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UNIVERSITY OF SOUTHAMPTON

FACULTY OF ENGINEERING AND THE ENVIRONMENT
FLUID STRUCTURE INTERACTIONS

Synthesis of Aesthetics for Ship Design

by

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ABSTRACT

In the search for consensus on a definition of beauty, fitting the task of appreciating a ship's design, this research revealed that other components of visual appraisal and 3d pattern analysis are required for a systemic approach. The model process presented is built around local adaptation and Gestalt psychology and uses retrospective case studies to categorise and calculate proportions, and recognisable patterns. The number of results from each type of vessel were found to be different, due to each ship or boats various geometries and anatomy, which illuminated the importance of standardising a procedure of categorisation in the appreciative approach.

The categorisation of functions around the philosophy of functional beauty and the maths of summation series, it is suggested here, will allow a library of algebraic patterns and parameters to penetrate further into the impending or emulated integrated systems of ship design. The process to derive physical parameters via the culturally focussed narrative of functional beauty, is deemed as a manageable and novel addition to the naval architect's role. However, for the results to have a decisive impact on commercial design or education, variance and validation through further case studies is required.

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DECLARATION OF AUTHORSHIP

I, Jonathan Andrew Sheridan declare that the thesis entitled Integration of Aesthetic Consideration and Ship Design, and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research.

I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- parts of this work have been published as:
'Why is it harder to design a beautiful Passenger Ship than it is to design a beautiful Work Boat?' (Coventry Marine Conference Sept 2011).

Signed:

J.Sheridan

Date:

9/6/2014

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1. Introduction

Transportation by ships is set to increase in the immediate and long term future and, as with any growing design discipline, ship design, which strives to be a progressive industry, must prepare to adapt for new technological innovation and purposes in all facets of design, including aesthetics. Aesthetics is the topic explored in this paper.

The ship is 'a seriously out-of-focus concept at the off, which continues towards optimisation'.

(Gillmer, 1984).

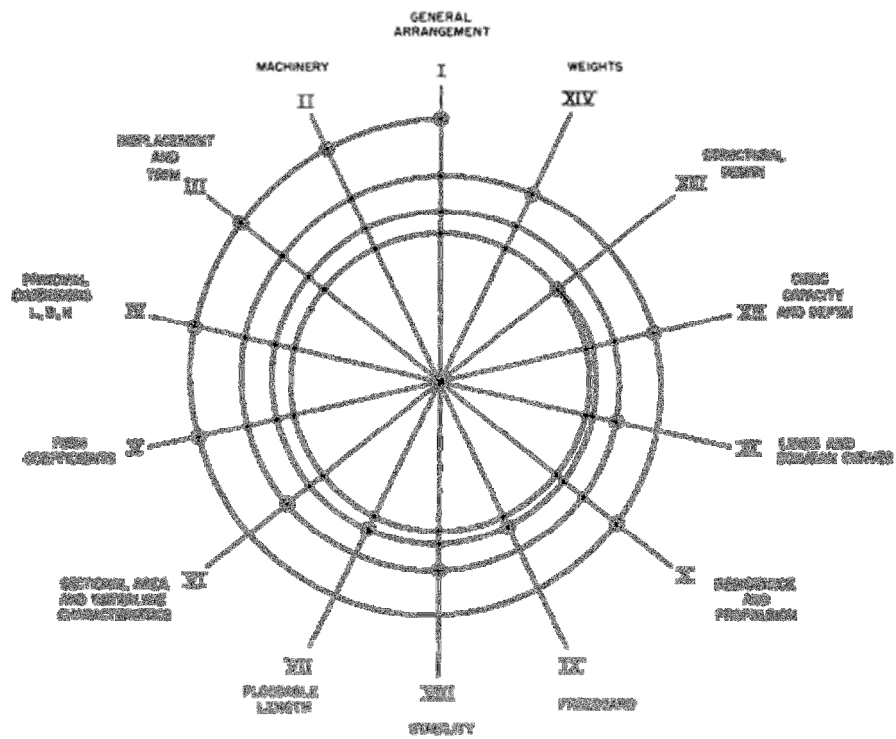


Figure 1-1 : Evans, J. H., 'Basic Design Concepts'

American Society of Naval Engineers Journal, Vol. 71, No. 4, pp. 672-678, Nov., 1959.

The standard ship design cycle, as shown in Figure 1-1, illustrates the evolutionary and iterative design process that is currently leading ship design methodology. The sophisticated and complex procedure that has developed and evolved over the past century employs concurrent and iterative design processes and procedures that synthesise a wide

range of systems and subsystems into one integrated and effective ship design system. In a core, disciplined approach that caters for naval, commercial, cargo and passenger ship design, it leads the field, and therefore, other types of marine design by proximity. The approach, however, does not link with aesthetics or experience centred design until after first principle design drivers have been met and applied in the marine platform. Linking these parameters with primitives of the overall hull or marine platform design to aesthetics, therefore, would seem like progression in the field. To let them develop concurrently throughout the process is an attractive idea to develop a new tool around. There is speculation, however, as to whether those streams of quality could then precipitate back into concept design, yet it is an exciting ideal that is one aim of developing tools for the interpretation of beauty, and that is explored through discussions in this study.

Subjective emotions and feelings that classify significant and valuable experiences are used for advantage in many areas of concept development and commercial design. However, the human soft parts of the engineering biased process are not formed into design drivers as they may be in other fields until after the core ship design process has run its course. This places aesthetics as an afterthought, which in the eyes of human centred design theorists is a 'flawed approach' (P. Wright, Wallace, & McCarthy, 2008). It is nonetheless seen as a way to keep ambiguity and acrimony out of the early stages of layout design, and a way to stop investment in considering costly radical change in the marine platform based on experiential design. The search for universals and essential components of aesthetics that are compatible and can be persuaded into the process without contention or cost is, thus, a persuasive proposition for founding an approach to aesthetic consideration into ship design.

It is no surprise that, in the past, ship design has tended towards an emphasis on cost, risk, and efficiency as opposed to beauty. The central systemic procedure is focussed on the primary aspects of 'fluid resistance, mechanics, buoyancy and stability at sea' (Gillmer, 1984). Its own natural development has moved ship design to a more efficient systematic process and to a specialised core routine. This reduction in components of design to fundamentals and first principles has refined the system to a sophisticated state and of a trusted and tried algebraic approach. The closed loop design cycle avoids any noise or conflict from aesthetics or human centred elements of design that are in the creation process of a safe and stable marine platform, and is for objectives and habitats to

grow upon it. Designers currently, however, need to absorb, understand, and be able to adjust designs towards aesthetic experience, in appearances, through to interiors, and in aspects of sensory experience to progress in the field. Any developments, it would seem, must be tempered with the same process of evolution in forming a disciplined approach to aesthetics as well as in development of the synthesis for a ship's design.

The agenda surrounding ship design, production and marketing is notably different to other design and engineering trades and is rather in line with its own design cycle and life cycle, as observed by Stopford (2009). However, the discipline is unlike mass manufacturing and cannot easily employ and integrate aesthetics into the design process, as linking production with a public audience is not as fluid as it is with mass produced goods. Acceleration in design methodology and technology to encompass theories from genetic evolution, bio-mimicry or intelligent design, that can enable the absorption of aesthetics in all its complexity, would seem ideal for a design conscious public. Yet this level of sophistication in terms of engineering design and production is currently not available. Quality from sensory experience that can precipitate into a design from good communication within the design process, as it is suggested here and evident in other fields of design, is a way that can unlock experiences that, for example, can help reduce fatigue and monotony in repetitive tasks or bring cohesion to a team through the design of heightened sensory experiences, improving moods and emotions in working environments. Therefore, it seems pertinent to define and validate the relative aspects of aesthetic appreciation, to move these schools and disciplines to within ship science.

1.1. Research Scope

In terms of perception, many philosophers and scientists have tried to tie the human consciousness side of design down and claim it as a science. However, opinions differ on the significance and meaning. Thus, whether or not core philosophies in aesthetics and beauty are valid or not, is central to the thesis. The search for a fitting philosophy and to produce a universal, theory-based approach to interpretation and appreciation, (which has been the focus of this research), is so that its ease of use promotes integration of aesthetics into the overall ship design envelope.

A ship is a world unto itself - a free vessel, a completely self-contained environment, and there are many opportunities for a disciplined approach for aesthetics to emerge. However, this research presents a focussed evaluation system that is both manageable and fitting and which is primarily focussed on analysis from the outside in, and an objective appreciation from the observers' perspective. Specifically, the research is focussed on external geometry in visual appraisal of a ships design.

Similarly, exploring the entire field in terms of types and technology is insurmountable for this research so large complex ships are used as the axiom for any theoretical or physical modelling. However, smaller craft are examined and appreciated for comparison and germination towards the model problem, in design philosophies and trends occurring in the design methodologies.

Provenance and historical referee are generally excluded from the appreciative case study investigations. These focus primarily on universals in the appreciation of physical form, yet the all-important contextual experiences held by society and public at large are cited for contextual and cultural referees in a combination with categorisation relative to specific and current technology. This leads to appreciation being made in retrospect and an external process of appreciation from the ship design process, is used to support a manageable contemporaneous and culturally focussed system.

Theoretical resources form the philosophy of aesthetics that is used to interpret and elucidate significant and sophisticated aspects of interest and quality mirrored in an approach for ship design. The cultural and societal aspects of valued experience, and those that define fundamentals and essentials in qualities of life experience (i.e. those that are

collectively significant, valuable, and cognitively rich and that can lead to comfort, happiness and well-being), are defined in the research as the focus and domain. Any neuroscience and biophysical measurements that supports the universal theoretical stance on aesthetic appeal, and that can act in parallel to a theoretical stance, is however only referenced to in the appendices.

The research has sought to derive mathematical results that can be used in an integrated and automated design system and that can also be used in communication of aesthetics between members of the design team or components of the design system without loss of quality. Discussions and debate on how a philosophy can give cohesion between and within the design group, for aspects of aesthetics in the design process to permeate throughout the design domain, are thus also reflected upon in discussions.

1.2. Aims and Objectives

There is currently a need to reinstate the connection between the end user and the method of production in ship design. Where 'the product designer is the modern folk artist' and the naval architect is only the engineer, there is currently a need to explore aesthetics - protecting the art of ship design whilst adding to its effectiveness' (Cooper & Press, 1995). The aim, therefore, is to synthesise methods from other areas and fields of philosophy, psychology and design philosophy, and to define the aspects of attraction associated with appearances in the various types and classifications of boats and ships. The approach seeks to interpret what it is people from outside of the industry and expertise find appealing attractive and beautiful about a ship or boat's design. It aims to illuminate the areas that germinate, cross, and overlap for elements, design drivers and properties or qualities of design to emerge and in a format that can be absorbed into the core design process.

The aim is to devise an accurate translator and interpreter for experiential value. This will comprise theoretical resources from the philosophy of aesthetics, which focus on a significant, cognitively rich and valuable range of experiences, relative to mental well-being, happiness and pleasure.

The model must deliver physical parameters of change relative to feasible, structural, or graphical alteration, those that are within the permissible solutions envelope and within the feasible range of alteration in the current ship design synthesis. Tools developed must, therefore, quantify perceptions relating to a contextual and cultural stream of interest and improve the chances of an aesthetic intention to survive throughout the iterative and cyclical ship design process.

Objectives:

- To present the universal theoretical and scientific resources for appreciating a ship's appearance, (defining parameters that make the process manageable and compatible for use within the ship design synthesis).
- To categorise the significance of aesthetic components and features across a selection of different ship and boat types by isolating, explicating, and elucidating qualitative elements of association, relative to each technology and its physical design.
- To illuminate dimensions, parameters and design drivers from the case study analysis for use within an integrated systems design model.
- To discuss how a philosophy can be used in an overarching approach to categorisation and cataloguing of associative geometry for use in ship design.

2. Aesthetics

The many fields of commercial design and Art that evolve with cultural context and fashion help to reduce the vast field of opinion on aesthetics into manageable areas of contemplation. Mass manufacture, Art, Architecture and Religious Architecture are thus large scale forums that address collective essentials in design.

2.1. Beauty and Aesthetics

It is important to define that beauty is not purely about associations with natural or modern phenomenology, but rather it has to do with contemporary human needs and wants. Beauty is, therefore, a concept often explored through fundamentals and also contextual interpreters in theories on aesthetics and aesthetic appreciation. Beauty can be quantified within definitions built around rationales, or romantic notions on perception, (Reich, 1993) or relational memory and personal history. Data supporting these definitions, can also be found in contemporary empirical sciences and from sources such as gleaned in situational psychology and related measurements in neuroscience. However the problem with beauty, in any definition, is that experiential intellectual aspects of beauty, that some may be able to define, exist, whilst others are intangible.

Experiences that relate to beauty or that can be reflected on with feelings of happiness and enjoyment programme and prime the brain in ways that persist to form aspects of sought after ethical virtue (Ryff, 1989). Those experiences attached to beauty become part of lasting memories in relation to life-scaled values. These can be significant, cognitively rich and reactions to distant, instinctive or essential aspects of sensory experience, and of contextual experience that reinforce and remind. The associative elements attached to an experience encourage and act as a platform for improvement in positive aspects of mental well-being and healthy structuring and restructuring in the mind.

Aesthetics has become an objectified method for reasoning on intellect and sophisticated notions of beauty, (R. Williams, 1985). That is more romantic, existential theory and towards higher pleasures in life, or to our most valued and cognitively rich

experiences, as explained by Graham, (2005); and Parsons & Carlson, (2008). Some perspectives on beauty can confuse a rationalists or universal definition, yet adds to understandings of the subjectivity and taste involved in the debate on art and beauty. It is in this sliding significance that Aesthetics has given Art and any field of design, a rich philosophy to reduce, reconstitute and reconstruct, and thus create aesthetic rationales around each field, and subject, (Reich, 1993).

Misinterpretations of the word 'aesthetics' are common. Many believe aesthetics to only be skin deep the picturesque, the adornment of decorations and the superficial, that it is intellectually dishonest and fake. Others hold it is for an elitist group of romantic scholars not connected however directly to reality, who test theoretical bounds in terms of scales of beauty and taste. However, across all interpretations, there are core aesthetic theories and properties that are meaningful and useful for appreciation and design and that have common laws.

The etymology of Aesthetics helps categorise firstly through sense perception that is, of 'Aistheta' as Kant prefers, and then deals with any subjective concepts of beauty by grading and scaling relative to nature and axioms of human values, (D. Thompson, 1996), that is of attraction in natural selection. The scaling and grading of each sensory value, combined or isolated to elucidate ethical perspectives of beauty via Baumgartens earlier definition in 1859, defines aesthetics as the study of beauty in Art and of lifes philosophies, (Blackburn, 1996). And although 'Aesthetic consideration' shares the same basic divisions and elements as practical or utilitarian considerations, and in aspects of sensory perception - it can be used to signify and define intellectual beauty, good taste, culture and natural beauty. The term Aesthetics can also be used to describe the qualities and features experiences that are sensed, and are perceived as elegant, the sublime and in moments of transcendental epiphany, (R. Williams, 1985).

2.1.1. Essential Interests and Universal Beauty

Universal beauty can be considered broadly as the ability to delight or please the aesthetic senses. The qualities of shape proportion and colour supply the particular point that gives satisfaction, ‘gratifying any taste’ (H.W.Fowler & F.G.Fowler, 1956; D. Thompson, 1996). This can thus be taken as a quality that is unambiguous, i.e. it is what one and all find alluring, attractive, and the significant things in life we choose above all others. Also, by definition beauty is a superlative quality and most extreme pleasure of perception and cognition that is, and can be considered as the ‘search for simplicity, that is a powerful aesthetic imperative that serves as a basic component of a designer’s value system’ (Hekkert, 2006).

When the aspects of what is conceived to be beauty are broken down into constituent components. A rationale for certain patterns and shapes that could be attractive because they are recognisable as valuable or useful, is an approach to deciphering perception that some consider instinctive; such as supported by Jung’s Archetypes, archaic remnants such as Helmholtz’s unconscious inferences (Dominic Lopes, 2001). In inferences that can be quantified in terms of knowledge and expectations, (Parsons & Carlson, 2008) or in essentials of a collective unconscious, and one’s natural atavisms - as described by, (Dutton, 2011) and partially through Richard Dawkins Memes, that are collective and ‘cultural objects’, passed on, and which in the processes of transmission evolve and seem to have a life of their own. Thus to found how interest is formed in us all, from philosophical bounds such as can be defined by a notion of beauty, for example – a compelling and all-encompassing definition and datum, from which commentary – appreciation and critical theory come, can be crafted from essential elements of why an object is attractive or not.

Universals considered as the building blocks for understanding sophisticated and cognitively rich experiences and also significant emotions are thus connected to the more measurable elements of hedonistic pleasure and pain. Which although is opportunity to measure happiness and pleasure within a bio physical range, is however often difficult to grade around the refined elements of experience, and as within an infinite range if influences from psychology and personal history, a complex domain. However the fundamentals still persist and what makes these experiences special and enlightening, upon

their fundamental release, can supply support for philosophical theory or from a reduced rationale. Universals can thus pin point when and where personally valuable and romantic aspects of experience happen, due to context and situational experimentation, yet however takes a theory led approach and reasons to quantify why.

Ancient Greek and Egyptian philosophies espouse ideals of perfect beauty, symmetry, and structure that follow natural law, for example, *'The Golden Mean'*. Ancient Oriental models also fit with *'The Middle Way'*, *'The Doctrine of the Mean'* and *'The Un-Wobbling Pivot'*. These all subscribe to common measured and balanced ethics of composed equilibrium, relativity, and virtue—describing not only geometry that is practical and functional, but also ethical, and morally balanced. For example, we find recognisable the significant geometry in the characteristics and accents of facial features that can characterise whether a person is friend or foe.

Aristotle saw the mean as the rational and virtuous course between extremes of excess. He suggested its widespread appeal as a practical ethical guide. *'Golden mean = moderation in a person's course of life'*. The Doctrine of the Mean is, for instance, one of the Four Books of the wholly independent Confucian canon, (Flew A.G., 1984). This concept partnered with beauty in the nature of maths enables one goal, an aim and intent from ethics into the anatomy of design. This is all very well understood in theory and in design practice from other disciplines. Ethical balance can be graded and scaled with reference to a good person's virtues, as well as the finesse in a structure or function, as noted by Macdonald's *'Aesthetic intelligence: Optimizing user-centred design'*, 2010, (Macdonald, 2010). It seems there are numerical norms that enable one to assess beauty based upon ethics and morals.

2.2. Objects of Natural Beauty

The beauty of natural objects is the first point of reference for any notion on physical or geometric attractiveness. The primitive associations with familiar and relative geometry and in how simplicity defines aspects of beauty in geometries, uses balance proportion and symmetry, in classical terms and in logic to encompass ones evolution and ones interest in natures values, (Little, Jones, & DeBruine, 2011). Many throughout history have refined aspects of attraction to perceived universals in geometries and maths in those equations that have become a symbol of beauty themselves. The universals and essential features can be potent and create advantage on initial visual impact and, through function, many are considered to act unconsciously as supported in works such as (Dominic Lopes, 2001; Dutton, 2011; Zimmer, 2003). That is in the use of surfaces that resemble a healthy and fit body, fruit or in the primary components of a machine that uses structural rationalism, is to illustrate elegance in mechanical power. Therefore there is a great deal of potency in aesthetics adding and innovating elements of human centred design.

Cultural and symbolic meanings can also be found within an object's topology, geometry or anatomy. The unconscious and conscious inferences and relationships made through familiarity and proximity to other similar products, materials or values such as discussed personality of products, (Bloch, 1995; Creusen & Schoormans, 2005; Leddy, 1997), is experience programmed and reinforced in our minds through interaction and use, via promotion, narrative or instruction, and as discussed, in 'A model of aesthetic appreciation and aesthetic judgments' (Davies 2010) – when a car makes you smile (P.M.A. Desmet, Hekkert, & Jacobs, 2000). These learned aspects of any object, if positively enlightening, can be classified as 'intellectually beautiful' (Leder et al. 2004) or when referring to prior or relational memory, as personally significant.

2.2.1. Gestalt

Fitting to concepts that are formed from objective, subjective and reflective points of view: Gestalt is considered in the broader sense of thought and psychology to mean a collective term for a 'unifying expression or wholeness and overall form, and can be considered as a containing statement on the outstanding concept or overall function', a proper function, or significant and teleological function at a top level, i.e. with final cause, purposeful and focussed aim: Zaha Hadid, a contemporary architect, recently winning the Pritzker prize, has driven theories on homogeneity in all of her popular and globally renowned designs, and is a theory that fits and is used in automotive design. Contemporary theories on Gestalt support classical architectural education, in tectonics and homogenous building and envelope design. The idea of a nucleus and its skin being used to categorise geometry in a containing phrase of significance and matter: is not only a philosophy to follow in design, it is a fundamental in the science of shape recognition in terms of bottom-up processing, and is to consider in philosophical terms, simply that all the parts form one overall product of thought, (Koffka, 1935; Rock, Irvin and Palmer, 1990).

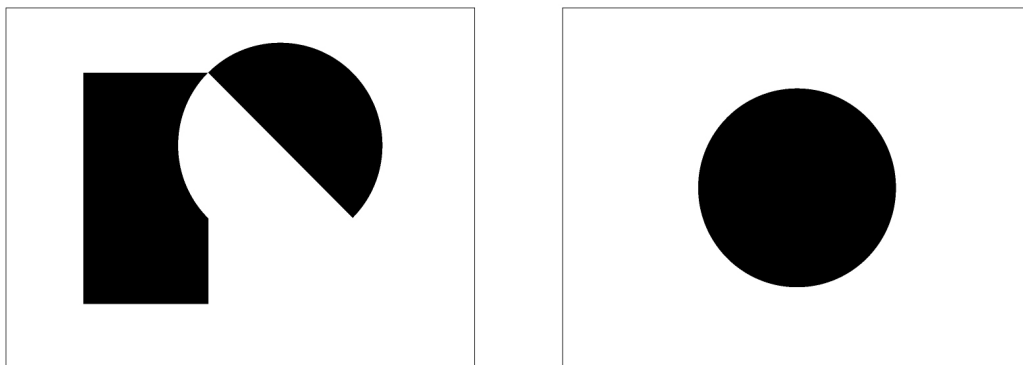


Figure 2-1 : Perception of Figure or Gestalt over ground

Gestalt is also to do with visual balance, and can be to do with the relationship between the page and the graphic, it is as an important Graphical rule as it is with the definition of balance in three dimensional design and geometry: And elements are perceived as either 'figures' (distinct elements of focus) or 'ground' (the background or landscape on which the figures rest) as illustrated in Figure 2-1 above. The illustrations

define the figure as dominant in both cases. Thus humans tend to interpret ambiguous or complex images as simple and complete, tending to look for a single recognisable pattern. The normal is to consider the uniform in connectedness. Simply the elements that share uniform visual characteristics are perceived as being more related than elements with disparate visual characteristics and are considered to have good continuation. A common fate, good proximity and similarity. The Gestalt philosophy helps the artist and the psychologists categorise component parts of visual form and function, in proportional and compositional layout - and also in detailed relationships between surface topology and underlying structure. Gestalt is thus a domain for an overall judgement on design and geometry, in relation to quality of function and homogeneity in design, (Behrens, 2008; Hoffman & Singh, 1997; Rock, Irvin and Palmer, 1990).

Gestalt theory can be used to analyse visual geometry and can be used to measure elegance and accuracy relative to the prototypical nature of maths and also maths in nature. The 'figure and ground' rules and 'semantic, top down, and syntactic bottom-up cognitive priming' have become common laws from which one can expect to form productive and reproductive thinking, and in interpretation of recognition, both visual appearances and in analysis of associative recognition of any type can be formed, (Lim, Stolterman, Jung, & Donaldson, 2007; Perlovsky, 2009; J. . R. W. Veryzer & Hutchinson, 1998). Thus contemplating the Gestalt (the overall shape and form), one defines the predicates leading to judgements on an overall form or functions efficiency. In fundamental components of processing and evaluation closely linked to recognition and judgements on beauty and then ugliness.

Gestalt theory isolates where opportunity could accentuate or camouflage the way a surface or edge is read, or has been executed through design and function, and in execution helps evaluate significance, elegance and beauty by proximity. Thus it could be considered that beauty is predominantly formed from how form is communicated and read in this way, yet it is not. The elements of surface curve continuity, tangency and connections need to be connected to an underlying structure and skeletal structural form, for it to be considered in evaluations on how, for example; an energy state such as dynamism or stickiness can be qualities present - even if only indicated in visual cues. It is thus important for one not to reduce beauty to a rationale such as with Gestalt theory, and simply there is much more to it. Features within the Gestalt for example, may play a part in deciphering value or fear for example. And placing this within the sliding significance of

the field of aesthetics in general there is still more complex social and psychological meanings behind the reasoning on physical beauty. One must not forget that ‘it is also a serious mistake to reduce minimalist aesthetics to homogeneity’, as this is a lack of substance (Halliwell, 2002). This so called substance, is context and subjectivity in appreciation of aspects of experience, and that is to qualify physical beauty alongside tools provided by theories on Gestalt, or any other notion of beauty using Gestalt as a model and base. Thus although Gestalt is persuasive in a process for defining beauty, beauty is often more than analysis of the overall form.

2.2.2. Beauty in the Nature of Maths

Turning beauty into numbers for complex system design, such as ship design, is an attractive proposition for an approach to aesthetics in design. That fits well with the objectives and production technologies of systematic engineering; For example, the way in which classical architecture has evolved to communicate mimicry of platonic perfection or dynamic aspects of proportion that is in repetitive patterns and scales, such as found in classical art, automotive design, and sculpture and as in the perfect city, can be used as a model for other products of design. However the use of simple dynamic symmetry and abstract geometry to illustration what can be entrance to the divine, does not always transpose into the asymmetrical or organic surfaces of modern design. Yet however this abstract geometry is a cultured function and of omnipotent referee, (K. Williams, 1997). What exemplifies the proportions found in nature and the nature of maths itself, are those figures that can act as codified messages, and has in the past been indication of membership and inclusion, to a powerful and sophisticated set.

The obsession with single dimensions of natural proportion in geometries can be considered elegant and sophisticated in terms of artistic merit and in some practical and primitive parallels to an elegant function in the effective and elite of society. Those have become a standard in design, for illustration in an icon for power and progression and in homage to us and a superior ‘means of production’. In design this elegant dissection of function is also available in leading technological and state of the art design, and affordable to everyone. In some cases, perfect structural geometry working with function, is a direct and fluid conduit for this message. In this way the nature of maths, that is those proportions

and dimensions that can be seen in the evolution of the most efficient functions and forms in nature, can pay homage to aspects of survival of the laziest and to the divinity of evolution. This is evidenced in ways of using the least amount of energy, taking up the least amount of space, or letting elements rub away to leave the strongest and most fitting structure, is identifiable and in parallel with the process of optimisation and geometry, in evolution of sophistication of function and design, (Taylor, 2007).

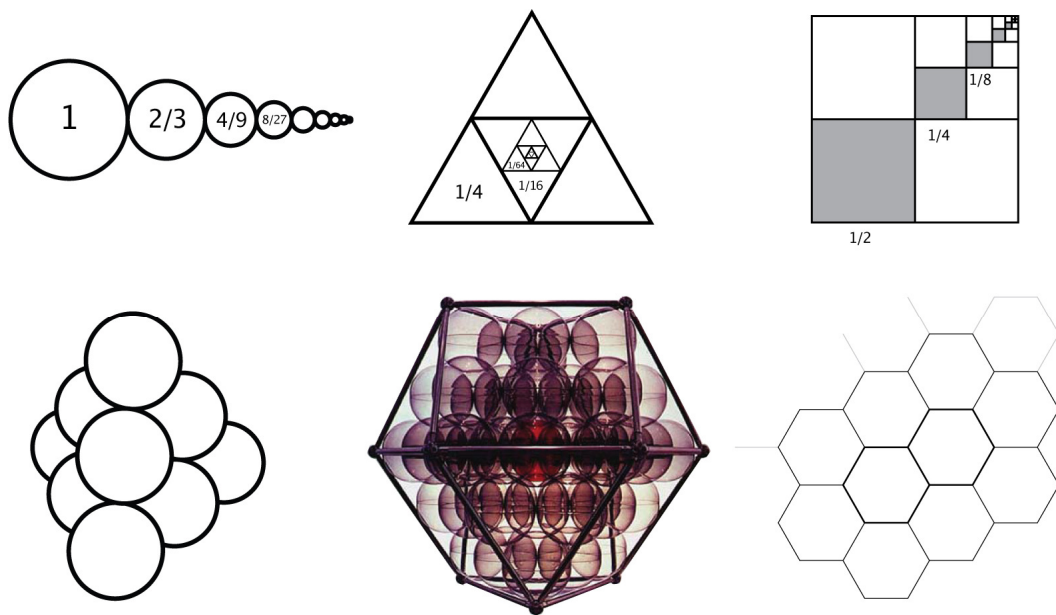


Figure 2-2 : 2D and 3D Geometric progressions.

Common Circle, Triangle, Square geometry progression and ratios.

Sphere packing. Bottom Centred Photograph = Buckminster Fullers Closest Packing of Spheres 1980 (Solway, 2013). Bottom Right Hexagonal Tessellation

There are many phases, sequences, and formulae that, with time and evolution, can form and create matter that is useful, and structural, or beautiful. Mathematics being at the heart of these formulae creates the patterns and proportions in geometric progressions, that link with fundamental structure in nature and thus plays a part in ones evaluation of beauty, Figure 2-2. The two parts of aesthetics in relation to proportions are underlying structure, or representation of it, and external skin deep representation, linked often with a sensory system. Is simple theory that becomes useful in definitions of patterns that form structure, and that in that, are both mathematical and visual informatics about function or value. Making the search for it in the initial part simple and then the reproduction of it accessible.

Great minds have discovered the patterns of nature, for example, Euclid, Platonic Geometry, the Fermat, Pythagorean and Cartesian, Pi, 1:2, the silver ratio, the square root of two and 1.618, the golden ratio, and Mandelbrot. And familiarity with these natural patterns aids in the understanding of the ways in which intrinsic value is associated in geometries of function, or in underlying purpose and value. That is through, for example; surface detail, edge strength, and boundary conditions and in the tectonics and homogeneity of design. Those familiar connections in geometry that are universally appreciated and made recognisable to one and all, (primarily through the omnipotence of nature in what can be termed instinctive notions of beauty, value, and function). Maths in summation series, or commensurate figures, have been explored and contested in investigations of the Golden ratio, (Green, 1995; Russell, 2000; R. W. Veryzer, 1999), yet emerge as components in an equation to define beauty, and allow an attractive logic and mathematical function for proportions especially in the three dimensional an natural world, to define composition of beauty in nature.

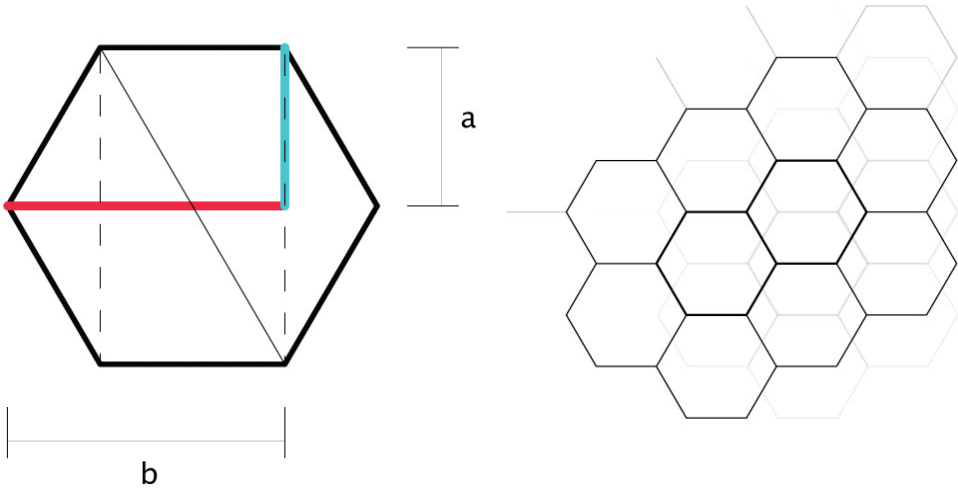


Figure 2-3 : One prominent archetype of maths in nature is Phi
 $(a/b = (a+b)/a = \text{Phi} = 1.61803)$

‘The Golden Ratio’ or Phi, is noted in Figure 2-3, and as a ratio most familiar in the sharing out of parts of sophisticated biological growth and in our own bodies and genetic structure. It can be seen in most geometry and structures, even in the formation of the very building blocks of crystal formulation, for example, as illustrated in the structure of carbon right in Figure 2-3, (Shechtman & Blech, 1984). It is also evident in the structural

and physical geometry of sophisticated life forms and bilateral creatures, in organisms with a sagittal plane. The Golden ratio is found in the very makeup of man's primitive and refined architecture, and this Pythagorean approach has been widely adopted, for example; The Pantheon, Architecture and Palladio, who have all paid homage to man's perfect form in geometry still holds gravity after almost three thousand years. Vitruvius, believed 'for any building to be beautiful it must have perfect symmetry and proportion as those found in nature.' It could be said that it is desirable to take proportions for design from natural geometry (Vitruvius, P. and Morgan, M.H. and Warren, 1914), as found in the composition of the human body or in the morphology of organic growth of petals on a flower, in *'orderly arrangement of parts of an organism such as is found in the adjustment of leaves on a plant, in the formation of a shell or in the bone structure of the human body itself.'*, for example, (Guiton, 1971a).

Figures of platonic perfection or dynamic aspects of proportion in repetitive patterns and scale, such as found in classical art, design, and sculpture and as in the Vector Equilibrium of Buckminster Fuller, shown in Figure 2-2, are prominently evident in animals that are bilaterally symmetrical, those that have mirror symmetry in the sagittal plane. Humans for example have sensory, limbic and facial symmetry. In the way that other bilateral organisms do, and simply due to the direction they evolved to move, nature has defined where sensors are positioned, and where for example elements such as eyes and a mouth tend to cluster, in familiar proportions and compositions that relate directly to summation series and more so specifically in humans the Golden ratio, or Phi.

2.2.3. Dynamic & Bilateral Symmetry

Classifications of beauty in geometry and of creatures' anatomy, become less ambiguous than quantifying cultural, intellectual and contextual beauty, yet still remain complex: The ancient definition of simple datums and axioms of beauty, such as symmetry, balance, and proportion persist as quantification, as in cultural and contextual interpretation, - however referencing natural selection and survival of the fittest, as does geometric sharing out in evolution. The omnipotence of nature helps quantify a collective understanding of how the world works in terms of physics / or physis (physics in nature). It is a notion that can help define one's unconscious mental system and in a fundamental judgement system

surrounding aspect of proportions, parts and components of geometry. One can say this composition in geometry communicates the function of a sophisticated design or organism that is in its dynamic sharing out of parts and symmetry, its dynamic symmetry.

Dynamic symmetry can be the focus for aesthetic appreciation, because it reflects sophisticated architecture and sophisticated maths, as illustrated in Figure 2-4. It is a system used to describe an ordered composition that fits together geometry that allows the two to complement each other in numerical proportions: The complementary values, sometimes referred to as numbers with recurrence relations, in the sharing out of geometry defined by the nature of maths and the nature of function, or what one can consider natural evolution; are quantifiable to a concept of beauty as they are both referee and the subject of what is under scrutiny and to other recognisable functions in the 3D geometry of physics or physics in nature. Jay Hambridge (1919) argues these dimensions of proportions can be found in the sequencing within organic dynamic symmetry, as found in the geometry of shells, pine cones, and the ancient Nautilus.

