RETURN TO THE RENAISSANCE

Alan R CRISP and James DALE
The Nottingham Trent University

ABSTRACT
Discussion was initiated and remains on-going, since a visit to the Royal Academy, by the course managers of Product Design, pertinent to the importance of 'craft techniques', 'form and function', 'time' and 'time to study'. The authors having been personally inspired by the Bronze exhibition at the Royal Academy initiated discussion around several aspects of design education contemporary within higher education. After analysis of Masters' students output from current curriculum delivery relative to drawing standards, manufacturing knowledge and ideas generation it was decided to revisit and redesign the curriculum; attempting to 'bring to the table' the quality of renaissance design and build integrated with new technology and facets of multi-disciplinarity. This paper describes that on-going process of educating students to produce artefacts generated through the renaissance process, of developing drawing techniques which enhance 3 dimensional realisation of form and enabling students to share that newly acquired knowledge with their peers. It was envisaged that they in turn would deliver and mentor a similar new content to the under-graduate students. It was also decided to initialise this approach by as usual teach perspective and orthographic projection but rather than use engineering or product artefacts to use organic models e.g., fruit, bringing an atmosphere of the art studio and 'still life' to the studio sessions.

Keywords: Craft, practise, time, mentoring, proctoring

1 INTRODUCTION

When analyzed the majority of course practise activities are deliberately time dependent; initiated by a desire to 'ape' contemporary commerce and industry, in readiness and preparation for the students employability, often at the cost of developing a true eye for form, aesthetics and function and the willingness to embrace new and lost technologies, materials and processes. The exposition 'Bronze' was enlightening from many aspects and perspectives, also thought provoking; one questions, whilst admiring Rodin's 'The Age of Bronze', can we instil in our students the desire to seek perfection in form and manufacture not hindered by time? Indeed is it possible to design the curriculum to incorporate the design and manufacture of artefacts that will be admired by future generations? One moves to question why are they so admired? They are seen as timeless, transcending as they do often 3,000 years to bring thought provoking pleasure to modern viewers.

The answer is believed to be the level of quality and nearness to perfection achieved by the designer and artisan through the masterful application of technique, process, technology and the time to practice it. The need to return to craft practice as so many designers have is compelling. One of the many drivers of the curriculum is multi-disciplinarity, coupled to collaboration between under and post graduate projects, moving the authors to re-introduce the life room to second year practice in an attempt to enable students to perfect form and using Master's students to mentor and proctor this activity. It was felt by the authors that the introduction of sculpture and particularly the 'lost wax' process of casting bronze artefacts would enrich this experience and the associated learning and facilitate research of new process, materials and technologies; often new in the sense of rediscovery. In the context of the argument for curricula change 'Bronze is ideally suited to the rendering of various textures and finishes and to the capturing of light' [1]. How better then to teach students the proportion of the human body, an introduction to ergonomics, than through sculpture. The ancient systems of human proportion drawing are not now practiced. The need to re-discover these coupled with the practise led to a heightened awareness of the time constraints within the courses and the perceived slow erosion of practise based activities which are not time dependent. The need to address the structure of the curriculum became obvious; and the possibility of a course long project was debated and realized. Returning to the renaissance theme, where time was spent not only in design and production techniques research but in self-learning and teaching, such that others could progress the work after the originator's time was spent, the authors saw the mentoring role of Master's students with under-graduates clearly as one of Master and apprentice, moving from 2D life drawing to sculpture adding the 3D context.

2 INITIAL DRAWING AND MANUFACTURE

It is noted that at both under-graduate and post graduate level students find difficulty in the creation of drawings to represent 3D objects, the authors are not alone in this observation, Evatt reporting in 2002 found that; 'their sketches of simple objects are more naïve than five years ago and the lack of 3D visualization skills is obvious'. [2] This presented the first problem in curricula design incorporating a long term sculpture project with which to enhance the design education; if the students had difficulty with drawing how could they initiate form through sculpture? The mastery, or lack of, using plane geometry to affect a 3D image, is often a hindrance to a students' ability to design products. They lack the necessary skills and numeric knowledge to effect good perspective, fall of light and scaled form; a consequence of this is their accompanying lack of modelling skills, their inability to produce persuasive maquettes. This can in part be attributed to their lack of training between 'A' level study and the commencing of university life; namely not partaking of the Art Foundation courses historically seen as a pre-requisite to higher education but now waning in popularity. It can also be attributed to cultural teaching and training of one specific art form which the authors perceive as not adequate for underpinning either under or post graduate design courses; the 'broad church' curriculum of the Art Foundation ideally underpinned the majority of design courses. The success of introducing intensive drawing sessions followed by a sculpture project led by post graduate students in terms of academic progression and enhanced student experience was believed to rely heavily on their understanding of 3D geometry and a heightened awareness of spatial visualization, which had to be developed from the curriculum and its delivery. As Strong and Smith have reported, 'Spatial visualization or the ability to perform complex mental manipulation of objects has been established as a predictor of success in several technology related disciplines [3]. This is supported by Sorby stating, 'Researchers have found that 3D spatial skills are critical to success in a variety of careers' [4]; this directed the authors to initiate the first phase of the course, intensive but separate drawing classes at both levels and the re-introduction of life drawing in the second year of the under-graduate course.

