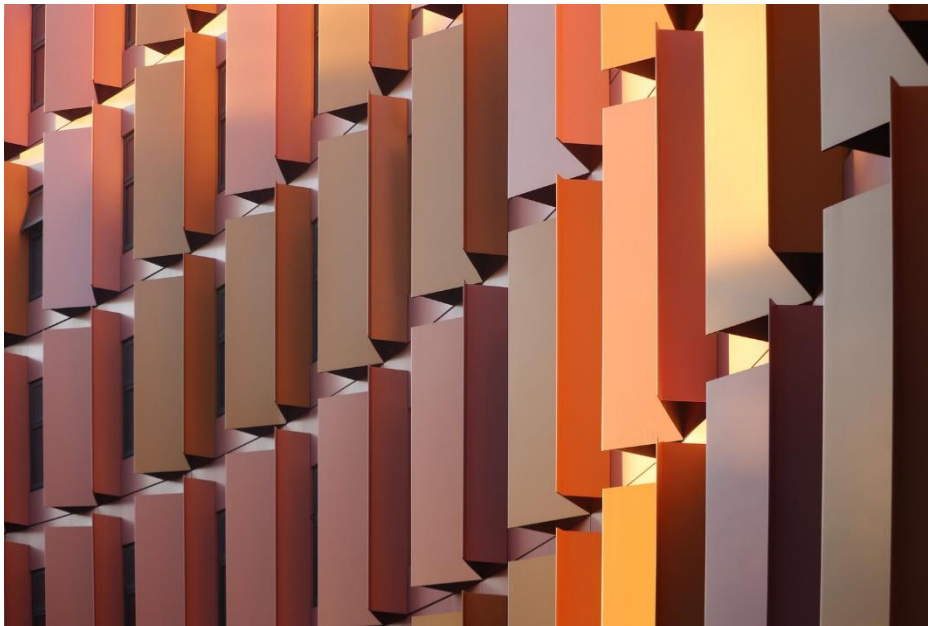

Figure 3.99: Prefabricated aluminum sun panels
(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.100: Grey scale façade facing exterior

(Retrieved from: https://www.archdaily.com/959330/la-trobe-university-student-accomodations-jackson-clements-burrows-architects?ad_source=search&ad_medium=projects_tab)

Figure 3.101: colour palette façade facing center courtyard

(Retrieved from: https://www.archdaily.com/959330/la-trobe-university-student-accomodations-jackson-clements-burrows-architects?ad_source=search&ad_medium=projects_tab)

3.3.8.3 Light condition

The building is oriented to receive better natural light. Glazed curtain wall is installed on the ground level in public space to increase visual connection between inside and outside for pedestrians (figure 3.102). Aluminum cladding panels are thermal break which forms a high-performance façade (Abdel, 2021). The panels are folded in angle to allow natural illumination while shading excessive direct sunlight. The reflection of glazing protects privacy for upper-level private bedrooms (figure 3.103) The insufficient natural illumination in corridors is enhanced with artificial pendant light (figure 3.104).
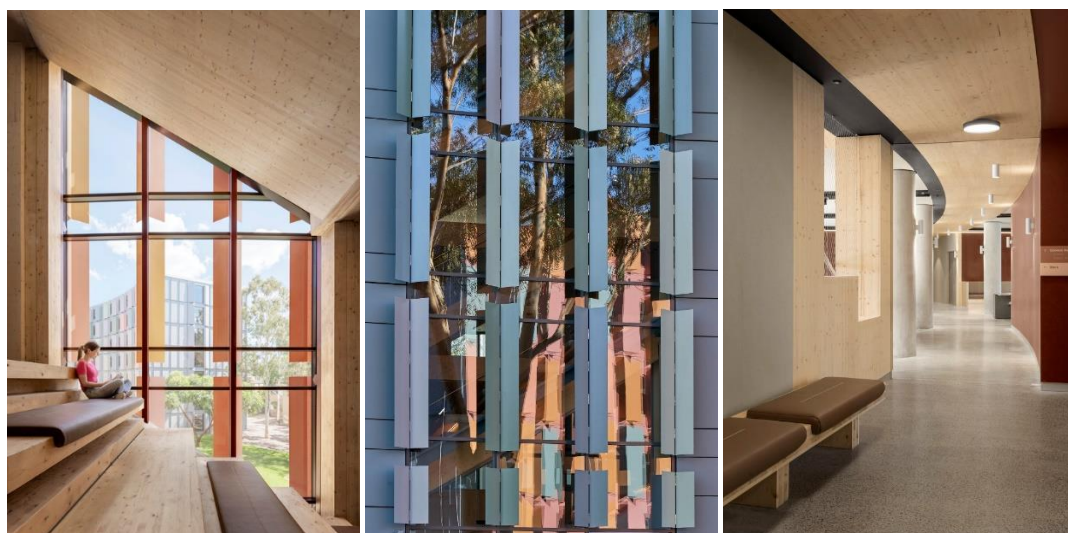

Figure 3.102 (left): Natural light through glazed curtain wall

(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.103 (middle): glazing reflection protects privacy

(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.104 (right): artificial light in corridor

(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

3.3.8.4 Material

The building is one of the projects with massive use of timber in Australia. Over 75%

of floor and roof area and over 90% of the walls and columns are constructed in Cross Laminated Timber and Glulam Timber (Abdel, 2021). The mass timber performs well in fire engineering and acoustic performance. It also creates a warm tone for interior finish, especially in the central common room climbing up through the building's core and reveals the nature of construction (figure 3.105). 20-meter-tall glulam columns references to the large gum retained in the central courtyard with respect (figure 3.106).

Figure 3.105: Exposed timber structure
(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.106: Large gums on site
(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

3.3.8.5 Accessibility to the common space

The student accommodation is equipped with public amenities such as shared kitchen for communal gourmet cooking (figure 3.107), study lounge for group projects (figure 3.108),

and lounges on each floor for casual talk with neighbors (figure 3.109).

There is a relaxing area besides the central circulation core (figure 3.110). The area is separated from the stairs with metal mesh screen to allow visual connection and promote chance encounters and spontaneous social interactions between student residents.