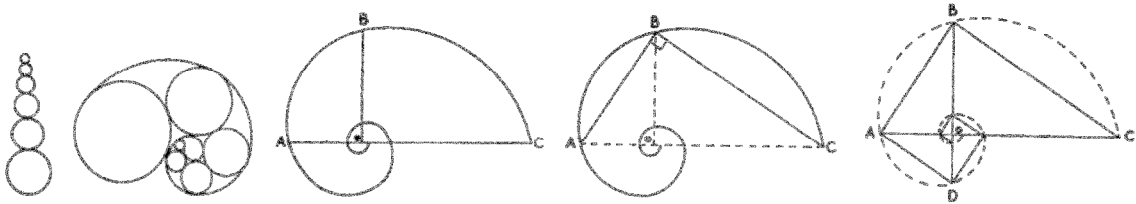


Figure 2-4 : Dynamic Symmetry in Nautilus 2D Section, (Elam K, 2001)

The geometric series as illustrated in the Nautilus 2D section and graphical construction of, follows rules that derive the golden proportion that in organic growth, and are explained by either genetic switches or physical conformity. The measures and proportions based on epigenetics, crucially relate to human proportions, that might 'require a great understanding and passion to use in design', (Elam K, 2001; Hambridge, 1919) — yet are addressable in categorisations of types and functions next to and in relation to nature's design.



Figure 2-5 : Oriental hornet (*Vespa Orientalis*)
MattiPaavola Sept12 2008. In the photo a wasp that has landed on the street in Lindos, Rhodes, Greece shows the abdomen and thorax relate to one another in relations relative to the golden ratio - that is in proportions of 1:678 that other divisions of anatomy display, such as the legs and major geometry of the antenna. However it is also evident that there are other summation series on the surface of antenna, in the sharing out of the sensory system parts and in body parts and patterns, and it is conclusive that there is not one summation series in nature but many.

Dynamic symmetry's 'great value to design lies in its power of transition or movement from one form to another in the system', (Elam K, 2001; Hambridge, 1919). This creates recognisable structural makeup, similar to the sequencing and order of natural growth that is in feature that have built around a central system. The primitive values of structure can be seen in simpler natural application, such as in the formulation of honey combs, and the nature of crystalline structure of carbon, as noted by (Shechtman & Blech, 1984). The scale of the systems are set to purpose around an organism, or sophisticated analogue system in design with purpose derived from optimisation. The evolution and optimisation in natural selection, such as in the sophisticated divisions of an insect, or plant geometry, and that we can consider here, can be seen in the tectonics of products, cars, transport design and architecture, is 'a type of orderly arrangement of parts of an organism found in the adjustment of leaves on a plant, in the formation of a shell, or in the bone structure of the human body itself' which supply us with a notion of beauty, by its own definition of existence, (Guiton, 1971; Hambridge, 1919).

The DNA of an organism is aimed and evolved to produce the healthiest, sexiest, strongest and generally symmetrical aesthetic forms and shapes. In 'morphology' and 'phylogensis' (race tribe): 'the branch of biology concerned with the forms and structures of living organisms' and that can be used to categorise and evaluate value and purpose (D. F. Thompson, 1996). In teleological 3D architecture and structure that is ultimately recognisable from the omnipotence of nature's refinements, the proportions and mathematics that orientate around bilateral creatures and the sagittal plane, those bipedal

animals, with a central nervous system and a central sensory system, define aspects of beauty, in compositions that can be defined in mathematical terms.

Homogeneity or harmony in phases and the cadence of natural summation series, in vector equilibriums, and basic geometry packing, as seen in figure Figure 2-2 - that illustrates circle, triangle, square and sphere packing as seen in nature and in the nature of mathematics, are geometry series that reflect sophisticated evolution within an aimed objective or teleological purpose, and sophisticated symmetry of a higher order. The recurrence ratios 'holding apparently equal differences in epigenetic enantiomorphism, austenite symmetry', or as with the golden section, found in fractals, flowers, and mammals, (Green, 1995), can be considered to have a function that creates ratios of natural evolution, and in compositions that are 'considerably more interesting than the resultant coefficient' of the equation, as is agreeable to; (Russell, 2000).

2.2.4. Beauty in the Geometry of Products

Modern design is bound to search for a laconic, 'hyper-normalcy' from the ultimate qualities and visual beauty, as found in nature, (J. . R. W. Veryzer & Hutchinson, 1998). However, using maths and geometry to design around alone is not enough; what is considered beautiful is more complex than this and although we are attracted to expressions in facial features, one can also be attracted to what is unusual, provided it remains within the bounds of a normal distribution, (Bloch, 1995; Chen, Wu, & Wu, 2011; Green, 1995). This is defined in domains such as the common 'Savannah Hypothesis' in works discussed by (Dutton, 2011). This notion is also explored by (Macdonald, 2010) via Dreyfuss' environmental tolerance zone, and as defined in Raymond Lowey's 'MAYA' concept of 'most advanced yet acceptable' and 'maximum effect for minimum means'. It is a philosophy that is still crucial keep in one's mind that simplicity and clear communication of value is where beautiful products are defined. Geometry with a tendency to be easily read, (Chen et al., 2011), and as explored (Sabelli, Lawandow, & Kopra, 2010), creates balance, proportion and symmetry in a fashion that appeals to one's ease of information gleaned, and although 'we like what is average, we might like more what lies nearer the extremes of what is not regarded as transgressive.' (Davies, S. 2010.). Therefore it is often design that uses mimicry of nature, as in 'miming' (Aristotle), to

influence aesthetics in design that are successful and regarded as so, rather than copy that could simply be bio inspired design, (Dominic Lopes, 2001).

Features and focal points that represent value and function, as in nature are thus a datum in definition of sophisticated structure, purpose and even within judgements on relative personality, such as discussed in section 2.2.3 above. That is in a sensory array or in limbs that that complement the gestalt. The communication of function however is not a boundless domain as for example ‘the adult public's taste is not necessarily ready to accept the logical solutions to their requirements if the solution implies too vast a departure from what they have been conditioned into accepting as the norm.’ (Hekkert, Snelders, & van Wieringen, 2003; R Loewy, 1988). So having universals in beauty at one end of the scale, it is important to define what is at the other end, and ugliness when posed as a universal can signify beauty’s boundaries in a rationale and foundation:

Dirt and grime, are commonly unattractive, as are diseased anatomy and degradation of property, because these things indicate danger. Balanced and symmetrical anatomy, cleanliness and order can be considered, in contrast, attractive. These signifiers can be interpreted as the result of cultural and social evolution and albeit more pronounced towards the hygiene hypothesis in the developed world, pollution on the whole is viewed as a cultural and religious taboo, which is quantified and discussed by Douglas & others (1991), in ‘Purity and Danger the route of religion’. The theory illustrates how religious defilement and its cultural implications and terms for categorising hygiene, repulsion and fear can be used as a datum or examined as a route to the categorisation of what one sees as repulsive, ugly, or repelling. Other notions regarding the fear of danger and that surround the ‘hygiene hypothesis’, can be reasoned to the link between intelligence and biophysical and physical genetic evolution. That is in smarting reactions to creature’s forms, or to danger and disease via sensations that are hardwired into man, such as discussed by Broadbent, (1973) and Dutton (2011) define. An instinctive fear of spiders, snakes or the natural fear of the dark are valid because there is reason to fear them, yet however have become instinctively so. This is supported by observations in propagation of emotions through encoding of Amygdala from fear and adaptation in one’s personal and species evolution, (Kringelbach & Berridge, 2009; LeDoux, 1994).

For example, internal organs and anatomy that should naturally be inside seen on the outside is repelling. Fear, with a narrative is the subject of much art and architecture.

Lloyds and Pompidou for example, display the internal workings of the building on their exterior, which illustrates artistic intent to appeal to a sophisticated understanding of business efficiency and anatomy. Forms and shapes that reflect disfigurement, essential fluids, decay, rot, injury or pain can thus also become art. The buildings are thought to be beautiful because of the creative brilliance of the concept in an aspect of design surrounding interest. This does not necessarily fit within the acceptable norm, and universals in interest, rather the ideas fit and work in harmony with specialised knowledge in design and art. Or in ideas of ugliness that also extend beyond associative geometry, and in judgements of an ethical nature. For example the display of ultimate wealth is grotesque or repulsive when things around display moderation – the unfair placing in a democracy creates a mental comparison, and that which when held in esteem, can help the difference lose its aesthetic appeal. This mental comparison is a measure of tasteful context, and qualifies how disharmony in intellectual beauty can be related to morals and ethical discourse.

2.3. Aesthetic Experiences by Design

Beauty can be considered as more than its appearance alone, and more than sensory experience alone. Significance within a definition of beauty is not all about association with natural or modern phenomenology, but rather it has to do with contemporary human needs and wants, such as parallels with aesthetics and value in ‘what is beautiful is useable’, (Tractinsky, Katz, & Ikar, 2000), or ‘When a car makes you smile’ (P.M.A. Desmet et al., 2000), and beauty resides in qualities some may consider intangible. However, this research sets out to make a tangible and manageable definition available through philosophy and for use with the complex and algebraic theory of ship design.

Beauty can be considered as pleasure that ‘supervenes upon experience’. Beauty has more than natural beauty alone, Aristotle (Graham, 2005). It is an experience that can be equated to the concept of ‘flow psychology’ noted by Csikszentmihalyi & Robinson, (1990), a quality that is not contained within the value of the product, but rather in the experience of using it, and the feelings and experiences felt over time and through use. The word ‘aesthetics’, which is connected to defining beauty, has deep-seated and

philosophical origins that makes its everyday use difficult. However, methods for contemplating and utilising aesthetics in commercial design and engineering are prevalent throughout commercial and visible products. Both sell and innovate in new design.

Mass manufactured designs can employ laws in aesthetics, by adhering to fundamental intent and through the communication of engineering into design, such as craftsman like attention to detail in design. Directing design or a group's design philosophy to keep everyone heading in the same direction when directing design or also what can be considered design intent, such as can be defined as a Narrative (Dominic Lopes, 2001). What is earned is an aesthetic that reflects this attention to detail and investment of its focussed value, leading to design that creates a notion of intent that is perceived to be beautiful, as suggested by Csikszentmihalyi & Robinson (1990). Those crafted qualities becoming emotionally potent aspects of attraction, ownership, repeated ownership and ingredients to brand loyalty is a specific style which elicits mental well-being, an emotional attachment to design that can be compared to relationships with a brand or product and as discussed by (P. Desmet, Overbeeke, & Tax, 2001; Mugge, Schoormans, & Schifferstein, 2009).

A craftsman's theory spread throughout a design group is able to extend out to this enrichment, encouraging experimentation and interdependency within a design philosophy that can influence engineers to be artists and artists to be engineers. The inter-subjective systems are methods in design that account for objective, relative and perspective accounts of aesthetic appreciation, (Mcgee 1999; Liu 2010a; Pahl, G. and Beitz 1996). However few bespoke and batch produced aspects of design can define a standard approach, similarly few mass product design practices can fully absorb or define aesthetics relative to personal variation, and the application is relative. The larger corporate animals such as mobile phone designers, automotive and architectural design, can to a commercial degree, create design relative to trend or more recently personalised aspects of bespoke design. Where 'extras' in trim and interiors can be updated and altered in parameters before production, at the same cost, testing mass data real-time in purchase, or in simulated direct marketing is carried out online. Those hand crafted items that are the model can themselves communicate specific character or personality into a design, in craftsmanship that is often the goal and directive in marketing for commercial enterprise.

2.3.1. Visual Appeal

In commercial product design, the majority of emphasis is on the visual. It is also the prototypical domain for questioning meaning and significance behind appeal. Exploring how to design for visual sensory experiences that can be sculptural, graphical and visual are associated with what is tactile and of taste, and draws parallels with other rhythms in other experiences.

Concentrating on visual attraction for use in commercially potent selling aspects of physical objects, as discussed by (Hekkert et al., 2003; P. Wright, Wallace, & McCarthy, 2008); Aesthetic qualities do not necessarily extend to an improved function. However function and form are in many cases inextricably linked, and visual cues and instructions can inform and instruct in use, just as they might with touch and tactile influence. This theory goes further when considering associative experiential design, and although many theories in aesthetic experience cross over between the senses, it is usual that the visual senses are the initial point of call and investigation.

Visual 'Aesthetics' that evoke those emotional responses for selection and purchase, as categorised in *Seeking the Ideal Form* (Bloch, 1995), look to purposefully elicit pleasurable cognitive, affective, or phenomenological responses. Conversely to the products that can wear a functional aesthetic on their exterior, those products that have an inward, intrinsic, or internal function instead build a positive visual representation of function through an external visual form—or some form of sensory association to value, i.e., to those recognisable visual and common aesthetic features, assumed from our natural, instinctual, or learned library of images. Associations that can hold natural referee, but placed next to modern function, can also grow into meaningful and recognisable contextual significance.

The direct accentuation of attractive external proportions, such as seen in car design application of tectonics and its tools; and two main elements in the principles: 1. the nuclear inner structure and 2. the outer cladding. And although 'The outer cladding should reflect the true nature of the internal nuclear, (Y.-T. Liu & Lim, 2006), the idea has been put to many theoretical applications, such as discussed in transferal of technological innovation from the well-defined design methodologies as such, in EBDIG etc, (Cheutet et al., 2007; Ziarati, 2009). Techniques that help communicate where the proportions and

parts of a product or vehicle come together or how they intersect and how they differentiate is also part of visual appeal. These qualities can be communicated with boundary conditions and edge strengths, and colour in partitioning. The relationship between structure and skin is what communicates function and quality and as with nature is inherited from overall function in design.

The commercial value of visual aesthetics, therefore, can be in the addition or refinement of features or facets of an item to attract and sell. Packaging, for example, can create visual metaphors or idioms that stimulate or communicate the hidden values or intrinsic worth of an artefact. Sometimes adding to the experience of purchase as the added aesthetic value, cosmetic packaging in the lustre and 'claritas' that simulates cut gems and precious metals exemplifies a retail psychology, for example, that attracts through the symbolism of precious and useful minerals, as explored in 'Sparkle and Shine' by Leddy (1997), and that can be beautiful in the execution of a design's communication of intrinsic values and hidden needs, adding value to a design and product in a way linked to one's association to intrinsic qualities.

It can be the skin, the adobe and render or finish and surface treatment that makes an object look solid and not superficial, even projecting solidity when it is not. The atomic micron level too, that is surface finish, and thus of minimal cost, can lead to illusion of investigation of material in 'that little transformative moment of change.' Surface treatment can capture audiences in a 'transcendental moment of time,' 'looking for where colour stops being the top layer of microns on the skin of another thing'. This provokes interest in, 'the moment where colour doesn't behave in a normal way, immersion, a condition that you feel' Anish Kapoor, (Cook, 2008). In this way, rules in shape recognition and in methods for developing how visual geometry is perceived, helps designers communicate the value and significance of an object or product through the visual 'strengths of the edges' and the 'boundary conditions of edges' (Hoffman & Singh, 1997). Defining and accentuating or softening the curvature of edges and the links between edges, which are properties in surface topology that define quality and function, portraying or communicating essentials and contextual elements of fashion to sell, and are often linked to interior or inferred proper value.

2.3.2. Emotional Design & Sustainable or Emotive Design.

Emotions used to formulate design directives is an area of design research developed from ideas on commercialisation of emotions from late in the twentieth century (Pieter M A Desmet & Hekkert, 2009). Emotions can be measurements of experiences that elicit mental well-being, happiness or sadness. However, discernment and deciphering of such qualities in experience has been a problem for the Emotional Design field. ‘Non-verbal instruments to measure emotions’ are contentious as links to specific drivers, and language is currently missing from the approach. ‘Verbal instruments to measure emotions’ using ‘self-report instruments’ also lack in a standardised approach and can require special training, especially with data from the subject matter and from cultural variation, to compile and categorise what is found to be attractive, desirable and beautiful, with authority and with validity (P.M.A. Desmet, 2006; Mahlke, 2003). Experience from coordinates in time, on reflection and through spatial aspects, through categorising vocabulary, attached to elements of design. In design tools which are reflected directly in theoretical approaches by (Dutton, 2011; Guiton, 1971; Reich, 1993), and as expressed in Aesthetic and Experience-Centred Design (Krogstad et al. 2011; Grudin-Pruitt n.d.). Helps to consider and sort responses and behaviour over time, and guide narratives to follow a chronological path, which is notably the important element of perception and as aesthetic referee. Knowledge of language, dialect and to be emotionally intelligent in interpretation, enables the discernment of objective, subjective and reflective modes of appreciation in feedback and visualisation. This ability to process and amalgamate adjectives, nouns and verbs on a subject into a collective expression, or in the case of geometry, for geometry terms such as: platonic solids, primitives and prismatic forms or organic morphology. Requires language skills – and basis for the designer, creator and appreciator in a disciplined approach, for example knowledge in anatomical terms of location, is useful in discerning and interpreting zoological comparisons.

Emotional design is a field of research and exploration has been useful in definitions for use in design and for an approach to changing emotional response over time. The specific application of this field, taking note of real time experience as a product or service, is being taken up and is in use. Most usefully and of contemporary significance, emotion as a design driver has illuminated after life and through life value, such as with the idea of sustainability of emotion for repeat purchase and brand loyalty, reaching

further than repeat purchase, attaining recommendation, emotional durability, and even sustained pleasure in use, such as discussed in (P. Desmet et al. 2001). (The Tipping Point of Design: How Product Design and Brands Interact to Affect Consumers' Preferences). In the paper *Measuring Emotions*, 2006 results of its study into this area of research define a 'product and emotion space' and show that negative as well as positive emotions can be useful in the theatre of a product through use, as supported in concepts of visualisation and 4D design (Robertson, 1997).

2.3.3. Significant, Sophisticated and Cognitively Rich by Design.

Art can create transcendental experiences that are said to 'go beyond monetary value' Csikszentmihalyi & Robinson, 1990a; Lacey, (2009). A specific set of philosophies encapsulated through insightful content that can be defined as 'intellectual beauty' or aesthetic appreciation in sublime sensory experience (Ross & Wensveen, 2010). These moments of experience can be elicited through aspects of context (subjectivity) and essential associations (objectivity) in default systems of the brain, such as discussed by (Gharibyan-Kefalloniti & Sims, 2012) and (Reich, 1993). These ideas that define experiences as cognitively rich, sophisticated and significant, are detailed and rich in information, by their very nature. Some elements of experience can also be defined in universals, and it is posed here that they can help build designs, that achieve pleasure comfort, mental well-being and happiness – and thus be used in a model to aim at many other facets of psychological and intellectual beauty through design, as explored by James, (1884); LeDoux, (1994) & Ryff, (1989)

Colour, sculptural form, haptic feedback (touch), or tastes can help create unconscious and conscious reactions for addictive, pleasing, or displeasing effect. In isolation, however, such elements of pleasure are only the measurable components of significant, long-lasting impressions that relate to mental well-being, ethical, morally-sound and positive aesthetic experiences — those experiences that can be classified as mentally healthy, rewarding in philosophical terms and biophysical too. To disclose those elements of sophisticated and cognitively rich experience to a field of design is to identify great potential in increasing value. To creating strong brands that have longevity and presence in the market place in ways that help self-promote and that have an emotionally

sustainable appeal, such as explored in extension of experience from unconscious and subconscious attractions; by (Chartrand & Fitzsimons, 2011; Lim et al., 2007; J. . R. W. Veryzer & Hutchinson, 1998).

One's search for healthy experience and knowledge is both ethically and morally justified, and can be explained with eudaimonism or virtue, which was coined by Aristotle. It translates to practical or ethical wisdom – in a positive function, and the word eudaimonism currently can directly translate to meanings in 'happiness' (Ryff, 1989). Combinations and activity that point towards the formation and reinforcement of long term memory, through neural pathways relative to rewarding memories such as self-acceptance: Mastery of environment and purposefulness Or, 'positive functioning' and 'personal growth' – 'towards self-acceptance (Self-esteem morale) and acceptance' continues to develop potential through a 'narrative' and 'flow' and in those desirable emotions, such as defined by (Ryff, 1989). It is expansion in new behaviours and in 'a feeling that there is a place in the environment for oneself, and an acceptance of what cannot be changed'. Which supplies happiness from these feelings is from ethical balance as discussed and tested in many classical and contemporary works; (Kringelbach & Berridge, 2009; Ryff, 1989) and Emotional bonding with personalised products (Mugge et al., 2009).

In light of one's goal for membership's reward, a propagation of self-acceptance is acquiring practical and ethical knowledge — for example from a notion of strength in numbers and from a group's ability and skill sets, experience can be positive, cognitively rich and good in a universal way — if only when it is realised in reflection of an experience. This idea purports to craftsmanship in design, which sells and adds value, and elicits all of these including philosophies that emanate from learning and understanding of meaning. Art work for example, which can reveal 'life lessons (life span)' and philosophies that enrich and give significant reward as the art work is unravelled and decoded, (Ryff, 1989). Certainly other recent research quantifies a moment in thought that supports this aim, in the moment of realisation, enlightenment and in the electric sparks of insight that are found in the 'Aha! Moment' (Kounios & Beeman, 2009).

In short there are universal elements to happiness, such as can be defined in a model of romance and in realisation of something that is of intellectual beauty, that are cognitively rich and sophisticated. One is driven to narrative, because of learning, for self-acceptance, power and control. In experiential values that converge in aspects of emotional

attachments to people and products, in craftsmanship and in part-taking in learning, in experiences that hold presence and ‘flow’, which was defined as flow psychology that is what makes you happy by (Csikszentmihalyi & Robinson, 1990; Pieter M A Desmet & Hekkert, 2009). Thus ‘Human Flourishing’ and eudaimonism is a significant and cognitively rich aspect of experience desirable to include in the development of design. Art for example uses an intentional and intended audience in the development of a storyline / narrative — and those aims satisfy a world of interest. In addition, to contemplate which states of mind create long lasting memories valued in ways that go beyond usability, as discussed by (Bloch, 1995; Ryff, 1989)

The sensation of awareness, expectation, lasting impression, theatre and life scaled experience all play a role in a beautiful experience, for example; the desire to have an object made or crafted for personal and individual use, or in an experience that no one else has seen or experienced before, as discussed by (Csikszentmihalyi & Robinson, 1990) (Ryff, 1989), is objectification of personal and special significance, and that can be played upon in design to create value. The collective, mass audience can be considered to respect design as if made by a skilled individual craftsman, more so specifically for them and it is this story line that is insightful and strikes a chord with acceptance and self-esteem and is therefore ethical. The designers approach similarly can communicate the end user into the design and production of an item too, and emulate the craftsman’s touch. Classification of products over the time that is experienced, thus, can illuminate where aesthetics are better absorbed and influenced into the design process. Captivating an audience with a story line about the way it has been made specifically for them and how fine work has been achieved, such as is inferred in the research that led to ‘Fieldwork in the living room ‘Socialness of Things, (S.H.Riggins 1994), can be made through theatre in the chronology and chapters from perspectives in space and time.

Narrative can also define fundamental aspect of interest that fuel happiness, in its ‘event changing states of affair, from one situation to another, contain at least one unified subject, in a temporally ordered, casually related goal directed behaviour, constitute the sequence of problem solving activity with obstacles, possess noteworthy value and tell ability’,(Graham, 2005). A psychological model, perspective or persona can be used as a narrative, and used to reveal or design around interests and philosophies of a common interest and requirement for essentials in life, such as noted in The Application of Personas

in User-Centred Design of Medical Informatics Systems and Services, (Krogstad, Burkow, & Fernandez-luque, 2011).

2.4. Summary

This chapter defines several theoretical resources from contemporary and classical schools of thought, which helps quantify how aesthetics can be effective within the bounds of the complex ship design system problem. The search for concise tools and formulae have led to one component of universal interpretation: Gestalt theory, which encompasses every aspect of ship's external design, as it defines both the overall anatomical function of the ship and the anatomy of associative prototypical geometry. The marriage of classical homogeny, in anatomical composition and narrative, creates a simple range of resources that encompass a rich and fulfilling foundation for aesthetics to take root in ship design.

3. Aesthetic consideration in Ship Design

The majesty of a ship's complex construction, massive scale and sophisticated role can be considered as an 'enlightening experience' both in cultural terms and as a cognitively rich experience, independent of design intent or context to other modern design (Guiton, 1971). However, besides size and stability, naval architecture is attractive, because of its functional value. Criticism and feedback from perspectives of a different volition, are needed to feed marketing campaigns and design strategies that elicit these.

3.1. Appreciation of Aesthetics in Ship Design

Established critics in literature are few and are often naval architects by trade, taking a professionals perspective on design. For example Guiton, the seminal writer on 'aesthetic aspects of ship and yacht design,' in 1971, wrote with a great deal of knowledge in ship and boat design. He subscribes to a specialists rather than a newcomers view, to notions of life or adventure at sea. He does however define a contemporaneous philosophy and suggests that ships characterise themselves through subscribing to the golden ratio, as in nature, in natural proportions that can be defined as attractive. Also, when underway, the traditional 'line' must visually balance with wave form and swell afore, and that clarity of form is supplied through grouping in the 'visual masses' that are relative to consistent focal points. Guiton believes that these classic rules, even if forced into a design as an afterthought or used to decorate with an illustrative and graphical line, (for example utilising rake and the angle of deck architecture), is an agreeable and natural course for the ship design process to take.

Quatermaine, 1996, and Votolato, 2007, take an objective passengers perspective on beauty and aesthetics, usually retrospectively on exemplar models, from their stance outside the ship design discipline. In critical theory that tracks style and fashionable trend, rather than being involved in quality relative manufacturing, they both appreciate style in context to other classical genres of design from the 'hay day', or the 'golden era' of ship design. Appreciation by land-based architects is a valid perspective in most cases,

especially when considering improved facilities that re-invigorate tired ports. The relationship between ship architecture and ports, most pertinent in aesthetic consideration for ships, is an aspect on aesthetics for ship design, however, that only injects operational data and navigation data from ship design into planning for land based architecture, as seen in emerging methodology in port design, (illustrated by (Frederick, Jr, Ret, Development, & International, 2012).

Contemporary writers on ship engineering and design tend to avoid contentious opinion on aesthetics and create short and concise affections to any philosophical approach to aesthetic aspects of ship design (as illustrated in works by Schneekluth H., 1985; Watson, 2002). Other texts from sophisticated engineering design methodology, however, that might touch on sensory experiences, often come from human factors and ergonomic design theory and practice, yet do not enter into debate on how the end user might perceive qualities of heightened aesthetic experience through design.

Opinions currently are amassing in minable data in online reviews, which can create valid influence from independent sources, and in data linked to photographs, interior design and experiences on board, in keeping with minable data in current research trends. Reviews on aesthetics, however, are not in a central, accessible format and it is often an informed account from within the naval architecture discipline, and from those professionals that already have knowledge of the functions of ships and about life at sea, that make the final call. This means that the naval architect or acting group require an interpretive approach, which is also true of academic retrospective, historical and archaeological research and documentation on aesthetics. In decorative adornment, for example, there is often complex and multifaceted associated history attached to semiotics and provenance as with high art.

Other reflections on aesthetics in ship design come from periodicals and glamorous glossy magazines, which promote luxury and opulence in super yacht designs that are often bespoke and esoteric by the very nature of their funding. The Significant Ships Journal also offers minimal reflections on appearances in design, yet is more engineering specification weighted.

3.2. Design Drivers for Aesthetics in Ship Design

Ship design has supplied the rest of the world with a unique aesthetic makeup. This can turn people away from its attractions in times that do not mirror other, more acceptable or more visible, social or cultural trends. In the past we have seen influences from technological advancement that has been led by technological revolution in ship design itself. This appears most notably across the period of both World Wars and through industrial invention and revolution, as illustrated in Figure 3-1.

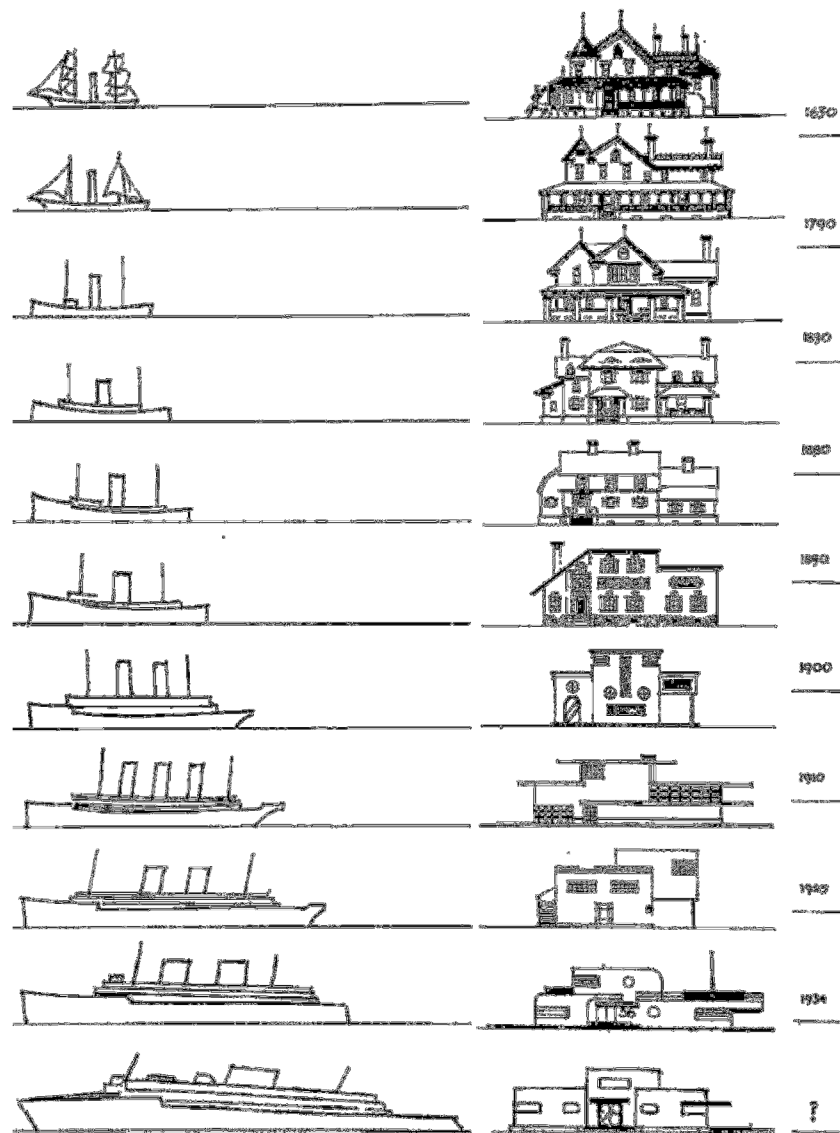


Figure 3-1 : Architecture and Ship design parallels (R Loewy, 1988)

For external appearances and interior design it would appear that, ‘Aesthetics still seem to come very much at the end of priorities for most merchant ships, shipbuilders and ship-owners, that used to vie with their competitors in respectively producing and operating handsome ships.’ (Watson, 1998). Philosophies on quality rarely survive through the iterative engineering biased system. This is why many superstructures are left to become engineering happenings, or left as an afterthought and altered superficially in retrospective design. This confusion in value is further compacted with the complexities of modern living, although ship design is considered as ‘progressive architecture’ by some, (Quartermaine, 1996). Progress in the field needs to quickly address cultural context and social evolution within its specialisation. The complexity has been thrown up by modernity and variance or choice in both continued technological innovation and in the passengers’ desires and needs to be addressed.

When design technology is tied to regulation and standards one gains more flexibility in processing but currently constraints are placed upon detailed and human centred aspects of design. The Goal based regulations set to develop and deliver new classifications around individual technology have been implemented due to the increased volume and variance in technology, and as an alternative to rule based regulations. Evolving standards and legislation present us with the opportunity to do away with certain erroneous criteria. Some features that are not necessarily required, such as bulwarks in areas that are never used are no longer compulsory and there is more room for aesthetics to figure in ship design. The new goal based classification systems, introduced in the past decade supplies tailored classification relative to each specific case in design even if more expensive to employ. These new technologies can bring novel and interesting designs with many possibilities with re-introductions of old technology such as sails in large vessels; kites, solar panels or nuclear power which are all foundations for new aesthetics under goal based rules in ship design, see Hoppe, (2005). The energy Efficiency Design Index (EEDI) and Energy Efficiency Operational Index (EEOI) is a case in point and is currently steering buyers towards lower emissions and lower pace in leisure pursuit. Primarily, through a slow steamer philosophy, reducing speeds by approximately 5 knots (Savitz, 2010). Sustainable parameters will change ideas. For example, redesigns of the hull and the metaphorical block for a different type of buoyancy and prismatic coefficient will make

what appear to be small changes on a clean design sheet, yet can now amount to something big.

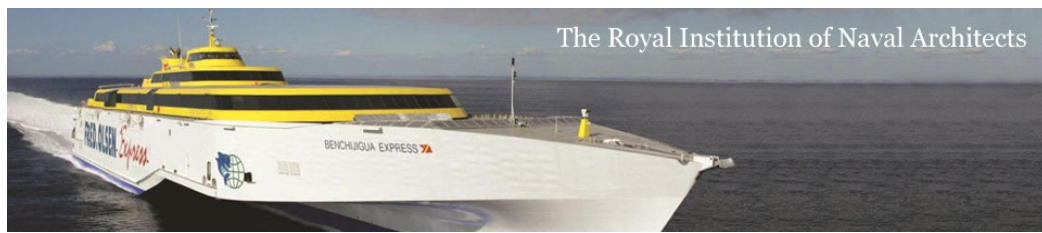


Figure 3-2 : New Technology – with new classification

Top: Benchuigua Express RINA website 10/04/2013. **Left:** SkySails kite powered cargo vessel: <http://www.skysails.info/english/skysails-marine/> 10/04/2013. **Right:** SolarPlanet Boat <http://www.geeky-gadgets.com/planet-solar-the-worlds-largest-solar-powered-boat-03-03-2010/>

Trends in style currently illustrate medium and large scale motor yachts that tend to mimic smaller craft and types of vessel, i.e. those following product design and automotive design. This has re-ignited investigations into approaches and tools for ship and boat design based on tectonics and mass produced forming, as discussed at the 2009 Design and Construction and Operation of Super and Mega Yachts (RINA, 2009), and supported in contemporary works by McCartan et al. (2011) (Cheutet et al., 2007; Ziarati, 2009). This illustrates how cultural context in those smaller vessels, that attract and adds value in their markets, just as with the automotive industry, is pertinent in selling tactics and telematics attached to the cycles of fashionable trend. A trend in which one can react and adapt quickly to change the customers desires. Other research and investigations currently on beauty in the exterior and interior appearances of motor yachts and yachts, in works by

Andrews, (2010); Shinoda, (1997) & Woods, (2006), illuminate a need for consensus on aesthetics and its influence on 'higher fidelity tools', emerging within the ship design discipline (Gray, 2012).