To return to the issue of drawing skills and 3D awareness, the authors believe the main problem is a lack of practice and the time devoted to this essential skill of the designer; exacerbated by their difficulty in the actual production, in manufacturing terms of 3D objects using conventional as opposed to contemporary machine tools; their choice of process and their choice of materials, causing them again undo hindrance in their design practice. As with drawing this can in part be attributed to a lack of training but it is believed that the main reason is the inhibiting environment of university workshops due to their reliance on 2D machine cutting techniques. As universities have moved closer to the commercial sector, post 1992, resources have been continually audited; not singularly against curricula needs but also against economic values; as such the curriculum and its method of delivery more than at any past time is driven by monetary as well as pedagogic needs. As university disciplines have been integrated and modified and new schools as a consequence have emerged, usually of cross-disciplinary nature, the need for rationalization has ushered in the need for shared facilities, that is workshops, studios and laboratories, not only between under and post graduate but also between taught and research driven courses of study. This in turn has led to a completely new method of delivery for manufacturing and materials processes study, one of group demonstration, often on research subsidized machinery, limiting the 'hands on' approach. This is far removed from the ideals of 'Engineering Appreciation' and skills learning as espoused by the Finnisten Report and underpinned by Ron Dearing's 1997 report, Higher Education in a Learning Society. This change has also led to the purchase of industrial type machinery, enabling the creation of artifacts in commercial numbers to be manufactured as student cohort sizes increased. This type of machinery itself falls into two general categories, namely, multi-axis machinery capable of 3D production e.g., CNC milling centres and rapid prototyping machines both capable of 3D production in a variety of materials and secondly, 2D profile cutters e.g., CNC water jet cutter and flat-bed laser cutters, again both capable of machining a variety of materials for flat pack design and fixture assembly. Both types of these machines drive the students to produce designs under-pinned by CAD techniques, which can be uploaded direct to the machine for manufacture, in so doing they also influence the students to design artifacts whose planes of geometry are a combination of various 2D profiles, itself derogatory to well practised form and function design. This development in HE workshops and laboratories has the authors believe led to an isolation of design students from the process of creation i.e. manufacture and in so doing inhibits their creative process in design terms. For this very reason it is seen as necessary to remove from the project the element of time and introduce the element of creativity from sketching through to manufacture with a 'hands on content'. This isolation is seen at both under and post graduate level leading to a desire by the authors to design a course of study that includes a year-long project at Master's level, which includes in the early stages integrated study with undergraduates pertinent to drawing and sketching skills.

3 DRAWING

Many practitioners of drawing, regardless of their profession, whether it be Architect, Decorative Artist or Product Designer have fundamental knowledge of the process of drawing and the processes of manufacture, both can be translated to the 3D process of 'lost wax casting' in Bronze, which should stimulate their ideas for product design and enhance their understanding of the design process. This transferable skill, particularly the sketching and drawing can be divided into six components, which become the foundation for the initial part of the project, taken by the Masters students in early October; they then transfer this skill base to under-graduates through a mentoring course at the end of the spring term. The six components are tactility, observation, rendering, scale, composition and co-ordination.

Tactility is often the starting point for young artists, touching the rough bark of a tree to transpose its nature onto paper or brass rubbing in some historic environment and is most important to the product designer e.g., the difference between two equally smooth surfaces in wood and steel is one of temperature, making one warm and friendly one cold and insular, to effect this by rendering takes time and acquired skill. Ingrid Calame states: 'from these tracings I make drawings and paintings,…my journey through tracing different sites, working with and meeting people and seeing their reaction to my work – all this has changed my understanding of representation and abstraction [5]. This is the very reaction and understanding the authors seek of their students. One exercise re-introduced to the Master's course is the exercise of blind drawing, to bring sensitivity to the work of tactility.

