A DESIGN CONCEPT PROPOSAL ABOUT
COMPACT LIVING UNITS:

USE CASE FOR STUDENT HOUSING

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ABSTRACT

In the recent years around the world there has been a constant increase in the number of students who apply to continue their studies at a higher level, this in turn has brought a great demand in the occupation for student housing. Finding a place to live is one of the issues that new students have to face when moving into another city or country, which can be really challenging at times.

The project speculates with a design concept that may help the demands for student housing in the city of Växjö, Sweden. The idea is a housing unit for one person that occupies a space of 13 m² with an interior space of 10 m² so it can be moved with a truck to the place where required for a temporary time.

The interior proposes an efficient, flexible and comfortable space for the needs in the everyday life of a student. This is done with an organize layout and some multi-purpose furniture that can also be retractable when not in use to save space.
With a good use of material the compact unit can have the possibility to be both environmentally and economically smart.

**Keywords:** compact unit, sustainable, student housing
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1. INTRODUCTION

According to studies of the UNESCO in the recent years around the world there has been a constant increase in the number of students who apply to continue their studies at a higher level (UNESCO, 2014). This in turn has brought a great demand in the occupation for student housing, since many of them move from their homes to other cities, including other countries for their further studies. Finding a place to live is one of the issues which they have to face when moving into another city or country, which can be really challenging at times.

The cost of rent for a student accommodation differs according to the country or city in which they study, for example London is considered one of the most expensive cities for a student to pay a rent with a weekly average of £202.40 per student, according to the recent survey by the Sturents, which is a student search engine to find accommodation (Sturents, 2015). Finding a place to live for the study period may not only be the issue, but it is also about the budget that the students have for it. There are many expenses that must be taken
into consideration when choosing a place to live. Students usually have a budget that may come from the help of their parents, study loans or maybe from having a part time job. Because of this limited budget, they need to divide it with other living expenses too, for example the cost of electricity (when it is extra), food, course literature, tuition fees (in some cases), amusements, local travel, personal healthcare and more.

The project seeks to find a concept proposal that could help the demand for student housing speculating that it could be used mainly for the city of Växjö Sweden. This proposal is based on creating an interior space of 10 m² where students can live and perform their main functions with comfort such as eating, cooking, sleeping, studying, personal hygiene, everyday social and storage. The unit would be mobile so that it could be transported with the help of a truck and placed with a crane in different areas around and out of the city where temporary permits are given by the municipality.

To achieve a concept proposal, I worked with some university students to get to know about their experiences when looking for a place to live, as well understanding certain aspects in their daily lives at their
student homes. This helped me to get ideas on how the space can be adjusted to their needs and that also led to new question like, could the compact unit be placed independently for a student? Or, could it work better by placing them together in groups?

In a personal level, I have also lived this situation of having to look for a student house in the city of Växjö. It took me over a year to find a place that will fit my needs to live, that after living in five different places and having to do so because there was no other options in that time.

If there had been an option to rent a small student place that is comfortable and has all the necessary services at a reasonable price, surely it would have been a good choice to live there for a semester or perhaps longer.

Some years ago I had the opportunity to work in some projects designing interiors for retail spaces which was interesting and challenging by having to adjusts to the needs of the consumers and clients within a budget. Now my attention has been caught to interior spaces that are considered small for living, especially in cities
where there is a lack of space for more buildings. Architects and designers have had to find solutions for these spaces to be functional, flexible, appealing and comfortable. This is a trend that I consider it will increase due to the growth of large cities. That is why I wanted to work with this project and transfer these small spaces to compact units for students, although I will say, in Sweden there is not a lack of space to build student homes, but I am relating to that context by initially considering the demand in student housing with a quick solution and certain sustainable aspects, as a small construction can contributes by using less materials, less waste, less use of energy for production and minor costs. But it can also contribute in other aspect related to the ecological, economical, socio-political and the cultural environment.

Building new spaces to meet the demand for student housing near the universities can be complicated, especially in the case of large cities, where finding new land to build will probably involve looking at the surrounding areas of the city or simply outside of it. There are other cities that have the space to build but their decision-making and construction time is slower
compared to the growing student population and their general population.

The average size of dwelling per person occupied in Denmark is 52 m$^2$ 2014 (Statistics Denmark, 2015), which is one of the highest in Europe, and one of the lowest worldwide is Hong Kong, a family of four commonly lives in a flat of less than 50 m$^2$ (BBC, 2013). The proposed compact housing unit is 10 m$^2$ which is smaller to the average living space per person in Hong Kong, and it is small too according to the housing regulations and codes of Sweden, but that is what I want to challenge. By investigating some case studies, I found that there are some housing companies that have created alternatives of small student housing at a low cost by challenge today’s building regulations. Whit this I realized that it was not a new challenge, but it’s something that I believe it had to continue but this time by proposing a compact units but in turn with the possibility to have it transported to temporary spaces. This will also be an opportunity to seek a sustainable alternative for the proposal building materials and contribute maybe to the local industry. There are many factors when considering environmental selection of
materials. Most of this discussion will center on the ecosystem implication of our material choices: how to sustainably utilize materials within the finite, closed-loop capacity of the Earth, how to use less energy to make these materials, and how to use and waste less material in general (Bergman, D. 2012, p.101).

There are many methods to apply for a project, although sometimes you follow certain steps to implement a result and then certain circumstances make this process to have change. My main focus in the research and process it’s through the tacit knowledge by trying to understand how students live in their student places.

Designing an interior space means understanding people and how they live, to approach this, I developed a workshop where students drew the layout of their current place of living, with it they explained certain aspects of their daily life in relation to space and the various objects or furniture that make it up. I also presented them four projects that have been developed as compact houses to get to know what where their perceptions about them. The last part consisted of a space of 10 m$^2$ in a real size so the students can
experience how it feels to move around in it and how it could possibly be arranged. This helped me understand their perceptions of a small space and hear more about their comments and changes. With this information analyzed in the paper, I would provide an answer with the design proposal on: how can a compact interior space of 10 m² be comfortable for a student to live in? Is there a potential use for a compact unit to be used as student housing?

When an interior space is designed by evidence-based knowledge of environmental-behavior relationships it is possible to achieve added value to daily living in a space (Poldma, T. 2010, p.4666). That applies to a small space and hope this proposal adds value to a proposal of student housing. By trying to make the 10 m² space feel larger than what it really is. A smaller living space can reduce the consumption of energy and its cost, which overall benefits the environment.
2. THEORY

The project starts with the idea of working with small housing that could be moved easily for a diverse niche of users and uses. From the different groups I selected the students, in order to narrow down the research and focus in their specific needs. To gather information the exploratory research includes primary and secondary data, this will help to later analyze and speculate of a future scenario for the concept design of the temporary compact units in the city of Växjö Sweden.

The proposal project will look into architecture in relation to environmental sustainability by using less construction materials for small spaces, without forgetting to take into consideration certain regulations, but it is mainly developed and focused in the interior design.

Interior design has had a misguided notion from the public as relating it to a decorator who recommends a fabric swatch or a color to paint a room. That could be a small part of it, but there work goes beyond that, “interior designers create interior spaces to house the social and personal activities of people from different
walks of life, from different backgrounds and cultures, and with different and specific needs” (Poldma, T. 2009 p.14). While in industrial design the focus might be the object and its specific context and design qualities, in interior design we are preoccupied with the more virtual realm of occupied space, its volume and its characteristics, and how this forms a backdrop for a complex set of inter-relationships between people and their personal or social lived experiences with other people and with objects in various contexts and situations (Poldma, T. 2010 p.4662).

To accomplish this it is necessary to use design processes, in my case I will focus on the students of Linnaeus University so that the space of the compact unit could be well adapted to their needs and comfort.

In the article Small is Beautiful by Wilson & Boehland they mention the increasing size of homes in the United States:

“Since 1950, the average size of new single family houses in the United States has more than doubled, even as the average family size has steadily shrunk. More area (square footage) per family member is being used
than ever before, and projections are that the trend will continue” (Wilson & Boehland. 2005, p. 278).

This situation is also happening in other countries, families with a higher purchasing power want to live in a larger space with more private spaces for each of their family members. Of course this depends where people live, there are highly populated cities in which a specific sector design and build smaller homes due to lack of space and the growing population in need of a place to live, as in the case of some cities in Japan, in which they take full advantage of any space to build a house. So we see people who want large spaces in smaller lots, this is one of the many challenges that architecture and design are facing in the construction and planning of spaces today and for the coming years.
2.1 Sustainable design

According to the United Nations the world population will reach this year 7.4 billion people and for the year 2050 the population will be 9.7 billion people (U. N. 2015). Efforts to stamp out poverty, hunger, health, educational systems and housing are a big challenges but also an opportunity for achieving a sustainable development in these areas. There is also the Global warming issue, were the increase of the Earth’s surface temperature is rising due to greenhouse gases that collect in the atmosphere trapping the sun’s heat and causing the planet to warm up. We are facing a time
were socially conscious design is needed more than ever to help in some of this aspects. There is a growing public awareness of the gravity of environmental damage and the reduction of the world’s resources. Sustainable design is essential for the development of architecture that can meet the needs of the future. Whether at the scale of urban structures or the detailed execution of buildings, we need approaches to materials and construction that conserve resources and build on existing values (Contal & Revedin, 2009). In relation to this last sentence, I will be on the search for materials that could be sustainable as a local material.