Figure 3.107: shared kitchen
(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.108: study room
(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.109: small lounge

(Retrieved from: https://www.jcba.com.au/projects/la-trobe-university-student-accommodation)

Figure 3.110: public space separated from stairs by metal mesh screen

(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)

3.3.8.6 Interior decoration and furnishing

La Trobe University Student Accommodation provides both single occupancy studios and 4-, 5-, and 6- bedroom units to meet the needs of different student groups (figure 3.111). Both types include amenities including kitchenette, bathroom, wardrobe, heater, and common area for student's convenience (figure 3.112).

Figure 3.111: interior of single studio (left) and multi-bedroom unit (right)

(Retrieved from: https://www.latrobe.edu.au/accommodation/locations/melbourne/north-and-south)

Figure 3.112: kitchen in single studio (left) and multi-bedroom unit (right)
(Retrieved from: https://www.latrobe.edu.au/accommodation/locations/melbourne/north-and-south)

3.3.8.7 Conclusion

As the previous case of RMIT Bundoora West Student Accommodation, La Trobe University Student accommodation is also a five-star green building (JCBA, 2021). They both are good examples of fitting the building into surrounding nature context and bring natural elements into the building. This environmentally friendly building method not only enhanced connection between building and site but also creates a comfortable environment for student to live, interact with others, and immerse in excellent nature landscape.

This case, unlike Baker House, arranges different types of bedrooms on both side of the curve. Multi-bedroom units locate on the longer outer perimeter of the arc, while single studios densely locating on the inner perimeter with a view into central year. This arrangement provides potential social connection for both types of bedrooms and increases overall population density in the building to form a community.

3.3.9 Residence Hall of Presbyterian University and Theological Seminary

Figure 3.113: Rendering of the residential hall
(Retrieved from: https://www.latrobe.edu.au/accommodation/locations/melbourne/north-and-south)

- Design: SAC International

- Location: Seoul, South Korea

- Year of construction: 2013

- Number of beds: 240

3.3.9.1 Location

The Campus of the Presbyterian University, sitting on Acha-san mountain's foothill overlooking the Han River, is surrounded by poetic natural landscape (figure 3.114). Despite its location at the urban center in Seoul, the capital city of South Korea, the surrounding environment gives the campus a 'retreat' (피정, 避靜) atmosphere due to the wooded forest (Valenzuela, 2015).

The accommodation building is the replacement of the demolished previous seminary hall. With the limited footprint area, narrow and sloped typology and restriction of height, the building is seven stories tall and goes three floors underground to contain a large occupancy of student accommodation and some university facilities, such as professors' laboratory and club rooms (figure 3.115).

Figure 3.114: the residential hall locates in the Acha-san foothill

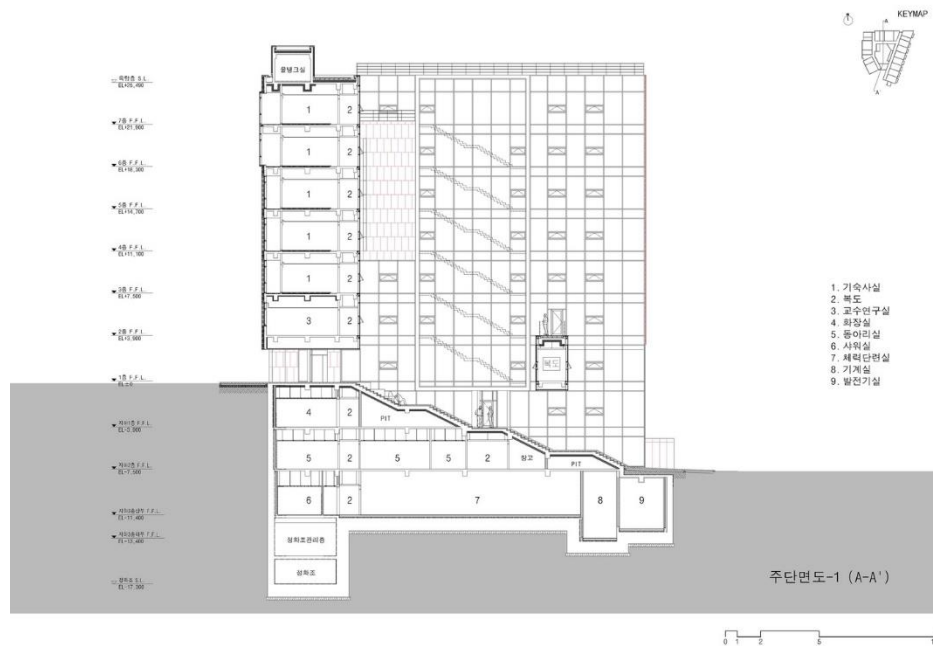(Map is retrieved from Google Map and edited with Adobe Photoshop by the author)

Figure 3.115: sloped terrain in section drawing

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

3.3.9.2 Light condition and ventilation

The composition of a courtyard (중정, 中庭) in the center of the building is the key concept of the design. The building's layout becomes a folded strip around the courtyard. The shallow depth of building mass allows nature sunlight to come into every room through windows on the exterior wall (figure 3.116).

The windows in basement rooms and doorways are installed all around the courtyard for natural lighting and ventilation (Valenzuela, 2015). The courtyard serves as a lightwell, as the atriums in the Simmons Hall in Case 6, to bring natural light in and take exhaust air out (figure 3.117).

The artificial light at night lights up the core of the building through glazing curtain walls in the courtyard, creating a spiritual atmosphere for the building (figure 3.118).
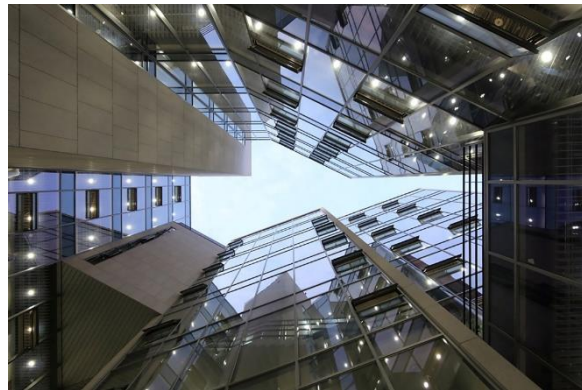
Figure 3.116 (left): each room has access to natural light in floor plan of stories 3-7

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

Figure 3.117 (right): skylight in courtyard

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

Figure 3.118: artificial light in the courtyard at night

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

3.3.9.3 Safety

The trend of seminary hall focuses on the convenience and privacy, accommodates small population, and normally has private bathrooms. However, as a religious institution, the Presbyterian University's residential hall aims to educate residents for a group life among

others by accommodating large population and fostering social interactions. The density of

population helps build a safer community in 'retreat' area.

