



# THE SOFTWARE IDEATED PLATE

Towards designing a new relationship of integration  
between digital technology and the intaglio process.

Johann Grebe Booyens



**DEBUT ENTROPIE**



# **THE SOFTWARE IDEATED PLATE**

Towards designing a new relationship of integration  
between digital technology and the intaglio process.

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Dissertation submitted in partial fulfilment of the requirements for the degree  
**Master of Technology: Graphic Design** in the Faculty of Informatics and Design at  
the Cape Peninsula University of Technology

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Cape Town, August 2014

**DECLARATION** I, Johann Grebe Booyens, declare that the contents of this dissertation represent my own unaided work, and that the dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



Signed

15/01/2015

Date

**ABSTRACT** This study investigates the application and use of the latest graphic design software technologies to help plan and ideate the intaglio printmaking process. This is significant as intaglio is a 600 year old process which has evolved little, if any, in the last few hundred years although it was born from technology. Furthermore, the intaglio process relies on mental visualisation of the final artwork, making the real outcome and the planned outcome dissimilar. Students of intaglio printmaking are often surprised or disappointed by the printed result due to the lack of efficient planning. There are several ways in which software influences the creative process, including enhancing visualisation and communication, premature fixation, circumscribed thinking and bounded ideation. In this research, computer software is used as a simulator to facilitate the planning process in order to minimise the disconnect between visualisation and outcome, and serve as learning instrument. The use of digital computer technologies has been a highly debated issue in printmaking as there exists a rift between printmakers; those who embrace and explore new technologies and those who reject new methods in favour of traditional means. New technologies in printmaking offer exciting opportunities, both innovative and creative, but these new technologies are often seen as alternative or auxiliary methods of printmaking compared to traditional ways. Since these debates have been buried but not necessarily resolved, this study reinvigorates some of these perspectives and seeks a common middle ground. This study does not argue for, or against computer technology, but rather for a third paradigm: technology can coexist with intaglio without compromising the beauty and authenticity of hand processes. Computer technologies, therefore, serve as a facilitator to amplify the traditional intaglio hand process. However, the issue of discussion in this thesis is not hybrid printmaking but rather a hybrid mode of thinking in the printmaking discipline.

This iterative design experiment consists of a written dissertation and intaglio printed artworks which inform and complement each other. The theoretical foundation of the art practice is found in the Bauhaus slogan: “Art and technology: a new unity”. Art and technology form the basis of the theory and the theme of entropy – the process of degeneration – is illustrated in the design artefacts. This theme shows process and illustrates the idea of a positive agent: the interference of computer in intaglio to instil new energy and value not only to keep it alive, but position it as an important skill necessary for growth in the knowledge-based economy. Furthermore, this study contributes to the scholarly discussion of design’s conceptual skills (ways of thinking) in order to enhance production capabilities (ways of making).

**KEYWORDS** Intaglio, Printmaking, Computer simulator, Computer planning, Printing matrix, Printing processes, Hardground, Softground, Aquatint, Computer ideation, Design research, Liminal space.

**ACKNOWLEDGEMENTS** I would like to express my sincere thanks to everyone involved in this study, from critics and supporters, to extra ears and hands, whether in front of the computer proof reading, or in the print studio, giving advice.

Thanks to my two study leaders, Dr Alettia Chisin and Prof Johannes Cronjé, for providing many hours of guidance and critical input. To the staff of The Ruth Prowse School of Art who made their studio available, and to Eunice Geustyn, the principal, I owe a special word of thanks. In particular however, I need to thank my father-in-law, Dr. Johan Wilkinson, for support, without whose assistance, this study would not exist. To my wife, Irma, who, although busy with her own PhD, always showed interest and offered critical thought. Thanks are also due to my mother, Prof Susanne Booyens, for proof reading, encouragement and babysitting. Finally, I would like to thank my mother-in-law, Naomi Wilkinson, who saw the need for emotional support, babysitting and endless words of encouragement.

*For Ariel.*

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# TERMS, CONCEPTS AND ABBREVIATIONS

**A la Poupée** is a printmaking process that involves coloured ink applied directly to a plate's surface and worked into the appropriate area of the design using cotton daubs called dollies or, in French, *poupée* (Woods 1996). This method of printing allows a common hue to be created when a coloured ink is placed over an already inked area. Separate areas of the printing matrix can also be inked individually with different colours creating a multi-coloured print (Grabowski and Fick 2009).

**Aquatint** is used for making tones in the intaglio process, and is composed of fine particles of rosin (Tala 2009). The acid bites around the particles, creating tooth (or a collection of little marks) in the plate that holds the ink.

**Chine collé** is a printmaking process in which the image is transferred to a finer surface substrate that is bonded to a heavier support in the printing process. This finer substrate allows the printmaker to print on a much more delicate surface which pulls finer details off the plate. Another purpose is to provide a background colour that is different from the surrounding backing sheet (Woods 1996).

**CMYK** is the abbreviation for Cyan, Magenta, Yellow and Keyline (black). These four colours together are known as the process colours and are the constituents of the subtractive colour model.

**Drypoint** is an intaglio technique where no corrosive agent such as acid is used. The matrix is made by making marks and indents directly on the plate, deep enough to hold the ink.

**Etch** refers to the corrosive process of the acid on the metal printing plate to create a printing matrix. This process is often called biting or bite.

**Hardground** refers to a hard wax compound melted onto the printing plate. In a hard ground etching, the artist draws through a wax acid resist (hardground) that coats the plate. Hardground lines are usually thin, wiry, and blunt at the ends. The acid bites or etches the exposed lines to create a printing matrix. The ground is removed and the plate is inked and printed.

**HSV** is the abbreviation for Hue, Saturation and Value. This colour model is commonly used to set and calibrate electronic colour output devices such as television sets, computer monitors, mobile devices and image projectors.

**Ideation** is the creative process of generating, developing and communicating new ideas, whereby an idea is understood as a basic element of thought that can be visual, concrete or abstract.

**Incunabula** refers to the first 50 years of printing, from 1450 to 1501. This period is also referred to as "High-printmaking". The word is derived from the Latin referring to a cradle. Bernhard von Mallinckrodt (1639) first used the term in *De ortu et progressu artis typographicae* (*Of the rise and progress of the typographic art*) which includes the phrase *prima typographicae incunabula*, "the first infancy of printing" (Eisenstein 2005).

**Intaglio** refers to a printing process where the ink is held in the recessed areas of the printing matrix. This is different from other processes such as planographic or relief, screen, lithographic and digital printing. Generally speaking, two categories of intaglio are described: the recess can be created directly by hand, such as drypoint or, secondly, engraving can be accomplished by corrosive agents such as acids (Adam and Robertson 2007).

**Matrix** is a surface that holds information to be transferred. It refers to the printing plate that will carry the image and transpose it to the substrate (usually paper). In the intaglio processes, the choice of material is usually a metallic plate. Zinc, copper, brass or steel are the most frequently used metals (Coldwell 2010).

**Resist** refers to areas of the printing plate blocked out by an agent that can withstand the corrosive properties of the acid thereby creating areas that hold no ink and, thus, transmit as negative space on the printed image (Adam and Robertson 2007).

**RGB** is the abbreviation for Red, Green and Blue. These three colours, combined as transmitted light, produce white, a process which is known as the additive colour model. This colour model is used to display colour on electronic colour devices such as digital cameras, monitors and mobile devices.

**Softground** is similar to hardground, but consists of a softer wax coating. In softground etching, the artist draws on a piece of paper that covers a soft wax coating on the plate. When the paper is lifted, it removes the wax where the pencil marks are made. Lines in a softground etching are often more fuzzy at the edges, similar to crayon lines (Adam and Robertson 2007). An artist can also use the waxy softground to make imprints of other objects such as leaves, cloth, rope or any thin soft material (Grabowski and Fick 2009).

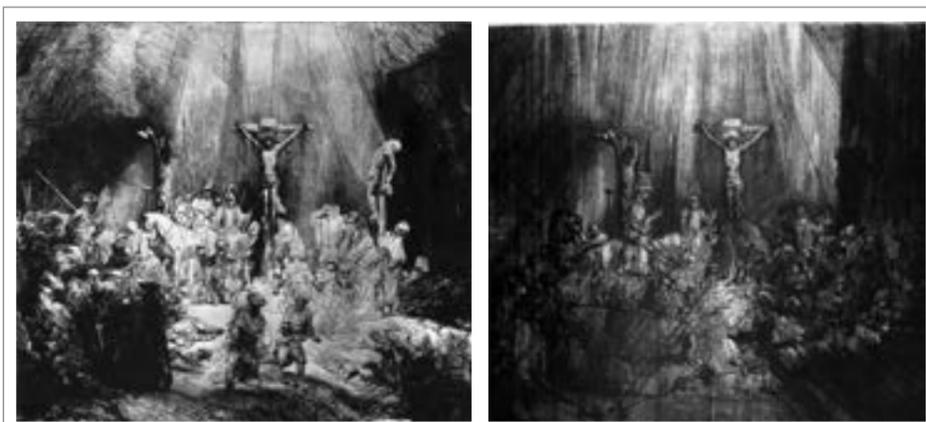
**Sugar lift** is made by painting the surface of the matrix with a brush dipped in a solution made mainly of sugar and water. The sugar solution acts as a repellent to a second oil based coat of resist (Adam and Robertson 2007). The sugar lift must be removed, or lifted, before the plate is submerged in the acid, thus exposing the areas initially covered by the sugar lift.

**Technology** as referred to in this document, refers mainly to graphic and multimedia design computer software and enabling systems such as scanners, cameras and networks used in the graphic design discipline. The technology described in this study, is specifically the latest available version of software that is used commercially in the creative industries. The software used in this study includes the Adobe Master Collection CS6 with other device specific software, such as scanning software, colour calibration and projection software and specialised printing software.

**Traditional Printmaking** refers to printmaking processes and techniques developed and used before digital processes were incorporated. Such processes span across all categories of printmaking but exclude the use of any electronic and/or digital process in the creation of the printmaking artefact.

# CHAPTER 1: INTRODUCTION TO THE STUDY

**1.1. INTRODUCTION** This study investigates intaglio printmaking as an artisanal hand method with historic links to technological advances. The nature of intaglio processes relies on a mental visualisation of the final product, therefore, it is not possible to see the result of the plate in an intermediary stage. Coldwell (2010:13) states that there exists a gap between the artist's original drawing and the final realised print. Unlike the modular sculptor who can add or take away, seeing the fruit of his efforts as he progresses, the intaglio printmaker can only see the finished artwork after many stages. The intaglio process is a one way process and to undo mark-making is difficult, laborious and often unsuccessful. As a result, experienced printmakers will encounter 'happy accidents', while novice printmakers often encounter the 'unhappy accidents' instead. An example of this variable can be found in the work of Rembrandt, who exploited these variances by inking the same plate differently to produce two prints that display an extreme difference in light and shape (Figure 1.1).



**Figure 1.1:** Two versions of the same plate  
Rembrandt van Rijn  
*Christ Crucified between the Two thieves (The Three Crosses)*,  
1653 and 1660  
Drypoint and burin  
406mm x 457mm  
The Metropolitan Museum of Art, New York.  
(Melot et al 1991)

Contemporary literature on printmaking embraces the use of technology as an evolution of process (Coldwell and Laidler 2012, Man 2002, Noyce 2010). It stands to reason that many traditional printmakers may feel inept and marginalised because they often struggle to keep pace with modern trends and software technologies. A natural feeling of antagonism and rejection is commonplace in master printmakers who vehemently reject any use of computer or computer technology in their studio practice. A well-known printmaking studio in South Africa rejects modern intervention and considers computers as sacrilegious to the fine hand discipline of printmaking (Benade, 2013)<sup>1</sup>. Most often the role of art and craft, as a traditional endeavour to return to a more conservative value system, is at the core of this 'away with computer attitude' (Noyce 2006). It is a view that transcends to culture as a whole – not just printmaking – where modern push button solutions and plastic value systems are rejected. The thesis presented here is that an understanding of tools and processes does not need to be limiting to either ends of the spectrum of thought. Computers and traditional hand processes can be used to complement, and not limit, one another.

**1.2. BACKGROUND** For more than 600 years, intaglio processes have been used for utilitarian means, rather than for the aesthetic creation of media. New technology in printmaking offers exciting opportunities, both innovative and creative (Platzker and Wyckoff 2000:9-10). The mixing of techniques has been central to printmaking from its inception to present, making it one of the most innovative and challenging art media. As Woods (1996:144) puts it, "nothing in printmaking is sacred anymore", referring to distinct categories of printmaking becoming blurred. Albrecht Dürer's fine woodcut cross-hatching was transposed to metal plates in the 1490's just as Edvard Munch used litho combined with woodcut (Platzker and Wyckoff 2000). To date many new processes have been added and refined, but, unlike painting, sculpting and other printmaking methods, intaglio printmaking specifically has evolved very little, if any, over the years (Timmers 2001). Whilst computer printmaking and digital technologies have found their way into the printmaking studio, these methodologies have seldomly been used to plan traditional processes such as intaglio. These new technologies are often seen as alternative or auxiliary methods of printmaking.



**Figure 1.2:**  
Pablo Picasso  
*Femme au Fauteuil no.1 (Woman in an Armchair No. 1)*,  
1948–49  
Lithograph printed in black  
The Museum of Modern Art,  
New York.  
(Platzker and Wyckoff 2000)

There exists a rift between printmakers, those who embrace and explore new technologies and those who reject new methods in favour of traditional means (Platzker and Wyckoff 2000). Artists such as Emil Nolde and Paul Gauguin considered basic woodcut as a primitive, but a creative, space to embrace old values (Grabowski and Fick 2009:38). Ironically it was Gauguin who experimented with new tools borrowed from lithography and explored printing with new wood types. Nolde experimented with techniques, using course hacking tools to work along the natural wood contours. An example of the collaboration of process and innovation is Picasso's *Femme au Fauteuil no.1 (Woman in an Armchair no.1)*, Figure 1.2). An initial five-colour zinc lithograph was reworked to produce five distinct black plates overprinted to a final artwork (Platzker and Wyckoff 2000). What is illustrated through this procedure, is not so much the final artwork, but the process of innovation that created it.