The result of an increasingly technology dependent world has had as a greater consumption of raw materials and energy, but the solution is not about giving up modern comforts to become more responsible and change the path, going back in time and living like the days before the industrial revolution, “reverting from electric or gar furnaces to wood-burning fireplaces on a widespread level is worse environmentally” (Bergman, D. 2012, p.10), that simply won’t work. Instead we have to rethink our individual and social lifestyles by making
better choices that at the end will redirect us to improve our lives.

There are alternatives and design directions ready done and others that are being developed that we can look into and contribute to reduce and stop the environmental problems that we are facing today. Some of the basic principles to consider are the Rs of environmentalism: reduce, reuse, and recycle. There is another category that some call the fourth R: rethink, an example, “rather than incorporating energy-efficient but expensive of complex heating and cooling systems, we could design buildings that rely less heavily on these systems or not at all (Bergman, D. 2012, p.12). This way I can find new answers that can help the environment and improve our lives with new design ideas.

2.2 Boverket and the regulations

Boverket is the National Board of Housing, Building and Planning in Sweden, it regulates the construction of a building with the building code that is needed to follow. The building code contains mandatory provisions and general recommendations. It is important
to take into considering certain rules when planning the project proposal, if the compact unit will be considered as a dwelling according to Boverket it should always have spaces for functions such as sleep and rest, cooking, meals, personal hygiene, everyday social contact and storage (Boverket, 2016 c). The next, is some general information from Boverket in relation to student housing in Sweden.

The Building and Planning Building Regulations, BBR, has created an opportunity to build flexible floor plans and smaller student housing. This gives the possibility so that certain areas for different functions can now be used jointly, lower demands on the interior lengths of kitchen and storage, and an opportunity for several students to share a washroom. The requirements for direct daylight in the common areas were also taken away. This has meant that today it is possible to build a student dormitory of about 17 m², which is accessible to people with reduced mobility or orientation. Most of the dormitories built after the rule change in 2014 is not so small without many student housing being built now are around 20-25 square meters (Boverket, 2016 a). This information may not adjust exactly to de student unit, as
the above is related to dormitories, but it mentions that 17 m² is the minimum space for the room. So my proposal will try to seek the opportunity to work with a smaller square meter interior space by challenging the existing rules.

The following is related to removable student housing at locations where permanent housing is not allowed, which will apply to the compact unit as the proposal is seeking to be placed in a temporary basis as having the possibility to be movable.

Another amendment that was carried out in the Planning and Building Act 1 July 2014 meant that the maximum period of temporary building permits rose, so with the possibility to get a temporary building permit of 10 years, now with a possible extension for another 5 years. The extended time has given better conditions for the depreciation of the building, which has resulted in an increased attractiveness to build student housing in the form of removable modules. This can be a relatively quick way to find housing land allowing a temporary use of housing where a permanent planning permission can’t be granted. Several such projects have been built
in locations including Stockholm, Gothenburg and Lund (Boverket, 2016 a).

If design dwelling for student is proposed for one person this will have to be taken into consideration, the functions of meals and home working may wholly or partially overlap the functions for everyday social contact and for sleep and rest. It is sufficient with a space for a sofa bed, a coffee table and an armchair/wheelchair; no space needs to be dedicated to a separate table for meals and home working. There is no requirement on separability, which means that all functions except the sanitary room may be in the same room and it is therefore sufficient to have a single window in the dwelling. The requirement for the least possible space and fittings for cooking is even lower than in dwellings not larger than 35 m². The requirement for space and fittings for storage is the same as in dwellings not larger than 35 m² (Boverket, 2016 a).

If the unit might have another use for other users, besides the students, it could have the possibility to be a *friggebod*, which is a shed. This is what Boverket
mentions about its construction, an addition to a building of a maximum 15m² may be built without a building permit on a one or two dwelling house, but you must provide a notice and await clearance from the building committee before the construction commences. The maximum height for it is 3 meters (Boverket, 2016 b).

2.3 Lived experiences

In this section of the project I will discuss about the framework that will seek mainly through tacit knowledge information for the design research. It will use direct storytelling, which allows designers to easily gather rich stories of lived experience form participants, using thoughtful prompts and guiding and framing questions in conversation (Martin, B. 2012, p.68). This will help me interpret the users experience to create the environment that best suits their needs. This process is based on studies made by Tiiu Poldma professor and researcher at the School of Design, Faculty of Environmental Design at the University of Montreal.

When an interior space is designed by evidence-based knowledge of environmental-behavior
relationships it is possible to achieve added value to daily living in a space that is considered small for that use (Poldma, T. 2010, p.4666). This will be possible through the arrangement of the various sections that make up mainly a student house, bathroom, kitchen, sleeping area and study area. Tacit research should be based on observation, narratives and conversations between the designer and the user.

When interior spaces are designed we care about both the tangible and intangible aspects. We are concerned about the volume and physical characteristics, but also the interrelationships among people, objects, context and everyday experiences, which are also not permanent as they evolve as time passes. In the interior space several experiences happen simultaneously in physical conditions that change, such as light and temperature. It also happens with changing time-space relations like in these contemporary ways of living and working, places where there are changes of activities (Poldma, T. 2010, p.4662), as in this case of study related to the student housing, where they sleep, study, work, eat and socialize in one single room or space. Because of this situation, the space can’t be seen
only as an entity with physical attributes, as walls, floors, lighting, materials and colors (In practice the interior spaces are used in a flexible way where various activities may occur in the same place (Poldma, T. 2010, p.4663). Different people can experience a same place as hostile or friendly, as comfortable or uncomfortable, or as a place for personal or social needs. By applying this type of research and understanding the needs of the students, then the compact unit and its internal space design could suite better the user.

Part of the research that I will try is objective-knowledge that uses questionnaires-based statistical data regarding people relationship in their environments through their daily activities. There are certain limitation with this current research system, for example if the questions are not made correct to collect the proper data required, the interpretation of the information can give a different result or even put off the researcher from situations of great relevance to understand the problems of the current environment.
3. CONTEXT

In this section of the paper I will present the currently situation in which the student housing in Sweden is going through and what is being done for the future. I will also present the potential student profile that currently has the possibility to study in a university in Sweden. Then there is a study case about a housing company in the city of Lund that has been experimenting with student housing that are considered small by the housing authorities. In addition I’ll explain the current situation in the University of Linnaeus in relation to student housing. Finally there will be four examples of living spaces that are considered small that can contribute to a better understand of these spaces through their analysis.

3.1 Sweden and the student housing

During 2008-2012 student housing construction was low in Sweden with a total of nearly 500 student apartments per year. Building and Planning carried out in 2013 commissioned by the Government in order to provide proposals on regulatory reform to boost the construction of student housing in the country. These
rule changes came into effect in July 2014, and student housing has now increased. According to housing market survey estimates that the municipalities in Sweden are expected to build over 4,000 student residences during 2016 (Boverket, 2016a).

Despite the increase in student housing over the next few years, there will still be a shortage of housing for students in many study locations. Most of the student housing now being built are for one person, but there are buildings even a lot of homes where two or more students live together (Boverket, 2016a). This shows that although there are actions been taken still it is required to build more and at the same time it opens the opportunity to create new alternatives that can help relatively quickly.

3.2 The students

The project can have multiple potential users and uses, but in this case of study I'm focusing on the higher education students who require a temporary housing from a minimum period of 6 months as for their studies who have mostly a Western way of life. These people are racially diverse, between 18 and 33 years old, they
are the generation called the Millennials. Some of their characteristics that describe them are: relatively detached from organized politics and religion, users of digital technology, linked by the social media, have student loans, do not have a hurry in getting married and in many they are different from older adults when they were the same age, among other things (Pew research center, 2014). The term Millennials began in the United States, but today it is used in many other countries as it describes well their same generation as we are facing a global world in which certain life styles can be the same. Knowing some of their characteristics can help me understand their needs and somehow to also prepare myself to collaboration with some of the students from the university by anticipating certain trends in needs that may arise, like in the use of certain technology and gadgets that could have relation to their needs at home.

3.3 The AF Bostäder conquest towards small and affordable housing for students in Lund, Sweden

The next is a case study, which is a research strategy involving in-depth investigation of single events of

Lund is a city located in southern Sweden in the County of Skåne, it is considered the number one city for students in Sweden (Lund U. 2016), it has a population around 100,000 and students make almost half of the population. Lund University is one of northern Europe’s oldest, largest, and most prestigious universities. Like in the large cities, especially Stockholm and Gothenburg, finding a student room in Lund can be challenging, there are more students than rooms for rent, and for that reason some students live in Malmö or Helsingborg which are cities not far from Lund.

In Lund you also find the southern Sweden’s largest student housing company AF Bostäder, who owns and manages about 6000 student housings in Lund (AF Bostäder, 2012). The company, like central housing services in most cities in Sweden, operates through the queue system for so called “first hand” rental contracts, or contracts directly between the tenant and the owner
of the property. Residents sign up for a queue in their city and are then able to apply for flats, which are allocated based on queue time. In large and medium-sized cities like Stockholm, Gothenburg, Malmö, Uppsala or Lund, queue times for a flat can be several years (Study Sweden, 2016). As such, on the private market the most common solution for students is finding a sublet.