The public space locating in the basement and private bedrooms on the upper floor are

accessed with two different entrance to ensure student's privacy and safeness (figure 3.119).

The entrance to the accommodation is in the courtyard and overlooked by the corridors on

every floor (figure 3.120). The staircase hanging on the wall is warped in curtain glazing, so

people can look students walking or resting on the stairs from outside (figure 3.121)

(Valenzuela, 2015). The visibility connection enhances the link between interior and exterior

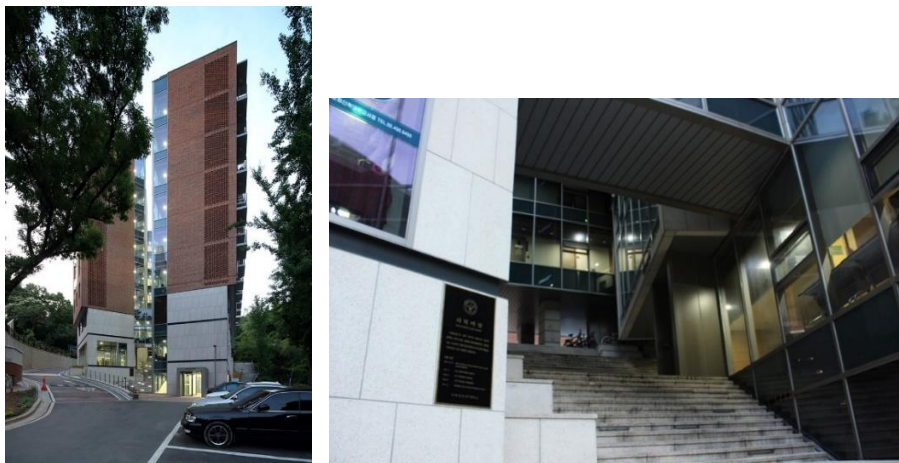space and forms an open and safe space (figure 3.122).

Figure 3.119: entrance to basement (left) and entrance to the upper floor in courtyard (right)
(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-
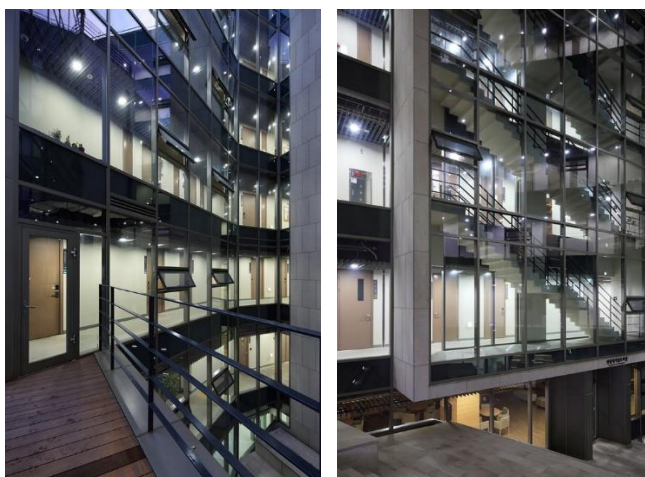theological-seminary-sac-international)

Figure 3.120 (left): corridors surrounding the courtyard

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

Figure 3.121 (right): Staircase hanging on the wall

(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

Figure 3.122: visibility through building's entrance

(Retrieved from: http://www.bomienc.com/en/portfolio-posts/residence-hall-of-presbyterian-university-and-theological-seminary/?ckattempt=1)

3.3.9.4 Material

The traditional red brick covers the entire exterior to blend with surrounding campus buildings (figure 3.123) (Valenzuela, 2015). On these brick walls, details such as projected parts and retreated windows added diversity into the unity. The granite finish in the lower levels serves as retaining wall under the slope of ground and distinguishes the public and private parts in the building from the appearance.

Unlike the exterior wall, the glass curtain wall in courtyard brings a more modern and vibrant image by exposing interior corridors. This contrast between materials shows the coexistence of the past and future (figure 3.124).

Figure 3.123: façade facing other campus building with traditional brick to blend in

(Retrieved from: http://www.bomienc.com/en/portfolio-posts/residence-hall-of-presbyterian-university-and-theological-seminary/?ckattempt=1)
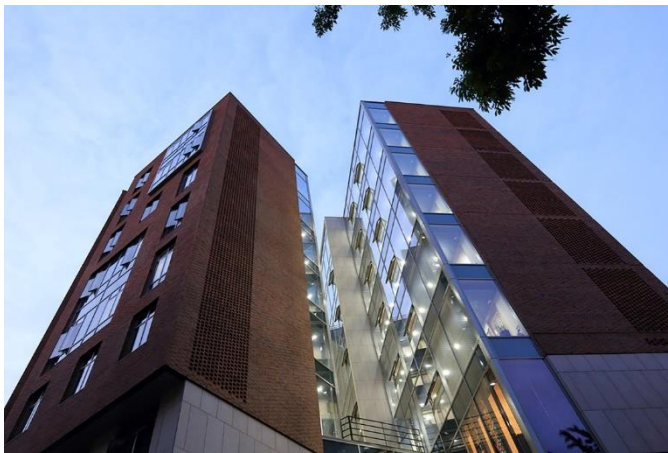

Figure 3.124: Contrast between traditional brick and modern glass wall

(Retrieved from: http://www.bomienc.com/en/portfolio-posts/residence-hall-of-presbyterian-university-and-theological-seminary/?ckattempt=1)

3.3.9.5 Accessibility to the common space

With limited building space and large population accommodated, the building is equipped with public shower rooms, toilets, and other public space. This also reflects the group living style promoted by the university.

