

Diving into the ethics of design in the yacht industry

Emily Sharwood – Smith (1700057)

BA Transport Design

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Paul Morrow

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Context

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Martin Luther King once said, “The time is always right to do what is right”. I believe this statement perfectly highlights the meaning of ethics. Put simply, ethics are an arrangement of moral codes which effects how outcomes are made and how people choose to carry out their daily lives. Ethics can be described as a moral philosophy; it concerns what is good for individuals and society as a whole. This report will take a look into the ethics behind the yacht industry. How do social factors affect the way in which yachts are perceived? What environmental considerations are deliberated when designing and producing yachts in our modern, and increasingly environmentally conscious age? What economic aspects effect the costs of yachts? Lastly, are their ways of reducing costs in this exclusive industry?

The Social factors that determine what people want from their yacht.

The demand for new experiences.

What is life all about? The meteorologist Jeff Haby articulates that life is a constant chain of different experiences which can be both good and bad, regardless of the outcome both can aid us in living a more educated and for filling life (Haby, 2006). We are taught from a young age that experience is the secret ingredient to getting a successful job. People view new experiences as a way of bettering themselves, sometimes maybe even to show off to their peers. People experience pleasure from gaining new experiences, it allows them to go to new places or learn a new skill.

New experiences are an integral part of human society and culture. We love going to new places and meeting new people. Transport is the catalyst which makes this possible. You get into your car, onto your bike or into a train and are transported to a new adventure. This is especially true of Yachts. Yachts can be perceived as the most freeing mode of transport. 71 percent of the earth’s surface is covered in water (Hawaii Pacific University Oceanic Institute, 2019) this gives a huge scope for independent and undisturbed travel. These lavish modes of transport are perceived as the way the super-rich teleport to their next magical escapade. Rolf Eliasson, Lars Larsson and Michal Orych the authors of the principles of yacht design stated that,

‘during the past 50 years yachting has expanded from being, generally speaking, a minority sport - too expensive for the large majority of people - into a major recreational activity practised by millions all over the world.’ (Rolf Eliasson Lars Larsson Michal Orych, 1994)

This shows how the demand for the industry is growing with an increase in global wealth.

Research into today’s current trends in super yachts by CNN showed that the current generation craves experiences over material wealth. Abeer Alshaal, executive management officer of boat maker Gulf Crafti exclaims that the current generation does not want to buy material goods, rather It's the generation that wants to go out and explore the world (Page, 2019) Ken Hicklings adds to Alshaal by saying people are now looking for a new places to relax. While many people enjoy the dream of sailing away on a yacht into a tropical sunset for many of the super wealthy this is easily a reality. The private freedom that the wealthy enjoy allows them to get away from the press and paparazzi and celebrate family time in a relaxing environment. An example of this is evident in Alshaali’s Statement to CNN, she explains that younger people are now buying into the yacht industry. Family are also coming together to purchase yachts as well (Page, 2019) this statement from Alshaali reiterates the concept that people are partial to the idea of chasing a new experience. The likes of this can be seen in children’s books and adventure stories. William Mathieson, editorial director of the Super yacht Group highlights this in his interview with the Guardian (Batty, 2016). This rhetorical concept of chasing new encounters further fuels the changes in super yacht design. This ever-

increasing drive to explore has hit the yacht industry over recent years. Alshaali discusses that the “explorer” super yacht with travel as the number one priority is the direction in which ship builders are heading. (Page, 2019) the adventure craze seems to be here to stay as more yacht builders discuss how to improve long-range engines capabilities and solar panels for assistance in power supplies and durable hybrid hulls.

The growth in wealth.

In nature animals exhibit particular features that make them superior to their rivals. This behaviour puts them ahead of the competition and makes them more likely to succeed in reproduction, and therefore fuel the continuation of their species. A common example of this is the Peacock seen in *Figure 1*, they perform displays using their colourful feathers to attract females thereby reproduce. Although humans no longer see ‘displaying’ as a necessity to gain a mate, there is still an inbuilt desire to flaunt a particular asset which others may not possess. The biologist Nathan H. Lents discusses the evolutionary forces



Figure 1 Peacock displaying (Milius, 2011)

of corporation and competition shared by both animals and humans in his book ‘Not so different: Finding Human Nature in Animals’. Lents goes on to discuss that our behaviours no matter how complex they might have become still mirror those found in the animal Kingdom. Furthermore, much of our urges find roots within animalistic behaviour (Lents, 2016). As we have grown as a species wealth has determined our social status. Throughout history many people have shown their wealth by building or buying expensive property, by wearing fine clothing or by dining in fine places.

At the beginning of the 19th century when private transportation was relatively new, wealthy people would show their status by travelling around in cars. More recently cars have become a common feature with some 79 million cars expected to be sold by the end of 2019 (Statista Research Department, 2019) the ownership of the car is seen as a necessity rather than a luxury. As a result, the wealthy population needs to find a different mode of transportation to show off their wealthy status.