Back in 2012 AF Bostäder experimented with an affordable single house with an interior of 8.8 m² to come with a solution for the shortage of student housing, (description of the house chapter 3.4.3). AF Bostäder created the home as a bit of a rebellion against what they feel are overly strict building codes (Nellemann 2012), which in a way prevent the construction of cheap student housing. The Housing Authority's rules say student living spaces should be between 24 and 26 m² to fulfill all of the different requirements of housing - such as wheelchair access (Treehuger, 2012). The core of the dispute between the developer and the municipality shall be required to access for wheelchair users. AF applied for dispensation
to build 60-100 dwellings of this type of 10-12 m², but where refused.

After the micro student house was not accepted, there were new proposals developed with Tengbom architects who worked together with students from Lund University, this time the result was a housing unit of 10 m². This is what architects comment on the project that was exhibited in Virserum Art Museum in 2014, “By exhibiting this well planned and sustainable student unit we want to challenge the conventional views and show new ways of thinking. What is ‘good’ living? What materials can we use? To meet the future in a sustainable way we must be innovative in all aspects and have the courage to break new ground” (Humble Homes, 2013). The prototype contributed to the debate on how small a home can be.

The other project of AF Bostäder and Tengbom was BoKompakt, 16 homes made of wood, giving each one 10 m² focusing in sustainability and quality to development for the future of housing, and again as they say, “in which we challenge today’s building regulations in order to build student housing of high quality with low living costs (AF Bostëder, 2015). In
October 2014 BoKompakt started to have students moving in, it took them about three years of negotiations with courts, architect’s offices, student collaborations and construction companies to get to this point.

*Figure 3.1. BoKompakt in Lund.*

*Figure 3.2. The Interior of a 10 m2 home of BoKompakt.*
This case demonstrates that there is a possibility to continue with projects that challenge the construction regulations, and opens the possibility that in the future we could see more options of student housing that can contribute with sustainable ideas, help students with a good rental price and shortage the demands of student accommodation. That is why my proposed project with its variants as been movable, will have its challenges to pursue this line of projects.

3.4 The situation related to student housing in Växjö, Sweden

Växjö is a modern city with more than 80,000 inhabitants. The city has been declared "the Greenest City in Europe" because of its focus on environmentally sound solutions and the environmental programs implemented, as described by the Linnaeus University in its web site (Linnaeus University 2016).

There are basically two periods in which students enter to study at Linnaeus University, one is during the spring semester and the other is the autumn semester. For their study time the new students require a place to live if they are coming from another city or country, that
is so, in most of the cases. There are two companies that offer apartments for rent in the campus, one is Stubor and the other is Växjöbostäder. Like in Lund, although not in the same level, the housing companies struggle to offer a place to meet the demands for housing. Of course it is impossible to have all the students who attend Linnaeus University to live in campus and there are other alternatives like living in the neighborhoods in Växjö, but the problem is that still is not enough, especially during the higher season which is the autumn semester when there is a higher number of international students who come to study for one or two semesters as exchange students plus the ones who come to study for a master’s or a bachelor’s degree. There are 3,700 student apartments and dorm rooms on the university campus housing approximately 4,600 to 5,200 students. The prices for a room in campus for one person offered by Växjö Bostadär are between 2818 kr. for a corridor room of 20 m² to 4191 kr. for a room with kitchen of 28.7 m² (Boplatshäfte Växjö, 2016).
According to Rikard Söderlund and Jenny Johansson who help new students to find accommodation as housing officer administrators at Linnéstudenternas (appendix b), a lot of international students who may not have gotten the information beforehand about the search for students housing, they don’t think it could be a problem to find a place to live in a small city in Sweden. They usually believe that problems related to finding accommodation happen only in Stockholm or Gothenburg which are the largest cities in Sweden.

Because of the difficulties for some people to find a place to live “some actually leave and return home” and others simply cancel their studies if they don’t get a place beforehand and then just choose another city or
country to study. There are no statistics that show the numbers of students who decide not to show up to start their studies is related to the housing problem, but housing administration of Linnéstudenternas have received emails from people telling them so. In the last semester there has also been an increase of students who cancel their studies and it has been suggested to the University that it is related to the housing shortage. It will be good to have this numbers proven so it could be an incentive for both the University and the City to build more apartments, Rikard suggests. There is actually a Facebook group for the students called “Växjö Campus”, administrated by Linnestudenterna and by the Växjö International Students, were students can write about activities and meet classmates, in it you will see many messages posted by future students who are constantly asking about student accommodation, specially some months before the begging of each semester and during the first two month of them.

Rikard explains, that it takes quite a long time for private companies to make a profit from student housing because it is expensive to build and they will only be for rent, so they are not really interested in building in that
sector. It is a process that also takes a long time with all the permits and appeals that delay the construction, a lot of bureaucracy is involved. Because of this for the private companies it is better to build condos, in this sector they will see an immediate profit because people pay in advance bigger amounts of money with the sign up deposit and when they move in, helping to cover building costs. For a student to rent a condo usually it will be more expensive, especially if it’s new.

Some students who come for a longer period of study and need a room for living get together with other students to rent a place with many rooms which may be expensive, and then wait for some months to accumulate a good amount of points in order to apply for a cheaper apartment (not corridor rooms).

In general the Swedish students are aware of the student housing queue point system, so some of them may not struggle that much to find a place, unless they want to live in the newer buildings for which they will require a good amount of points. For the international students who come to study to Sweden usually the queue system is something totally new for them, some of them sign up late so their probabilities to find a room
may take some time until they get some points to start applying for a room with real possibilities to get it. For that reason some end up living in the nearby towns like Alvesta or Lessebo which can be frustrating when they were expecting to be living in campus or at least in Växjö and in a way for some it is simply not acceptable to make those kind of sacrifices traveling from another town, even thought Linnaeus is a good University but instead prefer to go to some other University.

In the upcoming semester in autumn 2016 there are around 70 new apartments that will be available at campus of the University, the price for a single room is 7978 crowns. for a 42.9 m², still this won’t cover the demands but at least it is a start (Boplats Växjö, 2016).

3.5 Contemporary work carried out in the field

In order to understand what is a small house or a compact unit and to come out with a design proposal considering an appropriate layout that will appeal and function to the target user. It is important to know and analyze some contemporary projects that have been carried out in the same or related type of field in which my project is conducted.
I have selected four different projects that are relevant in the field of compact housing based on different criteria. All of the designs have taken attention by international or local media through books, newspapers, exhibitions, web pages, radio etc. because of their exploration in trying to find a good living space in a small footprint area. They have elements in their interior design that save space by having different functions in a same area or by simply been easy to put away when they are not in use. Two of these have an approach towards been self sufficient within the energy aspect, they can also be transported with a trailer and taken down with a crane in order to be placed. The other two houses, which are from Sweden, try to fit and experiment directly with their only user to whom they are intended the students.

3.5.1 The Micro compact home (m-ch)

The m-ch was designed by the architect Richard Horden, inspired partially by a Japanese teahouse. It is a 2.66 meters high quality compact cube dwelling for one or two people that adapt to a variety of sites and circumstances, in it you can live as well as work. It has a timber frame structure with anodized aluminium
external cladding, insulated with polyurethane and fitted with aluminium frame double glazed windows (Johnson, 2010, p.134). The researchers developed the m-ch as an answer to an increasing demand for short stay living accommodation for students, business people, sports and leisure and for weekenders. The m-ch is delivered by trailer or light crane and may be arranged as a single unit raised above the ground on a light aluminium frame (Gregor, 2016 a). The quoted price is 38,000 EUR for a single unit and frame and does not include delivery, installation and connection to services, consultant’s fees and taxes. Subject to site conditions the inclusive guide price is 50,000-90,000 EUR depending on the landscape fees and infrastructure (Gregor, 2016 b).
3.5.2 Diogene

Diogene is a living space seen as a voluntary place of retreat, designed by Renzo Piano, he is famous for
designing Europe’s largest skyscraper The Shardon in London. Diogenes has an area of 2.5 meters by 3 meters, the interior is split in two with a kitchen and shower at one side and a bedroom on the other side. “It is supposed to function in various climate conditions, independent of the existing infrastructure, i.e. as a self-sufficient system. The required water is collected by the house itself, cleaned and reused. The house supplies its own power and the necessary platform is minimized” (Vitra 2016). It also has Photovoltaic cells and solar modules so it can be independent form the local infrastructure and powered. The structure is constructed from wood, which also defines the interior, in order to be protected from the weather the exterior is covered with an aluminium panel. Because of its light weight it can be loaded with a crane onto a lorry and transported anywhere. The prototype costs £17,200 (Woollaston 2013).
Figure 3-6. Renzo Piano and his micro-house at the Vitra Campus in Germany.

Figure 3-7. The pullout sofa and the fold away table in Diogene.
3.5.3 Micro student home by AF Bostäder

AF Bostäder experimented and built in 2012 an affordable and autonomous micro home in Lund, Sweden which could help combat the shortage of student housing while offering affordable rents. It has a 12 m² size and the inside is 8.8 m². It is for one person and it has a bathroom with shower, kitchen, a corner study area, a raised front table for two and a sleeping loft that can be accessed with a ladder. A micro home like this is cheaper to build and maintain (Morgan 2012). This home will rent for 30,000 Swedish crowns ($4,400 USD) a year, when most student housing in Sweden rents for about 50,000 ($7,700 USD) crowns a year (Nellemann 2012).
Figure 3-8. The micro student house in Lund.