The rooms facing the mountain are equipped with balconies to access the view of the mountain and Han River in distance (figure 3.125).

The spaces needed in the campus, such as the professors' laboratory, gym, club rooms, and a small library are placed in this seminary hall in the lower levels (figure 3.126). Both users

of the residence hall and visitors have access to these spaces. There is also a roof garden for

the beautiful view of Seoul city, mountain landscape and the Han River (figure 3.127).

Figure 3.125: balcony with mountain view and path linking the building with forest
(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

Figure 3.126: small library
(Retrieved from: http://www.bomienc.com/en/portfolio-posts/residence-hall-of-presbyterian-university-and-theological-seminary/?ckattempt=1)
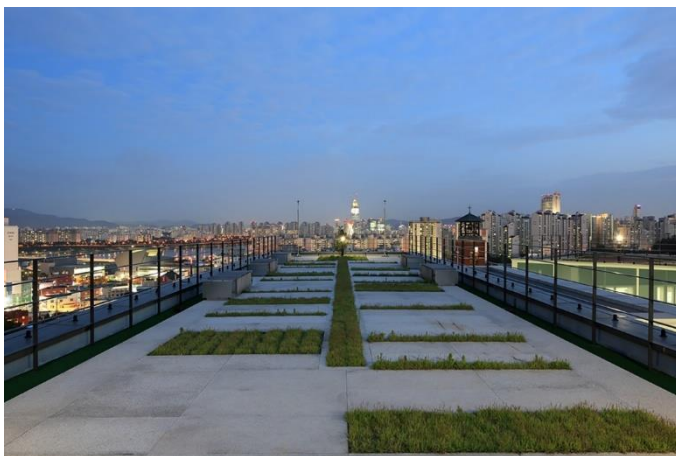

Figure 3.127: roof garden
(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international)

3.3.9.6 Conclusion

As part of a religious campus, this student accommodation has its own unique characteristic from other previous cases. The university aims to build a residence hall spiritual fullness (Valenzuela, 2015). The design attempts to reach the goal with all kinds of architectural approach, such as providing good lighting and ventilation, using diverse material, providing outdoors spaces and views, and building a safer community with visibility.

The accommodation provides a skillful resolution to existing restrictions and difficulties. It shows concern to local context and is a successful case to learn from.

CHAPTER 4: GUIDELINES FOR THE INTEGRATION OF SOCIAL SPACE IN STUDENT HOUSING

4.1 Introduction

The research question of this paper is how architecture design can help foster social interaction between residents in student housing and what methods should be taken to improve space quality and to reach that goal.

I have read books and looked through materials online about theories and existing international cases of student housing. I focused on the residence halls in tower apartments type to analysis the architectural methods applied in these cases and the advantages they offer, then documented them with writings, drawings, and photos.

The items below are the list of case studies and the key elements I summarized from my research and analysis. I categorized them into nine aspects to propose a guideline for the design of student accommodation which encourages social interactions.

	Case Study 1: "MySpace" Trondheim Student Housing - Architect: Murado & Elvria Architects - Location: Trondheim, Norway - Year of construction: 2012 - Number of beds: 116
	Case Study 2: Student Housing in University of Southern Denmark - Architect: C.F. Møller - Location: Odense, Denmark - Year of construction: 2015 - Number of beds: 250

Case Study 3: Tietgen Dormitory
- Architect: Lundgaard & Transberg Architects
- Location: Copenhagen, Denmark
- Year of construction: 2005
- Number of beds: 400

Case Study 4: Smarties, Uithof
- Architect: Architectenbureau Marlies Rohmer
- Location: Utrecht, Netherlands
- Year of construction: 2008
- Number of beds: 380

Case Study 5: MIT Baker House Dormitory
- Architect: Alvar Aalto
- Location: Massachusetts, United States
- Year of construction: 1948
- Number of beds: 353

Case Study 6: Simmons Hall at MIT
- Architect: Steven Holl
- Location: Massachusetts, United States
- Year of construction: 2002
- Number of beds: 350

Case Study 7: RMIT Bundoora West Student Accommodation
- Architect: RMA
- Location: Bundoora, Australia
- Year of construction: 2016
- Number of beds: 372

Case Study 8: La Trobe University Student Accommodation
- Architect: Jackson Clements Burrows Architects
- Location: Melbourne, Australia
- Year of construction: 2020
- Number of beds: 624

	Case Study 9: Residence Hall of Presbyterian University and Theological Seminary - Architect: SAC International - Location: Seoul, South Korea - Year of construction: 2013 - Number of beds: 240

Table 4.1: Key characteristics of the investigated case studies

4.2 Guidelines

4.2.1 Types of Functions and Spaces in a building

The design of student housing starts with the composition of bedrooms as the most fundamental function of the building. On one hand, bedrooms equipped amenities such as private bathroom and kitchen ensure convenience and privacy. On the other hand, shared kitchen, laundry room, showers, toilets in public area can save space and budget to increase the capacity of accommodation, more importantly, users get to experience group life and have more opportunities to involve in social activities this way. For instance, small conversations can happen while waiting for the laundry and communal gourmet cooking and sitting together at a long dining table and enjoy nice food can quickly shorten the social distance between residents. The existence of dining hall also saves young adults some excuses for asking people out for dinner.