Large-scale, complex design systems and naval architecture still keep aesthetic consideration outside the core design routine and discipline as it is cause for contention, and acrimony in design directives. The research-led and market-led interests do reach the design table through external consultancy. It is, however, a designer-led intent that is dominant in pre-concrete concept procedure, and in post-render application of aesthetic appearances and design, which places responsibility into the hands of the chief naval architect. Currently 'Post Occupancy' seems to be the only published user-led procedure that has been explored for aesthetics and perception specifically in relation to large scale naval architecture, (D.A.Joiner, 2007). The Naval Architect and ship designer's own disciplined approach to installing intent is therefore needed for design to persist throughout change, which means there are no standards to interpretation. This does not mean there have been no design drivers developed, researched or planned for aesthetic consideration. Rather that the design group and design team, who are often disconnected from other streams of fashion and trend, are tied to fixtures of mechanics, physics and means of production instead, and those design goals can be fractured in terms of quality as they come from multifarious levels of quality. The final call on unification on quality through aesthetics is, however, placed in to a role similar to a flag flyer, or craftsman. This comes through a democratised system and concurrent design and development systems, which, in overarching visions from design group meetings and consultation, doctor's cohesion to the overall design, in many cases without external help from industrial and post fix design.

Conversely, simpler and smaller craft can profit from more manageable interdisciplinary aims (Ziarati, 2009). Thus, those that are between the size of a rowboat and the largest super yacht can, within budget, be styled externally like a car above the water line, and the internals can have more influence on the marine platform. The marine designer's or naval architect's techniques focus on one sole end: user's desires and aspirations, which can rule the hearts of the designers, in pastiche styles. For example, in the Corvette, which has a design by the water-ski boat manufacturer Malibu, as illustrated below in Figure 3-3, and in other ways some yachts are the inspiration for models of Rolls Royce and Land Rover, which are at least prevalent in mimicry of a nautical style.



Figure 3-3 : Luxury Power Boats Styled Like Automobiles

Top: Alfa z by Michael Peters <http://www.mpyd.net/portfolio/details.aspx?Project=2&Image=450> (11/04/2013). **Left:** Malibu Corvette <http://hooniverse.com/2010/09/27/hooniverse-motorboat-monday-the-malibu-boats-corvette/> (11/04/2013) **Right:** The Porsche design boat, fearless 28 (done by the product and accessory studio Porsche design) <http://www.fearlessyachts.com/> (11/04/2013)

Recent influences dictate that the market is also using mimicry in natural formations and abstract forms in variations on technologies and crafts such as Starks Giga-yacht, that's appearances is likened to a submarine, or the leaf-like proportions of the Why58 Wally Ship. Designs that explore unification in less complex compositions and systems design, such as can be seen in purposeful stealth boat faceting, become attractive due to interest in abstract primitive geometry, both in tessellated and prismatic forms. The styling of larger ships has tended to mimic popular variation on the smaller and medium scale luxury yachts, creating the passengers' own super yacht experience and simulation of opulent ownership. This experience has, for a long time, permeated throughout the interiors and services in the theatre of the 'cruise', simulating captaincy and elitist membership. Larger ships, with larger budgets and corporate and bureaucratic structure, however, find it difficult to separate the hull and superstructure, or the interior and exterior in the same way. Especially in the common concrete marine platform design process agenda, as has been mentioned, the stringent design criteria for safety and running costs are balanced with returns on floor space, as is expressed by calculations of price per cabin berth relative to layout design and traffic tailoring, (Web.nao.org.uk, 2004). The limits that time places on styling and adaptation to human needs throughout the design process becomes marginalised within the frames of economy and the constraints of the established

design procedure. ‘Appearances become a dispensable luxury to many ship builders,’(Drummond & Owen, 2006). The economies of scale mean that designers can pay a great deal of attention to the primary function, in making it truly bespoke. However the time and effort to develop each individual interior and piece of external styling with the same approach, does not exist. Thus modulation is often focussed on minimising time spent design and so reducing costs in production and build. After all, it could be said that a passenger only sees from an internal perspective, so why consider homogeny in the exterior of a ships design at all?

The many various types of designers and consultants can collectively direct elements of design to mimic interiors in extravagant minimalism, opulence, and luxury reflected in the qualities found in exclusivity. They can work independently of the ship design process. The orbital and intensive design practice, thus, can be disjointed from the development of ocean going technology. For example, cabins and interiors can be retro-fitted and produced parallel to the ships construction, completely outside the core routine – with nominal links to mission objectives, design drivers and intent.

A successful period of delineation between inside and out, illustrates where style and fashion could not be matched between the two. Interiors by Johannes Poppe and the austere exteriors by naval architects AG Vulcan Stettin, in the SS-Kasiers-Wilhelm-Der-Grosse, are a clear reminder of how exclusivity and class orientated design from the Victorian/Edwardian era was encapsulated by technology that was immune to its division through design. The contrast between luxury and high functioning technology was actually a complimentary partnering, in what is considered beauty by pragmatic design. The divide between land-based interior design and state of the art ship design exteriors a far cry from contemporary genres and styles in this delineation, which, in passenger crafts at least, have both moved towards austerity their multi-disciplined design.

3.2.1. Introducing Parameters of Aesthetics into modern Ship Design

Sketching by hand in the concept stages of design is still used and seen as the most expedient process for aesthetics to permeate into the ship design process. It is currently used alongside computer aided design (CAD) to reflect on visuals at stages that might warrant generation of a total solution envelop, and in visuals that might help with visual representation (Bandula, 2002). A designer can visualise iterations of a designs form next to, or on top of, the concrete concept of the marine platform, as technology and production criteria evolve throughout the process while still referring to initial sketched concepts throughout. The use of CAD at this stage is not tied in with the ‘Sketching skills, which are difficult and exclusive to the Ship design field, and which can achieve instinctive harmony and balance’ (Schneekluth, H. and Bertram, 1998). The designer carrying knowledge in what makes a boat beautiful, can use ‘tacit’ skills, and extend sketching skills to a 3D investigation of layout in procedural skills that do not translate or which differ to 3D sketching skills. This keeps separate and in line parallel combinations of 2D and 3D concrete concepts that persist.

Currently ‘Aesthetics’ in ship design is commonly meant as the alteration of the superstructure and exterior appearance, and is commonly referred to as ‘styling’. After concept stages and preliminary calculations, the designer is supplied with a great deal of opportunity to develop external variety above the waterline and in a way that fits the function of its role in the vessel. This means maintaining a relationship with the hull or sea keeping technology, through the envelope provided by those initial calculations as discussed in greater detail by Andrews, 2006a; Gillmer, 1984 and Watson, 1998). Thus arises the opportunity to accentuate elements and features of design architecturally or graphically in visual elements that might be added, rendered, or smoothed over, especially in the last stages of the ship design process. A false line and graphic harmony between the parts and are elements of ‘skin deep’ visual appearance, that can be seen as superficial on closer inspection, as it is intrinsically so. This rendering has been the standard to address these elements, which has proven to be an effective aspect of post-additive styling as illustrated in Figure 3-4 top right, in the Industrial Designer Lowey’s silhouette design who shows a great degree of freedom in his development of the streamline style of the thirties, on top of a marine platform. In design drivers that would otherwise struggle, especially in

larger projects, maintain a quality or fixture to the practical intent of the vessels design, as the marine platform and subsequent elements in the primary physical design evolve.

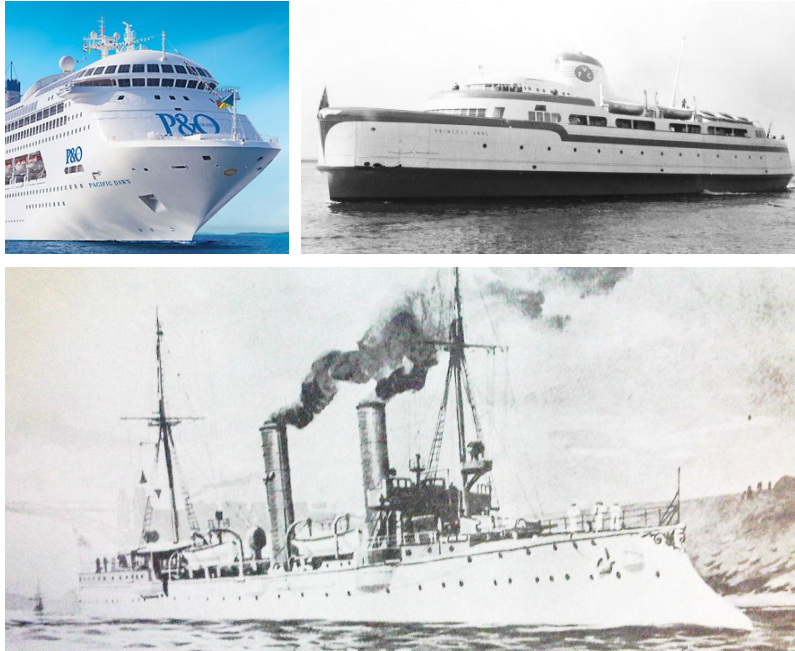


Figure 3-4 : Examples of ship styling, over the last century.

Left: Architects Renzo Pianos Dolphin inspired Pacific Dawn (Princess & Piano, 1991), illustrates anatomical structural rationalism. **Right:** The Princess Anne, Styled by Raymond Lowey the Industrial Designer in 1933, who ‘was given the task of restyling the ‘Princess Anne’s’ silhouette and its interior design. The ship was launched in 1936 with outstanding success’. Notes from sale Lot 9708 – christies.com. (Lowey’s distinct streamlined style is evident). **Below:** Additional decorative acanthus scrolls, and frons in the fine gold filigree of naturalistic form, on a reverse bow sprit of this German light cruiser 1901. Showing simple additions and bolt on decorations were still considered in styling until the early twentieth century.

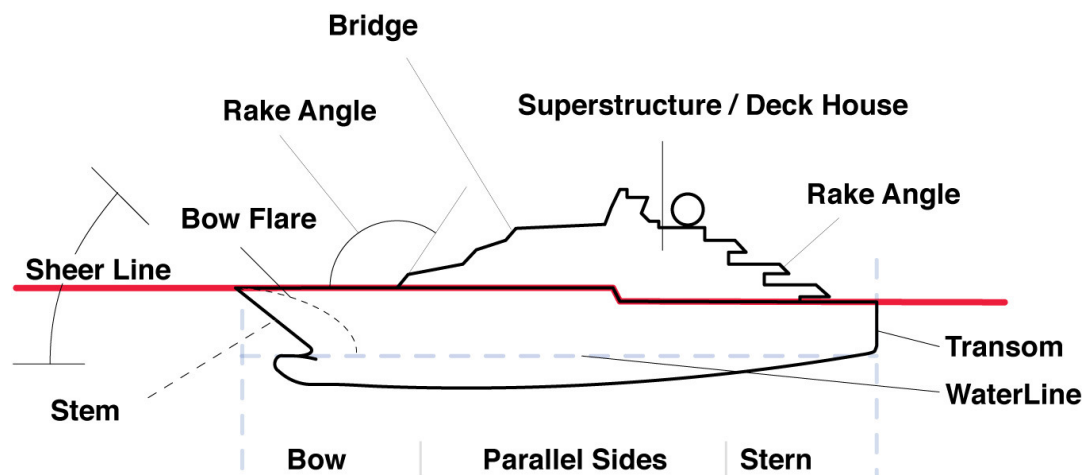


Figure 3-5 : Traditional Features of Aesthetics Consideration in Ship Design.

Methods to achieve an exterior appearance for the purpose of appealing to a market, owner, or onlooker, use traditional features: in the line, bow flare, sheer line or bulwark and rake, as shown in Figure 3-5 in initial formulation of appearances. Details that are all prominent features, and which include transom termination and design, make a ship or boat distinctive, or can be accentuated to such effect. It is primarily those features that form the marine platform that create structural points to attach the upper structures are structural partitioning such as the transverse bulk heads or transverse frames as seen in Figure 3-6 below.



Figure 3-6 : Frames and webbing visual,(one2three.com).

The figure above illustrates how webbing and stiffeners have a relationship with the superstructure portage, windows and aesthetic features. In smaller crafts they fit with the transverse frames and the underlying structure creates the overall form and visual aesthetics of function with, as example, dynamic lines that stretch the super structure across the boat with smooth continuous curvature across her length. With designs that are influenced by economies of scale, and might be lengthened or stretched to increase payload, there can be disparity in what are the perceived lines in an attractive or dynamic form. As the partitioning can be out of phase with recognisable structures, and similarly out of phase therefore with calculations of preliminary design, disparity can exist between function and form.

Ships transverse bulkheads do not always match other frames and vertical structural architecture. However, they do define major architectural features of the structural integrity and follow these, rather than subsequent super structure columns and

structural design: the appearance of complicated and organically influenced sculptural parts above the water line. Linked with underlying structural features, are becoming common place in ship and boat design. The design and production technologies that enable such aesthetic appeal, make organic and sculptural superstructures available within the same time frame and at the same cost as the comparable prismatic and primitive parts. These can help ships that have sister ships and follow in style through design DNA, (Bandula, 2002; Drummond & Owen, 2006; Hage et al., 2006).

The superstructure can use parametric computer aided design to test various configurations. Currently, however, it is widely considered a risk to commit design solely to a computer so primitive directives are upheld by the designer and design group through stringent legislation and direct calculation tools from governing bodies. Architects and stylists outside the core ship design procedure can change the layout of the interiors and, to some degree, exterior elements around these features. However, requests for major reconfiguration of internal architecture, for example to achieve large open spaces by moving internal pillars, can require a measure in the effectiveness of the overall beam in elements linked to first principles. This can be feedback from calculations to say that this change can be absorbed if change is required but could be a great undertaking, that in terms of knock on effects.

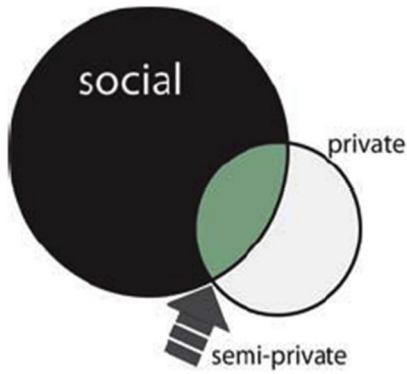
Validating and authorising mechanical options are linked to interiors and human centred aspects of design, (K J Rawson E C Tupper, 2001) and what can be considered concrete elements of the complex design system, such as plant room and fundamental structural features, define where large open spaces go and where passenger flow can be streamed and are often defined as unchangeable. Constraints like this define the solutions available to the naval architect and consideration in the connections between architectural aspects and features of design within these, promotes useful elements such as 'line of sight and corridor widths to bring architectural into spaces where possible', (Watson, 1998). The opportunity for aesthetics to influence radical change in these aspects of interior design, and thus exterior form, is not common and may only come from the passengers contextual interests with state of the art means of production.

The common annual / biannual time scale of the ship design cycle is one that means aesthetics can be left behind or be easily be dismissed next to other higher priorities. Drawing these multifarious systems of design and directives together in terms of styling

must use actions on parameters collectively in a parallel process with other routines in design. This is often orchestrated by the design team and overseen by the design group, (Gillmer, 1984) and can use parametrically driven design and concurrent engineering, amongst many various methodologies and techniques. The strict integration surrounding the engineering path of each ships' systems design means design philosophies and methodologies are often used at a different stages of evolution unlike other disciplined approaches and fields of design. Any connection between these design drivers is, however, rarely integrated with the primary problem-focussed agenda of 'improving the transportation efficiency' which is largely the responsibility of the design group as a collective, and therefore might not be directly linked or in direct contact with the Naval Architect's calculations or formula, (Hage et al., 2006). The superstructure and/or deck house, is considered in a secondary development envelope, underneath the priorities of the hulls domain.

3.2.2. Human Centred Design in the Layout Stages

Land based architecture has long used coloured lighting and audible sounds to express moods and to pacify or excite occupants or passers-by. Linked to instinctive and salient aspects of perception in engineering for sound and lighting effect, it is also now prevalent in naval architecture. Yet naval architecture appears only to achieve an operational and effective level of quality as standard within the cyclical and close design process of iterative design. For example, 'the level of both speech intelligibility and acoustic privacy must be improved' in progressive theory for improved human centred design (Savvides, 2010). Ship design is catering for practical operation, comfort, mental well-being and ergonomics and can be related to budget and the theories in the ships engineering briefs. These do not often extend to pleasure or emotional response in experiences such as 'aural and thermal delight', (Broadbent, 1973). Focus on 'where the more basic needs such as food, shelter and physical protection must be fulfilled before a human can afford to feel higher needs such as self-esteem or sense of belonging', is currently placed in a process that focuses on extremes, yet can bear fruitful knowledge in terms of aesthetics, (J. Thompson & Sjöberg, 2010).



Simple social, private and semi-private models exist within extremes in consideration for the naval architect, Figure 3-7. This indicates signs that elevations of practical utilitarian, ‘physical privacy’ and ‘mental privacy’ in experience centred design are emerging in ship design naturally, (J. Thompson & Sjöberg, 2010)

Figure 3-7 : Social, private / semi-private models

These areas of the discipline are emerging with tools and methodology from other approaches to experience centred design, for example, in architecture, and its specifically honed schooling on philosophy and environmental aesthetics, including outdoor living, the interior and exterior detailing, if not by proxy, geometric elements of appearances. What is delivered to the process is time and space to experiment with spaces and functions within the craft that ultimately define those areas of interest from outside.

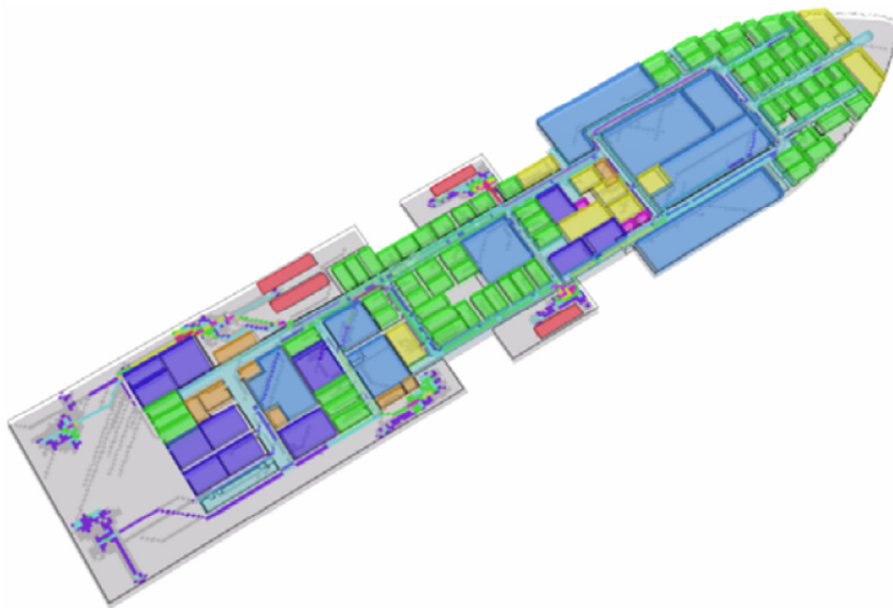


Figure 3-8 : Possible output of maritime EXODUS and SURFCON

This building block design model becomes part of the integrated systems approach through its hierarchical modelling technique – in parameters that can affect the overall design, and within the overall solutions envelope. Hierarchical components were used in this early mock-up as per: Classifications, crew types, cabins, access, lifeboats, stability, human factors, entertainment spaces, catering spaces and user defined specs that were contained within a concept model. Which infers, it is emerging, design for city and architecture status, in a ships design can be achieved, through a totally integrated and heirarchical 3D modelling design system.

According to the statutory computer simulation of passenger evacuation on the RINA website, interests held in connecting the social sciences and integration of humanities is prevalent. The integration of human factors, operability and personnel movement simulation, into the preliminary design of ships utilises the Design Building Block approach (Andrews & Pawling, 2006; Casarosa, n.d.). The connection between the social sciences and humanities within the core ship design process is highlighted in the state-of-the-art report on design methodology for ship design 1997.

The IMDC State Of The Art Report on Design Methodology paper addresses crucial requirements for the progression of the design synthesis in ship design, and compares strategies with humanities and the arts. Archer's pyramid, 1980, separates culture from the humanities and the science-based cultures. 'Useful arts' are described next to the design model, giving indications of scientific measures of art and universal laws of aesthetics that are being considered for scientific and engineering use within ship science. Showing key stages of redevelopment of humanities within engineering, this model illustrates methods exploring deeper into human-centred design. Making the broader exploration into aesthetic philosophies for ship design pertinent and contemporary. The useful arts theory, however, is currently not integrated in a model for ship design, 'thus, in considering design methodology, it is obviously the case that the concerns of designing for operation must figure not only in the objectives of the design, but within the methodology to be adopted' (Sen, P.; Birmingham, 1997).

Such human integration systems (HIS) can influence better design; either in design that facilitates reduction in crew sizes or in clever design to increase passenger numbers. It is, however, yet to be seen, as an influence on design. Human Factors Analysis, The Shipboard Environmental Department, the IMO and thus, the public as a whole, benefit from 'integration in seven technical domains of human factors engineering, manpower, personnel, training, habitability, personnel survivability, and safety/occupational health.' (Hemmen, Dana, & Stevenson, 2009) These use simulation and real time experience to develop experience-led design. The individual designers, engineers and forces from within the ships bureaucratic structure seek to elevate practical human factors to effective and performance-enhancing products of design, which is evidenced in progressive development outlying processes of ship and port design (Bronaugh, Ret, Development, & International, 2006).

The current passenger ship design synthesis draws together designers from many disciplines to achieve interior and exterior aesthetics. Using imported skills, such as seen in Oasis of the Seas, have used BG Studio International, and Architects Gensler on retail interiors etc. (Caribbean, 2003). Passenger ships often orchestrate experiences on board and gauge commercial design around data formed from design that uses price per passenger berth as its parameter on experience led design, (Web.nao.org.uk, 2004).

The naval architect can act as an overall architect making design comfortable as in many other fields of design (R. Payne, 2008). Yet this is a tall order for every aspect of a floating city. In Cruise ship design there is a clear delineation between exterior and interior space design and ‘the theatre of a ship is being designed with flexible high tech equipment, which can supply mood lighting and audible aesthetic appeal’ (Savvides N. Feb 2010). These, like domotics in architecture, are aspects of personalised narrative, i.e. direct marketing using artificial intelligence, which can even alter environmental elements of experience. An example is using the spaces provided by the initial calculations from first principle with partitioning and then layout relative to safety and evacuation.

Integrated Design and CAD visualisation is becoming fluid enough to enable more time in the design stages to allow intensive use for interior aesthetics, especially with improved parts and production turn-around. Through part management and the integration of the supply chain, such as unravel in design methods as ship design, methodology evolves (Hage et al., 2006). ‘to address the human interface, investigate large-scale ergonomics, will shortly enable a holistic interrogation of the concept’ (Andrews, 2006a).

What is emerging is a correlation between behavioural characteristics in safety modelling and social modelling, as digitised 3-D physical models can currently run complex virtual simulations as if in real time. CAD can be used for time based analysis that reflects a true to life operation and object based modelling that allows for interactions between simulated objects and human operators. Also, discrete event simulation (that uses the behaviour of the objects for accurate calculation of operational scenarios, uses a logical sequence of events rather than the effects of time, which is implemented in ‘Human Factors Simulation) can be ‘conducted with the introduction of mankind modelling with behavioural algorithms that closely match human movements and constraints’ (Bandula, 2002). 3D visualisation can be used to simulate the operations of sense of interior perspective. Layout validation offers staging in all modes of aesthetic consideration, ‘to give the design reliable memory from the CAD renderings’, and ‘significant three

dimensional and functional interweaving between the components and on-board activities', is posed as progression for operational aspects of design by Andrews, (2006b.)

Computer systems aid the design process, supplying more time and ability to visualise or embody real-time developmental change. For example, particular elements of evacuation can lead and elevate social and cultural investigation, especially for a purpose it was not devised for, that is creativity in the development of interiors and outdoor living.

3.2.3. Organisational Aesthetics in Ship Design

The romantic sea shanty and the organisational aesthetic is something that builds camaraderie in colloquialism and social cohesion, which can extend the mundane to energised and focussed work, leading to mental wellbeing, such as shown in (Peter, D, 1998). Where humans' natural ability to adapt and survive and thrive, even in harsh and testing environments, is used to improve working and play conditions. These elements of the organisational aesthetic, are prevalent in human factors design and in aesthetic consideration, as the concepts that they cover – are intertwined, just as the interior and exterior of a ship are also intertwined.

Emerging around practical work and tradition, the use of such scenarios for improvement of practical and workable aspects of design can be transferred through feedback, such as designed by (Drummond & Owen, 2006; Gharibyan-Kefalloniti & Sims, 2012) and in specific task research such as seen in (Comperatore, Rivera, & Kingsley, 2005) or as exemplar in design coming from leadership and the super organism of a ships' crew, (Gharibyan-Kefalloniti & Sims, 2012). Using design to elicit biophysical reactions that come with teamwork or solitary work, human factors and human-centred design can thus elevate from minimum condition to optimum scenarios pursued by (Dobbins, 2011; Griffiths & Mack, 2007; Liu, 2010b), and by which practical design and functionality can be bent towards heightened sensory experience, fitting organisational aesthetics to situational designs.

3.2.4. Totally Integrated Systems Ship Design:

Heterogeneous knowledge as a model design system for complex design systems is a theory that aims to share data and use the properties from that data to improve concurrent elements of design (Taylor, 2013). This is important for aspects of aesthetics to be absorbed for a better understanding of representational data. How this data can move between systems and be compatible as a parameter relative to initial calculations is only offered as engineering first principle data or in aesthetics that permeates into other fields of design. Using the hardware and software when considering external aesthetics is currently a complex procedure in the recalculation of principal dimensions, which are not linked to any aspect of detailed design (F. Mistree, W.F. Smith, B. Bras, 1990). Heterogeneous (disparate) models of a design system are especially obstructive for the total integration of aesthetics and human centred design currently, as the quality of beauty aimed for is primarily to do with unity and homogeneity.

Software is now becoming more than computational algorithms alone. Technical support purchased as part of the license includes specialised software and specialists to help integrate aspects of design into the system, especially in ship design. CAD systems and design methodology from product, industrial automotive and aeronautical design, all use hierarchical modelling systems linked to production technologies, such as NX and CATIA (digital projects). These can be used in modelling accurate progressions in a fully integrated systems approach, such as discussed (Catley et al., 1990; Oxman, 2006). Notably DNV seems to currently be the leading integrated system to enable the Naval Architect to have connections in all directions of the ship design cycle: 'Marine-Solutions may be applied to shorten the time and increase the quality of mid-ship drawing approval', (Rasmussen, 2004).

3.3. Summary

This chapter reviews the current technology in ship design, relating to aesthetics and experience centred design. The current state of the design field suggests that components can work together in partially or totally integrated design systems, by drawing together disparaging and complex elements of the ship design city model with priorities of safety, transport efficiency and economics. The naval architect can now address principal aspects of safety, design and construction, alongside people's movement, behaviour, sensory or aesthetic experience and thus exterior appearances, because of strict constraints and parameters on the design solutions envelope. The outstanding challenge identified for the total integration of aesthetic properties into the ships engineering biased design synthesis, is a compatible language, which can help develop design directives and that can add values within the stipulated constraints, without distracting or diluting the established concurrent engineering routine.

4. The Dual Complexity in Aesthetics for Ship Design

The translation of the client or architect into a ship, is today less to do with artistic intent, is more to do with economies of scale. Ideas currently have little time to evolve within the iterative, evolutionary and core design routine and those desirable societal, ethical, and aesthetic experiences, cannot always emerge from the concrete structural rationalism that current 'direct calculation tools' and classification rules might define, (Brown & Kerns, 2010). The current focus on 'multi-objective optimisation' might be reducing investment and freeing up time for experimentation, for example. However this system currently cannot truly be sensitive to aesthetics or experience in design, as inputs from this field are simply too vast and complex at this time.

After many years of refinement and a systematic removal of conflicts in the design process, ship design has become an exemplar of a 'complex design system' ready for a re-introduction of aesthetics into its core routine. Aesthetics has entered the heart of the discipline, a 'more substantial methodology' is being considered rather than relying on external and disconnected consultancy (Sen, P.; Birmingham, 1997).

In practice, integrating all parts of ship design together is more complex than in other fields of design - constraints from ship yards classification direct measuring tools, and even maintenance and repairs place limitations on what can be achieved. As constraints come from outside of the ship design system there is a complexity in the process that can only breed an austere result. The '20 to 40 years ago, in which it was possible to encompass the methods of designing a ship in a single volume' (Gillmer, 1984), is now not only science that dictates complexity but also science that is linked with overarching physical engineering and hierarchical legal constraints. The idea of a dictatorship within design thinking is not always profitable, and the introduction of a totally integrated systems concept is a theory that can glean innovation from technology and can place concepts design back into the hands of a theoretical flag flyer or underpin a design philosophy to control and direct all aspects of design. Aesthetics, if not from purposeful intent, is currently being worked back into the process of a ships design due to pure proximity to integrated engineering parameters. The softer sciences can be made accessible as design inputs via integration from recent and upgrading technological advancement in a totally integrated systems design system (Hage et al., 2006).

Ship design is currently primed to systematically absorb the human focussed aspects of design back into its highly evolved and sophisticated discipline and is becoming more aware of how experience centred design can influence the functionality and behavioural aspects of efficiency. However, augmenting change in iterations of the primary and problem focussed agenda of safety, efficiency and cost makes progressive development of attractive, ergonomics, psychological and behavioural elements of design problematic. The problems are twofold: firstly there is the problem of defining beauty and secondly there is the complexity of the design criteria, production and technology of the integrated ship design process. Research into human factors for ships, and beauty in the exterior and interior appearances of motor yachts and yachts, in works by Andrews, (2010); Shinoda, (1997) & Woods, (2006), illuminates a need for consensus on aesthetics and its influence on 'higher fidelity tools', emerging within the ship design discipline (Gray, 2012).

It is possible for aesthetics to be an influence if it adds and does not subtract in terms of effort and reward. These ideas need to be integrated to enable a fluid transposition of such valuable data up and down the design stream ensues. The objective is progression for aesthetics and experience centred design in the ship design field, (Olsen, 2000). The future of ship design needs to be infused with 'autogenetic design theory' or 'intelligent design' to unify complex organic objects and products, (Vajna, Clement, Jordan, & Bercsey, 2005): Or that are integrating manufacturing and life cycle information into the product model in smart, intelligent or bio-mimicry design, (Oetter, Barry, Decan, & Sorensen, 2004). The addition of a scientific and adaptive approach to aesthetics will aid acceleration toward an ethical and human centred design approach.

4.1. Engineering Aesthetics into Ship Design

The relationship between libraries, object based components and items in the supply chain - create space to develop superstructure and adaptable features of geometry above the waterline. That is from semantics and language based descriptors, such as defined in approaches for automotive design discussed by Cheutet et al., (2007), rationalisation of this adaptable geometry, in properties that can help visual representation, can usefully be visualised in CAD, to trick the eye in aspects of detailed design by using material mapping, as it is in the games industry. Referenced, repeatable objects and ideas that need to be stored in files rather than in random access memory is a process that mimics the way the

mind prioritises visual items in the brain, (Alvarez, 2004). Supplying visual representation of a concept earlier on in the design process, before it has been finalised, and just as it the brain processes through shape recognition - in associations between top down and bottom up cognition, see section 1.1.1 This is useful and progressive technology for engineering aesthetics next to first principal dimensions, yet however does not detail in the same way as building the ship for real and cannot define the finer details of elegance or sophistication, required to define qualities such as aesthetics.

Projected to enable adventure in surface and curvature continuity or adaptation of complex three axis (G3) surfacing, design details can now be linked to structural and simulation data through optimisation, as noted by (Goel, Rugaber, & Vattam, 2009). The commercial cross platform design tools that are available to the Naval Architect, and the design team currently only support concrete procedures linked with the stringent use of classification and direct calculation tools. State of the art technology in this area of design is encouraging in development of accurate 'representational data' transferal between systems of design, and actual production is promising, and as discussed by (F. Mistree, W.F. Smith, B. Bras, 1990). Ultimate efficiencies in communication between complexity and sophisticated function that requires quantifiable data from all aspects of design is emerging in valid formats. It also requires the abstract syntax and semantics specifically required to help aesthetics influence surface architecture, and it is this part of the synthesis that is the focus of this paper.

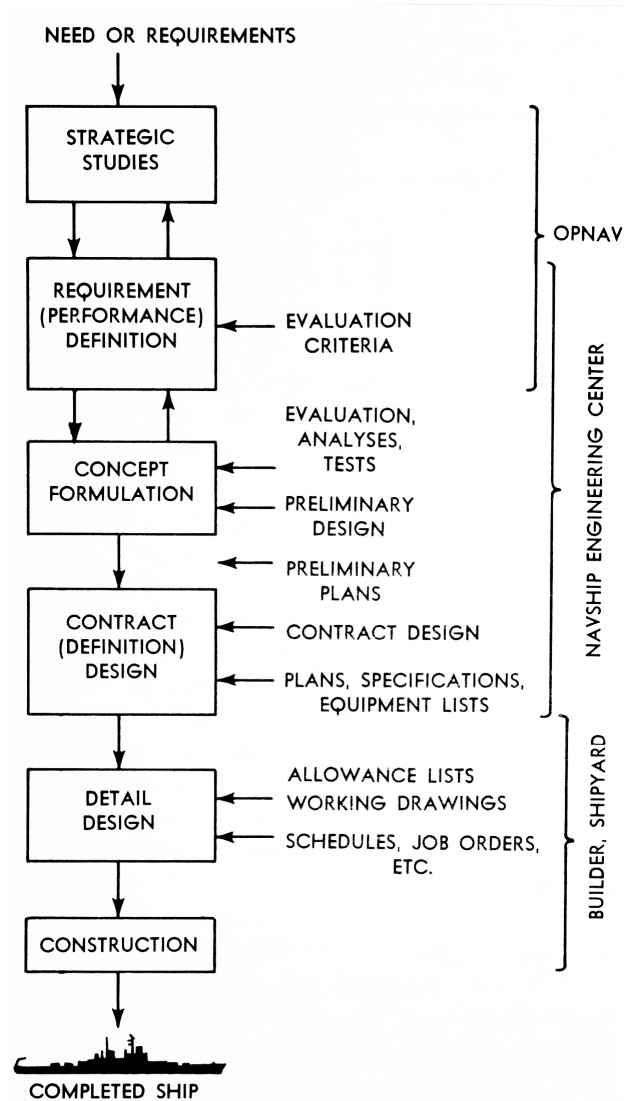


Figure 4-1: Gillmers, Sequential Steps in U.S. Navy Ship design, (1984)

In Figure 4-1 Gillmers Sequential Steps in U.S. Navy Ship design, illustrates the current and traditional ship design flow effectively. Importantly the sequence of events has ‘preliminary plans’ as the central feature, and which has been placed after the concept formulation, after the iterative ship design cycle is over. From this point forward design only flows toward a final solution, which shows design inputs from interior layouts have no influence over the core, or can add to any concept – and surprisingly cannot even influence a ‘radical new concept’, as it cannot act upstream from there. Influence in terms of human centred design are presenting themselves to the process in works that infer this area of design could be absorbed into ship design Andrews & Pawling, (2006). Aesthetic influence therefore can only currently come from a clean sheet in the design synthesis, which it is suggested here is a flawed approach.