Figure 3-9. RIGHT. The raised front table with the sleeping loft at the back.
3.5.4 10 Smart sqm

This compact house was designed after the result of the previous test done with the 8.8 m² micro student home in Lund by AF Bostäder (chapter 3.3). For this new design they have levelled up with 10 m² as the smallest they consider it is possible for a student to live for a longer time. The homes are designed to be kind on the light student wallet and are produced with the environment in mind (The Local Se 2013). The unit has a bed loft, kitchen and bathroom. The house in its total is constructed from locally-produced wood, which makes it relatively light, renewable and carbon-neutral, which means less carbon dioxide releasing to the atmosphere by not having the need of transporting the material for long distances. Furthermore the material enables a fast build and is easily treated to keep out the damp (The Local Se 2013).
Figure 3-10. 10 Smart sqm

Figure 3-11. RIGHT. The kitchen area and the sleeping loft.
3.5.5 The analysis of the four compact houses

Of the four designs described previously, some have features and details that are important to consider as pros and cons in a subjective point of view.

The micro compact home is the smallest of the four units, with a total area of 7.07 m², it is well organization and efficient in the different areas that make up the space, taking advantage of the verticality with two sleeping spaces, and even sharing the area with a retractile table used for eating, working and gathering with other people. Somehow it seeks well to exploit every space to its maximum even for storage, as this is one of the issues that some people explain that compact living sometimes needs more of. Although it has space for two people to sleep and live, I believe it might get complicated for them in terms of activities inside, you can’t have the bed and the table used at the same time, it is needed to take one out to make use of the other. In the case of students it can work as a guest bed so people can stay over for some days. This flexibility in the use of space is achieved through retractable furniture as in the case of the table or bed, this is an aspect that can be
taken into consideration when developing some functions in the interior space of my own project.

*Figure 3-12. Layout of the m-ch.*

![Figure 3-12. Layout of the m-ch.](image)

On one hand it is comfortable and practical to have all the furniture installed in one place, but on the other it does not give you the opportunity to make a personal arrangement which some people like to have, to be honest with such a small space that actually is a great challenge to achieve. The entrance to the unit is just next to the toilet and shower, on a personal level I find it not to be the best solution for that. I have the impression that this place forces you to go outside because somehow it keeps you restricted by its small space, which is not a bad thing, overall it is very tiny.
For some people the aluminum finishing gives it an aspect of modernity and cleaning, for others it generates a feeling of coldness and control. Due to its light structure the house is very easy to transport and install. It is well designed with advanced technology that somewhat defines it in a high price considering the few square meters it has, so probably the rental price will puts it out of reach for a student and in that case most of the people will prefer something bigger for a same price.

The **Diogene** cabin seeks to explore the possibility of living in an area of 7.5 m², the result is the classic look of a house with a gable roof, the exterior is cover totally with a mute gray color, which in my opinion those not look so inviting, although it is a prototype. It is interesting the way the engineering helps to make it fully self sufficient with the energy system by collecting rainwater and cleaning it so it could be use, and also when considering solar power as an energy source. These are sustainable aspects that could contribute to the conceptual proposal of my project. The interior has a very neat look thanks to the wood that covers it completely. It has a very small kitchen which may not
be very comfortable for a student just like the bathroom too. Some of the furniture it is retractable like in the case of the table which is fixed to a side of a wall. The sofa can be adjusted to the size of a bed by extending its wooden surface for a greater comfort.

*Figure 3.13. The Diogene cabin layout.*

The **micro student home** has been designed by taking into consideration the needs of students in their daily life at home; it explores the possibility of living in an 8.8 m² space. It is a fixed structure, which differs in the aspect of mobility for a temporary use which I seek to develop in the design concept, but still has a lot to offer in relation to its interior. It has a gable roof which resembles the shape of what could be a typical
construction of a Nordic house; the exterior walls are white and the laminate roof is black. Apparently the house meets to protect well from the climate, but yet if we consider that the users are student, maybe another shape proposal or facade would have been interesting to see, although it could be that the local construction regulations will not permit this. The interior uses wood to cover the floor and ceiling giving it a natural look, the walls are white with several windows around and the ceiling has two skylights that provide a good amount of natural light. When designing the interior space it is important to consideration the aspects related to natural light as a passive design strategy by using ambient energy sources. Another aspect that can be useful when it comes to add floor space in the room, although not everyone likes it, is the sleeping loft, in a way it does give a larger look to the floor space which is very good, but there are people who do not like sleeping on a bed above the floor level, some say it is difficult to change the sheets and climbing up and down a ladder is not comfortable and can be dangerous, in addition the space between the bed and the ceiling may not be enough for some.
The 10 smart sqm is a student house that takes well advantage of space, it offers the possibility to use furniture that can be put away to add space, this is the case of the table used to study or to eat which is located at the entrance, it can be stored by folding it and then occupying the space of the window, although the way it is performed it may not be so practical, if you store the table apparently you close a window, so you can’t have the window open with the table been stored. It seems that everything is built of the same wood, the front door and the bathroom door are pieces that have been cut from their corresponding wall space so they fit together perfectly fine, this way they maximize material usage and apparently there is not much waste of it. This is an
important point which can be taken into account as a sustainable aspect that can help in the conceptual proposal.

It has a sleeping loft to add floor space which seems larger compared to the design used in the micro student home, to get up there you’ll need to climb up through some very narrow rounded steps that makes it look complicated and even dangerous. In the part of the loft just a side of it, there is a wooden bar that crosses from side to side which is intended to hang clothes, perhaps this covers a need and maximizes space, but if you fill it up with hanging clothes it will start to create a perception of little space and disorder. Regarding the storage spaces there are shelves around the house that solve this but it seems there are no cabinets, only lower cabinets in the kitchen, maybe some organizing storage system could help, for some people not everything they have needs to be visible.

The exterior of the house is made of wood which gives it a good natural appearance. Its height exceeds the 4 meters which helps to have good space in the inside, but if it had to be transported with a trailer as a ready built house it will exceed the transport dimensions
by the European Commission. Overall it democratizes the functional and the aesthetic as its rental price was estimated in 2400 kr. when it was announced in September 2013.

Figure 3.15. The 10 smart sqm layout.
4. PROJECT & PROCESS

4.1 First approach

At the very beginning of the project I considered creating a kind of Tiny House for students in Europe due to the growing demand for student housing, when I mention Tiny House I mean the houses that are built on a trailers to be towed by a standard truck. In the recent years these homes on wheels have grown in popularity in the United States because of their low cost in construction due to their small area which occupies approximately the size of a car park space, for this reason they do not require a building permit according to the laws of that country.
For many people getting free of the mortgage was necessary especially after the real estate and financial collapse with the recession of 2008. In order to continue with the American dream of owning their own house, a group of people opted to construct their own Tiny Houses to continue with it.

There are not so many books published about Tiny Houses, somehow because it is a new trend for a specific group of people. Mostly the information I could find out there was in blog websites, where enthusiasts of the movement write about their experiences and knowledge on the subject helping other who want to
join the movement to gather information on the subject in order to start building their own homes.

The increase in the size of houses in some parts of the world and the population growth with its big demands is producing a negative ecological impact in the environment, diminishing are global natural resources. For this reason and others some people have joined the Tiny Houses movement trying to have a greener lifestyle, these people discuss mainly that Tiny Houses contribute to produce less ecological impact due to less building materials, it favors the less use of land for housing construction, it also reduced costs as well as waste materials, in addition to the lower energy use to heat or cool the interior.

Other reasons why some people believe that Tiny Houses are convenient it has to do with the mental well-being and sense of freedom that it produces by not having many possessions to worry about.

“The tiny house movement is one in which average citizens are picking up hammers to build their own future. They are saying to the powers that be, “We aren’t playing your game; we choose our own destiny.”
It is people recognizing that in their short time in this world, they want the freedom to live a life focused on what is important to them instead of tying themselves to sixty-hour work weeks to maintain large houses full of stuff” (Mitchell 2014, p. 11).

Somehow this reflects a rebellious aspect and criticism of some current lifestyles by not wanting to be part of an economic system based on consumerism where people prefer to be more independent and build lives easier feeling free.

By building a Tiny House with your own hands, as written in several blogs in the Internet, it gives people a sense of personal accomplishment based on "do it yourself" where the sense of appreciation for what you have is rewarding as they are involved in the process of building their own homes.

In relation to my project about the compact housing units with Tiny Houses, these provide information on how to get the most out of interior spaces in order to live comfortable in a reduced room. They also have different alternatives related to independent energy systems to provide power to a small house. On the
contrary the Tiny House movement is based on building the houses by yourself which does not apply well in relation to the students, during the investigation there was not a single case where a student had built or bought a house to live for their study period and neither it is something they were looking for to do in that phase of their lives. They all rented rooms, apartments or houses, in some cases they live with their parents as been locals and studying in the same city. It would be difficult for an international exchange student who comes for one or two semester to have the time and money to build a house. These houses are also built on a trailer with the idea to have them moving from one place to another, this mobility would not be something really needed for a student, of course it could be handy for some weekend travel and then return to the space where they were located, for that they would also need to have a car and that's something not all the students have.