Most of the cases in the previous chapters have a communal kitchen or a dining hall, 'Ultra Kitchen' in Trondheim student housing even have mini fridges belongs to each student for their convenience (figure 4.1). Both Baker House and Simmons Hall in U.S., and residence hall of presbyterian in South Korea have sink in the bedrooms and public shower rooms and toilets in the hallway. Sometimes a balance can be found between public and private as BWSA

and La Trobe university in Australia having a mixed use of single studios and 4-, 5-, 6-bedrooms with share living space for student to choose according to their preference.
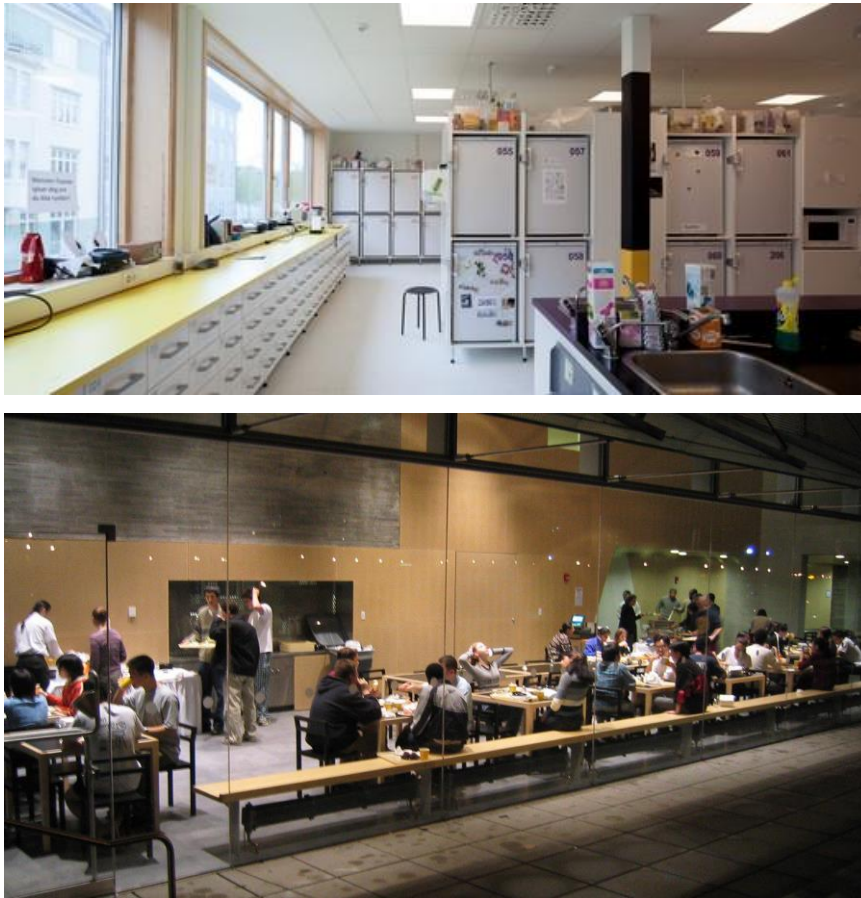
Figure 4.1: Self-managed kitchen in Trondheim (top) and street level cafeteria in Simmons Hall (bottom)
(Retrieved from: https://www.archdaily.com/284331/trondheim-student-housing-mek-architects
And: https://www.archdaily.com/65172/simmons-hall-at-mit-steven-holl)

Other than the amenities for basic daily living, successful student housings should always have more common spaces for study, hobbies, relaxing, and entertainment. There are study rooms for group projects, meeting, and discussions. Sometimes, there are printing room and quite individual study space. Many cases of student housing have gym, music room, small library for hobbies and active living. Lounges, outdoor terraces, roof garden, bicycle garage, and courtyards in student housing are places from small to large scale to relax, live in an active style, meet new people, and hang out with friends. Some student halls even have ball pit rooms, movie theater, and game room for their users to have fun.

4.2.2 Accessibility to the common spaces

For the public spaces to function properly, they need to be accessible to students by placing them in the appropriate location.

Basic amenities for daily life should locates within reachable distance from every living unit, public shower rooms and toilet, with individual ventilation system, are placed in the hallway on each floor for quick access. If there is sufficient space, lounges and study rooms should also locate on each floor along the corridor as 'pockets' for users to pause from daily commute and have casual talk or to study.

The rooms for larger groups, such as dining room, communal kitchen, laundry room, and game room, should be located together in a collective area with higher ceiling height, open visibility, and separate sound insulation. Furthermore, it is also more convenient for users to access and can easily trigger interactions between different groups. This collective area is normally ground floor, top floor, or at the intersection of multiple wings of the building. For example, student housing in University of Southern Denmark places kitchen on the center of each floor where three residential clusters intersect, a café as well as group rooms on the ground floor, and study areas and party spaces on the top floor (figure 4.2). The BWSA features a great common area with a resident lounge with TV, pool table, and table tennis; a gourmet kitchen; two game rooms; conference room; learning space with project rooms; and a club-style lounge for postgraduate students all in a public space at the intersection of three accommodation wings (figure 4.3).
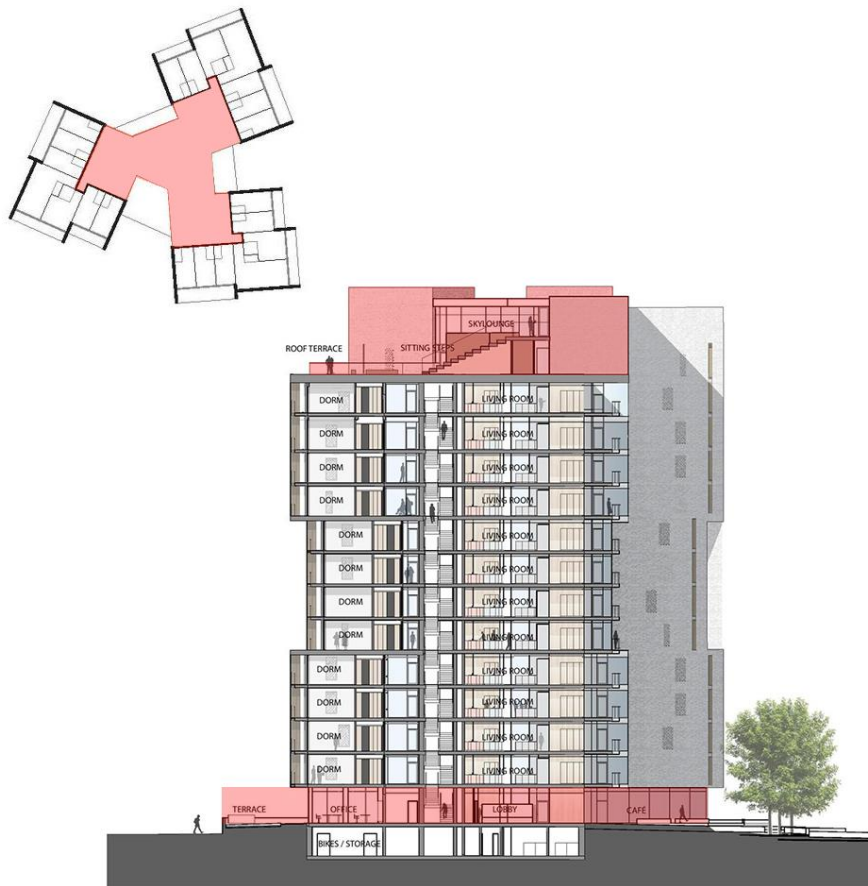
Figure 4.2: Public spaces in SDU dormitory