The super yacht industry has seen a substantial growth during recent years due to an increasing wealth among the super-rich. The number of individuals with a high net worth above \$30m, rose by 61% between 2005 and 2015 to 187,468 worldwide, according to the latest wealth report by estate agent Knight Frank. Of these, Credit Suisse calculates that the number worth at least \$100m rose from 30,000 in 2010 to 44,900 in 2015, while those with assets above \$500m increased from 2,800 to 4,500 in the same period (Batty, 2016). With the increase in wealth on the rise more people are looking at alternative ways to flaunt their earnings. A bigger boat appears to be better as highlighted by Broker Simon Goldsworthy, of luxury yachting specialists Camper & Nicholsons. He explains, that 15 years ago clients would have been satisfied with a 40-meter yacht, which would have then been one of the largest yachts in the bay, now finds himself surrounded by yachts exceeding lengths of 60 or 70 meters. This causes him to believe that he should upgrade. (Batty, 2016).

A bigger yacht means that more features can be added. A 60-metre yacht offers more space for luxury features such as infinity pools, helipads, cinemas, spa and gym facilities, and so on. Evan K Marshall, a London-based super yacht designer, says many of his clients’ yachts are more expensive, and far more personalised, than their homes.” (Batty, 2016).

The greater and more enhanced yacht you have, the more attention you will receive. This need for attention can be explained using the superiority complex. This is a behavioural trait that suggests a person believes they're somehow superior to others. A common feature of this trait includes an exaggerated opinion of oneself and the belief that their abilities and achievements surpass those of others (Healthline, 2019). The superiority complex can be the root cause as to why a person craves attention. After all, if someone appears superior then nobody will bother looking at any potential flaws he or she might have. M.Farouk Radwan further discusses the complexity of the superiority complex in his solid self-confidence program. He suggests that some people crave attention because they feel jealous as a result of finding someone else in the spotlight (M.Farouk Radwan, 2017).

This behaviour ties directly into the observation of Emma Spence, a British academic who has spent the last six years researching the industry. Spence has crewed on super yachts around the world. Like the pecking order or hierarchies found in the animal kingdom, the wealth of a person determines their hierarchy within society. She concluded that boats are used to establish a pecking order among the super-rich (Batty, 2016). Spence has established that yachts are unique among prestige assets as they



Figure 2 Kylie Jenner relaxing on a yacht (Daily Mail, 2019)

are not seen as a useful mode of transport, and their value also depreciates unlike art and property. Instead, as one owner told her, what makes a yacht desirable is that it “allows the wealthy to show off their status.” Furthermore, simply just possessing one of these elite boats is not enough to enhance the status of the wealthy, she explains that how and where the yacht is used is just as important. The Côte d’Azur is the centre of the super yacht scene. Hundreds of luxury vessels line the docks in Saint-Tropez, Nice, Antibes, Cannes and Monaco, the most prestigious ports in the Mediterranean (Batty, 2016). In contradiction to this argument in the book *Elite Mobilities* Thomas Birtchnell and Javier Caletrí discuss that the super-rich’s mode of mobility can be seen as “Invisible”, they make a case that the common man rarely sees the “fleets of private jets or helicopters that ferry the forbs rich list around (Thomas Birtchnell and Javier Caletrío, 2014)”. In part I am incline to agree with this statement, however,

when perusing through the pages of Hello or The Daily Mail it is not uncommon to see the likes of Kylie Jenner (*figure 2*) or Roman Abramovich jetting off to their next escapade on board their private jets or relaxing onboard a multimillion pound super yacht

Social welfare onboard.

An important ethical social factor that must be incorporated is the treatment of the crew onboard a yacht. A journal published by the Journal of Epidemiology and Community Health Highlighting the risk of Job control and its effect on public health. The report examines that in the past two decades, research on workplace psychosocial risk factors has produced a large amount of research into this issue. Health points that have been highlighted such as cardiovascular diseases, have been linked with the psychosocial work environment. Job stress models have come into existence over the last few years. These models try to explain the effects of workplace psychosocial risk factors on health for interactions in ordinary and challenging situations (F G Benavides, J Benach, C Muntaner Journal of Epidemiology and Community Health, 2002). To obtain a stress-free environment on board, it is important to ensure that all crew quarters are equipped with their own kitchen and living area. This is to allow the crew space to relax. Adding to this point, ensuring that there is enough crew to staff the yacht as to not add pressure to the staff through being over worked. This is something I wish to implement when designing my own super yacht for my third-year major project at university.