4.2 Defining the compact unit

After analyzing the Tiny House movement the project was defined as compact units that could be mobile but not on their own wheels, rather they could be
transported with the help of a flatbed truck and put into place by a crane. The reason for this is because the concept would be based on the idea of having units that could be rented and placed in various parts of the city of Växjö and outside of it for a temporary use where the municipality will authorize these spaces, in order to cover the demands of student housing, which I have explained in chapter 3 in context, where the demand is high in several cities in Sweden. This could be offered by a private company or local government.

In the interest of having the housing units transported it is necessary to review the measurements permitted by the European Commission about the weight and dimensions allowed to be transported on the streets and highways for safety reasons and to avoid damage to roads, bridges and tunnels. These dimensions are: 16.5 meters long, 2.6 meters wide, 4 meters high and weight 40 tons (European Commission, 2015). From these dimensions the most important ones I need to take into consideration are width and height as the interior space that I have established to work with for the unit is 10 m², for the length I would have enough spare meters because 16.5 meters is much more than I need.
Somehow my intention is to continue proposing living spaces with a smaller number of square meters allowed for student housing in Sweden, which has already begun with the projects undertaken by AF Bostäder that in some way it has contributed to changed the rules in 2014 by Boverket allowing to build apartments for students with a minimum space of 17 m², the previously minimum size was 26 m². Boverket has also permitted projects like Bokompakt, revised in chapter 3, wherein the internal spaces of 16 apartments in the city of Lund have 10 m² and are currently still in use. That is why in my project proposal wants to take the challenge and create a speculative proposal with an internal space of 10 m² and continue exploring the possibilities of compact dwellings that can also be placed in temporary spaces.
Once established the measurement of the unit I could start creating different possibilities for a layout in which I could indicate all the living areas that make up a house, like the a sleeping space, a table for working or eating, a kitchen, a spaces for storage and a bathroom, which are part of the regulations indicated by Boverket, with whom I definitely agree with as essential for a good living.

In this process it was necessary to respect the standard measurements of doors, kitchen sets and single size beds among other things. I had to also taken into consideration the measurement of some fixed objects.
such as toilets and sinks available in the market that could best fit the interior space proposal. On the other hand in order to make the correct arrangement of each object and furniture that create the interior space it was necessary to respect the anthropometric measurements so that a student may have a good movement around the space and likewise to make a good use of the furniture such as chairs and tables without getting hurt or causing obstruction.

By creating a reduced interior space where all activities of the daily living are performed in the same area, except for the bathroom which must be separately, it is important trying to avoid the creation of corridor spaces as they can reduces the mobility and produce a feeling that the place is smaller than it really is. My desire with the design is that the student will not have a feeling of been confiscated, with a waste of space without having the flexibility to have other activities in the room.

Several sketches were drawn with different possibilities for experiencing the interior space, from all of them I came to the selection of three main proposals. They all have an exterior space of 2.55 meters wide and
5.10 meters long, maintaining the adequate width in order to be transported on a flatbed truck, and length being twice the width to keep a good equitable proportion, giving as a result an outside area of 13 m². This is done in order to have at least 20 centimeter wide insulated walls, resulting in an internal area measure of 2.15 meters wide and 4.7 meters long with a total of 10.1 m² of the interior space.

In these three proposals I have put in a bathroom with a shower, a toilet and a sink within an area of 1.9 m². The intention with the proposed bathroom is to have all its components kept to a minimum of space without sacrificing the comfort, this is due to existence of smaller bathrooms where their functions become limited, as in some cases the shower shares part of the same space with the toilet, because of this taking a shower may be difficult and leaving toilet wet and hard to dry out.
Figure 4.3. Three layout proposals.

The kitchen used to determine its space for the proposal in its top view has a sink, drying area and two burners of an electric stove, based in kitchens that are currently used in some student apartments of 26 m² on the campus of Linnaeus University.

In the first image the bathroom is placed in a horizontal position in order to create a kitchen that will remain in a semi-enclosed space, leaving an area for the
bedroom on the right side. This leaves the entrance to the bathroom directly on the side of the kitchen, slightly limiting the movement in it. The bedroom is compact and the feeling of a spacious space it is kind of lost, in a place that in itself is already very limited, leaving little space for moving and placing the furniture in order to have a good circulation area. The entrance is on the right side so the door could be opened and also because there was not many other options on where to place it.

In the second image the bathroom is placed vertically in order to generate on the other side a bigger and more flexible use of space for the kitchen and bed area. The wall created to limit the bathroom supports on the other side the placement of the kitchen, which is suitable for the installation of plumbing pipes as these areas are next to each other which will help using less material. For the front door a space was left to respect the entrance to the bathroom and the bed which is positioned vertically, in this way entering to the unit you will have a view of all the areas creating a more spacious feeling of the place. The bed on one side is against the wall and leaves space on the other side for furniture, in a way by having the bed vertically somehow a kind of corridor is created
to get to the desk, limiting the circulation in this part of the room because of the placement of the wardrobe that it is complicated to have it in some other place.

In the third image the bathroom remains vertically but the kitchen is placed towards the top wall, keeping a good approach with the kitchen and bathroom which is good as mentioned above for saving material for the plumbing pipes, which ultimately it will be reflected in expenses of construction. The bathroom door is located at the middle of it, it is a sliding door which will help to not rest space inside when opening and closing. The main door is near to the entrance of the bathroom and leads you straight to the kitchen, the door opens outwards so it will not bump with anything you may have inside and also it will avoid taking out space. Having the bathroom in a corner with the kitchen and entrance, it allows the rest of the space to be used for the bed, table and wardrobe. The bed is positioned vertically at the other end of the layout, this will help generate a central area in which it will be easier to move around and also adds flexibility to the space.

Of the three options it is the third one that offers better functionality and use of flexibility for the
different areas creating a larger feeling in the room with good mobility in it. This layout is the one I selected to be tested in a student workshop where they could experience what is an interior space of 10 m², and also it will help me to take note of their comments and make improvements in the design layout.

4.3 Questionnaire

This questionnaire was applied to total of 20 students from Linnaeus University to see if it was possible to obtain some information that could help the development of the interior design for the compact unit, and also to corroborate their living conditions in the city of Växjö as students, not for statistical research but to understand more about the situation in relation to student housing. Alongside with the questionnaire I did an interview with some people working at Linnestudenternerna to complement the information and understand the situations students face in order to get a place to live. I tried to keep a short questionnaire with multiple answers mostly so that people could respond in approximately 5 minutes (Appendix A).
From the sample, 8 students were Swedish and 12 international from 11 different nationalities, men and women aged between 20 and 35 years, the average age was 26 years. Their study time varied between 1-2 semester mostly in the case of international students, 2-4 semesters mostly students studying a master's degrees and 6 semesters for undergraduate students (figure 4.4). Most of student lived in campus and the 2 persons who lived outside Växjö were Swedish students living in a house (figure 4.5). Most of them lived in apartments between 20 to 27 m² rooms for one person and in shared apartments over 45 m² (figure 4.6), paying extra for electricity. Only in the case of the corridor rooms there electricity was included in the monthly rent.

Figure 4.4. Period of studies in the University.
What is your period of study in the University?

![Bar chart showing the distribution of study periods among students.](image)

Figure 4.5. Where the students live.

Where do you live?

![Bar chart showing the distribution of living arrangements among students.](image)

Figure 4.6. Square meters in the place students live in.
An interesting result was that most of the students had at least lived in some other place before getting their current place of residence during their studies at the University (figure 4.7) and it took them several months to obtain their current place for living (figure 4.8), corroborating what was mentioned by the people from Linnéstudenterna, that it can be complicated to find a place to live and that there is a need for more student housing. Most of the students did not have plans to move to some other place for the rest of their study period.

Figure 4.7. Number of places you have lived in during your study period.
In how many places have you lived in during your studies?

![Bar chart showing the distribution of the number of places lived in.]

How long did it take you to find your current place of living?

![Bar chart showing the distribution of the time taken to find a current place of living.]

**Figure 4.8.** Time that it took them to find their current place of living.
Only 2 of the students were living in a place that was already furnished and opinions go half and half on having already furnished rooms when renting a place. Everyone receives visits at least once a month and some up to 2-3 times a week, for that reason it is important to consider a space where they can gather with others people. Just six of the students exercised at home and none of them had pets living in their apartments or houses.

Apparently most of the students showed a neutral and satisfied feeling with the place where they lived currently (figure 4.9).

*Figure 4.9. Level of satisfaction with the place they live in.*
These are some of the answers about what they like in the place where they live and what they don’t:

The place is cozy but too small. - Student at campus living in a 28-34 m² room -

A corridor room is good because the kitchen and bedroom are separated. The negative side is that it can be a chaos, people disturb you sometimes and they take your food from the communal kitchen. I like to live in a calm space but at the same time I want a place where I can communicate with others. - Student at campus living in a corridor room –

I like that I have quite a lot of space in my room and that the kitchen is separated. I dislike the fact that there is not much relation with the neighbors. The surroundings and the relationship you can create can help feeling at home and comfortable. – Student living in a shared apartment with another person at Campus -

I like the apartment because it’s big and comfy, what I dislike is the distance to the University which is 4 km. – Student living in a shared furnished apartment with another person in Växjö -
The questionnaire helped me to check and confirm certain information, like if there is a real need for more student housing, but generally speaking it is much more informative having a simple and direct conversation with the students to obtained information about their stories and experiences with the student housing in Växjö.