(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller?ad_medium=gallery)
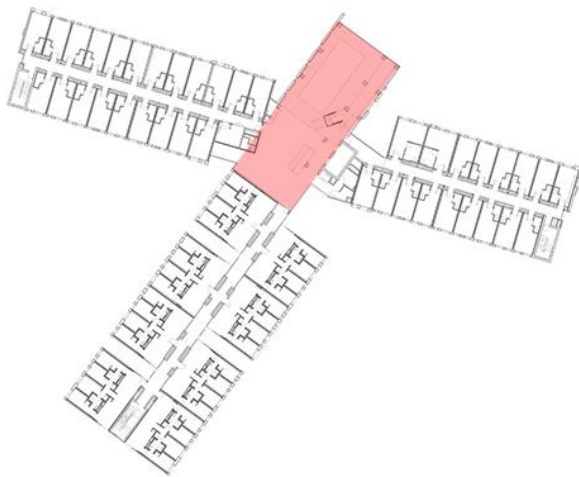
Figure 4.3: Self-managed kitchen in Trondheim and street level cafeteria in Simmons Hall

(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma?ad_medium=gallery)

Outdoor terrace should be placed outside of the indoor common area, along the edge of the building, and separated by a glazing wall from the indoor space to give a feeling of

community connection between the inside and outside.

Courtyards as the largest scale of group area were commonly located in the center of the building as a focal point with large volume of people passing by every day to provide more opportunities to meet someone new.

4.2.3 Light condition

Light condition is an important criterion in the design of any residential building. Public spaces, as large and open spaces, not only need good light condition for better space quality but also can help bring natural light into the building.

The depth of the building mass should not be too deep so that sunlight through the gazing on the façade can reach into each room. This suggest that the building needs to have a narrow and long rectilinear layout. Basing on the primary layout, increasing surface area will also increase the natural light exposure, like Baker House in the U.S. However, sites are not always located in the ideal long and narrow shape. To fit into the site, some buildings have folded strip layouts, such as residence hall of Presbyterian University in South Korea (figure 4.4), while others evolve into a circular or arc shape surrounding as Tietgen Dormitory (figure 4.5) and La Trobe university (figure 4.6). In these cases, courtyards are placed in the center of the building's layout. The outdoor courtyard with natural daylight and ventilation also functions as lightwell which allows sunlight exposure for inner façade facing the courtyard.

Without extra heat loss from increasing surface-area-to-volume ratio, atriums can also serve as courtyard in a smaller scale and brings natural light down into the building. The design concept of Simmons Hall in the U.S. is an ambitious attempt to compose atriums in student housing tower (figure 4.7). These atriums as the 'void' spaces foster social activities around it

with open view and natural light.

Figure 4.4 (upper left): Skylight in the residence hall of Presbyterian University in South Korea
(Retrieved from: http://www.bomienc.com/en/portfolio-posts/residence-hall-of-presbyterian-university-and-theological-seminary/?ckattempt=1)
Figure 4.5 (upper right): Courtyard in Tietgen Dormitory
(Retrieved from: https://www.archdaily.com/474237/tietgen-dormitory-lundgaard-and-tranberg-architects?ad_medium=gallery)
Figure 4.6 (lower left): Courtyard in student housing in La Trobe University
(Retrieved from: https://www.archdaily.com/959330/la-trobe-university-student-accomodations-jackson-clements-burrows-architects?ad_source=search&ad_medium=projects_tab)
Figure 4.7 (lower right): Skylight in Simmons Hall's atrium
(Retrieved from: https://www.stevenholl.com/project/mit-simmons-hall/)

Despite the demand of sunlight, excessive sun exposure can be an obstruction for user's daily study and rest, and cause over heating problem. In this circumstance, operable blinds, thick wall as sun parasol, and extruded aluminum panels on the façade can shade rooms from extra direct sunlight during summer months.

Cool tuned artificial lights as supplementary light sources are installed in studying area to help students concentrate and optimize learning performance. Warm toned pendant lights are still used in social area to create a welcoming and comfortable atmosphere for students to

relax and communicate with each other.

4.2.4 Ventilation

Natural ventilation is as important as natural lighting in a residential building to improve space quality and keep students healthy, especially in public area where a group of students gather. The courtyards and atriums can not only bring sunlight down into the building but can also move exhaust air out of the building. Placing the doorways around the courtyard would even enhance the performance of natural ventilation. Ventilation system should also be installed as a complementary method, and public kitchens, shower rooms, and toilet should have their individual ventilation system.

Operable window is also an approach to achieve natural ventilation. For example, in Simmons Hall, multiple operable windows are installed in a single unit, when windows at the top and bottom are both open at the time, warm exhaust air goes up and exist through the top window automatically sucking fresh air in from the bottom opening and forming natural ventilation in the room (figure 4.8).

Figure 4.8: Diagrams of two means of natural ventilation in Simmons Hall
(Retrieved from: https://www.archdaily.com/65172/simmons-hall-at-mit-steven-holl?ad_medium=gallery;
edited with Adobe Photoshop by the author).

4.2.5 Sound control

When group activities happen in public area, especially in game rooms, music rooms,

laundry rooms, and shared kitchen, the noise becomes a problem interrupting normal study and sleeping in the private area.