Traditional definitions and parameters were challenged more in printmaking than in other art mediums when the computer era swept across the art landscape. Computer technology entered the realm of printmaking which necessitates the learning of new skills. It seems, from an overview of the literature (Coldwell 2010; Grabowski and Fick 2009; Hobbs and Rankin 1997; Noyce 2006; Platzker and Wyckoff 2000), that contemporary printmakers have a great deal to say about the validity of the utilisation of digital processes, mixed media and combining traditional methods with digital prints. New means and influences are discussed with computer-generated matrices and computer-generated images moving to the forefront. There exist some intaglio printmakers who use the computer and its appropriate software in the manner suggested by this study, but in a limited sense. This practice is an issue, however, that has not been academically discussed and scrutinised (Geustyn 2013)<sup>2</sup>. This omission is due to the disconnect between academia and printmakers, especially in South Africa.

Printmaking has a long history, showing a troubled identity with no conclusive definition of printmaking. For this reason, Sassen (2008) writes that printmaking moves in shape but never in character. It is this character of printmaking that is often hailed as a unique hallmark of the discipline. In this arena two topics emerge: firstly, printmaking's strong political ties due to its inherent power of information dissemination and, secondly, its link with technology. Although both topics have been discussed in the literature, it is the link with technology that evokes strong emotional response and even more uncertainty. Due to some debates, mainly of the previous decade, this issue of technological influence and its legitimacy in printmaking has largely subsided and a culture now exists of blind acceptance of any technology as part of printmaking. The debating of issues relating to printmaking has largely fallen away although not all the concerns have yet been adequately resolved.

**1.3. RATIONALE** This study is conducted from a personal background of fine art printmaking in the traditional school, but written to address a university of technology audience. The study might therefore be less relevant to traditional fine art universities and schools who have, to some limited extent, resolved issues raised in this study. However, universities of technology, by definition, should be practice-orientated with a keen interest in technological advances and innovation. It is within this educational framework that the study is situated to address the serious lack of academic investigation and interest in such technologies in the graphic design curriculum. Furthermore, printmaking, although technically a graphic design subject, is usually offered as a fine art subject at traditional universities where key foci are theory, practice, art philosophy and history, whilst technology as agent for utilitarian art application is often under investigation at universities of technology. During the course of this study it has become clear that research gaps exist at universities of technology, insofar as a dearth of exploration addressing issues of fine art and design technologies is concerned.

**1.4. AIM AND OBJECTIVES** This study investigates how to apply graphic and web design software to plan the intaglio printmaking process. The objectives were to explore how to create and, indeed, to create new process, and to document and illustrate this process. This new process of planning for intaglio printing was informed by contextualising background interviews. The research objectives included:

- Exploring the problems of planning that confronts traditional intaglio printmakers;
- Explaining how the computer and its enabling software offer solutions to the problem of planning the intaglio print;
- Developing and testing a simulator as a means of aiding the intaglio planning process;
- Describing the strengths, weaknesses and value of the simulator.

**1.5. HYPOTHESIS** The working hypothesis of this dissertation is:

**Computer technologies (i.e. the use of software applications and the facilitating hardware) can help to plan, inform and ideate the processes used in intaglio printmaking in order to save time, cost, accelerate learning, create interest and ultimately develop mastery in the art.**

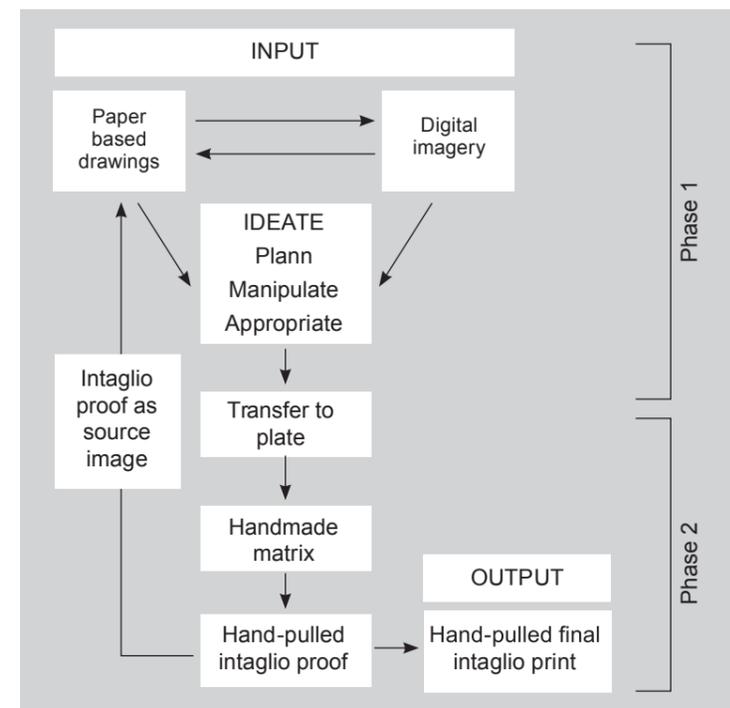
The basis of the argument is that if computers are indeed useful as tools for ideation in printmaking, innovation and adaptation are encouraged by utilising new technological advances as a core principle. This enhancement is the case since computers and the accompanying software must be able to assist, and be valid tools, for applying ideation and planning during the traditional intaglio printing process. The above belief leads to the research question:

**To what extent can computer technologies be used to facilitate the ideation and planning process of intaglio printmaking?**

For the purpose of this study, the intaglio printing process is broken down into two phases: Phase 1 that concerns itself with planning and Phase 2 that is the printing of the plate, the actual intaglio process (see Figure 1.3).

Although this study focuses on the ideation and planning with computer technology, and not the outcome of the final intaglio print, it must be pointed out that process and outcome, although separate, are part of the same creative activity. When investigating printmaking as a cognitive design activity, the planning phase cannot be compartmentalised and separated from the designed output artefact. The study, therefore, sees the intaglio process as a single design activity, although in distinguishable phases in a causal relationship. As thinking causes action, and planning causes design, so too does this study encompass both aspects: a written research piece and a practical application of an iterative design experiment as the result of the simulator.

This study does not propose the replacement of old processes with modern computer-generated forms of art, but rather suggests that software programs can be a valuable tool for planning and ideating intaglio artefacts. Planning is a crucial element in intaglio processes. Grabowski and Fick (2009) and Hobbs and Rankin (1997) acknowledge that digital technology excels at image ideation and can serve as a planning agent for a hand-printed matrix.



**Figure 1.3:** A theoretical work-flow model for the implementation of computer technologies as planning and ideating tool in the intaglio process. (Author's construct)

Figure 1.3 illustrates the workflow in Phase 1 that moves between digital and print, it starts with ideation/planning drawings (also known as thumbnail drawings or scamps), and digital images, often used together. The process alternates continuously between these two media (hand-drawn and computer). The computer allows certain accuracies that are not easily obtained by quick hand drawings. Correct size and measurements, accurate lines, accurate typography and other design elements are easier to create and ideate on a computer than by hand drawings. However, hand drawing allows some freedom of hand movement that is not easily replicated by a computer, although modern computer software and hardware have minimised this disconnect.

In order to provide an empirical, although personal and biased proof of validity of computer ideation, two sets of ideation documents were produced for the practical design experiment of this study. Hand-drawn sketches were made, in what is commonly known as a visual diary (a sketchbook for ideas and themes for a design project). Computer generated imagery was used together with the hand drawn sketches. In almost all instances there was a crossover between a single idea from paper to computer, or often computer first and then paper, moving back and forth between these different modes of visualising an idea. The main software used, Adobe CS6 Master Edition, allows now, more than ever, hand simulated drawing with the added benefit of ease of editing. This facility coupled with advanced input hardware, such as a drawing tablet and a pressure-sensitive electronic pen, make these computer technologies very attractive and realistic compared to traditional pen or pencil hand drawings. These advancements highlight computers as valuable planning tools because they enable printmakers to evaluate the result before production (Yeoh 2006).

**1.6. OUTCOMES, RESULTS AND CONTRIBUTIONS** The outcomes of this study can be described as both theoretical and practical. The research contributes towards the discourse in the field of technology and printmaking with a focus on intaglio techniques. Furthermore, the practical application of the design experiment yielded results that contribute towards a workflow model for using computers and computer software in the intaglio process. An accurate recording of the findings of the design experiment was made to highlight the extent of each of the planning experiments. The value of the design experiment is threefold: the lessons learned from the experiment in the act of making, the proving or disproving of the hypothesis, and the artefact as a valuable entity in itself. The result is, therefore, a better planned and executed intaglio print. This improvement is significant because these findings serve as a case study that can be applied to other design and printmaking disciplines.

This study has implications for education and process innovation because it contributes significantly to the practical application of design experiments as a research method. Furthermore, the recording and application of the experiment, iterative by nature, serves as model for future design experiments in related disciplines.

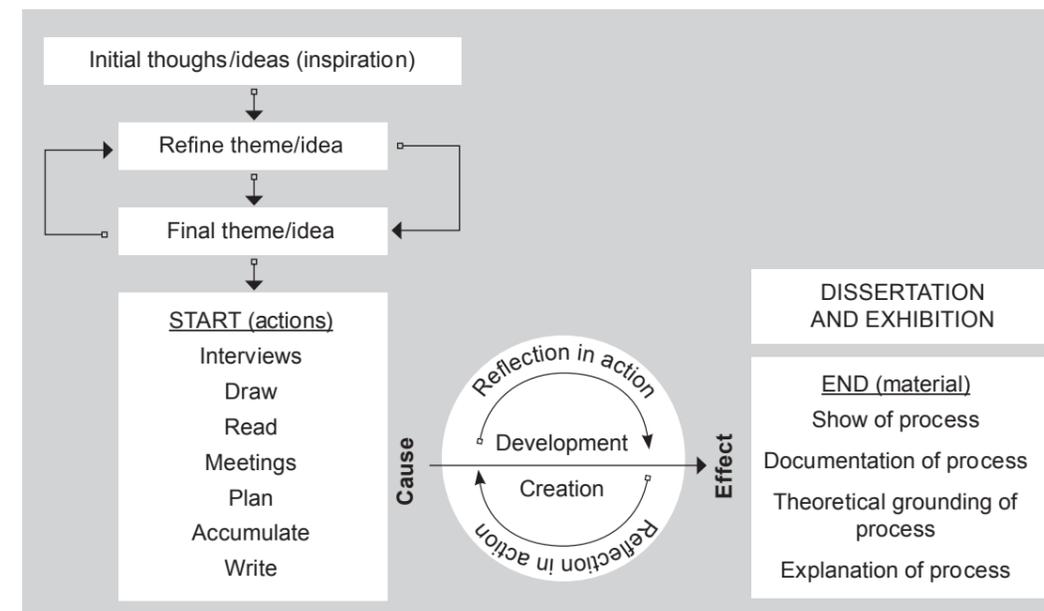
**1.7. KEY POINTS FROM THE LITERATURE** The literature describes a myriad of new methods, explorations and innovations, leading to the serious lack of academic scrutiny to discuss and question the legitimacy of these new methods. New methods are either accepted or rejected, but seldom debated adequately. Although process does receive limited recognition in the literature (Noyce 2010, Coldwell and Laidler 2012, Fishpool 2009) almost no mention is made of the planning process and the role it occupies in the outcome. Most literature discusses the making of a print as a single activity and, therefore, largely fails to address the finer nuances of the different aspects: motivation, inspiration, preparation, planning and execution. Literature on design in general offers a far better insight into these different aspects of such an activity but seldom acknowledges intaglio printmaking as a contemporary design activity.

It is evident from the literature reviewed that in professional practice traditional processes such as lithography, intaglio and relief are slowly being replaced by new digital prints (Coldwell 2010; Hobbs and Rankin 1997; Noyce 2006; Platzker and Wyckoff 2000). The literature describes these two worlds as separate and often presents them, in the writer's opinion, as 'a war between traditional ways versus the shock of the new'. Although this debate has been labelled "old and stifling" (Thorburn 2008:34, Coldwell 2011:14), and has been largely pushed aside, it seems to resurface intermittently. This 'come-back' appears to question whether, in fact, the issues raised in those earlier debates have been resolved, and if those debates are now widely accepted as outdated.

Art research has been largely neglected or even purposefully rejected in the past (Borgdorff 2006) and, consequently, few academic journals exist on printmaking. However, some major books have been published in the last 15 years on printmaking with a distinct focus on newer advances and at least two magazines in Australasia are dedicated to printmaking. It also seems from an overview of the available texts that most of the relevant literature exists online in the form of blogs or discussions, including conference proceedings of the series of Impact Printmaking Conferences. The Impact Conferences follow a distinct path of themes that are discussed in more detail in Chapter 3. The lack of academic standard and peer review criteria makes this literature (excluding conference proceedings) to some extent unreliable. Despite this, these sources have created a sense of understanding of the debates surrounding printmaking and identified topical issues in the field. Literature on print as a medium for political and social commentary, especially in a South African context, is abundant and seems to dominate contemporary discussions. This aspect is not, however, the focus of this study and is therefore purposefully excluded.

One topic that seems to be lacking in the reviewed literature is that of the limitations and shortcomings of printmaking although a focus on new advances in printmaking seems to dominate the most recent literature. The future and possible extinction of paper, as proclaimed by many since the birth of the internet, is another topic that only the bravest of authors dare address and then not in depth. An argument is made that there is such a focus on new technologies in printmaking literature without an acknowledgement of the shortcomings thereof for two reasons: as a defence against the proponents of the paperless world, but also as a result of a genuine renewed interest in hand skills, incorporating new advances in technology, to compliment these age old crafts. It is this renewed interest in hand skills that is explored in this research.

The above mentioned claim of new technologies does not suggest an end to traditional methods, although interest in intaglio printmaking in South Africa has declined. Novel innovation by European and American artist is visible in new techniques and incremental innovation is found in traditional methods being elevated to new heights (Noyce 2006). Artists and printmakers such as David Hockney and Jasper Johns were masters at refining old approaches, just as Pablo Picasso, Henri Matisse and Joan Miro had done before them. Platzker and Wyckoff (2000) write that this break with the traditional outlook was not a deliberate or aggressive activity to undermine any authority but should rather be seen as an approach seeking to unbind convention. They state that it was often a naiveté of what was possible or what was expected, that drove practitioners' desire to move outside boundaries.