Observation is a fundamental tool to the designer, whether sketching, noting a user group's reaction or reverse engineering a product, no detail can be overlooked. The need to translate that which is seen directly on to paper, accurately cannot be over emphasized, it is the tool with which to communicate what was seen what was felt, what others' felt. 'For me creating art is a kind of opening to awareness, whether it's slowing down your vision to look at the detail in a surface, being open to serendipitous accident or discerning flavours of your own internal states and emotions' observation as expressed by Keith Tyson [6] is that which is required by all product designers.

To perceive the fall of light and transpose this onto a sketch or drawing to facilitate the illusion of 3 dimensions, that is depth and body, is a skill most required by product designers in their quest to communicate their ideas to engineers, manufactures and business and commercial activities. Rendering in this manner uses many methods and takes many forms, from the Bauhaus use of pen and ink varying the thickness of the stroke coupled with light and dark shading of the pencil through to the contemporary practice of felt tipped rendering (marker) pens which come in 140 shades of colour. Richard Deacon when reflecting on his style of drawing commented, 'my work has lots of links to my work as a sculptor, but it's not predictive or preparatory; I construct drawings, often using highly mechanical processes (rulers, compasses and so on). In the past 10-15 years I have made a lot of line drawings, focusing on the vocabulary of mark-making [7]. This very connection between the drawing and the artefact, in Deacons case the sculpture, is the one the authors wish the students to make during the design process.

The actual depiction of scale and form are intrinsically intertwined, any object, image or space illustrated in a singular fashion loses its form and scale without a comparative datum with which and from a measurement by the eye can be taken. In sketching, unlike orthographic projection which relies solely on the correct placement of layers in geometric planes and the addition of dimensions, numeric by nature, the sketched artifact must communicate its form, scale, mass and material from the paper with little or no annotation to aid the process. The simple addition of a rule in a photograph of an artefact indicates clearly form and scale, it is for the designer to make some pertinent addition to the sketch to enable form and scale to be transposed and interpreted. Interestingly, the sketch more than any other form of drawing can truly become individual, no British Standards to constrain the designer allowing for genuinely inhibited thoughts and designs to be expressed on and communicated by the paper. This individualism, so required by practicing product designers is best exemplified by Paul Noble, who writes 'I use the devices of technical drawing. These devices help shine the sharpest light on the things I depict. I am against hierarchies and perspective. I arrange the objects of my drawings on a spatial plane using cavalier projection' [8]. To take ownership of the sketch is most desirable for the student of product design, for the designer can return again and again to this their individual palette and as they develop so does the sketch and invariably the product.

The greatest hurdle to overcome in sketching is the blank sheet, where to start and what with, then how to build a composition to make the sketch stand out, to sell the idea, to communicate not only the artifact but the designers self. Product and Engineering designers have a practice to annotate drawings, aid memoirs to the reader and the designer themselves; the skill is the balance between images and text so they support each other in their communication role. This difficult task of compiling the poster, the flat work the all telling sketch is best described by Sam Griffin, 'As a primary means of notating a thought process, drawing provides a tool for proposition, for making sense of something you do not understand yet or ever could; it is a catalyst for both hypothesis and comprehension' [9].

The need then is to put all six components together, to synergize the component parts such that in the first instance an unambiguous sketch is produced from which, as a secondary function a 3D artefact can be created; in the case of the Masters' students, an artefact produced by the lost wax process. To communicate then students must understand the concepts of transmitting and receiving through different media i.e. words, images and models, so that through the reciprocating process of transmitter-receiver the message is understood and un-ambiguous. The objective of the sketch, in that sense, its role remains unchanged. However, this paper argues that its image and role are currently not understood by students and all too often not taught with a degree of significance that sketching and modelling deserve. Its permanence in contemporary terms in Higher Education it is believed has waned. The sketch, both 2 and 3 dimensional i.e. the 'macchietta' and the 'maquette' remain fundamental to the arts and sciences, they often synergise the two by a common thought and research pattern; Sennett states' making is thinking' [10]; Schneider argues 'drawing is as much an act of making as it is of thinking and delineating' [11]. From music through choreography, often sketched directly on the theatre floor, via geometry, to physics and biology, DNA structures, the sketch is used to communicate, but what type or form of sketch? Breen suggests 'communication media should no longer be considered as a 'given', but rather as an intrinsic' [12]. A return to structured teaching of sketching enabling it to be used as a fundamental research tool is proposed, as Bramston so eloquently describes 'Visual-storming, using simple and iconic sketches to communicate fundamental ideas' [13]. It is necessary for efficient and un-ambiguous communication to take place for both sender and receiver to comprehend the structure of the sketch, which to the renaissance was a 'macula', a blemish, a guide, lightly sparingly done to be covered by the oils of the finished artefact. Once the structure is understood a choice can be made of the type required, dependent upon the message to be conveyed. Choice of type is extremely important, Breen argues 'that this has a significant effect upon the insights and outcomes and the form they take' [14]. All of this process both thought and practise has been re-introduced to undergraduate and post graduate practise to enable improvement in design.