The length of the yacht that I am looking to design will be 60 meters. The reason why I have opted for this size is as a result of my research. I have concluded that this is a large enough size to make a statement, however not too large to incur additional costs. These can include special docking, which per year can be \$350,000 (Batty, 2016) for mega yachts and additional crew costs at around \$1m per year (Batty, 2016) as a larger number of crew members is required to cater for a larger yacht. Looking into the sustainable approach to this size a yacht, any larger will require more fuel and electrical power making it unsustainable. According to Chris Caswell a journalist for the website boat international the most popular size for yachts ranges between 30 to 60 meters. These yachts carry between six to 15 crew members. I will be looking to have 15 members of crew on board my yacht. These crew members will range from the Captain, First officer, engineers, a chef and deck hands. From my research I believe having 15 crew members would be efficient. All jobs can be covered without having stress put onto the crew due to staff shortages. It is important to remember that payroll usually forms the largest proportion of a yacht's running costs. It is estimated that crew wages sit at around \$1.4m (Batty, 2016) for a super yacht.

Fair wages for the crew are an obligation by The Maritime Labour Convention 2006 (MLC). It covers all chartered yachts and does not make the distinction between those employed and self-employed according to the website boat international. The Convention instructs different contract terms such as hours of work, leave entitlement and repatriation. Crew conduct is also governed by the captain's standing orders as he or she usually takes the position of manager on board the yacht (Maltby, 2015). The care of the crew is down to the owner of the yachts. The better care and provisions that are offered to the crew the more they will be able to excel at their position.

Sustainability within the growing yacht industry.

The importance of sustainability.

The definition of sustainability was marked by the United Nations group, World Commission on Environment and Development (WCED) in 1987. In a report entitled Our Common Future but is more frequently referred to as "the Brundtland report" gave an overview on the increasing tensions between global economic development and environmental quality.

The report itself highlighted that sustainability is "development that meets the needs of current generations without compromising the ability of future generations to meet their needs" (Thompson, 2012). Since 1987 when the report initially came out the importance of sustainability has received continual growth, most notably in recent years through broad support both with the general population, political leaders and large corporations. Yet it remains inherently difficult to implement due to its complexity. A particular challenge that affects sustainability is the implementation of technology and manufacturing processes which can have negative consequences on the health of its users and the planet itself (Charles J. Kibert, 2012). With the word sustainability becoming increasingly important in today's age. In the Paper Green & Sustainable Luxury: A Strategic Evidence, the writer Corine Cohen has categorised this movement as an "eco-wave" (Cohen, 2015) which will continue on into the future with many companies opting for an environmental approach to design or manufacture in order to reduce their carbon footprint. Can this increasing environmental awareness be transferred to the yacht industry? In the race for an eco-friendly future, designers need to address the interior design of a super yacht as well as how it is powered, says Tory Kingdon (Kingdon, 2019)

By 2050 the way in which we travel around is predicted to radically change. Currently the privately-owned vehicle is the symbol of autonomy and freedom. This mode of transport has proved successful in people's daily life for the last 60 years. With populations predicted to increase by 2 billion in the next 30 years, cities and suburbs are going to become increasingly congested and air-quality is going

to deteriorate posing a serious threat to human health (Wall, 2019). In answer to this pressing issue governments worldwide are looking to crack down on non-environmentally friendly modes of transport with the increase of electric powered shared vehicles. Over the last 100 years wealthy people have always been able to show their status through large, luxurious and privately-owned modes of transport. Without this need to show power and wealth brands such as Rolls-Royce, Bentley and McLaren may not have been so popular or sought after. An increase in shared identical vehicles will make it increasingly difficult to show wealth and status.

Using design methodologies to address sustainability.

To address the issue of sustainability there are many design methodologies that can be looked at which illustrate how people interact with a construct. Of all these design methodologies design thinking dives deeper than most other theories and methodologies. What differentiates design thinking is how people deal with the nature of the situation or problem (Kumar, 2019). Design thinking can be applied when looking at the sustainability of the yacht industry. In the Journal Design and Culture, The Journal of the Design Studies Forum, Lucy Kimbell discusses that design thinking can be dealt with by looking at similarities between thinking and knowing and acting in the world (Kimbell, 2015). My understanding of this text highlights the importance that designs must be well thought through with adequate knowledge if they are to make an impact on the world. Design thinking itself as a methodology can be used to address the issue of wicked problems. A wicked problem is when the situation of the problem is highly uncertain, this can be seen as a largely complicated situation where there are many knows and unknowns. Wicked problems only have better or worse solutions there is no middle ground. The better solutions usually unveil more design challenges. It is important to remember that a solution that might work today might not necessarily work in the future. Furthermore, a solution that works in one market might not work in another market (Kumar, 2019). The issues of addressing sustainability can be looked at as a wicked problem. The solution of dealing with a more sustainable future isn't clear and there is no one single issue that needs addressing, rather it is a complex tangle of multiple concerns.

A sustainable yacht industry.