**Figure 1.4:** Theoretical model of the research design. (Author's construct)

**1.8. OVERVIEW OF THE METHODOLOGY** The iterative process of making and adapting is conducted for the practice in a series of five design experiments. Within each set of experiments the flow of information and actions is non-linear and uses an inductive system of reasoning to conclude the experiment. Although the variables (cause) are set, the flow of information and inquiry (values) of this experiment remained uncertain until such time as the actions are completed. Again, the cyclical nature of this study, both in methodology and theme, will show movement between the start and end points, highlighting the fixed cause and leading to an uncertain effect (Figure 1.4). Two aspects of the research are listed: interviews with current printmakers as well as practice-based process exploration through iterative design experimentation. These two aspects are described below.

An outline of where the research process has started and where the process has finished was situated within a broad practice-led research framework. Such a framework includes the iterative design experiment as applied in the practice which is based on Hume's (in Field and Hole 2003) model of causality. Sullivan (2010) states that many models of research are based on traditional forms of research, and that a new research paradigm has to be acknowledged when the mere act of making becomes research. The approach of the methodology utilised in this study is therefore partly practice-led using an existing model of experimentation of cause and effect (Field and Hole 2003). The applied model of iterative experimental research that has value (in this research), can be described as explorative research that leads to a developed artefact. A key aspect of the design experiment is the ability of the experiment to be adaptable. Popper (in Field and Hole 2013) mentions that an experiment often changes face. This aspect stresses the importance of accurate recording.

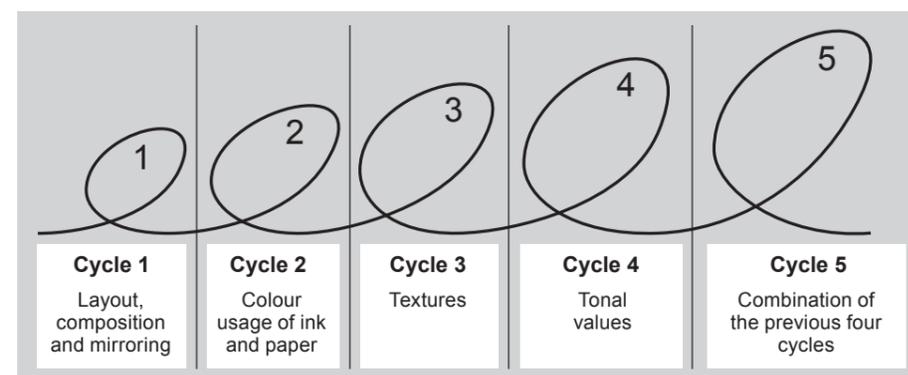
**1.8.1. INTERVIEWS WITH PRINTMAKING ARTISTS** Interviews were conducted with selected artists and master practitioners of printmaking to discuss their printmaking planning practice and processes, and to establish their opinion on computer technology in the field. The data collected from the interviews helped to determine how technology and the use of computer software programs can, if at all, help them to plan, visualise and enable their work. These findings were incorporated in the development of the printmaking processes as described in the next section.

**1.8.2. ITERATIVE DESIGN EXPERIMENT** As part of the practice of creative process, an accurate recording of techniques, effects and results is made to inform the next cycle of the experiment. The causal relationship between the two variables: cause and effect, is applied to every iteration. This recording acts as continual insight in the planning phase, whether initial planning or different states of a plate. This continual adaptation, or *create-and-critique* (Sullivan 2010), workflow is borrowed from Schön's (1983) reflection-in-action basis of learning. An obtrusive design experiment is conducted with a predetermined cause and hypothesis and the effect is then recorded, measured and analysed.

The basic function of the design software (Adobe Master Collection CS6) employed to both record and ideate the intaglio process in this study will be five-fold as listed below. The list is arranged in order of importance and application. The order speaks about the level of complexity or the scale of difficulty of mental visualisation of the process in intaglio printmaking. These following five points mark the outline of this design experiment:

- Layout, composition and mirroring of images for planning of the intaglio process;
- Colour usage of inks and paper in the intaglio process;
- Textures and effects from different techniques: hardground, softground and drypoint;
- Tonal values of aquatint;
- Synthesising of old plates and artworks into a new design.

The research cycle was repeated five times with an outcome of five sets of artworks increasing in complexity and contents (Figure 1.5). At the first cycle, layout, composition and mirroring were the main concerns. Cycle 2 built on Cycle 1 with the added functionality of colour usage. Cycle 3 and 4 respectively incorporated the previous cycles, coupled with textures and effects in Cycle 3 and tonal values in Cycle 4. The final cycle incorporated all of the above effects. This research process comprises a series of five sets of printed artworks. Each of the five sets contains approximately five to eight separate artworks to make up the body of work and show process-based exploration of the theme.



**Figure 1.5:**  
Cycles of research  
and artefact  
creation showing  
growing levels of  
engagement.  
(Author's construct)

**1.9. SIGNIFICANCE AND VALUE OF THE RESEARCH** Due to the dynamic nature of printmaking, the international community of printmakers' practice has implications far beyond its immediate confines (Noyce 2010:8). As discussed in Chapter 2, the development of new techniques and the inherent innovative nature of printmaking make this art form valuable across many disciplines. It establishes an application model for computer software within a field that has largely been excluded from modern technology. This research holds significance for both graphic design and fine art disciplines because printmaking falls in both fields and shares aspects common to both. If graphic designers are defined by the task they perform (Drucker and McVarish 2013:xxiv) then an understanding of printmaking (as a design activity) is a definite necessity.

Geustyn (2013) describes printmaking as a series of well-defined and logical steps that have strict variables and tolerances that flow in a linear path. Patience and dedication are key ingredients for becoming a skilled printmaker. The value of this study lies in the fact that a novice printmaker can use this research as a valuable tool to inform and learn the intaglio printmaking process at an accelerated pace, compared to traditional learning methods. Printmaking techniques need to be learned, ideally through studio practice and apprenticeship, leading to an improved understanding of the complexity involved in making an image on a plate (Noyce 2006:17). To this extent, the computer simulator workflow model as a research output of this study can aid in the above mentioned understanding. This study, therefore, has implications in education and process innovation

Computer design rates as one of the highest skill shortages in South Africa. Art and creative industries are often seen as a forerunner in the global knowledge economy (Kraak 2004:46). It is therefore essential that new interests are instilled and old values are recalled for creative career opportunities, both computer generated forms of creative production, as well as hand produced art. A report by the Human Sciences Research Council states that creative industries need to be developed because

currently there is little expertise this field in South Africa and yet these businesses have a significant importance in the economy and growth of the country (Kraak 2004). This research aims to address some of these challenges.

Lastly, this study aims to instil a new interest in intaglio printmaking by making it more accessible to a newer generation of printmakers who are familiar with digital technologies and who may welcome such modern interjections to old processes.

**1.9.1. DELINEATION OF THE RESEARCH** This study focuses on intaglio processes and is limited to hardground, softground and aquatint techniques. Collectively these processes are known as 'Old Master Printmaking' and excludes digital and photographic processes for making the print. The four factors of planning, as listed in the methodology, were the only factors considered for computer ideation and planning because they are considered to be the most important issues novice printmakers engage with. Five sets of artworks were created, encompassing three to seven artworks per series, showing the hypothesised process and development.

**1.10. DESCRIPTION OF PRACTICE** Since an aim of this study is to show how intaglio processes can be informed through digital technology, a mere final artwork will not suffice. Typically, the first artwork of the series shows the planning and idea formation as digital document which is then applied to an intaglio print. The second artwork shows an intaglio printed proof of a computer generated planning document at a second state. The third and fourth images are intaglio printed artworks, in full or partially planned digitally, to display the end result of the developmental process.

The above description serves as an example only and in many cases more artworks as design artefacts have been created. Five iterative cycles of the above work-flow were conducted and recorded.

Software such as Adobe Photoshop, or a similar bitmap editing suite, as well as an appropriate vector-based application such as Adobe Illustrator was used in the process. Hand-drawn ideated sketches were not excluded, but served as a starting point or as an intermediary step in the planning process. Such hand-drawn works were digitised and then used together with digital images in all of the planning phases in order to inform the final print artefact.

<sup>1</sup> Telephonic interview with Hanneke Benadé on 3rd May 2013. Benadé holds a BA (Fine Art) at the University of Pretoria with a focus on graphic printing. Benadé has lectured at the University of Pretoria and the Open Window Art Academy. She is a professional artist and has worked in collaboration with several local and international printmaking studios including A'telier Jean Pons in Paris, France; Cité des Arts Internationale in Paris and The Artist Press in Witrivier. She has held more than 40 exhibitions and has won numerous awards, including merit prizes in both the Sasol New Signatures and the Absa L'Atelier Art Competitions, two KANNA awards and the Brett Kebble Art Award.

<sup>2</sup> Interview with Eunice Geustyn on 11 April 2013. Geustyn is an artist and academic and has been the Executive Head of the Ruth Prowse School of Art NPC since 2002. Geustyn was Chairperson on the AVA from 2006 to 2009 and a Board Member of VANSAWC (Visual Arts Network of SA- Western Cape) from 2010 to 2011. She holds a Master's of Fine Art Degree, a Postgraduate Advanced Diploma, a Bachelor of Fine Art Degree and a Diploma in Fine Art. Her work is featured in many collections, including the Absa Bank Collection, the Boland Bank Collection, the Citibank SA Collection, the South African Reserve Bank Collection, the Katrine Harries Print Collection, the Kochi National Gallery, the Sasol Museum Art Collection, and the University of Cape Town Collection.

# CHAPTER 2: CONTEXT OF THE STUDY

**2.1. INTRODUCTION** Chapter 2 serves as a contextualising framework to situate the study as a scientific endeavour and to highlight the landscape around some of the topical issues. The theme of the design artefact created in the praxis, the value of the study and a broad methodological stance in terms of the design process and its overlap into other disciplines, are discussed in this chapter. The educational value of the study is also highlighted. The purpose of this chapter is therefore to prepare the landscape by emphasising some markers around the topic in order to provide an environment in which the study can be situated.

**2.2. ONTOLOGICAL STANCE OF THE STUDY** Literature on natural sciences, a great personal passion of the researcher, started to reveal serious questions and doubts about ideas regarding the natural world that he has accepted from a young age. From mathematics came Behe's (in Woodward 2003) attack on the Wallace-Darwin theory of evolution and chance; from geology came Hovind and Gentry's attack on uniformitarianism: the belief that the geological world is shaped by continual processes which are constant in speed, as opposed to cataclysmic events (Hovind 2002); from astrophysics and cosmology came Hawking and Ellis (1968), refuting most theories scientists have about the universe. In more recent times, a growing number of physicists have questioned the illusive Higgs-Boson theory and its validation of the Standard Model – which was 'tentatively' discovered (CERN [online 2014]).

Richard (1938) states that some fundamental questions have to be answered by more than science. Some metaphysical, or rather meta-scientific lens, has to be acknowledged. Most fields, or -ologies have boundaries (Field and Hole 2003), however, it is often these boundaries that scientific practitioners fail to realise or acknowledge. After the Age of Enlightenment, science became an oracle and people still feel the repercussions of that attitude towards the truths that science claims in non-scientific endeavours. A typical example of this phenomenon is the so called 'God-particle': the very notion that a deity can be proven or disproven with science breaks not only convention but also logical thinking.

To perpetuate this idea, it seems many scientists' belief system overpowers their sense of empirical objectivity and, in this fashion, the scientific method becomes ignored or altered to suit an outcome, which is then promoted as factual evidence. Duhem (in Field and Hole 2003) believes the scientist should be left to their own professional conviction to alter input cause, should a theory be proven false. This particular stance draws attention to the danger of trusting scientific 'facts'. What is promoted as fact one year is shown as incorrect and replaced by another 'definite fact' the next year. For example, it was promoted as fact for almost a thousand years that the earth was the centre of the universe. Dinosaurs, believed to be extinct for millions of years, died *en-masse* due to the lack of adaptation to sudden change of environment. This claim contradicts many other phenomena in natural sciences, such as macro-evolution and its mechanisms – namely adaptation, natural selection and mutation – the very factors that created dinosaurs (Darwin 1859). The list is endless and the researcher has become intrinsically sceptical of any claim that depends on theory rather than factual evidence, that is: it cannot be measured and accurately repeated but the theory sounds very plausible. A clear distinction has therefore to be made. Theories can claim personal conviction but scientific facts are unquestionable. Science is therefore acknowledged as valuable in this study but the limitations thereof must be accepted.

**2.2.1 ENERGY FLOW** The law of conservation of energy, or better known as the first law of thermodynamics, holds the most fundamental place in natural sciences. It is the point of departure for designing any machine or mechanism and is the most fundamental aspect when considering any other form of energy: mechanical, electrical, kinetic, static, magnetic, latent, light, sound, chemical reactions or nuclear. Included in this reflection, are biological systems as a compound of the above mentioned forms of energy. This law holds within the smallest living organism to the furthest star. It is mathematically exact and without exception (Richards 1938).

Linked to the first law of thermodynamics is the second law of thermodynamics known as entropy. Entropy is the measure or the rate of depreciation of available energy (Khanacademy 2014). This law states that within a closed system the available energy becomes less (Richards 1938). Energy, although indestructible, may be degraded, reduced or its availability to do work can be destroyed, thus indicating that the universe is running down. Scientists agree that this thermodynamic phenomena can be regarded as a law because it can be proven, measured, repeated and observed. This law has never been refuted, argued or disproven (Khanacademy 2014). This and other thermodynamic laws are the starting point of all sciences that are concerned with physics.

As Einstein's theory of relativity equates matter to energy, all systems – natural, man-made, organic or non-living progress to a state of disorder (entropic state) where there once was order. For instance: a cup of coffee cools down, organisms die and mountains erode. So too does human health and well-being deteriorate when upkeep is neglected. Just as the available energy becomes less, matter flows towards entropy. This naturally occurring process can only be counteracted and slowed down, if specific energy input is directed towards it. Entropy, in the sense that it is used in this study – is neither a point of departure nor arrival – but a process. It is the notion that intaglio printmaking is – or at least should be – in constant motion, expanding towards ever increasing levels of order if effort is made to elevate the discipline.

