National College of Art & Design
Faculty of Craft - Metalwork Department

The changing role of manual craft skills in a technological age

by

Susan O'Brien

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INTRODUCTION

As a metalwork practitioner, I chose to write this thesis in light of the dramatic technological advances that have been made in recent years. I thought the subject to be particularly apt right now considering how rapidly computer technology is affecting us on a personal level - the personal computer (PC) is becoming a household fixture, and more and more people are connecting to the internet. Soon those not affected by computer technology will be in the minority. In terms of craft, artisans (practising manually skilled people) are having to deal with the technological advances relevant to them such as CAD/CAM (computer - aided design / computer - aided manufacture) technology. It has become no longer necessary to use handskills in order to produce one-off designs. Will the electronic revolution complete the annihilation of manual skill which the industrial revolution began?

I will begin my exploration by looking at the evolution of manual skill from antiquity to the present day. This historical summary should help to put in perspective the issues affecting craft today. I will be discussing these issues in the second chapter, which will outline the powerful rise of computer technology. Chapter Three looks at the 'computer versus hand' debate on a human scale. Here I examine the work philosophies of craftsmen Stanley Lechtzin and Albert Paley, who emerged from similar beginnings but chose very different paths. Chapter Four deals with our human response to the dematerialisation that tends to go hand-in-hand with technological advances. This is especially relevant to the craft worker whose life

and livelihood are rooted in the practice of manual skill - skill which technology is rendering obsolete. As a metalworker faced with this prospect, I will use examples from the metalwork and jewellery profession (where possible) to closely examine the different factors involved in our dilemma. This examination will help to clarify the role of 'craftsperson' in an increasingly technological society.

CHAPTER 1 - Historical context

Due to crafts fluctuating status down through the ages, the histories of it's various disciplines are generally complex. Indeed, it is only in recent times that 'craft', as and independent subject, has been documented at all. Those who have endeavoured to do so are courageous people, and so to outline the main historical factors relating to my subject, I have looked to them - in particular Edward Lucie - Smith and Hermann Schadt. This chapter is mainly based on my review of Lucie - Smith's *The Story of Craft - The Craftsman's Role in Society* (1981) and Schadt's *Goldsmith's Art - 5000 Years of Jewelry and Hollowware* (1996).

In ancient times, all items were produced by hand as there was no organised form of industry. Everything was craft, both decorative objects and items produced out of necessity for everyday use. The Ancients engaged in a range of craft skills broader than anything we have encountered since. Ancient Greece is considered to be the 'cradle of European art and culture'. (Schadt, 1996, p.25) Here the goldsmith's art flourished, and wonderful pieces of work were produced by hand. The *Krater of Derveni (Fig. 1)* is an example of one such piece. It is a bronze vessel depicting scenes from the life of the wine god Dionysus. Many handskills were used to produce this piece. The base to the middle of the rim has been raised, and the upper section of the rim has been soldered on. Cast elements were also used by the Ancients - the moulds for which were prepared by hand. In this piece, the base, the handles and the hands of Dionysus were cast. (Schadt, 1996, p.28 - 31) Sadly with the decline of the

Fig. 1: *Krater of Derveni*, ca. 330 B.C., bronze, h. 91 cm.

ancient world, there was also a decline in the production of craft objects which resulted in the loss of these considerable skills forever. Why did this occur? There existed a distinct prejudice against craftsmen in general by the learned as both slaves and freemen worked side by side in the workshops. They earned the same rate of pay and somehow they all came to be seen as general slaves. (Lucie-Smith, 1981, p.43) Due to the lack of respect associated with craft, little has been recorded about their conditions, while artisans themselves (seen as mere slaves) must not have seen fit to keep records of their own endeavours. Thus apart from the objects they produced, their vast knowledge of skills seems to have died with them.

Due to the decline in craft production which mirrored the decline of the ancient world, craft objects gained greater value in the centuries that followed due to the sheer scarcity of them. Artisans themselves gained rank by the arrival of the Middle Ages. Now they were free men who were treated well in a religious society which recognised that Jesus Christ himself was a craftsman's son. Peoples' attention was focused on the life of the hereafter, and they believed their earthly existence to be a preparation for this. (Schadt, 1996, p.65) Therefore Medieval art and craft tended to function as a reminder of the afterlife - hence it was predominately religious. Relics, shrines, altarpieces and so on formed the bulk of the goldsmiths' output. *Fig. 2* shows an example of a shrine produced during this period. *Shrine of the Magi*, the largest and one of the most magnificent of the Middle Ages, was produced under the direction of Nicholas of Verdun. Many skills were employed to

Fig. 2: *Shrine of the Magi*, north front, ca. 1181-1225, gold, silver, copper, and gilded bronze over a wooden core, champleve enamel, antique cameos and intaglios, gemstones, h. 152 cm.

produce this wonderful piece including enamelling, engraving, embossing, impressing and casting. Constructed like a Romanesque basilica, this shrine was commissioned by the Cathedral Chapter. (Schadt, 1996, p.65 - 73) However traditional work practices began to change at this point.

At this time, workshops began to produce ranges of set stock to sell in the general marketplace, whereas before they had worked only on commission. There was an increased demand for work caused by expanding cities and population growth. Division of labour soon followed in the goldsmith's workshop. Guilds were formed in light of the increase in urbanisation and trade. They served to instigate and regulate commerce - a power which was to remain with them for quite some time. (Lucie-Smith, 1981, p.114) Therefore, in the Middle Ages handwork was seen as a means of producing goods. Master craftsmen, although highly skilled themselves, often delegated work to apprentices. They did not seem to possess romantic ideals of producing skilled craftsmanship solely by their own hand.

Surprisingly, craft during the Renaissance saw little change from what had preceded it in the Middle Ages. Notably, there was a renewed awareness of the design principles of Classical Antiquity such as proportion, clarity, contrasts and harmony. However, working conditions and technical methods remained fixed in place under the stern, all-seeing eye of the guild. Romantic ideas of handwork had no place in the mind of a Renaissance craftsman as he

tried to make a living, abiding by rigid regulations laid down by the powerful guild. The guild's dictation extended to all aspects of the craftsman's life - even marriage in some cases. You may wonder why one joined the guild at all? In goldsmithing, for example, there were those who failed to become part of the guild by working solely for a private patron. However, they faced tough times if the arrangements were dissolved for some reason, such as the death of a patron. The craftsman may remain forever outcast from the guild framework which might deny him the right to have his work assayed - hence making it unsaleable. In short, the guild's power was such that it could destroy the careers of those outside it as well as controlling and monitoring the careers of its members. (Lucie-Smith, 1981, p.146) *Fig.3* shows a Renaissance goldsmith's workshop.

Despite the compulsory, lengthy apprenticeships imposed by guilds to ensure its members were highly skilled, handwork was not necessarily held in as high esteem as it is today. Yes, Renaissance craftsmen devoted great chunks of their lives acquiring precision handskills - but once acquired, they adopted an extremely practical approach to their craft. Sometimes the craftsmen went to great lengths to avoid engaging in time-consuming handwork. Afterall, it was compulsory to acquire the handskills - it was a right of passage into the working world of goldsmithing - but it was not compulsory to use them for everything. In fact, you could liken the attitudes of the Renaissance craftsman to those of the modern factory manager. He approached his work very practically. His goal was to get things done as efficiently and cost-effectively as possible. He was highly skilled, but he used those skills more as a businessman rather than for purely artistic purposes. Methods of cost-cutting and time saving

Fig. 3: *16th-century goldsmith's workshop*, by Alessandro Fei.

were happily embraced, and these methods usually involved reducing the amount of handwork required to make a piece. Popular decorative motifs were pre-cast such as borders, stems and finials. Repeating stamps were also widely used. Indeed, some items may have been purchased ready-made! As time passed goldsmiths would add to their collection of time saving, cost-cutting devices, and they continued to use the same designs year after year regardless of changing fashions. They got so used to working and thinking in this manner that when presented with a completely new design by an enthusiastic patron, their response was much less enthusiastic. Instead of embracing the opportunity to show off their considerable hand skills, they often set about trying to dissuade the patron by telling him how expensive the design would be to execute. Then they proceeded to draw up designs for a less expensive alternative which of course incorporated many pre-existing parts. (Lucie-Smith, 1981, p.146-148) Thus, in terms of virtuosity and creativity in the craft of the Renaissance, time generally stood still.

Unlike today, a lot of craftsmen during the Renaissance had no sense of their own individuality. They had no desire to become 'artists' in that they had few concepts behind their work, and they often avoided relying on their own personal skills by using other peoples' designs and cutting down on handwork. Basically they often put as little of themselves into their work as possible. Indeed, the true spirit of the Renaissance was embraced more so by the fine artists of the time rather than craftspeople. Fine artists rejected the immediate past and tradition - whereas craftspeoples' skills were learned from an accumulated body of knowledge passed from one generation to the

next. Thus Fine Art somehow came to be held in higher esteem than craft during the Renaissance, a time when new attitudes flourished. This rift between skilled manual worker and conceptual fine artist took root in the Renaissance and still exists today in one form or another. (Lucie-Smith, 1981, p.157) However, Renaissance craftsmen were admired for their power over materials and, despite lacking a sense of their own individuality, their technical expertise gained them respect from their patrons and peers.

In the latter half of the sixteenth century, commissioners gained vast riches from a boom in silver mining. Their increased general wealth gave them more power to demand that their elaborate cravings be catered for. Thus certain goldsmith's such as Benvenuto Cellini and Wenzel Jamnitzer produced stunning pieces of work whose virtuosity of design, form, technique, and subject gained their makers status as artists rather than craftsmen. Renaissance ideals of harmony and balance were no longer adhered to. Instead tension, artistry, complexity, and deep symbolic content were favoured during this time which became known as the 'Mannerist Period'. Benvenuto Cellini's talent flourished at this time, aided by his freedom from guild restrictions enjoyed by all Italian craftsmen. A prime example of a piece produced at this time is his *Saltcellar, (Fig. 4)*, which was commissioned by the king of France. The quality and skill of the craftsmanship involved in its making have given this piece status as the quintessence of goldsmith's art. The figures were formed entirely by hand (not cast) using skills such as repousse and raising. Some of the small parts were cast. The structure is partially enamelled with a base of ebony.(Schadt, 1996, p.109-111) This piece represents the

Fig. 4: *Saltcellar*, Benvenuto Cellini, 1540-1543, gold, raised, small parts cast, partially enamelled, ebony, h. 26 cm., l. 33.5 cm.

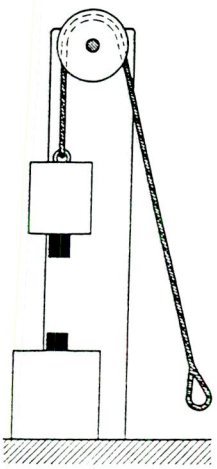
full potential of manual skill in all it's glory. Yet at the same time, these skills were used to produce the ordinary everyday necessities of life. Therefore handskills existed in this society to satisfy both basic and artistic needs.

