Jonathan Boyd
Silversmithing and Jewellery Department
Research Portfolio No.1
Research Title, Outputs and Methods used.

Title: Investigations and research into 3D printing, complex spruing systems and digital technology in Jewellery.

Outputs: Artefacts and works of jewellery and objects for exhibiting.

Methods: Rapid Prototyping, CAD design, Sound collage using editing Software, Lost wax casting, laser cutting, hand fabrication and Laser welding.

Reach: Exhibitions, Catalogues, Lectures, Publications. Please see Slide 20 for full listing.

Date of Research: 2010 – ongoing.
Artefacts produced by means of Research. Exhibited together 2010-2013
Explanation and Context of research narrative

Background:

Following on from work created during 2009 and from my MA at the RCA, I have researched complex ways of lost wax casting objects and jewellery. To create these complex structures I have been investigating ways an ongoing use of CAD design and ultrafine Rapid Prototyping techniques. Other ways of including Digital ways of manufacturing and process have also been investigated.

I have submitted two Research outputs as the there are two strands of research that always combine in the creation of artifacts. These are (Research Portfolio 1) an investigation and research into 3D printing, complex spruing systems and digital technology in Jewellery and (Research Portfolio 2) an investigation and research into the relationship between language and object, conversational dialects, disfluencies and object and the creation of artefacts on this subject.

Although the two research subjects combine through my practice to create finished works for exhibition, they can be viewed as two different strands of research as they look very differently at two subjects.
Methodology

How the artefacts are produced through Practice based research
Lost Wax Casting.

My research as described in this Portfolio is concerned mainly with ways of lost wax casting. For those unfamiliar with the process I have included a visual explanation (left). Waxes (or other materials that will burn out at a high temperature) are placed in a plaster mould and the contents burned out. Metal is then poured via vacuum into the areas where the wax was. The images work from top left down and have been created as an explanation to Silversmithing and Jewellery second years about Lost wax casting.
Introduction into complex spruing systems.

A sprue is a gateway for metal to enter into a plaster void so that it can be filled with molten metal. This process is called Lost Wax casting.

The lost wax casting system is used throughout the jewellery and sculpture worlds.

Several Jewellers before have employed CAD designing techniques to create complex objects for casting (such as Jeweller David Goodwin) Through wax rapid prototyping. Where my work differs from this is the sheer amount of the sprues, the complexity and the non-uniform way in which the way the sprues are placed.

The images of the left show how works made of scrambled text are held in place by tiny ‘hair width’ sprues. Some of the item had up to 3,000 tiny sprues (each one individually placed attaching top part of my work) acting as gateways for metal to enter the cast.

The works themselves are designed to be non uniform, this means that the sprueing systems must also be non uniform. Each model can take up to a month to draw.

The letters shown in these models measure 2.3mm height.
In 2012 a Solidscape 3zPro rapid prototyping machine was purchased in the capital bid. This enables the school to teach CAD design to students with possibilities of making 3D models and works in ultra fine detail. It also enables my research to create more complex and finely detailed work without prohibitive problems such as posting and casting fine detail models by outside contactors.

When rapid prototyping my I use Solidscape machines as they have an ability to print with a surface resolution of 197x197 dots per mm. This level of finish means that build lines will not be visible to the naked eye.

Also these machines print in two materials, a blue wax which is tough and fairly durable and a red wax which dissolves on the completion of a model. This means that nearly any idea can be created with out the worry of support structures for over-hangs etc and will produce a near perfect surface finish.

The work I create using these machines has been exhibited and published internationally.
Examples.

Examples of CAD designs with spues attached (left) and a finished work (right) once the piece has been cast, the sprue cage removed and finished to the required finish.
Examples of waxes rapid prototyped with the ultra fine ‘hair width’ sprues:

Note that they are often conical in shape this is to aid as much metal getting through the sprue as possible.

height = 32mm width = 60mm approx Diameter 10mm approx
Once Cast.

