INTERIOR DESIGN OF RECREATIONAL BOATS: A COMPARISON BETWEEN THE DESIGN CONSIDERATIONS OF NAVAL ARCHITECTS AND INTERIOR ARCHITECTS

AHMET CAN GÜVENÇ

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ABSTRACT

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Güvenç, Ahmet Can

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Thesis Advisor: Prof. Dr. Özgen Osman DEMİRBAŞ

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There are basically two main objectives of the thesis. One of these is to understand the basic priorities and design principles that are considered in the interior design of recreational boats that are 24 meters and above. To achieve this, construction techniques and materials in the last two decades are studied chronologically and their effects on the yacht industry are studied. In addition, as another significant factor the effects of the concepts like comfort, luxury and ergonomics of the interiors of a motor boat are examined. Second objective is to reveal the basic design approaches of naval architects and interior architects during the design process of a recreational craft. In order to understand the differences in their design approach in, the design process of a recreational craft is examined. Naturally, both naval architects and interior architects have different professional and educational backgrounds. For this

reason, it is assumed that there might be differences in their design approach. In order to understand these factors and to propose a better collaborative working model for yacht design, a survey has been conducted. According to the results of the survey, various design approaches and commonalities of the naval architects and interior architects are considered in relation with each other. According to the results, it is clear that the general design approach of both engineers and designers are similar with each other. As a general point of view, the inclusion of the interior architect to the design and production process of a yacht as early as possible is stated both by the naval architects and interior architects.

Keywords: Yacht Design, Anthropometry, Ergonomics, Interior Architecture, User-Centred Design, Naval Architecture

ÖZET

GEMİ MÜHENDİSLERİ VE İÇ MİMARLARIN GEZİ TEKNESİ İÇ TASARIMI YAKLAŞIMLARININ KARŞILAŞIRILMASI

Güvenç, Ahmet Can

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Tezin temel olarak iki amacı vardır. Bu amaçlardan biri 24 m ve üzeri büyüklükteki gezinti teknelerinin iç tasarımında dikkate alınan temel öncelikleri ve tasarım ilkelerini anlamaktır. Bunu başarmak için son yirmi yılda imalat ve malzeme odaklı gelişmeler kronolojik olarak incelenmekte ve yat endüstrisi üzerindeki etkileri araştırılmaktadır. Ayrıca motor yatların iç mekânlarında konfor, lüks ve ergonomi gibi kavramların etkileri, tekne tiplerinin ve yapılarının mekânsal etkileri ile birlikte değerlendirilmektedir. İkinci amaç, bir gezi teknesinin tasarım sürecinde gemi inşaat mühendisleri ve içmimarların temel tasarım yaklaşımlarını ortaya çıkarmaktır. Farklı yaklaşımları anlamak için bir gezi teknesinin tasarım süreci, ilk aşamalarından üretim sürecine kadar incelenmektedir. Doğal olarak, hem gemi inşaat mühendisleri hem de iç mimarlar farklı mesleki formasyon ve eğitim deneyimlerime sahiptir. Bu nedenle tasarım yaklaşımlarında farklılıklar olabileceği varsayılmıştır. Bu faktörleri anlamak ve yat tasarımı için daha iyi bir işbirlikçi çalışma modeli önermek için bu

iki meslek grubunun katılımcıları ile bir anket çalışması yapılmıştır. Çalışmada, gemi mühendisleri ile iç mimarların çeşitli tasarım yaklaşımları birbiriyle ilişkili olarak ele alınmıştır. Sonuçta hem mühendislerin hem de tasarımcıların genel tasarım yaklaşımının birbirine benzediği görülmektedir. Genel bir bakış açısı olarak, bir yatın tasarım ve üretim sürecine içmimarın olabildiğince erken dâhil olması hem gemi mühendisleri hem de içmimarlar tarafından belirtilmektedir.

Anahtar Kelimeler: Yat Tasarımı, Antropometri, Ergonomi, İç Mimarlık, Kullanıcı Odaklı Tasarım, Gemi Mühendisliği

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CHAPTER 1: INTRODUCTION

Human comfort and his ease of move in the space are two important factors for almost all design disciplines. Actually, every design object around us has been created according to the general anatomy and ergonomic needs of humans. This idea turns into something more significant in floating structures' interiors. Most of the vessels share a very common feature; which is limited space. From passenger ferries to recreational crafts the same problem can be observed. Hence, volumes in a boat need to be considered carefully. Additionally, if it comes to the interior design of the recreational craft industry, design cannot make concessions from comfort, safety and luxury. So, the interior structure of motor yachts needs to be designed under the circumstances of user satisfaction.

Furthermore, human being has been using vessels for thousands of years. Except for the manufacturing techniques and material selections, the usage purpose of the boats did not change that much. Since the discovery of the vessels, humanity has been using them for many various purposes like trade, military, exploration, fishing, racing etc. When it comes to the recreational craft concept, the usage objective of them did not change that much.

People with big incomes have been using them to express their power to the rest of the world. Additionally, those are highly expensive vehicles which take almost years to complete. During that process, there are many different professions that involve the construction of a recreational craft.

The main focus point of this thesis is to consider the design approach of the naval architects and interior architects. A general approach to the interior design of the motor yachts over 24 meters will be examined. When the size of a motor yacht gets bigger, the size of the areas, owners' requirements and the number of crew increase too. To be clearer, the vessel begins to turn into a complex floating living space. This can be observed more on the motor yachts which are longer than 24 metres. In some cases, because the owner has too many extreme requirements (jacuzzi, swimming pool, gym, helicopter, jet-skis, speed boats etc), an additional yacht supporter

accompanies to the main vessel during its journey. Despite the size of the vessel, naval architects and interior architects need to consider that the boat is still in the water. So, the interior areas must be located according to that. If it is not designed properly, user's psychological and physical health might be affected in a bad way. Those are some of the major points that need to be considered during the design and construction of the motorboats by the naval architects and interior architects. Nevertheless, because of their professional approach to the interior design of a motorboat, there can be some major differences. To comprehend this point more clearly, there will be a survey prepared and distributed to naval architects and interior architects that have certain experience and knowledge about recreational craft design and construction. According to the results common and different design approaches that are considered by both professions are evaluated. As a result it is concluded that collaboration of naval architects and interior architects during the design and construction phases of a motorboat is more effective.

1.1 Problem Definition

Except for the structural needs and proper material selection, interior layout and circulation can be considered as the most significant part of a temporary, permanent or movable interior. An interior space must be able to provide any needs of a user with comfort, ergonomy and functionality. When it comes to the movable places the usage of the interior becomes more important. Mobile interiors such as yachts, caravans etc. require different kind of needs and a designer must be capable of understanding and providing appropriate design solutions to the user. From commercially used aeroplanes to private off-road caravans, every mobile interior's safety and structure must be considered carefully by the design team through special calculations, software simulations and prototypes. According to the results of these analysis and research, if the vehicle requires some revisions, they have to be made. Additionally, in relation with the anthropometric requirements of the users, being in a closed and small environment could be quite uncomfortable. For this reason, all interiors of a mobile environment must be located carefully that is suitable for the users' needs and requirements. As an example, a seating unit can't be used only for sitting. There must be an area located underneath for storage purposes. Also, it must be able to turn into a bed when it's needed. In general, this is a valid principle that must be considered by every designer and engineer that is working on mobile spaces.

As mentioned before, each type of mobile interior has its own characteristic, structure and design.

According to the construction purpose of a vessel and the technical equipment that is located inside of the ship determine the main usage area of the ship. Most of the types of watercraft are designed and constructed under the general supervision of naval architects, marine engineers and construction specialists. Until recent years, interior architects and designers were rarely involved in the ship building industry. Instead of this, from hull design to the superstructure and interior layout design most of the job has been done by the naval architects. Actually, some companies are still applying this idea in some kind of special ships such as tugs, dredgers, anchor vessels, naval ships, tankers etc. However, benefiting from designers in the marine industries has been expanding day by day. The need for designers is increasing day by day, especially in recreational craft building industries. According to some opinions, recreational crafts are the only kind of ship that specifically requires the gentle touch of an artist or a designer. From riverboats in the ancient Egypt that are specifically constructed for the pharaohs to the steam-powered ocean liners, the impact of designers can be observed. The concept of recreational craft can be considered under several types such as sailing boats, motor yachts, speedboats, yacht supporters etc. According to the hull type and the specific regional characteristic, each category has also some sub-categories. In the scope of this research, only motor yachts have been considered.

Motor yachts have been in use since the beginning of the 20th century. However, in the beginning only a small number of wealthy people could own these boats, since these boats were designed just for high comfort and luxury for its user, it was quite difficult to afford one of them. For this reason, only the wealthy part of the society was capable of owing a recreational craft. After the Second World War, major technological improvements, the latest naval construction materials and techniques reflected on the recreational craft industry too. Hence, it became a little bit easier for some other groups to afford a motor yacht. In today's World, many different kinds of professions are working on the design of a recreational craft to make it more comfortable and effective under the general requirements of the users. These are: naval architects, marine engineers, naval construction specialists, architects, interior

architects, industrial designers and yacht designers. Among these professions, naval architects, marine engineers are the ones that work on the engineering part of the job. Additionally, interior architects are the ones that organize and decide every single detail that will happen inside and outside of the vessel. Working on challenging projects like motor yachts requires effective teamwork. Specifically, in recreational craft building industry the collaboration of naval architects, marine engineers and interior architect from the beginning is very important. Since, one single design decision by any of the professionals without informing the other could cost some major issues in the static structure of the vessel. However, neither naval & marine engineers nor interior architects are spending enough time with each other during the design and construction process. Consequently, it is quite possible to observe problems on the ships. Teamwork must be adopted by most of the professions and companies to spawn more comfortable, highly effective and usable recreational craft.

1.2 Aim of the Study

The concept of naval & marine engineering is a well-known expression for every person that is familiar with the industry. Since oceans are quite important for human life and civilization, the industry of ship building has a significant part in our daily life. To be more specific, it can be stated that marine industry is one of the most important industries. Since naval & marine engineers are trained specific for this industry, also in the recreational craft industry naval & marine engineers undertake both the design and engineering processes. Other than that, there are some new professions that have been joining the ship construction business specifically for the last two decades. Most of them are the professions that have already improved the product and different space qualities under the general needs of customers. Despite they can be observed in most of the other business sectors, they have begun to show themselves in the recreational craft industry for the last years. These professionals are: architects, interior architects, industrial designers and yacht designers. It can be seen as quite challenging to evaluate all these professions' general relationship with the recreational craft industry. Due to its main responsibilities both inside and outside of a motor yacht, in this study interior architecture is considered as being the core design profession that is coherent with the yachting industry.

From the first sketches to launching process of a ship into the sea, most of the naval architect and marine engineers focus their attention on the mechanical and physical structure of a motor yacht. This is mainly originated from their engineering based education. Naval architect and marine engineers' first principle can be quite easy but also important: to build a vessel that can float properly. While doing that designing a smooth hull structure, creating proper mechanical relationships between decks, using advanced technological equipment, choosing the structural materials, decreasing the vibration and creating a safe engine room can be seen as one of the main duties of a naval architect and marine engineers who works in a recreational craft project. Other than their engineering-based education and main duties they can show some differences from the designers in the way of design thinking. This mainly originates from the basic principles that they have adopted.

Furthermore, the point of view, general knowledge and experience to a certain subject determines your main decisions on the design and production parts of an element. In general, naval architect and marine engineers follow this kind of a path during the envisagement and construction periods of a motor yacht.

Different from naval architect and marine engineers, interior architects prefer to follow a different kind of design-based system while designing a recreational craft. Different from considering the design problem from the engineering point of view, an interior architect's design consideration is mostly rely on the design. A designer's main principles include concerns like, functionality, comfort, usability, safety and aesthetics. To make that happen they give most of their attention to the user group and profile. Accordingly, they shape the general structure of the vessel. During the design of a motor yacht, a person that is responsible for the envisagement part of the job focuses his/her attention on some basic stages. Shaping a customer profile and scenario could be one of the initial stages. To make that happen an interior architect conducts detailed research about the owner and organizes some meetings to figure out what are his/her requirements inside of the motor yacht. From the beginning to the end of the project a designer must keep in touch with the user to inform him/her how the work is going. After the detailed user profile research and writing a functional scenario, further stages can be carried out. Drawing the first interior and superstructure sketches, bubble diagrams and schematic diagrams could be counted

into some of them. Furthermore, after deciding some certain areas, the technical drawing procedures, interior and exterior material selections, lighting planning etc. will be some of the main duties of an interior architect. As mentioned before, during these processes every little step or revision should be shared with the other design team members who are also involved in the design and construction of the recreational craft project. Skip doing this could cause significant engineering and design-related issues. Understanding a concept with an aesthetic point of view and designing every element inside of the space for the user can be seen as some of the main principles that designers generally follow.

Collaboration between disciplines might be the critical factor to reach a proper design. There could be a big gap observed between engineering-based and design-based professions during the envisagement and construction periods of a recreational craft in today's world. However, from the point of view of interior architecture design disciplines and rules, those gaps will close with the help of a carefully prepared survey research. In order to figure out, some of the main differences between naval architects and marine engineers and interior designers is aimed to be determined through this research. Hence, it will be quite possible to understand what kind of perspectives they use to create a recreational craft. As a consequence of that, there will be some possible gaps found in both professions way of their professional act. Understanding these different approaches might be helpful to provide information for the future designs of the yacht industry. This is not only limited to yacht industry but it might be also provide some guidelines for all kinds of ship building problems. In addition, an interior architect's main duties and responsibilities in yacht design business through their collaborations with the naval architects and marine engineers, the way they decide on the interior layout and ways of realizing the design ideas into real boats will be emphasized in detail.

1.3 Scope of the Thesis

In the first chapter a general outlook of the thesis is given. First the problem definition is defined and then the rational of the research is explained in detail. In this sense, the design approach of the naval architect and marine engineer versus interior architect is stated and then the importance of their collaborative work is mentioned specifically for recreational craft design.

In the second chapter of the thesis, the concept of a recreational craft is deeply examined. First a time travel is done to understand, how people were using lakes, rivers and seas at first and what kind of vehicles they were using to cross them or travel along with them in old days. This can be seen as one of the main topics of the chapter. General developments in the ship design and construction from the Neolithic Age to the 20th century's modern ships are evaluated. In addition to that, to show the importance of vessels, different kinds of ship types, their design and construction purposes are explained under some certain headlines. While understanding them, it is beneficial to know the types of hull and their features. For this reason, generally preferred hull types, their usage purposes and regions are also mentioned in this chapter. Because it can be seen as the foundations of every ship and boat, basic principles and design processes of hulls are also considered. Last but not least, the concept of recreational crafts and their main requirements are discussed under this chapter. The main focal point is based on motor yachts. However, some basic knowledge about sailing boats is also discussed. To be more specific, because the concept of motor yacht spreads into a very large area there will be only vessels which are bigger than 24 meters examined. This also includes Mega yachts and Giga yachts. During that evaluation, their average sizes, interior area usage principles, what kind of technical and design-based features they have are some of the main research approaches.

In the third chapter, the interior design of recreational crafts which are 24 meters and over is analyzed. To make that happen the main principles and objectives of an interior architect has to be understood. After that, some of the main interior features of a motor yacht are mentioned. They can be listed as; comfort, security, functionality and luxury. These elements can be seen as some of the essential structures of a recreational craft. Without considering and applying them properly it cannot be possible for a user to live inside of the vessel comfortably. Furthermore, deciding the exact locations of common and private areas is one of the further steps of this part. Both types of areas show certain importance for their users and the crew of a motor yacht. To make them more clear and understandable, what kind of common and private areas required inside of a motor yacht that is bigger than 24 meters are evaluated. Explaining their characteristic specialities add another point of view while figuring out the life inside of a luxurious vessel. Another additional point

of this chapter is the mechanical and electronic structure of a recreational craft. Some of the essential elements inside of a vessel are provided via these systems such as engine rooms, lighting, air conditioning, technical equipment, water systems etc. To make it more clear, without the use of these systems it would not be possible to sustain life in a motor yacht. Another important point of this chapter is the consideration of the crew. Because the main focal point of this research will be done on big motor yachts, there will be a general need for crew and special parts in the boat for crew. Due to that, action of the crew, their interaction with the guests and usage of their own private areas are considered as the critical points of this chapter. Moreover, because the main research is related with mobile interiors, human anthropometry and ergonomic features has become more important. For this reason in the last part of this chapter, there is an evaluation made based on human factors in motor yachts and human-machine relationships in terms of anthropometric and ergonomic standards. While doing that some of the certain technical needs and main measurements are mentioned to create a more livable interior for a motor yacht.

Forth chapter is the research study in which the methodology of the research, the survey and the results are discussed. Due to the Covid 19 Pandemic, the survey has been conducted online an all data collection process has been online. In this chapter the whole process is described in detail. Furthermore, the results of the survey are stated and the findings are evaluated in the further step of this chapter. According to the results, a general comparison is done to find out if there is any design approach differences between naval architect, marine engineers and interior architects. Consequently, their professional tendencies in motor yacht design are figured out. In this way, the findings provides a common platform to discuss the possibilities of improving and revising the relationship between naval architect, marine engineers and interior architects in the design of recreational craft that will help to provide a guideline for further research future designs and construction.

CHAPTER 2: RECREATIONAL CRAFT

2.1 Yacht Sector

With the most basic description, recreational crafts can be seen as types of vessels that are used for travel, sport and entertainment purposes. If the general classifications are taken into consideration, the vessels that work with an engine system called motor yachts (Figure 1.). Other than that, the types of ships that go with the help of the wind are called sailing yachts (Anon., 2006) (Figure 2.). In today's world, every sailing boat also has the ability to sail on the water with an engine. This is mainly originated from the unpredictable structure of the wind. These types of vessel are commonly known as motor sailors.

Figure 1. Motor Yacht (Source: Azimut Yachts, 2021)

Figure 2. Sailing Yacht (Source: Ocean Yacht Charter, 2018)

In today's world, the production of sailing yachts is lower than motor yacht building.

Based on the Turk Loydu (TL) some of the main classifications of motor yachts can be listed as it below:

1- The types of vessels that are between 2.5 meters and 24 meters are accepted as excursion boats.

2- The types of vessels that are between 24 meters and 42 meters are accepted as superyachts.

Moreover, some of the main construction materials that are used to build motor yachts in Turkey can be listed like that: composite, steel, aluminium and wood. Additionally, yacht construction has been separated into some certain regions in Turkey. Some of the well-known and busy yacht shipyards are located in Istanbul, Antalya, Bodrum and Karadeniz regions (Arslan, 2010).

It is still quite hard to draw a borderline between the concept of motor yachts and excursion boats. In general, the term 'yacht' is used on the type of vessels which are 15 meters and over. Without having a certain type of comfort and luxury elements, it is not valid to use this term on a vessel. Focusing on the materials, choosing functional and comfortable furniture, making the interior layout of the project according to the user profile and taking into consideration of human movements in a movable space are some of the main elements that must be taken into consideration during the design process of a motor yacht. Taking into account all these elements, it may not be acceptable to say motor yacht to a Tugboat. Furthermore, yachts that are bigger than 15 meters have some significant production process differences from the excursion boats (Benford,1991). One of the most order taking, concept yacht design producer country can be seen as Italy. Without taking into account of United States, Holland and Germany follow Italy in the manufacturing of yachts. Additionally, with highly luxury-based requirements of the customers and the technological improvements, recreational craft that are bigger than 100 meters are in the construction schedule of most of the big yacht producing shipyard all around the globe (Misra, 2016).

In the production of superyachts and megayachts, Turkey has been improving itself for the last 15 years. Due to the reasonable prices of the labourship, most of the European countries are choosing Turkey to build their projects. With the experience from those projects, it will be possible to carry their own recreational craft projects.