In this case, acoustic materials can be attached to the structure in this public area to control noise (figure 4.9). While policy can restrict students from using these facilities or engaging in activities causing noise problem during sleeping hours (figure 4.10). The public facilities can also be placed in a separate building wing, on the ground level or even in the basement to minimize the disturbance. The design can also use concrete or brick as the building material in these public area for better acoustic insulation.
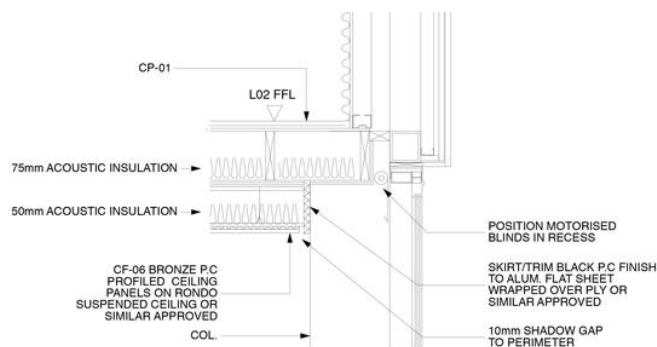
Figure 4.9: Detail construction drawing of BWSA shows 75mm acoustic insulation attached to the structure (Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma?ad_medium=gallery)
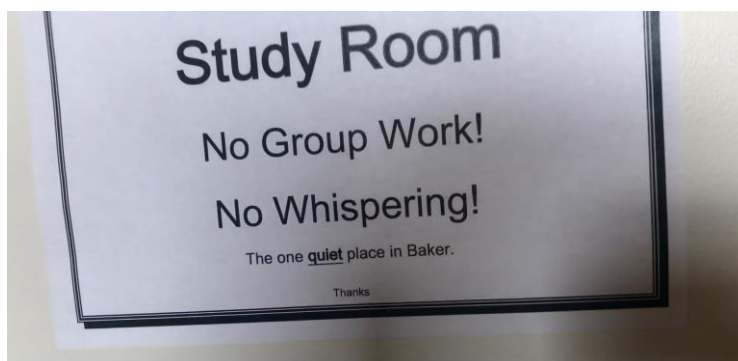
Figure 4.10: 'Quite sign' in Baker House, MIT
(Retrieved from a video in: https://mitguidetoresidences.mit.edu/map/baker-house)

4.2.6 Material

Different types of material were used by architects throughout the case studies. Each of them has its own strength and character, from concrete, granite, limestone, to brinks, timbers,

glass, and metal.

Concrete and masonry material are often used for their ability to isolate dissipate noise. The material offers excellent noise control by efficiently blocks airborne sound transmission over wide range frequency and absorbing noise. Bricks and other masonry units in modular pieces are more flexible to build curved walls.

Timber as a construction material performs well in fire by burning gradually and forming a self-distinguishing outer layer in fire and shields the interior thereby preventing sudden collapse. It is also an environmentally friendly material by reducing carbon emission. Let alone the aesthetic beauty of timber can create a natural and spiritual feeling.

Glass provides transparency and allows natural illumination. It also links the interior and exterior with via visual connection, which is an important aspect to promote social interaction. It lets view of the landscape into the building and present the interior quality to outside visitors.

Metal as an efficient modern material can be prefabricated which shortens the construction time and lowers the cost. Aluminum panel is also a good thermal break material to be utilized on façade as cladding and rain screen. The colorful choice of metal offers a dynamic and vibrant appearance of the building which can light up the user's mood and reflect the energy of the young-adult residents.

With different materials, most of the buildings use a combination of more than one element. For example, Baker House use rustic bricks to create curve that juxtaposes the solid limestone of the attached rectangular common room (figure 4.11). BWSA has a public central hub with timber structure and two accommodation wings cladding in zinc and powder coated

aluminum (figure 4.12). Residential hall of Presbyterian University uses brick on the exterior façade to blend in with other buildings on campus and glazing curtain wall around central courtyard for a contrast between traditional and modern perception (figure 4.13)

Figure 4.11 (upper left): Mixed use of brick and limestone in Baker House
(Retrieved from: https://baker.mit.edu/about)
Figure 4.12 (lower left): Mixed use of zinc and powder coated aluminum and timber in BWSA
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma?ad_medium=gallery)
Figure 4.13 (right): Mixed use of brick and glass in the residential hall in Presbyterian University
(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international?ad_medium=widget&ad_name=navigation-prev)

4.2.7 Relationship between the building and the local context

As material of building is sometimes chosen according to local context, many other design aspects can respond to the building's site to connect residents with a community at large. Students in universities often comes from different areas even different country and are going to spend years in their young adulthood to study and live in a place. It is important for them to build a connection not only within a small residential building or within the campus but also with the society of the local area. Therefore, a student housing should never be a tower which

is simply built with principles summarized from research and isolated from the site. On the other hand, the design should involve the building and its user with local culture and landscape.

For example, BWSA is a five-star green building and uses timber beams and wood interior finish in admiration of the ancient trees on site which is a historical heritage trail (figure 4.14). The Baker House offers view of Charles River to every user by facing the rooms to the river and creating the sweeping curve layout to imitate the shape of Charles River (figure 4.15). Many other cases have balcony and roof garden for a beautiful city view, such as student housing in SDU and the residence hall of Presbyterian University (figure 4.16). These design of each residential hall shows respect to its location and presents uniqueness while offers residents with belongingness and social connection with a larger community.
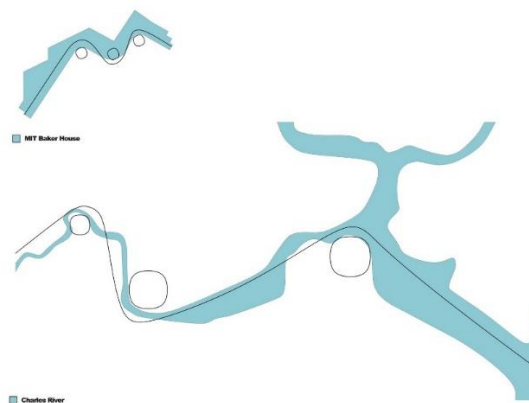
Figure 4.14 (left) Wood beams imitate ancient tree
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)
Figure 4.15 (right) Comparison between curvy building layout and the shape of Charles River
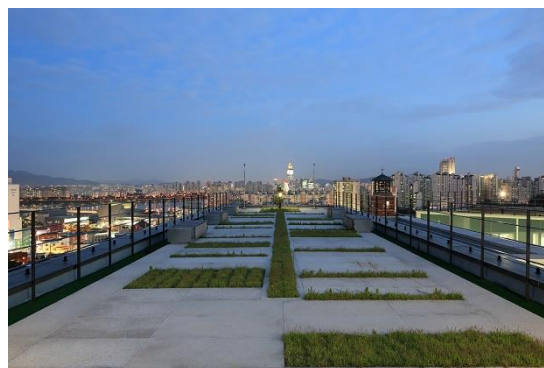(Retrieved from: https://www.souheilbm.com/housing-complex)