Overall, there was a pragmatic attitude to handwork in Ancient times, the Middle Ages and the Renaissance. All objects had to be made by hand (both everyday items and artistic pieces) as there was no other way of making them. Although we have seen some wonderful examples of metalwork from these periods, there was generally nothing unusual or special about using manual skills in these times as there is today, in an age when machines render handwork unnecessary. In the seventeenth and eighteenth centuries handwork continued to form the basis of all production methods. However, (for utilitarian and popular items mostly), the way in which the system was organised was more in tune with industrialisation than any practices of craft that had gone before. This proto-industrialisation encouraged division of labour so that each craftsman became merely a pair of hands working in factory-like circumstances. It is likely that he lacked a full body of craft knowledge as it was only necessary for him to perform a few tasks in a production line. However, one must remember that no matter how complex or tedious methods of manufacture became, all processes at this time were still pure handwork. Of course this set up of craft system was not the only form in which craft existed at this time. Guilds were still in place governing more specialist production such as goldsmithing, but overall we can divide the craft of this time into three categories. As we have already seen, there were the urban craftsmen. The heads of

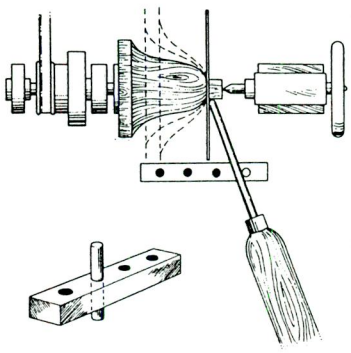
these workshops kept abreast of changing fashions in design and instructed the craftsmen below them accordingly. Secondly, there were provincial or country craftsmen who were not concerned with fashion as much as producing objects that worked well. These craftsmen had small scale workshops and so they generally needed to master a wider range of skills. Thirdly, there were crafts that were practiced at home, out of necessity in some cases, and in the case of richer families by ladies practicing craft as a pastime. In both instances there was no thought of resale. However, an increasing number of women spun yarn in the home to augment their husbands' incomes until mechanically spun yarn drove them out of the market.(Lucie-Smith, 1981, p.169-171) In general terms, the status of craftspeople plummeted at this time due to their unavoidable involvement in the factory-like system of production. However they have been of great benefit to us as they developed the range of craft skills and techniques used by hand-craftsmen today.

As we have seen, attitudes to handwork in pre-industrial times served to pre-empt the onset of industrialisation, which by the nineteenth century was firmly established. Trade and the pressures of competing with Eastern countries who produced items more cheaply (but to the same standard) due to cheap labour, caused Europeans to retaliate by developing technical expertise to cut costs. Traditional craft skills waned as new industrial methods were embraced. In the specialised area of metalworking, machines were now used for techniques such as metal 'spinning', 'stamping', 'embossing', 'lathing', 'electroplating' and 'electroforming'. *(Fig. 5)* These methods made it possible to produce items more efficiently. However, the machinery

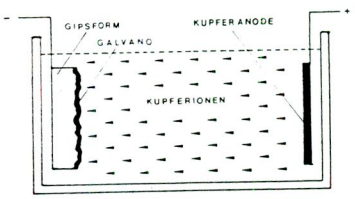
Fig. 5: Some new metalworking processes of the Industrial Revolution.



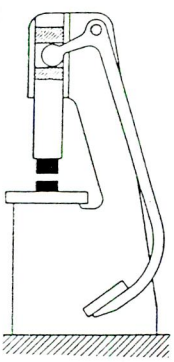
Drop hammer press
The free-falling hammer produces a kinetic energy that overcomes the sheet metal's resistance to being formed.



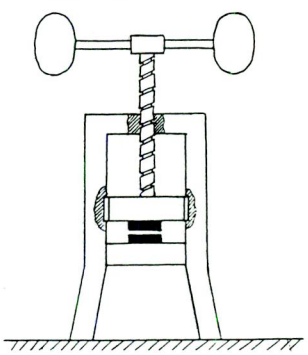
Spinning



Production of a replica by electroforming



Foot pedal press
Foot pressure creates a force on the long arm of the foot pedal. According to the lever principle, this force is enhanced in proportion to the transmission ratio.



Hand spindel press
Set in motion by a hand crank, the screw rotates rapidly bringing the ram down onto the die.

was expensive and so it was around this time that the guild system (with it's limitations on numbers of co-workers and restrictions on production methods for specialised practices) was finally disbanded. This enabled larger work forces to get the most from new production methods. With the abolition of the guild system, new methods of artistic education had to be found. Trade schools were set up and students became involved in the preparation of designs, the making of which was allocated to others. (Schadt, 1996, p.152-153) Thus a new age of production had begun which saw for the first time a definitive separation of design from manufacture. This gave rise to the phenomenon of the 'Industrial Designer' who was called upon to create a new design standard to mirror adequately the modern technology being used.

Industrial technology had consequences in all realms of society and caused an upset of values generally. Naturally the type of work most affected by new industrial technology was the skillful, productive work of human hands. People began to lose touch. "Workmanship in a factory setting became less a matter of putting oneself into the job and more of getting the most out of machines." (McCullough, 1996, p.16). Thus the personal nature of their work was affected by technology. Due to piecework, workers were not free to work at their own pace so in turn they had no control over quality. The detached nature of their working conditions discouraged involvement and care. This was bad for workers as human beings. People in order to be healthy and fully rounded individuals need to be stimulated simultaneously in both mind and body. What kind of society of people was this system producing? They were robbed of

their self-sufficiency by being employed as semi-skilled workers producing cheap objects, which were in turn marketed at precisely those unfortunates who formed the division of labour. It was a nasty vicious circle. All in all however, industrialisation did provide for the needs of society completely, without any need for manual skill whatsoever. This social transformation could not have been without consequence, which was what reactionary movements sought to point out.

The Arts and Crafts Movement, which originated in England and later spread to America, was one of the most notable for its strong standpoint against the effects of industrialisation. It was not the machine they objected to - but rather the mis-use of the machine which contributed to a society where human beings were used as mere tools.

> The Movement, indeed, represents in some sense a revolt against the hard mechanical conventional life and its insensibility to beauty (quite another thing to ornament). It is a protest against that so-called industrial progress which produces shoddy wares, the cheapness of which is paid for by the lives of their producers and the degradation of their users. It is a protest against the turning of men into machines, against artificial distinctions in art, and against making the immediate market value, or possibility of profit, the chief test of artistic merit. (Morris, 1996, p.12-13)

In response to industrialisation, people such as Richard Redgrave, Christopher Dresser, John Ruskin, William Morris, Walter Crane and many others saw part of the solution to be a return to practising craft

in the manner of Medieval artisans. To counteract the disjointedness of industrial processes, they believed in being true to your materials. This meant that a designer must have hands-on experience in the making of an object before he is qualified to dictate its manipulation. The key was to be involved in the production of a piece from conception to physical reality. They saw the revival of handscraftsmanship as a way of bringing people back in tune with reality by creatively employing both their minds and hands by practising craft skills. (Lucie-Smith, 1981, chapter 11) Ideally, work had to provide some satisfaction other than the monetary pay it amassed.

Due to the Arts and Crafts Movement there was a revival of public interest in well designed handmade goods. The way in which manual labour and skill had sometimes been looked down upon in the past was beginning to change. These were some of the principles of the Arts and Crafts Movement:

> ...an insistence on the quality of the product, to be achieved by its maker's respect for the material in which it is made ; on the maker's bringing into play his creativity and intelligence in making the product; with an underlying sense of a human tradition of making which industrialisation had severed and threatened to supersede. (Morris, 1996,p.xiii)

Indeed, Arts and Crafts attitudes provide us with the idea of craft as we see it today. This romantic vision serves us in the midst of our

electronic revolution. Ruskin, in his writings, laid down three rules for craft:

> 1.Never encourage the manufacture of any article not absolutely necessary, in the production of which invention has no share.
> 2.Never demand an exact finish for its own sake, but only for some practical or noble end.
> 3.Never encourage imitation or copying of any kind, except for the sake of preserving records of great works (Lucie-Smith,1981, p.209).

The Arts and Crafts Movement spawned many great craftsmen. The most famous was William Morris who wholeheartedly put Ruskin's proclamation into action. Despite the great impact of the Arts and Crafts Movement, it did not put an end to the confusion of styles of the time. It merely added a whole new dimension to things in general. Happily they re-acquainted us with handwork and its importance for us as human beings. Sadly, however, a few decades after its beginnings "it had become burdened with the stigma of amateurism". (McCullough, 1996, p.15) The impact of industrialisation meant that craft was unnecessary, and those who indulged in it were seen as hobbyists. At the end of the nineteenth century the position of craft and the practice of manual skills in general was in great turmoil. Of course there still existed people who practised using handskills for various reasons - people are in the habit of passing on knowledge from one generation to the next through apprenticeships. In country areas many practices of crafts remained in operation which were less affected by the industrialisation and the gross deskilling that occurred in cities. Other people still indulged in

the physical and creative side of their nature by practising manual craft skills for pleasure.

At the beginning of the twentieth century, art began to discard the need for artisanry also. (Just as industry had earlier usurped the position artisans had played in utilitarian production). Early modern art became increasingly independent of technique and as the twentieth century progressed, art was to go on to deny the need for any manual skill at all with the advent of genres such as pop art, found art, minimal art, and conceptual art. Thus as manual skill was cast out from both utilitarian and artistic production, it seemed there was no place for it to exist anymore in the scheme of things. Yet it still existed. People, by their very nature it seems "...cannot endure as 'consumers', but must actively practice at something, however humble." (McCullough, 1996, p.ix) Society's needs seemed to be well catered for by the products of both art and industry. However, art objects had no other function than to be beautiful and /or thought-provoking, and objects of industry generally had no reason for being apart from their function. Therefore there was a vast middle ground between the two. Was there a market for items that were both useful and beautiful? If so, craft satisfied that market. Craft could make artistic creativity more accessible to ordinary people by providing forms of art that could be brought from the gallery into the home. It could also produce interesting objects for use. Obviously these useful craft objects could not compete against industrially designed and produced items on a practical level. However they could appeal to people interested in quirky, unique, hand crafted items.

A phenomenon of the twentieth century has been that people seem to hunger for the unique. The more unique an object is , the more highly it is prized in our society. This is why phrases such as 'limited edition' or 'one-off' have been created - to whet our appetite to possess something no-one else has. We feel empowered by possessing collectors items. Why is this? Could this mentality be traced back to industrialisation itself? I believe it is possible that along the way people have become frustrated by mass production. We have been bombarded by products and advertising to the point where we feel like nothing more than consumers - just another number while calculating sales statistics. However, the reality is that we are individuals. We like possessing objects that reflect that individuality. Craft objects - objects made by hand - allow us to assert our individuality. Hence craft and manual skill found a small niche for itself at the beginning of the twentieth century and managed to avoid extinction. Out of this grew the desire to nurture skills of handcraft and personal creativity. Places of education were set up to cultivate the applied arts - none more renowned than the Bauhaus. The Bauhaus foundation course was absolutely committed to skill and craftsmanship. It gave students the opportunity to be creative through experiencing and handling materials as well as making use of new technologies. "With the means of manual skill and industrial production methods, the artists wanted to make the environment more humanely dignified in the technotronic era."(Schadt, 1996, p.182) It's students and teachers produced work of the highest quality that was also modern, innovative and experimental. Alas the plight of craftsmanship did not cease with the Bauhaus. By the mid-'twenties the Bauhaus had begun to emphasise design for industry - hence the conviction to craftsmanship waned somewhat. With the backbone of

craftsmanship's new found strength gone, craft skills became exposed to harsh opposition especially from members of the art world. They felt that craft had moved too far into artistic circles. In their opinion craft did not deserve status as art for numerous reasons such as its lack of conceptual depth and its marked waste of valuable time via the acquiring and practicing of laborious handcraft processes - time which might have been better spent absorbing inspiration from life perhaps. "Why make something when you find a ready-made and present it as art? It is your ability to choose and select, not your ability to make, that marks you as an artist, as a connoisseur." (Dormer, 1997, p.3)

By the 1970's, craft had adopted a position which we can still find evidence of today. There is a division in universities between fine art and craft. Craft skills are learned on a 'need to know' basis as four years of college is not long enough to comprehensively learn the range of handskills required. Therefore craft students usually have to earn their degrees based on their proficiency and excellency in a particular skill which they have mastered and explored in new and exciting ways. Thus much ingenuity and creativity is required. The practicing handcraftsperson of recent times has been afforded the title 'studio craftsperson' or 'artist-craftsperson', and has been given relatively low status in the scheme of things. (Dormer, 1997, p.4) In general they work on a small scale, producing items by hand using their 'trademark' process - the one which they mastered in college and became known for. If we take a jewellery designer, for example, he or she spends the majority of their time reproducing a set range of jewellery they have designed to sell in craft shops. This earns them

the money they live on - which is not very much considering the V.A.T. and percentage the shop takes out of the price. Only after this has been taken care of are they free to be creative - which is not as often as they would wish. "It appears that the studio crafts have no market at all other than the rather small constituency of studio craft collectors. If craftspeople who cannot sell to collectors want to earn a living then they have to make giftware. They need to discover the difference between giftware and art-craft.....making giftware will do nothing for an artist's status." (Dormer,1997, p.11) This scenario, (which seems pessimistic, yet exists) is not very appealing to the majority of craft graduates today who have grown up in this exciting age of immense change - the electronic age. It is at this precise moment in time that we have reached a crux. We are surrounded by new choices that have been offered to us by today's digital revolution.. It has been over 20 years since we had our first glimpse of the origins of what has become the computer age. However, it is only in very recent times that it has reached us on a personal level. It has taken 20 years for society to digest and develop this new technology to bring us personal computing. Now is the time in which we are free to make of it what we will. Free to use and abuse it - to embrace or reject it. Who knows where another twenty years of this crucial time will lead us. What are the implications for studio-craftspeople and the practice of hand skills in general?