The growing concern for the environment and uses of sustainable materials has revolutionised the way in which manufactures are designing. If the yacht industry wants to remain current and on trend it will need to keep up with these fast pace times. Andrew Winch of Winch Design explains that designers are becoming increasingly environmentally conscious of the choices they make. "We avoid using anything that is endangered or rare, and instead select materials that are rapidly renewable, such as wood veneers or bamboo silk carpets" (Kingdon, 2019). In the German Article, Opportunities of Sustainable Manufacturing in Industry the authors discuss that

'current globalization is faced by the challenge to meet the continuously growing worldwide demand for capital and consumer goods by simultaneously ensuring a sustainable evolvement of human existence in its social, environmental and economic dimensions.' (Günther Seliger, Holger Kohl, Jürgen Mallon, 2016)

Drawing attention to the 'sustainable evolvement' I will endeavour to ensure the use of sustainable materials in my yacht and additionally investigate the ethics of the manufacturing process. I believe these are important aspects of conscious sustainability that will aid in the war against material waste, employee abuse and throw away designs

In line with maintaining a sustainable approach I will be designing my super yacht with sustainability at the heart of its design. The materials used will follow two main principles, they should be ethically

sourced, as well as be aero dynamic which will reduce the drag therefore use less fuel. To give the yacht a luxury hand crafted feel I will be using wood in the interior and decking. This will also help to bring my yacht back to nature by using natural materials. The use of hard woods such as oak and mahogany, though tough and beautifully finished are not sustainable. An oak tree is slow growing, according to Doug Tallamy a professor of entomology at the University of Delaware It can take 50 years before an oak tree reaches maturity (Tallamy, 2019). Further research has led me to look at bamboo as an alternative to other more conventional hardwoods. On the contrary to conventional hardwoods bamboo is one of the fastest growing plants with some varieties growing as fast as four centimetres an hour (Spacey, 2018). Bamboo is viewed by many as a premium product that can be potentially stronger than some hardwoods such as oak. More importantly bamboo manufacturing is an important source of revenue to many Asian countries and natural sources can quickly be replaced due to its fast-growing speeds. If ethically sourced the product will not only benefit the user but also the grower and manufacturer. An example of an ethical bamboo manufacture is Bamboo Master based in Vietnam, which implements sustainable farming practices and fair wages for workers (Bamboo Master, 2017). Bamboo works well instead of many hardwoods, additionally it is as effective as a veneer. Some impressive features of bamboo are its high tensile strength and high compressive strength (Spacey, 2018).

A sustainable way of powering the light sources on a yacht is to use the left-over energy generated from solar cells to power any on board lights. Further research into different forms of light sources has led me to Bioluminescence (*figure 3*). This is a light produced by a chemical reaction within a living organism. Bioluminescence is a type of chemiluminescence, which is merely the term for a chemical reaction where light is produced normally inside the organism (National Geographic, 2019). The light produced is more of a soft blue glow which only occurs when the organism is disturbed or moved either from waves or due to other organisms passing. Keeping sustainability and nature at the heart of my design, I believe implementing these organisms in a safe and secure way could have the potential to make my design stand out and reduce the need for expensive inefficient decorative lighting. By running small tanks into the decking of the yacht mimicking that of strip lighting and filling them with bioluminescent plankton, I will be able to achieve the same effect as decorative strip lighting without having to use power. The plankton only glow when disturbed so a small wave current can be passed through every few minutes as to mimic waves found in their natural home. The Plankton feed off sunlight through photosynthesis therefore will be relatively easy to care for.



Figure 3 Bioluminescence (Credit; Kris Williams, 2019)

To further reduce the impact on the environment that a yacht might have it is important to look at the way in which it is made. The hull of the boat takes up most of the exterior manufacturing. It is important to choose a sustainable material for the hull that doesn't compromise performance. Supplementary investigations into the design and manufacture of hulls has led me to look at bioplastics. These plastics are substances made from an organic biomass source. They differ from conventional plastics which are made from petroleum. Bioplastics can be manufactured in using different processes. The main process involves using microorganisms to process base materials. These base materials can include vegetable oils, cellulose, starches and acids and alcohols. The added advantage of using bioplastics is that they produce less carbon dioxide in their production, additionally, they take a shorter time span to degrade with some taking just 180 days to biodegrade in the right conditions (Rouse, 2014). According to European bioplastics, during recent years there has been an increase in the growth in bioplastic materials. The properties of bioplastic such as flexibility,

durability, printability, transparency, barrier, heat resistance, gloss and many more have been significantly enhanced (European bioplastics, 2016). Added investigations into the use of bioplastics in the yacht industry led me to investigate a company that is combining traditional Glass Reinforced Plastic (GRP) hulls with bioplastics. The RPT company based in Minnesota explains that their product is a

‘Sustainable bio-based plastic suitable for durable and semi-durable applications that overcome the strength, stiffness, and heat distortion limitations of neat PLA (RPT Company, 2019).’

A material such as this would be ideal to use for a yacht hull. The robustness of GRP would withstand the challenging climatic conditions of the sea, therefore increasing the life expectancy of the product.

Supplementary research into boat hull materials led me to find the Swedish company Fast Forward Boat hulls which has the aim of becoming the world leader in sustainable, high performance, motorboat hull design. To achieve this, they have used a combination of a small wet surface and lightweight materials and construction techniques resulting in little resistance in the water which reduces fuel consumption by 50%. This means that the emissions of the yacht are reduced, adding to this 20% less material is needed to build the hull. Strakes on the hull ensures that the yachts will be stable at high speed (Fast Forward Boat Hulls, 2019).