4.4 The workshop

The workshop (appendix b) aimed to explore with some students of Linnaeus University the possibility to create a space of 10 m² that could suit their general needs and to create spatial experiences as a temporary living home. To do this it was needed to understand how they live and how they manage around in their current places of residence as students. Some questions that needed to be answered through the whole workshop were: How do they study when they are at home? What are the areas or spaces where they spend more time? What are the spaces that they like the most? What are the aspects they do not like where they live? How do they socialize when they are at home?
In order to get some answers the first part of the workshop consisted in answering a questionnaire with the 18 questions, that previously was checked out in this same chapter, to get a general view of their student living situation related to their type of room, renting conditions and level of satisfaction with their current place (Appendix A).

Figure 4.10. Students taking part in the workshop.
The second part of the workshop, started by drawing on a letter size paper their current space where they live and primarily pointing out areas like the kitchen, the bathroom, their resting area, their working area or some other that might be significant or relevant to talk about. For this study it was not necessarily for them to draw perfectly well, since the most important thing was to know some of their stories and how they typically act, think and feel on a daily basis at their place.

The third section of the workshop consisted in showing four examples of compact housing to the students, they were those reviewed in chapter 3.5. The idea was to hear different points of views about the possibility to live in one of these places by understand their tastes in relation to the design in general, their
perception of a small space, their opinion related to furniture with double functions, their suggestions for improvement in some of these places, among other things that could come out.

The last part of the workshop experimented with a full scale interior model of a compact unit with 10 m$^2$ with a potential layout for the design. The model was made from wood for structuring and creating the space, inside the area there was some furniture mockups, full size models used for design evaluation purposes, made of cardboard, to simulate a more realistic feeling of the space so that the students could move around and interact in a small house. The full scale model provided an experience that was not possible in the same way just by describing the area or looking at images.
These are some of the results from the drawing done by the students about their current living place (the names of the students who participated are kept private):

A student commented that the apartment where she lives is for one person but the living room area was adapted as another room so that two people could live there and have their own private space. She spends most of her time in her room which is the place where she gets done her university projects, but sometimes she may take her computer to the kitchen and work there or just simply pass some time there. The place where she socializes with her flat mate is the kitchen.
From another layout, a participant said that the time where she passes more time is at her desk and bed, which she also used as a sofa. What she likes of the apartment is that it has a lot of natural light that comes through the large windows she has, she adds that lighting is very important to feel comfortable. About the furniture she had to buy them but she is very pleased with them because she feels they give a cozy atmosphere to the place. She comments that having your own kitchen is very important and could not live in a place where she will have to share a kitchen among many people, referring to the corridor rooms.

One participant mentioned that she would like to improve the windows of her apartment specially the living room, they need to be larger covering the floor to the ceiling, because she likes the green area just next to them. This area in her apartment has a door that leads out to the green area, were she sometimes likes to go out to smoke a cigarette.

The kitchen and bathroom seem somewhat outdated and old. The building where she lives is actually one of the first ones that were built in the campus, at the beginning of the 70’s, and do not get much maintenance
as students often do not report failures. Regarding this aspect of maintenance she also mentioned that the housing companies make changes to the fixed furniture such as kitchen, refrigerators and bathrooms after certain years but they do not change style, which is something that apparently they do not want to spend much money on.

*Figure 4.12. Drawing of the current living place of a student.*

When it comes to her studies she is not always in the same place, after two days she needs to move to some other area to continue, for some strange reason she can’t concentrate if she has been too long in one same place.
Another student mentioned the area where she spends most of her time at home is the living room and if she has guests it is in the kitchen. She likes the connection between the kitchen and living room because there are no doors to access them and the areas are spacious. She also enjoys the balcony and the large windows, she considers it necessary to let the air in and ventilate the spaces which have high ceilings and likes too. About the furniture the most important one is the bed which needs to be comfortable. She does not like having many things around but just the basic ones to avoid having to spend time cleaning them later on, she defines herself as being practical but at the same time she feels that a space with few things is perceived as bigger. She dislikes the kitchen floor because it gets dirty quickly and easily. She also dislikes the bathrooms because of their simplicity and unpleasant yellowish color which seem very unexpressive. She notes that usually they do not hang much thing on the walls as they do not want holes on them because then they will have to repair them later on.

Another interesting aspect that she mentions it is related to the placing of the furniture, it is not always
kept in one single place, usually she resettles them in different rooms or moves them from place to place, giving a different look to the areas by creating a personal meaning with harmony and functional aspects.

One of the participants pointed out that she likes to collects bottles, which is a way to decorate her room. She also notes that when working on a school projects or just spending time with her laptop computer, she often moves around different places in her apartment, she says it is difficult for her to stay in one place as she gets bored and need to relax as well.

These are some of the comments from the four images of compact housing shown to the students:

One person commented that inside of the Micro Compact House was kind of sterile, but maybe by having the possibility to decorate it could have some other aspect. Another person mentioned that the interior looked cold because of the material used, which is aluminum, and that somehow that could make her feel depressed.

It was also mentioned that the outside appearance was fine, since the proportions of the windows were
good in relation to the size of the house. In general the students felt it was too small to live in.

Overall there was a greater preference within all of the other houses because they had used wood in their interiors giving a more natural and warmer look. Some mention the combination of wood with white walls helped in order to have better lighting inside, but that other colors may also help for that use too.

For one person the Diogenes house was the most striking because it had a good amount of natural light in the interior. She likes the interiors covered with wood, but for a small place she felt other materials or colors combined could work better. The exterior shape resembled her a little too much a small house, which it did not necessarily had to be so.

For another student the Smart 10 sqm house was the place where she could live, but maybe not for a long time. She liked that the bed is on a higher level because it is like another room in the same place allowing for her to have more space below. Another person said that in order to sleep in a bed on another level she needed to have a good space between the ceiling and the bed
because otherwise it will cause her claustrophobia. A student commented that she is simply afraid to sleep in a higher bed feeling insecure.

It was mentioned as a suggestion that because the project was based in Sweden it was a good fact to consider using wood as a sustainable material as there is much in this country.

A person said it is important the presence of colors in the interior to feel warmer and cozy, but she mention too that personal items can help to create that feeling and that is what really creates the feeling of a real home.

Another person commented that the exterior design in general of the four house were good with their simple and clean lines, but most important thing is the inside as it must be very comfortable, especially for the winter season which is when people spends more time indoors.

About small spaces in general a student commented that she wouldn’t need to have lots of furniture, the essentials will be simple enough, and perhaps what could help it will be if they were movable or with some other functions, in order to maintain an open space in
the area. Although we must remember that each person has different habits.

There was also a comment about the importance to have space for storing things especially in these small places used for living.

The subject about beds that could be stored away came out by some students as an idea that could work in a small space. But one person felt that the fact of having to remove it every time she stood up to make room was not very comfortable, in her opinion she likes that its always in one place to make immediate use of it when she felt tired.

For the final stage of the workshop these are some of the comments from the students about the 1:1 scale testing space of the compact housing:
The kitchen although it is small it is still on the right size for all the essentials and it doesn’t seem to be squeezed in some tiny space like some apartments have it. It is important to have good lighting and ventilation for cooking.

The cabinet has enough space to keep in the things they have, as international students usually they will bring two suitcases. It seems appropriate to have a door to keep the things not visible around. If it is necessary to store more things it may be possible to use the space located above the bed to create an area for them. Another suggestion would be to keep things under the floor keeping them hidden from the space view.
About the bed for some people it may be cozy to have it on a higher level, for that it will require good protection to not fall dawn. By having the bed up it leaves space under it that perhaps it could be use to put the desk or a sofa. It was also suggested that the bed could also be on a height a little bit more than usual so it could have some storage space beneath it. Opinions are divided about having the bed on a higher level or down, for some it was also either way.

For a small space like this one, apparently it is best to offer it furnished with the basics, this because sometimes people do not take the right measurements for the furniture they might need, and its precisely in a place like this were one mistake can mean not being able to place well the furniture or simply create a waste of space. Perhaps items like chairs people could buy them separately in any given case. What could maybe work well for the room is to have some flexibility to give some sort of change and dynamism to the place.

It was suggested to have a large window on the side where the desk is located for good day light inside the room. If the place was dark with a very close feeling it
would be very difficult to live in there. The ceiling is high which makes the room feel larger.

In general it seemed that the students who experience the housing unit test where pleased with the layout and there were no suggestions to make changes in the areas. It was just in the bathroom where the sink had a comment on its size because it was too small, besides that the bathroom had just the right size for an everyday use.

One person commented that perhaps living two years in a small place could be difficult, but she thinks it could be ideally for Erasmus who come to study for one semester. To hear about a 10 m² living space sounds very small but after seeing what it really is and how you can achieve to accommodate all the essentials within the space actually it does not feel that small as it sounds, and this proves it good enough for one person to live in.

Another person said that if the price is good enough she would not mind living in a place that is small, actually there is no point on overpaying for spaces that sometimes we don’t really use.
It was also mentioned that there is a market for people who like dynamic spaces where furniture has a universal use.