CHAPTER 2 - The situation today

Today we face many challenges to our physical experience of life through electronic media. Our lives have become increasingly more saturated with devices that promote disembodied relations such as television, video, computers and virtual reality. It is as if modern society is actively encouraging us to disregard the existence of our bodies and to function through our intellect alone. Meanwhile old arguments between art, craft, design and industry have presently been overshadowed by the popular culture of electronic communications. Buzz-words such as 'virtual reality', 'cyber space', 'cybernetics', 'CAD/CAM' (computer - aided design / computer - aided manufacture), 'the internet', 'electronic mail'.....and so on, surround us in our everyday lives. Are the inevitable changes brought about by our electronic age going to worsen the hand-mind split that first occurred in the industrial age? The electronic age is peculiar in that it promotes 'virtual experience'. This virtual experience is so convincing that it is very easy to become fooled by it. By looking at television we can travel the world and experience different things while sitting in our armchair. For example, we might empathise with the anguish of starving people. Digital imagery has the power to make us feel real emotion to the point where the representation might as well be in the same room as us. This shows us the potentially phenomenal power that the electronic age can have over us. We may lose our desire to experience life at first hand. Therefore, the loss of physical experience may not be as apparent to us as it was during the Industrial Revolution because we are fooled by virtual substitutes. This electronic age thus has particular relevance for people primarily working in a physical, hands-on manner such as the

handcraftsperson. He or she works with real materials - such as metal or clay - and manipulates them using hand tools combined with their physical strength and the skill of their mind and body. What factors stemming from our electronic age will challenge the use of handskills today? From this point onwards I shall concentrate my attention on the impact of the computer - it being the most significant invention of the electronic revolution. It presents a direct challenge to our traditional practices of craft with the array of new design and manufacture packages it has to offer.

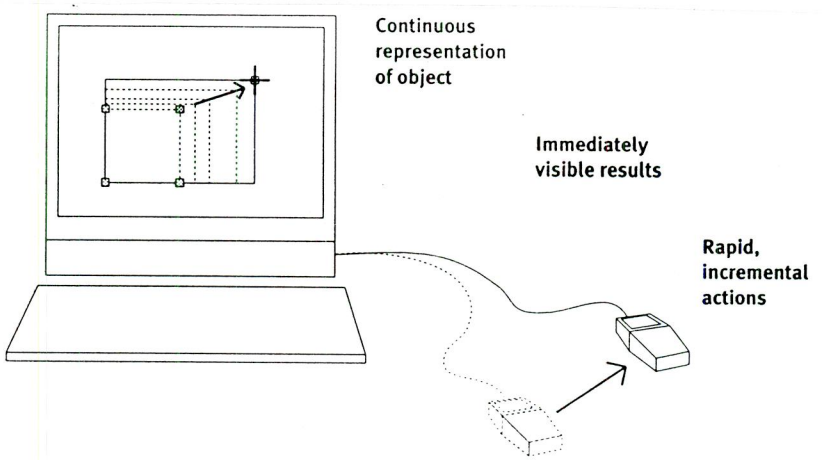


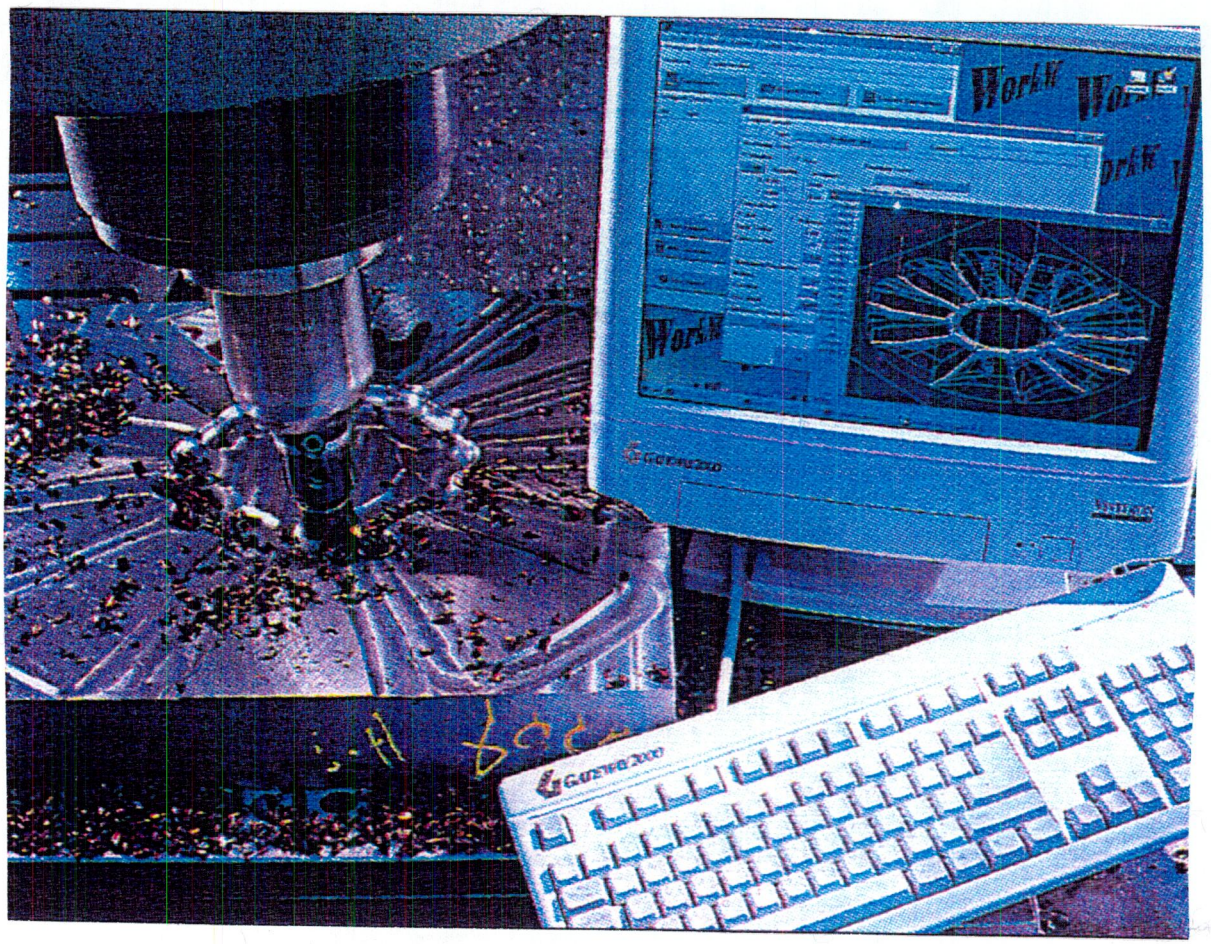
Fig. 6: Basic principle of 'direct manipulation'.

The first glimpse of a computer program which allowed "direct manipulation" (McCullough, 1996, p.23) was seen in the mid-1980's. This was a significant breakthrough in terms of design as for the first time one could manipulate and image on screen by pointing and clicking with a mouse instead of keying in complex sets of numbers *(see Fig. 6)*. You could draw by hand and see your progress as it happened. Macintosh created the first commercially successful direct manipulation programs - 'MacPaint' and 'MacDraw' which are still used today. From these solid beginnings, some computer design programs have been developed rapidly to include features such as

"three-dimensional renderings, tactile textures, complex multimodal structures, or abstracted architectures of information" (McCullough, 1996, p.24) and so on. The achievements of recent times have been astounding. I have mentioned the development of CAD (computer - aided design). However, the implications of new technology for the handcrafts practitioner have been taken one step further with the development of CAM (computer - aided manufacture). As the name suggests, we are coming to a stage where computer technology can be linked to manufacturing technology so that our computer - aided designs can be made a reality by the latest multi-armed lathes without any hands-on making whatsoever. Without CAM we might just have a glorified sketch pad.

CAD/CAM has existed in one form or another since the 1980's. However it is only now that it presents craftspeople with real choices on a personal level. Their use of handskills is being challenged because the existence of CAD/CAM makes traditional skills appear pointless and time-consuming. With CAD/CAM, images can become things almost instantly. *Fig. 7* demonstrates this. "Visual computing has expanded our capacity to visualise abstract symbolic structures as physical images." (McCullough, 1996, p.52) We can translate what we see in our mind's eye directly onto a computer screen to produce an accurate visual. This image can be created using an 'object-orientated' drawing system. (Dormer, 1997, p.52) Initially it looks like a three-dimensional grid construction, or wire model. This can then be viewed from any angle as the image can be rotated in computer space. The structure can then be modified in any way until the designer is satisfied with the shape. When the

Fig. 7: CAD/CAM - Automatic 3D Milling.



basic structure has been decided upon, wire models can be made look exactly like real objects using rendering facilities that show the three dimensional shapes with appropriate surface texture, reflections and shadows as in *Fig. 8* below.