I want to retain as much natural sourcing in my yacht as possible. By using natural light, I will reduce the need for extra electricity to power artificial light sources. To achieve this, most of the yacht will have large glass windows. Not only will this reduce the need for electric lighting, but it will also help to bring the user back to nature. Large open windows will allow the users to gaze out at the ever-expanding beauty of the ocean and remember the value of securing its future. The importance of using sustainable products will carry through into the glass that is used in the window. Glass has always been considered as a sustainable material as it is 100% natural. It is made from the age-old combination of sand, soda ash and limestone. Moreover, it is 100% recyclable. It can be melted down to produce more glass products. Making glass lighter in weight can increase its overall green credentials as it reduces the energy required to produce and transport it. Glass can be manufactured to make it 50% lighter (Balhuizen&Wood, 2013). Incessant heating and cooling of a space has a noticeable impact on our carbon footprint. Combining sustainable glass production with smart glass will further reduce the amount of energy used to heat or cool the yacht. Large glass panels and windows are one of the most common ways in which heat escapes. Smart glass works by allowing the user to choose how much light they want in the room. Smart Glass enables the glass to change from opaque to transparent by merely flipping a switch. When electricity is absent any light is prohibited from passing through. Once the current is switched on the glass becomes translucent. According to the smart glass international website smart glass ‘is an innovative approach in green architecture and is often referred to as the natural skin for modern urban buildings’ (Smart glass international, 2019).



Figure 4 Ocean Plastic (Image Source Istock, 2019)

Plastic Oceans.

According to figures published in the journal Science, in 2015, It is estimated that between 4.8 and 12.7 million tonnes of plastic enter the ocean each year. This Plastic can be in the form of large identifiable items (*figure 4*) or as microplastics which are defined as a plastic piece under five millimetres in length (Natural History Museum, 2019). Further research led

me to the article 'Plastic waste inputs from land into the ocean' by the magazine Science. In this article researchers

"calculate(d) that 275 million metric tons (MT) of plastic waste was generated in 192 coastal countries in 2010, with 4.8 to 12.7 million MT entering the ocean. Population size and the quality of waste management systems largely determine which countries contribute the greatest mass of uncaptured waste available to become plastic marine debris. (Science, 2015)"

With the global increase in social and manufacturing development particularly in developing countries, social gain has been prioritised over environmental factors. In accordance to this demand, ocean plastic has continued to accumulate over many years. It is only recently that people are realizing the effect that we are having on our planet, but is it too late? In a report by the Ellen MacArthur Foundation in partnership with the World Economic Forum predicts that by 2050, plastic in the oceans will outweigh fish. Oceans will contain at least 937 million tons of plastic and 895 million tons of fish by 2050 (Harrington, 2017). These harrowing figures are a rather daunting reminder of the desperate situation we as a population face. Moreover, in recent years the news that microplastics are becoming increasingly common. These plastics are posing a serious problem and if left unresolved the future of all marine life will be in jeopardy. In the Bible there is a passage from Galatians VI (King James Version) which states Whatsoever a man soweth, that shall he also reap (Anon., Undated), more commonly interpreted as you reap what you sow. I believe even two thousand years later this short passage perfectly sums up the current issue which we face as a global population.

Fish often eat or inhale the plastics which then build up in their bodies. Larger fish eat these fish and the plastics are brought up the food chain, till eventually, we eat the fish with the plastic inside its body. This issue expands the idea that the sustainability of our oceans is a wicked problem with no clear-cut single solution, rather we must address the issue at large from different angles.

The ongoing environmental concern of plastic usage brought about by my research has caused me to question, could there be a way of designing a yacht with the ability to reduce plastic in the ocean?

Chelsea M Rochman debates reducing ocean plastics will not prevail with a 'one size fits all' solution (Rochman, 2016). To achieve maximum effectiveness people's actions, need to evolve, coupled with the development of designs that are thought through from manufacture to end usage.

Most plastic can only be recycled a few times before they lose their original properties and are rendered non-recyclable. Only 31% of plastic is currently recycled in European countries. Plastic production is said to increase by 3.8% until the year 2030. During this time systems need to be produced to keep the plastic out of landfill and our seas. One way of doing this is by looking into "Plastic to energy", this can expose the chemical energy stored within the waste plastic which can then be used to create fuel (Konarova, 2018). Taking inspiration from natural forms focusing on Marine life. I have considered designing fins that stick out from the main body of the yacht. These fins will be able to move on hinges and open and close like the gills on a fish. The fins could be deployed in an area where there is a lot of solid plastic or microplastics floating in the water. The fins would allow the plastic to float into the containment section in the boat. Once enough plastic has been collected the machine can be turned on which burns the plastic and turns it into excess fuel through the process of pyrolysis. The machines will only turn on when enough plastic has been collected so that they don't aimlessly burn.