4 INTRODUCING THE CASTING PROCESS AND MATERIALS

The new, yearlong integrated project afforded the opportunity to introduce in an integrated fashion both materials and process to the students, in both cases bringing a new and enhanced knowledge base to their education. Materials were discussed and investigated at length, they found it stimulating to move away from the traditional research carried out on steels, plastics and composites and take in-depth study into Brass, Bronze, Zinc based Alloys, Magnesium based Alloys and finally Aluminium based Alloys. They were given a detailed insight into the casting methods commencing with traditional sand casting with 'cope and drag'; building up a familiarity with splitting a 3D object into its component parts to facilitate the production of at least two separate moulds that when joined together would form the required component. At this point the importance of the work done in drawing and the understanding of Cartesian geometry became all too clear to the cohort. The importance of producing the pattern either in wood for sand casting, wood or copper alloy for investment casting, used predominately in the jewellery industry; referred to as shell moulding in engineering when patterns are normally manufactured from oil hardened steel or cast iron; could not be over emphasized to the students, 'the first step, therefore, in making a casting, is that of making the pattern, and the pattern-maker may be counted as one of the most highly skilled craftsman in the engineering design industry. For it is he who first has to interpret a drawing, however complicated, into the solid shape it represents' [15]. However, to return to the renaissance, the manufacturing process, found so inspiring at the Royal Academy, and the one the authors wish to follow for the educational enhancement of the students is one of 'Lost Wax Casting'. This is a process in which the refractory mould, the shell, is manufactured using a wax model, which is melted out either before or during the pouring of the metal. There are two similar methods employed for the making of the wax pattern and then the mould, determined by the characteristic of the final artefact, namely a hollow product with cavities or a solid product. Traditionally there are normally three stages to the production of an artefact that is cast, namely, making the wax pattern; investing the pattern to make a mould and casting the molten metal before breaking the mould. For sculptures or designed artefacts with cavities this is more complex than described as both the internal features and the external require investment, that is, 'investment refers to the layer of refractory material with which the pattern is covered to form the mould. This form of casting has one element in common with ordinary sand casting in that the mould is destroyed each time a casting is made' [Ref 16]. The synergy of art and science as practiced within the renaissance period is nowhere better exemplified than in the process of pattern making for a sculptured piece. For not only was the was pattern 'fine sculptured art' of the highest order, it was by necessity hollow, both inside and outside form filled by a refractory material ensuring a casting of a precise and uniform wall thickness. At this point of the manufacturing process the authors have used modern process techniques as a substitution for the craft of the renaissance, namely rapid prototyping, using a low melt wax or plastic base material. The procedure follows the ancient tradition and that refined by modern engineering, namely the pattern is developed from an initial sketch of the required artefact, through sketch modelling and refinement using computer aided draughting techniques, enabling in parallel both the artifact and the pattern components to be finalized. The pattern is split along the part lines and by reversing both inside and outside forms are coated with the refractory material, in this case slurry of silica flour and water-ethyl silicate solution, which gives a smooth surface to the component. A heavier coating of silica and quartz grain slurry is applied to withstand the rigours of pouring prior to firing at 850 ^{0}C, when the pattern melts out. Currently this use of rapid-prototyping for the production of patterns is in the embryonic stage but early results are promising, with final year students taking the lead with production of supporting artifacts for their minor projects.

5 CONCLUSION

The students' initial reactions were the feelings of confusion and intimidation; however, they quickly gained confidence and began to produce drawings which may be described as, 'a fast and powerful medium for expressing design ideas' [Ref17]. In respect to drawing, documentation collated and analysed thus far gives evidence of improvement at first and Master's level, when the students are given the time and expert tuition to develop the relevant skills, exemplified by the initial and final drawing Figure 1. It is proposed therefore that by the fundamental curricula development the authors have ensured that the skills explicit as a product of teaching are implicit within the creative and interactive innovation of the students and within the discipline based teaching and learning of Product Design. This paper has described the authors' efforts in developing design and design capability and emphasises their concern with promoting design as a cohesive element within what often appears to be a fragmented syllabus. Their concern is also mainly with the post-graduate students and their role, currently under-played of mentors to under-graduate first year students and the enhancing of their educational experience. The authors believe that students implicitly respond to the system of teaching and learning they engage with. While the authors refer in this paper to under graduate and Masters Courses, their main concern is with the Masters courses. In this respect, design and build for the whole curriculum starts in the most important year and permeates through to Master's level as does the attitude of professional enthusiasm engendered and thereafter encouraged on the part of the student.