2.1.2 Motor Boats

Motor yachts the types of vessels that use one or more engines to move. It is not too difficult to figure out the main differences between a motor yacht and a sailing yacht. The main reason for that is to provide a high-speed capacity to a motor yacht with a long and a narrowed hull form.

If there won't be any sailing mast and technical sailing apparatus located in the vessel, placing the interior areas is easier in a motor yacht. However, there are some significant elements that decide the interior layout of a recreational craft. Some of them are listed as below;

1- Dimensions between the sections.
2- Bulkhead factor.
3- Location of the engines room and necessary technical equipments.

There are divergent many kinds of classification types on the concept of the motor yacht. One of the most common ones is done based on the construction material that is used on the vessels. Except for the well-known concept of 'Gulet', some of the most successful wooden vessels are constructed in Bodrum (Figure 3.). Some of the most common construction material that is used in the yacht industry in İstanbul is steel and aluminium (Figure 4.). Furthermore, polymer-based composite constructions are some of the most popular yacht construction methods in Antalya, Istanbul and Izmir. These types of ships are a little bit harder to construct and they are more expensive than steel constructed vessels.

Figure 3. Timber Constructed Bodrum Gulet (Source:Ramses Yachting, 2019)

Figure 4. Steel Constructed Charter Motor Yacht

There are some additional major elements that affect the interior layout of a motor yacht such as construction material, displacement of the vessel, usage purpose and sailing route. Furthermore, another kind of interior space placements classification is done by the hull type of the vessel. For instance, the stability of a catamaran hull against waves is more stable and consistent than the durability of a single hull (monohull) vessel. Other than that, in case of overturning situations, it will be easier for a monohull vessel to turn back into the surface than a catamaran overturning. In addition to that, if the number of points that touches the surface of the sea increases, it will be much more difficult for a vessel to turn back its original position.

2.1.2.1 Motor Yachts Between 24 to 42 Meters

Compared to the other types of pleasure boats which are 24 meters and under, these kinds of motor yachts design and production process requires more detailed analysis and engineering-based calculations. The length of motor yachts that are bigger than 24 meters is calculated and designed based on the horsepower that is going to be used, engine capacity, usage purpose and average distance that will be passed in each trip (short-termed, long-termed). Some of the main reasons that are used in the definition of luxurious motor yachts can be explained like that: they are capable to travel really long distances without any outer support or supplies (Dokkum, 2011). Additionally, the volume of the average interior spaces is much larger than regular sized pleasure vessels. With the increase in the size of the vessel, it begins to share similar design based features with a luxury building (Figure 5.). However, in our case this building won't be standing on the land, on the contrary, it is going to be float on the water.

Figure 5. Motor Yacht Living Room

From private spaces to the common areas every interior and exterior area usage increases significantly which provides a higher and comfortable usage performance to the owner and crew. Furthermore, from a general design perspective, this kind of motor yachts must be capable to provide at least three luxury cabins, exterior dining areas which are located on the different decks of the vessel, customer-focused entertaining or hobby areas and areas for special devices or vehicles such as speed

boat, ATV, mini-submarine, scuba diving systems, kayaking equipments etc. (Altın, 2014).

2.1.2.2 Mega/Super Yachts

The concept of luxury in floating environments is mainly based on mega yachts. Until the end of the 18th century, the idea of a yacht is used for the types of vessels that are used for fishing and sightseeing purposes. At the beginning of the 19th century, unlike their previous usages, they were mainly used for racing and forcing the limits of speed in the sea environments. So, it is clear to say that: the concept of 'comfort' was in the second plan. Although, volumetric enlargements both inside and outside areas of the vessel created more comfortable and livable environments which look similar to the life of the land. Furthermore, after interior spaces turned into more comfortable environments and usage of technological improvements on both interior and exterior areas created more ergonomic, luxurious and user-focused spaces. This made the concept of mega-yachts more preferable and common in the recreational craft construction industry. Since, most of the people that want to purchase a recreational craft require a highly comfortable environment that provides most of their main and pleasure based needs (Güler, 2017).

Only four decades ago the recreational crafts that are between 36 and 40 meters named 'Mega Yachts'. In today's world, due to the increase in the usage of mega yachts, size analysis of these recreational crafts have been standardized. Thereby, yachts (engine based) that are bigger than 60 meters referred to as mega yachts in the recreational craft industry (Figure 6.). Just like one of the major yacht producing company Blohm & Voss, there are steel, aluminium and composite material based motor yachts that have been constructing in Turkey for more than three decades. Moreover, a size increase in any type of vessel require detailly organized engineering calculations. In our case, with the general size increase on a motor yacht the concepts of durability, agility and user safety turn into more significant factors. For this reason, solid and light materials like sheet metal or aluminium became popular construction materials in the shipping industry. Just like the other motor yachts, exterior planning and superstructure design have higher importance. Due to that, every design and engineering based element like furniture selection, deck floor

coverings, lightings, technical types of equipment etc. need to be well organized and located (Dokkum, 2011).

Figure 6. 80 Meter Mega Yacht 'Tatiana' (Source: IYC, 2021)

2.1.2.3 Giga Yachts

In an outer view and superstructure design, these recreational crafts share a lot of similar features with cruise liners. This mainly originates from their colossal sizes and hull forms. Unlike the other types of recreational crafts, Giga yachts have generally more than five decks. The size of the vessel needs to be big enough to include that much areas. For this reason, a motor yacht that is bigger than 90 meters called a Giga yacht (Figure 7.). This kind of massive lengths turns the interior areas of the boat wide and luxurious enough for the owners to have whatever they want inside of the vessel (Figure 8.). Furthermore, most of the interior areas start to share similar features with luxurious buildings on the land. Except for the basic naval requirements, weight distributions, areas that are located close to the stern and bow parts of the vessel, choosing the proper materials that are resistant to the sea environments, air circulation and noise reduction a user can have a really comfortable, ergonomic and luxurious floating vehicle that provides almost the same opportunities that can be found on the land. When the number of areas and their sizes increase, the general responsibilities of designers increases too. For this reason, during the creation process of a Giga yacht, every private and common area must be shaped based on the demands and requirements of the customers (Boote and Pais, 2013).

Figure 7. 136 Meter Giga Yacht ‘Flying Fox’ (Source: Mega Yachts Fan, 2021)

Figure 8. Living Room Space of the ‘Flying Fox’ (Source: Superyacht Times, 2019)

2.2 Hull Types

The classification of recreational crafts’ hull types is made according to the body volume and hull shape. It is crucial to know how much and how the water touches the surface of the hull. Without knowing that, it would be quite hard to divide them into different groups (Altın, 2014).

2.2.1 Mono-Hull Yachts

It is clear to say that: most of the production system of the recreational craft industry is based on monohull vessels. They are the most preferred and used hull types in the yacht sector. The usage purpose and function are the main factors that shape the underwater hull structure of a recreational craft. Careenage forms are generally separated into three main groups. Types of vessels that have the V shapes hull form are called 'planning boats' (Figure 9.). Due to their hull structure, these kinds of ships touch the surface of the water as less as possible. During the sailing time at high speed, the bow part of the vessel starts to go above the water surface. Furthermore, there is no need to look for so much comfort and luxury inside of these kinds of recreational crafts. This mainly originates from their usage purpose and function. Generally, speed and racing boats involved in this group. In addition to that, unlike the planing hull vessels, semi-planning hull ships' propulsion systems can be less powerful and slow than planing hulls (Figure 10.). However, interior planning and comfort become a more critical factor in these kinds of pleasure vessels. Because there are more empty volumes and decks, the interior management and area location can be more beneficial and function for the users.

Figure 9. A High Speed Planing Boat

Figure 10. Boat Example to Semi-Planing Hull

Unlike using steel or metal sheets, the usage of composite materials on planning hulls provide the vessel lighter and faster opportunities that are compatible with these kinds of recreational crafts' general requirements. Moreover, there can be metal, aluminium and timber construction materials used on semi-planing hulls to provide a more balanced, comfortable, stable and long-ranged journey. The types of planing hulls that are big sized are generally constructed with a U shape hull. They are the type of ships that the hull form has the most intimacy with the water. Other than the previous hull types, there is no need to expect a high-speed performance from these vessels. Their most obvious features are luxurious living environments (both interior and exterior) and high cargo-carrying capacity. Additionally, to increase the speed capacity of the ship, there is a bulb piece located on the bow part of the hull. Other than its main function, this piece decreases the amount of vibration that comes from the bow and stern parts. The hull form of any kind of vessel must be decided and organized according to the main needs and requirements of the user (Kvilums, 2011).

2.2.2 Multi-Hull Yachts

Based on historical research, it was proved that this type of hull form has been discovered by Polynesia and Micronesia civilizations around the 1700s. In today's world, besides most of the vessels are constructed with a monohull structure, there are special usage purposes and user profiles observed for this kind of hull forms. Unlike monohull vessels, multihull ships are not durable against heavy weather conditions. Furthermore, compared with monohull ships, it is harder to overturn a

multihull. Although, if something like that happens, it won't be possible to turn a multihull vessel back to its original position (Figure 11.). For this reason, even a little bit of heavy weather situation can cause to cancel all kind of multihull vessel cruise that is used for public transportation purposes. Based on that, these kinds of multihull type vessels are used in short distances for sightseeing and transportation purposes (Tarjan, 2008).

Figure 11. Capsized Catamaran Hull (Source: Yachting World, 2015)

After the 19th century, with their effective stability performances, high amount of volumes inside of the hull and endurance potentials, multihull vessels have become popular recreational craft types among the high classes. In addition to these advantages, high-speed performances, extensive interior areas, larger storage units and dividing private areas and common areas easily are some of the other appurtenances of the multihull recreational crafts (Figure 12.). Due to the overturning situation, they slowly lost their popularity all around Europe. Nowadays, they are mainly constructed in these countries: England, France, Singapore, South Africa and America (Tarjan, 2008).

Figure 12. Concept Model of a Catamaran Motor Yacht

Because of the technological improvements, there are some other types of hull forms that started to show themselves. In addition to catamarans, trimarans are one of the other most popular and well known multi hull forms. However, due to their hydrodynamic structure, they are mainly used in sporting events and races. Currently, there is another type of multihull vessel that is used by the United States Navy. This concept pentamaran type of vessel is still in the improvements stages (Figure 13.). Hopefully, one day it will be used for other types of commercial and private purposes too (Benford, 1991).

Figure 13. US Navy Concept Pentamaran Project 'M80' (Source: Defense Systems Journal, 2019)

CHAPTER 3: INTERIOR DESIGN OF 24 METER AND OVER RECREATIONAL CRAFTS

A motor yacht is a highly complex industrial product that has a long construction process from the initial design work to the delivering the boat to its owner. Apart from the building process, the design phase of recreational craft and also all engineering work have a major role in this timeline (Figure 14.). Different kinds of professionals need to collaborate with each other during the design and building phases of a yacht. Not only the engineering, technology, safety and performance, but also the interior and exterior appearances of the vessel are very important for the satisfaction of the customer (Boote, 2014).

Figure 14. A Motor Yacht under Construction in a Shipyard

Furthermore, having a reliable structure is one of the most significant features of a motor yacht. For this reason, consideration of the hydrodynamic and stability calculations has additional importance on the general structure of a recreational craft. On the other hand, having comfortable and luxurious interior space is an essential criterion for a recreational craft, although, not well-designed hull form and superstructures will not be accepted as a good design. At the same time, a properly designed and hull structure is the essential point of a recreational craft. However, if the interior design with all important details likes providing a good and efficient layout, good lighting, thermal conditions etc., then the motor yacht won't be accepted as a good design. This means that not only engineering and exterior look but also interiors have a significant effect on each other. Furthermore, to create a well-

designed end product, all the parties working together should have some essential merits:

- Good level of professional knowledge in their own field.
- Good collaboration skills.
- Punctual with the workflow and respectful with the stakeholders business.
- Having enough experience in the yacht industry.
- Systematic working skills.

There are interior architects, architects, industrial designers, naval architects and marine engineers who take place in the design and building of a boat. Other than them, there are also some other necessary professions that work on the production and design processes of a recreational craft. Electronic, industrial and mechanical engineers are just some of them. Based on the work they are doing, the first-mentioned professions sometimes collaborate with each other or work separately. Moreover, there are mainly two phases of the building process of a yacht. The first phase is design and the second is the building phase. The most ideal production system is to involve the engineers and designers that have worked on the design phase of a recreational craft. In addition, most of the big shipyards prefer in-house engineering and design departments working in coordination together. Because of the job that they are doing, these professions work separately. However, when it's needed they can collaborate with each other too. Other than this system, most of the shipyards prefer to follow a different pathway. In this way, they just handle the building process of a motor yacht. The project, technical drawings and interior/exterior designs are provided from other local or international design offices, and/or shipyards. In both systems, other than the construction phase, the design process of a recreational craft is more critical than the other one. For this reason, inspecting the production of a yacht with the engineers and designers that worked on the design part will create a more accurate product (Güler, 2017).

In this chapter, the main duties and responsibilities of the interior architects/ designers and the interior design process of a motor yacht is under discussion.

3.1 Interior Architects' Role as a Yacht Designer

Every individual has a different opinion about the concept of luxury, comfort and aesthetics. In general, they have some minimum standards. A recreational craft must present itself to the users with high quality and usability (Figure 15.). This idea is valid both in the interior (common and private) and exterior areas. However, these features will not be enough for the user(s). Along with its comfort and luxury, a motor yacht needs to provide safety, proper interior circulation, gathering and socialization areas for the owners. Because these features require a lot of space, it is quite hard to apply them on small yachts. For this reason, the main focal point of this study will be based on motor yachts which are 24 meters and over. (Boote, 2014).

Figure 15. Collaboration of Luxury and Functionality inside of a Motor Yacht

Before the sketches, diagrams or draft drawings, the first thing that an interior architect needs to do is to make market research about the motor yacht. After that, based on the customer requirements and technical needs, the first draft and scenarios are created. Even if an interior architect/ designer is included in the building phase, it might be too late so the interior architect/ designers who are working in the design phase, should also be included in the very early stages of the project starting from the inspection and evaluation phases. Thereby, production-based mistakes can be found in an easier way and the necessary revisions can be made instantly. Additionally, some of the main duties of interior architects in the design of a recreational craft are listed as below: (Dokkum, 2011)

- Making market research about recreational crafts.

- Arranging meetings with customers.

- Interior design concept development (Figure 16.).

- Organizing a soft passage between the exterior and interior areas.

- Interior layout organization.

- Interior and exterior furniture design.

- Technical plans, elevations, sections and detail drawings.

- Interior and exterior lightning organization (Figure 17.).

- Choosing the right textures and colours.

- Material selection of floors, ceilings and walls.

- Technical organization and drawings of wet areas.

Interior architects need to have strong communication with the naval architects during the first phases of the motor yacht project. During the interior area arrangements, an interior architect needs to be aware of the rules of the related authorities (like classification societies'). Knowing the rules that have an effect on the interior spaces helps the designer to gain a lot of time for the design phase. Other than that, throughout the interior planning process, the authorized architect must keep in contact with the naval architect to know the locations of portholes, watertight bulkheads, structural columns and bulwark stanchions. Furthermore, from the first stage to the delivery, interior architects participate in almost every phase of the project. Just like other professions, they have special duties that can be done only by them too. Other than them, interior architects and other professions that work on a motor yacht project must be in direct contact and collaboration to make an efficient final product (Özüdoğru, 2015).

Figure 16. Interior Design Concept Development

Figure 17. Exterior Lightning Application

3.2 Interior Design Features of Motor Yachts

A well-designed hull form and superstructure are some of the essential elements of a recreational craft. As mentioned before, without the properly arranged engineering calculation it will not be possible to build a vehicle that floats on the water. This idea is valid for every kind of floating environment. Other than that, creating properly organized interior spaces is one of the other hard parts of the job. If we are talking about recreational crafts that are specifically used for different purposes (based on the users' requirements) the interior layout situation might get a little bit more difficult and complicated. Because these kinds of places are going to be used by a group of people there are a lot of elements that must be taken into consideration.

Interior material selection, calculating the general dimensions of the furniture, creating a functional air conditioning system can be listed as elements that must be evaluated inside of a motor yacht (Özüdoğru, 2015).

Furthermore, during the creation of every little detail inside of a recreational craft, the human factor must be seen as a primary factor and every piece of furniture, corridor, staircase, private and common areas must be designed around this factor. Without considering the human figure, it is quite possible to make mistakes (Güler, 2017).

Besides, due to the recent improvements in technology and construction techniques, it is quite possible to desig areas that are similar to the ones on the land for recreational crafts. For this reason, there are some elements that must be taken into consideration throughout the interior design phase of a motor yacht. In this chapter, some of those essential points will be examined in detail.

3.2.1 Comfort

The idea of comfort is a phenomenon that can change from individual to individual. Based on a person's feelings, perspective and perception this idea can be divided into many divergent pathways. Feeling hot inside of a place may not be the same for another person. Also, sitting on a comfortable chair might not be the same as another individual's feelings. These kinds of differences are directly connected with our five senses. An individual's ability to smell may not be the same with another person. Additionally, a meal's taste is a changeable factor for different people. Some of them could like it more, whereas some people could like it less. When it comes to the sea environments the importance of the concept of 'comfort' gets into a higher situation. Since, a user group of people will use a limited environment that floats on the water. So, it will be quite possible to observe some limitations and difficulties. The thing that a designer needs to do is to reduce these factors into a limited level with the use of comfort (Figure 18.). Furthermore, there are some institutions that are specifically established to organize the interior arrangements inside of a vessel or a recreational craft. GMO, IMO are just some examples of those institutions. Observing specifically selected individuals and evaluating them based on the comfort standards are just some of the things that these establishments do (Altın, 2014).

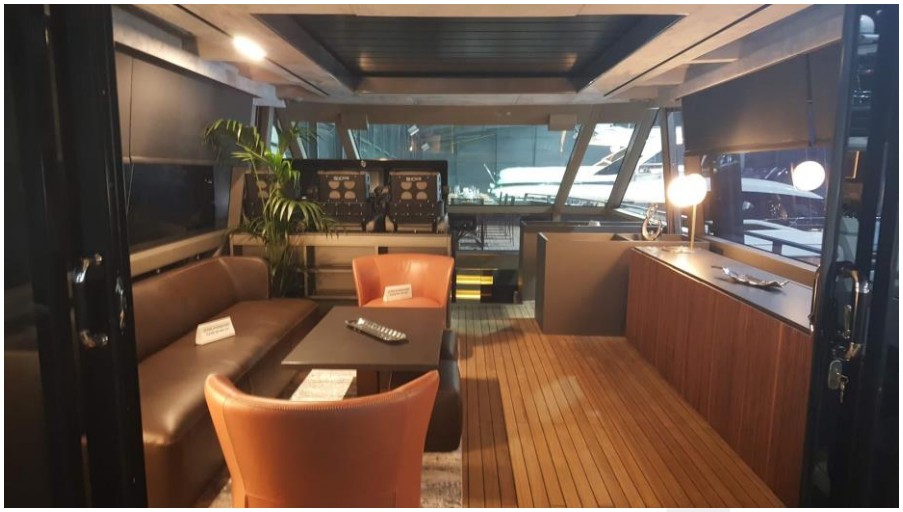

Figure 18. Well-Arranged Interior Living Environment of a Motor Yacht

When the idea of comfort is evaluated on motor yachts, there can be a general separation observed on private and common areas. Interior appearance, being appealing to the eye and auditory factors are more essential in a private environment. In addition to that, being ergonomic and coherent to the human anatomy and movements is much more important in gathering areas (Figure 19. & Figure 20.). Other than them, humidity, temperature, floor material, electronic device usage and hygiene are the other crucial factors for the wet areas that must be carefully arranged by the designers (Altın, 2014).