In keeping with my ongoing theme to bring the user back to nature I wish to design an observation deck onboard the yacht. I believe this is important as it would allow the user to be connected to nature as well as making a nice peaceful area where they would be able to sit back and listen to the waves. In addition to this a sea viewing deck would allow the user to view what's under the ocean. I could

turn this space into a potential lounge. This area would maintain the theme of being connected to nature as the user would be able to view coral and marine animals under the waves.

An economical approach to the yacht industry.

It is no secret that the running cost of a super yacht are not cheap. The basic annual maintenance and operation costs of a super yacht is expected to be 10% of the original purchase price. For a 71-metre yacht, fuel usage is 500 litres an hour (an average of \$400,000 per year), according to Towergate Insurance (Batty, 2016). These luxurious prices ironically attract the wealthy as it assists them in showing off their super privileged lifestyle. I previously discussed this when looking at Nathan H. Lents book *Not So Different: Finding Human Nature in Animals*, however that's not to say that addressing the extortionate running costs of a super yacht cannot be amended by designing a yacht with lower running costs.

An economical approach to fuel the yacht industry forward.

In line with reducing the running costs of a super yacht I would like to implement several environmentally friendly cost saving measures onboard. An unusual alternative to producing energy is using Salter's nodding duck (*Figure 5*). Salter's nodding duck sits on the surface of the waves and the motion of the waves enables the harness of energy (McGrath, 2019). Extra energy can be sold back to the National Grid. Oceans cover 71% of the earth's surface (Hawaii Pacific University Oceanic Institute, 2019) so the energy is very accessible. Another added advantage is that wave energy will not run out and doesn't produce any harmful gases whilst collecting the energy. Since waves are essentially always in motion and are never interrupted, it's a reliable source of energy when compared to other sustainable forms of power.

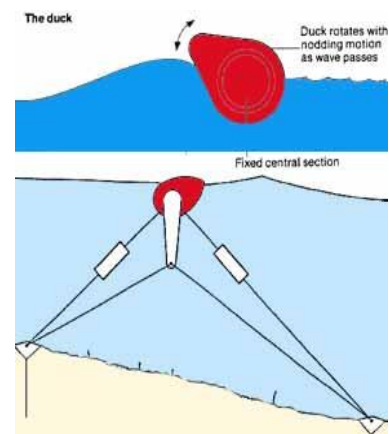


Figure 5 Salter's nodding duck (Kirtley, 2007)

The use of solar panels would further enhance the green credentials of a yacht. Solar panels that deploy when the sun is out and double up as sunshades or the use of solar sails would increase the functionality and require less space. Over recent years NASA has been researching into the use of solar sails to use in space as an alternative form of power for rockets. Solar sails work just like cloth sails, they collect the wind in the same way. In addition they capture the energy from light particles as they bounce off the reflective sheet. According to the Department of Energy these sheets could save fuel and provide further manoeuvrability (Fox, 2010). Any left-over energy from the production could be used to sell back to the grid at the next port. This would help with running costs making the yacht more affordable. In addition, by creating an area for an on-board car park designed for electric cars, left over electricity could be used to charge the cars. Furthermore, extra power could also be used to power air conditioning, refrigeration and lighting appliances.

At the beginning of this report I posed three main questions, how do social factors affect the way in which yachts are perceived? What environmental considerations are considered when designing and producing yachts in our modern, and increasingly environmentally concerned age? What economic aspects effect the costs of yachts?

Research into the social factors that determine what people want from their yachts has led me to believe there are several factors that govern the success and continued growth of this exclusive industry. A shift in the times has affected the way in which people now choose to spend their money.

When speaking to CNN Abeer Alshaal highlighted, that people have an increased desire to gain more experiences (Page, 2019) therefore, people are more inclined to buy into this idea of spending money to gain new experiences. The wealthy can afford to gain access into the yachting industry and choose to witness new experiences in comfort and style. I discussed how a growth in wealth has led to a rise in the way in which people choose to flaunt their earnings. Additional research into the way in which the super wealthy choose to show their earning led me to look at the biologist Nathan H Lents, who observes the behaviour of humans and animals, and has drawn links between both from his findings. From this I observed how the superiority complex has evolved within our species and the need to determine our social status through wealth. This led me into looking at the research of Emma Spence, who discusses how the affluent have devised a pecking order based off yacht size and features. This has fuelled the production of mega and super yachts in an array of shapes and colours.