4.2. Methods for Synthesis of Aesthetics into Design

Currently, approaches such as Kensei Engineering, Taguchi, Ambient Intelligence, and Quality Function Deployment, that are quantitatively driven, or research based methods of influencing end user data into other fields of design – which can be used to integrate the end user into complex design system. There is still however a requirement for pre-non-numerical interpretation and theory led processes that can often develop around each field’s specialism, and in knowledge that must develop over time to complete the processes with a connection to the end user. For example, Kensei engineering that uses ‘relative vocabulary’ in domain and space synthesis, is method for collating relevant data in a structured approach for the end user and product — yet does not define this approach as a method focussed around cultural interest or appreciation, but rather as a statistically and research based approach (Kuang & Jiang, 2009). Similarly, TAGUCI, QFD, and Ambient intelligence methods are all frames for interpretive modes of appreciation that still require a focus—on an object or experience placed as an interest and in a process, i.e. to discern the significant and valuable elements of experience relative to social context. This is often the problem in the field of Aesthetics, which is indefensible when relative to personal history. However methods do exist in this field and elements of research and development and data processing using the Thurston scale, social distance scale and the Likert and Factorial Scales do present a process, yet still require interpretive measures.

The challenges set up for the creative and design-conscious naval architect, is exemplified by the statement ‘users often say one thing, do another and often feel something else’ (McDonagh, Denton, & Chapman, 2009). The complexity in categorising and cataloguing, positive aesthetic experiences, relative to, or associated with subjective and personal history, i.e. romantic rather than rationale on pleasure, emotion and enjoyment (Reich, 1993), can be contended definitions of perspectives that can be off putting. These significant and sophisticated aspects of personal experience, those that are both valuable and useful in design, yet are often avoided. The common characteristics that can be used to elucidate personal and subjective value are essentials and universal aspects of thinking and experience, can link and can be the source for personal experience in ways that would otherwise require psychoanalysis and detailed personal investigation. The ontological (introspective) reasoning required to elucidate essential elements of aesthetic experience is intelligence, and some would suggest a creative skill, in the use of psychology and philosophy. In design skills that clean up ambiguous feedback and penetrate through

sensory perceptions, that in other fields of design have developed technique in, yet currently is not a part of the ship design discipline.

Reducing complexity in aesthetics to valuable systemic inputs for design from notable rationales and from the creative industry seems pertinent. However context may take a rationale too far away from a useful connection to the context, market and subject matter of ship design, which can bear fruits in theory and procedure. For example many car manufacturers, use a concept of beauty to encompass aspects relative to quality of life, mental wellbeing, and feelings, such as social belonging or lasting memories in the scale of one's life, and in emerging researchers work in ship design, (Gharibyan-Kefalloniti & Sims, 2012; J. Thompson & Sjöberg, 2010). For cars however using focussed campaigns and models of cars that appeal to markets and social demographics is researched in house with ease. Innovating details of design that are attached to ergonomics, haptic feedback and tactile elements of controls, but also in sculptural external appearances, that sometimes are not economic or aerodynamic, rather ego-centric, or additions to function in 'Supra Functional' fashions such as discussed by (McDonagh, 2011).

Extending elements of utility to aspects of novelty or intrigue onwards to 'sensitively considered aesthetics, regarded as personally meaningful in ways that go beyond utility or monetary value,' (Csikszentmihalyi & Robinson, 1990) and can sell a car and make people gain emotional attachments due to inclusion and membership to that guild or party. This craft of fashion that can be considered 'valuable partly because it recovers a place for money in thinking about design' (Mcgee, 1999) adding experiential value which is often secondary as a priority in engineering and austere design, as it requires time and control to influence them into complex design systems. The philosophical domains - realms and worlds that structure appreciation of experience, can help filter ambiguity and misdirection from feedback and end user interpretation, to purposeful aim. For example a car styled on speed or comfort are areas of aesthetic perception composed from perspectives and interests, and can be combined in various ways to school thought in engineering and design that influences qualities into engineering as experience centred design.

4.2.1. Objective Visualisation / Spectator Ab Extra

The elements of design that are often ambiguous and off-putting, are often relative to the desires of a group of people, a language or buried in an individual's personality and mind. The elucidation of when and where combinations of sensory experience become significant qualities, such as pleasure, happiness or beauty – has more often than not been the creative designer's domain. And until such a time as cognitive sciences, neurosciences and shape recognition are able to synthesise beauty into a predicative measurement system, such as suggested in techniques by (Kringelbach & Berridge, 2009; Salimpoor, Benovoy, Larcher, Dagher, & Zatorre, 2011), designers, especially those focussed on a specific set of people or interest, must interpret facets and features of feedback next to a catalogue of verified, validated, and contemporaneous insight – insight that may very well be informed by the cognitive sciences. However, ultimately it is judged with introspective measure, next to one's own reaction and reason.



Figure 4-2 : Complexity in the perception of a boat.

Being able to interpret aesthetics in an unbiased way, looking at something from the outside in, that is in the Latin: 'Spectator Ab Extra', can be compared to Aristotle's critical role of being 'Dis-interested' as discussed by (G. C. and L. J. Cupchik, 1992; Leder, Belke, Oeberst, & Augustin, 2004) and (Parsons & Carlson, 2008). This reasoning classified with unbiased self-examination can be explained in comparison to the ancient 'disinterested role', which can enable the 'non-specialist or amateur to make a significant contribution to a problem-orientated intellectual decision and that can equally enable the

expert to be unbiased and objective’(Csikszentmihalyi & Robinson, 1990; Parsons & Carlson, 2008). However, this is only a literal and laconic or concise introduction to a contemporary, culturally focussed or collective philosophical approach to objectification, such as delivered to product, industrial, and architectural designers throughout education and experience and in practice in their practiced creative roles (Ö. A. C. Akin, 1996; Krogstad et al., 2011). The designer must approach perspectives on the aesthetic problem by considering object, item, or experience from another’s perspective. ‘Why is it meaningful?’ ‘Why is it meaningful to one individual and not to another?’ in pertinent questions to be addressed and thus theoretical resources from various perspectives, can be ways of looking at a problem, walking around a problem, and attempting to see it from the viewpoint of another. The feelings and emotions that are attached to romantic notions and to personal aspects of experiences can then be elucidated in realisation of the moments of collective or universal reward. The collective, essential philosophies on beauty and aesthetics thus can supply knowledge in subjective moments and in where special and personal moments happen crucially without getting bogged down with ego-centric, personal history and miscommunication of emotions in interpretations for design. This is objective and chronological visualisation, or in philosophical terms: Ontological and temporal worlds, (Mccarthy & Wright, 2010; I. Wright et al., 1996; P. Wright et al., 2008). Insight to significant value that cannot be discerned with an algebraic approach, such as in investigation of personal history. Psychology needs to take a philosophical stance on the subject, and for design it means choosing modes of interpretation based on specific sets of pertinent interest.

It is important in visualisation to rather than disable subjectivity and become ‘detached’ or ‘neglect’ the situation, as discussed by (Mugge et al. 2009; Csikszentmihalyi & Robinson 1990). A culturally-focussed objectification needs to crucially be both rich and contemporary. For example, consider how one might feel when walking out of a narrow aisle with a low ceiling into an open space and a crowd of people. There is a need to take an ‘interest’ and ‘attend’ the idea of interactions with the crowd. Rationalising how one might feel and enjoy the situation in a cultural way, even if one does not like being in a crowd or is agoraphobic, and that objectification for a collective approach to design is insight to another’s point of view, rather than a reduction of one’s own opinion, (Dutton 2011; Reich 1993). In the case of ship and boat design the appreciator must be able to take an unbiased view on the situation. Judging around functions or ‘mechanisms’, e.g. comparing the physics of sea keeping technology or the comfort of a habitat and the perception of both in a way that is from a concentrated and collective view, that is from

the passenger’s perspective. Gleaning inspiration from the end user and drawing out desires and needs – which encourages spatial, colour, temperature and to ‘order in the ways of living’ that can elicit pleasure through design (Broadbent, 1973).

Table 4-1: Interpretive approaches to interest and attraction.

	Product	Automotive	Architecture	Art	Ship	Boat
Theory-based	Raymond Loewys Most advanced yet acceptable. (MAYA) (1930s) Verz/Bloch Prototypicality,	Streamlining (1930s) Dodge RAMs distinct physiology (1950s) Tectonics , (1990s)	Geometric abstraction (1990s). Suprematism. Fragmentation, flotation and distortion. Functionalism. Minimalism. Modernism (1900s).	Cubism , (1900’s) Impressionism - Pointillism , (1870s) Realism , (1930s) Surrealism , (1920s)	Art Deco , (1930s) Jelly mould, and homogeneity of form through streamlined graphics.	Wally (Luxury) 1990s Futuristic and military styling . Mirroring trends in fashionable architecture and automotive design.
Research-based	Behaviour observation , (1990s). Theatre/Time 4D Biophysical monitoring and brain scans .(1990s) TAGUCHI(1960s) FMEA (1950) KENSEI Eng. (1970s)	Ergonomics through research and real time developments. Saab dash board/ seat. Toyotas QFD (1966) Quality Function Development.	Environmental Psychology , (1960s) Recently using brain scans and monitored biophysical reactions, to changes in design.	Tends towards subjective designer based and theory led approaches to interests held in the observer.	Clients reflective experience, influencing the captain and design group. Through marketing data, socio demographics. Post occupancy (Woods).	Real-time and linear developments in design through human factors and ergonomics. Similar to user led tailoring by the client. E.g. MOD, led.
Designer-based	Vitra futurism and ergonomic structural rationalism in furniture for airport lobby halls. (Mass products becoming designer signatures of brands and styles).	Tends towards corporate design in philosophies, that equal theory led approaches in designer products. And in some prominent brands such as Porsche.	Hadids, homogeny , (1990s) Calatrava, skeletal (1990s). Lloyd Wright atavisms of world architecture (1920s).	Proportions of handsome figures in Giacommetti sculpture (1900s) & Hirsts interpretation of economic climate, diamond encrusted skull .(1990s)	Loewys Streamlined aesthetics (1930s). Super liner clipper bow. Vladimir Yourkevitch , (1931) Renzo Pianos’ dolphin inspired Crown Princess (2006)	Wally luxury. Freivokh Giga Yacht (2008) CAD reverse sheer and submarine style bow) Chevrolet, Corvet, Porsche , (2010).
User-based	User experience design (1990s). Tailored clothes and crafted hats and jewelry. Supply and demand in fashions and through direct marketing.	SMART cars interchangeable modular panel system. Experience centred design . Tailored selection of upholstery. Engine size and additional features.	Parker Morris standards (1961). Bahaus minimal living life style. Survey specification. Smart buildings, reactive and adaptable interiors and domotics. EKG scans (1990s)	Installation art using interactive participation as art event , such as Maurizio Bolognini. Direct feedback of statistic in expressive graphics and animation.	Domotics and modular or adaptable interiors. Ergonomics.	Domotics and internal environmental control. Client specification for functionality and design. Experience centred design.

Contemporary thinking on interpreting interest in product design and industrial design, are categorised usefully by (Pieter M A Desmet & Hekkert, 2009): Theory-based approaches to the interests held by the end user can be considered as a way to conceptualise new user/product relations; ‘User-based’ approaches that use observations and monitoring, in an interpretive approach to deciphering significance and meaning; and ‘Research-based’ methods, that make use of statistical analysis, such as questionnaires or feedback (NB real-time feedback and design through making/research is fruitful for engineering within parameters of exceptional control). However these categories also create a place for ‘designer-based’ experimentation that places the designer’s personality at the centre as a creative force, and although this can challenge or codify messages within a design. The ego-centric stance can also bring novelty from the principal fundamentals is an option presented too. Table 4-1 below is based on (Pieter M A Desmet & Hekkerts categorisation, (2009). It is illustration and collection of examples in a dissection of popular design and

culture is linked with interest that many commercial designers use to explore and predict and stay ahead in commercial design.

The holistic, constructionist, and dialogical modes, domains, and methods of visualisation for experience-centred design as discussed by (P. Wright et al., 2008) and similar categories of user, designer, theory, and research-orientated approaches to observational behaviour as discussed by Desmet & Hekkert, (2009), crossover and interweave in approaches that can fit many subjects, products, and commercial experiences. However the interpretive methods currently used in specialised areas of design rarely get defined in accessible and concise parameters useful to a complex systems design. Due to contextual novelty that can drive a unique selling point value, with parameters of function disabled, (Hekkert et al., 2003). Those aspects of design, that can be the result of an artists' and designers' personal insight into a field of design or from subjects surrounding an object, must use direct feedback from a contextual domain or interest to drive design. The problem with complex design systems is that their bespoke nature cannot be easily directly connected to a public's interests and views in terms of contemporary interest.

The quiz and logic that defines the conscious, subjective side of appreciation can be considered as 'local adaptation' to a situation, and whether formed in constructs from relational memory or in the immediate temporal response to experience, that is in 'associative generation', (Reich, 1993). And similarly in techniques explored to decipher this such as 'Affective Reactions', by (Mahlke, 2003), can be rationalised and formed around ones survival instincts, or in natural evolution and fixing of neural pathways in the brain, (Dominic Lopes, 2001; Douglas & others, 1991; Dutton, 2011). One's ability to be aware, experience, feel, and perceive and an ability to be autonomous in the mind, is supplied and defined by how the underlying 'default' system of the mind and body work - and this is where universals and essentials can be found for a fundamental approach to interpreting perception. The associative aspects of one's unconscious, can be quantified in either terms of knowledge gained throughout life - or from 'autogenetic' insight and instinct, (Dutton, 2011). i.e. Akinos, is that 'there is nothing in the intellect that is not first present in the senses', (Aristotle (Dominic Lopes, 2001). This defines fundamentals in what is found interesting, attractive or appealing, as a set and focus, for use in a contextual frame. This can be considered as mutual in categorisation, and through considering perspectives in:

- Objective = Universals.
- Subjective = Contextual.
- Reflective = Sophisticated.

This categorisation is not a rationale to say that all reflection is sophisticated and cognitively rich - however that those significant parts of thinking and learned aspects of brain function, that are enlightening and insightful can be considered by using this perspective. Ones associative memories, recalled most often in reflective modes of thought, can thus be quantifiable when based around significant interests and narrative - such as can be defined by desires of power, speed, comfort or utility or in more significant values. Isolating where the significant, social and contextual events happen relative to universals and essentials in experience, brings one rationale in a theory based technique, based on simple reflective thinking which objective visualisation in this way can elucidate when, where and why transcendental insight and enlightenment happens. Studies instigated from perspectives of a specific interest or using multidisciplinary lines of inquiry on an experience or art work, lead to a more subjective analysis and supply room to examine the more esoteric or codified experiences, such as explored in an approach to interpretation by, Csikszentmihalyi & Robinson, (1990), through ‘flow psychology’ and ‘gestalt psychology’ as in sections 2.3 and 1.1.1

4.3. Summary

The complexities presented in both aesthetics and ship design are defined in this chapter, illuminating pertinent areas for a rationale to stream directives from aesthetics into developing automated procedures in ship design. The broad range of theoretical resources available, it is suggested, can encompass directives and translators for a language, which can exist and persist in the ship design cycle, and that leave out additional complex and conflicting vocabulary. This can steer design solutions towards results that are deemed mentally healthy, and beautiful, through experience centred design.

5. A Rationale for Ship Design

Throughout the investigation into value of function, in associations relative to a ship's design, combined with interest into how the flow and rhythm of experiences can create signatures, long lasting memories, or sophisticated experiences, a process of analysing emotional responses can be ordered and measured in a visualised walkthrough procedure. These investigations into why aspects of experience can be more sophisticated, subjective, more or less rewarding, or more cognitively rich than others, can be made in reflection of shared perspective in space and time. In a process formed around temporal experience, as explored in 4D design (Robertson, 1997), and which structures experience and creates narrative, in a chronological account of experiences for use in appreciation and design.

In the case of the Ship, the Naval Architect is best placed to take on the role of the informed critique, as it is he / she who understands the already sophisticated language of design. This is the current and preferred method for introducing the end user into design as it is direct to consider the Naval architect is in best place to facilitate aesthetic consideration, and influence persistent intent throughout the design group.

Initial associations map, define and categorise points in time where special and individual experiences arrive, such as value in the new and novel - and initiating experience explored by (Bloch, 1995; G. C. and L. J. Cupchik, 1992; Paul Hekkert, 2006). This forms an approach to question the quality of 'associative generation', and 'local adaptation', in ways that can influence design, (Reich, 1993) which crucially can attach the majority or weight of judgements to the exploration of universal associations with nature, and the subject matter, such as supported by works by (Dutton, 2011; Gregory, 2000). The universal association to nature and the notion of analogue function make the approach a simple method to use in assessment of complex mechanical and functional products. The primary interest in variation and diversity in sophisticated bilateral organisms functions, can be argued as another universal, and the metaphor of DNA is a semantic aspect of interest, which is well founded in theories, such as 'teleological fitness', (James, 1884). This element of beauty attaching itself to the X&Y chromosome and apparent DNA can be associated with other familiar and recognisable consumer durables, automotive design and products, which creates context relative to a societies current means of production, and political aspects, which is a parameter on contemporary context that is both terse and persuasive, (Parsons & Carlson, 2008).

It is also agreeable that the Golden ratio and other commensurable figures are predicates for beauty in design. Where Guiton, the seminal writer on 'aesthetic aspects of ship and yacht design,' suggests that ships beautiful when they display natural proportions form the golden section/ ratio. Andrews D.J. in the (Sen, P.; Birmingham 1997) agrees in the use the proportions of the golden ratio as basic rules in ship design. Shinoda's similarly has made investigations on proportions and ratios in ship design (Shinoda, T., Fukuchi, N., Yoshida, S. and Takao, 1997) which also follow the appreciation of dynamic symmetry and the golden ratio. The identification of abstract geometry relating only to this ratio in the composition of a ships parts and components is however not robust in terms of emotional content. And it is here posited that it is the application of these series in dynamic symmetry, in a purposeful role that makes proportions interesting and often beautiful in nature's sophisticated designs, similarly in man-made design.

Categorising and defining those areas of interest as axioms of appreciation or directives for design, can counter the infinitesimal base of 'training data' required for a fully robust definition of aesthetics, beauty or attraction by design, (Borenstein & Sharon, 2004). What further defines the ability to judge and grade quality is ones short term memory, which is said to have 'seven, plus or minus two' slots, in chunks that depends on the task at hand which in tests it is seen it can be as little as three parts. The size of any one chunk can vary depending on the associations that it has and hence how it can be thought of as a single concept. It is notable that newspaper columns often hold on average about seven words. This allows the whole line to be taken in at one glance without having to move the eyes horizontally. These facts are similar in reading geometry, yet however with the complexity of significant and meaningful visual associations, communication of value, can be both made in a short spread of time and it would appear form judgements on clear communication of function in design, which would be best placed in analysis of three to four items, that help define the archetypal measure of emotions in the face and in the amount of information one can hold when judging beauty, (Baddeley, 1994; Cowan, 2001). The usual period of twenty to thirty seconds, is also an experiential time frame that can be placed around judgements made on contextual and sophisticated elements of an objects gestalt, or a concepts' gestalt, as noted in works on Gestalt Psychology (Kohler, 1947).

5.1. Functional Beauty

Aesthetics is the taxonomy of its subject, categorising the useful features and facets of its product and firstly considers the development of an attractive external appearance. Functional Beauty in this way is the embodiment of a positive visual representation of function: A simple analogue tool for example, like a ‘butter knife’ will effectively communicate its function through its aesthetic form without any visual cues or instructions in addition to its functioning parts. (Parsons, G 2008). This simple functional aesthetic model is the pursuit of many a commercial designer; mimicking natural efficiency and nature’s rules of attraction to gain merchandising appeal.

Occupying a central and primary place in all aesthetic experience, functional beauty is an aspect of aesthetic appreciation that has universal relevance. Brought to the field of aesthetic philosophy by Parsons & Carlson, (2008), it defines, a concise notion of beauty that is built around values seen in the efficiency and elegance of a mechanisms function and fitness to purpose. It is a fitting philosophy for the exploration of complex technological experience, and emerges from appreciation of design made from the boundaries of such a honed perspectives; It is a human focussed and culturally orientated design philosophy that defines a essential aspects of philosophy on beauty and a stream of intellectual beauty fitting for evaluation of manmade designs.

Context and thoughts on beauty, that often confuse and complicate aesthetics in design, such as unpredictability, existentialism or opposing ends to the scale from fear and repulsion, can be quantified under a specific philosophy on aesthetics. Categorising a type of beauty without any attachment to universals, is less attractive for the collective markets of large ship design, albeit not useless in specialised case and a progression from fundamentals, in those that may very well ensue from a foundation and rationale in the disciplined approach set up in arguments by Parsons & Carlson, (2008). The ‘proper function’ of an object or experience, such as with the purposeful end of teleology, and its thus labelled functional beauty, is a universal. In terms that can be further appreciated for collective and introspective quality without ambiguity: The Philosophy frames a sophisticated, manageable and scientific, setting, appropriate to the complex design problems of a ships design.

Having universal aspects of beauty at the heart of its philosophy, functional beauty can be measured next to the elegance and accuracy in the ‘prototypicality’ nature of maths

(J. . R. W. Veryzer & Hutchinson, 1998), in terms of visual geometry, homogeneity in form, saliency in parts recognition and in mechanisms, amongst cultural norms and shared aspects of function and technology in society. The philosophy contains the essential elements required to fulfil a robust and rounded account for psychological pleasure in theatre and experiential design, and sets up arguments in aspects of taste, interest and appeal that constrain beauty to a focussed discipline.

Man-made structural and mechanical geometry can be defined by functional beauty and helps ordered in how series and sequences of geometry, colour or proportions are organised in terms of anatomy. Those that are relative to sophisticated organisms or other recognisable and refined products, such as discussed in referees to product design by (Bloch, 1995; J. R. W. Veryzer & Hutchinson, 1998; R. W. Veryzer, 1999). Finding rhythms, signatures and patterns of similar D.N.A. in products that have evolved and been adapted for the mass market and those that are made as poignant and recognisable, from the universal physics (physis) and morphology in nature, can be considered an axiom, philosophy or intent for appreciation or design, the attachment to cultural variation and natural variation in the evolution of design is both cultural and ethical perspective that is healthy to design around, (Parsons & Carlson, 2008).

Functional beauty is defined around two primary criteria, namely knowledge of function, and fitness to purpose which helps order and explicate objective, subjective and reflective perspectives in a systematic process. The catalogue of progression and change around cognition, can be compared to stages of shape recognition and processing of gestalt form, (Lim et al., 2007) or in the search for a 'proper purposeful function' in a forms fitness to function. Referring to values attached to functions and forms of primitive and sophisticated significance in detail or in the overall Gestalt. In a reduced mnemonic on functional beauty and shape recognition designers are supplied categories, thus:

a. Knowledge of function

- i. Identification of comparable mechanisms, in parts or whole.
- ii. Experience in the theatre in use, understanding over time.
- iii. Identification of significant function and proper function/s.

b. Fitness to function

- i. Judgement in functional efficiency of purity in aim.

- ii. In unity of components of function and efficiency, that is in a mechanisms communication of elegance.

The interest in function from nature and in its precipitation into culture illustrates the overlap and interconnections, or spandrels, made between bottom-up and top-down thinking, that is in re-cognition and cognition (Davies, 2010). This supporting the approach as sophisticated and cognitively rich, comes from theories developed in schools of neuroscience and shape recognition, and in assessment of where one's knowledge is connected by thinking from shared appreciation - such as a natural understanding in teleology, instinct from fear, and common sense, built in the default encoding and fundamental bridges to and in the amygdala, (Gregory, 2000). This is a science that also directs to biophysical connections such as release of opioid = pleasure, dopamine = happiness, serotonin deficit = depression, oxytocin = love, nucleus accumbens = reward, (Kringelbach & Berridge, 2009). Design thus is given insight into values expressed by aesthetics and sensory experience, and that can therefore link to beautiful design. It is then recognition that becomes the parameter and boundary of top-down aspects of sophisticated appreciation and in a rationale on ideals of how one judge's the beauty of function in this case, as shown in Figure 5-1 as an illustration of how functional beauty can be defined by universal parameters.

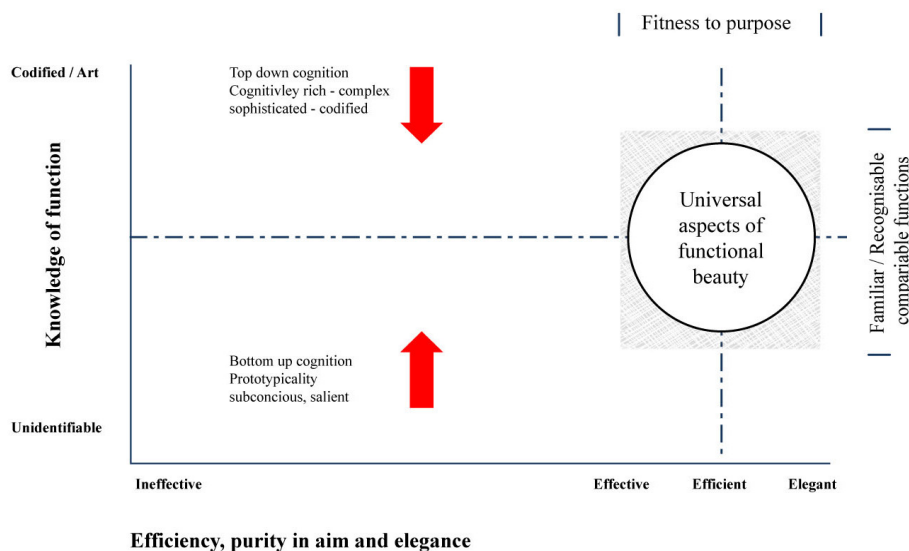


Figure 5-1 : Universal parameters of functional beauty

As within artworks, beauty lies in provenance of historical and semantic referee. Some areas of appreciating an objects functional beauty might be inaccessible to those

without knowledge, or in understanding around a specific or unusual function: However these elements as illustrated are connected to universals, which can be made obvious through illustrative function in design which is accessible in appreciation through reflecting on the real time learning and didactic experiences, and in local adaptation to the happening or experience - as it is happening, or shortly after and over time. This reflective pattern of thought formed around essential matters, creates a place to make a comparable to the value in personal and subjective experience; and can lead analysis to illuminate where insight and enlightenment - from pleasure in learning, discovery and reinforcement of significant and explicitly rewarding life lessons – or philosophies, happen: For example, geometric abstractions in the rhythms, intonation and cadence of forms, as seen in the cabins and habitat of a ship; are representational of both structures in social and organisational behaviour and of engineering combined. The geometry if communicated with other aspects of the ship, can thus project feelings of inclusion to a super organism, and in the case of a large ship, might come from the peace of mind gained from both knowledge of elegance and sophistication, which, if not present can be re-designed or made a ‘visual’ cue accentuated through design. Those aspects and parts of geometry that show how the sponsors are protecting with their means of production, or in design intent for one’s social inclusion/exclusion – an intellectual and objective, or shared aspect of the designed experience, can be defined around the culturally focussed and ethical aspect of functional beauty.

Functional Beauty can be used in analogue matters. It can be used in universals, such as one’s ability to judge stability and the basics of a floating body. It can supply a measure of interest to judge purity in aim and elegance in purpose; and that can define social function, also - if required. How one perceives the visualisation of a passenger’s cognitively rich, significant, and sophisticated experiences in terms of function can be thus contained and quantified in stages of cyclical categorisation, by considering how analysis of fitness to function and a proper function feeds and alters ‘knowledge of function’ over time.

5.2. Most Advanced Yet Acceptable (MAYA)

Design rarely moves away from recognisable values in geometry, in artefacts that can be alien or outside bounds of acceptance - that can be said to be attractive within the bounds of the most advanced yet acceptable (Lowey MAYA, (Hekkert, 2006)). For example, stealth jets and boats, those have become symbols synonymous with cunning and deception, rather than flight and speed. The interest and attraction in this type of geometry is literally 'deceptive'. The mechanical and analogue beauty in flight is lost and illusion becomes the associative function for comparison. For example, the initial Dodge RAM™ minivan range-inspired by the 1957 pickup-that 'gives an initial impression of brute power', manifests and accentuates through geometry in the vehicle's oversized front end, cabin, and small windows. This enables differentiation of the RAMs™ robust anatomy to other products physiology (Bloch, 1995), with referee to an extreme in communication of power, that has evolved to geometry on the boundary of acceptable understanding, and contemplation, as shown in Figure 5-2 (below). The anatomy is universally attractive and intriguing, (Hekkert et al., 2003). Importantly the elements that make the vehicles culturally familiar and of societal interest, come from the nationwide distribution of the product and from the expression made next to technological means of production, making an impression from associations with the production method behind the physical anatomy.



Figure 5-2 : Morphology and species transmitted through design DNA.

Illustrates how the current 2500 model holds the same distinct anatomy as the D100 1958 pickup and resemblance to the 1957 Cabin over Engine (COE) type Dodge Pickup.

5.3. Summary

It is evident that interest in functional beauty from anatomical narrative is a focus that can deliver a plethora of commercial and novel cultural solutions in ship design. The fundamentals presented by the MAYA theory in combination with theoretical, culturally rich resources from aesthetics and notions on beauty, sets up a domain that can encompass and supply a connection between practical design and interests, in commercial value centres. In theory it is suggested that it can solve ambiguity in what is often acrimonious in engineering.

6. Proposed Methodology

Universal and essentially weighted value can, it is suggested here, work alongside the primitive and first principal dimensions of complex ship design, to bring ethical, stylistic and good design as an element of performance quality, and as design intent into the ship design routine, focussing on the Primary and Secondary Functions and their Proportions. A mathematical formula can be intertwined with a contextual domain and it is proposed that functional beauty is a sufficient criterion for this is defining beauty, especially for utilitarian design, and in particular, ship design. Where one can focus on a refined concept of beauty as a common interest in the topology and geometry in layers of significance and importance. Functional beauty thus frames a manageable and scientific setting, appropriate to the complex design problems of a ship; it can work within a frame of universal and local associations and adaptations to geometry - such as seen in shape recognition – and that can deliver grades of quality in valid dimensions of geometry.

Using functional beauty as the manageable and expedient contextual domain, categories for geometry and or associated experience can be created around two primary criteria, those are; knowledge of function, and fitness to function. This helps order and explicates objective, subjective, and reflective perspectives in the quality of experience, relative to shape recognition and Gestalt psychology, and in retrospective categorisation:. Which places the generation of design drivers initially outside the ship design domain. Delivering judgements on the beauty of a ship, boat or naval architecture simply through chronological commentary on design, which unlike other techniques for influencing aesthetics and human focus into a process, defines the pertinent elements specific to ship design and about a ships aesthetic makeup, rather than using images and relational objects from other streams of interest and design.

Setting out that the aim of a ship's appearance is to communicate symmetrical, healthy watertight anatomy, intricate inner workings hidden and protected space. It must embody safety and protection in securing inhabitants in an alien environment; to cloak any vulnerability is what makes a ship attractive. It does not mean that artistic intent of a radical and intellectual basis cannot be played upon, but it supplies a parameter to work within that stays away from those aspects that are perhaps too esoteric for a collective and mass audience, and that is fitting to the model case of the large scale ship, and a safety conscious and often virginal passenger on an ocean adventure, (Cruise Lines International Association., 2011). This is also a good platform to quantify and clarify an approach to the

overall process of design that might include the extremes of esoteric fields of appreciation and beauty.

In the multidisciplinary procedure, three centres of value that overlap and germinate the decisions in the chronological and temporal investigation of a ship, are devised from the theoretical resources to deliver cognitively rich, significant and sophisticated experience associated with functional beauty, Figure 6-1.

The centres of value to judge around are:

- Associative Generation, (relative to nature’s species and functions):
- Local Association, (relative to modern and contemporary products).
- Gestalt theory in shape recognition and homogeneity of form.

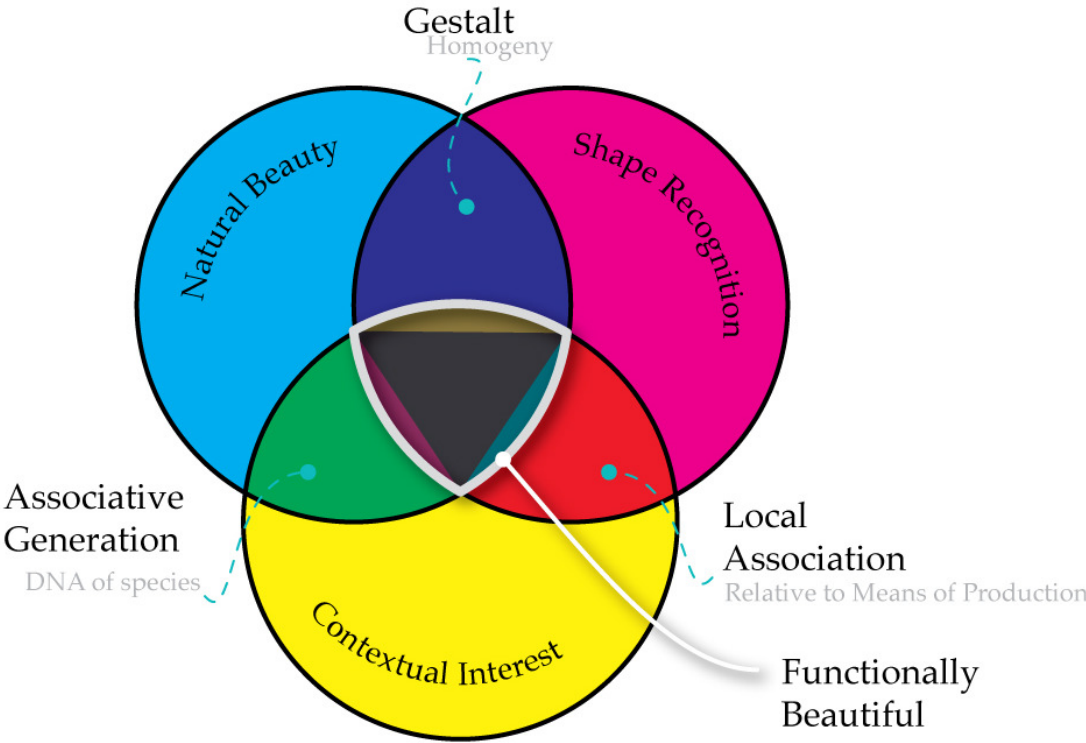


Figure 6-1 : Components of Categorisation for Functional Beauty.

The training data or relative library formed from the parent domains, creates a reduction in complexity – and that is to only consider function as a grading system in analysis. This initially considers analogue and mechanical function in the overall form or gestalt (1), which can be compared and analysed next to other similar functions in nature associative generation (2) or Local Association (3) in the effectiveness or efficiency and elegance of function. It is suggested that the common interest function; can be considered

the element of design that ties geometry and parts of experience together to make an object beautiful or not. The persuasive philosophy reduces the need for more complicated analysis and interpretation of the cultural context, and carries with it a social and contextual element of function and organisational structure in appreciation. — Usefully connecting essential and contextual ideas within the process to sophisticated sensory experience and in the theatre and storytelling through evaluating experience through time and in temporal narrative of function.

This algebraic approach to discerning dimensions and proportions from a theoretical approach to appreciation, and thus design, can use theories that hone in on an interest or appreciation of the operational or practical usefulness of an object or experience, using these tools because they are universal. One then can consider ‘fitness to purpose’ by judging, evaluating, and grading how well an item compares, in terms of function, to other recognisable geometries and mechanisms from both universals and cultural variation in nature and in physics. Using a system based on the rationale of one’s own ‘knowledge of function’ (Parsons & Carlson, 2008), and in league with approaches of visualisation via self-analysis, in ontological reasoning (Ö. Akin, 2001), the approach becomes manageable and specialized to a type or classification of design in appreciation of interest in that object, in terms of functional beauty from another’s point of view. The categorisation system grades and judges value around theoretical resources that are to be repeated:

Knowledge of function

- Identification of comparable mechanisms, in parts or whole.
- Experience in the theatre of use, or understanding over-time. (Didactic).
- Identification of significant function and proper function.