Figure 19. Private Owner Cabin of a Recreational Craft

Figure 20. Exterior Gathering Spaces of a Recreational Craft

3.2.2 Safety

To create a movement in space there are certain types of security elements that must be located in necessary areas. Parapet, railing, non-slippery floor materials and staircase lightning care some examples of those security needs (Figure 21.). Other than them, there are additional security-based architectural factors that must be considered during the design phase of the project. These considerations can be listed like that: fire escape corridors, emergency staircases and elevators need to be located based on the general people circulation of the structure. Additionally, their main dimensions (length, width and height) must be calculated based on the maximum capacity usage and standardized emergency usage regulations (in case of a natural disaster, drill etc.). One of the main dangerous elements that must be considered during the design process of a building is house accidents. From minimum to maximum impacts, all kinds of injuries that could happen in a house environment must be considered by the designers.

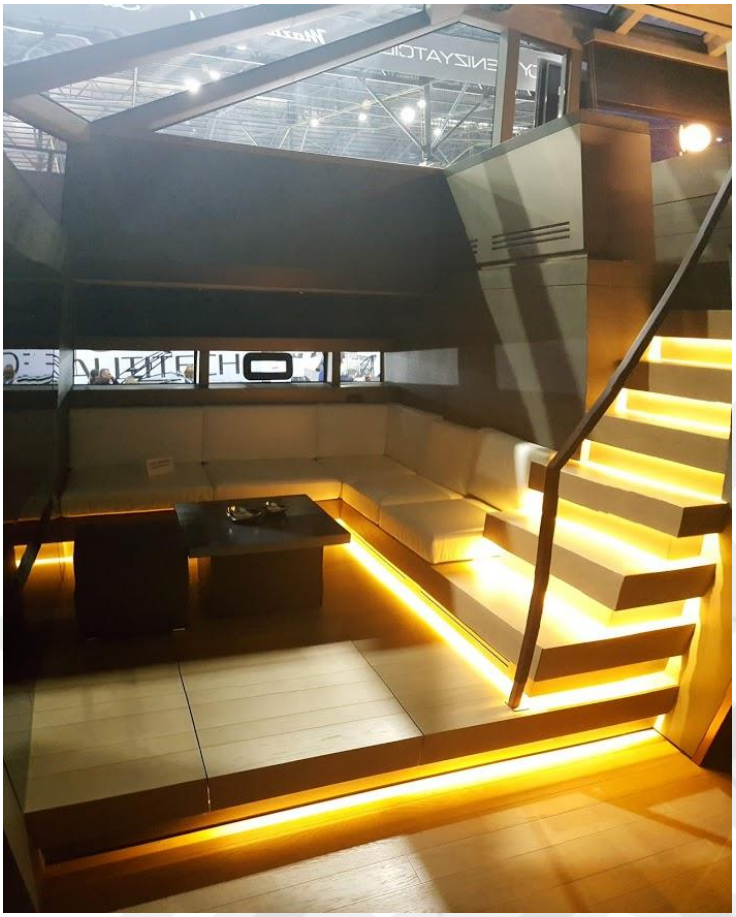

Figure 21. Properly Lightened Staircases and Railing System

In addition to human movements, if space itself is a moving environment, safety precautions become a more significant consideration. When we add sea impact on the regular individual moves, it is quite possible to encounter some security-based issues. These problems can be solved during the design phase of a recreational craft. Furthermore, unlike the buildings on the land, there can be divergent kind of nautical factors observed in the environments that float on the water. Some of those elements can be ordered like wave movements, offshore winds, humidity and rough sea environments. Based on these factors, increasing the life and health standard of users in a floating environment needs to be seen as one of the preliminary elements. To make that happen, there are some security measures that must be considered during the design of any kind of floating area by the designers and the engineers. These measures are listed as below: (Özüdoğru, 2015)

- Floor covering (Figure 22.)

- Wall covering (Figure 23.)

- Movable and functional furniture

- Thickness of the windows

- First aid kits

- Handholds

- Fire extinguishing system (Figure 24.)

- Water distribution

In addition to that, to hold casualties in the minimum levels, it is a necessity to have life-raft, gas alarms, first aid bags, rescue flares and life jackets (both for adults and children) in motor yachts and sailing boats.

Figure 22. Non-Slippery Teak Floor Covering

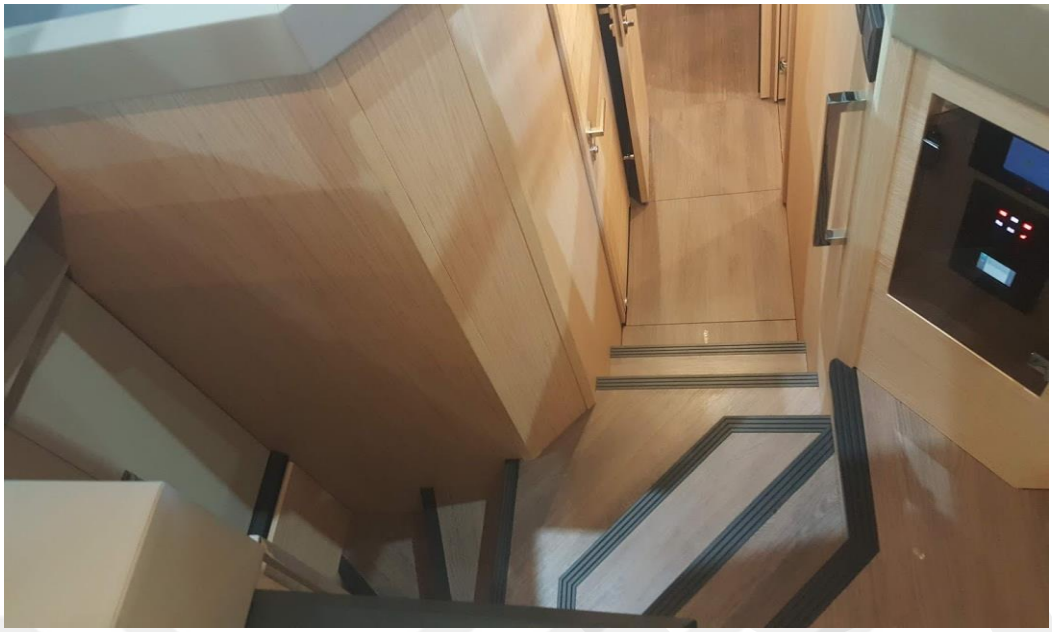

Figure 23. Heat Resistant Wooden Wall Covering

Figure 24. Fire Extinguishing System of a Motor Yacht (Source: Sea-Fire, 2014)

3.2.3 Climate Control

The amounts of excess heat and humidity have a huge impact on the creation of comfortable and healthy interior environments for the user group. Using heat and humidity in their upper and lower standards could cause temporary and persistent health problems on users. Based on the air movements in space, there are some basic elements that affect the design of the area and material selection. These factors are listed like that: ambient temperature, level of clamminess, heat source and metabolic needs of the human body. Every living and working area needs to be designed considering these elements.

HVAC systems have different kinds of impacts based on the warmth or coldness of the space (Figure 25.). Living or working in an environment where it is always cold could cause issues on an individual which are listed as below:

- Common cold

- Freeze of some parts of the body

- General lose on observation and reaction

In addition to that, living or working in an environment where it is always hot could increase the pulse, body heat and sweating. Except for these points, it is possible to observe problems that are mentioned below:

- Lack of water in the body

- Lack of salt in the body

- Circulatory failure

- Lack of sweating

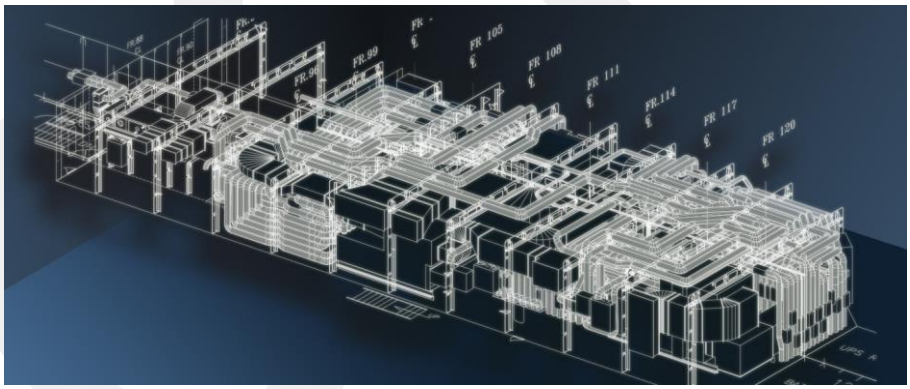

Figure 25. Marine HVAC System (Source: Knude E. Hansen, 2018)

Other than the indoor air conditions that are mentioned above, there are additional harsh exterior factors for boats (Koçak, 2007). Since a motor yacht is mobile, both the vessel itself and the users experience different kinds of weather and environmental conditions. This means that the interior and exterior spaces of the vessel will be exposed to different thermal conditions. So the general insulations, area managements and air circulation must be designed considering these extreme

factors. Climate conditions are one of the most significant factors that must be conceived both in the design and production parts of a recreational craft. Other than that all the necessary sub systems of a vessel need to be arranged considering the most extreme weather condition and natural events. This kind of a pathway can lead the design and engineering team of a vessel to the right directions (Özüdoğru, 2015).

3.2.4 Functionality

The concept of functionality provides a different perspective to the recreational craft industry. If the deck areas are considered floors, it will be easier to understand the cycle of function. Since, in these spaces being comfortable and luxurious won't be enough for the users. Based on the general opinions of Frank Lloyd Wright; " -An architectural space is a combination of a person's soul and an environment which is capable to provide necessary requests of the user. To make that happen, there must be a pure harmony between form and function." Furthermore, based on the features of the area, necessary functions, compositions and main elements must be placed inside of the space (Göler, 2009).

Creating a usable composition is a critical challenge for every designer. For this reason, most of the designers focus their design disciplines during this stage to create a proper and functional product. If it comes to architectural projects, all the interior and exterior elements must be placed in a balanced structure to form a functional and visually impressive environment. To make that happen some of the main factors like colour, shape and material must be located in a balanced structure to create a satisfying feeling on the user/s. The same understanding is also acceptable in recreational crafts too. In addition to that, the concept of spatial integrity turns into another significant factor in this design phase. This idea consists of different processes and could change based on the relationship between interior elements. Also, the cultural background and main requests of the client could affect the functional integrity of the interior space too (Atalay, 1995).

Furnishings are another significant factor to create functional interior and exterior environments. Except for the areas which are designed for private usage (i.e. cabins, wet areas, gym etc.), steady and semi-mobile furnishings which are located in the common and socializing areas (i.e. living room, dining area, sunbathing area, bar,

sun beach etc.) must be designed considering the general forms or layout of the space (Figure 26. & Figure 27.). Also, there must be specially designed storage units located underneath almost all furniture in a recreational craft. Some of the necessary elements that must be kept in there all the time can be listed as below:

- Life jackets
- Emergency equipment
- Emergency bag/s
- Pillows for exterior sitting units and sunbathing area/s

Other than that, some of the technical elements that are used to increase the comfort level in a please boat are hidden inside of furniture too. For instance, placing air conditioning pipes and electrical wiring systems inside of the furnishing is a common technique that is observed in almost all kind of recreational crafts (Altın, 2014).

Figure 26. A Sofa Unit that is Specifically Designed for the Sundeck Area of the Boat

Figure 27. A Kitchen Unit that is Placed Considering the General Interior Layout of the Boat

3.2.5 Luxury

The idea of luxury is seen as a concept that has no measurable limits. It is mainly connected to user/s expectations and requirements. Based on the needs of a client this idea cross the limits of design or it can stay in upper average standards (Figure 28.). Also, the concept of luxury can be evolved and improved during the design phase of a recreational craft. This is mainly related to the perspective and design approach of the interior architects. Based on the customer limitations, interior volumes and general sizes of the vessel, luxury has a major impact on the producibility of the recreational craft. Emphasizing luxification in a balanced system is one of the main duties of the designers (Godoli, 2007). Thereby, customers will be able to figure out that they are not just buying products, they are also purchasing meanings too. Most of the boat owners use objects to find emotional, psychological and socio-cultural pathways to relaxation and pleasure. For this reason, recreational craft designers need to look beyond the technical features, functions and productivity of the objects. The main thing that they must look for is the true meaning of objects. In addition to that point, the concept of luxury is adopted by the wealthy class. However, it is translated and criticized by the rest of the society. An interior architect needs to understand and consume the main principles of luxury. So, he/she will be capable of answering the excessive requirements and needs of the clients. Also, creating or revising

one floating environment won't be enough for the designer. It will probably answer the general needs of the client for one time. However, without creating a sustainable subsystem that is based on the principles of luxury, the designer will not be able to create innovative and continuous works. This will affect his/her design value negatively in the yacht design market (McCartan and Moody, 2010).

In general, the idea of luxury is directly related to the desires and dreams of the users. Actually, designers and engineers' main objective is to turn the client/s imagination and requests into a tangible object (Figure 29.). After turning an extraordinary desire into an ordinary object, the client starts to think about new and different stuff that will be located inside his/her recreational craft. Creating an impregnable idea in real life can be seen as the metaphysical side of luxury. Unlike physical and material based objects, the idea is about the true desires and dreams of the users. The general role of an interior architect is to make a connection between them and find a proper market value in the yacht industry (McCartan and Moody, 2010).

Figure 28. Impact of the Customer, A Modern Style Living Room of a Motor Yacht (Source: Boco Do Lobo, 2019)

Figure 29. Impact of the Customer, A Classical Style Living Room of a Motor Yacht (Source: Superyacht Digest, 2015)

3.3 Layout Design

The concept of layout design includes a lot of disciplines. This chapter will be explained and examined in detail. To make a comfortable and ergonomic motor yacht there is some footstep that must be followed. Knowing the basic movements of human beings, general anatomy of man, number of users (both owner/s and crew), necessary and requested areas are just some of them. These ideas will be explained properly in the further parts of this chapter.

As it is commonly known, a motor yacht almost has all facilities and technical equipment that can be observed in a luxurious dwelling. So, when an owner/s of a vessel comes on board, he/she won't fall short of anything that is found in his/her regular home. In general, providing the same opportunities that can be found on land in the sea environments forms a relaxed, warm and comfortable journey. Furthermore, for some people, it is a precedent to live a proper yacht life. During the design phase of motor yachts, it must be well known that: there is a direct connection between man and space itself. There are some necessities that must be answered to create a snug and functional interior environment (Larsson, 2000).

Even if it is a motor yacht that is bigger than 24 meters the interior usage and area distribution must be done properly. Since it is going to be an environment that floats on the water, the general access to some of the basic needs and resources will be

limited. In addition to that, it is yet another necessity to provide an effective interior circulation. With the help of that, both user/s and crew will be able to move efficiently inside of the vessel. To make that happen, knowing the general movements and dimension of a human being is a critical factor. After applying them in interior areas, it is possible to create cosy spaces (Güler, 2017).

With the interior design of a motor yacht, the project planning phase begins too. In this stage, the cognitive structure of the recreational craft starts to appear. After some regular meetings with the client, the general structure of the recreational craft divides into two main spaces which are client and crew. The client is kind of a group that does not use the recreational craft so frequently. When they use it, most of them prefer to spend their time in common spaces. Contrary to this, crew members spend most of their time inside of the vessel. After deciding the number of guests (except for owner/s), when and how the motor yacht is going to be used, and the separated spaces' interior project planning process begins.

Locating and deciding on certain environments can be seen as one of the other difficult parts of the job. The areas must be defined and separated into sections. This is mainly determined by the usage type and user group of the space/s. However, this cannot be decided only by the designers themselves. Because there are hydrodynamic areas located inside of the motor yachts, designers need to collaborate with naval architects. Moreover, during the design phase of motor yachts, a designer needs to consider the whole volume of the structure, not only the interior areas that are used by people (Dokkum, 2011).

Furthermore, furniture design also starts at the same time as the interior design of a recreational craft. Unlike the regular furniture in our daily lives, yacht furniture is designed based on the interior and hull structure of the vessel (Figure 30. & Figure 31.). If any kind of revisions and changes happen inside of the boat, the same revisions need to be applied to the furnishings too. Although, all those detail calculated technical drawings, production planning and 3d modelling processes, there could be still some discrepancy issues observed. Additionally, the furniture design for a motor yacht is generally done considering the general measurements of the vessel. During the design phase of the furnishings, there are four main factors that must be well thought by the designer too. They can be listed as below: (Güler, 2017)

- Furniture's structural material

- Type/s of fabric

- Distance between furniture

- Bearing capacity of the furniture

Figure 30. Stable Sitting Unit of a Motor Yacht under Development

Figure 31. A Cabinet Unit for the Lower Deck Guest Room Area

The best way to make sure that all the furniture is located properly inside of the vessel is to take some measurements on the recreational craft. However, because the construction processes take a lot of time (both for the superstructure and furniture) it won't be possible to take those measurements on the real boat. For this reason, there must be a general model of the project that must be built. After that, selected or designed products need to be tested on that scaled model to make sure that they are coherent with the technical project. Furthermore, after the construction of walls and frameworks, interior frames can be located inside of these areas. The main reason for that originates from their structural factor. Except for that, all the electrical and mechanical cables and pipes are located all around those frames (Figure 32.). Without covering them with a proper sound and heat insulation, it is not possible to

envelop all the walls with additional panels. The interior design of a recreational craft needs to answer all the requests of its owners and guests. Based on the frequency of usage of the areas, there must be a division scheme prepared. Thereby, the square meters of each space can be determined (Larsson, 2000).

Figure 32. Interior Frames to Divide Areas and Cover the Necessary Cable Units

In terms of colour and material selection, the selected elements should not strain the eyes of an individual. For this reason, there are simple and calm colours and textures generally preferred inside of recreational crafts. With the usage of natural and artificial lighting systems, these simple but significant elements attract more attention. To provide the natural light inside of the vessel as much as possible, there must be wide windows and ceiling potholes (if necessary) located in the vessel. Putting portholes in a symmetrical position is an essential factor in increasing the general comfort and eye quality of the environment. Interior and exterior ceiling heights and furniture sizes must be adjusted during the placement of portholes. Although there are a lot of porthole types that can be used on motor yachts, generally the small size ones are preferred by the designers (Figure 33.). The main reason for that is as simple as important: to protect users' own privacy. Furthermore, the general user group of motor yachts prefer to spend most of their time in common areas or open deck spaces. Areas called 'cabins' are used for resting or storage purposes. Depending on the overall size of the motor yacht, shower and restroom spaces can be designed together or separately. Based on the same idea, the number of bathroom/s can be divided into different groups (crew, guest and owner bathrooms). In addition to that, circulation between galley and dining areas need to be organized properly to

create a balanced service system. In general, this could be seen as a quite easy task in motor yachts. However, due to the sailing mast, the same circulation is not as easy as in motor yachts (Duman, 2016).

Figure 33. A Lower Deck Porthole that is Covered with Unfinished Wooden Framework

3.3.1 Common Areas

In a most general perspective, areas that are used for entertainment, dining, sitting, having a conversation with other people and resting purposes called common areas. These specific areas must be organized based on the general user and guest capacity of the vessel (Figure 34.). The average height of the sitting units can be changed between 50 to 60 cm. Also, based on the general structure of the seating units, the underneath parts of them must be designed considering the elements that are going to be stored in there. Because, when the time comes, user/s and crew of a motor yacht won't have any direct connection with the mainland and any resources. Due to that, every single zone must be used effectively. In addition to that, just like every other space in a motor yacht, furniture design is directly related to the overall size of the vessel. Not considering the volume of private and common areas and placing the furniture without measuring any spaces will cause a magnificent amount of budget failure.