**2.2.2 ENTROPY OF KNOWLEDGE**  $E=mc^2$  describes energy (E) and matter (m) as the same entity at different states of movement (c) (Haisch et al 1994). Einstein's theory of relativity opened a new chest of treasures when the researcher investigated claims of c (speed of light) being non-constant and even affected by matter, according to Newton's first law. It seemed all the more true to the researcher that energy and matter or, knowledge, and the production of a body of work, are the same thing, but at different states of existence. The implication of this discovery was that the researcher realised that if he wanted to carve out a niche in research, he needed to act purposefully and directed on the niche. In order to understand and find this niche, the researcher needed to understand and grasp the flow of energy, which is the same as the flow of matter or knowledge content. This discovery implies study and, therefore, action because being stationary means inevitable degradation and ultimately, death.

The researcher 'accidentally' discovered Shannon's entropy: the average unpredictability in a random variable, which is equivalent to its information content (Ricotta 2002). The higher the possible rate of unpredictability, the higher measure of what is commonly referred to as Shannon's entropy. It became more and more evident to the researcher that the flow of energy is the key to illuminating so many other fields, not only of science, but also of the human condition.

Early investigations into liminal spaces highlighted the emergence of new ideas, knowledge and, therefore, value in typically old spaces that are juxtaposed or in close proximity. As an experienced design lecturer, the need for 'new' ideas is, therefore, critically important. The combination of Intaglio, an 'old-world' printmaking process and contemporary design technology, a practice which the researcher has become somewhat complacent with, are therefore, the stimuli required for a new thrust.

The value of this study of printmaking lies in its nature as a case study in the flow of effort. Designers across all disciplines face the same challenges the researcher has encountered. The extreme pace of technological advances in the design industry and the world artists and creatives have to design for, as well as the increased expectancy of new knowledge and cross-disciplinary skills to keep up with technology, requires a large amount of energy and labour. Not only do designers and design lecturers produce design artefacts but also need to determine what to produce – in the design process – to a desirable outcome. In that sense, the action of practice – intaglio printmaking – is less important than the theme of process that can be used to inform other design disciplines in order to find patterns and show the flow of effort.

**The human condition** The intaglio artefacts created focus on the human condition as affected by degeneration. These artworks show humans, with all their faculties, subordinate to the laws of thermodynamics where outside technological interference is needed to counteract or slow down the degrading process. Five aspects of human degeneration are illustrated in the practical artwork (listed below).

This research study also draws on a scientific lens to inform and enlighten the topic. It serves to comment that all objects must be maintained in order for humans to draw positive input from them, thus making the viewer and reader aware of the implications of degeneration. Intaglio printing likewise must be kept alive by infusing it with new energy. Nothing can be of value unless its existence is not continually supported. This theme of entropy was purposefully chosen for the artefacts created in the practical application of the research because of its links to the theoretical component of the study, since both address a system of erosion and the counteraction thereof as defined below:

1. Vision as case study for the degeneration of the senses with technological input to counteract this process;
2. Fertilisation of the human egg and the technology to support and facilitate the process in infertile couples;
3. Mental disorders as a societal problem and the medication to counteract this problem;
4. Physical beauty as an important aspect of human existence that is a combination of revealing and hiding;
5. Synthesis of old ideas to shape paradigms as a hallmark of cultural capital and acceptance to shift over time, allowing new ideas to emerge.

**2.3. ENTROPY OF INTAGLIO** Intaglio printmaking is a process subject to the above-mentioned laws and it is a prime example of degeneration due to lack of energy input. Intaglio therefore serves as a subject for applying these laws of energy. The theme expounds natural science to be something more than just laws applied to matter. This method of application hypothesises that these laws of energy can be used to illuminate phenomena in human interest and learning behaviour.

As humans create, interfere, or not interfere, with systems – natural or built – entropy is affected, reversed or slowed down (Richards 1938). Art as human creative endeavour and communication is informed by both positive and negative input. Technology such as modern design software often becomes the change-agent of art and design. It is this relationship of input and change that informed the imagery of the final practical artefact. This relationship also suggests that technology can be linked to something not only of beauty, but of greater social value and importance. Based on the theme of positive change directed away from entropy, refusal to adapt leads to death, although blind acceptance of the new is not promoted. Rather, new creation can lend improved insight to the skill and authenticity of the classics.

An intaglio print is subject to degeneration as the physical matrix wears out with each print. Although of high quality, the amount of incremental degenerative loss is dependent on the material used for the matrix. As found in the first series of artworks, a polycarbonate plastic matrix deteriorates more quickly than the traditional copper plate. With the advent of digital files this problem of degenerative loss has been overcome through the use of what is called ‘lossless file compression’. This process does not exclude computer technology from entropy, on the contrary, it represents a directed effort to counteract degeneration. Likewise, the intaglio process as a whole needs constant energy input to keep it attractive to prospective printmakers and thus ensure a stable community of practitioners.

Counteracting this entropic intaglio process is the enthusiasm and dedication of a few practitioners. Worldwide a phenomenon of resuscitating classic fine art techniques in printmaking and other allied fields, is growing in popularity although only within a small community of practitioners. Many new students easily succumb to the romantic ideas of this old world method and quality, but the realisation of the high skill level and laborious effort required for the successful practice of such crafts often means a high drop-out rate. This situation means that only a few students move to an increased level of skill in intaglio practices (see Chapter 5).

A key reason why intaglio must be kept alive, not despite of, but because of, its slow hand-orientated process, is to ensure that the work ethic and hand skill inherent in this specialised traditional art form is not replaced by what is perceived as an inferior

automated machine solution. The situation exists that because digital technologies become available so quickly and in such large quantities, anyone owning a digital camera may be seen as a photographer and anyone with a home computer becomes a designer, often to the dislike of design and art professionals alike. Naturally then, ubiquitous computing lends itself towards a renewed interest in hand processes, since these require skill, attention and contain an inherent superior value of dedicated effort. Often the argument of lack of quality is used as a legitimising factor for rejecting new advances in printmaking, and it is this paradox that the study addresses.

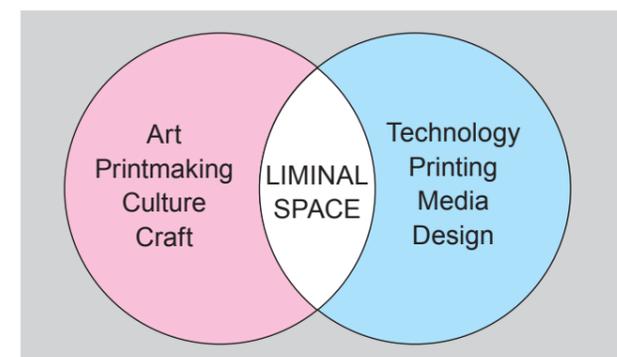
**2.4. LIMINAL SPACE AND DESIGN RESEARCH** Because of a lack of a clear definition of printmaking, this form of art sits in a state of flux and therefore its interaction with other media cannot be bordered exactly. Printmaking and its claim to the medium of fine art comes into play. However, it is printmaking’s outcome compared to the process of printmaking – and its precarious position with technology – that is valuable for this study. Furthermore, an ontological stance of an acceptable union between old and new is compared to that of generally accepted opposites.

The union of the two disciplines, intaglio printmaking and graphic design technology, was created in this study. As a design lecturer and novice printmaker, this union seemed logical to the researcher due to the origin of printmaking. A preliminary investigation showed a range of contentious issues surrounding this study such as the unclear definition of printmaking and the precarious position printmaking shares with technology.

The term liminal from the Latin ‘*limen*’, meaning ‘threshold’ is used widely in social sciences to describe the space ‘in between the margins’. Gennep (in Herman 2005) used the term first to describe cultural transition rites such as marriage, puberty and funerals. Later anthropologists used his term to describe the time and space of initiation rites outside the bounds of daily conventions but within a socio-cultural norm during which the focus is on the transition after the event.

In recent times liminal space has been used by academia to describe a cross-disciplinary space of disordered engagement with the unexpected and outside of a cultural norm (Herman 2005). For Badha (in Herman 2005) liminal means hybrid or a border space where two disciplines mix to create a cross-border artefact (Figure 2.1). This unexpected positioning of two seemingly paradoxical ideas can then inherently create a new discourse and if this is of value it fits the requirements of creativity (Robinson 2011). In this sense printmaking and its engagement with technology sits in this border space where the culture of craft and hand work are questioned in the light of new technologies.

The most important aspect of liminal space is the move to an understanding that is outside people’s cultural experience. In this state, consciousness is altered and they break from rules that have limited their perception and ability to create anything new. It is therefore a state of creation outside personal normative thinking where the movement to extend borders of thinking is important. In that sense, no truly new knowledge can exist without the willingness to move into such a space. Herman (2005) notes that it is in this interior liminal space that people access images that were previously outside their capacities of thought and, consequently, they are able to see new patterns in what was previously only chaos. The challenge for the researcher is then to apply this new thought and examine disciplines that share borders. He also needs to explore the interaction, and even more importantly, the movement of ideas within that space.



**Figure 2.1:** Liminal spaces  
(Author’s construct)

Research in art and design often encounters artful presentation of data but Herman (2005) argues that the process of artfully encountering data is not addressed sufficiently. Herman (2005) asks whether academia should not consider the design images themselves as data, that is, the subject of research. Pierre and Willow (2000:10 in Herman 2005) address this question when they ask what constitutes data. “Can data be enlarged to include sensual data, dream data and response data... If so, what exactly are the methods that produce such data?” The language or mode of such data positions itself in a liminal space.

Herman’s (2005) proposal that academics must allow such image data to affect them, coincides with artists’ claim that an aesthetic response is the most appropriate epistemology to an artwork. This strongly contradicts Barrett and Bolt’s (2007) claim that people should view artworks as artefacts and not subjectively judge the artwork but examine the artwork’s accuracy of acting as a piece of the research puzzle (artefact of research). The researcher agrees with Barrett and Bolt’s contention that personal value judgement of the artwork is irrelevant in art and design research, such as undertaken in this study.

It should be realised, however, that design creation is difficult to evaluate and that it is difficult to fit art and design research into a scientific research framework (Brabazon and Dagli, 2010). To address this problem, creating an artefact rather than artwork, becomes a useful approach. Consequently, this dissertation includes artefacts and written text. Bolt (2006) suggests this as a way of assessing quality, in that the artefact becomes part of process. She proposes that practice-led inquiry, both studio practice and written text, be evaluated as process, as well as the production and reproduction of knowledge.

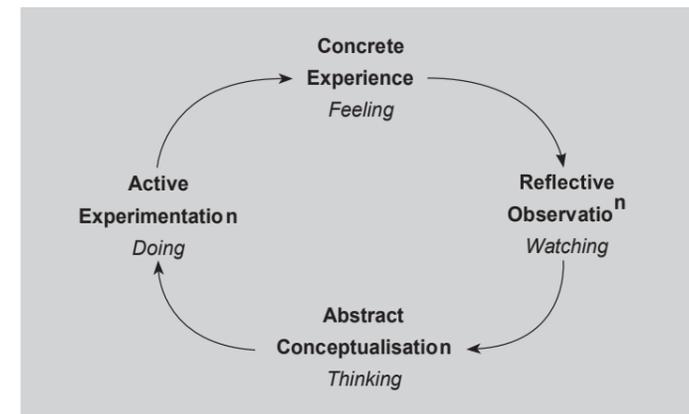
Although McNiff (2013) states that the reader or viewer should have an aesthetic response to the research and experience the work presented as an artwork, Knill, Barba and Fuchs (1995 in McNiff 2013) argue that this response does not have to be pleasurable but only that a response is necessary. Whether the text is typed, sung or danced, it should be performative, and produce an embodied effective response in the receiver. This response propels the receivers to a coherent plan of action as their new knowledge, or viewing platform, is incorporated (Herman 2005). These concepts resonate with this study, and specifically the artworks created, which should indeed create a response to be acted upon. The viewer, therefore, enters the internal liminal space to question his or her known values and perceptions of acceptability and cultural norms. Thus, an artistic value judgment of art critics is not connected to the value of this study. What is sought rather is an artful response.

A deeper and more complex liminal space exists between thought (how the researcher thinks the printed artwork will look) and plate; between matrix and paper; between technology and art; and between personal acceptance and refusal. This space is the centre for the investigation although a selective permeable edge exists that allows or blocks input into this space. The cross border engagement with other ideas, data or inquiry is thus determined by the level of permeation and its relationship with other elements in its discipline. In order to study the space in-between objects, the edges and the content of those objects needs to be clarified. It is the flow of matter and energy through this edge that determines the interaction within that space.

**2.5. DESIGN THINKING AND PROBLEM SOLVING** Important to this study is the alignment of the design process of the practical artefacts as component of the design experiment, and the methodology employed. In this regard, continual small incremental changes rather than major alterations after the fact, were the hallmark of this research. The basis of this workflow resides in Schön’s (1983) reflection-in-action model.

Schön (1983) sees design as an involved or embedded science as opposed to an applied science. Instead of a problem versus a solution in design thinking, there is a state of a system: A (the problem) and state B (the solution) where state A is undesirable and state B more desirable or stable (Figure 7.5 p85). The designer and the user are part of this process of transformation. Schön (in Waks 2001) says one cannot act upon a system, but act merely within a system. To do this one must understand the morphology and intelligence of a system. While the designer and user are part of the system, they are also being transformed and educated (learning something new) (Findeli 2001).

Schön (in Waks 2001) looked at differentiating the tacit knowledge inherent in expert practitioners from explicit technical or theoretical knowledge. He defines the notions of reflection-in-action (the application of a repertoire of theories, examples and actions) to new situations, that is the capacity to think what one is doing while doing it. The main purpose of this reflection-



**Figure 2.2:** Kolb's Learning Cycles (Kolb and Kolb 2012)

in-action principle is the practice of using reflection as a learning strategy to focus on turning the learning into the reflection, so that learners may better capitalise on the learning opportunities offered in a particular experience and internalise the knowledge gained through their experience in order to build up a repertoire to draw upon in the future.

Reflection is presented as a cyclical stage process and many stage process models of reflection have been proposed to be used as metacognitive tools. Several models exist that are either an extension of Schön’s reflection-in-action or share similar iterative workflows. The models all share some variation of three basic stages:

- Experience (the event and feelings toward it);
- A critical analysis of the situation;
- Any new knowledge gained, development of, and internalisation of new perspectives and strategies to apply in the future.