Figure 4.16 view from roof garden in SDU (left) and Presbyterian University (right)
(Retrieved from: https://www.archdaily.com/785806/student-housing-cf-moller/5715befde58eceac8b00012e-student-housing-cf-moller-photo; https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international?ad_medium=widget&ad_name=navigation-prev)

4.2.8 Safety

Safety is another primary concern in student housing. However, architecture can do way more than following code and adding railing system to reinforce users' safeness when designing a student housing.

A positive aspect of being a member in a community is that people take care and help each other to overcome difficulties. And this feeling of belongingness is also good for mental health. Safety is both the reason and a benefit of promoting social interaction in student housing.

In specific design detail, visibility in public area can not only attract more users but also provides a safer environment. Because people are less likely to commit crime while being watched. Many cases place main traffic core in the center of the building with open public relaxing space instead of placing it in a corner at the end of hallway (figure 4.17). Some other case locates doorway around the central courtyard (figure 4.18). These arrangements make both staircase and the public area a safer place for students to use.

Furthermore, sufficient light source and warm toned decoration also help users to relax and render a comfortable and safe atmosphere.
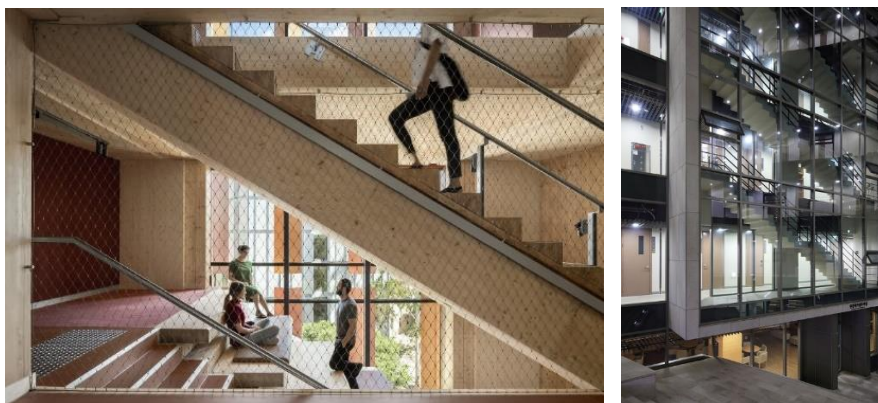
Figure 4.17 (left): Public relaxing space next to the staircase
(Retrieved from: https://www.archdaily.com/787627/rmit-bundoora-west-student-accommodation-rma)
Figure 4.18 (right): Doorways around central courtyard
(Retrieved from: https://www.archdaily.com/617771/residence-hall-of-presbyterian-university-and-theological-seminary-sac-international?ad_medium=widget&ad_name=navigation-prev)

4.2.9 Interior decoration and furnishing

The decoration of interior is the most direct way to influence people to make social contact and it is also easy to change or improve. The major design principles in interior design are comfortable, creative, and inspiring.

A building becomes a complete project by carrying the design concept through structure to interior finishing. Based on the structure material, concrete building can be painted to transform interior wall surface to large chalk boards for ideas and group discussions. Buildings with timber structure always leave the structure exposed inside to create a natural feeling with unique wood texture.

Interior installations and furniture for fun, including large chess, pool table, and projector screen are also encouraged, because they offer chance for users to participate in group activities together and talk (figure 4.19). Sometimes, an open public area can stimulate students to occupy the space with creative thinking.
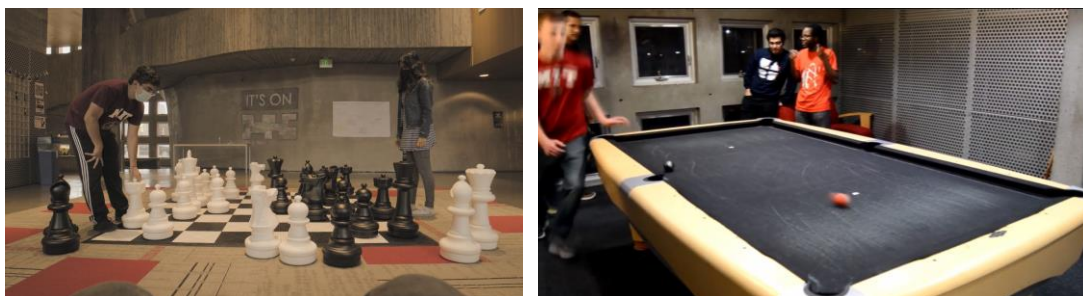
Figure 4.19: Large chess (left) and pool table (right) in Simmons Hall
(Retrieved from a video in: https://mitguidetoresidences.mit.edu/map/simmons-hall)

Some building has customized furniture designed by architect could be inspiring aesthetically. Furniture as large dining table can be placed on purpose to encourage user to meet

new people and gather with friend. The design can choose vibrant and warm toned color for wall painting or the furniture to lighten up users' mood in their daily life, and to encourage people to positively talk and make social connections.

4.3 Final Reflections

This research about how architecture design can integrate social space and foster social interaction in student housing provides case studies and references of successful cases so that architects can analyze and design the housing active social space. Although architecture has its own limitation, different policy, culture and insufficient funds could also influence the result. It is still important to build great public space which makes student housing a community or even a small city. With more attempts and more successful cases, the trend would also have an influence on policy and culture. More and more student housing will not only solve students' accommodation issue but also focus on educating young adults with group life, helping them to build their social connections, and preparing them for entering the society and exploring a bigger world.

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