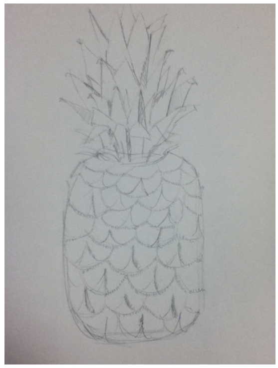 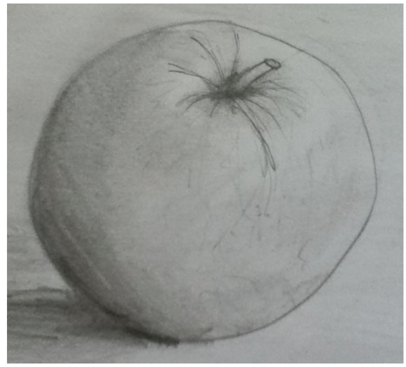

Figure 1. Initial Drawing [Pineapple] juxtaposed to the Final Drawing [Apple]

REFERENCES

[1] Royal Academy. Bronze, *RA Gallery Guide*, 2012, 15th September-9th December, page 1.
[2] Evatt M A C. Sketching a Dying Art. In *9th National Conference on Engineering Design Education,* September 2002*,* page 229, ISBN 1-86058-397-0.
[3] Sorby S.A. Developing 3D spatial skills for engineering students, Australasian journal of Engineering Education, 2007, Vol 13 No.1
[4] Strong S and Smith R. Spatial Visualization: Fundamentals and Trends in Engineering Graphics. Journal of Industrial Technology, 2001, Volume 18, Number 1
[5] Calame I. and Card N; Berning D; Baker k; Tracey (E Editors), *The Guardian and Observer Guide to Drawing Part 1;* September 2009, page 19.
[6] Tyson K. and Card N; Berning D; Baker k; Tracey (E Editors), *The Guardian and Observer Guide to Drawing Part 1;* September 2009, page 25.
[7] Deacon R. and Card N; Berning D; Baker k; Tracey (E Editors), *The Guardian and Observer Guide to Drawing Part 1;* September 2009, page 37.
[8] Noble P. and Card N; Berning D; Baker k; Tracey (E Editors), *The Guardian and Observer Guide to Drawing Part 1;* September 2009, page 44.
[9] Griffin S. and Card N; Berning D; Baker k; Tracey (E Editors), *The Guardian and Observer Guide to Drawing Part 1;* September 2009, page 19.
[10] Sennett, R., The Craftsman: *Yale University Press; New Haven and London;* 2007.
[11] Schneider, P; Working: Drawing: *Communicating Design by Practise:* Proceedings of the Colloquium 'Communicating [by] Design', 15th – 17th April 2009, Brussels, Belgium, Sint-Lucas School of Architecture, ISBN:978-908-132-380-02; page 133-142.
[12] Breen, J; Designing Design Communication: *Communicating Design by Practise:* Proceedings of the Colloquium 'Communicating [by] Design', 15th – 17th April 2009, Brussels, Belgium, Sint-Lucas School of Architecture, ISBN: 978-908-132-380-02; page 259-268.
[13] Bramston, D; Basics of Product Design – idea searching: *AVA Publishing SA;* Thames & Hudson 2009; page 15;
[14] Breen, J; Designing Design Communication: *Communicating Design by Practise:* Proceedings of the Colloquium 'Communicating [by] Design', 15th – 17th April 2009, Brussels, Belgium, Sint-Lucas School of Architecture, ISBN:978-908-132-380-02; page 259-268.
[15] Chapman W A J; Workshop Technology Part 1: *Edward Arnold Publishers*, 1963, London, pp3, page 66.
[16] Chapman W A J; Workshop Technology Part 1: *Edward Arnold Publishers*, 1963, London, pp2, page 78.
[17] Evatt M A C. Sketching a Dying Art. In *9th National Conference on Engineering Design Education,* September 2002*,* page 230, ISBN 1-86058-397-0.