Figure 34. Living Room Area of a 35 Meters Motor Yachts

Compared to the other spaces, a common area must be one of the warmest, comfortable and relaxed spaces in a motor yacht. Based on this idea, furnishings of this zone must be the extension of the same comfortable idea. In other words, they need to guide people to a warm conversation. The main living room must be located considering the view. Moreover, except for the artificial lighting system, the natural light needs to get inside of the common space as much as possible. Natural ventilation and air conditioning must be well provided in the common space too (Duman, 2016).

Preventing the unpleasant appearance of electrical cables, instalment pipes and ventilation devices is one of the other significant tasks of a designer (both for common and private areas). Luckily, these technical rigs can be easily covered with the help of furnishings and wall frames (Figure 35.). For this reason, the design of furniture must be done before the general installation of technical equipment. If it is necessary to revise something, the design of both technical and furnishings must be changed. Thinking about the structural features (i.e material, insulation etc.) of the furniture that are located on the broadside is a critical situation. Their general appearance can be right on the paper. However, during the production phase of a recreational craft, not calculating them could cause a loss on the volume of the space (Atalay, 1995).

Figure 35. Wooden Ceiling Frames of a Sailing Yacht

About the importance of common spaces:

"Living area is one of the most fascinating parts of a motor yacht. Due to its size and location, it gives first impressions about the general structure of the vessel. The visual and structural appearance of this area, its relation with other spaces, circulation, material selection, colour choice, natural lighting and air ventilation system must be well-organized by the design and engineering teams. Because generally these areas are located above the engine room area, both the vibration issue and floor insulation need to be thought carefully. Otherwise, spending quality time in this area won't be possible by the user group."

3.3.2 Private Areas

One of the most obvious and well-designed private area is cabin parts of a motor yacht. In the most basic way, these areas can be seen as the individual rooms. In general layout plans, these private areas are located on the stern and bow parts of the vessel (Figure 36.). Cabin rooms can be seen as spaces that are used for resting and sleeping purposes. Depending on the volume of the area, these spaces could be organized for one or two users (Figure 37.). To make that happen, main dimensions and square meters of the recreational craft must be considered by the designer. Additionally, because this is going to be an environment that floats on the water, almost all furnishings and technical equipment must be immobilized. Bedstead and wardrobes are the main furnishings that must be taken into consideration in cabin spaces. To make that happen, a skeleton structure is built by

the workers and the necessary elements are attached to this structure. Moreover, to prevent any kind of cracks and stretches, an enodal and strong type of timber must be chosen. After deciding the certain positions of the bed and wardrobe, the rest of the elements like small storage units, nightstands, dresser etc. are placed inside the cabin area. Based on the general dimensions of the room, the bed size can be changed between 180x200 to 200x200. This size change affects all the rest of the furnishings that are going to be organized inside of the room. Thereafter, according to the requests of the customer, the interior fabric, timber and wall coverings are decided in private spaces (Dokkum, 2011).

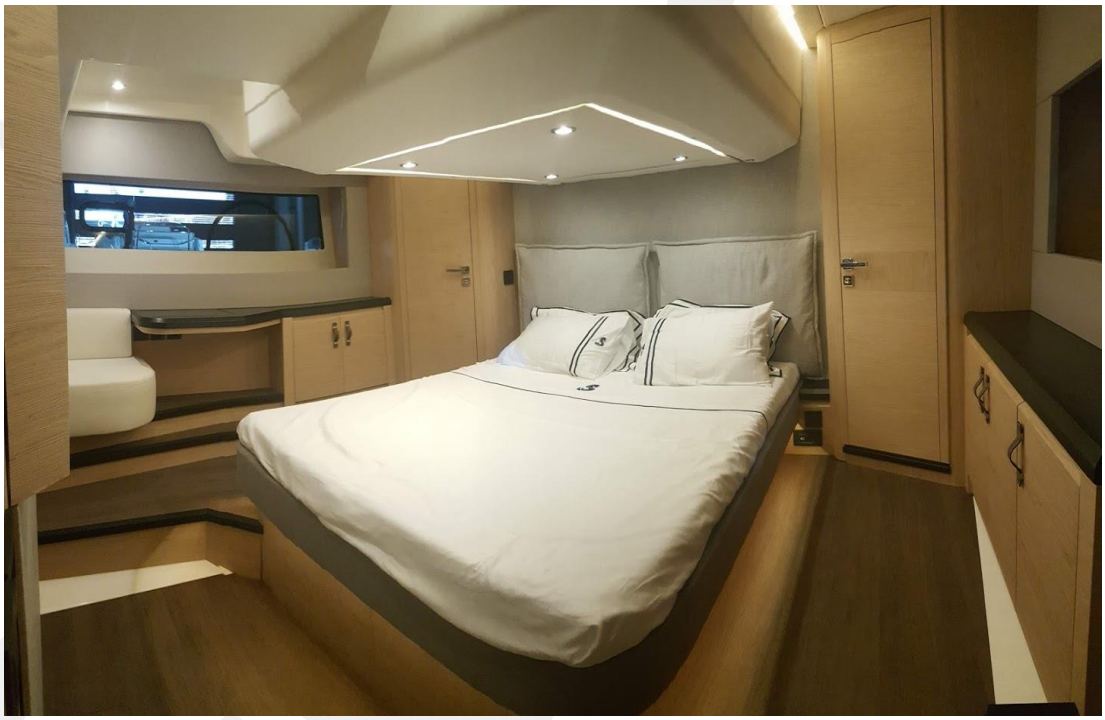

Figure 36. A Master Cabin Unit of a Motor Yacht that is Located on the Bow Part of the Vessel

Figure 37. Guest Room Area of a Motor Yacht for Two User

Cabinets should not be designed too wide and large in the cabin area. Due to the limited amount of space, big cabinets only be used for large clothes. Rest of the clothes and personal belongings must be placed inside of the drawers. In addition to this, because there are not going to be special storage units or clothing rooms located inside of a motor yacht, almost all the possible volumes must be filled with drawers, cabinets or wardrobes (Figure 38.). As mentioned before, depending on the general capacity and the size of the pleasure vessel, there can be additional sitting and resting units placed near the bed in private spaces. All the necessary needs and furnishings can be changed based on the demands of the customers. For this reason, before starting to work on the project detail, the entire desires and demands of the customers must be understood well by both design and engineering teams (Güler, 2017).

Figure 38. Cabinet Unit & Makeup Table for the Master Cabin Area

3.3.3 Wet Areas

The concept of wet spaces can be examined with two main areas in a motor yacht: bathroom and galley. The galley area can be divided into three main parts which are storage, food preparation and cooking units (Figure 39.). Depending on the size of the recreational craft technical needs, types of equipment and unit volumes can be decreased or increased. To maintain a proper service circulation, these areas are generally placed close to the common areas. Based on the customer preferences they can be placed close to the dining room, living room or open deck sitting and resting spaces. Just like the rest of the spaces, during the design phase of the galley area the general size of the ship and capacity must be considered by the design team. Additionally, dining activities can occur in open deck areas on a big motor yacht. For this reason, the galley and outer deck relationship must be as strong as possible. If the motor yacht has dining areas in other decks, the food service can be provided with a food elevator. Unlike the complicated industrial style kitchen areas on the land, galley areas are much more functional and small in motor yachts. Some of the

main functions that shape the design of a galley area can be listed as below: (Köse, 2016)

- Washing

- Cooling

- Cooking

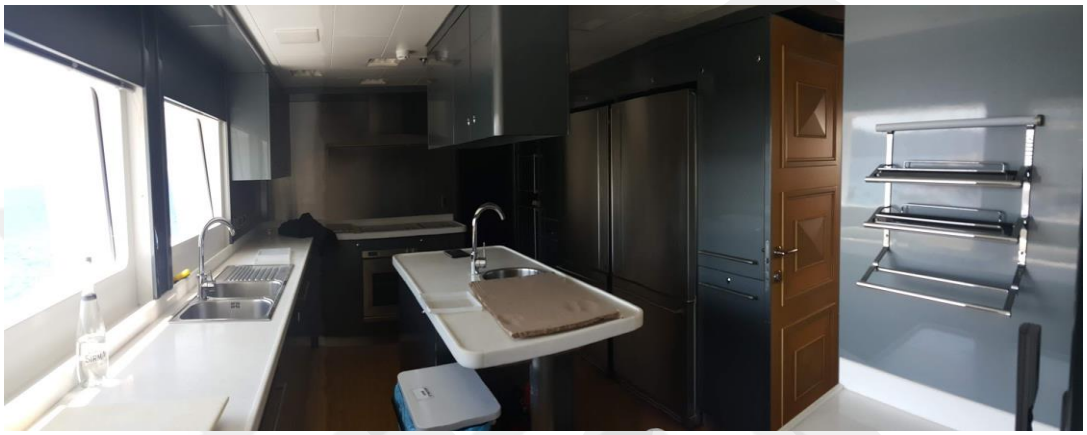

Figure 39. Galley Area of a 35 Meter Motor Yacht

Without considering these activities it won't be possible for a designer to create an effective and functional galley area. Other than that, taking the natural light into the interior area as much as possible will increase the general food preparation and service circulations in a positive way. Due to the overall heaviness of the kitchen equipment, they must be placed inside of the area while considering the weight distribution. Furthermore, the galley area can be seen as a critical place for both users and the crew. Thereby, it must be formed within a small volume with as much function as it can (Figure 40.). One of the critical elements that must be placed in every galley area is a storage unit for frozen food and a microwave to warm the meals. Correlatively to the size of the vessel, size and quality of galley areas increase too.

Figure 40. An Example to Minimal Galley Area (Under Development)

In addition to that, safety measures are another significant factor in galley areas. During the meal preparation processes, the lurching movements of the vessel must be kept in mind and the general environment organized based on that. Design of closed cabinets and putting clips on the corners of the cooker to hold the fryer are some of the precautions that can be applied in galley areas. Also, every single piece of furniture and technical equipment must be mounted on the walls and the floor with the minimum shaking risk. Including the galley area, every single cabinet units' door must be designed with the push-to-open system. With the help of that, cabinets won't be able to open by themselves during the shaking movements of the vessel. In general, galley areas are not used during cruising times. Instead, they are preferred when the vessel is anchored or going in a light course time period. After the engine room area, the galley can be seen as the second most dangerous part of the motor yacht. For this reason, they must be covered with maximum security measures such as smoke detectors and fire extinguishers. Also, heat resistant materials like stainless steel or fibreglass are used in the galley areas. This area's water, heat and fire insulation must be organized in a most effective way. In addition to the walls, the floor material needs to be durable against water and fire (Köse, 2016).

As mentioned before, the other type of wet spaces in motor yachts is bathrooms. Regardless of the size of the vessel, there must be at least one bathroom placed in every recreational craft. If the size of the motor yacht increases, the number of restrooms increases too (Figure 41.). Other than the crew and guest bathroom, the

master cabin's own restroom area can be more comfortable, bigger and luxurious than the other ones (Figure 42.).

Figure 41. Standard Guest Bathroom

Figure 42. Master Cabin Bathroom Area

If the bathroom is placed on the starboard and port directions, the location of restrooms must be arranged considering the shaking movements of the boat. Due to the same reason, the general location of bathroom/s areas must be placed pondering the evacuation of wastewater. To make this more certain, there can be an additional piece added from the bottom part of the vessel to the restroom spaces to increase the

height of the toilet bowl. While applying this factor, designers must keep in mind the average human height and apply the necessary revisions (Özüdoğru, 2015).

Additionally, vertical and horizontal handles are positioned inside the restrooms in case of extreme shaking movements or ordinary usage purposes. They are mainly located around the toilet bowl or inside of the shower. Taking account of the average human movements, the handles are mounted directly on the walls. Gaining space must be the main priority during the design phase of the bathrooms. For this reason, there must be outward-opening doors chosen to increase the usability and spaciousness of the area. This is also a beneficial factor in case of emergency situations for people to get out of the area as fast as possible. Moreover, it is not possible to provide a natural ventilation system in restroom areas. For this reason, there must be an effective artificial air system created for these spaces. This system must be placed on a certain elevation to reduce the amount of moisture and steam. Also, interior materials that are going to be used inside of these areas must be resistant to a high amount of wet and water.

During the design phase of wet areas, human movements and ergonomics are considered as the main precedence. Unlike the wet areas on the land, they must be ready to be used during the cruising times too. The general functions of the bathroom areas need to be well known by the designers and these areas must be always ready to provide the necessary requirements of the users (Godoli, 2007).

3.4 Electronic & Mechanical Structure

When it comes to the technical part of the job electrical wiring turns into the most significant element. Every type of boat that has a cabin structure directly has an electrical system too. Fundamental needs inside of a recreational craft are supplied with this factor. To make it more clear, these requirements can be listed as below:

- Bilge pump
- Radio system
- Water booster
- Freezer/s
- Lighting
- Electronic devices etc.

In general, there 24 watt electrical systems are used in middle-sized recrational crafts. If the size and technical needs of a vessel increase, the voltage system used inside that recreational craft change too. In other words, technical equipment will need a higher voltage system. Just like the previous spaces and technical requirements, both electrical and mechanical needs are shaped considering the basic requests of the customers (Figure 43.).

Figure 43. Piping System on the Ceiling Part of a Motor Yacht

About the importance of electrical structure inside of the recreational crafts:
"When it comes to the pleasure vessels some of the main electrical consumers are navigation lights and bilge pumps. After that, interior cabin lightning, cruise and communication devices, electric gypsy, water pumps and electrical cooling units follow these elements. Depending on the size of the vessel number of electric-based devices can be increased or decreased. To avoid any kind of water leakage, a floating switch directly connects to the electrical wiring via any kind of pumping system. If this kind of negative situation happens, without the interference of anyone pumps will evacuate the water to the outside of the vessel when it reaches a certain level."

Additionally, there must a certain type of copper cables used in the electrical wiring system of a recreational craft. The special part of these cables come with their insulation structure (consider that using electrical cables in a floating environment without a proper insulation system). These copper cables need to be covered with

multiple tin-coated cable wirings and a two-layered insulation structure. To transmit the energy from one space to the other one the diameter of the cables must be wide enough. It is a critical priority to keep the electrical cables away from heat, seawater and oil (Figure 44.). To make that happen, their general location must be arranged during the design phase of the recreational craft. Furthermore, there must be galvanized cable canals used to create coordinated ways for electrical wiring systems (Köse, 2016).

Figure 44. Electric Cable Way inside of a Steel Motor Yacht

From the design to the production phases, electrical wiring and its placement is a significant consideration that must be done carefully by the designer. Because, just like the other technical processes, it will turn into a critical need during the cruising time. Electrical wiring must be done before the installations of common and private space lightning, electrical kitchen equipment, music systems, tv units and furnishings. Because it is going a critical factor all around the recreational craft, it is a concern for both engineering and design teams.

In addition to that, the mechanical structure is also a critical factor in a recrational craft. There are main elements involved in the mechanical system of a vessel. They can be listed as below:

- Heating, cooling and air-conditioning instalment
- Sanitary system
- Fire fighting equipment

The main priority of all kinds of mechanical systems is safety and cleanliness. Despite the fact that it is a recreational craft, it must be well considered that there are going to be limited supplies and resources inside of the vessel. Due to that, mechanical system calculation must be done during the first design phases of the recreational craft. Before the cruising times, amount of users must be well thought to arrange clean water-contaminated water levels, air conditioning, heating and cooling systems. With the calculation of these mechanical systems that are going to be used inside of the recreational craft an effective and comfortable cruising can be provided. Furthermore, the main priority of mechanical systems is to provide safer and more comfortable interior circulation. To provide previously mentioned mechanical needs in a motor yacht, there must be constant clean water circulation all around the boat (Larsson, 2000).

3.5 Crew Usage of Interior & Exterior Areas

Under this title, the general responsibilities and main duties of the crew members in a recreational craft will be evaluated. Depending on the main usage purpose of the deck, there can be crew members which have a different duty located on each deck area. To make it more clear, if the galley area is located in the main deck, most of the crew members that have directly or indirectly related with this space spend most of their time in this part of the vessel. Depending on the distribution of their tasks, there are level differences observed between crew members. Furthermore, the certain number of crew members are determined considering the general size of the vessel and the time of the journey (how much time are they going to spend in the sea). In general, there are 6 to 15 crew members actively work in recreational crafts that are between 30-60 meters. Although crew members are experienced and qualified enough for every kind of mission in a recreational craft, they have to follow certain orders and duties which are given to them by the crew members of higher status (Altın, 2014).

In the interior parts of the vessel, most of the crew members which have different responsibilities and duties work with each other to create a proper circulation system. To make that happen, instead of only giving orders, high-ranking crew participate in the job cycle too. Unlike the crew members who work on the open deck areas, people who work in the vessel's interior parts cannot act so freely like them. This mainly

originates from the general needs of the space that they are working. In other words, it is against the vessel rules for a crew member to leave his/her working space during the hours of labour. The general responsibilities of stewards who are in charge of cleaning the cabins and common areas are not the same as the chef's assistants. Some of the main duties of stewards that work in the interior parts of the recreational craft can be listed as below: (Duman, 2016)

- Change of bed coverings
- Providing towels and necessary needs in the wet spaces
- Ventilating the interior areas

Other than that some of the main tasks of the people that work in the galley area can be listed as below:

- Preparation of the meals
- Cooking the meals
- Delivering the food to the crew members who are going to serve them to the owner or guests of the ship
- Hygiene of the galley area
- Ordering the food products that are going to be stored in the vessel

In addition to that, just like the crew members who work in the interior parts of the recreational craft, there are other crew members that work on the open deck parts of the boat. Their main duty is to keep the outdoor parts of the vessel as secure and clean as possible. These crew members' main duty areas include sun beach, outdoor dining space, bar, sunbathing area and pool (if there is one). If the owner of the boat wants to spend some time with his/her speedboat which is generally located in the lower deck part of the recreational craft, it will be launched into the sea by these members of the crew (Altın, 2014). Also, they are in charge during the cruising time of the speedboat, taking it back into the main boat and cleaning it in the most proper way. Additionally, during the preparation of the dish of the day, both interior and outdoor crew members are in charge of the preparation of the dining area, service of the meals and cleaning the space. While the meal is preparing, most of the users prefer to spend their time in their private cabins or common areas where they won't

encounter any member of the crew. For the people who won't participate in the dining activity, there must be a crew member always ready to serve in the bar or pool areas. Not following the orders and not being ready in his/her duty area might cause big issues during the service times of a recreational craft (Atalay, 1995).

3.6 Human Factors Definition

The concept of the human factors considered synonymous with ergonomics and it has been developing itself for the last sixty years. It has been improving itself to understand the nature of human-product relationships from different professional perspectives. With the proper usage of this factor, some of the main difficulties that are encountered in the built environment can be solved or fixed efficiently. If it is considered as a scientific, technological, engineering, and design-related principle, it will be easier to create more effective, functional and usable products (Salvendy, 2012). The International Ergonomics Association (IEA, 2003) characterizes human factors as the logical control worried about the comprehension of the connections among people and different components of a framework and the calling that applies hypothesis, standards, information, and techniques. Some of the professionals that became an expert on human factors have been examining different jobs, tasks, environments and systems to understand this concept more clearly. Based on the results that they collect they suggest necessary improvements or revisions on certain products or environments. From a historical point of view, this concept has been suggested and defined by famous Polish scientist B.W.Jastrzebowski (1857a-d). It was defined as a scientific discipline that spreads into a wide area of work including all types of human movements and activities. Under this title, some of the basic and significant principles of ergonomics and anthropometry will be evaluated (Salvendy, 2012).

3.6.1 Ergonomics

Since the beginning of the first ages, humanity is in a deep search for constant or variable living environment. The concept of space where inhabitants feel safe is still in serious consideration in today's world. While considering an individual's main living needs, people have been adding new functions and features to the space like working, studying and shelering etc. With all these factors, the concept of space or creation of space is mainly focused on human and its comfort in a space. One

scientific discipline won't be enough to create a livable living or working environments for the users. It can be only provided with a proper collaboration and knowledge exchange between different scientific disciplines. Among all of them, 'ergonomics' is the science that examines the human factor, human movements, anatomic features of human with every possible direction.