Greenaway (1995 in Hovelynck) shows the model in its simplest form, namely Do, Plan, Review. Johns (1992 in Kolb and Kolb 2012), Rolfe (1998 in Kolb and Kolb 2012) and Atkins and Murphy (1993 in Kolb and Kolb 2012) expanded on this model but with the same flow of information in cyclical motions. The experiential learning cycle (Kolb and Kolb 2012) developed the model to transfer knowledge from one cycle to the next (Figure 2.2). It is within this iterative nature of transference of a previous set of knowledge gained, that this study applies the design experiment. This model is further adapted to the ‘Build, Test, Learn’ model as found on p30.

Schön (in Waks 2001) argues that people’s knowledge is ordinarily tacit in everyday doing, implicit in their patterns – their knowing is in action. Similarly, the professional depends on tacit knowing-in-action. Compared to this, people often think about what they are doing. As the professional tries to make sense of what he is doing, he also reflects on the understanding which has been implicit in his action, understanding which he surfaces, criticises, restructures and embodies in further action. According to Schön (in Waks 2001) it is this entire process of reflection-in-action which is central to the ‘art’ by which practitioners deal with situations of uncertainty, instability, uniqueness and value conflict. According to Scrivener (2000) the process by which problem-solving research arrives at research outcomes is very similar.

Reflection-in-action has a characteristic structure. Should the practitioner find that the problem cannot be solved as it has been initially set, the framing of the problem must be surfaced and criticised, and the problem reframed. A way of shaping the situation to a new frame must be found. The reframed problem becomes the basis for experimentation to discover what consequences and implications follow from it, and the situation is made to fit the new frame. These changes to fit the new frame generate another set of unintended changes that give new meaning to the situation – the situation ‘talks back’, and the problem is reframed. New discoveries call for new reflection-in-action. The process cycles through stages of appreciation, action, and re-appreciation, whereby the unique and uncertain situation comes to be understood through the attempt to change it, and changed through the attempt to understand it. This complex, although logical workflow, forms the basis of the iterative design experiment applied in this study

Schön (1983:146) views the practitioner's experience as a repertoire of "examples, images, understandings, and actions". According to Schön, when a practitioner makes sense of a situation that is perceived to be unique, he sees it as something already present in his repertoire. He notes "Seeing this situation as that one, one may also do in this situation as in that one" Schön (1983:150). It is this capacity that allows a practitioner to bring past experience to bear insight on new cases. Schön (in Findeli 2001) defines a hypothesis-testing experiment to succeed when it effects an intended discrimination among competing hypotheses. He argues that experiment in practice is different from research in several ways:

- The practitioner is interested in transforming the situation from what it is to something better.
- When a practitioner reflects-in-action, experimentation is exploratory, move-testing, and hypothesis testing. The three functions are fulfilled by the very same actions.
- The practitioner violates the canon of controlled experiment, which calls for objectivity and distance. The practitioner's relation to the situation is transactional. The situation is shaped – but in conversation with it – so that his own models and appreciations are also shaped by the situation. Popper (1959 in Field and Hole 2003) likewise agree that phenomena are changed to make the hypothesis fit.
- The practitioner needs to discriminate among contending hypotheses only to the point where moves are affirmed or yield new appreciations of the situation. In the practice context the experimental logic is one of affirmation not confirmation.
- Hypotheses must lend themselves to embodiment in a move. Only hypotheses that can immediately translate into action are of interest.

Any design activity can be seen as an experiment if the causal relationship between two variables is described (see Chapter 4 p31.). Such as the above mentioned design activity, this study uses design as experiment to serve as method of investigation to create an artefact. The value of the design experiment is threefold:

1. The lessons learnt from the experiment in the act of making.
2. The proving or disproving of the hypothesis.
3. The design artefact as a valuable entity in itself.

This study, therefore, seeks to employ all three of these criteria, not to serve primarily as valuable to others but firstly to the researcher. Nelson and Stolterman (2003) lend a perspective when they claim that design decisions are based on judgement and judgment is both personal and situational. In the end, design is always an act of faith in one's abilities and oneself.

## 2.6. THE EDUCATIONAL VALUE OF PRINTMAKING

The main argument as to the value of this study is based on Bernstein (2003), Schön (1983) and Findeli (2001) who promote education's wider social value. The above authors mention that education should not develop humans into money-making entities (human capital) but create a larger social benefit to enrich both individual and society on a deeper level. In a sense education gives meaning to everyday existence. The argument is for the value of art research not to create direct fiscal wealth, but to enrich people's understanding so they can become better human beings and, as a result, have a better understanding and capacity for earning as well as spending. As South Africa is looking forward to an economy based primarily on knowledge rather than resources, agriculture and labour, a stronger focus on education at all levels is necessary. Booyens (2012) states that the creative industries are often seen as a forerunner for this knowledge based economy due to the high skillset the sector requires. The outcomes of work are not problematised and policy takes for granted that the purpose of education is to 'revolve around the cultivation of appropriate skills and attitudes for employment' (Bates et al 1998).

Sullivan (2010) states that academic policy changes have been largely ignored or opposed by the art community. Funding often becomes limited as the cycle of less research produces fewer proposed students and vice versa. For most of South African Schools of Art there have been a careful consideration on what subjects to offer and which ones to sacrifice. Printmaking is often regarded as non-essential because it has no apparent marketplace value, which would explain to an extent, the limited academic writing in this field.

Some noteworthy effort has been made to update educational policy to meet the demand for the knowledge economy. Wheelehan (2007) notes that reforms to all sectors of education through seeking to subordinate education to economic needs, and to align 'skill' development with the 'needs' of the economy, were made. The danger of this policy is the direct linkage of education to monetary value. It is then not surprising that old world printmaking – such as intaglio – is an under-resourced and undervalued skill.

South Africa struggles with upliftment issues in education whilst implementing educational policy that is often considered a piecemeal approach of Eurocentric views forced into a South African context (Cadle 2009). The secondary school system makes little or no provision for the visual arts and even less for design. Students therefore enter higher education with no contextual reference point for design. So begins the complex process of creating literate, informed, socially conscious designers (Cadle 2009). It is in this problem area that subjects such as basic printmaking, a subject that is not resource intensive, can fulfil a valuable role.

### 2.6.1. PROCEDURAL KNOWLEDGE

Intaglio is not only a skill but also encompasses a knowledge and understanding of procedure. Computers are also generally seen to be tools for knowledge workers (Rochester 1993) and hence, the application of computer technology in intaglio has much value. The intaglio reproduction methods or techniques are of importance not only to understand and master, but also serves a value for acquiring a broad understanding of methods in other disciplines of design.

Newfield et al (2003) are concerned with multimodal assessment and regard the process of production to be as important as the outcome. Printmaking is deterministic in the sense that it relies heavily on sequential procedures in order for the outcome, namely the print, to be considered successful. A paradox occurs within the classroom. On the one hand art is considered creative and imaginative. On the other hand printmaking is structural and can sometimes be rigid in the process. A balance to accommodate both the creative input and structured process is required in a design curriculum. In addition printmaking practices are sediment in convention (Thompson 2014). Students are encouraged to follow these processes accurately and the students' frustration is mostly exacerbated by the fact that they work on a surface that is not the final product. Since the mark-making is transferred from matrix to paper, there exist uncertainty until the final moment when the print is revealed. This insecurity often leads to students experiencing annoyance and anxiety during the intaglio process. Printmaking can be a complicated process and Hobbs and Rankin (1997:3) provide a definition that epitomises this process: ".....the print is a product of delay, the process laborious and time consuming, and the result of each technical step withheld until the final moment of ink discharge and the generation of the print from the matrix."

A computer simulator may help to break the boundary between Thompson's (2014) description of 'printmaking knowledge' and 'everyday knowledge' that is strong but it is not always made overt. Thompson (2014) argues that novice printmakers may wrongly use the everyday knowledge in printmaking to obtain a result. Where the unfamiliar student printmaker or artist would press harder to make a darker line with a pencil, the master printmaker would realise that it is the corrosive action of the etching medium that determines the darkness of the line and, therefore, would not attempt to draw darker, but rather etch longer. The computer simulator can anchor a time value next to the tonal value to show that darker tones, are a result of time and not hand pressure.

Printmaking comprises equal parts of process and product (Thompson 2014). For the purpose of education, many authors list the process as the most valuable aspect of knowledge creation (Bernstein 2003, Wheelehan 2007, Cadle 2009, Nardi 1996) and within a South African context, with its history of turbulent educational policy, this is of great significance. Wheelahan (2007) and Winberg et al (2013) mention the total disregard for process and path as some of the most important reasons for what they consider to be the failure of Outcomes-Based Education.

Thompson (2014) describes printmaking pedagogy as based on the apprenticeship model whereby the lecturer gives a demonstration and the students are expected to imitate what they have seen. This limits learning because certain important markers are absent. The intricacy of the process, the students' meaning-making potential and use of the meta-language

attached to printmaking is seldom explored because emphasis lies with the final print and not the process (Thompson 2014). The creation of the design artefact can have several valuable contributions and features, but it is the knowledge value, as listed by Scrivener (2000), of designed artefacts in formal studies that is applicable in this research. Scrivener (2000) mentions that such artefacts have value because:

- Knowledge reified in artefact can be described;
- Knowledge reified in the artefact is more important than the artefact;
- Knowledge is widely applicable and widely transferable.

The production or reproduction of knowledge is an important aspect since all education is veered towards doing something better. Design as a creative endeavour seeks not only to sustain a livelihood for the designer but also to make every design activity a learning experience.

**2.6.2. SKILLS DEMAND AND POLICY** In 2009 the European Academy of Fine Arts received 15 applicants for sculpting, fewer still for ceramics and textiles and more than 60 for printmaking (Noyce 2010). The renewed interest in printmaking in Europe and America has been firmly established by the Arts and Craft Movement in these countries. In South Africa, the picture seems the reverse. In the Western Cape Province, universities and private artists offer sculpting, ceramics and painting as short courses because public interest is abundant. However, there are fewer than four workshops and studios in the province where one can study or participate in intaglio printmaking. In 2012, less than ten per cent of all fine art graduates in the Western Cape chose printmaking, and of those ten per cent, only two students were found to use intaglio. The result is in stark contrast to the nearly 100 sculpting students and 360 photography, 210 painting and 48 ceramic art graduates (Survey of six Colleges and Higher Education Institutions in Western Cape 2012).

The above figures indicate some of the typical disinterest in certain hand skills. One of the key factors for the current state of skills shortages in South Africa is the rigid form of division of labour along racial lines in the past. As a result, in recent times, many South Africans tend to shy away from professions that require a strong hand skill component, even though the demand for such skills has returned (Kraak 2004). Kruss (2004) states the importance of the creation of interest of scarce skills and highlights the industry's demand for these skills. In the creative disciplines, computer design rates as one of the highest skill shortages in South Africa.

There is a growing consensus that design is a powerful vehicle for social change and economic development, a view underscored by Grefé (2007:23) when he expressed that the American Institute of Graphic Arts (AIGA's) role is "...to stimulate thinking about design; to demonstrate the value of design..." and more recently, "...to advance designing as a professional craft, strategic tool and vital cultural force". Ravi Naidoo, South Africa's self-appointed 'design evangelist', reiterates this sentiment because he believes that the creative industries, and design in particular, have the potential to contribute towards building the South African economy (Naidoo 2004). Cadle (2009) makes the important observation that although business and government alike agree on the value and critical role of design in the growing South African economy, policy documents and strategic plans serve little purpose in the practical rollout of ideals and programmes. What Cadle (2009) describes is the lack of a concerted call to action to implement what mainly business has set out to do. Naidoo (2004:34) writes: "Our country does not have a plan for the creative industries... and we need one, pronto. We need an over-arching, all-encompassing route map for the growth of the creative industries".

**Hand skills** Particularly significant is what Cadle (2009:34) calls the "inequitable scenario in schools' art and design education that results in poor hand skills proficiency and crafting ability". Of extreme importance is the growing numbers of entry level students at tertiary institutions who display a lack of hand-skill dexterity and as a result require significant practice performing simple tasks which one would assume would be natural to someone wishing to study within the visual arts field (Cadle 2009).

Atherton (2005) claims that when psycho-motor skills, or hand-eye coordination and cognitive processes are balanced, allowing the idea or concept to be crafted and complete, 'real' learning happens most effectively. The opposite is hence true because the inability to craft or finish an artefact well detracts from the resultant artefact, design or work, and effectively

diminishes its intrinsic value. Few design students come to art school with sufficient experience of basic hand-skills. This is indicative of a school learning system that has avoided psycho-motor development in favour of psycho-social and conceptual development (Cadle 2009). The fine motor skills needed to prepare the intaglio plate can therefore serve as valuable activity to facilitate this learning.

Often educators (but not printmakers themselves) embrace newer technologies in printmaking, albeit only after a student has mastered the classic skills. Artists must first understand and then practice the printmaking process. To do so they must explore both traditional and non-traditional methods as their first engagement (Brown in Breuer et al 1997). The age-old belief still holds fast that one cannot move to new innovation unless one has mastered the classics. In that sense, this research piece challenges that notion by utilising modern software as planning agent in intaglio printmaking.

**2.6.3. THE BAUHAUS MODEL** The Bauhaus and new Bauhaus in America embraced a threefold curriculum: Art, Science and Technology (Droste 2002). Soon it was decided that technology is applied science, and together with art, technology can reach new ways of articulation (Findeli 2001:7). The Bauhaus saw design as artistic or aesthetic theory applied to practice. The value of this view lies in the linkage between technology and art. This research draws on both science (computer interference) and art (intaglio printing) to inform and explore these fields in a new process.

Cadle (2009) builds an argument for trans-disciplinary design to build design capacity in South Africa. Cadle (2009:38) emphasises the importance in a developing economy of the artisanal – the notion of crafting – and the sense of pride and achievement that "results from mastery of hand skills as the keystone to the creative process – the place where design and art meet". The need for an even stronger focus on artisanal skill and an educational approach based on the Bauhaus model of apprenticeship and master is proposed. Although some educational limitations exist within this model, the basis thereof needs to be used with an adaptive approach to address the limitations of this model. Such limitations can be overcome using appropriate tools such as simulators.

The influence of teaching strategies of the Bauhaus Model that have been adopted in curricula of design and art schools internationally are still flourishing today (Droste 2002). The Bauhaus Model attracted such attention due to its radical departure from classic modes of teaching and art to an embracing of technology. In the Bauhaus curriculum students participate in formal classes in drawing and painting as well as science (Droste 2002).