After understanding why yachts are becoming so popular particularly with the wealthy, I decided to focus my attention onto the sustainability of the yacht industry. Research lead me to address sustainability as a wicked problem with no one clear cut solution, however I was intrigued to find out how these elite modes of transport might be able to gain some green credentials. Research into current sustainable paths in the yacht industry led me to look at Andrew Winch of Winch Design, who explains that designers are becoming increasingly environmentally conscious of the choices they make. With this in mind I proposed a set of sustainable principles that I wanted my own yacht design to have. All materials should be ethically sourced, as well as be aero dynamic which will reduce the drag thus use up less fuel. I investigated sustainable bamboo wood, bioluminescence, Glass Reinforced Plastic (GRP) hulls with bioplastics and combining sustainable glass production with smart glass. Additional research led me to find that it is also possible to convert plastic into plastic energy to use as a fuel source. My research into alternative fuel sources opened the door to other methods of sourcing fuel that are both sustainable and economical. I discussed the possibility of using Salters nodding duck to collect wave energy and to harvest the suns energy using solar power. These methods not only aid in the environment but also help in reducing the extortionate fuelling costs of a super yacht. I discovered that it was possible to produce a yacht made from alternative design and fuel methods. This gives me hope for an ethically sustainable future in the yachting industry. I believe that we are sailing into the right direction to tackle increasing environmental, social and economic concerns.

Bibliography

- Anon., Undated. *King James Bible*. Champaign, Ill.: Project Gutenberg.
- Balhuizen&Wood, T. a. D., 2013. *How innovation in glass manufacturing is turning green even greener*. [Online]
Available at: <https://www.theguardian.com/sustainable-business/innovation-glass-manufacturing-green>
- Bamboo Master, 2017. *Bamboo Master*. [Online]
Available at: <https://www.bamboomaster.co>
- Batty, D., 2016. *Superyachts and bragging rights: why the super-rich love their 'floating homes'*. [Online]
Available at: <https://www.theguardian.com/lifeandstyle/2016/oct/09/superyachts-and-bragging-rights-why-the-super-rich-love-their-floating-homes>

Caswell, C., 2015. *Who's who in a superyacht charter crew*. [Online]
Available at: <https://www.boatinternational.com/charter/luxury-yacht-charter-advice/the-importance-of-the-crew--1785>

Charles J. Kibert, L. T. A. P. M. M., 2012. The Ethics of Sustainability. *The Ethics of Sustainability*, pp. 1-2.

Cohen, C., 2015. Green & Sustainable Luxury: A Strategic Evidence. *Thriving in a New World Economy*, p. 270.

Credit; Kris Williams, 2019. *Bioluminescence: Where to go to see this incredible natural display, from Anglesey to New Zealand*. [Online]
Available at: <https://www.countrylife.co.uk/travel/bioluminescence-go-see-incredible-natural-display-anglesey-new-zealand-197311>
[Accessed 21st November 2019].

Daily Mail, 2019. *Kylie Jenner PICTURE EXCLUSIVE: Billionaire, 21, showcases her curves in a TINY white bikini as she joins BFF Stassie on her \$250 million superyacht in Capri... ahead of her 22nd birthday*. [Online]
Available at: <https://www.dailymail.co.uk/tvshowbiz/article-7342383/Kylie-Jenner-EXCLUSIVE-Star-flaunts-curves-TINY-bikini-250-million-superyacht-Capri.html>
[Accessed 21st November 2019].

European bioplastics, 2016. *What types of bioplastics do exist and what properties do they have?*. [Online]
Available at: <https://www.european-bioplastics.org/faq-items/what-types-of-bioplastics-do-exist-and-what-properties-do-they-have/>

F G Benavides, J Benach, C Muntaner Journal of Epidemiology and Community Health, 2002. Job control and its effect on public health. *Psychosocial risk factors at the workplace: is there enough evidence to establish reference values?*, p. 244.

Fast Forward Boat Hulls, 2019. *Fast Forward Boat Hulls*. [Online]
Available at: <http://www.ffwdhull.com>

Fox, S., 2010. *How Do Solar Sails Work?*. [Online]
Available at: <https://www.livescience.com/32593-how-do-solar-sails-work-.html>

Günther Seliger, Holger Kohl, Jürgen Mallon, 2016. 13th Global Conference on Sustainable Manufacturing – Decoupling Growth from Resource Use. *Opportunities of Sustainable Manufacturing in Industry 4.0*, Volume 40,, pp. 536-541.

Haby, J., 2006. *The importance of experience and being respected*. [Online]
Available at: <https://www.theweatherprediction.com/habyhints/84/>

Harrington, R., 2017. *By 2050, the oceans could have more plastic than fish*. [Online]
Available at: <https://www.businessinsider.com/plastic-in-ocean-outweighs-fish-evidence-report-2017-1?r=US&IR=T>

Hawaii Pacific University Oceanic Institute, 2019. *Aqua Facts*. [Online]
Available at: <https://www.oceanicinstitute.org/aboutoceans/aquafacts.html>

Healthline, 2019. *What Is a Superiority Complex?*. [Online]
Available at: <https://www.healthline.com/health/mental-health/superiority-complex>

Image Source Istock, 2019. *What Is Ocean Plastic?*. [Online]
Available at: <https://www.greenmatters.com/community/2018/12/11/6PstBD6/what-is-ocean-plastic>
[Accessed 21st November 2019].

Kimbell, L., 2015. Rethinking Design Thinking: Part I. *Design and Culture, The Journal of the Design Studies Forum*, 3(3), pp. 285-306.