In the early days, the science of ergonomics was considered a significant factor only in working environments to improve workers' psychological and physical working conditions in a better way. In today's world, from a simple industrial pen to all kind of living spaces it is possible to encounter the impacts of this science (Dinçer, 1978). Shaping the environment considering the main needs of people where they live is one of the main duties of ergonomics (Figure 45.). For instance, depending on a person profession and working space, creating a long-termed, functional and safe environment and work equipment is one of the main purposes of ergonomics. To make that happen, the anatomical structure of humans and anthropometrical dimensions must be always considered in every position and condition.

In addition to that, the beginning point of ergonomics which is quite relatable with the working laws was observed in workspaces. Its main objective was to create more reliable, less dangerous and more effective fields for the workers. Besides the working environments, it is possible to observe the effects of ergonomics in every part of our lives. If the general definition of ergonomics is examined from different sources this kind of results could be achieved; "It is an applied and multidisciplinary science that aims to reach productive efficiency by reconciling the working environment and all the systems it contains with all the psychophysiological and sociocultural capacities and limits of the human being." (Toka, 1988)

Ergonomics is a result of massive study and data collections that are done by different scientific disciplines. Besides making people's lives easier and more comfortable, ergonomics tries to improve one of the most significant parts of human beings: productivity. Under this title, some of the main objectives of the concept could be explained as below:

- Improving working efficiency in working environments.

- Producing products without making any concessions from good working conditions in long durations.

- Creating direct and safe relationships between human and machines (which are a critical factor for a sustainable economic structure).

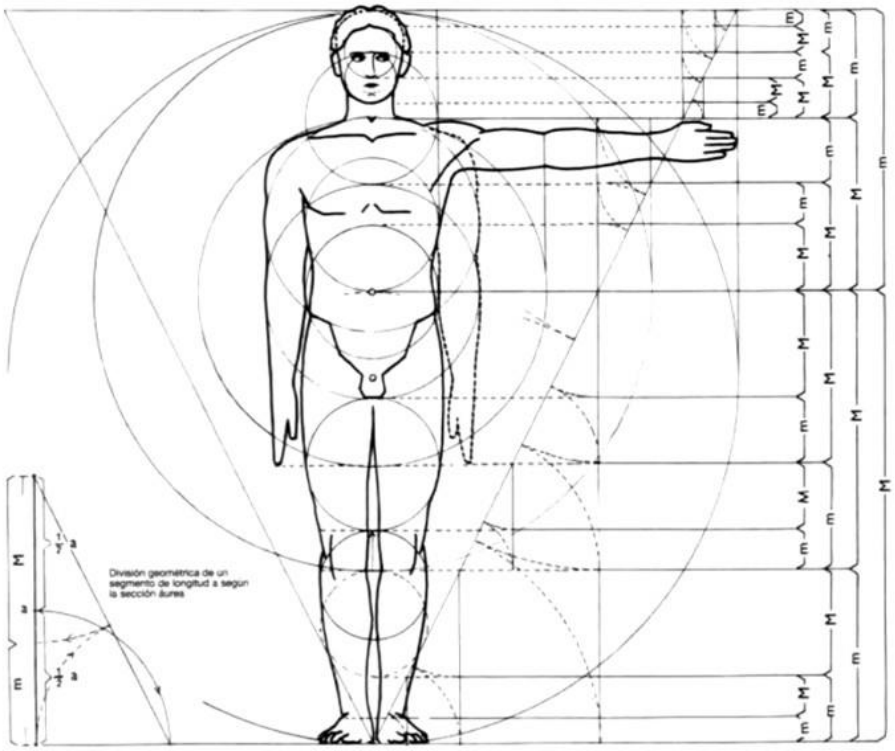

Figure 45. Main Dimensions of a Person (Source: Arch Daily, 2020)

The main starting point of ergonomic can be explained like that: providing good and safe conditions for the workers in work environments. Without considering the production element/s of any establishment, working conditions must be coherent with an individual's nature, body, anthropometric dimensions and physical strength (Figure 46.). Under these circumstances, ergonomics provides the necessary regulations and information to make any working space more human-oriented. To make that happen, this concept examines some features of human beings. These elements can be listed as below: (Özüdoğru, 2015)

- Physiological and biological properties of humans.
- Energy requirements of a working person.

- The working process of the energy and its relationship with an individual.
- Nutritions and their relationship with the working conditions.
- Tiredness processes of the workers.
- Human-machine relations and their impact on the working environments.

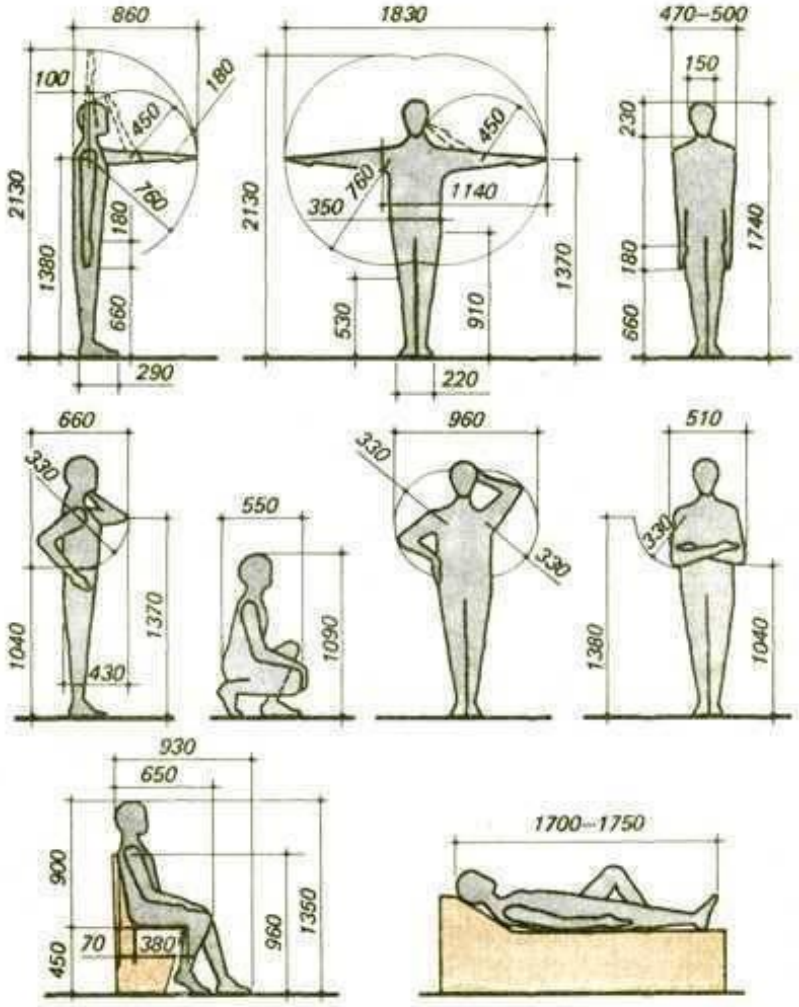

Figure 46. Human Dimensions with Minimum Standards (Source: Life is a Design Thesis, 2020)

While the main objective of ergonomics is the adaptation of humans to machines and working environments, the main purpose of architecture is to provide harmony between all kinds of areas used for vital activities and human beings. If it is examined through these directions, it will be quite possible to say that there is a strong bond between architecture and ergonomics.

Features of a proper physical space known as 'ergofit' are named 'performance standards' in both stable and movable architectural environments. These features can be summarized as below:

- Visual (natural or artificial lighting)
- Auditory
- Olfactive
- Tactual
- Thermal
- Moisture
- Chemical
- Dimensional
- Spatial

Collecting information about the dimensional data from the anthropometry and physical data from the ergonomics is a preliminary objective for the designer to proceed with the work that he/she is working on. With the proper collaboration of both of these factors, an effective product or space can be created (Baytin,1988). With the usage of ergonomics sources, architecture shapes effective, comfortable, reliable and safe environments for all kind of users. For instance, considering the climatic structure of the region, some of the necessary insulation and exterior precautions can be made even before the construction of the structure. In addition to that, based on the routine and general requirements of the user/s some of the most proper, functional and comfortable interior layout plan and furniture selection can be made. As mentioned before, human anatomy and movements is an essential factor for ergonomics. It is not possible to create an effective product or environment without conceiving the human factor. To make that happen, production, consumption, working routine and other necessary factors must be directly focused on human beings (Özüdoğru, 2015).

3.6.2 Anthropometry

The concept of anthropometry is explained as a scientific discipline that examines the physical features and dimensions of human beings. It evaluates people's body structure, body ratios and weights considering their nation, region, race, gender, age etc. and examines them based on these classifications (Table 1.). The essential approach of ergonomics is 'the adaptation of a job to human beings'. Based on this idea, anthropometry could be a good data collection for ergonomics (Babalık, 2007). To increase the productiveness of the workers in any working environments, there must be physical comfort provided to them. Furthermore, a proper working space where they can effectively use their abilities needs to be procured for them. To make that happen, there is a concept called 'anthropometric techniques' that can be used in almost any type of working environment where people collaborate with different objects or devices (Erkan, 2005).

Table 1. Anthropometric Measurements of Different Parts of the Body for Different Genders and Nations (Source: ResearchGate)

	North America		Italy		The Netherlands	
anthropometric measure	males	females	males	females	males	females
a) waist back	481 (35)	399 (28)	468 (30)	405 (30)	475 (36)	401 (29)
b) bustpt brth	236 (27)	187 (23)	217 (20)	183 (21)	230 (25)	206 (26)
c) hip brth, sitting	382 (36)	408 (46)	359 (25)	375 (29)	382 (29)	416 (38)
d) ankle circ	269 (15)	240 (15)	263 (13)	238 (12)	267 (16)	246 (16)
e) bi-lat fem epi brth sit	463 (55)	361 (64)	449 (46)	350 (48)	427 (59)	340 (53)
f) chest circ	1040 (109)	958 (124)	958 (79)	890 (80)	1015 (102)	998 (119)
g) chest grth at scye	1055 (96)	921 (100)	978 (71)	854 (60)	1022 (85)	943 (88)
h) neck base circ	468 (30)	410 (27)	475 (21)	425 (21)	489 (36)	441 (33)
i) weight	86 (18)	69 (18)	73 (11)	58 (9)	84 (16)	73 (16)
j) triceps skinfold	13 (7)	24 (10)	13 (7)	21 (7)	10 (5)	19 (8)
k) bi-lat hum epi brth sit	561 (53)	475 (57)	557 (45)	469 (39)	562 (49)	496 (49)
l) shoulder brth	496 (36)	430 (35)	459 (27)	405 (23)	472 (29)	431 (31)
m) radiale-stylion lth rt	265 (17)	237 (15)	265 (14)	239 (14)	265 (17)	239 (16)
n) waist circ (pref)	914 (125)	789 (135)	843 (83)	752 (78)	918 (109)	845 (131)
o) knee height	562 (31)	509 (28)	541 (26)	497 (24)	558 (35)	514 (28)
p) sitting height	926 (40)	865 (36)	908 (35)	855 (30)	945 (41)	887 (38)

There can be some major elements taken from anthropometric data by the ergonomics to create a properly running environment. These factors can be listed as below: (Babalık, 2007)

- Specifying the general dimension of the workers' significant organs such as arm, leg, hand, foot and head.

- Determining the natural position of the body.
- Articulations' movements areas and their reaching points.
- Applicable standing forces.
- Field of vision.

However, every individual's physical and biological structure is different from the other one, anthropometry gathers general knowledge and takes the average results. After that, it separates these results into different classifications (Figure 47.). As a consequence of that, there will be a certain type of regulations and dimensions for every kind of working area that must be considered by the ergonomics to shape an effective, functional and reliable working environment (Kan, 2014).

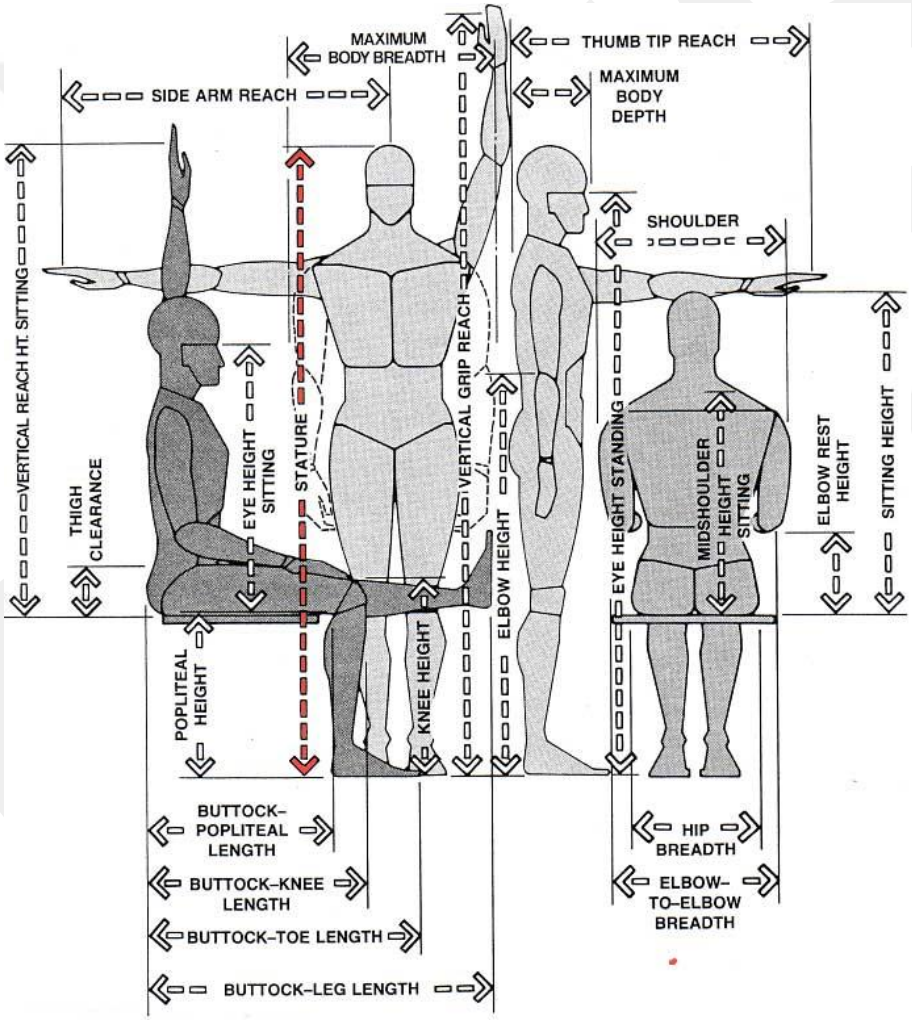

Figure 47. Average Anthropometric Measurements of a Person (Source: Practice, 2018)

CHAPTER 4: CASE STUDY

In this chapter a general analysis is discussed on the case study that has been conducted as an online survey. A general summary of the previous parts, their features and what direct me to this research are explained under the 'Methodological Background' topic. After that, methodology of the case study, research process, encountered issues and their solution are evaluated in the 'Methodology' part. In addition to that, overall analysis of the online survey is examined in the 'Results' parts. To collect solid and tangible data, all the valuable questions that have been asked and answered in the online survey are analyzed one by one. As a consequence of that, obtained data is highlighted and discussed in the final parts of this chapter to reach conclusion.

4.1 Methodological Background

Until this part of the thesis, a detailed research has been made on the progress made by different cultures' and civilizations' approach on the water environments. These process titles can be explained like that; the different construction techniques used by these cultures in shipbuilding, the contributions of technology and new discoveries throughout history to the maritime industry, different types of ships, a general approach to the yacht industry, different yacht types in size and hull structure, design issues that need to be considered in yacht interiors, and how important the human element is in floating spaces. If we need to evaluate these chapters as a main topic, since the discovery of the fire, humanity have taken an intense interest in the marine environments and tried to adapt themselves to these areas with the floating vehicles they have been developing. Boats, whose main purposes of use are trade, military and fishing, have also started to be used for advanced racing and pleasure thanks to the opportunities brought by the technology. After the industrial revolution, the popularity of the concept of recreational crafts increased among wealthy people. According to their interest in sea environments, they have begun to use different types of pleasure vessels with divergent hull structures. Throughout history, the general improvements in the technology, construction materials and techniques used to build recreational crafts have been changed and improved. Thank to that, popularity and the user number of these kinds of vessels increased too.

In addition to that, some of the main design and mechanical related parts have been evaluated to understand the interior structure of a motor yacht. As a consequence of that, some of the main points that must be well thought by the designers and engineers have been highlighted.

In a general point of view, one of the main elements that must be considered as a priority in recreational crafts is the human factors and ergonomics. Giving a shape to an environment or a product without considering the dimensions and anatomical structure of human beings will probably become a huge failure for that designer or engineer.

Human factor was always the focal point for architects and designers. After some revolutionary improvements in the global industry, ergonomics became a necessity for all types of environments and products which are related to people. Without considering the human factors it will be quite difficult to shape an object which appeals to society. The same idea is also valid in movable environments too. Especially in those spaces concepts like human dimensions, movements, functionality and usability turn into more significant factors. Because there are going to be limited space inside of a movable space every corner and little detail must be evaluated and processed carefully. From self-propelled caravans to mega yachts this idea is valid for every type of movable area.

In addition to that, when it comes to the sea environments from construction materials to the interior fabric selections every detail must be durable against the heavy sea conditions. If it is going to be a recreational craft, there cannot be concessions made from the user comfort and luxury. This means that there must be an extra effort spent on the recreational craft by the designers and engineers. During the third chapter of the thesis, this main idea has been tried to emphasize. Without following some of the main steps during the design and construction processes of a motor yacht could cause a disaster both for the owner and the shipyard. To prevent that there are some main headlines created in the second and third chapters. With the help of them, there can be a general image crated on engineers and designers heads about the motor yacht design before the first meetings with the client/s. Some of those titles can be listed as; comfort, safety, climate control, functionality and luxury.

Other than that, some of the major environments that must be had in every pleasure vessel have been evaluated in this chapter to guide yachts designers in their future projects. These spaces can be summarized as common and private areas and their relationship with each other and exterior environments. Shaping a balanced interior layout structure in a concept motor yacht could be a big challenge both for engineers and designers. Since, while they are creating the environments they need to consider some of the main needs and requests of the customers too. In addition to that, both engineering and design teams must inform each other in case of a little or significant change inside or outside of the vessel. So that, there cannot be any technical or design-related issue can be encountered during both design and construction processes. To emphasize the significance of this, there is a title that talks about the importance of mechanical and electronic structure in the third chapter. Most basically the second chapter talks about the history of vessels and it is kind of an introduction to the third chapter. In the third part of the thesis, from design-related information to the human factor need in a pleasure vessel every single detail has been evaluated and explained.

The main issue that directs me on this specific topic comes from the insufficient collaboration between naval architects and designers on the recreational craft projects. Also, not considering the human factor and ergonomics as the main element in super yachts can be seen as the head problem of this thesis. From the general perspective of an interior architect, an assessment has been made considering these main head titles and necessary evaluation and explanations have been made to highlight some significant points which are related to recreational craft design.

As it was mentioned before, except for the global ones, most shipyards prefer to work with design offices or freelance designers for the interior and exterior structure of a motor yacht. There are also some shipyards that have permanent engineering and design teams too. In both scenarios, there is not sufficient communication between the engineering and design teams. For this reason, it is quite possible to observe some issues during the construction processes of a recreational craft. To prevent that, it is a necessity to have a sustainable collaboration with all departments which have a responsibility on the design or construction part of the recreational craft. Moreover,

all the different departments must inform each other if a necessary revision or change is made on the project.