Perhaps the place does not work for people with disabilities, but let's face it most of the people who need a place here in Campus are students with no disabilities. By the way there are already apartments that meet the requirements which fit everyone.

About the sustainability of the place, they believe it is an important issue to consider it in its construction, especially if the material used is recycled or if it can be easily dismantled so it can be reused or recycled too.

4.4.1 Conclusions of the workshop

Overall the proposed layout seems to be appropriate and work well for one person to live in comfortably with the essential for a daily life as a student. It will be important to have natural lighting and large windows as it seems a common point in all the participants.

It seems it is important for some people to arrange the furniture in their own way so that it has logic to help them perform a specific activity or just to feel more
comfortable through a personal harmony. For some this may involve the need to reinvent the space occasionally, this might mean that they will need to buy their own furniture to create their own space. But after seen and test the 10 m² living space they felt for that kind of accommodation it is better that the place comes furnished for rent. In that case it will be good to consider the use of furniture that can give some flexibility into the space. It will also be good to leave or create some space where they can put some personal things that can really create the feeling of home, and consider their main essentials and more important objects which in general nowadays they seem to be a laptop computer, a mobile phone and a tablet.

For some people sleeping high up from the floor level, like in a loft or a bunk bed may be acceptable for a few days but for a longer term they will prefer to sleep on a lower bed down. Two of the reasons you hear more often of not liking to sleep on a high level are having to climb up and down, and hitting your head on the ceiling felling not safe. For other people it is ok to sleep on a higher level because it may add some more extra space
on the lower part which could be used to place other furniture.

It is important to consider a space to socialize within the room but also outside of it, as it has been mentioned that some of the students do not know their neighbors and it would be good to create new spaces that could facilitate getting along with others.

In relation to sustainability it makes it more attractive because somehow they are aware that it is important to contribute towards the environment and for that it is good to consider local materials which could be recycled or reused, that would not harm the environment.

4.5 Final Layout

After reviewing the results of the workshop and putting it together with other information of the research, I continued to define the final layout of the unit. In general it remained very similar to the one presented at the workshop as students found it to be well arranged, the suggested were done mostly on details related to the furniture.
Part of what now is been considered is that the furniture would have to be included in the rent of the compact units. This furniture should have some dynamism inside by creating a space that could be more flexible by adapting to different situations such as socializing or create more space if required.

*Figure 4.14. Layout of the compact unit.*
Figure 4.15. Layout of the compact unit on 3D.

Figure 4.16. Interiors of the compact unit, sleeping area view
In the case of the table or desk it will be attached from one side to the wall and it would have the possibility to be removed by folding it in case of wanting to add more space to the area.

*Figure 4.18. Folding desk.*
Figure 4.19. Folding desk taken away.

With the bed I attempted to see if it could work at an upper level to create more space under it, the problem was that the space between the mattress and the ceiling was somewhat small. On the other hand I tried to re-dimension the height of the ceiling but it was difficult, as the unit is being proposed to be transported with a flatbed truck, so the height measurements were beginning to exceed the limits determined by the European Commission. For this reason the bed was kept on the ground level, but then suggested as a Murphy bed, which can be store vertically against the wall as one side is hinged to one end. This type of bed will help create more space in case of having guests or for any other activity. The bed does not need to be constantly
raised up to be able to move around the room, it’s only in the case if requiring more space, because for some people it is not comfortable having to pull down every day the bed for sleeping. The fixed structure supporting the bed to the wall at its top has some shelves for storing books or other personal items which may serve to give a personal touch to the place too. To give a greater use of the space once stored the bed to the wall, from its bottom it’s possible to unfold a small dining table were two people can make use of it.

*Figure 4.20. LEFT. Murphy bed folded in.*
Figure 4.21. RIGHT. Table that comes out from the lower part of the Murphy bed.

Figure 4.22. Students gathering inside the compact unit.
4.6 Main construction material

The exterior design of the units somehow it’s determined by the dimensions that are required for it to be transported, and also by the functions that are required in the interior space. Another aspect that should be taken into consideration, although it’s only a concept, is the price for rent as a single room for students which should be economical for its size, this should be around 2500 and 3000 kr. for a month as these are the prices for similar and cheapest places in the Campus of Linnaeus University and Växjö. This indicates that it’s better to keep it simple with low costs for materials and manufacture to achieve a price within that range. In the workshop it had been mentioned that the exterior design could be something simple but the most important thing will be the interior been comfortable. Although the exterior design might be simple, perhaps it can reflect something in relation to the students.

It was also mentioned in terms of sustainability that the construction material could be some kind of local material. Therefore by reviewing the local and sustainable materials which the city of Växjö uses
definitely wood is the ideal material. This is what the municipality of Växjö mentions in their document about Wood construction strategy:

“Växjö is committed to taking an active lead in the use of wood in new construction. This focus on wood is a fitting example of the strategic sustainability work in the Greenest City in Europe. The strategy aims to promote the use of wood in new building projects, not only for the municipal companies but for all the other players in the wood and construction industries as well” (Växjö M, 2013).

That is why I am proposing wood as the ideal local construction material as the municipality wants to promote it as a local product and for its sustainable properties. Besides the city aims to become within the next years a fossil fuel free city and by having a leadership in the timber industry with construction techniques it gives an advantage to it in that context. Here are some of the city objectives from the Wood construction strategy document:
A fossil fuel free Växjö (Växjö Municipality’s Environmental Programme, adopted by the Municipal Council):
• We will stop using fossil fuels
• We will make efficient use of energy

By 2020 the province of Småland will be a leader among Europe’s wood regions (“Think Wood for a Sustainable Småland”, Regional strategy for timber and wood-related industries, adopted by the three regional development councils in Småland in 2012)

Växjö Municipality and the city’s municipal companies (Executive Board §317/2012):
• By 2015 25% of new builds will be wood-based
• By 2020 50% of new builds will be wood-based (Växjö M, 2013).

4.7 Exterior design
Taking the above into consideration and establishing wood as the main material of construction I began to make a series of sketches to create the exterior design of the unit. Somehow I felt that due to the regulations with the measurements, the exterior space was practically already defined in a rectangular area but I did not want
to fall into that shape, so I went on with a series of sketches to see different alternatives. These are some of the sketches that were made to create the exterior design:

*Figure 4.23. Series of sketches.*

After the series of sketches, there were two possible potentials designs to developed, the two are based on simple lines, one is formed with some curves and big window front, the other has more straight lines which are placed in some different angles. It is this last one I selected to continue for the development of the final design, its shape is based on strait lines that are easier to
produce and goes far more in relation to the context of Växjö. The other concept wanted to create some change with these straight lines that are seen in the majority of the houses around, but at the end if the project is for the city of Växjö, I think it is better do something that fits to the local context.

Figure 4.24. Sketch rounded corner option.

Figure 4.25. Sketch straight lines option.
When testing the possibility to put the bed on a higher level I decided to try the use of an angled wall so that the bottom could have a little more space, preventing people to hit their head with the bed, in case of having a table or sofa underneath. Although this idea of having the bed above was complicated to develop, I decided to keep the sloping wall for the design of the unit giving it a more dynamic look.

The roof is proposed with a low slope so the rainwater and melting snow can come down over the continuous metal roof, this same material covers two sides of the exterior walls too. To apply this I had to check that the interior will fit this following rule mentioned by Boverket: in sections of the room where standing height is needed, the room height must not be less than 2.10 m under horizontal sections of roofs or 1.90 m under sloping roofs (Boverket’s Building regulations 2012).

For the other two outer walls, front and back, which are the largest, wood is used to cover them. There is a white frame, which covers the thickness of the two side
walls, ceiling and floor, which connects to vertical boards with different lengths, varying in three different shades of one color. This is idea was inspired by the houses around Växjö, where you can see houses that are identical in shape but their variation is done with different colors. I applied this idea to the design by adapting to the context, with a slight variation using the different tones of one color. The idea of the different tones arises when contemplating the landscapes of Småland where you see kilometers of forests stretching to the horizon, with the green color in different shades. In relation to the use of different tones of wood, this is something I've also seen in other buildings and even in Växjö, in the façade of the Myresjöhus Arena.

*Figure 4.26. Houses around Växjö, same shape with different colours.*
Figure 4.27. A variety of different colours for the compact unit.

Figure 4.28. Facade of the Myresjöhus Arena.
Figure 4.29. Single unit perspective in green.

Figure 4.30. Front view of the compact unit, units in cm.
4.8 Power and water supply proposal

Normally a house in Europe is connected to a system of permanent access to water and energy because they work on the grid, but what are the alternatives to a house that will have a temporary location that could be placed for a minimum time of one year? In this case the compact unit may not always have the guarantee to be connected to a water and energy sources, therefore it is needed to propose a power supply system and an alternative to get water in and out.

First of all the unit shall be designed in such a way that energy use is limited by low heat losses, low cooling demands, efficient use of heat and cooling and efficient use of electricity. We can choose a heating system that can be energy efficient but with the space being reduced it will need less heating in the first place.