Fitness to function

- Judgement in functional efficiency, (Purity in aim).
- Components of function and efficiency
- Proper overall function or Gestalt form, (Additional reflective process based on Gestalt theory and shape recognition.)

6.1. Appreciating a ship's appearance

The appreciator can examine experience by grading how a 'proper function', a 'primary function', or 'secondary function', is perceived and also reflect upon through recognition on these ideas, by using focal points and proportions as illustrated in Figure 6-2 and Figure 6-3. For example, transport can be considered as a primary function and habitat as secondary. Components of beauty in geometry can be quantified further by considering symmetry, harmony, and proportion in terms of function in the overall gestalt of the ship. In particular, homogeneity or harmony is quantified in evaluation of perception of function via the Gestalt thinking process set up to identify the features and facets of an overall proper function and connections between the overall form in the ships Gestalt. The details of surface curvature, edge definition and boundary strengths in definition of natural proportions and functional proportions, pertinent, however patterns and summation series is also something to search for in the geometry. Elements that define or accentuate proportions and complimentary components of function helps categorise significance and functional value. Phi in particular which is a most pertinent figure to discuss when considering how anthropometrics, ergonomics, and habitat are recognisable in primitive dimensions and compositions that can be defined as attractive – in terms of fitting proportions at least can be categorised around each specific system, subsystem, and technology involved, which can be used to define aesthetic interest in specific components of a vessel, attaching to types and classifications around these themes.

1. Initially functions can be defined:

- a. **Primary function:** (is there a proper function visible?)
- b. **Secondary function:** (is there a secondary component part of the overall?)

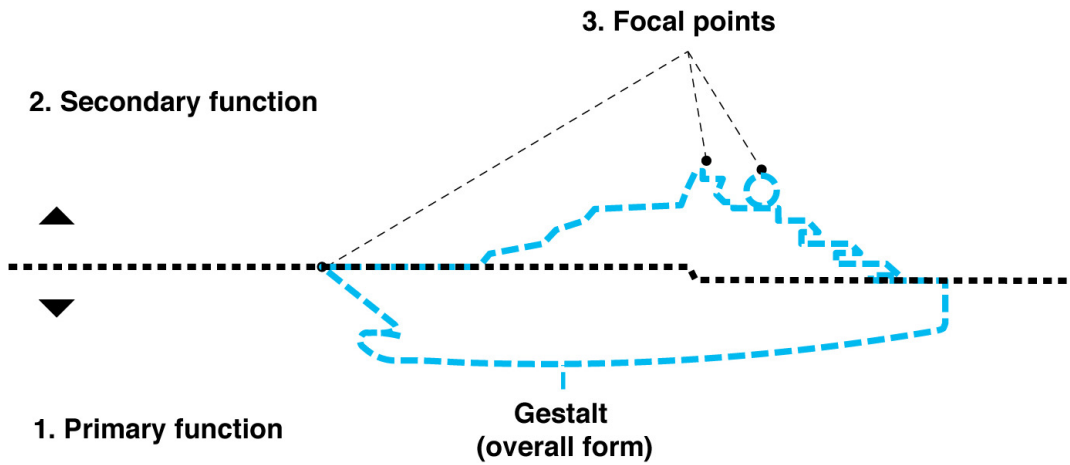


Figure 6-2 : Components of Function in the Gestalt of a Ship.

2. Identify:

- a. Divisions and parts made by the proportions, and tectonics of parts.
- b. Visual Balance can be examined or judged.

Visual Balance / Negative Space

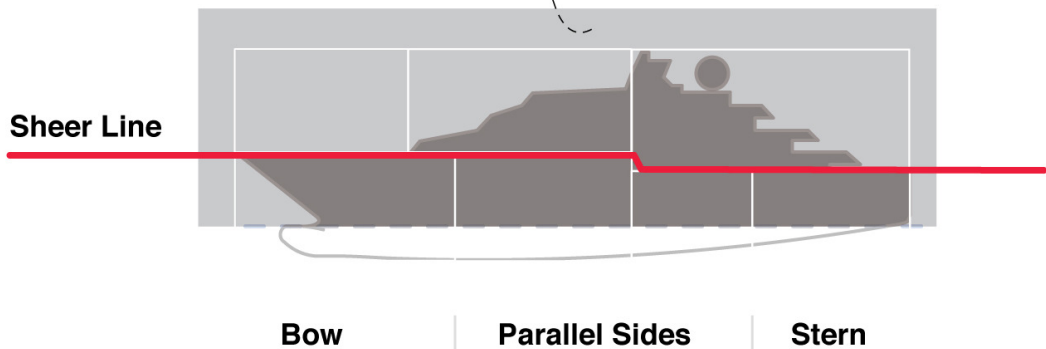


Figure 6-3 : Major Proportions of Function to assess Visual Balance in a ship.

The divisions, and sections can be used to define summation series, and symmetry. However, when no geometries of proportion are seen in the sequences and series, it is attractive in the initial part to use Phi in fitting to any pertinent and significant associations made between the anatomy of a ship and the anatomy of man for example.

The analysis of harmony and homogeneity uses negative space in the silhouette of the ship and around the ship to decipher balance between visual components and the visual massing, Figure 6-3. It is also pertinent to define dynamic lines and components of rake which are also a line of accent to be noted.

The additional illustration of an eye in one side of the seemingly bilateral symmetry also denotes a sophisticated sensory system. The pilot visor or window, often in a prominent sensory position, gives credence to a sophisticated function. The Waterline (blue) also plays a part in understanding above the water geometries and the recognition of Gestalt, in light of buoyancy adds to interpretation.

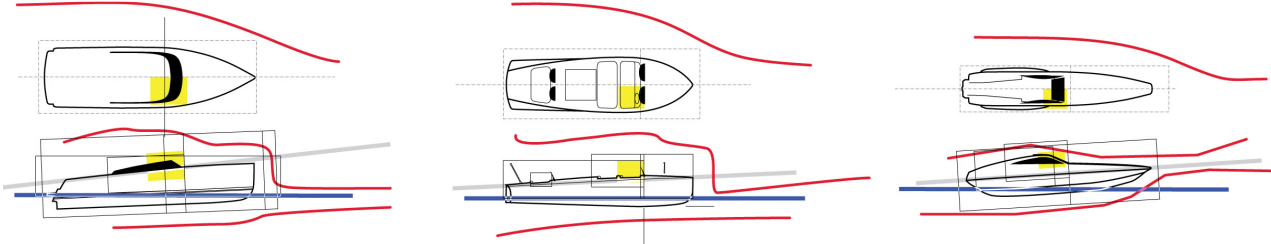


Figure 6-4 : Speed Boat Dynamic Lines. XSR48 Superboat Von Dutch 40 & 1940 Rivera.

In addition to the proportions of function, there is visual balance to consider and the massing of the parts. Lines of dynamic and responding aerodynamic rake, can define character next to simple proportions of function. The posture and attitude, as illustrated in the three speed boats above in Figure 6-4, differentiates the three in terms of character. Thus penetration further into how these objects and proportions are significant uses context and association – and a rationale on beauty that acts as a perimeter and narrative in all assessment and in reflection on these components of geometry a shared domain plays a part in a robust and full appreciation of a ships beauty. However there is a need to continually refer to values above geometric division alone, and reflections on interest and enlightenment in the realisation of an ultimate value, such as functional beauty, is required.

6.2. Summary

The components of robust and enriching theoretical resources for the interpretation of a ship’s beauty are wide reaching and also attainable in terse and compact approaches such as those highlighted in this chapter. The specific rules identified as a foundation are not the only way to rationalise an interpretive approach to beauty, or how something holds interest. This approach however is novel and fundamental to defining and controlling the ultimately valuable aspects of aesthetics that are currently sought alongside those in engineering.

7. The Elbe SWATH (Workboat)

7.1. Background

Christened 11th March 2010, this third revision of the specialized maintenance and supply vessel for offshore-wind farms was developed by Abeking and Rasmussen (A&R). She has been designed and produced specifically for the mouth of the river Elbe near Cuxhaven, Northwest Germany.

The SWATH (Small-Waterplane-Twin Hull) navigates through rough tidal waters, reducing wave-making with automatic self-righting computer control at rest. The 60.4 meter in length deployment platform goes at 12 knots, and is designed for multiple deliveries of pilots to and from larger ships and boats. The model is a larger SWATH that supersedes smaller predecessors.

7.2. Market & Persona

Considered to have the primary role of delivering pilots to larger boats, the craft's professional crew is classified as the primary audience and perspective for appreciation. The end user, coming from within the professional organisation, is skilled in the ways of the sea and has knowledge of other similar craft and vessels. Expertise and experience in the local waters of the Elbe means a local social demographic with a tendency to be middle aged and male is pertinent to follow as a profile.

Visualisation and interpretation of perceptions are based on the quality of work experience, and associations to organisational behaviour. In appreciation that extends to the public at large, yet however will come from perspectives from portside. The SWATH will be prominently visible in functions and when underway from the estuaries bank-sides and riverside communities, and from other larger vessels that are receiving and embarking their pilots.

7.3. Chronological Experience – (Visualised)

The illustrations and images are inserted to aid the reader throughout the case study.

As a starting point, the function of the Pilot Boat's appearance is considered, orientated around the axiom of safety, efficiency and the organisational aesthetic, using a design philosophy for a practical solution rather than attempting to extend to individual passenger requirements. The Elbe SWATH's single purpose is to deliver and receive pilots from large ships and boats. The design has had only to consider the practical working environment in delivery of said Pilots and facilities for housing its rotated team. The design has not been aimed toward any secondary function in the accommodation of recreation or beauty of any type, rather for low cost, high reliability and safety.



Figure 7-1 : Elbe at Bremerhaven, (Christian Eckardt, 2010)

From side view and front the superstructure appears very similar, castle like, blocky, a distinct planar residential like unit centrally placed on a nominally larger and raised foundation. Having a lighter appearance and distinguishing her with a bi-pedal like stability, as we see her in three quarters view Figure 7-1 above, the central section of hull that is recognised in a traditional mono hull displacement is missing. Set back on the tops of the red hulls weather decks a singular sealed deck-house straddles a gently chined hull above the water line. Colour is reflected in a prominent stripe across the top of the bridge, and the singular house, appearing hermetically sealed, the junctions, small portage and rounded doors of the deck house define watertight.

Side views and front views are very similar, castle-like, blocky, showing a distinct planar residence-like unit on a nominally larger raised foundation. The singular central housing is straddled equally across the top of the upper hulls.

The deckhouse is bright white, and contrasts against many backgrounds. Reminiscent of practical working habitation on oilrigs and other commercial vessels, the light steel handrails around the deck house facilitates a scaled down look of an oil platform habitat.

The termination of transom reveals a suppressed sheer line, and the associative shortening appears to be in austere measures, which leads to focus on the larger forecastle form. Which is blocky and heavy looking in balance with the slender marine platform.

When seen in side view, she appears extremely stable; when underway she doesn't lose the stable look, but does however have a separate dynamic functional aesthetic:

The mechanical platform sits on minimal, almost invisible contact with the water, and the miniature cross-section of hull at the waterline creates the illusion as if floating on air. While flying across the surface of the water, the torpedo bulbous hull technology is invisible and under the waterline, which supplies a perfect level that makes it look like a skimming frictionless anomaly.

Usual masts and technological pods go with an array of deck mechanics and space-age life pods, and the addition of a Helicopter pad to deliver a steady flow of pilots, places it in one's mind as of extremely high importance, and of stable financial backing. It is chiefly identifiable as a workhorse that is of the utmost professional and ethically sound business credentials.

It seems the Elbe can magically deliver its pilots on the end a mechanised extending platforms, whilst gliding through the water unaltered by swell. Imbuing the passengers of the vessel being boarded and the pilot being delivered with feelings of importance and support, and also delivering an important piece of the machinery of the boats bringing trade to the pilot boats' home town.

Skin Quality and Sculptural Form:

The symmetrical upper hulls look robust with geometric prismatic quality. The skin is stretched across filleted corners, and the almost invisible fading to the parallel sides of the

outer hull detail, uses subtle fillets that embodies a strong structural form. The corners are all softened with equal fillets and chamfers; possessing looks as if machined from a solid.

Consistency is not maintained throughout the overall form as the block form deckhouse is different in quality to the bridge; its angled faces contradict the panelling of the vertical walls of the house. This can be considered as a lack of flow and clarity fractures her look, especially at the rear where the box house terminates abruptly into a two-tiered balcony.

The right-angled superstructure on closer inspection doesn't look naturally sealed weather hardy or aerodynamic, around the square angle seams and the plate aesthetics, which are cockled, do not project quality or the envelopes' durability in nature's way.

Her colour is practical for visual recognition: primary red and white. Parallel horizontals on top and bottom leave the house floating. The bright red has a sheen that looks protective and robust. No graphics or information on the flat canvas of the deckhouse walls adhere to the classification criteria rather than to advertise. The Elbe's platform, in terms of colour ratio, gives more impressions of functional solidity and profession. The small number of components are easily read.

The hulls either side have sharp cuts and a paring back of chines at a stern, with distinctive angled shoulders that run to the parallel sides of the body with another single and gentle curve.

There are snub-nosed twin upper hull forms up front, with anchors hanging from the two tip ends. The corners are softened with more fillets, which helps the overall robust impression.

Natural reflection on the Gestalt:

Elements that are human scaled are noticeable in the gestalt, for example the curved corners of the doors and portage appear secure and protecting. Human stasis crafted into the design as a priority. Constructed for the quality and safety at sea and noticeably considerate to human fragility in the ocean environment. The overall aesthetic instils confidence in professional crew and onlookers, visualisation of its work in protecting a close knit crew visible in the superstructure.

The bridge geometry balances a strong character in the gestalt, a poignant focal point. Seemingly protective oversight of the habitat and group scaled community. The

direction of visibility for navigation and control covers over all the parts and is scaled and weighted in balance to the overall vessel envelope.

The invisible SWATH technology might at first be difficult to understand, yet through realisation and knowledge of function, its appearance as if floating over the water becomes the source of animation for the visualisation of a most beautiful technology.

The hidden crew quarters masked by prismatic cube planar walls and small windows, remain a mystery to the onlooker. Black box theory applies here and the high tech primary function would lead one to believe the deck house is furnished with similarly high functioning technology and work spaces.

Those functions that are known, i.e. the platform for delivery and buoyancy are portrayed well when at rest and in motion. Those functions that are portrayed to us through motion are nominally reinforced by the sculptural hull geometry above the water line and the high level of buoyancy with the slight aftward angle. A recognised knowledge of primary propulsion whilst on board at speed or in viewing from another vessel, give us an impression of precise and high tech work efficiency, motion in knowledge and of its beautifully engineered technology.

Eliciting efficient, lean and good design in its form, the Elbe SWATH shows its priority for pilot delivery with no need for additional parts and features in promoting its efficiency at work - accentuating and promoting value and worth in no other way than through its raw functional makeup. Whilst the deck-house is not an organic aesthetic, the twin underwater hull technology supplies an aesthetic motion and is a practical foundation for superstructure in its batch build, that is crucially in this case, well-proportioned and balanced.

Proportions and Harmony of Parts:

The design, in its sharing out of features and in the massing of its parts, is appealing to natural references and to our natural instincts. The communications mast sits forward onto a broad and spacious bridge; this main focal point is a good vantage point that extends to rooftop balconies. Architecturally, the bridges look top-heavy from the front on, yet have a well-balanced distribution from a side view.

The overall shape of the Elbe SWATH is stocky with muted characteristics, slight features and the small windows and hatches accommodated within the planar white walls,

do not show any organic pattern and are a-symmetrical in places. A complex that is multifaceted appears operationally potent. However no tearing decks in the main deck house move the Gestalt away from an organic anatomy towards a deeper understanding of practicality, space, and of manufacturing efficiency in her production.

A bridge that promises a very wide peripheral view in proportions resembles eyes. No other features communicate a face, yet this craft's geometry, when related to animal species, is insect-like and has a similarity to the natural proportions in the abdomen and body of a beetle, this due to the symmetrical biped-like bows and deck forms. It doesn't look threatening or predatory but does look powerful, as if it is a creature that could carry many times its own weight.

The components of geometry in this small craft are satisfyingly natural and the deck width manages to give a buoyant functional appearance to the overall, even with the top-heavy bridge and the decks' wide footprint. There are discrepancies though; the stern extends to an appendage and the bridge that is not integrated but an addition to the cube-like block – which does not reflect sophistication in function in this area.

Defined as single purpose, i.e. unified under one philosophy in the organisational intent. The work boat, or SWATH has several elements within prominently a two part design, see figure Figure 7-2: 1. Sea keeping technology, 2. Accommodation buildings. These elements are unified not only by function but also through the connection in geometry and in the overall quality in surface finish made via production and professional crafting. This quality of finish, promotes organised and practical work horse appearance, projecting its attention to the 'Organisational aesthetic', as discussed in section 3.2.3.

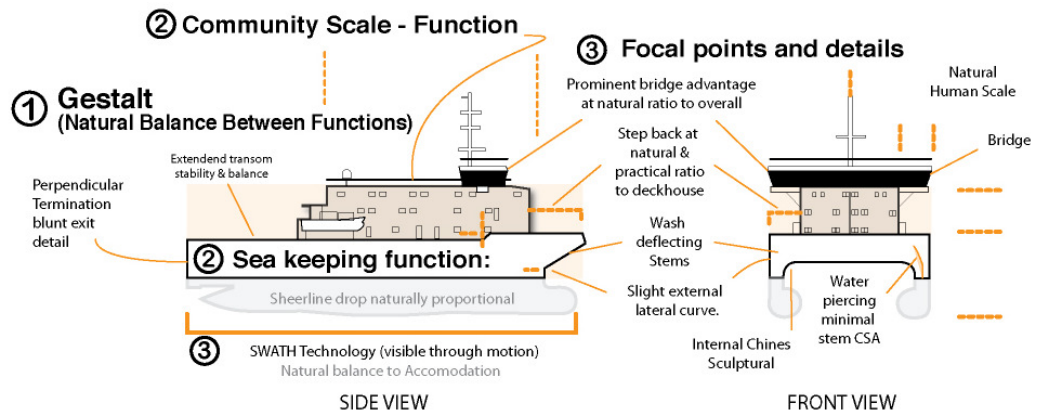


Figure 7-2 : Elbe SWATH front and side illustration.

The natural ratios and sequences related to the golden ratio are marked with orange dotted lines, in Figure 7-2 above that is those natural proportions of human scale that fix to the ratio 1.618, and in association and recognition of nature’s maths. The ratios are drawn relative to the primary and secondary’s prominent geometries and features.

The superstructure holds the majority of massing in elevations, and in the end, elevation shares similar volumes to the masses below the waterline. In plan view, the length of deck to deckhouse fits to ratios of the golden ratio and is also human scale. In plan and elevation, the deck to floor space is also similar to the ratio 1:0.618, and the distances from the deckhouse to the full breadth are naturally proportioned as in proportions that increase with the same magnitude, (see Figure 7-2 above). The length of the deck does not hold such a good balance in relation to nature’s maths and this extended transom seems empty and rudimentary. This is also true of the bridge, and when above the waterline forms are considered as a collection of square modulations and forms, can be associated with a sophisticated bilateral symmetry, or the brow of a bilateral sophisticated organism. Thus because of their positioning the bridge windows can resemble eyes see Figure 7-3 below. Which supplies a distinctive characteristic, adding to this the brow-like red stripe crosses above the bridge creating a hardy look, protective and focussed.



Figure 7-3 : Elbe Visual Balance Analysis

Outdoor Living:

A short bulwark looks more like a balustrade than a protective sheer line. It would seem obvious that it is not to stop large waves coming over the deck. This SWATH stands further out of the water than conventional mono-hulls and in this usage, will be accommodating trained experts in the ways of the sea - who both know how to act professionally on deck and at high seas, and understand that the Elbe SWATH is a functional platform rather than a social place.

Preparing the Pilot for transfer, or in stock of equipment for maintenance, the deckhouse looks depersonalised and very clinical, professional, and practical. This is empowering for the professional pilot giving a feeling of discernment and focus in work, and removing social elements in a strict environment where state of mind and clarity of thought are paramount to the tasks on board this and other vessels.

Honest in function with obvious economic priorities, the Elbe SWATH gives the appeal of a product designed by engineers to do an engineering task. There could be improvements to social space outdoors, i.e., large open air and shared space, or interiors making use of views forward, yet the practicalities of it encapsulating a maximum space protected from the weather is a evidently of higher priority and of a more valued aesthetic to the crew than outdoor space.

Habitat:

The economic square form doesn't reflect comfort, well-being, or a feeling of speed and aerodynamics, even with the proportions for the golden ratio. The setback deckhouse from the protective hull form does look practical though, and safe, and the bridge is visually high-tech and efficient.

7.4. Homogeny and Gestalt form

The Elbe SWATH has little natural beauty from the front; the superstructure is dumpy and squat. It doesn't look aerodynamic or organic at all. To add to this, the hull above the waterline is minimal and faceted; that is, the inner of the two hulls have only slightly curved lines that fade out under the main deck.

Such an overall prismatic blocky design is unusual in mono hulls aesthetics, and its initial appearance, looks different and awkward, especially in aerodynamic terms. The hull form above the waterline is smaller in proportion to the deckhouse and bridge; and a normal single hulled displacement vessel would have these proportions inverted. Even with a tugboat the hull is the larger of the two, especially in the sheer line forward.

The ship's functional beauty is quite extraordinary and the technology explains itself when she is underway. The shortcomings of the deckhouse do little to undermine the beauty of this craft.

The lack of chamfered corners on the superstructure has given the opposite of an aerodynamic or dynamic appearance; the mirroring of the chamfers on the upper hull gives symmetry above and below the sheer line at the bow and is a most prominent feature.

Through colour, and to a lesser degree, familiarity of form, this new version of the pilot vessel, holds resemblance to her predecessors and has a similar design DNA;

7.5. Reflective Analysis

Sequences in major geometry are illustrated in Figure 7-4. The singularity of intent through a function that is aimed towards one goal combines the subsystems of the vessel to achieve functional beauty, and the major focal points, shows a good balance and stable equilibrium, and in an apparent low centre of gravity. The sequences of parts appear natural and the proportions of harmonic and dynamic symmetry, in ratios that can be likened to a summation series, and that are visible in the overall anatomy of the form.

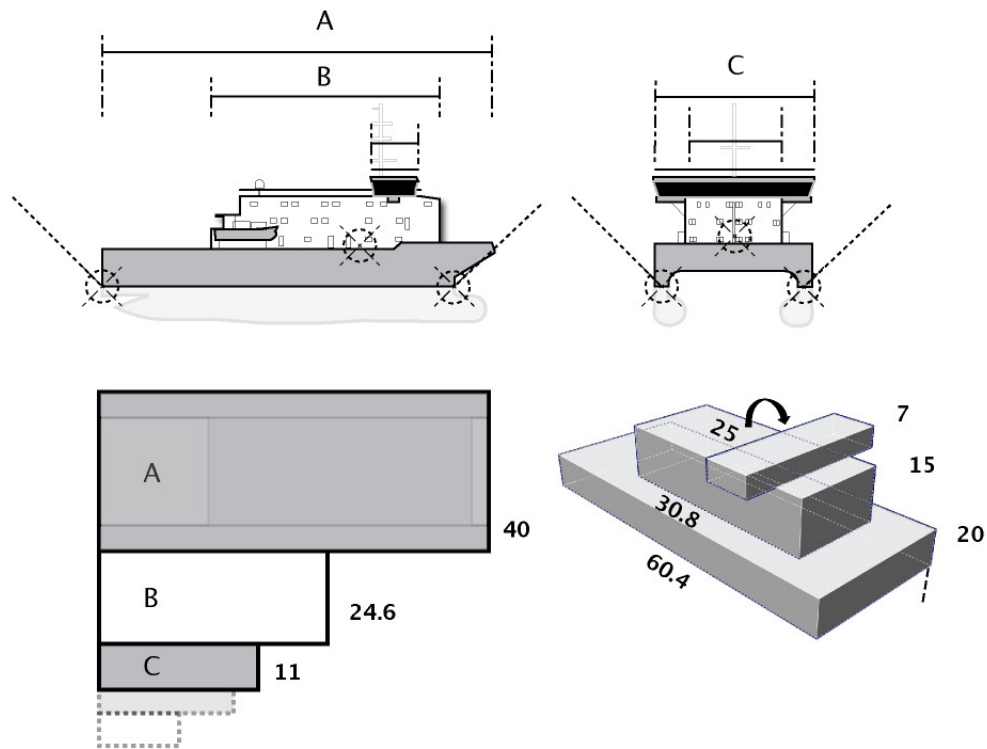


Figure 7-4: Sequences in Major Geometry: The Elbe SWATH

	Length	Breadth	Height	Area	Volume	SUM 0.49
(A) Twin Hulls	60.4	40	10/20	2416	24150/4832	
(B) Super structure	30.8	24.6	15	758	11370	
(C) Bridge	25	11	7	275	1925	

Table 7-1: Sequences in dynamic series : Elbe SWATH

The two major component parts of the Elbe SWATH that create a dynamic symmetry, as shown in ratios of A to B illustrated in Figure 7-4 and Table 7-1, which are indications of natural progressive sequence, unifying the features in equivalence relations and proportions. These increase in magnitudes in the same ratio, are indicators of natural beauty, as discussed by (Guiton, 1971; & Hambridge, 1919), which communicate harmony and balance in function as well as form. The Summation Ratio of 0.49 that is derived from the proper functions' major proportions –is something that could have been used in detailed design.

The natural balance, visible between the two hull forms, informs the observer on stability. Recognisable in the primary function from natural mathematical and prototypical stability models one has in referee, any kinetic knowledge of function reveals further

beauty in technology. The ability to sail without reacting to the waves and surface of the water, as one would expect, builds associations with a most advanced technology and in a recognisable form and function.

The deckhouse does not have appeal in terms of habitat or relevant aesthetic properties of comfort. Looking strong in its rectilinear structure and of high importance, however, due to the size and envelope that fits a strategic group. The bridge being a higher functioning element of the overall structure and considered as the secondary function component of the vessel in respect to the overall seagoing function, is made prominent with the dark recess and glazed wall.

Neighbouring the bridge, the accommodation is unified in a collective professional organisational envelope, that could be considered in terms of a super organism, town, or tribe-sized scale. However the windows do not project sophisticated function in the habitat part of the superstructure. The short, squat, and broad strength of the SWATH creature can be seen to promote elements and ethics of a company of experts and professionals: strong, reliable, robust, and efficient (Dutton, 2011; R. W. Veryzer, 1999). However the asymmetrical positioning of the windows on the deck house, do not project a sophisticated function.

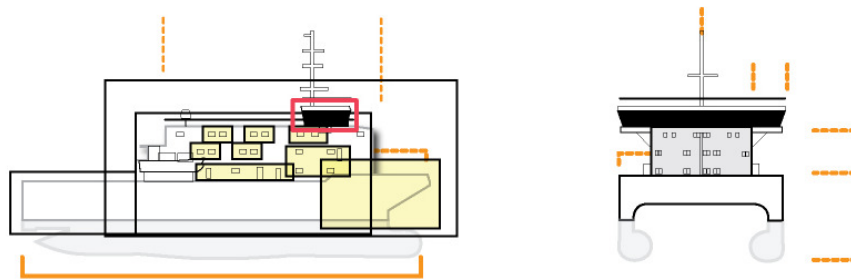


Figure 7-5 : Elbe Visual Balance

	Objective	Subjective	Reflective
Gestalt	Healthy Anatomy, 1.5 : 1 length x breadth: 60.4 x 40.6M.	Professional discipline, 2 : 1 length x breadth: 35 x 24.6M.	Light manoeuvrable (Elbe class strategy)
Primary - A	Cushioning	Human scale	Blockiness
Secondary - B	Practical loading	Human scale	Processing class built community
Focal points	Bi-pedal and bridge naturally shared out	Bi-pedal	Nominal traditional hull, (Not reflected in superstructure)

Table 7-2: Interpreted features of functional beauty: Elbe SWATH

The interpretation of features that unify components in sequences fitting to the functional beauty hypothesis is illustrated in Table 7-2. It is most evident in the bridge which promotes the vessels as a sophisticated insect like function in anatomy – which could be played up on in retro styling graphical representation and redesign for more aesthetic appeal. Similarly the need to mirror or reaffirmed how the deck is as advanced in function as the hull, and unity and homogeneity in quality is defined through this categorisation system. The flare in the bow architecture also reinforces this need to mirror this kind of finesse in the deck house.

The aspects of proportions in the geometry that make the Elbe SWATH functionally beautiful lie in the communication of a singular purpose, and the unification of geometries in the composition of her parts, as seen in the bilateral and bipedal like proportions of a sophisticated creature in Figure 7-3 and Figure 7-5. The anatomy has similarities to facial features in the front of the sagittal plane, and this is compacted with an elevated and biped-like configuration of parts. This natural balance becomes more obvious with knowledge of function and in top view, with reference to sensory focal points in the bridge. The modern and sophisticated work that is the Elbe Swath is to be put, is directing to familiar functions in nature and in other technology. The connections made between unconscious and instinctive elements of recognition and function create a special and intriguing morphology, similar but new in a role as a utility craft.

In the Gestalt form, communication of the stabilising role she plays in delivering pilots, the well-balanced proportions of the deckhouses, and twin hulls reassure steadiness; these elements brought together show an efficiency that can also be seen in the details. The subtle refinements of the prismatic parts show little optimisation in design. The human and community scaled deck houses, combined with the commanding geometry of the bridge, support the idea of efficiency in command and organisation.

As highlighted as the key features of aesthetic significance in Figure 7-6 and Table 7-2 the focal points revealed that the slightly chined corners in the deck house would create the same self-assurance, if placed in the geometry of the deck house. Optimisation in the superstructure could reflect the slight sculptural inner chines of the hull form, if budget allowed and could improve visual, or aerodynamic balance.

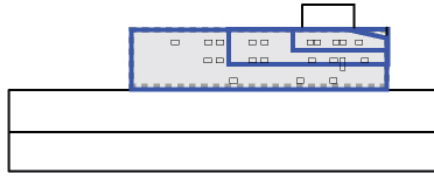


Figure 7-6 : Elbe Summation Ratio Transferred to Secondary Function

Patterns on the habitat, have been identified as having visual disparity between component parts in the Elbe SWATH, and the summation ratios identified in Figure 7-4 could be used to reinforce pattern balance through nominal design – i.e. with positioning of windows – or in use to layout graphics for the deck house design, as in illustration Figure 7-6 above. This nominal use of the proper functions summation series, as seen in the primary and secondary function of sequences, fits with a sophisticated organism – and could bring subtle details of balance, into modern graphics for the the deck house, to give a more impressive visual appeal.

7.6. Summary

The initial judgments on efficiency and effectiveness in association with nature’s anatomical forms and proportions are pertinent in investigations on the SWATHS external appearance. The continual and cyclical analysis required to glean finer details may have led to the cultural and contextual connotations and associations with functional finesse and elegance, yet were difficult to ascertain from those prominent first appearances. The reflective manner required, however, revealed how tectonics and edge definitions in neighbouring cells or parts of the boat define relationships with the design DNA, that in much of the detailing of design reinforced the practical function of top down design.

8. The Oasis of the Seas

8.1. Background

The Oasis of the Seas is a 361 metre long Caribbean cruise ship that can house a maximum of 6,360 passengers and 2160 crew. Being an '*Oasis class*' cruise ship the Oasis is one of the largest passenger cruisers in the world and is North America's newest addition to an already estimated 17.46 billion dollar trade (Cruisemarketwatch.com, 2011a). As a direct reflection of the current commercial luxury travel industry it uses 'state of the art' large scale mono-hull sailing technology to dampen sea motion and to provide a platform of unrivalled facilities. She is currently the largest and most expensive passenger vessel built in the world and this class of ship appears to be saying a final farewell to the transatlantic super liner, introducing a new role as a 'Mega Cruiser' that is at sea for only three days. This means that passengers whether enjoying sea days or destination days can always have premium luxury experience.

8.2. Market & Persona

The 16 decks of accommodation and entertainment provide for a broad spectrum of ages and socio demographic groups. The middle aged market, who are most often accompanied by spouses and a growing number of under 18 year old children (cruisemarketwatch.com, 2012), will travel on a circuit around the Caribbean, from a purpose-built 140 thousand sq. metre cruise terminal at Port Everglades, Florida, a cold yet light modern building, which boasts 'Curb to cruise' times of fifteen minutes (Fain's, 2009). Please also view the QM2s similar market catchment and personas, in the QM2 section 9.2.

The *Oasis of the Seas*, has the function of transporting vast numbers of paying passengers around islands for the recreational experience and has an initial rectilinear forward kinetic appearance. This case study will search for those successful and unsuccessful aesthetic properties objectified within the overall exterior form. Describing feelings from the passengers perspective, toward physical form and secondly preconceptions of indoor and outdoor living.

The vessels appearance is important for people to view in marketing literature, on websites and also when in port. However when the ship is at sea, the external perspective is of less interest to the passengers and more of an interest to the critics. The objective visualisation thus starts at portside.

8.3. Chronological Experience – (Visualised)

The illustrations and images are inserted to aid the reader throughout the case study.

Approaching the Oasis from a portside town, one may well see what appears to be just another building amongst the interminable office blocks and port architecture.

At a distance, the man-sized compartments can hardly be identified within the multiple reflections of the accommodation either side, and only a minimal framing by the ship's hull and technology means that these tiny compartments become a myriad and patchwork of colours.



Figure 8-1: Views of the Oasis from the Portside, (AFP, 2010).

The foredeck does not look accessible, safe or of any organic and of natural appeal, it looks of a technical purpose, displaying robust engineering and is of a most exposed aspect, unprotected and barren.

Structures on top decks sit high above the sea giving architectural context to the vantage and vista from up high. These shapes mimic the foredeck and bridge, allowing the passenger to consider the excitement of having the sailing experience from this perspective.



Figure 8-2 : Side View - Oasis of The Seas (Burnell, 2009)

Topside parts that look awkwardly tied to her main hull. Architecture is fractured, projecting out, and seems to be insecure for the speeds that are represented in the rake.

The glazed accommodation opens the solid architectural structures afore and astern into transparent sides of tiny individual habitats, like a huge human cargo container lodged in-between the bow and stern. However the prominent stem and forecastle stretches out and points to the horizon and the open seas.

The transoms complex holds inviting and interesting environment to explore.

The Primary geometry above the water line is that of a square section beam, which has an initial rectilinear forward kinetic appearance. Which is a generic form that conveys forward motion and speed.

The overall oblong appearance is stretched and purposeful in direction. However the two solid ends of the marine platform seem to have a weak hold on the translucent precious cargo and hold and the massing make her appear top heavy.

The reverse sheer bow at an acute angle, reflected in the superstructure which rakes back to her parallel sides, and stretches straight back over eighty percent of the main massing, steps down in tiered plateaus to a convex and shallow transom astern.

At a length to breadth ratio of 1:6, the ship has a white skin over raked superstructure afore, which connects to a flat covered foredeck that extends horizontally to its sharp apex. From the fore-most point the bowline drops to the water in a reverse angle. It is this angle that is mirrored in the raked superstructure above that reinforces an overall impression of forward motion, with a strong polarised kinetic look.