Consequently, some of the necessary elements and design principles have been evaluated from the perspective of an interior architect and they have been explained in the different chapters of the thesis. Seeing and not doing anything about this problem in the recreational craft industry cannot be a proper solution for a designer. For this reason, this kind of research has been prepared and a case study has been done. In this part of the thesis, this case study and its results will be evaluated as proper as possible. Finally, a brief consequence and a final suggestion will be made to create an alternative pathway for engineers, designers and shipyards in future motor yacht projects.

4.2 Methodology

In this part of the thesis, the methodology technique that has been used to make this research will be explained. To make that happen, there must be a detailed literature review made to figure out the design principles of motor yachts which are twenty-four meters and over.

Firstly, the concept of luxury, functionality and comfort must be seen as the main principles during the design phase of a motor yacht. Unlike the mass-produced sailing yachts and motor yachts, it is more possible to observe concept design recreational crafts when the size of the ship increases. If a recreational craft's general size crosses the twenty-four-meter limit, the technical requirements and equipment list of the ship changes too. This means that the price of the vessel directly increases with its size too. For this reason, there are only certain types of people who can actually afford recreational crafts which are twenty-four meters and more. Hence, they generally have certain requirements and requests for both interior and superstructure parts of the boat. At this point (beginning of the concept design) naval architects, architects, interior architects and industrial designers begin to participate in the project too. From the first sketches to the final landing of the ship to the sea they involve in the design and construction part of the motor yacht.

Furthermore, according to the general requests of the customers and the Lyod rules designers try to create a balanced interior and exterior plan layout which answers both customers and regulations. Using necessary elements and shaping the interior structure of the vessel according to the general needs of the customer will create a balanced luxurious and functional recreational craft.

During the preparation of the survey, the main priority is to figure out in which stages of the recreational craft do the naval and interior architects involve in the project? Moreover, how does a naval architect approaches the design of a motor yacht and how does an interior architect approach the design of a motor yacht, are another significant questions to figure out in this case study. To find proper answers to those questions, there has been an online survey prepared and distributed to the people who have certain knowledge and experience on recreational crafts which are twenty-four meters and over.
During the first preparation of the survey, there has been a huge help taken from the thesis advisor. With the help of his academic and technical knowledge about the recreational crafts, the general structure of this case study has been created. Due to the situation that all of us have been experiencing in the past one and a half years (Covid-19) and the difficulties of spreading an online survey in the yacht sector. It was decided to make a survey by using the snowball technique. To make that more clear, the online survey has been sent to the people who have a direct connection with the researcher or the thesis advisor. After that, we asked them to send the survey to the people who have certain knowledge and experience of the concept of 'recreational crafts'. With this technique, the survey has been reached to many designers and engineers.

In addition to that, before the online survey is published, there has been a pilot study made to observe and revise the mistakable and complicated points of the research. To make that happen, the first version of the survey has been sent to four people. Among them, there were two designers and two naval architects. Based on the proper comebacks from them the online survey has been revised and published to the public.

At the first beginning stages of the survey, it was designed as an interview. In that interview, the researcher supposed to visit different kinds of shipyards and yacht

interior and exterior design offices and make a proper interview with people who work there. However, due to the negative impacts of the pandemics, almost none of the shipyard wanted to have a visitor from outside of the working environment. For this reason, there has been an online survey created using 'Google Forms'. Due to the idea of yacht design has an international range. The survey has been prepared in two languages. The first one was in Turkish. Since there is a wide range of people that work both in the design production processes of yacht design and the improving structure of the yacht industry in Turkey the first survey is prepared in Turkish. The same survey's second version was in English. Because of its international structure, every person that has a certain interest in recreational crafts must know this language too. Also, people that live and study abroad that has a professional relationship with the researcher and the thesis advisor was another reason for the preference of this language. Hence, the second version of the survey has been prepared in English.

Furthermore, there are multiple selection questions, evaluation parts, writing and comment parts are located inside of the thesis. Depending on their vision about the questions, participants were free to choose or write whatever they want. At the beginning of the thesis, there is an information paragraph for the participant that explains to them what kind of research that they are going to involve, what is the focal point of the thesis, what the researcher is trying to achieve etc. After the participant read them they enter their email addresses and click on a confirmation button that tells them they are joining this research with their free will not the pressure of anybody or any establishment. After that, they begin to answer the question. Moreover, due to the research technique of the thesis participant answer will be anonymous. This means: readers won't be able to see any participant names or personal information. The only thing that they are going to see is the average graphs of the participant's answers, their professions, genders and overall responses to writing questions.

4.3 Results

Until this part, significant points, guidelines that are used and the research process that has been done to create this case study have been mentioned. Based on that, online survey questions and their tangible outcomes will be analyzed under this title.

After that, considering participators necessary qualifications, a final discussion will be made in regard to the collected outcomes from the online survey.

4.3.1 Demographic Data

In this part, a detailed analysis will be made on the substance of the online survey. The main purpose of that is to evaluate the participant average answers to the questions. Some of the multiple answer questions average answers will be explained on a pie chart. Additionally, the rest of the writing questions' individual answers will be perused one by one. After that, based on their closeness to the centre point of the research, an average separation will be made considering those answers.

To begin with the first part of the online thesis, the total number of individuals that have participated in this survey research was 95 people. Before they start to fill the survey, all of them accepted the terms and conditions that we have explaining at the beginning of the survey. As mentioned before because this is going to be anonymous research. Hence, there won't be any participants' personal information shared here. In addition to that, in terms of age evaluation, most of the participants' average age is between 21-30 years old. In total, with 69 participants this age group constitutes 72.6% of the general participatory. Moreover, the second-highest age group involves people between 31-40 years. The total number of people that includes this group is 17 people. With this number of participants, this group includes 17.9% of the chart. In addition to that, the next highest participant group comprises 6.3% of the chart. This group of people includes the ones between 51-60 years old. The total number of people that joined the survey under this group is 6 individuals. In addition to that, there are only 2 people that joined the survey between the age group of 41-50. These people involve 2.1% of the pie chart. Last but not least, again, only one participant attended the online survey in the group of 20 years old or bigger age. Close to the previous one, this participant includes 1.1% of the chart (Figure 48.). Among all the participators there is nobody who attended the survey whose age is bigger than 60.

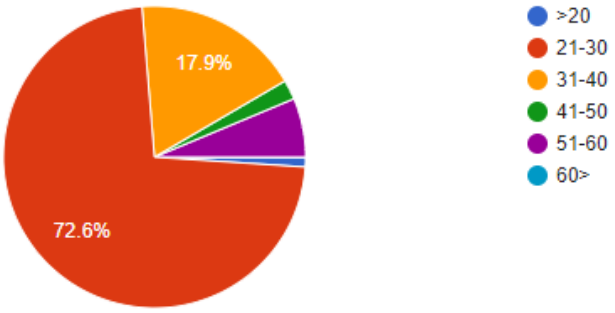

Figure 48. Participants' Age Distribution

To move on to the next point of the survey, the gender distribution of the participants is compared. In this part, the question left open for any kind of answers from the participants. Among 95 participants, there is only one answer which did not fill this particular question. Except for that, other than males and females nobody added a different kind of an answer. Moreover, based on the answers that have been collected as data, there are 59 males and 35 females participated in this survey. With the help of this answer, it is quite possible to say that there cannot be too much gender-related difference observed in the yacht industry.

The next point is the average professions of the participants. When it is examined in detail there are many individuals that have different kinds of a profession participated in this survey. From mechanical engineers to technical painters, divergent kinds of people participated in this online survey. Despite their specific jobs, due to their general interest and knowledge on yacht design, they have participated in this research. In the general picture, these participants' number is quite low compared to the number of other participants' professions. The people that have joined this survey mostly have a profession that is directly or indirectly related to design or yacht design. Those professions can be listed as; architects, interior architects, naval architects, academicians, industrial designers, yacht designers and marine-related electrical engineers. With their precious answers to these questions and general knowledge of the recreational craft industry, a significant amount of data has been collected (they will be explained in the further parts of this chapter).

4.3.2 Analysis of the Questionnaire

To understand the general structure of the online survey and question, all the significant points and answers is analyzed and evaluated properly.

In this part of the chapter, participants' general nautical experience will be evaluated (Figure 49.). When the general ratio is examined there are 38 people that have no experience in nautical environments which includes the 40% of the participants. If the general number of participators is taken into consideration this could be seen as a high number. Considering the geological structure of Turkey (three parts of the country is covered with different types of seas) this number cannot be acceptable for a country like that. Additionally, 24.2% of the participatory see their nautical experience at the beginning level. With 23 people this category involves almost a quarter of the general number. With 11.6%, 11 participants see themselves in the advanced beginner level. In addition to that, 9 people that have joined this online survey accept their nautical experience at the competent level. This ratio involves 9.5% of the general chart. Other than that, 8 people accept their nautical experience at a proficient level. This also contains 8.4% of the chart too. Last but not least, only 6 participators accept themselves as an expert in the marine environment. This number of people only involves 6.3% of the general ratio. When the nautical experience level starts to increase, the number of people that see themselves above the advanced beginners' level begins to decrease. With these findings it is possible to say that; it could be quite difficult to be an expert that has certain knowledge and experience in nautical environments (both in sea and shipyards).

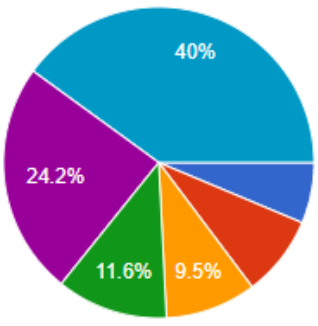

Figure 49. Experiences Distribution

If we move one to the next question, not all participants preferred to answer this part. In total there are only 87 people who responded this particular question. The main aim of this question is to figure out if they have ever been on board of any kind of vessel. Among all those responses 98.9% of people answered 'Yes' to this question. This means that, out of 87 people 86 of them at least got into a floating environment. In addition to that, the next question is kind of linked with the previous one. It is asked to participants to answer that have they ever stayed overnight in a motor yacht. Just like the previous one, this is an optional question Fur this reason only 85 people responded this particular question. Based on the answers of the participants, there are 51 people who stayed overnight in a motor yacht. This number comprises 60% of the general ratio. Moreover, considering the responses of this question, there are 34 people who have never stayed overnight in a motor yacht. This ratio, involves 40% of the pie chart. Based on the information that has been gathered from this answer, it is quite possible to say that: there is a fifty-fifty situation can be observed in here. Almost half of the participatory spent at least one night in a pleasure vessel and the other half couldn't do that.

To move on to the next question, in here it is asked participatory to define a mega yacht with their personal opinions. Because this one is also an optional one, out of 95 participatory there are only 75 people responded this question. Its main difference from the other ones is quite simple. People who accept to join this survey need to write a couple of words or sentences about the question. Not all answers will be explained one by one. However, based on the comebacks their average analysis will be made. Additionally, many come backs was not that much different from each other. In most of them there we some certain words used to define mega yachts which are luxury, comfort, modern and secure. In addition to that, when a general definition is made considering the data that has been collected from this question, a mega yacht can be defined like that: it is a floating environment where both owner/s and guest/s can find the exact relaxation that can be only finding in their homes. Besides, it can also be seen as a luxurious palace where can be only found in one of the most luxurious hotels. Most of the participants defined different kind of sizes for the length of a motor yacht. When the average picture is examined, the general number is yachts that are 40 meters and over (based on their own knowledge). Although, a 60 meter motor yacht is defined as a mega yacht twenty years ago, it can

be seen as a regular size of a pleasure vessel in today's world. This is mainly originates from the general increase on the construction of motor yachts which are one hundred meters and over. Furthermore, some of the participants used these kinds of expressions to define mega yachts too: above the standards, a floating mansion, a colossal boat that is capable to sustain itself in log range distance etc. Basically, almost all the participators that answered this specific question defines a mega yachts as huge, comfortable, luxurious and ergonomic floating environments that presents its users a various types of entertainments opportunities. Consequently, it is possible to say that; these kinds of vessels are kind of a representation of wealth, power, comfort and luxury.

The next question is about to learn participators thoughts about the role of an interior architect in yacht industry. It was asked participants: is it necessary to have an interior architect in the design of a mega yacht. Based on the answers that has been collected from the survey: 98.9% of the participants say 'Yes' to this particular question. This means that 98 people think that there need to be at least an interior architect who works in both the design and construction phases of a mega yacht. However, with 1.1% there is only one participant who thinks the opposite of it.

In addition to that, the next question is about figuring out which part of the process should an interior architect or a designer get involved in the design of a recreational craft (Figure 50.). 46.3% of the participators think that an interior architect must join the project before even is it begun. This ratio has been constituted with the free thoughts of 44 participators. The second-highest ratio is 32.6%. 31 people who have chosen this option believe that an interior architect joins the design process of a mega-yacht during the first meetings with the clients/s. Two of the highest ratios of this question can be summarized like that. Moving on with the rest of the ratios, 9.5% of the people think that an interior architect gets involved in the design face after the hull construction process is completed. In other words, this value contains 9 people and based on their thoughts an interior architect should join a mega-yacht project during the superstructure construction of a pleasure vessel. Furthermore, 7 participators put an interior architect’s role after all hull and superstructure processes are completed. In other saying, 7.4% of the participators think that a designer or an interior architect should participate in the project during the interior layout

preparations, not in both hull and superstructure design and construction phases. Last but not least, 4.2% of the participants believe that an interior architect should join the project during the design phase of the hull. With the lowest numbers, this ratio only involves 4 participators.

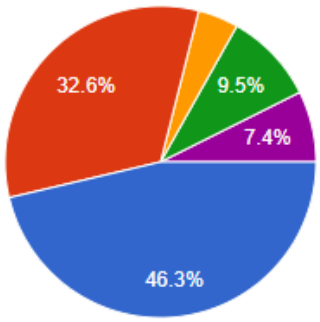

Figure 50. Opinions about Which Part of the Process Should an Interior Architect or Designer Involved in the Project

To move on with the further question, in this part of the survey there are in total of 31 questions located underneath the main question. The main question asks participators to answer the questions in terms of considering the interior design related issues of a super or mega yacht. Each question will be evaluated individually, but the general ratio that is collected from a single question will be evaluated. To make it more clear, the highest ratio of each question will be taken into consideration.

To begin with the first sub-question, it was asked participators that should the interior space of a motor yacht be as comfortable as a house. Based on the collected responses, 42.1% of participators strongly believe that interior environments of a recreational craft must be as comfortable as a house. This means that out of 95 participators 40 people have chosen this option. Furthermore, on the other question, 63.2% of participators strongly agree that a focal point of a recreational craft must be user-focused (Figure 51.). This ratio contains 60 participators out of 95 which make it the highest ratio for this question.

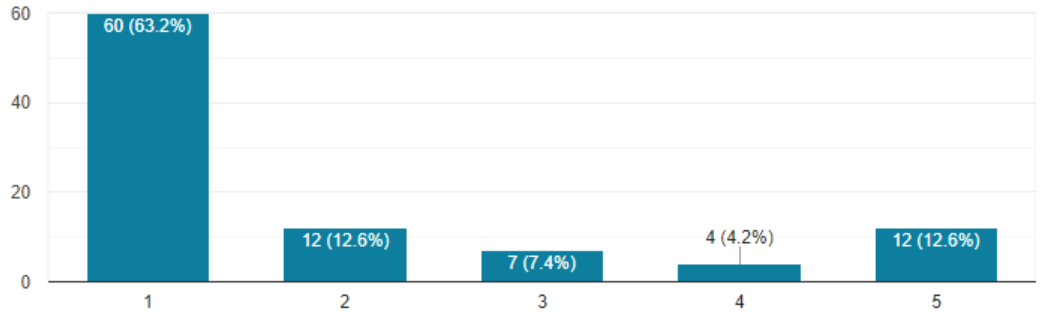

Figure 51. The Importance of the Interior Design of the Boat Being User-Oriented

Moving on to the next question, 67.4% of the participants strongly agree that security is the primary element in the interior design of a boat (Figure 52.). With 64 participants independent answers this ratio forms the highest point of this particular question.

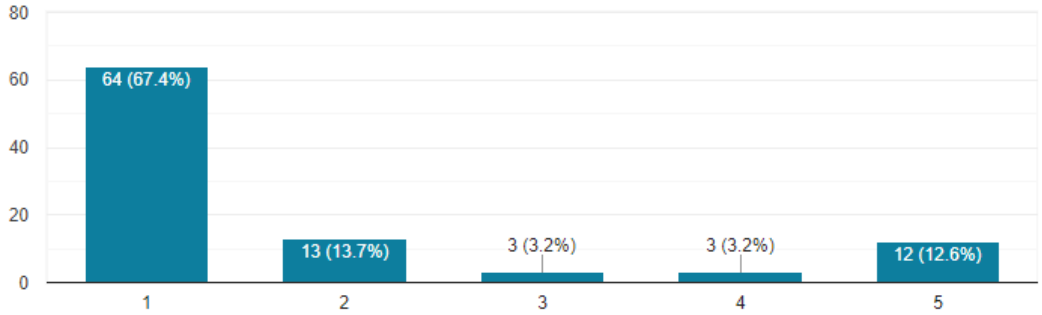

Figure 52. The Importance of Safety in the Interior Parts of a Boat

For the next question, 42.1% of them answered not sure about this question. It says that: the interior design of a recreational craft must be simple. Out of 95 people, with 40 answers this ratio is the highest point of this question. The next question says that: a recreational craft need to provide almost every possibility that a house can. When the general answers of it are examined we encounter a separation. With 31.6% most of the participants have chosen strongly agree with this question. This ratio only includes 30 people. Proceeding to the next sub-question, 33.7% of the participators selected a not a sure option for this question. This means that 32 people are not sure about the interior environments of a recreational craft must be highly decorated, fancy and luxurious. In addition to that, 46 people strongly agree that accessibility and circulation are the most significant criteria. These people form 48.4% of this question's ratio which is the highest number for it (Figure 53.).

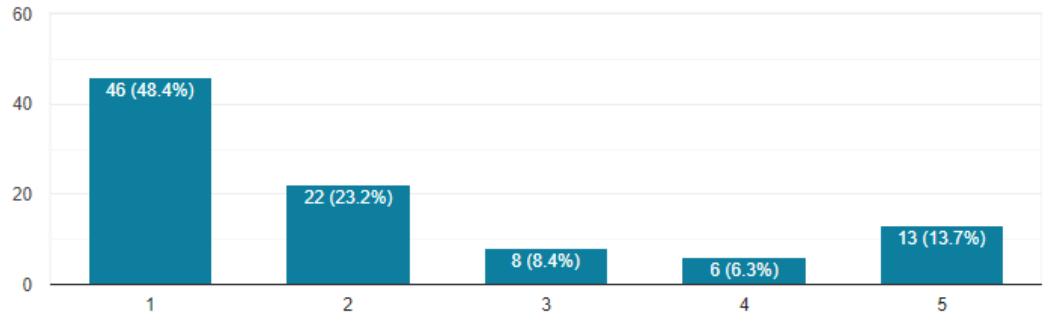

Figure 53. The Importance of Accessibility and General Circulation

Additionally, in this question, there is almost a quality captured between the two options. It says that: private spaces (cabins, bathroom, restroom etc.) are the most important interior areas that are going to be designed. With 30.5% most of the participators answered not sure about this question. A total of 29 people are not sure about the importance of private environments. Moving on to the further question, just like the previous answer, again with 32.6% most of the participators have chosen not sure for it. The question says that: the interior of a mega yacht must be luxurious and fancy. Out of 95 participators, 31 people are not sure about it. Moreover, with 40% most of the participators have chosen agree option on this question: common areas of a recreational craft are the most important ones that must be designed. In total, this makes 38 participators which is the highest ratio for the question. Additionally, 41.1% of the people who joined this online survey strongly agree that the interior spaces of a recreational craft must be graceful and modern. Out of 95 participators, this ratio involves 39 participants. For the next question, it says that: service areas are the most significant ones that must be designed. Based on the collected data, 29 people answered not sure about this question which is also the highest ratio of this question. It constitutes 30.5% of the general graph. Furthermore, 33.7% of participants strongly agree that there must be separate staircases solutions proposed for different kinds of usage purposes and this ratio contains 32 individuals. Addedly, just like the previous question 38.9% of them strongly agree that wet areas' interior organization must be as important as the other spaces. Out of 95 contributors 37 people have chosen the strongly agree option for this question. Additionally, 68.4% of the participators strongly agree that the interior lighting system of a pleasure vessel must be well-organized (Figure 54.). This ratio contains 65 people which is the highest ratio for this question.