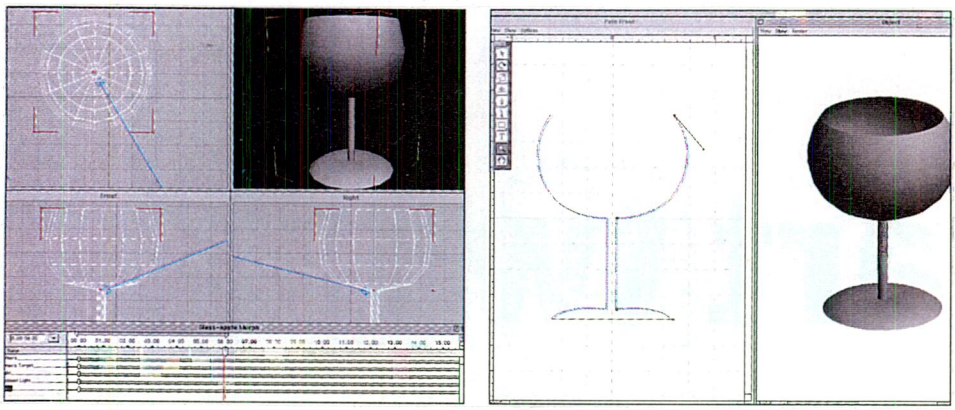
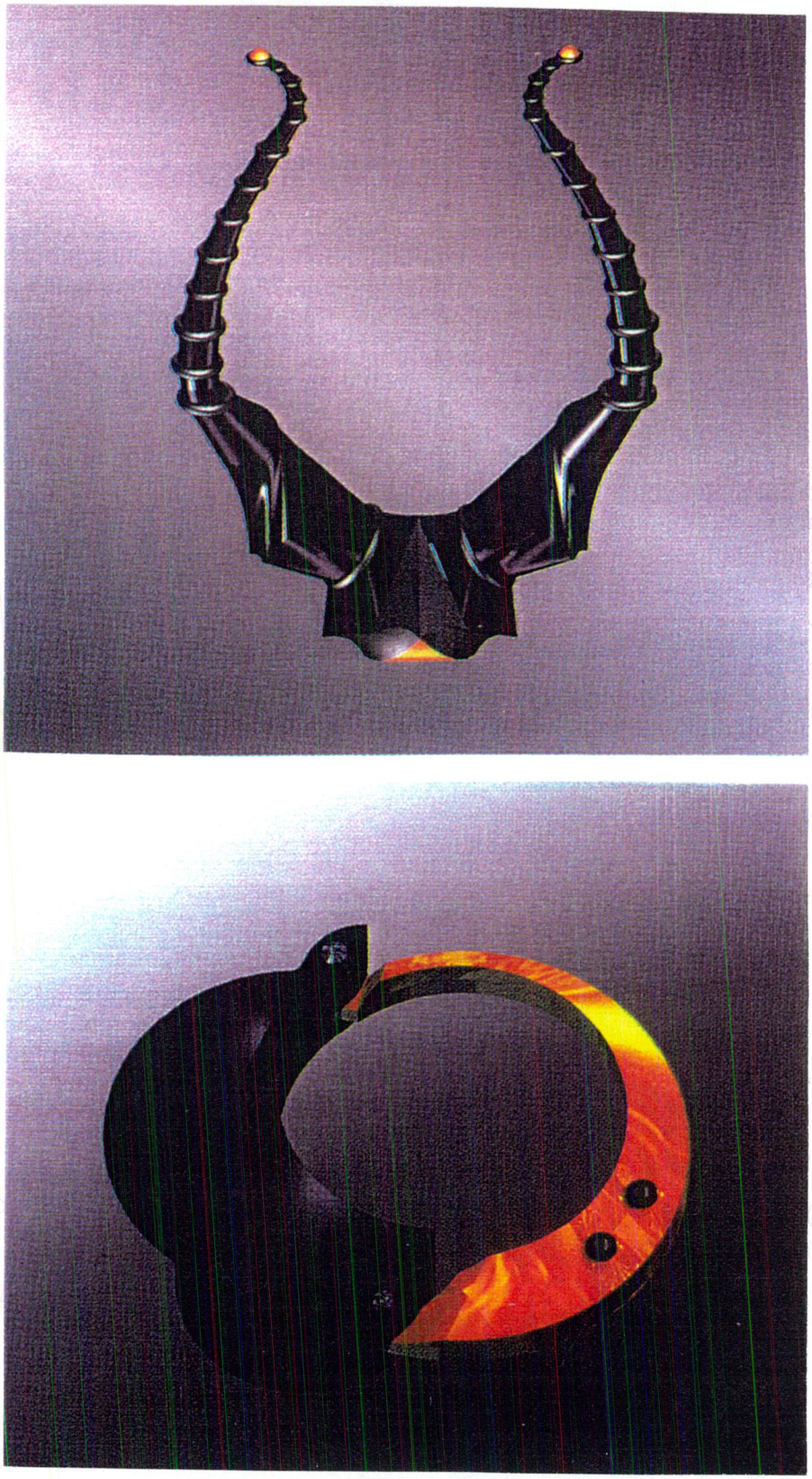


Fig. 8: Construction and rendering of a 3D object.

As the computer image is realistic, decisions are easy to make. Some people have even seen fit to submit these renderings to exhibitions rather than photographs of real objects. One such person is Margaret Yaukey. She submitted these computer renderings *(Fig. 9)* to a *Metalsmith Magazine* Exhibition in Print. Hers was the only submission that was not of real objects, and the jurors were confused as to whether her entry was legitimate. This makes us aware of a growing number of craftspeople who, when presented with computer technology, see the potential for a new branch of craft - 'Virtual Craft'.

Everyone in today's society is becoming computer literate. Naturally, so too are craftspeople who as a result look for ways of incorporating this new tool - the computer - into their craft practice. In some cases a new breed of craft has resulted - 'Virtual Craft'. We

Fig. 9: *Collard* (top), 1995, gold, resin, rubber, (computer rendering), & *Batear* (bottom), 1995, black delrin, brass, (computer rendering), both by Margaret Yaukey.



are already familiar with CAD/CAM technology which computerises the design and manufacture of an object. However, for some, this has just been a stepping stone to virtual craft which pushes 'craft' a giant step away from our traditional perception of it. Virtual craft is different to CAD/CAM in that it does not use the computer to design for physical production. It seeks to generate craftworks valid in their own right inhabiting virtual space. This is done using 3D modelling programs in conjunction with the vast array of functions the computer has to offer. Freed from the practical constraints of the material world, one can introduce physically impossible elements to one's work. Gravity can be defied, surfaces can be constructed from any image source and so on. (Goldate, 1998, p.2) If you think of this in terms of CAD/CAM technology, it becomes apparent that although huge amounts of design variations are possible using computer - aided design, few of them are suitable for production through computer - aided manufacture. CAM technology is not advanced enough to physically construct the weird and wonderful designs of a creative craftsperson using CAD programs at their full potential. CAM technology is really only geared towards industrial design at present. Certain craftspeople are prepared to work with CAD/CAM technology, despite it's restrictions, because with it they can produce a physical piece of work. To some this is a defining aspect of craft. However, others who want to fully explore the potential of computer-aided design packages accept that their creations can only exist in virtual space. Some craftspeople feel that if by using computers handwork is restricted anyway, they shouldn't let their brainwork be restricted also. In absolving themselves from the restrictions posed by time-consuming manual skills, and also those caused by computer-aided manufacture, the fruitful mind of the craftsperson is set free to

create in ways never possible before. Thus, truly exciting and mind-expanding designs result which collectively belong to the world of 'Virtual Craft'. How do these and designs by CAD/CAM advocates measure up to the work of traditional craft practitioners? I shall explore some different attitudes and pieces of work in the next chapter.

CHAPTER 3 - Computer generated versus handmade

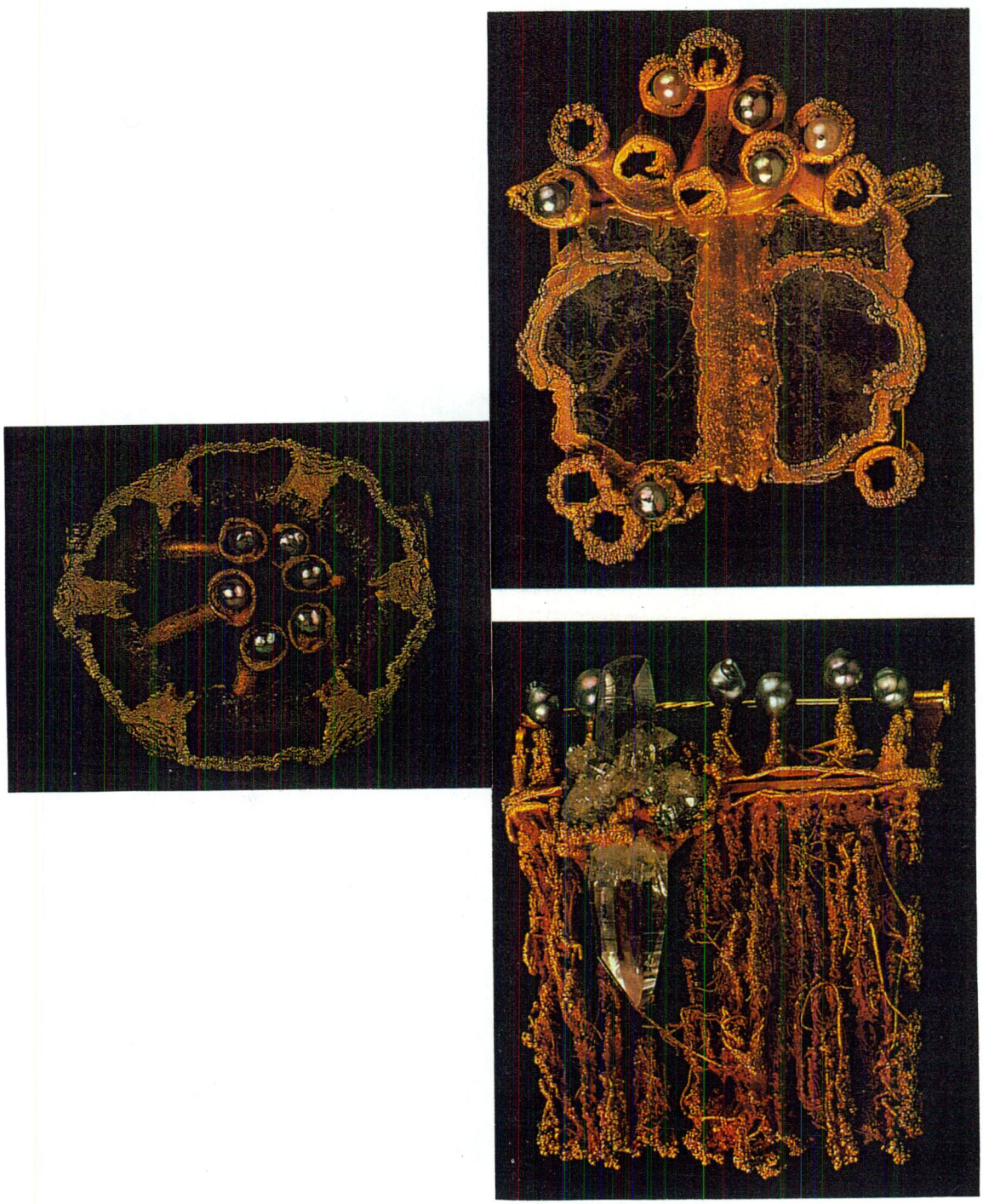
Computer technology, as with any new development has given rise to much debate in the craft world. Naturally computers are acknowledged by all because they are becoming part of our everyday lives. Yet craftspeople have reacted in different ways. There are those who continue to practice their craft using traditional methods. In addition to this they dabble in the new facilities which the computer has to offer. The majority of us fall into this category and thus we occupy a happy medium. Others however, such as jeweller Stanley Lechtzin, have wholeheartedly embraced computer technology. They feel it is the only way forward in this day and age. People like Lechtzin feel that handwork is nearly dead - made redundant by the computer. Therefore they have ceased using their manual skills altogether for this reason. Very different attitudes are held by craftsmen such as Albert Paley who relish everything about working a material by hand. It is particularly interesting to look at the work and attitudes of Lechtzin and Paley as they have a history together, and despite this, their approach is worlds apart.