Appearances in unification of functions have not been brought out in the appearance of the superstructure form, and no clear significant function is evident.

The main focal points are top heavy, with a low centre of gravity. The atomistic parts in silhouette around the topside architecture, are off putting in the overall image of a proper function, and can be considered as ugly relating to both the lack of simplicity and cleanliness. Their ancillary and un-needed additions do not share homogeny in form or line.

The proper function, crucial in interpretation of significance is not made truly obvious by any focal point or composition of focal points. Disparate features of the ships geometry that disturb a line that might convey the kinetic of transport that is in rake that does not reflect true speed. And in the apparent recession in organic growth, that appear as if they are quarterized bit parts and erroneous limbs. These features are abstract patterns that do not reflect community scale and thus human scale.

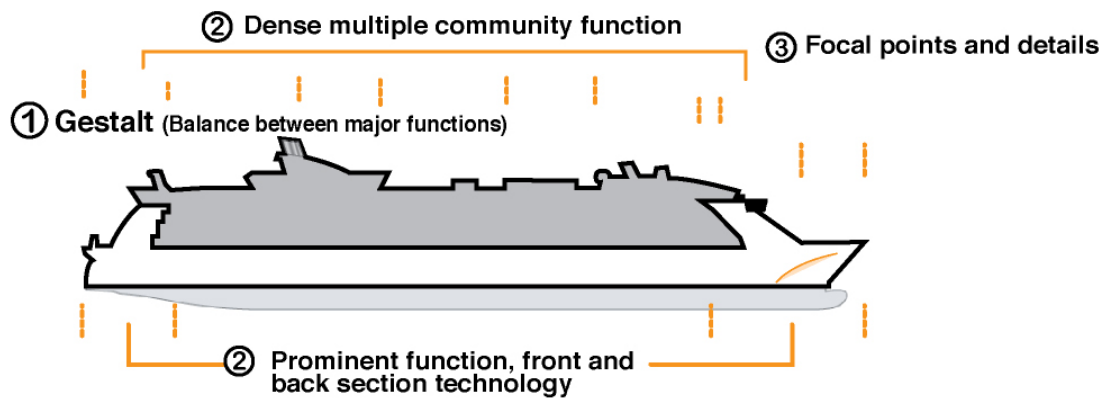


Figure 8-3: Oasis Divisions in Geometry that Illustrate the Golden Ratio.

Figure 8-3 illustrates the Golden Ratio. In the main body and the side elevation we can see a correlation between the parts and nature's maths, relating to geometric features of a summation series.

The Oasis communicates no overall proper function, rather an indeterminate complex that cannot be read.

The length to breadth of 1:6, is a less recognisable proportion in associations made with a traditional boat.

The prominence of the long rectangular beam is compounded by the habitat or superstructure at 1:4, and at the same width, which does not break up or synthesise to an organic dynamic symmetry, or to an accentuation of the significant secondary function of habitat.

Equivalence relations that increase in magnitudes of the same ratio might be seen in volume, and length, but not in heights, and it is the natural anatomy of a head and body that strikes as a familiar sharing out of the parts, relating to the primary function of transport mode alone.

The Oasis's architecture thus has similarities in components, to that of a head and body of a creature, in particular the Oasis has a very large main body similar to an insect's abdomen. (That is the scale of the parallel sides dominate the other features, and appears as if the soft and translucent abdomen of larvae, which supplies similarities to the surface patterns in a soft body, rather than a strong skeletal frame, and that appears a weak habitat envelope).

The major structural components and proportions appear healthy however, as they reduce in proportions that adhere to cadence in sophisticated organisms.

The design of the aft section of the ship delivers an organic form and with details of viewing decks, balconies and rails at various heights, it is a decorative and ornate opening. Looking like the mouth or the filtering gills of a fish, the natural proportions of this opening lead us inside to investigate interior features.

A face and mouth elicit feelings towards an animal form and an overall shape that we recognise. Supplying attachments to purposes relating to the natural features that will develop in the gestalt from this morphology, that is depictions of healthy skin and of its sculptural form from the anatomy analogy.

On first reflection the additional buildings on the top decks seem to be bit parts, limbs, antenna and additional parcels giving an incongruity to an anatomical form, which seems superficial to the overall. These protrusions and calluses are less attractive than a constrained form and of a form with overall organic smooth line. Associations with our common notions of ugliness and repulsion, the internals seem to be hanging out of the ship, and when in context with primary functional gestalt, less attractive, detracting from a functional or natural beauty, as discussed in section 2.2.4.

Focal Points:

The bridge above the wrapping corners of the front of the superstructure, has a completely open glazed wall to floor, which contrasts with the white of the superstructure in $\frac{3}{4}$ view. A stark and dark recess in the centre where it continues internally, its single component that stands out, yet it does not clash with any other parts as it sits in an organic and natural

position, i.e. where the eyes should be. Its angled crystalline quality gives a salient prominence in the gestalt and reflects the importance of primary function and of its fine craftsmanship through its quartz like geometry. It also stands out from the lighter viewing deck and double height glazed spaces above, even with similarities and embodies the core routines of the running of the ship - captaincy and control.

The bridge on the Oasis is a strong external visual component that gives onlookers a fundamental confidence in her sea keeping abilities, reflecting a well-designed product that visually helps us connect the primary function and sophisticated technologies, which are associated and directly related to a specific human scale and a proper function in overall form.

Technology visible above the waterline includes the main Smoke Stacks, antenna and central fins for control masts that sit afore and aft. Some of the larger features act in the overall gestalt, in frame with the hull and main massing, whilst others are questionable in functional terms and need more focus to read.

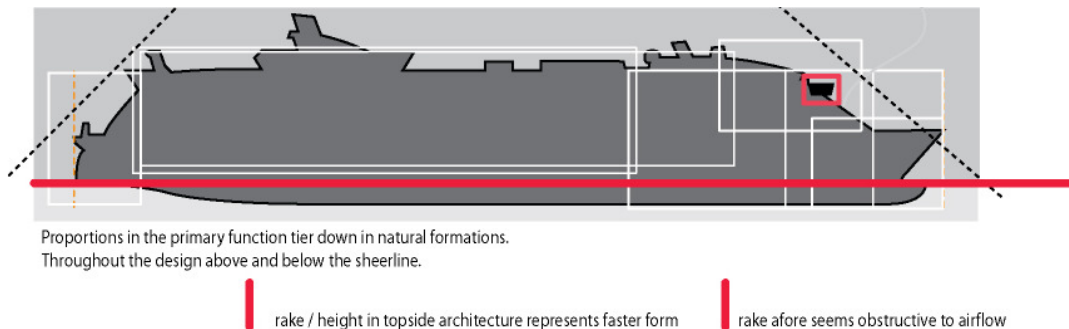


Figure 8-4 : Major Proportions and Rake in the Oasis

The major proportions and rake in the Oasis are illustrated in Figure 8-4. The main focal points on the sundecks are raked aft to describe overall motion and primary function of transport, clearly stand out from messy curved protruding partitions and panels and houses running length ways from the top sun decks do not represent the aero dynamic line presented by the primary functions rake.



Figure 8-5 : The Oasis at sea; in three quarters, front on view,(Reuters, 2010).

The horizontally slatted surrounds at the base of the funnels stand out and look like the heat sumps on an electrical device, see Figure 8-5 above, but the chromic metal cylinders poking out of the top look flimsy and a compromise on those qualities of the ships singular power. The bunching or grouping of these pipes don't fit with the aesthetics of the solid steel appearance, that is of the hull, or of the solid corners of the superstructure and are lost amidst the glazed units up-top. Just adding to the noise of the upper decks, dispersing and fracturing any meaningful line. Detracting from any purposeful contour or silhouette.

The freeboard is visible to the line of safety launches, where the start of the windowed sides open up to square windows and accommodation. The amidships sheer line is partly hidden by the safety catamarans, and cover an important visual reference for the portioning and balancing of the visual massing of the parts. These two storey high life pods hang four or five stories high above the water line, and are initial reference to human scale, illustrated in Figure 8-5 above, which supplies the onlooker with a message about the ships priorities towards passenger safety and sea worthiness. However it is not until one sees how this compares to other vessels and with visible passengers on-board from a far, one can understand the enormity of her scale.

The counter stern, which appears small in comparison to deck architecture above, becomes slightly larger as it curves to the water line, there it tucks under into the bilge radius at her sides and disappears below. An initial deck that juts out at the sheer line opens the transom up to house balconies and stepped seating for an audience in the amphitheatres round. These stepped decks on either side, use the same angle as the stern curve all the way up to the top deck, and sit either side of an opening that is very organic.

The raked tiers in the rear superstructures give credence to an Aztec architecture which influenced and worked so well for luxury spaces of the deco period. This taff-rail style, only evident in this part of the ship loses a connection to the rest of her style, it stands alone, fracturing any overall style. The aft section of the ship having enough detail to appear as another major visual focal point. The stanchions, rails and uprights from balconies that are many, like teeth, and the sculptural uprights appear like mandibles on the lower jaw of a deep-sea creature. The symmetry and regiment of openings and features give an organic makeup, leading us inside a cavern and habitat, a protected refuge that's newness creates suspense and intrigue, a living sculpture that appears in tune with natural habitats.



Figure 8-6: Aft of the Oasis, (Reuters, 2010)

The Oasis has new twin superstructure architecture as in Figure 8-6, which brings new aesthetic questions to light, and additional aspects of appreciation to understand. Not only has the Habitat got an interior function, it also has an exterior function too. The questions about aesthetics, tread a line between the ships function and land based architecture and habitat: See post occupancy visualisation in the Appendices

Skin Quality and Sculptural Form:

The Chine on the sheer-line around the fore deck, tricks the eye into believing there is a high protective bulwark and makes the structure look robust and well designed. The hull form, aft is also architectural and sculpturally complex, its compact small flared cylindrical geometry curving in two directions gives impressions of a tough structural quality and her skin here is full and protective. This area has square openings around its bowed centreline which nominally break the casing, sublimating structural integrity.

The front of the superstructure form and how it sits adjunct to the foredeck and set back on top of the bow, is the most visible external feature of the ship. Implying form, function and protective design consideration, it holds an aerodynamic envelope, and a backbone for the overall internal environment. Its smooth white skin and sculptural form

reflects the sophistication in technology and engineering. It gives reassurance in respect towards safety, robust technology and fine engineering.

The reflections and patterns projected from the faceted sides of the habitation remind of biological culture collecting around the edge of ceramic, rather than a lustrous skin of a leviathan. Next to the white clinical and rectilinear frame of the seagoing technology, the rippling reflection's are made prominent by boundary white and the yellow of the launches, making a stark and messy visual contrast to the crisp lines of the hull, in ugly and repelling features of the design as discussed in section 2.2.4.

The skin over the forecastle deck makes this sharp forward pointing structure look solid, and the Helipad engineered to be perfectly prismatic, which is a visual reinforcement of her strength. Giving very little connection to natural water repelling convex curves, open to the elements of sea and weather systems, as shown in Figure 8-7 below.



Figure 8-7: View from above at sea. The Oasis of the Seas (Reuters, 2010).

At the front of the Oasis the superstructure form is completely closed. Its shoulders wrap around to the parallel sides where again the surface opens up to glazed units. Portholes on the front angled face, unlike the previous class, change from square to round as the corner wraps around to the amidships.

The connection of the superstructure to the hull at this point suggests economical consideration of a linear additive design procedure and has left different parts, like balconies and features of its interconnections, interwoven and fractured as they round its corners, as illustrated earlier in Figure 8-1 above.

Where all the geometries meet at the curvature at the front of the superstructure reflects design D.N.A. from earlier models. Compared with her predecessor ships that all have a smooth line that connects the inner curve of the flat of the habitation to their sides, the Oasis fractures what should be the organic and sculptural lines with lapping joints to the balconies. These additional square cabin modules eradicate a smooth line around the corner and at its intersection which in combination with deck lines from afore, that appears to dip, and balconies that fade before the tangent, create a junction that disturbs any clear line. Similarly port holes and windows do not express cadence or social partitioning as one

would see in nature or healthy habitation development, the port holes that work around the sheer line on the Bulwark also drop in size, rather than in a smooth transition of geometry.

The Oasis has an economic bow flare that quickly smoothens into a chine-like flat through the parallel sides. Combined with a forecastle that has a high prominence as part of the gestalt and is highly visible to the observer. These features work with afore superstructure, that work as a visible symbol of apparent seaworthiness, and when the interconnections between the well positioned vantage point and functioning hull structure are combined support sophisticated function.

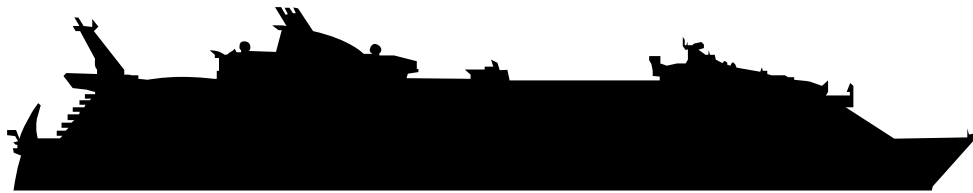


Figure 8-8: Silhouette of the Oasis

The Oasis and space around its form could be compared to two simple prisms cut from either end of a beam. The space around the sun decks and top of her superstructure appears complex and jagged, yet the primary geometric oblong form stands out.

The Oasis shares an outline that is a common shape for passenger ships, and the various additions and protrusions from the top decks are also becoming common place.



Figure 8-9: Oasis external balcony sets, (Travelphant, 2013)



Figure 8-10: Oasis inner board walk sculptural uprights (Caribbean, 2012)

The exterior image of cabin space is not conveyed as well as the interiors and the individual curved balcony units remind of portside holiday architecture, economical and dense, maximising floor space and minimising privacy. When viewed from a portside, each unit is lost in the vertical wall as in

Figure 8-9.

In the central interior of the Oasis there are fewer internal partitions than on the exterior and balcony sets in the boardwalk aft. Giving this internal habitation an aesthetic more in tune with spacious private envelops, the boundaries between group size compartments are subtle and intimate. These curved elements mimic the compartments one would find in the bulk heads and watertight components. They supply a natural and well-scaled aesthetic appearance in terms of habitat and human scale. The proportions and maths show credence to the art in design and craftsmanship, which increases a sense of well-being and the connection to the marine technologies focus on safety.

The feeling of land based architecture is total in the interiors studio apartments internally, and their wood panelled ground floor reflects premium portside architecture. It also refers at the same time to architecture in the marine platform, connecting with the technology of the sea and to our shared notions of habitat (Associations with safety from sheltering and safe habitat that can be quantified by the ‘Savanah Hypothesis’ of effective from works discussed in section 2.1.1.)

Invisible technology and perception of underwater geometry:

When under way the ship looks as if she will be stable in any wave; sluggish, slow and safe-looking. Her gigantic scale above and below the water is evident. Steady looking from three quarters view and front on (see Figure 8-5 above), and when focussed on the open and low transom or counter stern, her ample draught looks relatively heavy in the water. In contrast to her static dynamic she looks very stable at sea and underway.

Measurements reveal the forecastle around these features is relatively small, a fifteenth of the overall structure above the waterline, which illustrates an extended but relatively low freeboard. The freeboard is raised, but is not accentuated in the Oasis.

The swell from the bulbous bow and across the draught line afore, shows stable and purposeful buoyancy, and when underway, through the waves and weather, the visible swell around amidships is nominal. Showing good balance in respect to centre of gravity and a small wave drop within the draught line afore, the Oasis’ wake at low seas compared

to her giant size makes her seem very stable and does not affect any longitudinal aesthetic line.

8.4. Homogeny and Gestalt form

The Oasis's' purpose appears unrefined, uncaring and purporting to a lack of valuable quality throughout. It goes beyond a subconscious notion of a weak structural securing of the hold. Passenger gaze is ultimately driven to other parts more congruous in the gestalt or more agreeable, like the bow stem or forecastle, that are refined and crafted geometries displaying purpose, or to consider internal experience. The primary function if defined in the messy gestalt may be of healthy proportions. However the multiple facilities, create a disinterest in further examination of the primary function, rather than adding to a proper function, and influence more interest and a more pleasurable experience overall.

Craftsmanship and quality in the forecastle and transom does however persuade and influence confidence in the seagoing ability; this is however not homogenous or interwoven with any significant geometry or tectonics of the habitats function or the gestalt.

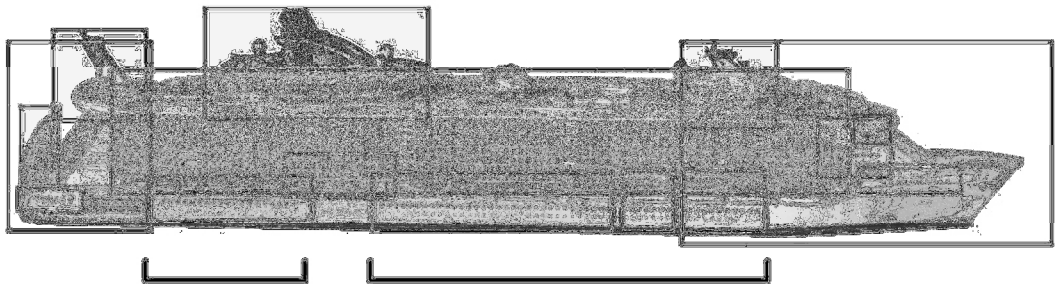


Figure 8-11 : Oasis Proportions of Distribution in the Gestalt.

Figure 8-11 illustrates that both port hole and window grouping above and below the apparent sheer line - and architectural pods up top, do not represent purposeful partitioning in the frames of the overall design. These external features and proportions; ratios and structures in the overall gestalt are used to evaluate human, social and end user aesthetic value, which is indeterminate and fractures the significant primary functions. Length to breadth however does give a natural balance, and characteristics of the functions in the anatomy are nominal, as no accentuation of a 'proper function' is evident.

Those functions that are unknown, i.e. luxury interiors are not portrayed in the architecture of the exterior. The internal open air space is conversely considerate to human

scale, in the exterior gestalt though, and overall form. Distraction moves any gestalt geometry away from a unified functional beauty. Rake does not resemble speed, and fractured architecture does not display the clever use of interior space.

Mental well-being through itinerary and projected vista is not a characteristic in the exterior gestalt, and social and communal membership and human proportions seem to be lost in her gigantic scale, Figure 8-12. For group scaled communities, read section 3.2.3 and 3.2.2.



Figure 8-12: Structural sequences of habitat on Oasis .

Those functions that are known, i.e. the sea technology are portrayed well, including safety and powerful size, yet machine features are ‘flimsy’ and stability looks ‘top heavy’.

Those functions that are new in the Oasis, (interior space), arrives with the passenger from marketing literature, rather than through the more valuable, theatrical and real-time experience of actual gigantic scale.

The hermetically sealed interiors open up to the interior’s magical garden. The safe haven and community scale, that is connected to the sea keeping frame here and in clever use of design layout, could create a special life-scaled experience.

The appearance and value of technology and functions such as accommodation, habitat and the organisational aesthetic, in the significant secondary function, can be seen to have subconscious significance and valued in the function of habitat. Which are aspects that could be more significant to the passenger in retrospect, more so than that of the primary function of sea keeping.

8.5. Reflective Analysis

The external appearance of the Oasis is not sophisticated, elegant or 'naturally beautiful'; she looks lumbering, a chip off the old harbour side block. The passenger quarters sit juxtaposed, disparate and rudimentary next to the functional beauty of the sea keeping technology. Overall the ship looks to be a steady going craft in transit, with a high centre of gravity at rest, having many parts and features that striate and disturb areas of her skin, which contrasts with the smooth, sculptural and taught skin of the visually sea keeping parts.

The design of the ship satisfies the commercial brief; fitting and framing the end users requirements, but is not universally attractive. The architects created designs tempting passengers to the cruise experience through itinerary. Using new technology, they were able to adapt designs to market needs, thus giving lower levels of priority to outdoor areas with strong social and communal cohesion. Function does not reflect outwardly.

The high tech seagoing function is adjacent to the dense arrangements of habitats. However these do not connect to our aesthetic expectations of dwellings and neighbourhoods. The top decks also have this problem too, where the interior and central cavity has pushed all exterior character into a flat box and because the overall size of the Oasis, which allows the main deck to become part of the interior.

Appearing as if her internal organs have been pushed to the outside due to the maximising of internal space foot print have given a busy overweight look. Additional parts seem superficial and ugly additions to the primary function.

The small fore deck and a large front balcony that sits on top of the bridge, pays little credence to a neglected theme. The connection to ocean going capabilities is almost completely lost due to her enormous size. The pre-conception of the cruise, the reality and the desires of the end user are satisfied, but the designers have pandered to 'market pull' rather than pushing new ways of living through the technology and could have done more to guide people away from choice, free reign and influenza stricken behaviour, i.e. to be given the genuine perspectives of adventure and a story line orientated around the journey and adventure.

The innovative twin superstructure has managed to become an Oasis habitat of the sea, a refuge in an alien environment. A place that harbours Western ideals of comfort and luxury. External indication of smaller social grouping and neighbourhoods, or townships would add purpose to the exterior. Inspiring notions of stronger social and communal bonds, of deeper meaning and of higher levels of social interaction. Compartmenting in natural proportions at this scale would add character to her daunting numbers of parts, and move towards homogeneity and beauty in the Gestalt and unification of function.

The Oasis is a moving city experience with all the connections being of vantage point, giant kinetics and Western society. Avoiding the endurance of the elements and of the seagoing experience, the luxury of a hermetically sealed capsule can miss out on the ‘Journey’ and the elegance and sophistication in the technology that makes this possible. Passengers could quite easily avoid the connection to seafaring completely. However, the majority of passengers coming from North America ‘prefer to be indoors away from the elements’. This does not mean that an attempt to illustrate this aspect of natural beauty, should not be made through accentuated anatomy in the external features and proportions of the ship. The appeal that is harmony with ‘passengers from the U.K., who have built up a culture of seafaring and a desire to be out in the open air, exposed to the elements’, (Quartermaine, 1996), could be promoted to the less adventurous USA market, to attract them to common and instinctive pleasure in mystery, the novel and novel experience.

Views of this pioneering cruise architecture, from astern, draw us into the social areas within, and reassure on many levels about cruise experience. Any misgivings about her overall top-heavy appearance will be dispersed with knowledge of the open interior. These perspectives however do not lend themselves to the initial external views of the overall craft, and in marketing terms this ‘hidden need’ will surprise and bring an added dimension to the passengers adventure, as well as illustrating the overall top heavy appearance.

	Length	Breadth	Height	Area	Volume
(A) Hull	252	60	72	21660	1559520
(B) Superstructure	252	50	30	18900	945000
(C) Deck	99	49	49	2451	192093
(D) Stern	21	50	52	1092	27720

Table 8-1: Sequences of dynamic symmetry in the Oasis of the Seas

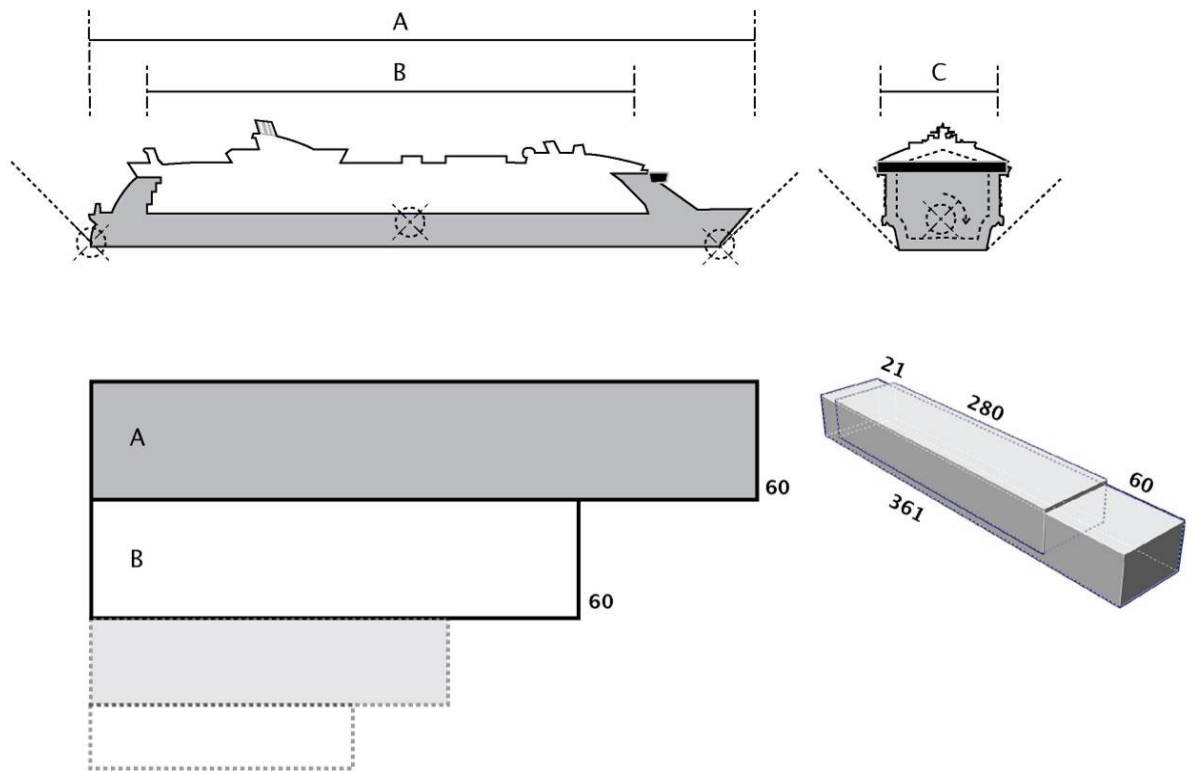


Figure 8-13: Major Proportions - The Oasis of the Seas

The relationship of the two major elements of geometry in the Oasis of the seas, as shown in Figure 8-13 and Table 8-1 can supply a designer or program with a summation series fitting to this hull form. The summation ratios that can be used to base mirroring of geometry and design of sensory system like positioning and pattern, fits with notions of functional beauty and to bring homogeneity to other functions summation, in terms of visual appeal. The SUM as noted in Table 8-1, (SUMMATION RATIO) is derived from the Length of the Hull, divided by the difference in length to the Habitat; i.e. $361/81/1 = 0.28$ – Similarly other summations can be derived, yet this one fits and unifies the overall identified proper function and in details of cadence that otherwise would not exist. Which replaces thinking in design about class division and social grouping.

The Oasis of the Seas, which currently appears to satisfy the commercial brief, loses out on in exterior form, as it is considered it compensates with the interior gardens. Simple aspects however could divide the vertical and horizontal lines to improve exterior appearances and the analysis reveals other flaws that can improve visual aspects of design within the solutions envelope.

Two opportunities exist to redevelop the Oasis, from the visualisation. Highlighted with a border around the respective box, and the complimentary features of

passenger significance in grey, as show in Table 8-2 below. This the ‘Gestalt Objective’ is to do with observations on the dynamic line in the proper and overall form of the ship.

Interpreted, Crew/Passenger Significance

		Objective	Subjective	Reflective
Function	Gestalt	Forward kinetic, $6:1$ length x breadth: $361 \times 60M$	Habitat, holiday, $4:6 : 1$ length x breadth: $280 \times 60M$	Various densities, (Partitioning character lacks clarity)
	Primary	Single power (Substructure)	Human scale (Partitioning character)	Community and social grouping (Partitioning character)
	Secondary	Line, Refinement, Perspective (None)	Take, Decor, Reflex, Speed (None)	Does not display clever use of interior outdoor living space
	Focal points	Atlantic plate (Inconsistent partitioning in the vertical and horizontal)	Transition in organic growth and bit parts (Inconsistent partitioning in the vertical and horizontal)	Continued bit parts and flairs, (Inconsistent partitioning in the vertical and horizontal)

Table 8-2: Interpreted features of functional beauty: Oasis of The Seas

Secondly the Reflective account of the Gestalt, as also illustrated in Table 8-2 above reveals that a group of pertinent features, as illuminated in light grey, combine to isolate that there is a problem in the habitat appearance. That is, it requires Partitions that represent, group scale communities and character to a human scale.

Problem: The lack of relief and character in the parallel sides of the habitat mutes any sophisticated social function between various communities or social standings. Illustrative scaling in proportions could fix this. However one must keep the secondary function under the primary function in terms of visible accentuation of function, for example in any hierarchical modelling of aesthetics, i.e. the accentuations of the partitions should not lead the eye away from the elegance of the primary function, or oppose visual elements of the primary function. Rather encourage harmony.

Action: There is opportunity to dress this overweight city, to make her curves look airy! See Figure 8-14. The most fitting address of the problems of the Oasis is the refinement of visual partitioning in the habitats in the parallel sides. That is in proportions relative to proper functions dimensions, and the defined summation ratio of 0.28 for example, to work with and within the habitats visible function as shown in Figure 8-12. Is suggested to improve aesthetic appeal through partitioning the habitat: Creating tectonics in the habitat that compliments and balances the appearance of natural anatomy, and also supplies the chance to reproduce cadence in aspects that relate to a sophisticated sensory system, which would then reinforce the overall natural homogeneity. Using windows, graphics or portage achieve visual balance in the gestalt and dynamic symmetry in functions, through minimal design change. Similarly, the development of more defined apparent shear line, which is an important and recognisable feature, will improve

perceptions in the Oasis being top heavy, in determinate and overhanging, and can bring elegance to the currently invisible structural function. This will support the habitat in one's mind, affirming a strong grip and solid foundation in the marine platform. The accentuation of such could also conversely remove the idea of a mounting for the abdomen completely – and instead aim for extending the clear skin abdomen feature to one of art, that is morphing this into its most advanced, yet acceptable extreme.

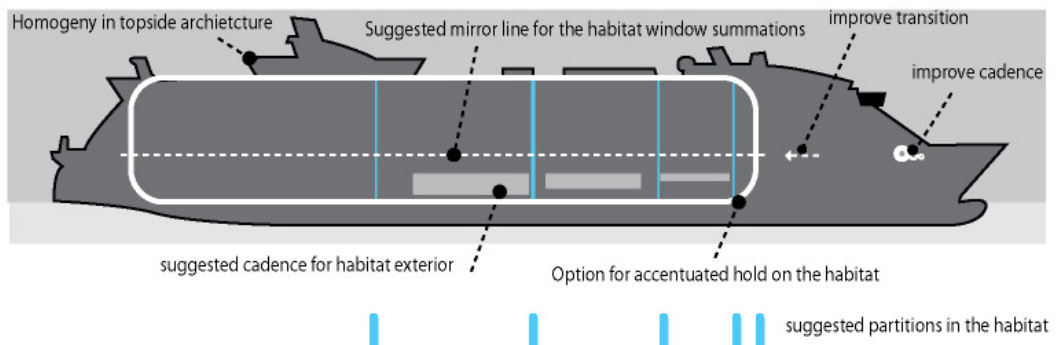


Figure 8-14 : Design Action on Oasis From Appreciation

Using portage and other division in the habitat and hull, to indicate, a mirror line, for summation ratios above and below- would enable homogeny through elements such as in sensory and anatomical patterning. Other elements would also bring functional beauty to the ship in accentuations of a proper function, which would also start to address homogeny in the topside architecture and cadence in portage afore or smooth transitions of foredeck around to parallels sides in the superstructure. These details of design, it is considered, could also be absorbed into the design with only positive impact, through focussed resourcing and design.

8.6. Summary

Throughout the visualised events, investigations into how the Oasis is perceived illuminate that she is a vessel of pedigree in terms of mass transport effectiveness. However, retrospective study on her appearances reveal that the overwhelming number of inboard social functions detracts from a pure and true function, or a proper function, as the functional beauty theory defines. Notions created by the redundant sub functions bring about perceptions of unhealthy DNA and, thus, a style that is destined to become obsolete.

9. The Queen Mary 2

9.1. Background

The RMS Queen Mary2 (QM2) built over two years by Alstom Chantiers de l'Atlantique in France and launched officially on the 8th of January 2004, is a 345 meters long transatlantic cruise liner that has a beam of 41 meters at the waterline, named after her predecessor the Queen Mary. Her total height of 72 meters houses 2,620 passengers and also holds 1,253 crew in a design able to hold 30 knots. The transatlantic and world tour she is able to make once a year, distinguishes the QM2 from all others, as they can only take local cruises. Her design reflects the national pride, and competitive excellence that mirrors style from the pre-war golden age of liners.

9.2. Market & Persona

The QM2 as many other cruise liners do – must attract newcomers to a market that is occupied by holiday and leisure passengers; who desire multiple destinations. They also want the luxury and exclusivity; in fast transportation to destinations abroad and across the Atlantic, (Cruise Lines International Association., 2011).

The Queen Mary 2 has 13 decks, designed to provide, accommodate and entertain a broad spectrum of ages and socio demographic groups from across Europe and the World. She mainly caters for the middle-aged market, those who are most often accompanied by spouses and a growing number of under 18 years old children.

Functions and experiences offered by cruise liners is typified in market data from the United States, (cruisemarketwatch.com, 2012) Which identifies where opportunities lie to attract a growth market from the existing and a steadily growing trend in cruising.

Cunard attracts many of its clientele from the U.K.s 1,850,80 holiday makers. The opportunity to attract newcomers, that can keep a sustained interest, is apparent in a growing market as defined in cruiser likelihood index US, (Cruise Lines International Association., 2011), who are in search for multiple destinations with luxury and premium

quality. Therefore, the higher percentage of this newcomer market is searching for a safer spectrum of variance in 'contemporary' qualities, which is useful to explore in the visualisation of experience presented here. The 75% of the market that are graduates, 30-60 year olds, usually from a family orientated partnership, or in old age, can be placed into a projected and target market - to influence those to take up values in a cruise through the designed experience and exterior appeal, Younger markets -12.5 index of attraction and the middle aged non-family part of the market, 30-39 -25.00 indexed, are less of a priority (Cruise Lines International Association., 2011).

The current expansion of the market is warranting attention to improve perceptions in the same market and in new 'cruisers' and non-vacation market share, that is promotion through integrated design', that other cruise liners may not have. Where the Queen Mary can seek to entice from a broader spectrum of people across the globe, and by considering that European and UK interests lie more in outdoor living, (Quatermaine, 1996), keep a local client base, and a cultural theme that promotes recommendation in the same market. That would suggest that the prerequisite private balcony, currently very popular in designer led associated value, can be seen as less significant to the UK market and European counterparts. This segment of the passenger market tending toward outdoor living and open spaces, suggests contact with other guest and the open air environment are important, (Ward, 2012).

Aiming at Non-cruisers, attracted through their own research, rather than promotion from agents, visual appeal may be more important than itinerary to attract newcomers that can be influenced through advertisement of qualities that show, short multi destination trips that appear to be 'contemporary'. However, passengers more likely to return for luxury and premium experiences, must also reflect on quality in experience and value in an aim to focus design on this market (Cruisemarketwatch.com, 2011b). The persona to visualise experience around, therefore, could be aimed at first time cruisers that go for multiple destinations travelling in contemporary style, for less than five days.

The vessel's appearance is important on paper, and when in port. However when the ship at sea, an external perspective is of less interest to passengers and more of an interest to critics.

9.3. Chronological Experience – (Visualised)

The illustrations and images are inserted to aid the reader throughout the case study.

Beam section and primary geometry is a tall rectilinear section beam, common to agile naval vessels, transatlantic architecture and as seen in some cruise liners.

Detailed textures and patterns of geometry, in interwoven geometries and functions, show a sophisticated design.