To provide electric power to the unit it would have the possibility to be connected to the grid and also to a portable power supply. I am also proposing to use solar energy, collecting this through photovoltaic panels, which produce electricity from light.
The design is considering for the bottom of the house a metal structure that will support it and also contain two water tanks. One would be for clean water and the other for wastewater. The idea would be to collect rainwater to be used for bathing and washing dishes when this water has been used it would go to the wastewater tank. It is clear that at times and depending on the season, rainwater would not be enough so the company which leases the units would be responsible for filling the tank of clean water whenever it is necessary well in advance. A person from the municipality of Växjö mentioned that there is a possibility to get the water supplied from them, but I think in this case it is better that the company who rents the units will have to include this service and also remove the wastewater. On one side of the unit there will be a small storage area where the water heating system would have to be placed in. For the toilet I am proposing a composting toilet, for some people this may be a bit extreme, but this will help the wastewater tank to be easier and cleaner to dispose because it would not be connected to the toilet. Today there are many modern options of composting toilets, where the difference with a conventional toilet is not really seen, of course each
time the tank is full you will have to trough away the waste, but this has also been developed to be an easy and clean process. Due to their water efficiency, they are also beginning to be employed even when conventional sewage options are available (Bergman, D. 2012, p. 41).

*Figure 5.31. LEFT. Single unit perspective 1.*
4.9 Location

To locate the units in Växjö and its surroundings, the proposal aims to create groups of eight houses divided into two groups of four each, the idea of this is to create small communities. One of the units would be used as a laundry room for the other seven houses, it would also have a wheelchairs accessible toilet. In each of the groups of four houses I am proposing a space to sit outside, gather with friends and even have a barbeque. This idea was taken into consideration as in the workshop and talking with other students, many commented that there is a lack of space to gather with other students and in many cases they do not know their neighbors. To group the four houses I am proposing a
wooden structure that could be installed and function as a deck. It will have a ramp for wheelchair users as determined by Boverket, the maximum slope shall be no more than 1:12 (Boverket’s Building regulations 2012). By using this structure the water tanks will be hidden but there will be one side from where the water could be supplied and discharged.

Figure 5.33. Top view of the group of eight units divided in two groups of four each.

Figure 5.34. Group of four units.
To install the group of units the location proposal would be a land or parking lot where the municipality can give temporary permits for that, people from the municipality of Växjö said that it could be possible. In this last picture there is an example where a parking lot near the Campus of Linnaeus University is proposed to occupy a group of eight units.
Figure 5.36. Two group of four units each one vied from the top on a parking lot area.
5. SUMMARY & DISCUSSION

The project aims to provide a design proposal of a temporary compact unit as an alternative that could help reduce the shortage of student housing in places that it may be required but mainly speculating for the city of Växjö, with the possibility that it may be used in other parts of Sweden too.

I explore the possibility of living in a space of 10 m², which may sound like something small to live in, but as we have seen in other cases and in the workshop held with the students, when presenting the interior space as a suitable accommodation having everything you need to live comfortably, their idea had changed by accepting the possibility to live there for some time, as the space is not perceived as too small anymore. Still it is clear that this type of housing is not for everyone because for some students living in an apartment of 26 m² it is already too small, but it is an idea that can work for some students who may feel comfortable in a compact space for a fair price.

Living in a smaller space does not mean you will have an uncomfortable life. What is sought with this
project it is to optimize the area by being more flexible and to be efficient in the organization of it, in this case furniture with double or triple use proves it can contribute into that aspect. By reducing our space we also become more selective about the things that we really need for living. Learning how to live well with less by downsizing the amount of stuff will help to consume less which means that it will also decrease the consuming of less environmental resources.

According to the actual regulations of Boverket, the proposal of a 10 m² living space for a student is too small. But it is good to know that certain student housing companies have been looking for different alternatives in the compact housing area to reduce the shortage of it. As a result their effort and proposals had led to the change of certain construction laws and also having some special permits where living spaces with a small number of square meters had been possible.

I had the opportunity to talk with Krister Eriksson who works at the Växjö municipality as an engineer checking the building permits, I presented him part of my work of the compact unit, he basically revised the general measurements and thought it was small for a
house, it was no surprise as the regulations indicate so. Although he mention it will be possible to have it as a friggebod (shed) because it works according the regulations. I told him about the permissions that have granted to build small housing in the city of Lund but apparently he was not aware of this. As for the land to place the compact unit in temporary places, he says it is better to have your own, but there is a possibility of having some places around Växjö.

The acceptance of compact apartments by certain students in the city of Lund and by some people knowing about their existence opens the possibility and curiosity for the temporary compact unit as an alternative to be used with this same niche.

I think the compact units could potentially work for international students who come for an exchange semester or for students who can stay for a semester meanwhile they are gathering points to later on apply for an apartment as that is how the Swedish systems for renting an apartment works, of course if they want to stay for a longer time in the compact unit they can.
After the research, the results led the compact unit to be placed in groups, due to the need for areas to spend time with other students and because not all of the necessary services for living could be placed in the unit, like the laundry room. Overall by having the compact units in groups it will be more functional to operate and maintain.

The project in general has been a great challenge by trying to make the compact unit fit and balance the required needs from the students, regulate it regarding certain construction rules and possible systems than can work off the grid among other things. Part of what I've learned from the project has been seeking and developing tools and methods that can help facilitate people respond and contribute with ideas that can help create and develop the design.

The next step could be to take the compact unit into a further evaluation and at some point with the right adjustments from experts of various disciplines, implement a series of functional prototypes to evaluate the results and subsequently adapt the requiring changes according to the operational and users needs. It has been seen with projects that have a certain similarity to this
one, that in order to develop a functional prototype for a test it has taken some years of research with a large number of experts participating to achieve that.

These are the main aspects that the compact unit will like to achieve considering that it would have a functional prototype test at some point in the future:

- Reduce the number of students who decide to cancel their studies at Linnaeus University and go to study to another city or country by guaranteeing them a place to live during their study period.
- Create and promote an environmental awareness among students who choose to live in one of the compact units by learning about some alternatives that exist for sustainable energy.
- Support the local industry by using local materials and try to work with manufacturing processes that could also be developed or existing in the area.
- Reduce the ecological impact with the use of local materials that do not require a complicated process to transform raw materials, so that the carbon footprint will be less.
• The construction of the unit should be pre-fabricated in an interior space to reduce time, costs in production and waste that is generated more when construction is done on site.
• The installation process for the units on site should not be complicated and should not require more than 24 hours for that.
• The maintenance of the compact units should be easy and once its lifetime has finished it should also be easy to dismantle for a new use of the material or simply for recycling.
• It should also be possible to offer it for sale to anyone who wants to have an extra room in the backyard of their house for any kind of use they might want for it.
• With a good use of materials and minimal dependence on energy-consuming systems, the compact unit can have the possibility to be both environmentally and economically smart.

The project could have more adjustments, this is what I believe it is part of any design, it starts with an idea that later on in its process takes a shape to achieve a result, but there are always things that can
be changed or could later on be adapted by evolving with technology, needs and new ways of thinking. Through time some designs may no longer be in use and later forgotten, others may serve to inspire to create new things that can contribute for a better life, putting it in sustainable terms, a good quality way of life with a responsible use of natural resources, which after all it is the big challenge.
APPENDIX

A. Questionnaire

The questionnaire is intended to gather information about some of the aspects of students housing and living situation for those who attend Linnaeus University. The master project is related to compact units with a study case for the use of students.

Your answers are confidential and will only be used for research purposes.

Gender:

Male       Female       Other

Age:  Nationality:

1. What is your period of study in the University:

   Less than a semester 1 semester 2 semesters
   3-4 semesters 5-6 semesters
   More than 6 semesters

2. Do you live in:
    Campus   Växjö   Outside of Växjö

3. Do you live in:

    apartment  corridor room  house  other
4. How many square meters do you have in the place where you live? (if you don’t know more less try to guess)
   under 20  20-27  28-34
   35-45  Over 45

5. How many rooms do you have in the place where you live? (Do not include the bathroom)
   1  2  3  4
   More than 4

6. How many people live with you?
   only me  another person  2 more people
   3 more people  4 or more

7. Do you pay extra for electricity?
   yes  no

8. In how many places have you lived so far during your study period at Linnaeus University?
   1  2  3  4
   More than 4

9. How long did it take you to find the place where you live now?
   less than 15 days  15-30 days  1-2 months
2-3 months 3-6 months more than 6 months

10. Are you going to move to some other place during your study period?
   yes  no  maybe

11. When you got your room was it:
    furnished  unfurnished

12. What is more convenient to have?
    furnished room  unfurnished room

13. Do you have people who come to visit you at your place?
    every day  2-3 times per week
    1 time per week  1 time a month  No visits

14. Do you exercise inside the place you live?
    Yes  No

15. Do you have a pet living with you?
    Yes  No

16. What do you like most of the place where you live (inside)?
17. What do you dislike the most of the place where you live (inside)?

18. On scale of 1-5 how satisfied are you with the place you live in?

1 very dissatisfied  2 dissatisfied
3 neutral  4 satisfied  5 very satisfied

19. Is there some extra comment that you will like to write down?

Thank you very much for your participation!

Taneli López Vallejo - Design Master Student at Linnaeus University

B. Interviews and workshop

Rikard Söderlund and Jenny Johansson, Housing officers at Linnéstudenterna – 31 March 2016

Krister Eriksson, Building permits Engineer at Växjö Municipality – 2 May 2016

Workshop with the students – 1 April 2016
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