By 1926 the mantra of the Bauhaus Model was "art and technology: a new unity" (Meggs and Purvis 2006:312), and the result was the development of a refined and more sophisticated understanding of craft as a significant aspect of 'making'. Krukowski (1992:198-199) stresses the importance of this unity, pointing out that the "dissolution of certain 'artificial barriers'", imposed by tradition, allowed for art, craft and design to become more integrated at the Bauhaus Art School. These artists became designers who used technology to craft artefacts for machine production. Intrinsic to their premise was the knowledge that art, craft and design could co-exist, that it was virtually impossible to separate them without losing the values that they individually fed into the process (Cadle 2009).

**2.7. CONCLUSION** The topics in this chapter, namely the origin of the research idea founded in science, design thinking, the educational value, and knowledge and skill, prepare a lens through which this study should be viewed. The disciplines named, are positioned to show the inherent value of the study derived from an ontological stance. Furthermore, the importance of 'pure' science juxtaposed with perceptions thereof is highlighted with a background way to view and solve design problems. The themes set to prepare a liminal border space include: science, technology, art, knowledge and skill. The importance of these multiple points of discussion is the nature of learning, that of not being compartmentalised and isolated from other thoughts, fields and disciplines. Another important aspect of design as facilitator of learning, in its broadest sense, is to discuss the problem: how can computer technology be used to facilitate the planning of an intaglio print? In this sense, the eclectic mix of science and the application thereof namely technological problem solving and the educational value of hand skills, are highlighted.

# CHAPTER 3: A REVIEW OF THE LITERATURE

**3.1. INTRODUCTION** Although Noyce (2010) claims that the history of printmaking is also the history of innovation, a certain Luddite-like animosity exists towards technological innovation beyond the scope of acceptability for some printmakers. This is especially true of intaglio because it is often considered to be the only category of printmaking that has not been industrialised and remains largely reserved as a fine art medium, although it has firm roots in the design discipline. Furthermore, Noyce (2006) claims that the debate regarding digital technologies in printmaking has largely receded; however, it has not been resolved. Two polarised views seem to exist regarding the acceptability of computer technologies in the printmaking studio.

This study focuses on what is commonly referred to as 'Old Master Printmaking' with 1830 as the end date to define processes and techniques of intaglio (Meggs 1998). The research shows the strong link between innovation and printmaking in a historical setting, to arrive at the contemporary local scene of printmaking. However, because this study is conducted now, almost 200 years later, modern printmaking technologies and their influence on 'Old Master Printmaking' are considered. At some point in time printmaking veered away from technology just to be counteracted by a complete polarised view of 'an all-or-nothing' approach to technological influences in printmaking.

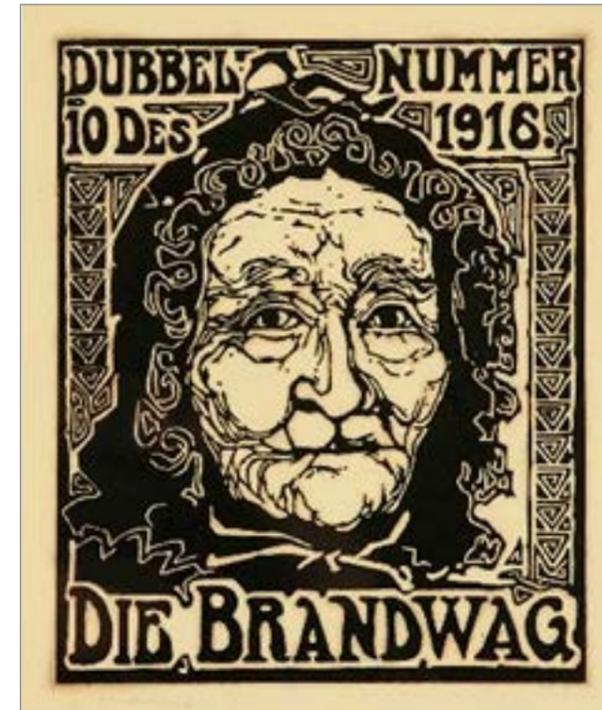
In this chapter debates are discussed regarding technology in printmaking as well as the troublesome definition of printmaking based on its inception from technology. Furthermore the literature on the planning of intaglio as a distinct phase of the production cycle is explored. The need for critical discourse in this field is highlighted.

**3.2. BACKGROUND TO THE LITERATURE** Literature on printmaking can be divided roughly into two categories. Firstly there exist many books and documents on the practical application of printmaking, that is the "how to" guides of materials and processes, with limited discussion on the role and place of printmaking as an artistic and design endeavour. Commercial printmaking as encountered every day on multiple levels is the most obvious example of these guides. An issue that is never even considered is the process behind such obvious products such as magazines found in the living room, newspapers, books, restaurant menus and practically everything on a flat or folded sheet containing information that exists as a multiple.

Secondly, some academic literature is found in journals on fine art, design, and, in a limited sense, on printmaking itself. The latter often merely explores the position printmaking occupies in the arts and society, and the value thereof. The application of the practical act of making a print is thus not linked to the value thereof as a design endeavour. Although literature discusses process as an intrinsic part of printmaking, few authors pay attention to the value of this process in a detailed sense (Thompson 2014, Pelzer-Montada 2008).

Between the two categories of literature discussed above, there exists some liminal space where a print artefact can be positioned. There also exists the fine art print: the high quality hand-crafted limited edition multiple with predominance in the aesthetic and often more obscure in message and reason. Hence there exists the printer – the commercial technical artisan, and the printmaker – who is more closely aligned to the artist. This latter form of art printmaking typically occupies a less prominent space than other forms of fine art.

The separation between artist and artisan is a recent one because the early printmakers, both in Europe and in South Africa, were skilled artists whose work had both a commercial and a pragmatic interest. Jacob Pierneef's cover for *Die Brandwag* (Figure 3.1) is a classic local example that shows the artist and artisan as a single entity, similar to many printed German books that were both commercial entities for everyday consumption but also masterly skilled works of art (Candy and Edmonds 2002). Just as printed materials have become so ubiquitous in our daily visual culture that they pass unnoticed, so too print processes have become an integral part of art-making and design without being acknowledged properly (Alpert 2010).



**Figure 3.1**  
Jacob Hendrik Pierneef  
Cover for *Die Brandwag* magazine,  
1916  
Linocut  
310mm x 270mm  
Private collection  
(De Villiers 1997)

One of the main reasons why printmaking occupies such a limited space in academic literature is due to its troublesome identity (Noyce 2010, Candy and Edmonds 2002). Not only is the recording of the birth and development of printmaking rather segmented and incomplete, but the definition and space that print occupies is also contested (Parshall and Schoch 2005, Eisenstein 1980). It is thus logical that an entity with an unclear past, together with an imprecise motive and mandate, is extremely difficult to pin down. Despite this problem, both printmaking professionals and novice practitioners have strong opinions and claims regarding their craft (Drucker and McVarish 2013). They have come to expect (and disregard) criticism from other fields of design, art and culture regarding the legitimacy of their craft and the importance of printmaking.

To combat this attack on printmaking, a revival of printmaking studios and accompanying literature surfaced during the latter half of the twentieth century. Many printmaking studios were established, focusing not only on printmaking as a craft, but also on the dissemination of this art form to a wider audience. A typical example of this approach is that of Brown who expounds on the establishment of Crown Point Press (1962) in San Francisco as follows: "I liked printmaking and I wanted everybody else to like it too. I wanted to save etching which seemed like a dying technique that serious artists weren't using and that nobody was doing anything to rescue", (Brown in Breuer et al 1997:67). Philadelphia in the USA has a nearly 300 year history of being a major printmaking centre, yet it was in this city that the need for the urgent resurrection of the art of printmaking was recognised. Philagraphica, a printmaking organisation in Philadelphia also saw the need for critical discourse in printmaking and began to foster such dialogue. Brodsky (2011) mentions the lack of wide enough circulation of existing literature on printmaking, as well as the lack of critical new work in printmaking. In contrast, European printmaking was on the rise during this period. In post-communist countries such as Estonia, Lithuania, Poland, The Czech Republic and Germany, printmaking flourished. This growth gave rise to eight Impact Printmaking Conferences (established in 1999 and still held to date), that account for the main body of critical discourse in printmaking.

American based organisations were established in 2010 to meet the demands of what Brodsky (2011:11) called "the growing crisis within the field of printmaking". The crisis described is twofold: firstly, the perception that printmaking is subordinate

to other forms of fine art and, secondly, the subsequent steady decline in enrolment in printmaking courses at universities. Brodsky (2011:11) describes printmaking laboratories being replaced by digital laboratories owing to the “perceived need” for newer technology. Soon international design and art fairs began to exclude fine print dealers. The aim of these recently established organisations was primarily to reclaim the rightful position of printmaking in contemporary fine art and to strengthen the confidence of printmakers. Despite the claim of Noyce (2010) that printmaking is alive with alacrity and energy, an academic poverty in traditional fine art printmaking is a reality, both in America as well as in South Africa.

South African printmaking literature shows a gap in an array of topics, including digital technologies and their part in printmaking (Hobbs and Rankin 1997). In South Africa, printmaking literature often links print’s power of dissemination to the turbulent political background. Hobbs and Rankin (1997) established that South Africa’s printmaking heritage often served as a vehicle for political change which limits the discussion to a great extent. Printmaking as an art and design activity is often not acknowledged and the act of producing – and the skills involved as valid enterprise – do not feature in South African printmaking literature (Thompson 2014).

Literature on printmaking and the arts produced and disseminated in South Africa and the rest of the global South is both limited and underdeveloped (Geustyn 2013)<sup>2</sup>. Academics and artists constantly, and often erroneously, look to the global North for literature on this discipline, which offers limited discussions that are usually irrelevant and excludes the global South context.

**3.3. THE DEVELOPMENT OF PRINTMAKING** The purpose and importance of the discussion on the development of printmaking is to position the discipline as an innovative and technologically advanced endeavour with a utilitarian aim. This birth right and mandate has largely shifted to its current position which is fragmented and often contested. Furthermore, it is necessary to understand the historical setting of the given topic in order to establish its heritage, because it is this view of the past that directs the way forward. To start this discussion, an explanation of innovation is given below.

**3.3.1. INNOVATION IN PRINTMAKING** Schumpeter’s (1934 in Camison and Monfort-Mir 2011) perspective of innovation lends a view for the application of new processes in printmaking (digital, mechanical or conceptual) as applied in the praxis of this study. Schumpeter’s theory of innovation relies on the process of creative destruction whereby old processes are destroyed in order to create newer ones. This theory suggests that any activity needs to create new knowledge or combine existing knowledge to develop innovations (Camison and Monfort-Mir 2011). The essence of innovation is thus the creation of repeatable newness through synthesis. De Miranda et al (2009) as well as Robinson (2011) mention that this newness must have meaningful value to be considered creative and innovate. The creation and application of new knowledge, through the utilisation of intellectual capital, is central to this process of innovation.

To highlight this view of innovation, Platzker and Wyckoff (2000) mention that other art forms such as painting and drawing, have evolved very little due to the limited ability of the medium in use. Unlike printmaking that can accommodate genuine innovation, these mediums have not remained bounded by technology. Platzker and Wyckoff (2000) argue that the possibilities of printmaking are interminable but that this fact would raise the question of what constitutes a legitimate print.

There exist two streams of innovation, that is the new technological advances being incorporated into printmaking and the reinvention of old methods. Innovation should thus not always be viewed as an attempt to break with the old and embrace only modern technology.

The history of design is filled with instances reconciling inherited formal models with new technologies together with the spontaneous invention of appropriate styles (Drucker and McVarish 2013). For example when Chuck Close used mezzotint (Figure 3.2) in a reinvigorated manner, recapturing the classic elegance of this demanding technique (Platzker and Wyckoff 2000). Another superb example of incremental innovation in intaglio is that of Rembrandt and his willingness to defy the constraints of the medium laid-down by the establishment of the day. In 1650 he created *Christ Crucified between the Two thieves (The Three Crosses)*, a monumental drypoint that illustrates the extreme measures he was willing to take to push the



**Figure 3.2**  
Chuck Close  
*Keith*,  
1972  
Mezzotint Edition of 10  
1320mm x 1066mm  
Private collection  
(Platzker and Wyckoff 2000)

limits of drypoint. Adam and Robertson (2007) describe drypoint as a fragile medium due to the shallowness of the lines and the delicacy of the burr. Comparing the third and fourth state of the *Three Crosses* (Figure 1.1 p2), one can see the audacity with which Rembrandt salvaged a composition that would otherwise have been exhausted after only a few impressions (Platzker and Wyckoff 2000). A more contemporary example is the work of Borne (1969) who investigates colour in intaglio printmaking by borrowing from woodcut techniques. His mixed technique application is rationalised within his “experience as artist and experiments made into the problems of perception...” Borne (1969:107).

**3.3.2. HISTORICAL DEVELOPMENT OF PRINTMAKING** To define the exact birth of printmaking, in its true form will be impossible. From as early as the Palaeolithic age printmaking has existed. Handmade impressions in Lascaux and Altamira, were found dating back to about 17300 BC. In the Indus valley and in the Far East, printmaking developed separately into a highly skilled means of utilitarian art. Since printmaking evolved into a functional artefact, innovation became a common endeavour and the available technologies were incorporated to further the process. In Mesopotamia, cylinder seals used well before 3000 BC, still exist today as printing artefacts, showing both the modern pigment and material used during that age (Meggs 1998).

In Europe and India ink printing on cloth preceded printing on papyrus or paper. This was probably also the case in China (Parshall and Schoch 2005). In Europe special presentation impressions of prints were often printed on silk until at least the 17th century. During the Han Dynasty (200 AD) seals cut from ivory, jade, silver or gold were used with red ink made from cinnabar, to print calligraphic characters. The foundation for block printing was set and showed more advanced material use and the combination of artistic expression, not only in product but also in tools (Meggs 1998).

There also exists a second theory as to the birth of printmaking. Historically recorded is the ancient practice of making inked rubbings from stone carved inscriptions, as practiced by Buddhists in a wide region of the Far East. It is thus assumed that modern printmaking, had multiple points of origin and influences and can be viewed as series of successive technological stylistic improvements to this ancient craft (Grabowski and Fick 2000).