The large blue funnel and red curved fins attached, when viewed from the port side are different forms to other land based buildings – nominal fins, sail like features and heavily fileted funnel geometry reflects organic appeal from the deco period, albeit in details rather than overall: the habitat for example reflects modern structural minimalism.

The structural and colour connections between the hull and superstructure are fluid and organic. The highly sophisticated joins could be considered beyond natural organic geometry, on the fringe between natural and prismatic form.

The prominent QM2s reverse sheer bow is at an acute angle in contrast to the forward superstructure geometry.

The forecastle's footprint sitting within a protective wall and second bulwark in surround, defines the strength of the forepeak, forecastle and deckhouse - and the one hundred and eighty degree views, supplied to passengers by the steep windowed gradient around the forecastle as it slopes back to the bridge places the idea of a comfortable viewing deck, deep in the heart of the vessel in mind.

The bridges fall home and inter-connects in structures to the breadth of the hull, and the habitat or hold can be considered as a superstructure aft, sat in relief and back from the parallel sides of the hull. The setback face of the accommodation illustrates a protected cargo, and the chines on the bulwark and upper hull, a protected deck house afore Film Referee (Port-Fever, 2011).

Length to breadth, and stature.

The grouping and partitioning in functions and gestalt for QM2 is shown in Figure 9-1. Illustrating the painted sheer line extends the appearance of an upright and proud stature, further than in other contemporary and familiar vessels, that have more breadth overall. Placing more visual mass above the painted sheer line and connecting the superstructure and hull balances what could be a bottom heavy appearance.

The portholes and windows in the painted band between the superstructure and the hull crossing the real sheer line aid this homogeneity in the overall. The connecting geometry of the secondary and tertiary functions made out in a white painted frame, draws the forecastle and tiered aft together visually.

The top of the superstructure and the top of the hull, create a mirror and a visible balance between the hull and seagoing geometry. What is accentuated is the proportions relative to top side massing and habitat, rather than defining the super structure as cargo like.

The overall gestalt form can be likened to any athletic creature. The forecastle and bridge, associated with alert and athletic / predatory facial features. Accentuated with forward rows of windows in describe of its tangencies and accentuated height have proportions of natural summation.

The agility, athleticism and quick wittedness characterised also in the taught muscular and minimalistic geometry, attached to a slender beam is prominent. This can be associated with the fast running and slender frigates as seen in recent and contemporary naval ships. The Muscular, svelte, slender, structural rationalism is recognisable from comparable geometries in nature and cultural referee in description of strength in structure.

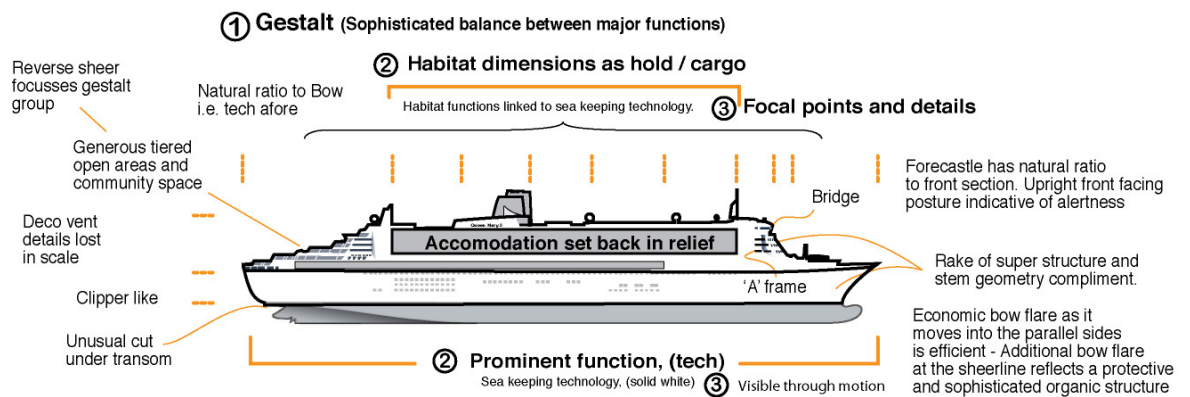


Figure 9-1: QM2 Grouping and partitioning in functions and gestalt

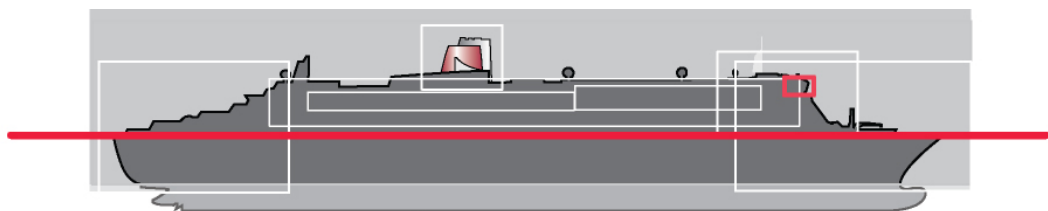


Figure 9-2: QM2 Prominent Features in the Visual Massing

With close inspection, the structural uprights of the setback accommodation complement the structural white frame. Also the frame proportions of the secondary functions of habitat, and in proportions that are visually tiered in the side view, as in Figure 9-2 and Figure 9-1. This geometric summation series of proportions, seem to place more people afore, fewer and fewer as we move to the aft, which with knowledge of her motions, could be seen to be more practical in reverse, however natural in terms of the primary functions of anatomy in nature and in physical terms.

When in motion, holding her course very well in calm water, the QM2 appears under used and looks as if can take on rougher waters. Returning to the Gestalt form, the habitat being modern and of a structural minimalism is concealed in overall form, as the connection between the hull and superstructure is fluid and organic. The highly sophisticated, organic and angled join around the sheer-line, links organic and prismatic styles in geometry, that appear on the fringe of a natural form, tending towards futuristic technology. The curved funnel on port side is different to other land based buildings reflecting the deco period lost in an overall composition of structural rationalism of the underlying structure. Balance in this taught skin at the rear and afore, in geometry that combines complex curves to produce structural strength, can be considered comes from the underlying perfect prismatic and symmetrical primitives, Video Referee - (Port-Fever, 2011).



Figure 9-3: QM2 Leaving Vigo. November 8, 2011 (R.Montero)

When at rest – The slight curve up from the stern to the bow along the length of the QM2, is accentuated by a painted sheer line and set back protective bulwark as shown

in Figure 9-3, that creates a dynamic appearance: as if she is sat back on her rear, and planing over the water at a higher speed than appears.

Focal points:

The curved set back bulwark, that flares out to the parallel sides, keeps the forecastle separate from the body in proportions. The bow structure obviously fine in cutting through the waves, is visible in the buttock lines afore that are curved heavily in the transverse sectioning, and in what is commonly called bow flare that is designed to pierce the water's surface. The athletic and taught structure afore separated in form and portion from the large body that has had an accurate channel cut to pass through, is weighted with extended sheer line afore, creating an apparently protective curtain in the sculptural flare, reminiscent of previous liners, however updated and refined.

The bow flare looks to be constructed by spiralling a line down the stem.

The smoke stacks connected and prominent as part of the power trains breathing apparatus is also visually connected to the ancillary functions and secondary functions of the habitat, standing in the centre of the vessel, and raking only slightly aft. Its red organic curved geometry akin to gills or a filter, is symbolic rather than to mimic a leviathan.

The aft, tiered down in generous decks, can be associated with it hosting a community indoors and out, the scale in each private and public space generous in proportions that again appear to be summation series and natural progression of tiers. Such as in plant life or in optimisation of weathering levels, that are also natural in human scale and fit the curved exit detail of the transom.

The transom sits over a square cut back in the hull that make it float above the water in an illusion that reflects nominal movements and motions relative to sea conditions.

The same purposeful sharp bow, as seen in the QE2, is enhanced as leviathan like creature, by the small bridge profile in side view. Reminiscent of a small eye from the side, natural in larger creatures, such as the river salamander and sharks, whales and large mammals also. That reflects a powerful giant, even in her relative scale.

Taught tendons and neck muscle refer to anatomy that is lean and athletic. The small hardened skull reinforcing function focussed on one agile and determined purpose, see Figure 9-3. The majority of other familiar geometry in sensory positions reinforce this look. There is even a smile, due to her cheeks rising where the foredecks meet at the

forecastle. And also hips are evident in the square blocks at the rear of the parallel sides, suggesting a set of hind legs in fast quadra-ped like motion. This particular geometry extends out to become the transoms foundations and the tiered aft accommodation and balcony system.

The complex and convex curves that travel from the forecastle perimeter to the bridge - gather as they climb. This fine filigree of detail worked in the structural and aerodynamic surface, is a point that helps reflect on the overall functional beauty in crafted and refined geometry. It communicates structural strength and craftsmanship. The front of the superstructures rake, creating the envelope that is mirrored in the transoms forward rake and in homogeny of mass.

Reflecting values of warmth and protective hermitically sealed interiors, in parts at least, the QM2 appears wash and water proof. Her angles and faces can be seen to naturally help and guide water to fall off and melt away. Where the partitioning of a modular design system and tectonics that is seen even in bulwark sections at the rear tier down and protect bathers from side winds and rain. Or in the forecastle, that defines structural strength and weather hardy curves at each of the geometries primitive intersections.

From front view the faceted silhouette from the bridge suggests that an acute angle connects the hulls weather deck to the super structure. The white surrounds of the mast like structure at the aft of the sun decks disguise the diesel funnels and compliment the white architecture to become part of the overall superstructure – again helping homogeny in form.

The windows that splay and follow the same convex curves on the face of the ship also indicate an unusual connect between the sheer line and the superstructure. It has been both disguised and hidden along the parallel sides.

From $\frac{3}{4}$ view, the QM2 has an unfamiliar form in terms of homogeny – in the prismatic parallel sides of any creature at least. And in the convex and concave surfaces join at where the forecastle meets the parallel sides, creating a subtle but impressive component in the overall appearance, see Figure 9-3. Not sitting well with notions of natural geometry however, as the adjunct of two primitive and simple geometries do not naturally fix like this, unless in a specialised and refined function of a sophisticated organism. Such complex multiple curved surfaces are an unfamiliar combination.

The abrupt change in direction and curvature in the forecastle of the Queen Mary 2 can be considered less familiar as geometry that can be associated with the primary function of buoyancy and transport. More to do with structural integrity and high functioning geometry, as seen in nature or in other complex structures, making the ship difficult to quantify in natural and familiar mammalian architecture at least.

Reflection

The complex composition with the other elements and multifarious links to the primitive function of flotation become increasingly difficult to read, and creates the idea of a new function. In relevance to interest and attraction, this requires specialised or further knowledge that cannot be gleaned from appearances alone.

Homogeneity in the style throughout structures that are athletic and refined in an almost prismatic filigree of surfacing, promotes craftsmanship and invention, reflecting an association with the futuristic styling of consumer durables and automotive design of the later twentieth century. The connection to the primary function of seagoing promotes these as valuable new functions that the passenger might reinforce, with the scale and itinerary and with persistent development in knowledge of function.

The apparent protective outer wall of the forecastle protrudes higher than the real sheer line and in a bulwark at an obtuse angle to the hull. That makes the Queen Mary 2 look sturdy, strong and in some aspects futuristic or alien like.

The continuation of an unusual and unfamiliar form continues with the slender and proud superstructure. That seems to be a compact with a svelte torso, unable to carry a significant load in comparison to the length to breadth, built more for speed and stealth. With further inspection the parallel sides of the superstructure that are set back from the sheer line can be seen as a deckhouse aft of the forecastle. The relief creates character, and associative functions of social and outdoor living. The bridge fits this style too, setting the wide screen windows back into structural skin. In decks that taper and are chamfered to indicate structural geometry and in qualities from industrial processes, and industrial design overall the front presents a robust quality in hardy outer and protective casing. The topside: Silhouette is simple and functional, easily read, with no raking in either direction. The bow flare is reinforced, and accentuated in graphics that advertises Cunard and the QM2, in geometry that is indicative of protection at extremes, i.e. realistic, in materials and design that are honest and true to function.

Proportion and harmony of parts:

Habitat: Divisions, reflecting class system is a valuable communication in diverse experience, and the cell density change also associated with a sophisticated organism is evident. Parts of an animal that also absorbs tribe sized and manageable group scaled communities’, is a cognitively rich exposure to a proper function.

Outdoor living doesn’t seem good at the front and in the parallel sides, luxurious however astern. The protected tier of social outdoor spaces are spacious enough to entertain small groups in events and in envelopes that contain and compliment a manageable and efficient social group - creating spaces that are totally inclusive and instil notions of a community.

9.4. Homogeny and Gestalt Form

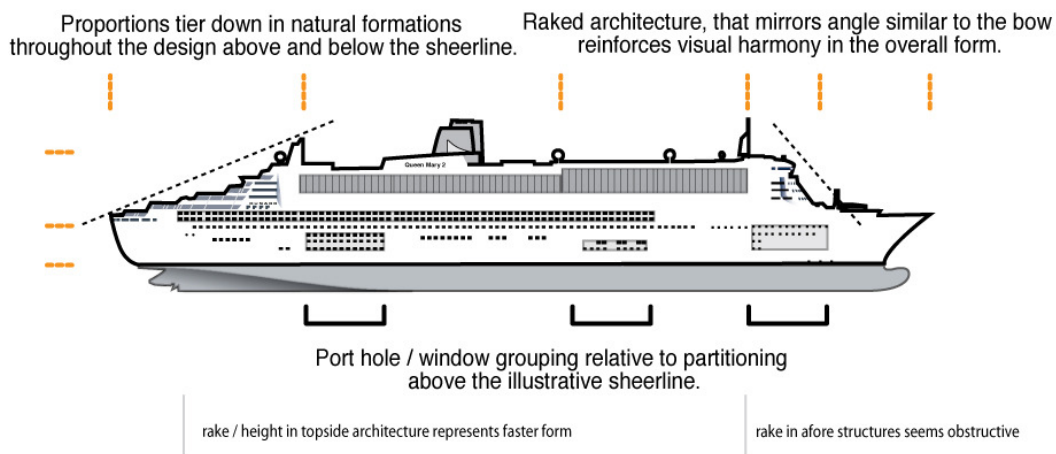


Figure 9-4 : QM2 Visual Balance Line and Rake

The QM2 Visual Balance Line and Rake are illustrated in Figure 9-4. The curve in the bridge windows, creates a small change in geometry. Noticeable by the change in the angles of the reflections, which can be considered negligible, almost redundant styling at this scale. The association with the strength provided by the curved surfaces in the face of the super structure, is from geometry, associated with a segment of a cone. That is presented with the different purpose in the white structural column composition and that frames the windows afore - make the curved detail in the bridge redundant and the link to facial features is made unusual by the change in 3D curve topology. In a part that could be better presented in one

single primitive, or in another more efficient geometry that links the bridge and the fore castle with practical construction and purpose. The attempt to create relief in the front corners for the superstructure, afore and aft with 2D graphics has done the same. The illusion of depth and character in these prismatic forms - that might work at a distance are diminished in terms of quality in function when on closer inspection. These deco vents or openings, turn out to be surface decoration alone. Any association to ventilation of exhaust fumes and power train related strength, as at the rear is too small afore to reflect the retro style proportioning. Details that do would not necessarily create similarly valuable social spaces or viewing decks afore, use scales usually working in an overall dynamic symmetry, such as seen in the aft tiered decks or in Aztec architecture.

Protective panelling cut from the same structural fabric. Not organic, but fitting at the tiered steps aft of the transom further supports gestalt in the rake. Tiered community sized envelopes, exclusivity connected and in summation series as noted and as seen in Figure 9-4.

The unusual curves and flats, place judgements in the remit of the fringes of recognisable geometry and one's understanding of functions of extremes of the sea and social functions that fit this association, are appreciated with knowledge of function. That makes the QM2s external form sophisticated and that adds considerably to a sophisticated story line and cognitively rich experience. However there is knowledge required in the appreciation of cadence and fine filigree of detailing in important functions, of power and safety. That must come from fairly detailed study of the exterior or in contextual knowledge.

Advanced - Knowledge of function (Historical and expert references):

The QM2 promotes herself not only in function but also in the precedence of a line of liners from the golden age. Her heritage isolates her in the last of the line and she is unique in being the only remaining transatlantic passenger liner in the world. The technology and style that she mimics from the past highlighting her as a unique and retrospective, and thus sophisticated in experience - however with the majority of routes following a similar path to the cruise liners. The notion of the transatlantic quality is subdued and becomes a subtle uniqueness in function and form. That is also reflected in the price per passenger berth, through life and in the passenger audience she attracts (Ward, 2012).

It could be considered that she shares the same DNA as the *Astonia*, and the *Queen Victoria*, or it could be seen that it is a clone and an expansion and evolution only in length.

Either way the QM2 uses known techniques to deliver quality based on her refined and specialised technology. That has both benefits and fall-backs.

Interiors mimic earlier styles that sit uncomfortably with some high tech equipment, for example the planetarium sits in a luxurious period cinema that does not hold the same style or quality.

The theme running throughout ties quality to the analogue functions that are often dressed in rare materials fitting with the image the Cunard Queens DNA. However this is sometimes disturbed and the attachments to opulent times – those that are reflected upon in Art Deco and or Russian Cubism do not sit well next to modern minimalism. In many places modern and deco jar and dilute in this way.

The Cunard line fleet, from 20thC had a common bridge built upon the same square foot print, creating a thin rectangular footprint for the bridge, from the convergence of the facia and tiered forecastle, that has almost disappeared from the new ships.



Figure 9-5: QM and QM2 Bridge architecture

The curved façade resembles Cunard's Lusitania and Mauretania, while the enclosed bridge wing cabs evoke White Star's Olympic and Titanic (S. Payne & Rdi, 2009).

The forward superstructure on the Queen Mary, shares both Cunard and White Star design lineage, however more prominent fillets and curves on the corners and bridge details, are not reflected in the newer design.

The complex and convex 3 dimensional curves, as illustrated in Figure 9-5, that travel from the forecastle perimeter to the bridge in the QM2, gather as they climb in geometry, mirroring the more primitive shapes of the original Queen Mary. However, the new production technology reflected in these sculptural surfaces and organic structures display expertise in both design and manufacture that reflects futuristic associations. In form that doesn't have the same tiered deco appeal - nor the appealing prismatic building block

composition. It is however clear that the complex naval architecture can benefit from the connected G2 and G3 curves, which is at extremes of what is most advanced yet acceptable MAYA theory. (See section 5.2). Its appearance is made salient in edge boundaries and structure in where functions and geometry join, creating a sophisticated initial impact. With further investigation this geometry is a removal from an understandable analogue procedure in production which then makes the QM2 harder to discern in her complex and organic geometry:

The chamfered upturns either side, at the top of the blue horizontal stripes, that flow down to fins in connects to the raised bulwark and sheer line, create a chine along the upper hull that meets at the forecastle adjunct with the superstructure in an awkward junction, just above the Cunard logo as in Figure 9-3. These geometries that could be considered as an over engineered façade, might repel those observers without knowledge of function, or in light of the complexity in production. However on reflection and as already covered in initial impact; the geometries forward proper function, looks solid and effective and this promotes security. Its geometric precision and protective design is the makeup for her hermitically sealed purpose, and again the mix of modern and retro that might function well together, and can be seen as fine engineering in strength and homogeneity in the curvature, does not necessarily sit well together visually, in terms of function. The ease at which one could read function in the evident contrasts of style, those that are in the single surface that flares out in the bow, and its interaction with the parallel sides, could be deemed weighted towards an analogue function. The two surfaces with cut outs, appear weaker in nature's structural finesse and in terms of the physics of geometry contrast with the overall solid impression. Thus it is considered these aspects of design and quality require further effort to read.

In contrast to the QM, that did not have the clipper shape streamlined bow, the QM2's flare reflects structural integrity at extremes of geometry as popular in pre-war liners. This also illustrates, the buttock lines under the water protective geometry. That also projects the craftsmanship and ingenuity in mimicking nature's evolution, albeit with the familiar straight sheer line afore.

9.5. Reflective Analysis

The combination of all the QM2's elements, creating sequences in dynamic series, as illustrated in Figure 9-6, creates notions of a sophisticated function. However the primary functions, sit on extremes, and can be considered beautiful only when her function is experienced or fully understood on reflection, and in absorption of sub functions and facets of design through experience.

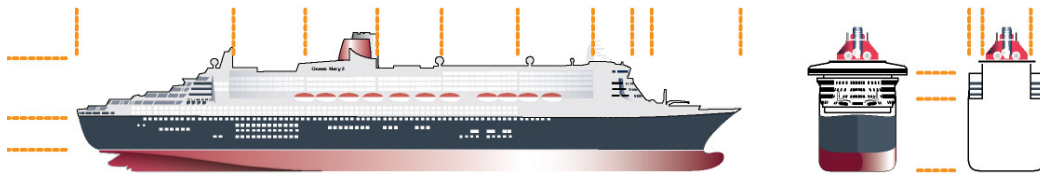


Figure 9-6: Sequences in Dynamic Series : QM2

The slender main body, with prismatic shoulders afore and aft are complimented in terms of reflecting an organic anatomy. The intricate and crafted geometry of the sensory systems that form a face in the forecabin and front section promote sensitivity to design in function. Her overall tall stature and gestalt figure, which is exaggerated in the structures above the water line, can be considered menacing in terms of appearances. Especially when considered next to the sophisticated curved interconnects, in the organic protruding bulbous bow, or in the link between the funnel to the roof and the forecabin to the foredeck. The aspects of designed finesse between functions in combination with the use of colour and graphics balance the two major components of function out, and directs onlookers to a sophisticated overall purpose, and complex primary function.

Passengers having few natural referees, or in fact contemporary comparable in land or sea based transport design, must consider the QM2 as alien in appearance. The geometries that communicate an intelligent and keen design, for fighting the ominous forces of the sea can, it appears only truly be appreciated and understood, when that function has been experienced.

The impressive giant scale, as Guiton suggests needs not concern itself with aesthetics, as has been done in the case of the QM2. The sophisticated curved and organic geometry that is used to connect elements together, provoke comparisons to the natural geometry and anatomy of a predatory creature such as a pike, or a shark – do so more readily than with prismatic geometry alone. Curves and softening compliment the size and add to appeal in ways that could not be conveyed by scale alone.

Also, there is natural balance in major and minor functions, which continues to be sophisticated throughout the series and cadence between the functions of seagoing and habitat, in both geometry and colour proportioning.

The change in direction of rake in the tiers at the rear of the ship, to the gradient on the forecastle face is complimented with the habitats relief in the parallel sides. The sophisticated element of function that prescribes the balconies and cabins to be set back however, only becomes apparent as an intelligent placement - when the relief is seen to create a protective and safe setting, for outdoor living only when people are seen on deck.

	Objective	Subjective	Reflective
Gestalt	Healthy Anatomy, 8 : 1	Endeavour and protection from	Tending towards athletic experience.
Primary	Safe transportation	Hermetically sealed	Athletic posture
Secondary	Community	Structural	Protective and safe environment
Detail	Structural	Structural	Detail

Table 9-1: Interpreted features of functional beauty: QM2

As noted in Table 9-1 above, the aspects that make the QM2 functionally beautiful lie in the clear method of design for the passenger’s safety and protection. The high parallel sides that might be daunting as they are seen from port, become the safe refuge from the most powerful forces at sea, as listed in boxes with light grey shading, and which are positive elements of the deckhouse/ habitat design. Distinguished by Primary Objective / Subjective categorisation and Secondary Subjective/ Reflective accounts, the other successful projection of aesthetic quality is posted in grey in the chart. These positive elements of the primary tectonics, are to do with – as noted, ‘lean and efficient’ / ‘svelte’ athletic posture, ‘tending towards aesthetic experience’ in Reflective Gestalt categories is an accolade, to say that the overall appearance has narrative and a story line that guides the observer to a sophisticated proper function, through clear communication of function and elegance in that function – or in functional beauty.

Minor or secondary focal points are scarce, and the sundecks seem to be a protective roof over habitat, rather than areas to explore. The viewing decks that might become active in port, are a seemingly minor function in itinerary, reinforcing the designer’s intent for safety and strength in transport. This can be seen in peripheral geometry to the primary function - such as seen in outdoor architecture which is purely for entertainment.

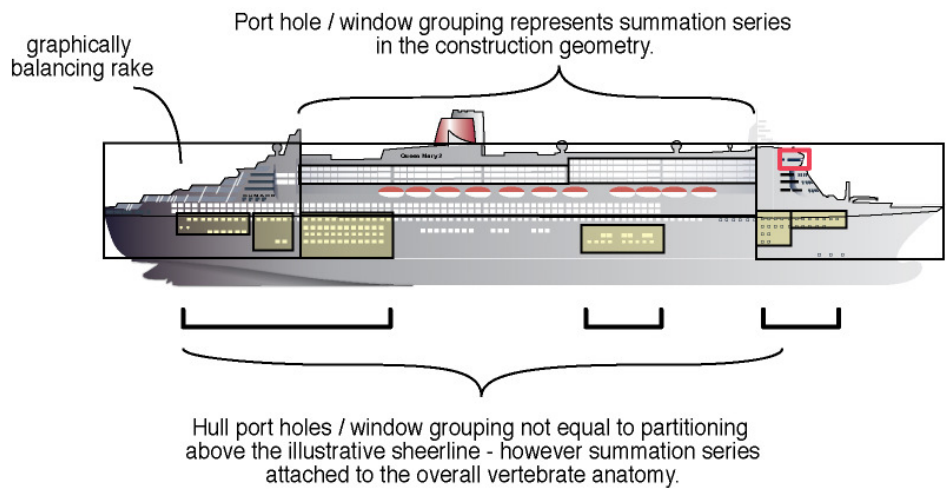


Figure 9-7 : QM2 Summation Series between 1st & 2nd Functions

The outdoor space beneath the cabins and forecastle are protected and appear safe in universal notions of natural architecture as overhanging protective growth, as discussed in section 2.1.1.

It appears that singularity of intent has been the method for sharing out the components of function, with great attention to details in the design layout of the primary function. In aspects that do not confuse, rather conveys tasteful amount for visual assessment, Figure 9-7.

The colour scheme is DNA from the historical Cunard line and liners, promoting reliability, business like organisational behaviour and quality. The red, white and blue in combination reflect serious business, and technological invention, in graphics and geometry that might repel those who might be in search of an extravagant adventure in hedonistic pleasures. It is those who may not understand or have knowledge of that particular brand of retro luxury, indicating endeavour and exploration in a journey or passage, with a company of professional sailors, and state of the art equipment in what is paradoxically advertised as a luxury experience. This is a contrast to the protective and hardy appearance that is evidently for the stresses and danger of being at sea.

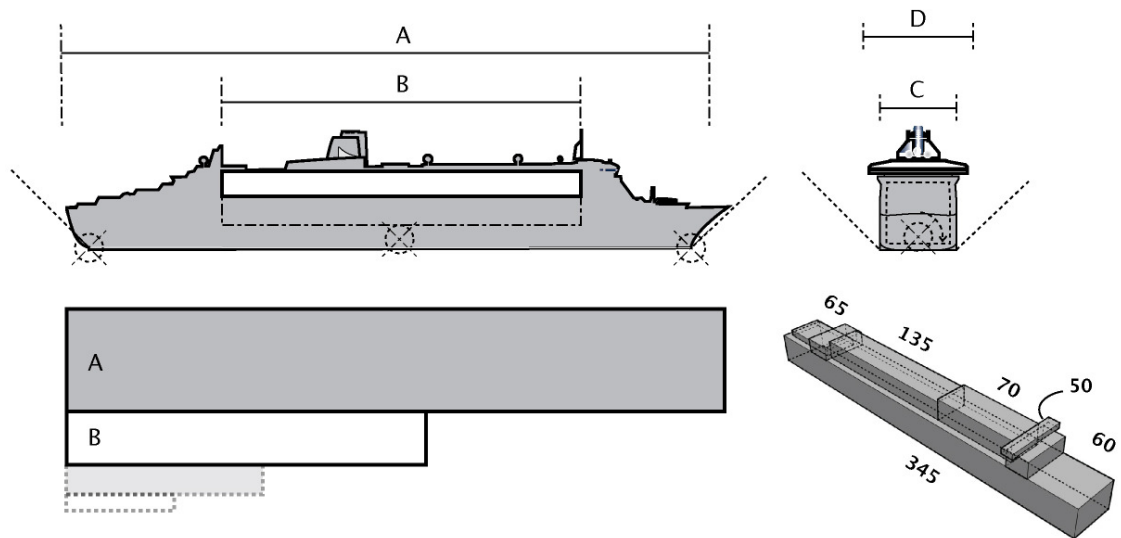


Figure 9-8: Major geometries & sequences in the QM2

	Length (m)	Breadth (m)	Height (m)	Area	Volume		
(A) Hull	345	41	36	14,145	509,220		
(B) Super-structure	135	29	19.3	4,756	114,738		
(C) Bow	60	30	19.3	3,000	57,900		
(D) Stern	65	41	13	2,665	34,635	0.45	0.48

Table 9-2: Sequences in dynamic symmetry: QM2

The several components of primary and secondary function that create a dynamic symmetry, Table 9-2 and Figure 9-8, as shown in ratios of A, to B and within each, as they contain sections, that equally tier down in a summation series and are notably in the QM2 continued in the curves of the foredeck, (illustration) and in the curves in the funnel connects. The windows and portholes also display cadence in division as noted in Figure 9-7 and Figure 9-8, in the initial geometry experience, along with secondary function windows and portage following summation series that is well balanced and shared out.

The QM2 has to a certain degree got some false filigree in the illustration of balconies in the forecastle structures sides. However the details are fitting in terms of decorations that recreate the anatomy of a sophisticated bilateral creature, and that is for example in associative terms of gills or also deco expressionist graphic styling.

9.6. Summary

Throughout the visualised events, investigations into how the QM2 is perceived reveal that she is a vessel of pedigree in terms of performance design DNA. However, the retrospective and cyclical study on the finer details of styling and design detailing show that little has been done to steer away from a safe and austere retro focus, albeit there is adherence to truth in materials and functional form. This is a ship, that by this detailed design has been committed to be the last of its type, and so is not progressive in terms of styling.

10. Case Study Analysis

From the case studies it appears that ships do not on the whole fit within the overall recognisable ratios and proportions of anatomy in land based habitats or animals. However, the dynamic symmetry between the parts of the mechanisms and functions often creates a recognisable configuration - that hold a form of beauty accessible in part of a universally or commonly accepted makeup. The signatures, scales and symmetry following the ships fundamental purpose and function can orchestrate natural beauty. The relationships between the proportions in the proper function and the detailed patterns in the secondary functions, however, often do not and could be improved upon with knowledge of how these can fit with one another. Using anatomy, to compare the bridge of the ship to eyes, sharing out components relative to the sensory systems of a sophisticated organism, as discussed in section 2.2.3, which can be considered earlier on in the design stages by using associations defined in analysis that coincide with underlying structures of the primary skeletal function. Identification of detailed aspects from the appreciation process can be considered progressive largely because this level of investigation does not exist in the design process. A cyclical procedure defining detailed elements of whether elegance exists or not, leading to refinements relating to valuable notions attached to craftsmanship, seems to show that the suggested process of appreciation and discernment can be augmented without experimentation in the design cycle.

In addition to the fundamental aspects of form and function (being recognisable to a collective audience), the features of efficient societal and human centred design, either in part or in the whole, leads us to ask where and how the two functional aspects meet; in the successful or unsuccessful synthesis of the gestalt. In the case of the Oasis of the Seas, for example, this is why this large multifunctional ship finds it hard to communicate a unified function through external form, and in the case of the Elbe SWATH, where it can be seen that the superstructure is missing similar attention to craftsmanship as shown in the chines of the twin hulls. However, the QM2 illustrates that this homogeneity exists throughout the overall structure, and in elements joined with filleted filigree and acute elements of natural surface continuity throughout, this promotes the skilled craftsmanship in the production of the entire ship: The associations to futuristic styling within the means of production, which has been extensively used - reinforces a connection to the primary function of seagoing, and in turn, promotes value in new functions and new technology via the same craftsman like qualities and properties – and that can be seen in the Gestalt.

11. Case Study Discovery

What has become clear is that beauty in ship design is not just to do with a proper primary and secondary function, rather the relationships between the underlying structural function (nucleus) and the visible functions of habitat. It is also to do with where portage and windows appear as sophisticated sensor arrays of the overall anatomy. Ultimately it is clear that what is happening naturally in the ship design process is what we find attractive. However, the patterns that resemble a sophisticated sensory system from a sophisticated organism's anatomy or from a bilateral creature for example, is an attractive addition to a well-proportioned primary function, that can be used to improve design. These recognisable features can be defined as attractive in associations with natural and functional beauty, in details that can be illuminated through a process of appreciation, and that helps form an agreeable narrative on a sophisticated function, design and production.

The case studies, therefore, have proven that passenger craft in particular are multi-functioning products that can become indeterminate through optimisation that is equally 'moderate to all parts' in its geometry, as discussed in the 'Functional Beauty' philosophy (Parsons & Carlson, 2008). This can be an appearance that draws attention to its indeterminate function. In particular, the case studies illuminate that simple summation series maths identified in the proportions can define what brings a ship's design project quality and finesse – or beauty, from the primary and proper function dimensions.

Any relationship between the major components that reflect both habitat and sea-going function, in terms of visual aesthetics together, can promote combined functions as a proper function in the gestalt or in homogeneity that is evidenced in hindsight. The idea of a proper function defined by those looking for both an ocean-going experience and a journey more connected to the sea, can push the boundaries of the design envelope and bring new exciting form to the gestalt, making it clear that complex architecture can benefit from an external perspective that can be deciphered by universal or objectified philosophical interpretation. This helps to identify the fundamental primary valued purpose, the perceived proper function, and to emulate what has made the Elbe SWATH balanced in harmony with its parts and functions. A philosophy that is a simple linear definition is tied to the qualities found in beauty or persuades an aim towards a singular design directive and categorisation in this way. This enables style to permeate into the design synthesis as algebraic and mathematical formulae, especially in the context of the DNA of a design that defines clear proportions of dynamic symmetry and summation series or consonance

signatures relative to the nature of the product and that are evident in the details of its design.

Grouping the complimentary aspects of visual disparity into categories of objective, subjective and reflective experience, as in the case study results, has proven to be a useful tool for prioritisation next to the end users most valued functions. For example, if the Oasis of the Seas aimed to ‘display clever use of interior outdoor living’ in re-design based on that hull and twin super structure form, a great departure from the initial concept would need to be made (as shown in Table 8-2). This driver is based on a secondary function. Reflective analysis however becomes redundant when considering the value in applying various densities in the partitioning of the parallel sides to give character, and as identified in the Gestalt category. Thus it can be considered that choosing subjective or reflective properties tends to hold more narrative value, and when paired with the Gestalt, such categorisation could be used in alterations of the overall appearance, which in this case, would not need a great deal of reinvention and can add potentially more value. That is, these ideas could be illustrated in graphical terms, at nominal cost.

The notion that a ship can look like an animal has been played through and then dismissed as a flawed approach as with Renzo Pianos dolphin inspired design, which was dubbed as a failure in terms of aesthetic appeal at least. However the addition to primitives, and essentials - and to consider what it is that makes a ship look interesting, a cognitively rich connection between sensory experience and relative significance, is supplied as a perspective which can, as it is suggested here, improve ship design for everyone.