Lechtzin and Paley met at Tyler School of Art, Temple University, Philadelphia. Lechtzin was the newly appointed head of the metals department, and Paley was his student. Paley found Lechtzin to be an inspiring teacher due to his "...intellectual resources - from his considerable technical knowledge to his penchant for rediscovery and enthusiasm for finding new ways of doing things..." (Lucie-Smith; Norton; Drutt, 1991, p.61) Lechtzin was the most demanding professor Paley had ever had, but due to his love of

challenge; Paley thrived under him and they became friends. There were many similarities between the two as well as differences. For example, the aesthetic of Art Nouveau is evident in both men's work at various times. However this was so for different reasons. The fundamental difference between these men is their attitude towards the techniques involved in making a piece. Lechtzin has always allowed the technology he is using to govern the aesthetic of his resulting piece of work. For him, the technology must be new and innovative for it's time, and require little or no manual skill. Thus his use of the electroforming technique happened to produce pieces of work reminiscent of Art Nouveau. Lechtzin's results were achieved with minimal hands-on contact with his material - his forms 'grew' as a result of the technology he used. Paley's forms are also governed by the techniques he uses, but in contrast to Lechtzin almost all of his techniques are manual ones. He has direct contact with his material, and so intimate is he with it that they work together as one. Therefore, by using manual techniques such as forging, Paley achieves sinuous lines and organic forms reminiscent of Art Nouveau. It is obvious that Lechtzin and Paley are both equally dedicated men - but dedicated to different ideals. Lechtzin strives for proficiency in new and innovative techniques which facilitate the making of an object without the need for handwork. Contrastingly, Paley has sought and gained proficiency in traditional handskills in order to push them further than ever before and hence realise his full potential as a craftsman. Lechtzin's love of finding new ways of doing things has led him to the computer, and in 1987 he gave up all other techniques in favour of it.

Stanley Lechtzin has posed the question that by practising craft "...Are we engaged in a handwork activity or is the resultant object and its communicative values more important?" (Dunas,1988, p.20) He believes it is. As we have seen, even before the advent of computer technology, Lechtzin's practices of making were deeply rooted in processes that did not involve handwork, such as electroforming. *Figs. 10, 11,* and *12* show some of Lechtzin's electroformed brooches. I find these pieces strikingly organic. The animated nature of their forms makes them look alive and reminds me of life at the bottom of the ocean. Indeed *fig. 12* looks like the hull of an old shipwreck deep beneath the sea. The electroforming process enabled Lechtzin to produce relatively large scale, yet lightweight jewellery. This process employed twentieth century technology which Lechtzin himself significantly developed. It seems that he has purposely set out to explore the possibilities of twentieth century science and industry. Since the 1980's, Lechtzin has been exploring the computer as a tool for the studio craftsperson. To downplay the role of manual skill he suggests that "...The importance of an object is not how well crafted it is but in how communicative it is of the human condition". (Dunas, 1988, p.20) This attitude is akin to that of the fine artist who also believes that the conceptual element of a piece is the most important. However, Lechtzin believes that you know you are a metalsmith if you are producing objects normally produced by metalsmiths - by whatever means. He does not believe that labour intensity is a quality that warrants aesthetic value. People have thus far tended to have respect for items that have been laborious and time-consuming to execute. Lechtzin totally disagrees with this attitude believing that allowances should not be made for such items if they lack important qualities such as strength of design

Fig.10: ***Brooch*** **1969 (top), Stanley Lechtzin, gold-plated silver, mica, baroque pearls, electroformed.**
Fig.11: ***Brooch*** **1967 (middle), Stanley Lechtzin, gold-plated silver, amethyst, blue baroque pearls, electroformed.**
Fig.12: ***Brooch*** **1967 (bottom), Stanley Lechtzin, 14k gold, quartz, baroque pearls, eletroformed.**

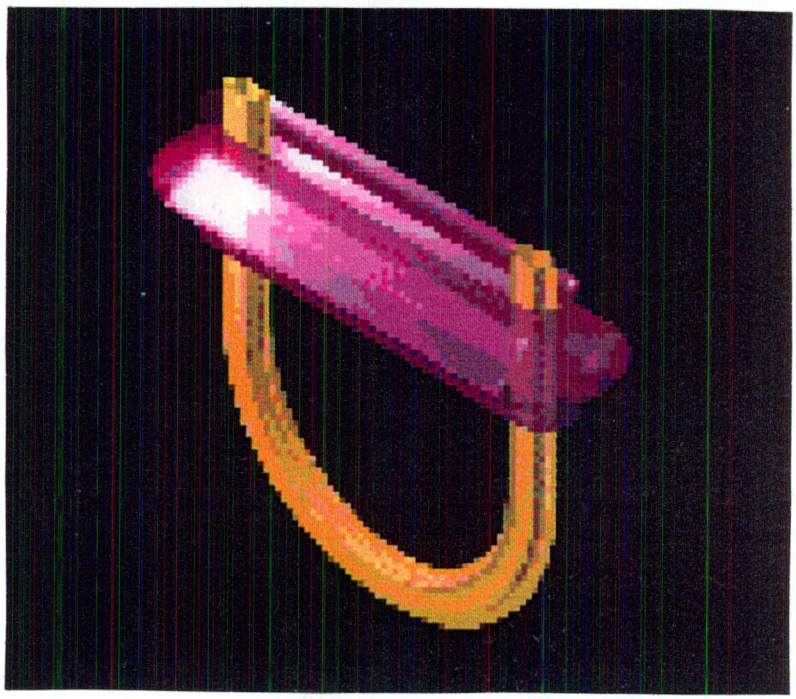


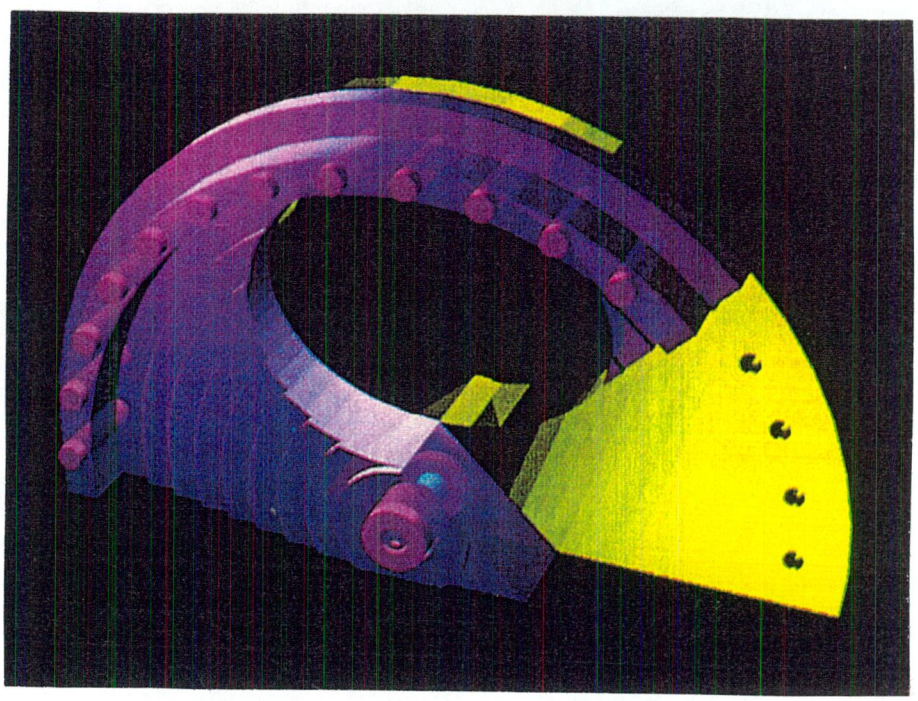
and idea. "Much of the content of jewelry today is a communication of lavish expenditures of time. In many cases that may be the only thing it communicates! I do not think that this is very intelligent at this time in our history." (Lechtzin, 1989, p.2) Having established Lechtzin's belief that the concept behind a piece is all-important and it being handmade is not, let us explore in practical terms his regard for the computer.

Lechtzin does not see the computer as having any of the negative social manifestations that industrialisation created in society. On the contrary he sees the computer as "a true creator of freedom and independence." (Dunas, 1988, p.20) Nowadays it is inexpensive and readily available to everyone. Therefore the computer is human friendly so we don't need to fight it. Lechtzin's problem with handmaking processes seems rooted in the fact that they are so time-consuming. He argues that his ideas flow far more rapidly than his ability to physically execute them by hand. For him CAD/CAM will ultimately be a way of producing unique objects in quick succession. Once tiring, slow, manual labour is eliminated, one is freer and more alert to explore an idea fully and at the same time produce objects of potentially higher quality. One is also free to concentrate on the more innovative aspects of object making. He sees these factors as a great improvement on the traditional state of affairs.

Figs. 13 and *14* show some of Lechtzin's more recent computer generated designs. These are, at present, rendered images existing in virtual space rather than actual physical pieces. Looking

Fig.13: ***Arcbrace*** **(top), virtual bracelet, Stanley Lechtzin, CAD/CAM virtual gold, titanium, acrylic.**
Fig.14: ***Bracelet #49F*** **(bottom), 1994, Stanley Lechtzin, CAD/CAM virtual acrylic, anodized aluminium.**





at these, (having seen his earlier work), it is immediately apparent the extent to which Lechtzin lets the process he is using govern the aesthetic of his design. "...his work has been consistently led by technology..." (Dormer, Drutt-English, 1995, p.26) These designs are very geometric in aesthetic. His forms are sleek and uncluttered. Compared to his electroformed work, it is astounding how radically his forms have changed. Lechtzin has gone from highly ornate crustaceans of precious metals and stones to solid, rendered geometric shapes which incorporate non-precious materials such as acrylic and anodized aluminium. In fact, his 'style' has changed so much that it is hard to believe it is the work of the same person. However, Lechtzin believes in computer technology, and he is convinced that he will reap the rewards of his dedication in due course.

Lechtzin realises that computer technology is not developed enough yet to allow absolute freedom. It's present restrictions probably account for the degree of difference between his past and present work. "Liabilities - I would say at this point, our lack of experience with it and its very very short history. It's clear that all I envision can't be realised at this point...." (Dunas, 1988, p.24) However, he accepts present liabilities believing wholeheartedly that we will soon experience the significant benefits of these technologies. One benefit in particular he is looking forward to is the elimination of handwork altogether with the help of computers. "....all that we know about materials and process can be communicated through a master craft data bank, which will ultimately develop, and therefore the knowledge of the hand in contact with material will probably no

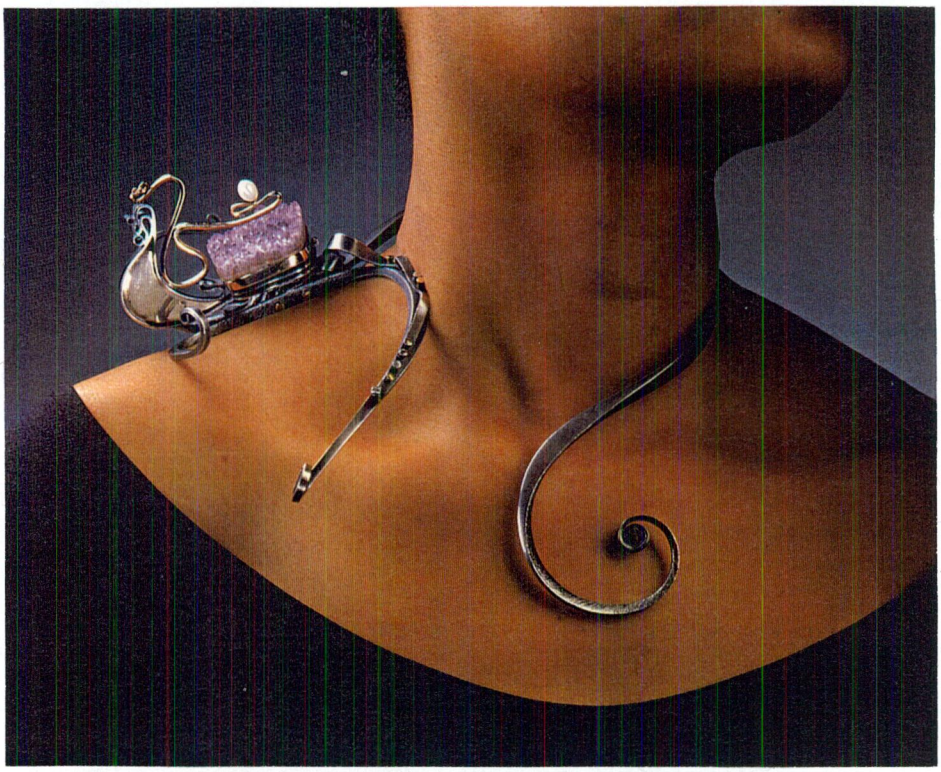
longer be necessary..." (Dunas, 1988, p.23) A very serious prediction indeed. Now let us explore the outlook of a craftsperson whose attitudes and work methods are deeply rooted in tradition.