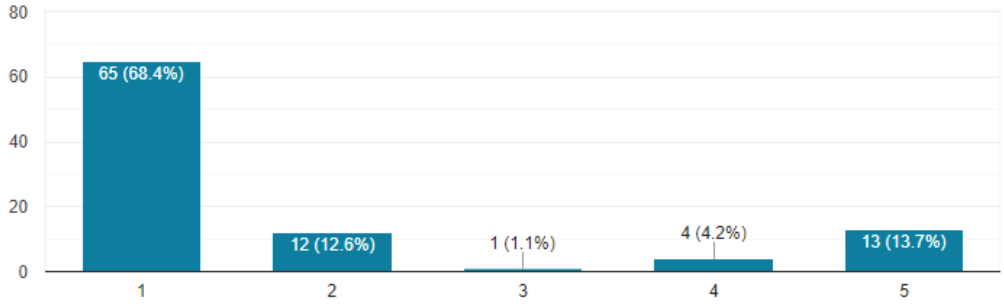

Figure 54. The Importance of the Organization of Interior Lighting in a Recreational Craft

Proceeding to the next sub-question, it says that: the interior environments of a mega yacht must be covered with technological devices. 51.6% of contributors strongly agree on this question and this ratio involves 49 individuals' answers (Figure 55.).

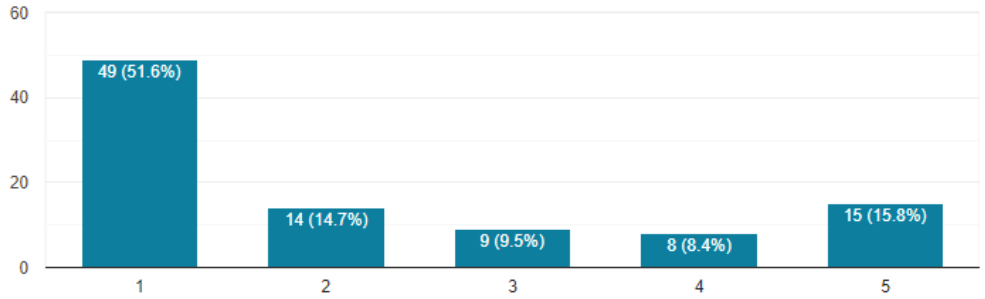

Figure 55. The Importance of the Usage of High Technological Devices

In addition to that, 32.6% of the participants are not quite sure about this question. It says that: there must be extreme indoor and outdoor facilities (gym, swimming pool, tennis court etc.) located in a recreational craft. With 31 people's answers, this ratio contains the highest ratio of this question. Moreover, 44.2% of participators strongly agree that there must be a direct connection between common areas and open deck spaces. 42 people have selected this answer which is the highest ratio for this question. Moving on to the next sub-question, there is an obvious closeness between the answers. 3 of the options display almost equality. Among these options, 28 people have chosen strongly agree option that wheelhouse is one of the most important technical areas in a recreational craft. With 29.5% this ratio contains the highest number for this question. Furthermore, 53.7% of the participators strongly agree that user satisfaction is the most significant factor in the design of a

recreational craft (Figure 56.). This ratio contains 51 participators which is the highest number for this question.

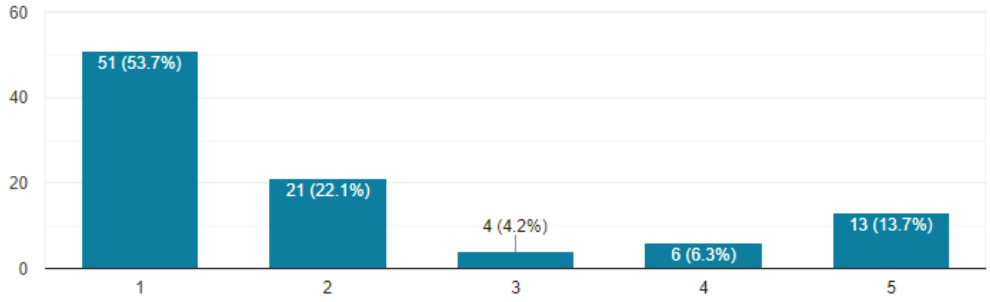

Figure 56. The Importance of the User Satisfaction in a Recreational Craft

The next question says that: windage, aerodynamic weight and air-flow evaluations have huge importance for the user relaxation environments. Considering that, 47.4% of the participators strongly agree on this particular question. Out of 95 responses, with 45 answers, this ratio contains the highest number. Moreover, 43.2% of participators strongly agree that there must be an aerodynamic analysis made during the spatial design processes. 41 individuals selected this option which makes it the highest ratio for this question. The next one says that: roll motion is a crucial consideration for interior design. 49 participators have selected this option which makes the 51.6% of the general ratio which is the highest one for this question (Figure 57.).

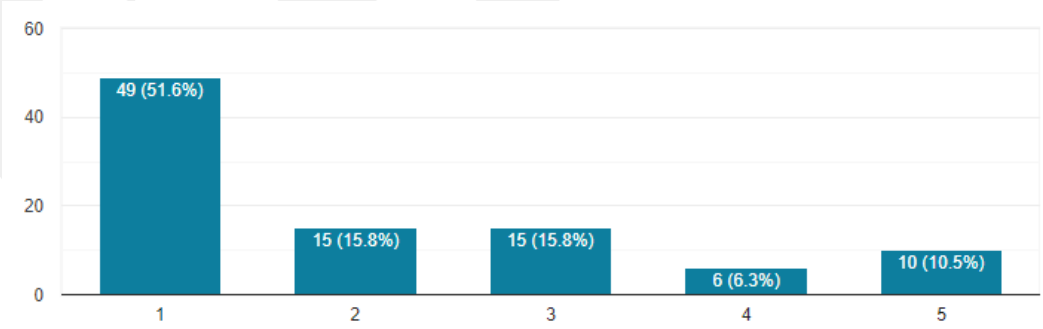

Figure 57. The Importance of Roll Motion in Interior Areas

Similar to the previous question, 50.5% of participators strongly agree that pitch motion is a crucial consideration for interior design (Figure 58.). This means that, out of 95 responses, 48 participators have chosen this particular option.

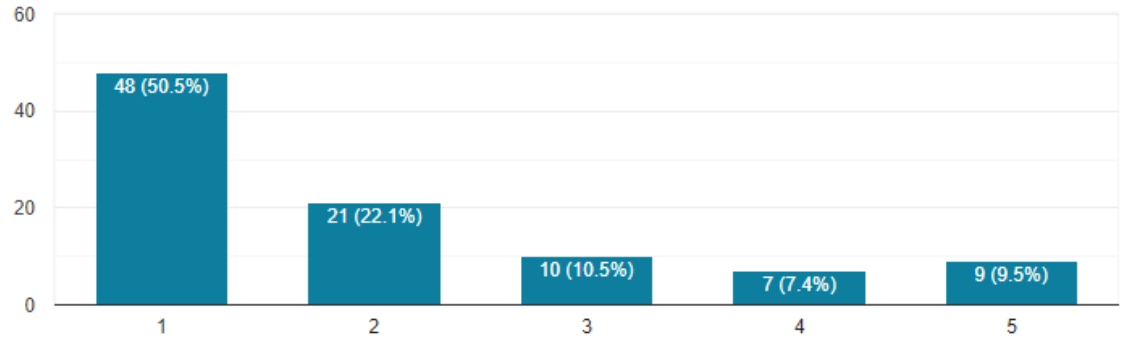

Figure 58. The Importance of Pitch Motion in Interior Areas

Moving on to the further sub-question, 44.2% of participants strongly agree that the most important criteria for the interior design of a mega yacht are the users' needs and expectations and this ratio contains 42 participators. The next sub-question says that: sea keeping aspect is the most important criterion for the design of open deck areas and interiors. When the general answers to that are examined, some of the options general numbers are quite close to each other. However, with 31.6% most of the people have selected strongly agree on option for this one and this highest ratio involves 30 contributors. In addition, 32.6% of participants strongly agree that vibration is the most significant impact on the interior design of a recreational craft and it contains 31 participants which is the highest number for the question. In the next question, 60% of the participators strongly agree that unwanted smell can be avoided through good interior ventilation (Figure 59.). When the general chart is examined it is quite possible to say that there is a huge ratio difference between the first one and the rest of them. Out of 95 responses 57 people have chosen this option.

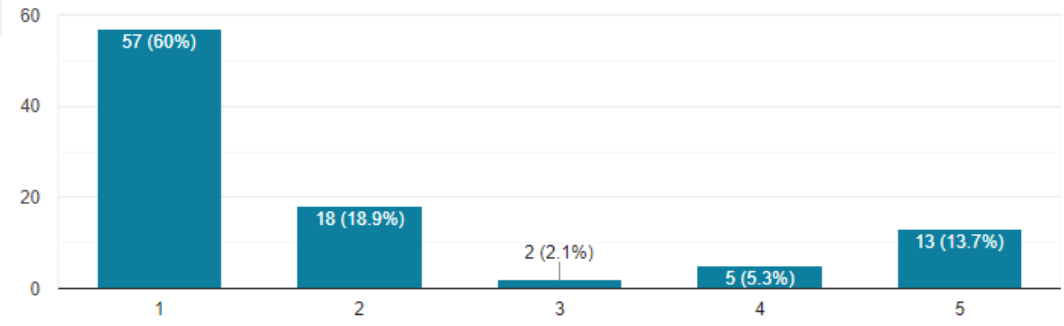

Figure 59. The Importance of Good Interior Ventilation

Moving on to the next question, it says that: user expectations can be fully met through interior design. 43.2% of the people who joined this online survey have selected strongly agree on the option for this question. In total this particular ratio includes 41 participants. Next further sub-question say that: unwanted noise problem (i.e. engine room) can be avoided by good interior design solutions. 49 people have marked the strongly agree option for this question which makes the 51.6% of the general ratio (Figure 60.).

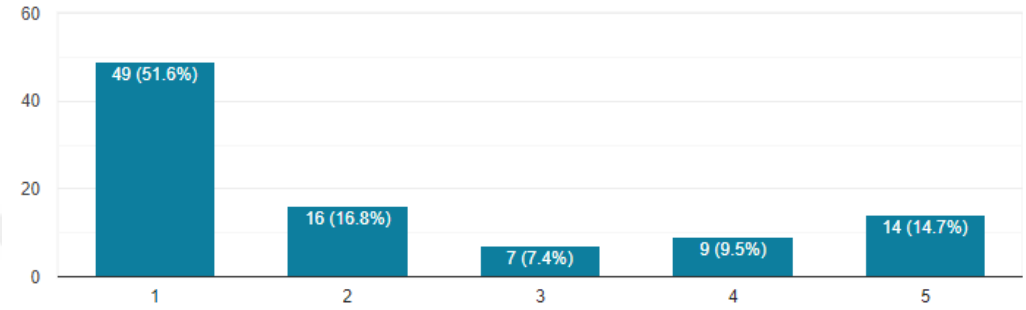

Figure 60. The Importance of Preventing Unwanted Noise Issue with Interior Solutions

For the final sub-question, 43.2% of the participators selected strongly agree option for this question which says that: humidity problem can be solved through interior design solutions. Out of 95 general responses, this particular ratio involves 41 individuals. This makes it the highest number for this particular question.

In the last part of the survey, it was asked participants to share their personal comments that they want to emphasize. Out of 95 participators, there are 16 individuals responded to the comments part. The general evaluation of the comments part will be made considering these people's personal opinions. Furthermore, it is quite possible to collect these comments under three groups. In the first group, participators' ideas are more design-related ones. The second group's general opinions are more related to the producibility and the engineering parts of a motor yacht project. The third group is more about customer designer relations. All three groups' general opinions will be explained for future studies and improvements.

In the first group, design-related opinions can be explained with this clean explanation: If it is a pleasure vessel that is under the motor yacht title, there are a

couple of criteria that must be meet in the same environment. They can be explained like that: safety, comfort, luxury, and functionality. All these features must meet in a modern, not too fancy, and customer-focused space/s.

The second group of people mainly believe that the critical part of a motor yacht is that: it must be producible. To make it more clear: although the interior architect and designer elements are important, due to the technical and mechanical-based requirements of the environments, these professions should follow the engineering branches. For example, the roll, oscillation, and nautical criteria of the boat vary depending on the hull form and the position of the weight distribution, which is completely related to the engineering process. Although interior architectural design processes provide helpful solutions in such matters, it should not be forgotten that the engineering process is the keystone for all yachts, regardless of size, construction material, and equipment.

In the third group, participants believe that an interior architect or a designer must get involve in almost all processes of a recreational craft. While doing that they must be in direct contact with the customer/s. If it is going to be concept project, customer participation into the project is a critical factor to proceed in both interior and exterior parts of the vessel. Other than that, meetings with the customer in the critical periods of the vessel carry an extra weight. Since, at those times revisions and changes must be made depending on the requirements of the customer/s.

4.3.3 Statistical Analysis

In order to figure out more solid interpretations from the collected data some statistical analysis has also been conducted. Through the statistical analysis, first it is aimed to find the internal consistency reliability of the instrument, second in order to test the hypothesis if engineers and designers have different approaches in the process of yacht design, a *t-test* is used to determine if there is a significant difference between the means of engineers and designers and lastly, principal component analysis tests are used to determine the latent factors of design approach for engineers and designers separately and the results are compared with each other. For the statistical analysis the latest version of JASP (ver. 0.14.1) software that has been developed by the University of Amsterdam is used.

4.3.3.1 Internal Consistency Reliability

The instrument is a self-developed questionnaire* (Appendix) and this version of it is[1] used for the first time for this research. At first a pilot study was organized; a few numbers of naval engineers and yacht designers from the industry have been selected and asked to complete the questionnaire. Then they were asked to evaluate the questionnaire. According to their comments and suggestions the questionnaire has been revised with some reductions and corrections. After the pilot study, the revised version of the questionnaire has been used in the case study. At this stage it is not possible to test the validity of the instrument. However, the reliability of the questionnaire has been checked through Cronbach's Alpha analysis. Other than the questions that aim to collect demographic information, there are two sets of Likerd style questions, Q11 and Q12 (Appendix). These questions are aiming to understand if there is any approach difference of engineers and designers during the yacht design process.

Table 2. shows Cronbach's Alpha coefficients, means, and standard deviations for Q11 and Q12. The results show that the average scale reliability of the questionnaire (averages of the internal reliability scores of Q11 and Q12) indicates good internal consistency reliability ($\alpha = 0.80$). The Cronbach's Alpha score for Q11 is 0.97 which shows a very good reliability. For Q12 Cronbach's Alpha score is 0.62 which is lower than the accepted satisfactory score 0.70 and above, but still considered to be acceptable. This might be because of the limited number of participants.

*The original questionnaire has been developed by Prof. Dr. Ö. Osman Demirbaş during his research at University of Glasgow, UK. The original questionnaire has been revised for this research.

Table 2. Internal Consistency Reliability and Scale Statistics of the Survey

Question	Chronbach's Alpha (α)*	Mean	Std. Deviation
Q11**	0.97	3.80	0.31
Q12	0.62	2.79	0.17
Average (α)*	0.80		

* $\alpha \geq 0.9$ – Excellent; $0.7 \leq \alpha < 0.9$ – Good; $0.6 \leq \alpha < 0.7$ – Acceptable; $0.5 \leq \alpha < 0.6$ – Poor; $\alpha < 0.5$ – Unacceptable (George and Mallery, 2003).
** Item 6 in Question 11 (Q11-6) has been removed. It is correlated negatively with the scale. Removal of this item doesn't change the α score.

4.3.3.2 Independent Samples t-test

In order to test if there is any statistically significant difference between the approaches of the engineers and designers in the yacht design process, 'Independent Samples *t-test'* analysis has been applied. The samples are grouped under two main categories as engineers and designers, out of 95 participants 5 of them are neither engineer and designer, for the rest 90 participants 60 of them are designers and 30 of them are engineers (under graduate degree has been considered for the grouping). Table 3. shows the main differences between the alterations for the two groups of scores (engineers and designers). According to the *t-test* scores the difference between the approach of engineers and designers are statistically significant in item 4 ($t = 2.045$, $df = 88$, two tailed $p = 0.044$) and item 27 ($t = 2.165$, $df = 88$, two tailed $p = 0.033$). According to item 4, although for both groups the responses are mostly on the indecisive side, engineers (M = 3.67, SD= 1.028) mostly think that it is better if the yacht interiors are more simple and plain whereas designers (M = 3.15, SD = 1.176) are more indecisive about this factor. According to item 27, engineers shows more concern about the vibration issue (M = 4.03, SD = 1.066) in the interior design of a yacht whereas designers are indecisive (M = 3.45, SD = 1.268).

Table 3. Independent Samples T-Test for Question 11 (Appendix)

							95% CI for Cohen's d	
	t	df	p	Mean Difference	SE Difference	Cohen's d	Lower	Upper
Item 1	0	88	1.000	0	NaN	0	-438	438
Item 2	611	88	543	183	300	137	-302	575
Item 3	1.127	88	263	333	296	252	-188	691
Item 4	2.045	88	44	517	253	457	13	899
Item 5	-1.011	88	315	-283	280	-226	-665	214
Item 6	-170	88	865	-50	293	-38	-476	400
Item 7	326	88	745	100	307	73	-366	511
Item 8	-829	88	409	-233	281	-185	-624	254
Item 9	-179	88	858	-50	279	-40	-478	398
Item 10	0	88	1.000	0	NaN	0	-438	438
Item 11	274	88	785	83	304	61	-377	499
Item 12	-1.071	88	287	-267	249	-240	-679	201
Item 13	654	88	515	183	280	146	-293	585
Item 14	-62	88	951	-17	269	-14	-452	424
Item 15	328	88	744	100	305	73	-365	512
Item 16	-603	88	548	-200	332	-135	-573	304
Item 17	-791	88	431	-217	274	-177	-615	263
Item 18	866	88	389	233	270	194	-246	632
Item 19	1.495	88	139	417	279	334	-108	774
Item 20	270	88	788	83	309	60	-378	499
Item 21	58	88	954	17	288	13	-425	451
Item 22	-453	88	652	-133	294	-101	-540	338
Item 23	1.309	88	194	383	293	293	-148	732
Item 24	1.042	88	300	300	288	233	-207	672
Item 25	336	88	738	100	298	75	-363	513
Item 26	1.502	88	137	433	289	336	-106	776
Item 27	2.165	88	33	583	269	484	39	927
Item 28	863	88	391	267	309	193	-247	632
Item 29	-700	88	486	-200	286	-157	-595	283
Item 30	-1.296	88	198	-417	321	-290	-729	151
Item 31	-400	88	690	-117	291	-90	-528	349

4.3.3.3 Principal Component Analysis (PCA): A Comparison between the Design Approach of Engineers and Designers

In order to identify and figure out the different patterns of both engineers and designers design approaches in mega/super yacht design, Principal Component Analysis (PCA) that is a method of Exploratory Factor analysis has been used. In order to compare the patterns of responses of the participants first the data has been separated as engineers and designers. Separate PCA has been applied for each group. PCA is a data reduction method that helps to simplify the subsequent analysis of the data by clustering highly correlated variables (Landau and Everitt, 2004).