11.1. Synthesis of Aesthetics into Ship Design

Learning about features from retrospective appreciation is an aspect of influence that may eliminate redundancy in geometry above the waterline or reduce cost in the process of developing better designs, which may influence the overall solutions envelope, especially if it were categorised next to that ship’s form and function and used at the concept stages. If these directives were to act throughout the design process in persistence with other elements of design and in-line with the overall anatomy, a model for innovation could be met. It is the value and confidence that these aspects of design carry that will help them penetrate further into the design synthesise and so categorising these elements of experience is where innovation may start. The initial diagnosis is that it may be complex

to instil the appreciative model, yet in taking such an approach up, it will provide analysis tools for the initial part of a total integration.

The important contextual elements of aesthetic philosophy can be brought into the design stream in a domain that does not press the boundaries of the primary and first principle dimensions of design. This means that those elements of retrospective analysis and aesthetic observation can work their way back into the core of the systematic process through iteration and generation of designs. It is also posited here that those can carry up the design stream as well as becoming a persistent influence in aesthetics; that when thoroughly researched and logged, can open up new varieties of innovation and improve the quality of functionality and utilitarian design, as well as experience-centred and visual aspects of that design. The skills in putting the end users consciousness down onto the page are the skills from the arts and user orientated design that are often neglected in a complex design systems procedure. It is posited here that ship design too can adopt and readily employ a scientific approach to appreciating and categorising aesthetics for consideration in this way, such as in the other fields of design and architecture. This however must be done while taking care to stay within the rules and regulations, which should not mean constraints but rather options within the first principle domain, and possibilities for a human focus on design that can ultimately lead to more options.

Primarily ‘visual disparity’, as seen throughout the results in the case study comparisons, could be used to examine how recognisable and significant geometry, unifies or fractures primary and secondary functions are visually, both in terms of reflective appreciation and in how the ships are put together in an evolutionary production and design process. This information as it is reflected upon and defined will both form the parameters and proportions for a proper function and can also isolate where a summation ratio may fit, or need more room to fit on the secondary function, and in patterns relative to sensory systems for the ship to look balanced and sophisticated. For example, lifting a false sheer line up to accommodate cadence in portage afore and aft to mirror a pattern in the superstructure, could be acceptable and achievable at the same cost as a super structure redesign.

Smart design with cross-platform and integrated connectivity means that aesthetics can become part of the core routine, in so much as to become a part of the DNA of a ship. In connecting the skin and fitting external blocks together, or determining preference in terms of aesthetics, experience centred design and experience function, could extend to a link with the bulk head arrangements or the prismatic coefficient, for example. Currently,

however, employing computer aided design for experimentation in configuration and embodiment of the overall design, the designer is testing controls for engineers to act as artists and designers to similarly act as engineers, as is current practice, simply by committing the design to the CAD machine, will not produce good results. The system is still currently too complex and although CAD is a powerful tool for the flag flyer to coordinate design, lending an automated resource management to the designer, it will only give the kind of time to consider both the engineering and aesthetics required with designer inputs. The case for artificial intelligence (A.I.) driving aesthetic consideration is not the focus of these studies, but it is however an interesting hypothesis to consider in the evolution of design. Designers will get closer to A.I. driven decisions and when an automated system does exist for both engineering the ship design system, gleaning and interpreting quantifiable aspects of aesthetics, so why not move aesthetics closer to absorption with interrogations on current types of technology and classifications, as suggested in this work?

The designer, until a fully integrated and automated system exists, can act as facilitator emulating the craftsman's approach, giving the engineer and everyone in the team, room to make mistakes, to be creative and work in the same direction with the same directive. This idea is difficult to implement in a time controlled systematic and linear design routine, for example, 'The Rugby Approach' may not extend to this (Cooper & Press, 1995). As illustrated by Erichsen, (1989), 'When looking at a larger task and large team it might take much longer to cover points to sufficient depth'. This more creative approach to innovation is a question for another aspect of research into the ship design process. However, a mission statement that can be likened to artistic intent or the communication of the end user into the design process can give cohesion between the various qualities evident throughout the various systems of design. This develops appearances and aesthetics around a disciplines language, language that combines CAD, design and Marketing languages, in vocabulary specifically developed for a type, technology or form of design as is outlined in a contemporary perspective on, 'Aesthetic driven tools for industrial designers' (Giannini et al. 2006).

It is persuasive to think that the ship design group can evolve to become a unified body and act as the architect. As Erichsen suggests in a core design team of ship design: 'to select core permanent staff and using a top down approach to large scale ship design team directives, moving anyone with different goals out of the project group into consultancy', will unify direction in engineering and it would seem an aesthetics and experience centred design, 'to explore or develop new ways of doing things, innovation of concepts and ideas

with tasks shared, with no distinction between group members and client groups or consultants', as defined by Erichsen, (1989). This harmony, is as with other modern management techniques is what gets everyone moving in the same direction, that is through a design or working philosophy. Advancement in integrated technologies, for use in design and manufacturing, means so much more for the naval architect, and is emulation if not progression in a unified design intent, i.e. in letting the engineer become the craftsman and supplying space to experiment under artistic intent and around experience centred design. Supplying a great deal more scope for creative solutions to a problem, and addressing qualities of the work and leisure social and community based directives. Computer integration supplying generative design solutions, in the concrete envelope of the superstructure at least, use data from human factors as discussed by contemporary researchers such as (Andrews & Pawling, 2006; Griffiths & Mack, 2007; J. Thompson & Sjöberg, 2010), yet are still being influenced by pertinent research from other fields of transport design and architecture, and can be seen in their treatment of social interactions, behaviour and aesthetics, and in ways that can be employed in terms of overarching philosophies on habitat design, as discuss in theory by (Ö. A. C. Akin, 1996; Broadbent, 1973).

In reflection on this process, the presentation of the components of the procedure has been complicated - as there are many to define for a fully robust aesthetic philosophy, that is, one that can deliver elegant and sophisticated aspects to interpretation: Gestalt for example is one such component that is important as it can be used to understand how humans perceive the whole of an object, even if partially obscured, as can be seen as a common element of a ships design, shown in Figure 4-2 : Complexity in the perception of a boat. This illuminates that the process may also be difficult to absorb and comprehend in the first part, which is dangerous, as it threatens this process or another fully robust theory making it into the ship design procedure: The investment for interpretation to work, would supply opportunity for a process to be formalised, and bring in new philosophy from outside the ship design process. Standardising a step change approach to its use in integrated design. This seems a feasible and compatible approach that can be augmented through the use of retrospective case studies that reside outside the ship design cycle, as here defined.

Language also present a problem for integration of aesthetics into ship design in the initial part as delineation between perceptions and actual in the process of analysis, is required to bring the appreciative process closer to the ship design and engineering routine.

Future work to influence the drivers into design could examine various configurations of superstructure in simulations of design that are also linked to practical constraints. Basing parameters around dynamic symmetry related to the hull form - or other technology. Rendering geometry based on various designs to a sample set of people to gain real time feedback, in a scenario of experience, which could be a route for tests after the thesis is complete. Fixing or switching, modes of function on or off in design development, and accentuate functions in the sharing out of parts, in testing the visual DNA. Letting aesthetics evolve throughout iteration and optimisation with parametric modelling. Also letting models become inharmonious and ugly – moving them away from recognisable parameters proven and supported by such as to be attractive. NB importantly measuring when this happens, and what responses are made.

Using perceived interests held by the end user as design drivers and as artistic intent to alter edge strengths and boundary intensity to define various aspects of gestalt function. Building external geometry around envelopes in layout, general arrangement such as modelling around ceiling heights, and deck heights, in relational and intelligent modelling. Honey Comb modules orientated and geometry produced from wind, and ventilation – relative to notions of beauty residing in geometric abstraction. Combining key terms or concepts of beauty, in a design model to frame two design directives – are all aspects of exciting experimentation that could happen within the design process if there were a defined domain, and a core foundation. Pinpointing when unification and dynamic symmetry becomes visually harmonious, and relating this to the numbers of design drivers for use within the complexity and connections relative to interest and beauty. The search for maximum or minimum amount of possible design drivers before the forms become indeterminate or disfigured, is also sought and validates a component aspect of philosophies ‘superlatives’ (design for x) in identification of the best structures and ingredients to base aesthetic formulae around type and classification.

Illuminating which aspects can be considered essential and specific aesthetic characteristics of the type of vessel is described. Components of Gestalt relating to the proportions and recognisable ratios helps link the ratios, coefficients and proportions of ships principal and subsystems dimensions, such as prismatic coefficient or calculations on centred of buoyancy, longitudinal centre of area curve etc. The interpretation process used to illuminate these ratios and proportions that relate to physics and buoyancy in aspects of sea worthiness, i.e. length to breadth (height), and those that relate to human scale and social or communal scale, i.e. as seen in the silver and golden ratio, i.e. of 1.618, which can

be as ‘hidden dimensions’, (Pheasant, 1986) and are from polar origins, one from the end users perspective, the other of technical expertise. These connect to unconscious inferences to the prototypicality in nature and product design and (Robert W. Veryzer, 1999) to synthesis appreciation into design directives is novel and useful in aesthetics design. Which can be deconstructed in the sequencing and dynamic symmetry between the parts, in an analysis of purity in aim and organic unity, (Guiton, 1971a; Hambridge, 1919). It might be complex to make simple, yet is addressing common and essential elements of beauty -and can develop into more sophisticated and esoteric aspects of appreciation, with context.

Co-ordination in branding and image can be controlled by using relationships in the neighbouring cells or in systematic block design planning. Design develops in a small area of the solutions envelop. External appearances, whether graphical or physical can be linked to fundamental principles that detail both longitudinal and transverse bulk heads. The primary distances and structural partitions such as founded by the prismatic coefficient of the marine platform or in ratios and proportions relative to performance can be used at an integral level to create functionality and inherent beauty. Aesthetic considerations are incorporated at a much earlier stage of the design cycle. This type of incorporation is already evident in the automotive trade. The marriage of these dimensions in design for aesthetics is however currently more about exterior surface design in a post-fix ‘make-good’ design way. It is posited here and supported with smaller craft design that surface and skin deep appearances can be altered with reference to principal calculations in design, and within a permitted solutions to create attractive aspects of design from links with primary parameters up stream, or, and which is currently the case, after the design cycle has been played through.

Some examples of principal dimensions for aesthetics to work from:

- Positions of Longitudinal and Transverse Frames.
- Froude number.
- Speed to length.
- Prismatic Coefficient.
- Displacement ratio (CircularM)
- Sail Area/Displacement ratio
- B/L relation (Beam to length).
- S/A Sail Area/s to Hull
- Midship area coefficient
- Waterplane Area.
- SOLAS regulations on Transverse watertight Bulk Heads / (relative to life boats)

Using fully parametric design modelling, in minute iterations in a total design, that could be considered as metaphor for DNA, or a type of biological growth: as explored in

works by (Fischer & Universtitat, 2003; Takamura, 2003; Vajna et al., 2005). These are ideas that consider steel as skeletal bone and layout schemes as block panning of neighbouring cells in underlying structure and flesh. This metaphor for design and narrative is discussed in section 2.3.1. These are notions of aesthetics that are a part of the structures function and form and can create appearances, relative to healthy anatomy, that can be changed whilst staying connected to parameters of primitive performance. Similarly in visual representation of external appearances, surface decoration and finish could give the illusion of inherent properties such as warmth, stickiness, tactility or robustness as noted in section 2.3.1. Using a natural metaphor in tangible, progressive and integrates aspects of hierarchically modelling and design can come from a current hybrid approach of inter-related modules in design and from modulations within a concurrent system. These techniques create narrative interest. Design methodology and design tools in this field are progressing and are encouraging aesthetics and human centred aspects of design into ship design process. Such design tools are developing across all fields of technology in a response for design – and which has compelling libraries for aesthetic appreciation. However, next to engineering and physical design drivers, these parametric domains may be assumed to have less significance.

11.2. Functional Beauty a Founding Theory

Functional Beauty is a key component to the novel system. Instead of having to ‘climb of a mountain knowledge’ (Dutton, 2011) to understand and appreciate the contextual message, as with many pieces of Art and provenance, that might be ‘codified’ (Csikszentmihalyi & Robinson, 1990), experience of every day products can inspire elicit pleasurable experience and supply notions of membership and ideals of placement and inclusion in a system and community. Geometry, configuration, space and layout can transparently lead the end user to the beauty of function which will make everyday products, tools and apparatus fitting to the reduction made in the functional beauty approach. Ship design too is a place for contemplation of functional beauty. The concise definition of beauty can be more commercially viable in creating the valuable connection between indoor living and outdoor space. It is beneficial therefore to suggest a collective appreciation for attracting the mass market and improving exterior appearances, alongside interiors and overall function too.

Theory-led interpretations based on universal and collective aspects, such as in the functional beauty approach, supply complex systems with a persuasive and coherent way to investigate shared and cultural aspects on beauty in retrospect, categorising the significance and value held in the functions and parts of the vessels, in the order to which they are presented. This value system similar to artistic intent is summated by considering that there is a universal ability and interest in recognising elegant function and efficiency - which is the type of axiom in design for the masses sought. Dismissing a need to contemplate the mental ability of the end user, and creating in the notion of quantifiable beauty, it is both a sophisticated reward system and a foundation for further experience centred design. Whether thinking from a reflective recognition of geometry or experience, or a reflexive (bottom up salient or instinctive) reaction, the result is the same. Inherently to do with cultural variation and exposure to similar or prototypical functions, contemplation of nature or nurture becomes only complex when cultural or personality conflict within supra-functional context (McDonagh, 2011). Those specialised elements added and managed by market research and feedback interpretation, as in similar levels of research, as discussed in: ‘Homeostasis and consumer behaviour across cultures’ (Parker, 2000), illuminates that research related to end users behaviour, is a variable factor in design, that can be related to demographics, amongst other cultural variation – equal to essentials in life.

Using what can be considered in the research as a theory led approach in the initial part, other aspects of emotional design for the end user in aspects such as user, designer and

research based approaches, such as defined by (Pieter M A Desmet & Hekkert, 2009) one can make a foundation. These fields too, lead to integration of a systematic approach to designed experience - following the integration of essentials via consideration of one's local adaptation to an experience.

The problem caused by the subjective opinion of the end user has been avoided in the approach to functional beauty, and thus reduces for some, the valued and heightened experience that comes from subjective points of perception. Culture is however rooted in the philosophy of functional beauty giving elasticity that can link or combine any delineation of categories to investigate these values. Creating more subjective investigations and romantic or personalised significance through knowledge of function and can be supported in situation application via 'associative generation', and local adaptation', (Reich, 1993) fixing to social evolution in the X and Y chromosome of global technology trend.

Through addressing a cultural approach, not a political one, functional beauty can overcome free market fundamentalism. Dismissing the need to contemplate the mental ability of the end user and help to improve external visual aesthetics that create design that is playful. Supplying narrative in the spirit and a process behind creation, interests can be considered as valuable 'partly because they recover a place for money in thinking about design', such as it does with craftsmanship, (Mcgee, 1999). By keeping people captivated and renewing experience and 'flow', through the theatre and experience crafted into a design, which is ultimately what people want, (Csikszentmihalyi & Robinson, 1990; McDonagh, 2011).

11.3. Summary

There is a scientific way of introducing aesthetics into the ship design system and that is by using processes of retrospective analysis along with measurements in proportions and symmetry. This then can be compared to the nature of maths and sophisticated organism anatomy. The qualitative parts of an equation, however, must be generated outside of the ship design process, until such a time as data can define which proportions from nature can be associated directly with functions from the ship. It is clear from the case studies that any language coming into the ship design system from orbital theoretical resources for styling or designing towards what can be collectively deemed beautiful, needs to have an identifiable tag, distinguishing it from ship engineering phraseology.

12. Conclusions

What this paper has presented is a multi-layered process of appreciation, which is needed to develop and elucidate what is attractive about a ship's physical form. The terse and compact or concise process, it is suggested, can create detailed analysis on how the primary and secondary functions of a ship's aesthetics interact physically with one another, which is an effective process for communicating significance, from the observer and passengers perspective into the ship design process. This procedure has been to do with the relationship between sophisticated function in natural homogeneity and a cultural and ethical narrative, as defined by the functional beauty philosophy. It is a systematic, mathematical and ethical approach to elucidating equivalence ratios in proportions of anatomy, that can influence algorithmic parameters to work within the aesthetic envelop to connect functions, and distribute attractive composition through visual components of geometry. The design drivers that are suggested can persist, due to their validated and accurate categorisation, throughout the complex design systems and generative path, and are suggestive and persuasive in their stature. That is in terms of creating experience that can elicit mental well-being happiness and cognitively rich associations, in pertinent and culturally focussed design drivers that are able to be used within the ship design domain.

The implications could mean the start-up of a whole new role within the ship design process and within the design group and procedure. In turn, this could introduce aesthetics into the disciplines taught programme in parallel with ship science. However, for the results to have a decisive impact on commercial design or education, variance in the case studies is required. Categorisation of functions and their relating summation series, will bring a library of patterns and parameters into the impending or emulated totally integrated systems of design, which will then be able to be mined relative to types and classification of ship or boat design. Being able to attach a summation series algorithm will be able to influence aesthetics into multiple classifications and types of technology design. The procedure can work in an integrated and closed loop system, which is fitting for aesthetics to fully integrate with the synthesis.

Using interest in functional beauty is particularly pertinent for ship design. It is, however, not the only concept of beauty that could be applied to a process of appreciation. It is considered central in the debate on beauty and as an accessible and concise parameter around the elegance of function in its terse rationale. The cultural and collective referees

to nature and evolution are most fitting especially when one considers that ‘for in the final analysis it is spirit that animates technology’ (Goethe (Findeli, 1994).

In short it is evident that the nature of maths and the summation series from nature are present in all ships and naval architecture, and in complimentary configurations that can be defined as attractive and even beautiful. However, in some cases unification between the primary and secondary functions, in terms of visual dynamic symmetry and natural homogeny, is not present. This sequencing, it is posited here, can be synthesised into a manageable tool and formula of directives that can stay within attainable parameters of appreciation and production. Evidence from the three model case studies suggests that the sharing out of parts using the summation ratio, that is from the primary to the secondary functions – for use in directing balance, harmony and homogeny relating to functional beauty, can be made within a system that respects physical containment by the ship’s design envelope, whilst adhering to a notion of beauty – that is rich and contemporaneous.

Appendices

Neuroscience and Interpretive Psychology

There is a struggle in empirical approaches to deal with cognitively rich and culturally orientated thinking. Currently neuroscience is only able to support methods for interpretation, rather than contain it as its own science, (Leder et al. 2004; Csikszentmihalyi & Robinson 1990; G. C. and L. J. Cupchik 1992). The measurement of dopamine and serotonin released in the brain, and monitoring activity, is currently not able to define sophisticated notions and the analysis of 'peak experiences' only supplies indications of how the brain reacts and is programmed. And it is still the job of philosophical reasoning and psychology to interpret how thoughts and memories are recognised, primed and work together, such as shown in how aesthetics and emotions can be measured, (Boehner et al. 2007; P. Wright et al. 2008). However neuroscience is useful in multi-disciplinary approaches, which combine with interpretive psychology and observational experimentation.

Using principles from the pioneers in interpretive psychology such as Maslow's hierarchy, Piaget, Freud and Adler to mention but a few; definitions for the priming and encoding of the brain through nurturing consider that one's direct environment is key: 'Give a child a floor to crawl on and it will learn to crawl' supplying joy in 'active mastery' (Piaget, Sroufe (Kemper, 2007)); defines how situation is key. However it must not be forgotten that external factors such as age may influence and in personality traits, that are used in extensive and penetrative interpretive psychology. The fundamentals from interpretive psychology however become a way to contain the multifarious system of analysis and that can easily become too complex for use in specific scenarios for design. For example and most pertinent here, is how short term memory feeds long term memory. In defining domains such as the amount of data one can store in short term memory or the number of images one can store in the short term memory – a designer can use time as a guidance system for appreciative design. Television adverts for example stick with 30 seconds or there about, making heavy visual stimuli and information stick in the mind recent filler adverts reducing to fifteen seconds also helps define common attention spans and windows for drawing people in, (Alvarez, 2004; Cowan, 2001). The archetypal product of advertising creating design that communicates features that – can be as effective as the face in communicating character or function in design.

Jean Piaget the Swiss developmental psychologist and philosopher illuminated to the psychology world that abstract reasoning is a trait of mature adults, which is a clear delineation in how ways of thinking can alter perception. Thus interpretive methods can

support with interpretive psychology and neuroscience for accurate interpretation of reasoning in fundamental elements of psychology. However psychology is a complex field of research and measuring and feedback from emotional experience is not a simple black-and-white affair of amounts of serotonin or dopamine in the brain. Currently analysis of how the brain works can reveal quite detailed accounts of pleasure and pain, anticipation and lack of stress, (i.e., power and control, or lack of control, self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life, and personal growth), and more recently, dialogue and language however, imagery is still difficult to define.

Pharmacological literature abundantly demonstrates that practically every type of motivated and emotional behaviour (feeding, aggression, play, sexual, and maternal behaviours) can be reduced to correlations between this measured neurochemistry and notions of pleasure and beauty (Panksepp, 1986). 3D imagery from situational and relative behaviour can be scanned to isolate activity in the brain that is currently leading to accurate interpretation of more detailed aspects of experience and emotion. The connections between regions such as the hypothalamus, which is a key producer of oxytocin, and also has a role in moderating anger, in part of the limbic system, that can be crudely considered the social centre can be read in terms of activity. Showing interesting interactions between the reward system and the social centre showing that dopamine and oxytocin interactions are associated with pair bonding. The data produced by CAT scans that is unusual equipment to wear day-to-day, is rarely true situational and rather relational in experiment. Results do provide correlations between feelings emotions and recognition, and less powerful but more transportable EEG scans are adding to validation in these areas. 'Neural pathways involving the neurotransmitter endomorphin triggered by in associations in areas of the hippocampus happen when participants are presented with a richly interpreted images', this – 'demonstrates that enjoyment generated by this interest is a mechanism to trigger activity in the pleasure centre', (Bateman, 2010; Hekkert, 2006). Empirical data confirms similarities through neuroimaging techniques, including PET (positron emission tomography) and CAT scans. Brain scan imagery, still in its infancy, illuminates moments and areas of the brain with higher activity, in what researchers believe to be the brain's 'default system' and that would lead to isolating subjective cognition linked to perception.

Interest in an object, experience, or person could be said crucial and fundamental in learning and as component of cognitively rich pleasure and experience. Especially in those emotional episodes that create and reinforce useful and significant memories in

valuable and significant aesthetic experiences and that can evoke, encode and fortify positive and useful functions. This reinforcement can be put down to the fortification of the neural networks synapses and pathways associated with methylation and prions, that is, as mentioned above, that build long term memory through short term associations. This is a challenge in the measurement of reflective contemplation in search of positive and significant experience, which is also complicated, and difficult to fathom, even from EEG or CAT scans, and in elements that are minuscule structural details - that have evolved from personal experiences through each individual's experiences and life time. However it is important to identify when aiming towards the peak and most significant or most valued aspects of experience in design, that enlightenment and insight can be relied upon to be a positive development for the mind.

Using neuroscience to uncover how memories and experiences are encoded and stored such, as defined and explored by (Alvarez, 2004; Baddeley, 1994; Cowan, 2001). Experiments have revealed how memory works yet does not uncover what those memories contain or are composed of. Explorations of how visual elements and items that might be more readily stored than others do not provide how these are associated or relative. The address of a quantifiable domain in the infinitesimal base of 'training data', such as seen in shape recognition, is a case to provide theory for contemporary interpretation, (Borenstein & Sharon, 2004). Taking the stance of a persona or common perspective on interest or a personal interest in matters, such as speed or luxury supplies and can furnish our comprehension of visual parts in relation to vocabulary and thus form appreciation in intellectual associations with visual interpretation. Thus analysis that uses story line and interest, are domains for interpretation that can be supported by essential categories from brain functions, related to for example *The Neurobiology of Play*, (Bateman, 2010).

Post Occupancy Simulation/Visualisation on the Oasis.

A circus top on the deck in-between the two halves of the 'Boardwalk Neighbourhood', looks like a sea anemone, nestled and immovable, protected from the natural forces of ocean and weather. There is the suggestion that passengers will be protected in the same way. These clever tertiary functions, which lack in the rest of the ship, include group excursions on a hot air balloon, which appeals to a sense of escapism and as an invitation to a social theatre experience. In features in accessible to initial impact and external appearance.

To maximise the premium luxury experience and alleviate any boredom inherent in sea days, entertainment offers diverse and distracting itineraries. These programs are designed to entertain many different kinds of passengers and for some rely on the level of luxury built into the entertainment quarters. A trip to the casino perhaps or out onto the upper decks for some sport, socialising or to pass the time in individual pursuits is catered for. Supplying something for everyone, and using deep hull locations for many activities that can be artificially lit.

The wake from the ship can be seen from within the 'Boardwalk Neighbourhood' it is firmly set into a modern living landscape, with few ocean backdrops that are communal. There seems to be no close parallel with the ocean's surface only an occasional portal is connected with the sea. These short cruises, with low risk at high prices, can only simulate the aesthetic experiences and connections to the sea that were once created by the trans-Atlantic luxury liners.

When aboard, acoustics, motion, fuel smells and alarms / calls to deck and connections to the rhythm of the sea, can be either detrimental or a welcome addition to the theatre of the passenger. Integral to the communication and organisational behaviour of the crew, it can be where the running of the ship can bring additional value to the passenger experience. What the Oasis has done to appease these passengers desires in this respect, is play with physical and sculptural representation of the primary function without any infringement to the operation, by adding buildings to the top decks that share similar views to that of the bridge.

The shared social communal aspect that brings value to the experience of the primary function, is separated in many cruise ships, but there is a conscious effort to bring this fundamental quality of the journey to the top deck experience in Royal Caribbean

Cruises and those visible elements, viewing decks, vantage points afore, reinforce new social experience through design.

Indication of shared social experiences, those that mirror the theatre of captaincy and are voyeuristic toward operational routine and work, and are attractive to those who want to experience the motions of the journey. However there are only few group scale, small and intimate areas evident in the ship design afore, from her exterior and only 'weak' connection between public and private space elicited. The shared spaces on the Oasis are visibly large scale and have a softer social meaning, but still attract through 'feelings of safety' in its communities. (Talen E. 1999)

The embodiment of the sailing experience and most visibly connected to the ships technology, are the interiors of the bridge, portholes in and around the sheer line, chine, forecastle and transom, and are most connected to the primary motions of the ship. Most affected by the pitch and heel around the centre of mass, these afore and aft locations are of advantage to those who want to fully experience the aesthetic of motions on-board. Almost completely sealed and within the hull, these spaces inaccessible by exterior reflection indicate operational views, protection and a shared primary experience. These locations have outstanding aesthetic qualities and combine all functions, physics and natural beauty in the sculptural form of the overall ship.

Ocean going technology in the many parts and appendages of spherical pods and antenna topside – and in the anchor cut-outs in the bow, indicate mechanisms and hidden technology within. Only visible by the compartment packaging and many of these sea keeping mysteries: This supports theory on a 'magic' 'black box' technology, or technologies watching over the passengers and crew, automaton planning itinerary and keeping all aboard safe too. Technology is a distraction from what one understands of the primary objective of buoyancy and stability, and in details of sailing that becomes less important in gestalt form – that is for the passenger at least.

The technology below the water line is hidden, yet its hydrodynamics and propulsion technology manifests itself to the end user through motion and its analogue properties and can be appreciated as a feeling without being seen. This is a most important consideration for the passenger as it determines, speed, comfort and travel experience, i.e. from universal notions of primitive modes in the physics of motion, travel and kinetics.

The lower hull form, as seen through the water and from images in dry dock, is beautifully crafted for performance and economy with a fine bulbous bow. The organic and

sleek acute angle of bow flares out to a broad flat box, a box that has relatively small bilge radius in comparison to breadth is a beautiful form afore and mirrored / re affirmed, and successfully mimicked in an organic hard shell above, albeit in a prismatic angle, in the super structure afore, and as with previous classes of vessels in a recognised feature of design.

Evidence of motion and propulsion through the relationship between the upper hull and the ocean, and how she lies in the water is indication of sensory experience of the ships motion whilst on board: And where we can see the lack of ‘snappy’ (Jeanna Bryner, 2009), movements pitch, roll and yaw. We understand that it is due to her being of such scale, that motion appears negligible to the overall gigantic size. This retrospective analysis of the Oasis makes her an attractive bet for those that get sea, motion sickness and where experience of occupying in the larger vessels can be pre cursor to the aesthetic appreciation, a visible advantage in scale.

Interior: Cabins

Internally the luxury of space is expressed well in the clever use of double height rooms and in most enclosures and in the ‘state rooms’ (cabins) a mezzanine floor for sleeping. The passenger must feel open and confident in the tall living quarters, which let plenty of light in and still allow a bunk like retreat.

Central Board Walk:

The central features of the entertainment sector seem to be the Aqua theatre and the ‘rising tide bar’ that moves between enclosed commercial floors. Both incorporate themes of the ocean but are poor imitations of other available vistas and exterior locations.

There are entertainment facilities throughout the interiors where only few have natural light. Appropriate for drama and the limelight of the theatre, productions are well placed in central hull locations.

There is an ice rink, the theatres and the main Opus Dining Rooms, which have low ceiling heights inherited from the deck heads, some central atriums opening up to triple height ceilings with cubist imagery and chandelier decoration.

The internal spaces and oblong layouts, i.e. using generous human scales and natural proportions in floor plans, giving a good sense of architecture and design consideration, the double height rooms connect passages out onto deck, and travelling through these interconnected ships spaces creates theatre of being on board giving feelings of 'well-being'. (Watson D.G.M. 1998). Unfortunately modernist mixing of styles removes any continuity of décor, which detracts from an overall aesthetic. Scale however and multitude of spatial experience must give openings cathedral like and metropolis like feelings of super organism society.

Examining where the luxury suites and commodores accommodation sit under the bridge and in primary place afore, observations lead to where the ships spare blades have been put on display in a hidden walk way below. Used in the theatre of function perspectives from on-board or from outside on deck of these precision sculptural parts of function are made in a protective walkway, and in a way and position like a row of flesh cutting teeth in the lower mouth of a fierce and flesh eating creature.

Aesthetics and beauty by design

There are very few streams of design that do not consider aesthetics, as it is a philosophy that deals with modelling of self and is the natural progression of any problem that considers an end user. Whilst product designers consider ‘Aesthetics’, as the analysis of a design in terms of visual attractiveness, it is used to different degrees, holds various meanings and used to add value in different ways.

‘When I am working on a problem, I never think about beauty but when I have finished, if the solution is not beautiful, I know it is wrong.’ - R. Buckminster Fuller

Relative to a product’s value and function, and raising questions that can penetrate further into modelling of self, aesthetic consideration and philosophy in general can help reason on how the end user could benefit from a design’s features and function, that go beyond practical purposes, (G. C. and L. J. Cupchik, 1992). This is seen in personalised products, and emotional design, by McDonagh, (2011) & Mugge et al., (2009). The recognisable features of contextual design that can influence the uptake of a consumer product, not necessarily as a result of LEAN, Kaizen or by practical or functional optimisation alone (Schaffrina, 1991). Rather in valuable personal or intellectual aspects of interest, attraction and beauty, that one can consider in the craftsman’s communication of the end user into handmade objects — that creates a product that perfectly fits its function and patron – and in a product that has no redundancy, no inadequacies and that could be considered as a perfectly beautiful thing, as form, function and beauty are locked together. Multidiscipline research by (Lim et al. 2007) and (Csikszentmihalyi & Robinson, 1990) suggests that it is in the interest in, and thus in the detailing of craftsmanship that gives long-lasting rewards, as in the release of serotonin, however it cannot simply be this black and white – and the story and intention for the craftsmanship has a part to play.

Glossary

Anthropomorphism - Attribution of human motivation, characteristics, or behaviour to inanimate objects, animals, or natural phenomena

Austinite - is a rare mineral that has crystalline symmetry-similarly enantiomorphism is Either of a pair of crystals, molecules, or compounds that are mirror images of each other but are not identical

Autogenetic succession - Self-generated: automatic design.

Automated - Automation or *automatic control*, is the use of various control systems for operating equipment such as machinery, processes in factories,

Bilateral symmetry - (also called plane symmetry), only one plane, called the sagittal plane, will divide an organism into roughly mirror image halves.

Cadence - A rhythmic cadence is a characteristic rhythmic pattern that indicates the end of a phrase.

Commensurable - adj. 1. Measurable by a common standard. 2. Commensurate; proportionate. 3. Mathematics Exactly divisible by the same unit an integral number of times. Used of two quantities.

Consonance - Harmony - 'Rhythm is in time what symmetry is in space.'

Consciousness - is the quality or state of being aware of an external object or something within oneself.

Design DNA – A metaphor that uses 'information that encodes the genetic instructions used in the development of all living organisms', for products of design.

Didactic - "related to education and teaching", and signified learning in a fascinating and intriguing manner.

Dynamic Symmetry - as a form making methodology or a symmetry law related, not to the geometric structure of the constituents of matter, but to the laws which govern the dynamic behaviour of these constituents.

Ego-centric - characterized by preoccupation with one's own internal world.]

Epigenetic - In biology, and specifically genetics, epigenetics is the study of changes in gene expression or cellular phenotype,

(G2) (G3) surface curvature - expression with respect to complex curvature, form 'A Class' automotive industry surfacing and three axis or two axis curvature and surface continuity.

Gestalt - Die Gestalt is a German word for form or shape.

Her / She – A ship or boat or any vessel that carries passengers, for that reason.

Homogeny - Similarity of structure between organs or parts, possibly of dissimilar function, that are related by common descent.

Instinctive - any behaviour is instinctive if it is performed without being based upon prior experience (that is, in the absence of learning).

Intellectual beauty' – of intellectual beauty, rather than intellectually beautiful.

Morphology - (*biology*) the study of the form and structure of animals and plants.

Ontology / ontological - is the philosophical study of the nature of being, becoming, existence, or reality, as well as the basic categories of being and their relations.

Pedagog –parent like, leader, someone who educates young people.

Phylotaxis - The arrangement of leaves on a stem

Phi - The 1.618 proportion makes a rectangle named the 'rectangle of the whirling squares.' Hambridge pointed out that the diagonal of a rectangle, when joined with a perpendicular leading to one of the corners created a 'harmonic subdivision.'

Physis – Physics in Nature.

Prismatic - relating to, resembling, or being a prism.

Prototypicality - original type, form, or instance serving basis or standard for later stages.

Sagittal plane - is a vertical plane which passes from ventral (front) to dorsal (rear) dividing the body into right and left halves.

Spectator Ab Extra – Latin from the outside in. “I think he possessed more of the genius of a great philosophic poet than any man I ever knew,... he ought never to have abandoned the contemplative position, which is peculiarly, perhaps I might say exclusively, fitted for him,. His proper title is, *Spectator Ab Extra*.” (Specimens of the Table Talk of the Late Samuel Taylor Coleridge. July 21, 1832 – Wordsworth)

Subconscious - is the part of consciousness that is not currently in focal awareness.

Sublime - metaphor for an experience that is transcendental, insightful and in a phase transition from one state to another, as in the chemical sublimation.

Symmetry - means consonance (unity) between the whole and its parts.

Tectonics – Plates and parts, Greek origin meaning builder.

Teleological - is any philosophical account that final causes exist in nature.

Transcendental - climbing or going beyond some philosophical concept or limit, as with sublime, a phase transition, that transcends previous phases.

Transgressive - Exceeding a limit or boundary, especially of social acceptability.

Unconsciousness - the lack of consciousness or responsiveness to people and other environmental stimuli. In psychology.

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