Once cast the pieces of work are still housed in their sprue cages. Each sprue then has to be removed by hand and cleaned. In the case of Case Study No1 (left) almost 3,000 sprues were removed.

The images on the right (top and bottom) show the work before it was cleaned and finished.
Spiral Sprues:
Integration of sprue system into works and spiraling structures.

As can be seen from previous slides my works used hundreds of tiny sprues that would then be removed when cast by hand. This is an effective way of creating extremely intricate artifacts with no visual explanation of their creation.

However it is also a very time consuming job removing each tiny sprue and this lead to research into building sprues as part of the structure of the works.

Works were designed to have intricate spiraling sprues inside them. The structure of the spiral meant that metal would flow easily through the work. The diagram on the right shows how such a sprue would aid the flow of molten metal.
Example of large spiral sprued work.

The piece is designed in two parts so that there is minimal points of connection making it harder to understand how the object was fabricated.
Three stages of spiralled spued Chain.

The Solidscape machine creating waxes of half links. The machine is printing with a fineness of 0.000254 mm.

The links after casting and joining. The material is Sterling Silver.

The finished Brooch with a oxidised surface.
Scale.

On the left is a piece of work (‘speechbubbles’ - brooch) that shows the experiments with scale that I have undertaken. The spiralling dome sentences are 9mm wide and the text becomes a pattern when seen with the human eye. Only on closer inspection does this delicate pattern reveal itself to be text.
Laser Cutting

Experiments into different effects created by using different materials, and laser cutting as an effective way of creating detail in cast objects.
A laser cut bangle in Perspex and 18ct Yellow Gold (left) and Cad drawing ready to cut sentences out of card for casting (right).
Collaboration with Andrew Lamb

Collaboration with Andrew Lamb to create an award for the Arts and Business foundation. The work was created using laser cut Perspex and then layered using steel rivets. The ‘&’ was also laser cut before being cast in bronze.

This work tied in with both mine and Andrews design interests as well as using my experimentation with casting laser cut materials.
Using card to laser cut very fine text patterns means that unlike perspex the material won’t melt beyond thickness of 0.5mm (the text shown on the left has thickness of 0.2mm in areas).

Two layers are of card are cut- The top text layer and the bottom layer a spiralling sprue. The two are carefully glued together then dipped in a natural resin. The resin has two functions, one to stop wet plaster leaking into the card and causing it to deform and two natural resins have a better burn out in the lost wax process.

Visually the process of using laser cut card rather than using Rapid Prototyped waxes creates several key differences. Scale can be considered at much less expense and the mottled effect created by the burn out of the card gives the work a more natural and less engineered finish.
Laser cut individual sentences (right) and CAD drawing (left) for cutting two different materials to fit together.
Sound

Experiments with integrating digital sound and sound Collage
Digital Sound.

Both laser cut and Rapid Prototyped lost wax castings have been used in this work. The work also contains a digital recording that is held within the work. When worn the piece should also be listened to. The sound collage works alongside the works narrative.

Several experiments using digital (MP3) sound collages with worn objects have been undertaken with the ‘I.P.A’ (left) the most successful and only exhibited one so far.
Selected Exhibitions

2013  Forming Words, Flow Gallery London & Design Centre Manchester
2012  BKV Young Applied Artists of the Year (finalists), Munich & Schmuck International Jewellery Fair
2011  Not Pretty (Glasgow, London, Sydney,)
2011  40 Years in the tower (Glasgow School of Art)
2011  In Tandem, London (Electrum, Collect/Flash)
2010  Jonathan Mathew Boyd – Solo Show (Au Studios Glasgow)

Selected Awards

2012  BKV Young Applied Artist Finalist. Munich
2010  Best New Design Goldsmiths Hall
2010  Scottish Arts Council Development Grant
2010  Goldsmiths Fair Bursary 2010

Publications


Lectures and talks