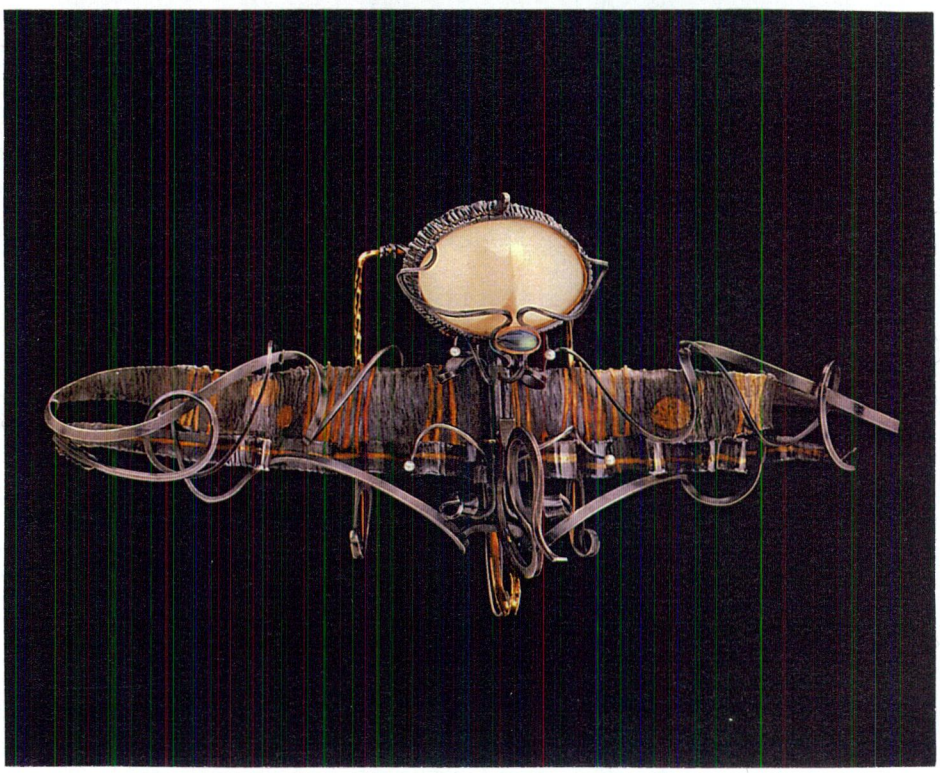
Albert Paley began his career making jewellery. He chose it in college because he found that the techniques involved in it were much more challenging to him than those required for other disciplines such as painting, drawing and modelling. (Lucie-Smith, 1996, p.12) Therefore we become immediately aware of the value Paley has placed on the acquisition and practice of skill. This value has remained with him throughout his career from his beginnings in jewellery to his present work in large-scale forged iron. Paley had found "when making jewelry that it was the direct metalworking process that most appealed to him - forging, rather than casting or stone-setting." (Lucie-Smith, 1996, p.24) This was because, with forging for example, the metal reacted immediately and so the piece of work took shape before his eyes. This was much more satisfying for him than casting, for example, which involved many time-consuming stages before the piece was made. *Fig. 15* shows a beautiful example of Paley's early use of the forging method. He learned this technique using precious metals. *Neckpiece* of 1971 is especially important to him because it is one of his first pieces to primarily use the forging technique - a technique he still uses today in his large-scale ironwork.

Even though Stanley Lechtzin proved crucial to Paley's development as an artist and human being, it was their different

Fig.15: *Neckpiece* **1971 (top), Albert Paley, forged, fabricated and oxidised sterling silver and 14k gold, with amethyst crystals and pearl.**

Fig.16: *Sectional Brooch* **1969 (bottom), Albert Paley, forged, fabricated and oxidised sterling silver with fused gold inlay, and 14k gold, with ivory, pearls, and labradorite.**





sensibilities that led them in opposite directions. "Stanley didn't allow for sentimentality. He was very much the role of the avant-garde man, idealistic and existential. Emotions were a weak part of your personality. It was only through intellect and rational thought [that Stanley believed] you could perceive". (Lucie-Smith, Norton, Drutt, 1991, p.65) As we have already seen, it has been Lechtzin's emphasis on intellect and rational thought that has ultimately led him to the computer. Paley, by contrast, felt drawn to the philosophy of the English Arts and Crafts Movement in the face of the materialistic society he found himself in. It's regard for the human spiritual condition appealed to him. The philosophies of Art Nouveau also appealed to him for similar reasons. Paley explained that

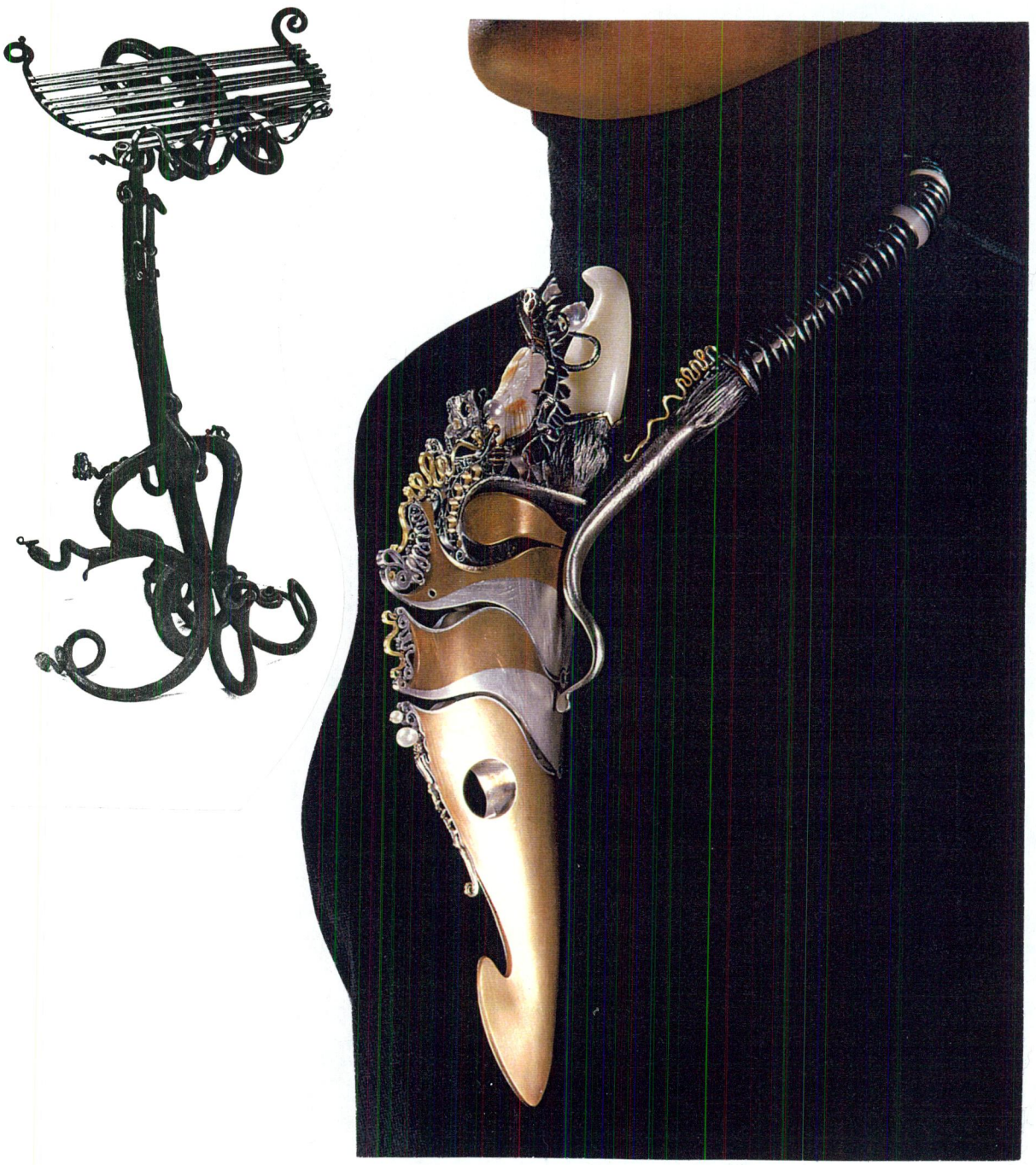
> "It entered the realm of the subconscious, dealing with human perception and intelligence, with needs and desires...At a time when the art world was stressing rational, analytical thought, Art Nouveau showed me that emotions were enough to go on, that you could rely on your senses as a means of direction..."(Lucie-Smith, Norton, Drutt, 1991, p.17)

It was the spirit of the Art Nouveau movement that influenced him rather than the aesthetic. His forms were similar to those of Art Nouveau quite by accident. In the spirit of Abstract Expressionism, Paley allowed his forms to evolve in their own way from the materials and techniques he used. As Paley became more technically skilled, he realised that every process had it's own aesthetic uniqueness which he embraced in his work. His exploration of different processes required much problem solving and improvisation along the way. However Paley thrived on it and produced many exquisite pieces

such as *Sectional Brooch* 1969 *(Fig. 16)*. This type of aesthetic - one directly resulting from manual processes - may be lost forever if Lechtzin's desire to do away with handwork is realised.

The evidence suggests that if Paley and Lechtzin have remained friends, it is likely they debate regularly on methods of production. Lechtzin has claimed that the only way he could keep up with his ideas was by using the computer. However, Paley claimed that by hand-forging metal he could work as fast as he could think. (Lucie-Smith, Norton, Drutt, 1991, p.17) While Lechtzin's contemporary forms are geometric in aesthetic due to the computer technology he uses, Paley has expressed revulsion at the sterility of the geometric approach, and so he continues to construct organic forms. (Lucie-Smith, 1996, p.17) *Fig. 17* shows one of his larger pieces, *Lectern* 1971, which fully retains his organic aesthetic. Paley has explained that his jewellery, which is inspired by the body (the female form in particular), is only truly complete when worn by a woman. *(Fig 18)* Her entire body and Paley's piece of jewellery become one and transform into a sculptural form. Therefore, to achieve this, Paley's jewellery has to be physically made - it needs to exist in reality in order to be worn and fulfill its function. The majority of Lechtzin's jewellery at present only exists as images in virtual space. None of it can be worn and fulfill it's function as jewellery. I don't believe Paley would respect this approach. He has said that he does not even respond to images produced by painting and printing as "...They're illusionistic and they don't deal with what I consider to be tangible reality." (Lucie-Smith, Norton, Drutt, 1991, p.18)

Fig.17: *Lectern* 1971 (left), Albert Paley, forged and fabricated steel, brass and copper.
Fig.18: *Pendant* 1973 (right), Albert Paley, forged, fabricated and formed sterling silver, copper and 14k gold, with antique cameo, pearls and delrin.