Kingdon, T., 2019. *Going for green: Designing the interior of a sustainable superyacht*. [Online]
Available at: <https://www.boatinternational.com/luxury-yacht-life/interiors/going-for-green-designing-the-interior-of-a-sustainable-superyacht--40483>

Kirtley, B., 2007. *Is Salter Duck Water Power The Uranium Banana Skin?*. [Online]
Available at: <http://www.marketoracle.co.uk/Article1018.html>
[Accessed 21st November 2019].

Konarova, M., 2018. *If we can't recycle it, why not turn our waste plastic into fuel?*. [Online]
Available at: <https://theconversation.com/if-we-cant-recycle-it-why-not-turn-our-waste-plastic-into-fuel-96128>

Kumar, V. D., 2019. *Design Thinking and Wicked Problems*. [Online]
Available at: <https://hackernoon.com/design-thinking-and-wicked-problems-9265c14fe8e4>

Lents, N. H., 2016. *Not So Different: Finding Human Nature in Animals*. New York Chichester, West Sussex: Columbia University Press.

M. Farouk Radwan, M., 2017. *why do people crave attention*. [Online]
Available at: <https://www.2knowmyself.com/why-do-people-crave-attention>

Maltby, B., 2015. *Essential Rules and Regulations of employing crew*. [Online]
Available at: <https://www.boatinternational.com/yachts/luxury-yacht-advice/management-advice/essential-rules-and-regulations-of-employing-crew--599>

Materials Today, 2017. *New way to recycle carbon fiber composites*. [Online]
Available at: <https://www.materialstoday.com/carbon-fiber/news/new-way-to-recycle-carbon-fiber-composites/>

McGrath, J., 2019. *Could Salter's Duck have solved the oil crisis*. [Online]
Available at: <https://science.howstuffworks.com/environmental/green-science/salters-duck1.htm>

Milius, S., 2011. *Male Peacock Feathers May Have Lost Their Sexy*. [Online]
Available at: <https://www.wired.com/2011/04/peacock-mating-feathers/>
[Accessed 21st November 2019].

National Geographic, 2019. *Bioluminescence*. [Online]
Available at: <https://www.nationalgeographic.org/encyclopedia/bioluminescence/>

National Ocean Service, 2019. *What are microplastics?*. [Online]
Available at: <https://oceanservice.noaa.gov/facts/microplastics.html>

Natural History Museum, 2019. *How much plastic is in the ocean?*. [Online]
Available at: <https://www.nhm.ac.uk/discover/quick-questions/how-much-plastic-is-in-the-ocean.html>

Page, T., 2019. *'Millennial' superyacht makes waves at Dubai boat show*. [Online]
Available at: <https://edition.cnn.com/travel/article/superyachts-dubai-international-boat-show-2019/index.html>

Rochman, C. M., 2016. *Strategies for reducing ocean plastic debris should be diverse and guided by science*, s.l.: CrossMark.

Rolf Eliasson Lars Larsson Michal Orych, 1994. *Principles of Yacht Design*. London: Adlard Coles Nautical Bloomsbury.

Rouse, M., 2014. *bioplastic*. [Online]
Available at: <https://whatis.techtarget.com/definition/bioplastic>

RPT Company, 2019. *Glass Fiber Reinforced PLA Bioplastic Compounds Literature*. [Online]
Available at: <https://www.rtpcompany.com/technical-info/innovation-bulletins/glass-fiber-reinforced-pla-bioplastic-compounds/>

Science, 2015. Plastic waste inputs from land into the ocean. *Science*, 347(6223), pp. 768-771.

Smart glass international, 2019. *Smartglass and sustainable living*. [Online]
Available at: <http://www.smartglassinternational.com/smartglass-sustainable-living/>

Spacey, J., 2018. *14 characteristics of Bamboo wood*. [Online]
Available at: <https://simplicable.com/new/bamboo-wood>

Statista Research Department, 2019. *Worldwide car sales 1990-2019*. [Online]
Available at: <https://www.statista.com/statistics/200002/international-car-sales-since-1990/>

Tallamy, D., 2019. *Planting Oaks*. [Online]
Available at: <https://www.gardendesign.com/trees/planting-oaks.html>

Thomas Birtchnell and Javier Caletrio, 2014. *Elite Mobilities*. New York: Routledge.

Thompson, P. B., 2012. *Sustainability: Ethical Foundations*. [Online]
Available at: <https://www.nature.com/scitable/knowledge/library/sustainability-ethical-foundations-71373239/>

Wall, M., 2019. *BBC The Disruptors, On the move*. [Online]
Available at: http://www.bbc.com/future/ bespoke/the-disruptors/on-the-move/#sa-link_location=story-body&intlink_from_url=https%3A%2F%2Fwww.bbc.co.uk%2Fnews%2Fav%2Fbusiness-47628920%2Ffuture-transport-how-will-we-get-around-in-2050&intlink_ts=1569677639747-sa