Considering the factors are uncorrelated with each other, Orthogonal Varimax rotation model has been used in order to achieve a simpler structure. Factor loads 0.5 and over have been included in the PCA Matrix. According to the PCA analysis 7 factors (Figure 61.) have been identified for engineers and 4 factors for designers with Eigenvalue > 1 (.).

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	Uniqueness
V11-1	0.57	0.57						0.19
V11-2	0.79							0.16
V11-3	0.76							0.17
V11-4						0.89		0.14
V11-5		0.86						0.12
V11-6			0.89					0.13
V11-7					0.56			0.17
V11-8			0.60					0.16
V11-9			0.88					0.18
V11-10	0.77							0.20
V11-11		0.55						0.26
V11-12					0.83			0.23
V11-13							0.74	0.13
V11-14				0.79				0.15
V11-15	0.77							0.12
V11-16	0.51							0.15
V11-17			0.70				0.50	0.18
V11-18	0.78							0.13
V11-19	0.72					0.52		0.18
V11-20	0.84							0.11
V11-21	0.63				0.58			0.10
V11-22					0.61			0.13
V11-23	0.86							0.10
V11-24	0.82							0.10
V11-25	0.83							0.10
V11-26	0.67							0.23
V11-27	0.65							0.29
V11-28	0.77							0.09
V11-29				0.79				0.09
V11-30		0.54						0.31

Figure 61. PCA Engineers, ‘V’ represents the each statement in Question-11 of the Questionnaire

	PC1	PC2	PC3	PC4	Uniqueness
V11-1	0.720				0.283
V11-2	0.871				0.172
V11-3	0.846				0.140
V11-4		0.817			0.256
V11-5	0.621				0.372
V11-6			0.846		0.256
V11-7	0.818				0.190
V11-8	0.502				0.422
V11-9			0.863		0.255
V11-10	0.718				0.439
V11-11	0.673				0.303
V11-12		0.676			0.373
V11-13	0.740				0.327
V11-14	0.617				0.365
V11-15	0.915				0.103
V11-16	0.781				0.238
V11-17			0.533		0.357
V11-18	0.731				0.423
V11-19	0.685				0.347
V11-20	0.904				0.130
V11-21	0.830				0.251
V11-22	0.856				0.207
V11-23	0.836				0.257
V11-24	0.864				0.173
V11-25	0.847				0.251
V11-26				0.779	0.252
V11-27	0.658				0.313
V11-28	0.900				0.114
V11-29	0.765				0.286
V11-30	0.878				0.142
V11-31	0.800				0.278

Figure 62. PCA Designers, ‘V’ represents the each statement in Question-11 of the Questionnaire

For engineers Component 1 with Eigenvalue = 14.912 explains the 49.7% of total variance and Component 2 with Eigenvalue = 3.443 explains the 11.5% of total variance whereas the other 5 components have smaller Eigenvalues (between 1.83 and 1.10), each explains between 4% to 6% of the total variance (Table 4.).

Table 4. Component Eigenvalue and Proportion distribution for Engineers

	Eigenvalue	Proportion var.	Cumulative
PC1	14.912	497	497
PC2	3.443	115	612
PC3	1.828	61	673
PC4	1.413	47	720
PC5	1.358	45	765
PC6	1.157	39	804
PC7	1.096	37	840

For designers Component 1 with Eigenvalue = 17.828 explains the 57.5% of total variance whereas Component 2 with Eigenvalue = 2.335 explains the 7.5% of total variance, Component 3 with Eigenvalue = 1.451 explains the 4.7% of total variance and Component 4 with Eigenvalue =1.110 explains the 3.6% of total variance (Table 5.).

Table 5. Component Eigenvalue and Proportion distribution for Designers

	Eigenvalue	Proportion var.	Cumulative
PC1	17.828	575	575
PC2	2.335	75	650
PC3	1.451	47	697
PC4	1.110	36	733

In addition to that, based on the analysis that has been explained in Table 4.16 and Table 4.17 one of the most obvious and tangible data is observed on the first component parts. This data is valid for both engineers (PC1) and designers (PC1). For this reason, questions that are located under these first components will be compared with a discussion to figure out the main design approaches for both professions.

When the first component of Table 4.16 is examined (PC1), it is quite possible to reach some concrete data. From V11-1 to V11-28, there are certain types of questions and results that directly show the engineers approach the design principles for a motor yacht project. Evaluating those certain questions and answers are more helpful to analyze the first component. Under the PC1 factors, these certain questions and answers could lead a more tangible data: V11-1=0.57, V11-2=0.79, V11-3=0.76, V11-10=0.77, V11-15=0.77, V11-16=0.51, V11-18=0.78, V11-19=0.72, V11-

20=0.84, V11-21=0.63, V11-23=0.86, V11-24=0.82, V11-25=0.83, V11-26=0.67, V11-27=0.65 and V11-28=0.77. These 14 answers under the PC1 component are the principles accepted as the basis in the design approach for engineers.

In addition to that, just like the previous evaluation is it quite possible to reach some tangible data in Table 4.17's first component (PC1). To understand the designers' approach to a motor yacht project, some of the questions and answers will be examined. From V11-1 to V11-31, there are concrete answers that can be beneficial to understand designers' points of view about the design approach to the project. Under the PC1 factor, those questions and answers can be analyzed like that: V11-1=0.720, V11-2=0.871, V11-3=0.846, V11-5=0.621, V11-7=0.818, V11-8=0.502, V11-10=0.718, V11-11=0.673, V11-13=0.740, V11-14=0.617, V11-15=0.915, V11-16=0.781, V11-18=0.731, V11-19=0.685, V11-20=0.904, V11-21=0.830, V11-22=0.856, V11-23=0.836, V11-24=0.864, V11-25=0.847, V11-27=0.658, V11-28=0.900, V11-29=0.765, V11-30=0.878 and V11-31=0.800. These 25 answers under the PC1 component are the main design principles that are accepted by the designer to approach a motor yacht project.

Considering both PC1 (engineers) and PC1 (designers) components, it is possible to figure out some common conclusion. Other than the design factor, most of the engineers show additional importance to the technical and mechanical structure of the vessel. Mainly, the factor of design is in the second plan for them. Also, when it comes to the design principles and interior structure of a motor yacht, most of the engineers prefer to have a more simple, functional and durable environment. Moving on to Table 4.17's PC1 component analysis, unlike the engineers' answers, most of the designers put importance on both technical and design-related questions with a single difference. This is design-related principles have additional importance for them. Most of the designers strongly want to add or improve something innovative inside of a recreational craft. Usage of technological devices, functional, safe and modern common and private environments demonstrate a further significance for them. Other than that, with a little difference technical, mechanical and regulatory based elements have lower importance for this profession.

CHAPTER 5: CONCLUSION

Under this title, a brief summary of the previous theoretical parts and the research study are stated first and the conclusion of the research is discussed.

At the beginning part of the thesis the problem definition, aim of the study and scope of the thesis have been explained. To make it more clear, the main issue that is willing to be considered as the design approach differences of engineers and designers is explained in this chapter. The main purpose of that is to give the readers a first impression of what is going to be discussed in the further parts which could act as a guideline for the person who is reading it. Additionally, it is mentioned that what are the critical problems during the design process of a recreational craft and lack of collaboration between naval architect, marine engineers and designers are the important factors that are discussed in this thesis.

The second part of the thesis is more on forming a perspective about the nautical environments, history of boats, types of boats and recreational craft industry. At the beginning of this chapter, developments of the boating industry have been explained throughout the history. From the first boats that are carved from a log to the first ocean passing cruise liners, every significant element and their origins have been explained there. Furthermore, to create a clearer picture on the readers' minds some of the main ship types and their sub-types have been explained in this chapter too. Those two main titles act as narrowing down elements to reach the final destination which is the recreational crafts. Under the second chapter's ‘Recreational craft’ title, there is a brief explanation for the recreational crafts; what are they used for, customer profile and qualifications etc. After that, the types of recreational crafts (sailing yachts and motor yachts) are explained. In relation with this information, depending on their sizes the types of motor yachts are explained in the following parts of the chapter. Furthermore, as mentioned before, the main objective of this chapter is to make a brief explanation about the marine environments and the vehicles that are used in these environments. After that, there is an emphasis made at the end of this chapter which the importance of interior design principles of a motor yacht.

At the beginning of the third chapter, an interior architect's main duties and objectives in a motor yacht are underlined. After that, some of the main interior features are emphasized in the further part. They can be listed like that: comfort including thermal comfort, safety, functionality and luxury. Moreover, some of the main features of both common and private spaces are mentioned in this chapter too. Their main function is to highlight the critical points that must be considered by both engineers and designers during the design and building processes of a motor yacht. Other than the visible areas, some of the technical and mechanical structures like electrical wire systems are mentioned in this chapter too. Also, just like every other movable environment, nothing can be done without considering the human factor, human action and dimensions. For this reason, ergonomic and anthropometrics and the needs of human beings are mentioned too. These are the primary considerations that must be considered by every designer before the project begins.

In the last part of the thesis, the case study that is conducted to understand the different design approaches of engineers and designers during the design of a recreational craft is discussed. Before that, the methodological background of this case study is explained. To make it more clear, what has motivated the researcher to this research, what are the main issues that are going to be solved and the general summary of the previous chapters are explained under this part. Furthermore, the methodology of the research study is explained. Based on that there is a general analysis made to explain the structure of the survey. Proceeding to the next step, after the analysis of the questionnaire questions one by one, there is also a statistical analysis to understand the similarities and differences between the engineers and designers during the process of recreational craft design.

Among the online survey, there are some certain sub-questions where both naval architects and designers agreed. By evaluating similar and different questions it will be more obvious to figure out both of those professions approaches to the concept of recreational crafts. The first thing that will be evaluated is the common points. In the first sub-question, both naval architects and interior architects believe those boat interiors should be as comfortable as a house. The second sub-question says that the interior design of a boat should be user-oriented. Furthermore, the third question emphasizes that safety is the primary consideration for the interior design of a boat.

Moving on to the tenth question both naval architects and interior architects believe in the common spaces of a pleasure boat (i.e. salon, sundeck, dining area etc.) are the most important areas to be designed. The fifteenth question says that the interior lighting of a recreational craft must be well-designed. Additionally, the sixteenth question says that mega/super yacht interiors should be highly equipped with high technology devices. In the eighteenth question, both professions strongly agree that there must be a direct connection between common spaces and open deck areas. In the nineteenth question, the wheelhouse is one of the most important technical areas in a pleasure boat. In the twentieth question, user satisfaction is the most important factor in mega/super yacht design. Moreover, in the twenty-first question, both naval architects and interior architects strongly agree that windage evaluation, aerodynamic load assessment and airflow considerations are very important for the design of user relaxation areas. In the twenty-third question, roll motion is a crucial consideration for interior design. In the twenty-fourth question, pitch motion is a crucial consideration for interior design. Furthermore, in the twenty-fifth question, both professions believe that the most important criteria for the interior design of a mega/super yacht are the user's needs and expectations. The twenty-seventh question says that vibration is the most important aspect of the interior design of the boat. Lastly, the twenty-eighth question says that unwanted smells can be avoided through good interior ventilation. These are common sub-question that both naval architects and interior architects agreed on. However, there are a couple of questions where naval architects did not agree with the interior architects. Those questions which are mainly preferred by naval architects can be explained like that: boat interiors should be plain and simple, a pleasure boat should provide most facilities of a house, mega/super yacht interiors should be highly decorated, ornamented and luxurious, accessibility and circulation are the most important criteria, private spaces (i.e. cabins, wc, bathroom etc.) are the most important interior spaces to be designed, the interior of a mega/super yacht should be luxurious and fancy, boat interiors should be sleek and modern, service spaces (i.e. galley, storage etc.) are the most important interiors to be designed, there should be separate staircase solutions for different functions, interior organization of wet areas must be as important as the other spaces, there should be extreme indoor and outdoor facilities on a mega/super yacht like a spa, gym, swimming pool, basketball area tennis court, golf pitch etc. , aerodynamic analysis should be done before the spatial design process, user expectations can be

fully met through interior design and unwanted noise problem (i.e. engine room) can be avoided by good interior design solutions. Based on the naval architects' answers' to the online survey, these questions can be listed as the ones that they do not agree on as much as the designers.

To sum up, based on the analysis that has been done in Table 4.16 and Table 4.17 there has been obvious data analysis collected from the charts. To make them more clear; both naval architects and interior architects show a huge care of the user satisfaction and usability of a recreational craft. From safety precautions to the customer orientation, these factors show a huge importance for them. However, it is quite obvious to see some differences between these professions too by just examining their answers on the definition of a mega yacht. Most of the engineers interpret it with its producibility. Instead of focusing on style, interior layout arrangements, wet area locations, crew-user interactions, their main focal point relies on the hydrodynamic and statistic calculations, mechanical and technical parts of the job. On the other hand, most of the designers describe their opinions to this concept by following design trends, ergonomics, user-interiors relation and proper interior layout allocations. With this collected data it is quite possible to say that both professions have a lot of common points in the design and construction phases of a recreational craft. However, just like the common points, there are some gaps between them too. To fill those gaps, collaboration between engineering and design departments, informing each other in every single revision, arranging meetings with customers and discussing the situation at the same time, following the construction phases on the field step by step one are some of the possible solutions. These factors must be taken into consideration by both naval architect and marine engineers and interior architects who work in the recreational craft industry. Moreover, due to the negative impacts of the Covid 19 the case study is only done as an online survey. For this reason, it was limited to reach high numbers of engineers and designers. Due to limited interaction opportunities it was quite difficult to keep in contact with all of them. Lastly, under the direction of all these information there can be a design process guide created for the future studies on recreational crafts for both engineers and designers. With the help of it project planning processes, and guiding the customers in a more functional and comfortable ways become more likely to do.

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APPENDIX

Yacht Interior Design Survey for Naval Architects/Engineers and Interior Architects/Designers

Thank you for agreeing to take part in this survey. The survey aims to understand the different approaches of engineers and designers towards the interior design problems of the mega/super yachts (that are 24 meters and over). It takes 5-10 minutes to complete. Be assured that all answers you provide will be kept in the strictest confidentiality and all of the obtained data will be used anonymously only for academic purposes. Below, please read the following consent text and if you accept check the related box before starting the questionnaire. If you don't accept, you can leave the questionnaire link anytime you want.

*Required

1. Email *

2. I accept the use of the data obtained within the scope of the research for scientific purposes, its presentation and publication on the condition of complying with the confidentiality rules, without any pressure or coercion, with my own free will. *

Tick all that apply.

☐ I agree

Click on the most suitable answer to select. You need to scroll down the page to see the rest of the questions. Please write in the given text boxes for additional comments and open-ended questions.

3. 1- Age *

Mark only one oval.

- ◯ >20
- ◯ 21-30
- ◯ 31-40
- ◯ 41-50
- ◯ 51-60
- ◯ 60>

4. 2- Gender

_____

5. 3- What is your profession? If you are a student what is your subject of studying?

_____

6. 4- Under which professional group are you considering yourself? (Please consider your undergraduate degree) *

Mark only one oval.

- ◯ Engineer
- ◯ Designer
- ◯ Both
- ◯ Other (Please explain in the section below)

7. If your answer is "other" in the previous question please explain

_____

8. 5- Level of nautical experience *

Mark only one oval.

- ◯ Expert
- ◯ Proficient
- ◯ Competent
- ◯ Advanced Beginner
- ◯ Novice
- ◯ No Experience at All (If this is selected please continue with the next question otherwise jump to the question 8)

9. 6- Have you ever been on board?

Mark only one oval.

- ◯ Yes (If this is selected please continue with the next question otherwise jump to the question 8)
- ◯ No

10. 7- Have you ever stayed overnight in a yacht?

Mark only one oval.

- ◯ Yes
- ◯ No

11. 8- How do you define a mega / super yacht? Please briefly explain.

12. 9- Is it necessary to have a designer (interior architect/designer) in the design team of a mega yacht? *

Mark only one oval.

- ◯ Yes (If this is selected please continue with the next question otherwise jump to the question 11)
- ◯ Maybe
- ◯ No

13. 10- At which stage of the process should the interior architect/designer get involved? *

Mark only one oval.

- ◯ Before the project begins
- ◯ During the first meetings with the customer
- ◯ During the design phase of the hull
- ◯ After the construction process of the hull and during the construction of the superstructure
- ◯ After the completion of the construction of the hull and the superstructure, just before the construction of the interiors
- ◯ Interior architect/designer should not take part in any stage

11- Considering the mega/super yacht interior design problems; please rate the below statements from a professional point of view.

14. Boat interiors should be as comfortable as a house *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

15. Interior design of the boat should be user oriented *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

16. Safety is the primary consideration for the interior design of a boat *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

17. Boat interiors should be plain and simple *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

18. A pleasure boat should provide all/most facilities of a house *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

19. Mega/super yacht interiors should be highly decorated, ornamented and luxurious *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

20. Accessibility and circulation are the most important criteria *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

21. Private spaces (i.e cabins, wc, bathroom etc.) are the most important interior spaces to be designed *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

22. Interior of a mega/super yacht should be luxuries and fancy *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

23. Common spaces of a pleasure boat (i.e salon, sundeck, dining area etc.) are the most important areas to be designed *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

24. Boat interiors should be sleek and modern *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

25. Service spaces (i.e galley, storage etc.) are the most important interiors to be designed *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

26. There should be separate staircase solutions for different functions (service vs general use) *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

27. Interior organization of wet areas (i.e WC and bathrooms etc.) must be as important as the other spaces *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

28. The interior lighting of a pleasure boat must be well-organized *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

29. Mega / super yacht interiors should be highly equipped with high technology devices (i.e wifi, TV, automated controls etc.) *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

30. There should be extreme indoor and outdoor facilities on a mega / super yacht like a spa, gym, swimming pool, basketball area, tennis court, golf pitch etc. *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

31. There must be a direct connection between common spaces and open deck areas *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

32. The wheelhouse is one of the most important technical interior areas in a pleasure boat *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

33. User satisfaction is the most important factor in mega / super yacht design *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

34. Windage evaluation, aerodynamic load assessment and air flow considerations are very important for the design of user relaxation areas *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

35. Aerodynamic analysis should be done before the spatial design process *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

36. Roll motion is a crucial consideration for interior design *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

37. Pitch motion is a crucial consideration for interior design *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

38. The most important criteria for the interior design of a mega / super yacht are the users' needs and expectations *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

39. Sea keeping aspect is the most important criterion for the design of open deck areas and interiors *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

40. Vibration is the most important aspect for the interior design of the boat *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

41. Unwanted smells can be avoided through good interior ventilation *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

42. User expectations can be fully met through interior design *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

43. Unwanted noise problem (i.e engine room) can be avoided by good interior design solutions *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

44. Humidity problem can be solved through interior design solutions *

Mark only one oval.

	1	2	3	4	5	
Strongly Agree	◯	◯	◯	◯	◯	Strongly Disagree

45. 12- Rate the importance of the below environmental control systems and design factors in the consideration of mega / super yacht interior design *

Tick all that apply.

	Very important	Moderately important	Not at all important
Acoustics	☐	☐	☐
Lighting	☐	☐	☐
Daylight control	☐	☐	☐
Heating	☐	☐	☐
Ventilation	☐	☐	☐
Cooling	☐	☐	☐
Fire fighting systems	☐	☐	☐
Food and water storage	☐	☐	☐
Low environmental impact	☐	☐	☐
Energy efficiency	☐	☐	☐
Longevity and flexibility	☐	☐	☐
Modularity	☐	☐	☐
Accessibility	☐	☐	☐
Safety	☐	☐	☐

46. 13- Additional Comments. Please write down any additional comments that you want to emphasise. Thank you.