It seems that Stanley Lechtzin and Albert Paley have endless conflicting viewpoints. However each of them makes a strong case. It is interesting to see that although Lechtzin's designs possibly could be constructed using traditional handskills, he continues to wait until technology is developed enough to produce them. Paley's designs, contrastingly, due to their complexity and asymmetrical forms, would be impossible to construct using computer-aided manufacturing techniques. Still one admires both Lechtzin's and Paley's steadfast dedication to their beliefs. Maybe Lechtzin will achieve a transformation of the jeweller's art in this technological age just as Paley did with his assertive jewellery for women amidst Women's Liberation and the counterculture of the 1960s.

CHAPTER 4 - Implications for craftspeople and the human response

"Hands are underrated." (McCullough, 1996, p.1) We use our hands constantly in everyday life. They perform an incredible amount of mundane yet necessary tasks. If you think about it, most people have not realised the full potential of their hands. Maybe they do not care; so hands, although far from idle, are underemployed. Hands carry out the intentions of our brain in the world. The mind would become quite frustrated without the facility of hands. Hands process information in the opposite direction also. Hands absorb knowledge from the world around us. They hold, they feel, they probe. They are filled with nerve endings, yet they tolerate a wealth of different situations. They resist pressure, heat, cold, roughness and wetness. Yet at the same time they can still appreciate the delicacies of softness and fragility. When it is called for hands can exert great pressure and force, yet they maintain the ability to be gentle. Hands can go where eyes cannot. Fingers can probe the inside of something to bring us additional information about texture and form. Our mind uses this information to create a pretty good image of what we cannot see with our eyes. Even the most advanced computers in the world cannot simulate the human hand.

In addition to our natural capabilities, hands have an amazing capacity for acquiring additional dexterities. This comes from habitual experience, and once acquired become almost instinctive. Our hands have the capacity to perform complex combinations of motions in quick succession. The hand is quicker than the eye. If you think of a musician, for example - the guitarist, his hands perform

a myriad of complex actions simultaneously. His left hand shapes different chords instinctively, moving rapidly on the fret board, knowing without conscious thought where the correct position is. Meanwhile his right hand plucks different strings rapidly in accordance with what his left hand is doing - all the while maintaining rhythm and harmony. This learned ability to perform a process well is generally referred to as skill. Skill is learned by doing. If you do something enough it will eventually become second nature to you. Our hands adapt physically also to our preferred form of manual practice. Our skin toughens in certain places. Our hands may get stained. In short they pick up experience. The knowledge gained by working with our hands is called 'tacit knowledge' or 'know-how'.

'Tacit knowledge' is a hugely important quality to have in our lives as it keeps us in touch with our bodies and the physical nature of our being. However in this technological age of disembodied relations it is doubly important. Craftspeople know this. "Handcrafts - long bound by tradition - have re-emerged as radical and fresh practices". (Ullrich, 1988, p.25) This has occurred in response to the growth of technology. The products of the electronic age are infiltrating our society at an amazing speed affecting everyone. Nothing can ever be as it was before. In the face of such monumentus change people like Stanley Lechtzin embrace it and endorse it thoroughly. However, there are increasing volumes of people who are not as enamoured by society's new 'toys', and intend to redress the balance by reinstating the importance of our bodies (and hence manual skill) rather than forsaking the body altogether.

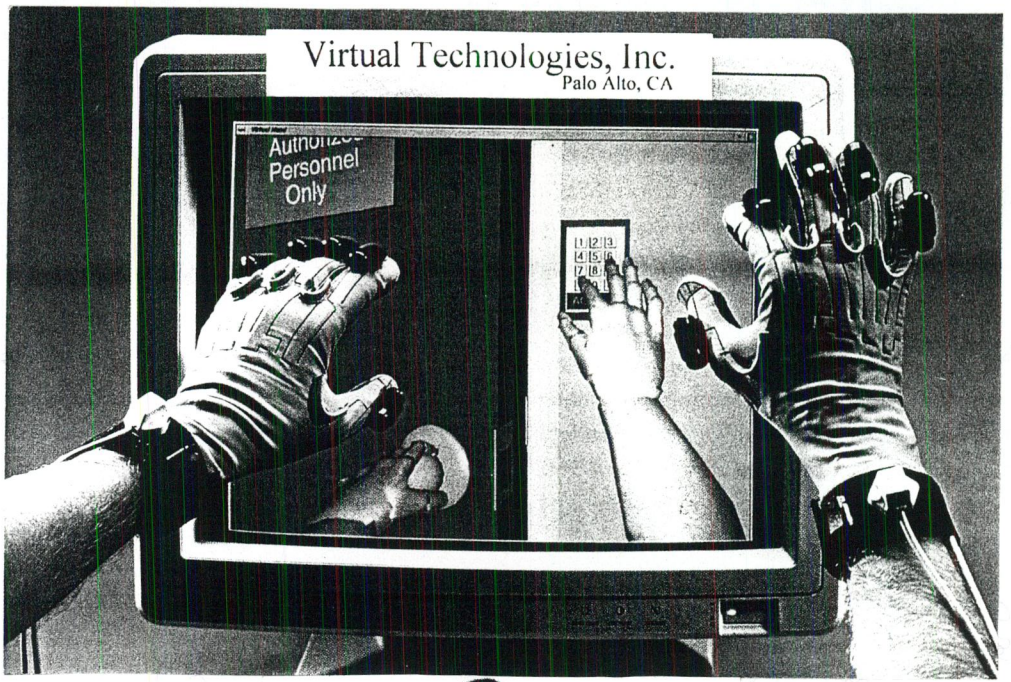
In reaction to Lechtzin's rash theories, Bruce Metcalf wrote and article for *Metalsmith Magazine* - (Winter '97, v.17, No.1, p.6-8). In it he states that the exercise of the body is in fact an important component of intelligence. There is a part of the brain that deals with "Bodily - Kinaesthetic intelligence". It controls all types of muscular co-ordination including the fine motor skills associated with the crafts. Therefore Lechtzin's hierarchy that places mind over body is flawed. Metcalf believes that "...Craft acts as an antidote to the increasing dematerialisation we encounter in modern life. People recognise this intuitively and they value craft for this reason." As a result, the fact that craft traditionally involves physical labour and the skilled use of the body encourages people to practise it. Computers prevent us from using our bodies, as do the majority of modern conveniences. In our daily lives, we are never encouraged to use our bodies. We spend the majority of our time sitting - in the car, at a desk, etc. Lifts and escalators ensure that we do not have the difficult task of climbing stairs. We use remote controls so that we do not have to leave the comfort of our armchair to operate the television or stereo system. Therefore it is understandable that some people find the physical aspects of handwork enjoyable and beautiful in the face of today's disembodied culture.

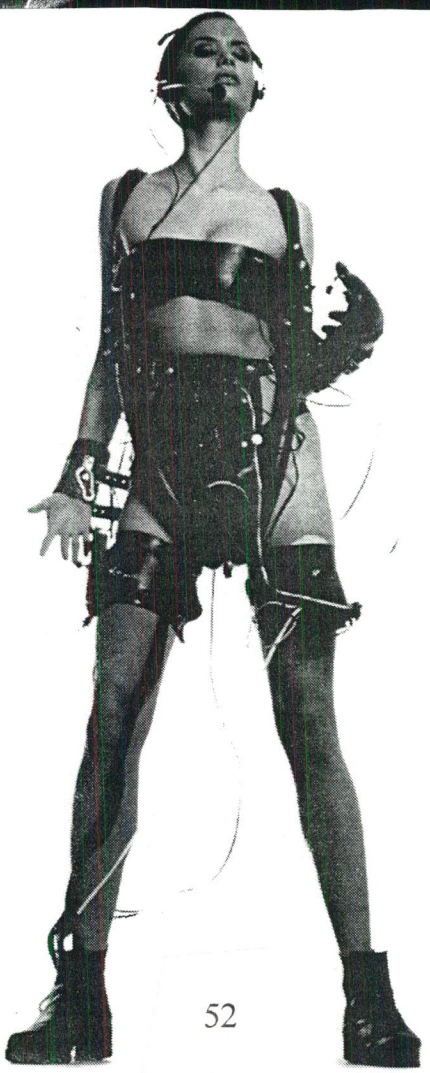
Unlike Lechtzin, I believe that the body and mind are of equal importance. It is impossible to separate them either physically or theoretically. They are symbiotic. Our experiences in life link the body and mind through learning. That is the learning acquired through physical existence rather than through books or data banks of knowledge on CD-ROM. The body is a vast receptor for learning

experience acquired through the senses. When we practice manual skills, our sense of touch is heightened. This is because our hands enable us to actively touch with their combination of the fine motor skills of complex joints and muscles - and skin. "Skin feels contact, temperature, pressure, vibration and texture". (McCullough, 1996, p.131) Despite touch being our most important sense psychologically, computer technology cannot yet cater for it. We feel deprived as we are unable to touch our work. Computer technology is only now beginning to recognise how important our senses are to us as human beings, and so ways are being developed to cater for them. Clumsy body-wear has resulted, *(Fig. 19&20)*, which is usually tangled with wires to feed electric current to our most sensitive parts. Although the results are presently crude, advocates of computer technology are aware that through sight, sound, smell, taste and touch we learn infinitely more about life than could ever be conveyed to us virtually. How impossible it would be to describe adequately the mystical qualities of a gentle kiss or caress to someone who never experienced them. These things are only truly understood when felt. Literature would not be as effective as it is if it did not rely to some extent on readers' memory banks of personal experience. This is why craft is often misunderstood. Craftspeople do not endeavour to convey craft experience through literature as it would be quite impossible to do so. They know that craft can only be truly understood when it is practiced - when you physically experience the qualities of a material (be it clay or metal) with your bare hands.

Fig.19: *CyberGlove* (top), Virtual Technologies, Inc., provides a touch sensation to the user's fingers and palm.

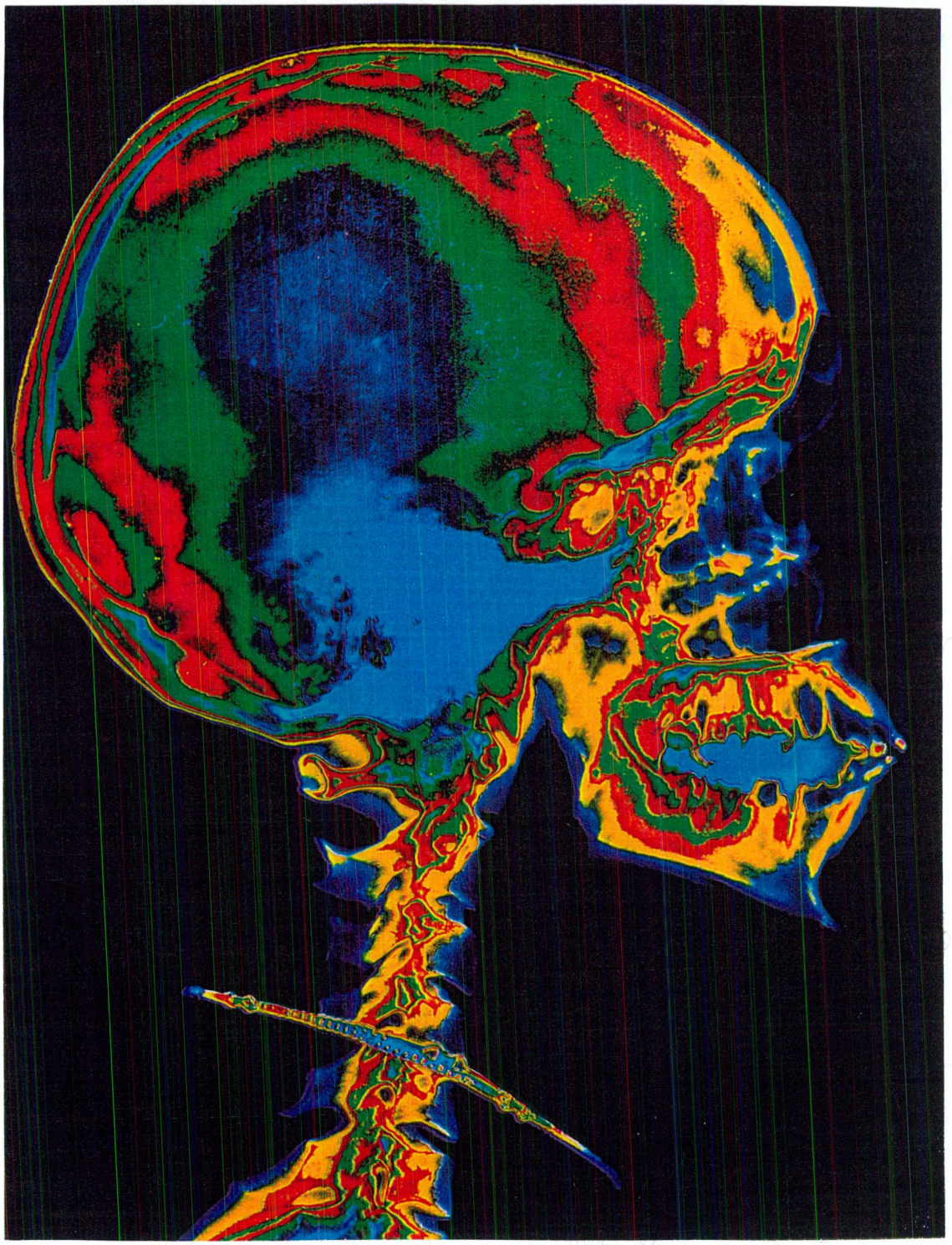
Fig.20: The *Solve et Coagula* project (bottom) wires the user and machine through a lightweight body suit which provides tactile stimulus with vibrators pressed against the body.