Meggs (1998) states that it was in Europe that the right climate existed for printmaking to be developed from the early Asian block printing to more advanced techniques. The demand for books became insatiable and, as the emerging literate middle-class grew, so too did universities and schools. However, the construction of books up to the point of printmaking, was labour

intensive and thus costly. It took the art of papermaking 600 years to reach Europe from Asia, but when it did, the requirements for printmaking to become liberated were met (Meggs 1998). The arrival of paper in Europe highlighted the void that more technological advances in printmaking could, and did, fill.

By 1500 more than 140 centres practised printmaking. Estimations show that in 1450 Europe's monasteries and libraries housed around fifty thousand books (Parshall and Schoch 2005). By early 1500 Europe had more than nine million books, excluding religious tracts, pamphlets and broadsheets (a single leaf of paper, printed on one side only) that were distributed free to the public (De la Croix et al 1991). In 1276 the first paper mill was established in Fabriano, Italy. The trends of mass dissemination, as well as collaboration, were established (Meggs 1998). Although these two aspects have been belaboured in literature, many aspects thereof are still uncertain. A more complete discussion of these issues is found later in this chapter.

**Johannes Gutenberg** In 1439 a blacksmith, by the name of Johannes Gutenberg began developing moveable type and eleven years later he mastered this technique. Scholars (Eisenstein 1980, Drucker and McVarish 2013) regard this as the birth of modern printmaking and a crucial step in the Enlightenment. Gutenberg is also attributed with the invention of the most important event of the Modern Age (post the Dark Ages)(Candy and Edmonds 2002) namely the printing press. The main significance of this invention for this study is that Gutenberg was the first person to accommodate a technological invention as a tool for printmaking. Hitherto, ancient hand-drawn methods that were passed down mainly by scribes, remained the method of reproduction (Parshall and Schoch 2005).

The advent of mass communication that followed the Gutenberg invention altered the structure of society and triggered the Reformation. A way was found to reproduce text, accurately, cheaply and in large quantities and so the printing revolution started. A letter by Pope Nicolas V to pardon the sins of all who aided the struggle against the Ottoman Empire was printed in thousands by Gutenberg in 1454, the first example of printmaking's power to influence society (Parshall and Schoch 2005). Until 1450 knowledge was exclusive and reserved. Gutenberg's invention of moveable type was largely responsible for the liberation of thought (Thorburn 2011). Man (2008) and Eisenstein (2005) attribute the birth of the knowledge-based economy to Gutenberg. It is, therefore, clear that technology had a pivotal, if not an all-encompassing, role to play in the development of printmaking. As design is necessarily a technologically facilitated activity, printmaking serves as a valuable activity in design.

**Further developments** During the seventeenth century many painters began to take advantage of new developments in printmaking. This resulted in fewer professional printmakers being employed. Soft and hardground made etching more accessible to painters than engraving, and soon two streams of practitioners were established: painters and fine artists who became printmakers and professional engravers who became artists (Meggs 1998). A clear division of labour was an important aspect in the development of printmaking (Platzker & Wyckoff 2000). It was however the scribes, block printers, woodcarvers and typographers, and not the engravers, who were key in developing the first illustrated typographic books (De la Croix et al 1991). Grabowski and Fick (2009) mention that this division is accepted and should not be questioned which already gives a clue towards a certain lack of academic discussion – to question this division of labour.

From the 16th century onwards printmaking has been the agent for mass communication. Many sceptics of printmaking claimed the end of the printed page was near, when the digital age descended on the twentieth century (Lovejoy 1989). However, print responded with new vigour and 10 years after the advent of the television, there were more newspapers in press than ever before in New York and many other important centres (Candy and Edmonds 2002). When the internet became a household reality, many claimed that the end of the printed magazine would appear, with e-zines, blogs and podcasts claiming the space for preferred means of information dissemination. (Lovejoy 1989). To date the opposite is observed. Magazine sales soared and the printed book is still a commonplace article in our lives (Eisenstein 2005). Contrary to these developments it is the fine art print that followed a different path. When and where print became printmaking (where the former is a purely utilitarian object of information and the latter is more the artwork) is not clear. Printmaking is however, in the minds of some, under great threat (Brodsky 2011, Coldwell and Laidler 2012) whilst others claim it to be stronger than ever (Noyce 2010, Grabowski and Fick 2009).

As mentioned earlier in this study, the history of printmaking is inextricably linked to the spread of information. Coldwell (2010) states that printmaking records the changing way the world has been perceived by artists. Print provides a mirror, reflecting the engagement of the printmaker with technology to produce an international currency of the multiple not bound by location or time (Coldwell 2010).

From this it is concluded that the history of printmaking has been driven by three fundamental imperatives. Firstly, the capacity to disseminate information to a larger audience due to the multiple; secondly, too exploit the different expressive qualities of printmaking techniques to meet the artist's need for expression, and thirdly too respond to the commercial marketplace's needs and opportunities (Coldwell 2010:5). This opens up another field for discussion, one that is missing in literature, namely that of printmaking as a contemporary design activity.

**3.3.3. THE ORIGIN OF INTAGLIO** Platzker and Wyckoff (2000) describe the history of printmaking as a sometimes deliberate and sometimes arbitrary rejection or retention of facts and artefacts. Lepic (in Melot et al 1991:23) wrote on the origin of printmaking as part of the great innovations "they have lost their birth certificates". Clear evidence of this loss is the contradictory literature on the origins of much of the intaglio techniques.

Although intaglio is an Italian word meaning "recess", all indications are that the techniques were invented in Germany in the 1430's (Parshall and Schoch 2005). During the same period and in roughly the same geographical region that Gutenberg developed moveable type, copperplate engraving was founded (Meggs 1998). Evidence also exists to show a smith by the name of Maso Fingiguerra taking a print on dampened paper as early as 1440 (Adam & Robertson 2007). Many scholars claim Gutenberg was – at least in part – also responsible for the engraving technique. Meggs (1998) as well as Parshall and Schoch (2005), however attribute an unknown artist, called the Master of Playing Cards, with the creation of the first known copperplate engravings in Mainz, Germany (Figure 3.3). The work of the Master of Playing cards is the earliest datable intaglio prints (Parshall and Schoch 2005).

Despite some missing clarity as to the origin, all literature claims that copperplate engraving was born in Europe from blacksmith practices. It was in South Africa, however, that the earliest known engraving was found. Ostrich shell water containers, believed to be up to 60 000 years old from the Diepkloof rock shelter, showed banded engravings (Texier et al 2010, Adam & Robertson 2007).



**Figure 3.3:**  
Master of Playing cards  
*Queen of Flowers*,  
circa 1450  
etching  
Private collection  
(Heilbrunn Timeline of Art History 2014)

**Albrecht Dürer** Nuremberg in Germany became the print centre because it was Europe's centre of commerce and distribution (Meggs 1998). What Gutenberg did for typographic printing, a fellow German from Nuremberg, named Albrecht Dürer (1471 – 1528) did for engraving. Strauss (1973) emphasises that Dürer never stood still, and was always busy innovating and experimenting.

At the age of twenty seven, Dürer was renowned throughout Europe. Panofsky (in Strauss 1973) attributes Dürer's fame, who is widely regarded as the greatest artist of the Northern Renaissance, to his innovative and inquiring nature (De la Croix et al 1991). Dürer experimented with the then, commonplace woodcut printing and with his goldsmith background, developed the engraving and etching into refined forms of illustration. Although he was, strictly speaking, not the founder of engraving, Dürer is regarded as the most important inventor of intaglio printmaking techniques (Drucker and McVarish 2013). Dürer's work was known throughout Europe and he travelled to other European countries, spreading his knowledge and influence.

Dürer was also the first artist to realise the entrepreneurial properties of printmaking and soon started selling his prints as artworks (Strauss 1973). This was a striking move away from other prints of the time that had a purely pragmatic value. He therefore established the commercial benefits of making money through technological application in the design process. This innovative integration of material and technique is a critical aspect in the modern application of the design artefact. Not only does the modern designer need to be aware of such technological advances, and design by using them, but should also design for these advances. Dürer consequently serves as both an inspiration and a classic example of a designer who exploited the available technology to create appropriate artefacts and techniques.

**3.3.4. FURTHER DEVELOPMENT OF INTAGLIO** In Germany the illustrated typographic book, as well as tracts and pamphlets, became such successful mass communication methods that countries to the south, especially Italy, leading the Renaissance, were influenced by these developments. From Italy and Germany intaglio printmaking spread to France, Spain and the Netherlands and, subsequently, to their New World Colonies. In 1538 Mexico erected its first printing press and, according to Meggs (1998), information had become truly liberated.

In Europe the method and techniques of printmaking were refined and around 1600 Dietrich Meyer developed a soft wax resist to coat the plate for acid etching. Less than 50 years later Callot developed both a hardground and the modern etching needle (Adam & Robertson 2007). Intaglio techniques were continually refined in the next 150 or so years and by 1830 another far-reaching development occurred with photographic processes being incorporated into printmaking (Adam & Robertson 2007).

Some argument exists as to the development of aquatint and mezzotint. Adam and Robertson (2007) attribute the aquatint process in 1650 to Jan van de Velde and mezzotint's development in 1670 to Bloteling. Platzker and Wyckoff (2000) note aquatint as a collaborative effort between two eighteenth century practitioners, namely Jean Baptiste Le Prince who sold his dry powder technique to an unknown English gentleman. Platzker and Wyckoff (2000) again contradict other authors on the invention of mezzotint by claiming this as an invention by Prince Rupert, a Bohemian born cousin of Charles II. Yet another author, Hugh (in Chrisholm 1911) attributes the invention of mezzotint to Ludwig von Siegen.

The Industrial revolution marked a new era in human history and, as the machine replaced the hand, printmaking seemed to be in place ahead of its time. The Luddites (a group of textile artisans who led a protest against people being replaced by machines and losing their jobs) gave rise to a popular notion of returning to the value of hand crafting (Eisenstein 2005). An example of this, is the Arts and Craft Movement that started in Britain as a powerful rhetoric by William Morris (1834 – 1896) and his peers (Drucker and McVarish 2013). The aim of this movement was the aesthetic rebirth of using hand skills with resultant handmade publications of high quality compared to the appallingly poor quality of machine mass-produced books and magazines (Drucker and McVarish 2013).

These artistic journals benefitted from mass-culture infrastructure by selling their hand-made journals in kiosks next to other mass-produced magazine stands (Adam & Robertson 2007). Soon commercial magazines adopted the design features set out by the Arts and Craft movement. Although the Arts and Craft movement was a reaction against industrialisation, its hand-made

artefacts were popularised by mass-produced artefacts, namely mass produced magazines. Yet there was always a longing by members of the Arts and Craft movement to return to the Incunabula (birth) of the first 50 years of print (1450 – 1500), and the hand quality associated with this period (Parshall and Schoch 2005). The establishment of the Fine Press Movement and the Private Press was thus an attempt to return to the high quality hand-made prints and recreate the "book beautiful" (Drucker and McVarish 2013:167).

**3.3.5. ARTISTS VERSUS TECHNICIANS** Artists were considered the same as artisans less than a century ago (Ingold 2001). Burford (1972) explains that the root words for art, *artem* (Latin) and technology, *tekhne* (Greek) meant the same thing. These words were used to describe a skill or practice of any kind that involved the manufacturing of durable objects by people whose livelihood depended on it (Burford 1972). In a strict sense design, as we have come to know it today, falls within this definition.

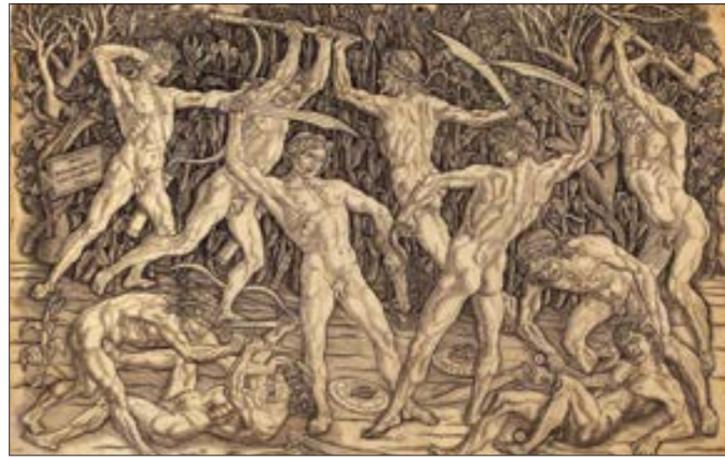
The polemic between artist and technician, that of ideator or visionary versus pragmatic creator is not a new one. Platzker and Wyckoff (2000) state that as early as the 18th century this tension occurred. Lepic (in Platzker and Wyckoff 2000:18) states that "For true etching, the artist is everything and the workman must not even be taken into consideration". Artists, understandably, require a high standard, as set out by themselves, for their own work. It is, however, often the printer and not the artist who is the catalyst for innovation because they are familiar with the technical requirements and act as artistic collaborators, and not just as facilitators (Platzker and Wyckoff 2000). While some artists prefer to work alone, others embrace the experience and energy of their collaborators. The collaborative aspect is an important aspect of this study and is discussed in Chapter 2.

Early reproductive engravers, trained as printmakers, often did not meet the artist's – mostly painter's – expectations of transferring their image from one medium to the other. Bartsch (1803 in Parshall and Schoch 2005:35) rationalises this disconnect between painter and printmaker by declaring that a print can only be perfect if the printmaker possesses the same "talent to seize the spirit of the original and to render the value with the lines of the burin". Lepic (in Platzker and Wyckoff 2000) made his disdain for the tradesmen explicit and the antagonism was soon returned. Another exponent of this contempt is Goltzuis, a publisher and printmaker who only published his own work, and at the height of his career, emulated six different artists' styles so accurately that he was often mistaken for the likes of Dürer (Candy and Edmonds 2002).

Besides the numerous superb examples of Dürer, *The Battle of the Nudes* by Pollaiuolo (Figure 3.4) exists as a monument of artist and artisan as a single entity. This above-mentioned work is the only known printmaking work by Pollaiuolo although he was renowned as a goldsmith throughout his career (Meggs 1998). On the other end of the spectrum is Picasso's extreme effort with *Femme au Fatauteuil no1*. (Figure 1.2). Picasso reworked a combination of five plates with the help of Mourlot, his technical assistant and printer (Platzker and Wyckoff 2000). Mourlot had to transfer some images from one plate to another as the plate was worked too extensively to maintain the quality of the matrix.