What is it that motivate a person to practice manual skill? Why do some of us get involved in craft while others see it as a dreadful waste of time especially now in this age of technology? Bruce Metcalf submits the theory that "...craft grows directly from the human cognitive potential for fine motor control, and that this potential is actualised as a cultural response to late industrial conditions." (Dormer, 1997, p.72) As I have mentioned, Metcalf supports a theory formulated by Howard Gardner which suggests that the brain is divided into multiple intelligences. (Dormer,1997, p.74) The brain is made up of several regions, each dealing exclusively with specific cognitive functions. It is as if the brain consisted of many computers, each assigned to a specific task. (*Fig. 21* shows activity patterns in the brain). Gardner suggests that there are about six distinct types of intelligence - one of them being bodily-kinaesthetic intelligence. This bodily intelligence enables us to use the body in skilled ways using fine motor movements of our hands and fingers and also gross motor movements of the overall body. (Dormer, 1997, p.75) It directs how skilfully we carry out tasks such as making objects for example, as the craftsman does. Everyone is different, and so naturally the strengths of the different intelligences in the brain varies from person to person. Some people may be very good at mathematics due to a strength in the region of the brain that deals with logical/mathematical intelligence. Craftspeople tend to have a strong bodily-kinaesthetic intelligence. Thus there is a biological reason why some people feel compelled to practice manual skill. They intuitively recognise and respond to their own innate abilities. They are almost predestined to find an outlet for their abilities, be it dance, athletics or craft. As well as accommodating the exercise of a gifted bodily intelligence, craft is one of the few outlets

Fig.21: X-Ray of a young woman with the colours highlighting the activity patterns in her brain.



for the practice of handwork in the technologically advanced age we live in. In addition to this it attracts those of us with a passion for objects.

People who like objects tend to express and explore that liking by making things for themselves, despite the availability of suitable technology. Objects fascinate some people, and the beauty they see around them compels them to make objects of their own. Their passion to create the perfect form cultivates a willingness to keep on making - they gain understanding through making. "Making is a form of intellectual and imaginative possession". (Dormer, 1997, p.152) The manual skills involved in each piece contributes to the craftsperson's knowledge of the materials and processes relevant to that form. This knowledge can then be utilised in the making of the next form, and so one's work develops and improves. Each stage is a step on the road to achievement, and that wonderful feeling of fulfillment. The satisfaction involved in making objects by hand is what CAD/CAM technology neglects. Craftspeople enjoy the challenge of making. They know that it is a difficult task involving risk and requiring constant judgement, concentration, intelligence and skill. Yet for these very reasons they feel like they have achieved a great deal when they successfully produce an object from conception to reality by hand.

"Conscious attention and skilled action are closely interrelated, and this is one reason why traditional craft has meditative qualities." (McCullough, 1996, p.141) When we practice

craft we combine our senses. Using our tacit knowledge enables us to pay attention to life and to really live it by using our minds and bodies productively at the same time. Thinking and doing flow together - the whole self is united in harmony. Albert Paley *(fig. 22)* fully understands the spiritual qualities involved in practicing manual skill. It is an open-ended pursuit. There will always be some new process to learn - something to strive for. The knowledge acquired through practicing a manual skill changes us and the way we see the world. It becomes an extension of ourselves. In order to understand something well, one has to try doing it. If Lechtzin's proposed computer data bank of craft knowledge and skill comes about, in a matter of years we will have lost real skill and experience altogether. If people fail to directly pass on their skills to others, and those people on to others, these skills will be lost forever. This is because it is impossible to gain tacit knowledge from books - it is best learned first hand. Hopefully we will not allow traditional handskills to become extinct. It is not the computer itself that will upset our society - it is our reaction to it.

Fig.22: Albert Paley demonstrating at Skidmore College, New York.

CONCLUSION

The wonderful advantages made available to us by modern technology cannot be ignored. Neither can we abandon the abilities and practices (such as handwork) that remind us we're alive by healthily engaging our senses. The key may be to compromise. Technology is constantly improving, but that does not mean that society will change instantaneously because of it. There is what Malcolm McCullough has aptly described as 'a cultural lag'. (McCullough, 1996, p.74) There are many people who are as yet untouched by computer technology, and feel no pressure to jump on the bandwagon. There are others who own personal computers (PCs), but use them for nothing more than playing computer games. Because of this 'cultural lag', we need not worry about becoming suffocated by new technology. The pressure to acknowledge it is not as great as it may seem. There is plenty of time to assimilate the pros and cons in order to use technology to our advantage rather than our detriment.

The computer is very powerful. Yet it is still a tool. We should be in control of it - not the other way around. In fact the computer is a myriad of tools at our disposal. The name 'tool-bar' is even used on the computer screen when referring to one's choices of functions. "Human-computer interaction methods use tools as a metaphor for developing some comprehension of abstractly conceived activities." (McCullough, 1996, p.80) This means that on the 'toolbar' of the computer, you may choose a 'paint brush' in order to apply colour and 'paint' on the screen. Thus the computer is

tailored so that we may understand it by association with real life. It has been suggested that craftspeople, who actively do use tools in real life, may be the ones who get the best results using CAD/CAM technology. This is because of their 'tacit knowledge' - their actual experience working with real materials. A sensitivity to the material and its properties enables one to fully use the potential of the computer..."...one needs to learn to think in three dimensions in the real world before one can get the best out of the computer's 'virtual' world." (Dormer, 1997, p.166) Therefore CAD/CAM technology can be used beneficially, especially by those who posses manual skills. In the present moment, most craftspeople have tacit knowledge and manual skills simply because technology has not yet affected traditional craft teaching methods. Therefore CAD/CAM is good news for them as they can get the best of both worlds. Stanley Lechtzin spent years practicing manual skills before he got involved in electroforming and later in computer technology. Maybe his tacit knowledge has helped him to use technology more effectively. Craftspeople "...are in control by virtue of possessing personal know-how that allows them to be masters or mistresses of the available technology..." (Dormer, 1997, p.140) It will be interesting to look at the situation a generation from now when any deficiencies in CAD/CAM will have been ironed out and the full capabilities of it realised. There is a whole generation of young people for whom computing is normal. Thus they will be the ones to instigate radical developments which might have been unimaginable a short time ago. Huge advances are made all the time. Lechtzin believes that "when a better tool is invented, those who ignore it go out of business". (Dunas, 1988, p.20) This may be true, but what he fails to realise is

that we can acknowledge the computer as a tool without forsaking our hand tools altogether.

Craft and manual skills have stood the test of time. However, they have endured tough times in recent history. The industrial revolution in the nineteenth century and more recently, the electronic revolution of the twentieth century have both deprived craft of a definite role in society. Industrialisation meant that manual skill was no longer required to produce utilitarian items as it had done up to that point. Yet craft and handskills survived on a small scale in one form or another. This is thanks to various independent practitioners and revivalist movements such as the Arts and Crafts Movement. In the present day as we approach the end of the twentieth century, the practice of hand skills has received another blow. The advent of CAD/CAM technology has meant that, on a personal level, craftspeople can use manufacturing processes to produce one-off pieces. Some even feel that the production of a physical object is not crucial anymore with the development of virtual craft. Industrialisation did not facilitate personal production, and so handskills survived for that reason. Therefore, is the practice of manual skill doomed from this point onwards? I believe the evidence suggests not.

Craft has had a rough time, but amidst the confusion between reality and virtual reality, a definitive new role has emerged for it. The role is that of nullifier - craft and the practice of manual skill has the power to neutralise the more harmful effects of advanced

technology. "Craft reminds us that we are mortal creatures and that our bodies as well as our minds and spirits give substance to our legacies." (Rowland, 1997, p.xxiii) In this technologically advanced age, it has been made ridiculously easy for us to neglect our bodies and the many physical aspects of our nature. However the practice of manual skill, alongside technology or in conjunction with it, is the key to living life with our bodies and our senses as well as our minds. Who knows what science and technology will come up with in the future. For the moment, handcraft is here to stay.

APPENDIX OF TECHNICAL PROCESSES

Casting The pouring of molten metal into a mould of the desired object. After the metal has cooled and hardened, the mould is removed and the object is then filed, cleaned and polished.

Electroforming A metallic object is formed by electrodeposition on a mould or matrix. This mould is submerged in an electrolyte in which a metal salt has been dissolved. An electric current is then passed through causing the metal salts to deposit on the mould. Objects can be exactly reproduced.

Electroplating A metal object is coated with a layer of a different metal while submerged in a solution charged with electric current.

Embossing (chasing; impressing; repousse) Low relief surface pattern is achieved by forming sheet metal on an elastic bed of pitch or wood with a hammer and punches made of harder metal.

Enamelling A coloured glassy substance, translucent or opaque, is fused to the surface of metal objects.

Engraving The inscribing of a design onto a metal surface by carving, etching with acid etc.

Fabricating Constructing a metal object by joining together separate metal elements by soldering, riveting etc.

Forging To shape metal by heating and hammering it repeatedly.

Inlay Strips of softer metal are hammered into grooves and depressions in a different harder metal resulting in attractive colour contrasts.

Intaglio Negative relief formed by engraving.

Lathe A machine for shaping metal in which the piece is turned about a horizontal axis against a fixed tool.

Oxidising Metal is blackened by undergoing a chemical reaction with oxygen.

Raising A process used to shape hollowware by hammering sheet metal in a spiral from the middle to the rim over a stake.

Soldering A method of joining metal pieces using an alloy with a lower melting point. The metal pieces to be joined and the alloy (solder) are heated using a gas torch until the alloy melts. When it has cooled and hardened, the pieces are joined.

Spinning Using a lathe, a disk of sheet metal is formed over a wooden model using hand-held, rounded levers.

Stamping A set shape is repeatedly stamped out of sheet metal with a rapid falling weight on a set punch made from hard tool steel.

Stone-setting A stone is secured in a metal form where the claws or rim of the form (setting) are pressed over the stone to keep it in place.

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