It was in France that the distinction between *beaux art* (fine arts) and *metiers* (trades) was established to make separate the scholar-producer of fine books in privately issued editions and the working class printer as a manual labourer (Drucker and McVarish 2013). Industrialisation drew a line between high art and graphic work. Mediating machinery was used by technicians to exploit the properties of their printing rather than to express themselves. This shifted the identity of print to a distinct new category. Graphic designers were once artisans of the manuscript page and painted sign. Then they became professionals with specialised skills. More recently, they have become artists or even celebrities (Drucker and McVarish 2013).

Many great European artists, such as Albrecht Dürer, Rembrandt, and Francisco Goya, were dedicated printmakers (Melot et al 1991). In their own day, their international reputations largely came from their prints, which were disseminated far more widely than their paintings (Meggs 1998). Today, as a result of colour photo reproductions, and public galleries, their paintings are much better known, whilst their prints are only rarely exhibited. These above mentioned examples indicate the marginal space that great printmakers of their time occupy today. This question should be raised as to why printmaking, a critically important aspect of life in the time of these famous artists become such a limited field of discourse in today's design discussions.



**Figure 3.4:**  
 Antonio del Pollaiuolo  
*Battle of the Nudes*  
 1465–1475  
 Engraving, Second-state 424mm x 609 mm  
 British Museum  
 (All-art.org *The Early Renaissance: Antonio Pollaiuolo* 2008)

**3.4. DEBATES ON PRINTMAKING** With the above section as historical background the next section discusses various debates on printmaking since the inception of the discipline to the present. The layout of the discussion is, however, not on a linear timeline but rather traces the debates of topics. These debates can roughly be classified into two fields: Firstly, the debates and discussion regarding printmaking’s definition, in other words, what constitutes a print? Three topics are discussed, namely the multiple, the matrix and authenticity. These topics lead to the second field of discussion: the debate around technology in the discipline. It is this discourse that is valuable for this study because the specific notion of this research is the liminal space between printmaking and technology.

Although many authors may claim these debates to be old and stifling (Thorburn 2008, Coldwell 2011) they either dominate discussion without clear direction or are completely ignored in academic literature. Satisfactory answers to most questions seem to be still eluding. As a result, a strong faction has risen calling for a return to traditional techniques only, which is completely exclusive of modern technology (Noyce 2011). The flaw in this argument is highlighted later in the conclusion to this chapter. It is therefore valuable to show the duality: the for and against modern technology arguments in these debates in order to reach a satisfactory conclusion.

It is necessary to establish a working definition of the constituents of the hypothesis to be clear as to what is suggested. It is specifically the troublesome delineation of printmaking that makes this research valid due to this problem of identification. This study also leads to some open ended concepts about technology usage, media and the definition of printmaking which need further investigation

**3.4.1. THE DEFINITION DEBATE** In 1968 the critic Leo Steinberg, introduced the audience at a lecture at the Museum of Modern Art (MoMA), New York, to the notion of the ‘flatbed.’ This term was borrowed from the flat bed of the printing press. For Steinberg such a conception was necessary in order to register the unwieldy pressure put upon traditional views of the picture plane by the art of the time (Ingold 2001). This conception did justice to the possibility of a ground open to receive the technological dynamics of new media together with the mediated image. This meant a rethinking of print media in much broader terms, no longer simply as a technical support but a synthesising and negotiating of a variety of representational, formal and technical tools (Parshall and Schoch 2005). Steinberg’s lecture revolved around the unclear markers that define printmaking. To address this problem, there has been a call for a return to printmaking through media-specificity, that is printmaking should be defined by a set range of appropriate media (Pelzer-Montada 2008, Coldwell 2010).

Thorburn (2011) contradicts the media-specificity by a proclamation that printmaking serves as mediating factor between fine art and commercial or applied arts. In the past, printmaking activities were defined by techniques and media. “The print was defined as a map, and not the land the map describes. Print today is not a technique or even an art object: it is a theoretical language that constrains ideas and dialogue” (Thorburn 2011:62). This author states that printmaking cannot be defined as a series of technical processes. It is defined by its function, its philosophical approach and the “ideas and images it generates.”

(Thorburn 2011:63). What emerges here is the view that the printmaking process becomes of secondary importance to the created work. Thorburn’s view is a modernist approach where form follows function or method, and approach follows message and theme. This view legitimises any new method, technique or way of creating, as long as it serves the purpose. Other arguments for, and against, media specificity, are made by Naren Barfield and others (2001) when they propose a more conceptually driven digital practice. Ruth Weisberg (1986) argued that the process of (what is now) ‘conventional’ printmaking lends itself to such a conceptual or ‘cerebral’ approach (Platzker Wyckoff 2000). Pelzer-Montada (2008) in return does not expect a conceptual approach to rely on the medium or the media an artist chooses, technical or otherwise, however crucial to his/her concept they may be.

Steinberg’s problem is raised: how do artists/printmakers negotiate practices that both lie in the traditional core of printmaking and those that appear to thrive at its edges or periphery? This problematic issue was still an unsolved topic of discussion during 2013 at the 8th Impact International Printmaking Conference in Dundee, Ireland.

As process and product are linked, some effort has to be made to define what constitutes a print in order to discuss the process of the creation of that print. Notable authors on printmaking describe an aspect of the field that lies beyond the obvious definition. Grabowski and Fick (2009) speak about the generative matrix and the process of the creation thereof as a key aspect. Noyce (2009) discusses the “edge of printmaking” and what lies “beyond the edge” while Brodsky (2010) speaks of the conscious and unconscious space that printmaking occupies. Thorburn (2011) argues for the state of flux printmaking is in, whilst Platzker (2000) review issues of subversive practice. What can be concluded from all these views is the notion that printmaking speaks a deeper language than that of technology, innovation and art. It occupies – at least in the minds of some – a place of meta-conscious meaning, a philosophical value to enlighten other aspects of thought. The danger of these notions is the highly interpretive and often vague definitions of something as direct and powerful as the printed sheet.

Although traditional definitions of printmaking have been challenged in recent years (Coffin 2000), there is a need for printmaking to accommodate certain criteria to be regarded as legitimate. According to Noyce (2010) these criteria include a reasonable amount of editions of near perfect similar prints, and the transfer of information from a matrix to a substrate. Hobbs and Rankin (1997) argue that the application of pressure in the printing process is the legitimising factor. Grabowski and Fick (2009) specify only a matrix as the qualifying factor. Brodsky (2010) lists three criteria in her definition of printmaking. The first is the actual act of making the print, the second is its multiplication and the third is the implied dissemination thereof. Yet another criterion is that of Coldwell, (2012), who states that printmaking is concerned with the act of transformation, the mark on the etching plate is transformed and translated to paper. These open-ended definitions might explain artworks such as *Print Back* by Eric Avery (Figure 3.5) as printmaking according to Hobbs and Rankin’s (1997) definition.

Marchel Duchamp, whose artwork *Fountain* is hailed as a hallmark of the Dada movement and one of the most important artworks of the 20th century, also left his influence in printmaking. Duchamp radically challenged the definition of printmaking with his self-published artwork: *Boite-en-valise* (Box in a Valise) (Figure 3.6). Platzker and Wyckoff (2000) describe this work as the most important work of the time to enter virgin territories in printmaking. The work consists of the artist’s oeuvre in miniature, folding open and metaphorically back into itself. Consisting of miniature drawings and painting rendered in photographic offset it also includes miniature sculptures. Importantly this portable museum broke the fixed definition of printmaking: that of a print being a flat piece of paper that can be framed. Duchamp also changed the valuable – self-anointed – multiple as art object into a commercial entity, thereby breaking his own conventions and becoming a seminal work in the medium of the artist’s book.

With every criterion proponents of printmaking list, an exception can be noted. Monotypes as single artworks break the first rule of the multiple, whilst photographic processes require no pressure. Three dimensional computer ‘printed’ products created in many art schools and design institutions alike, challenge the requirements Platzker and Wyckoff (2000) list, namely a flat paper that can be framed as a legitimate identity for a print. This comes at a time when the world biggest blog reported that in June 2013, the world’s first 3D printed gun, named the Liberator, was fired, produced by a company who is advocating *Do It Yourself* weapons (www.huffingtonpost.com [online 2013]).



**Figure 3.5:**  
Eric Avery  
*Print Back*  
2009  
Sand blasted toilet seat  
Edition of five  
Courtesy of the artist  
  
The imprinted text reads:  
**Abandon all hope ye who  
enter here**  
(Coldwell 2012)



**Figure 3.6:**  
Marcel Duchamp  
*Boite-en-Valise*  
1941  
cardboard, wood, colour  
reproductions, colour  
and black and white  
photographs  
410mm x 380mm x 105 mm  
Museum Boijmans Van  
Beuningen  
(Platzker and Wyckoff 2000)

Diedericks<sup>1</sup> (2013) does not acknowledge computer generated printouts or outcomes as legitimate prints because he does not acknowledge a digital document as a matrix, and so the definition breaks down. Diedericks also questions the open edition found in digital printmaking. This view is in direct contrast to that of Thompson (2011) who argues for the digital matrix and paperless print to be accepted as a new extension of fine art printmaking, that has more in common with performance art and music than visual art and design. Digital technologies have not established a clearer definition of printmaking but have rather widened the crack in identity to form an ever larger crevice.

Another confusing variable that needs to be considered is that of photographic techniques in printmaking. Hobbs and Rankin (1997) acknowledge photography – as making identical multiples – in a broad definition of printmaking. Since pure photography occupies its own space and falls outside many authors' strict definition, such artists will mostly include photographic techniques to generate a matrix in traditional printmaking practices.

Yet another contradiction in the field of artistic printmaking is its strong link to industrialisation and even closer links and lineage with industrial processes than with the aesthetic world of fine art. Printmaking initially evolved as a pragmatic method that represented the quickest and cheapest reproduction method, with acceptable quality, to disseminate information within a market economy. This method of printmaking directly stands against the small edition of highly prized art prints of contemporary times.

The issue of quality in relation to printing and printmaking is also not clear. With quick repeatability comes lack of authenticity and high volumes of cheaply printed sheets which are marked by a lack of quality and designed with obsolescence built in. Millions of copies of newspapers are redundant a few days after publication due to their dated content as well as the poor quality of print and substrate. This transience is an aspect of discussion sorely lacking in literature on printmaking. If one compares a newspaper's worth to the most valuable of all prints; that of paper money designed and manufactured with the highest possible lifespan and quality to ensure maximum levels of authenticity, it is obvious that the aim and reason for the print determines cost, quality, value, edition and lifespan. Traditionally intaglio sits well established on the high value, high quality and relative small edition's side of the argument. A classic example is this status is Platzker and Wyckoff's (2000) mention of Chris Burden, who tested the ability of Crown Point Press, a printmaking studio, by asking the workshop to print – as accurately as possible – an Italian ten-thousand-lira note. Burden's artwork, *Diecimila* (1977) was aimed at matching every element of the true currency.

Another interesting aspect that seems to be missing from literature on printmaking is the ability of the print to be author-less. Unlike a painting or drawing that carries the signature of the artist in the mark-making, certain types of printmaking can be without a known author. Stencil graffiti artists use this ability of stencil printmaking successfully to distribute their message in the strongest of languages without putting their name to it.

**The multiple** A critical discourse in printmaking is the concept of the multiple. The multiple is the only characteristic of printmaking that authors (Coffin 2000, Platzker and Wyckoff's 2000, Brodsky 2010, Noyce 2010) agree upon due to the other unclear definitions of printmaking. Grabowski and Fick (2009:11) note that it is this aspect that makes the print so democratic. The fact that monotypes are within the realm of printmaking, despite the fact they do not subscribe to the multiple, breaks this convention.

The multiple nature of the print has been its most powerful characteristic (Coffin 2000). As a communication method with exactly repeatable statements, the printed image has played a significant role in technological, scientific and cultural developments (Coffin 2000). Furthermore, printmaking, due to its nature of innovation and collaboration, opens up possibilities difficult to conceive of in other art mediums, such as the more static world of painting and drawing. Printmaking was developed and conceived to produce mass media of a religious and political nature. However, there exists conflicting but also parallel attitudes towards the multiple. The reproducibility of printmaking became a valuable aspect with social and political agendas because it enabled dissemination (Grabowski and Fick 2009). Print's ability to disseminate also had negative implications. Censorship became common and printed material was divided into good and bad (Drucker and McVarish 2013). William Tyndale was strangled and burned in 1536 for publishing the New Testament with content that was considered erroneous by the Church. In 1550 all printed material in Britain had to be first approved by the Crown before it could be published anywhere in Britain (Drucker and McVarish 2013).

Since the inception of printmaking there has been an on-going conversation about prints and their claim to be art objects. Grabowski and Fick (2009) associated the multiple with a non-artistic function and, therefore, suspicion exists as to the originality of printed artworks. The notion of the multiple original is troublesome. Grabowski and Fick's case is amplified by other modes of reproduction that use indicators of fine art prints. This above-mentioned case means that print artists and publishers have great trouble in differentiating the limited edition multiple of an original print from the photo-mechanical reproduction of artworks made in other mediums.

As soon as prints entered the realm of fine art, competition was established with other forms of fine art (Grabowski and Fick 2009). Walter Benjamin (1936) wrote in his famous essay *The Work of Art in the Age of Mechanical Reproduction* about the originality, uniqueness, and permanence that prevailed as measure of the integrity and authority of an artwork. To describe these characteristics he used the term "aura". Benjamin (1936:230) writes that: "...that which withers in the age of mechanical reproduction is the aura of the work of art", The presence of the original is the prerequisite for the concept of authenticity. A problem arises when a print loses its authenticity as single great artwork. In this sense, the matrix itself can become the single

entity of art. To combat this problem, the concept of the limited edition has become the middle ground because it allows the power of the multiple, but also permits only a set number of prints to exist in order to establish an investor value to each copy of the artwork. Whilst the individual print is not unique, it is one of only a few in an exclusive edition. The concept of a fixed number of prints from one matrix, born out of an economic context, remains the standard practice in printmaking today (Grabowski and Fick 2009). The multiple has the obvious power of spreading an idea to a greater audience than a single piece, however, this proliferation also has a negative impact on the value of the artwork. Generally speaking, the more prints from a single edition, the lesser the value of the individual print (Jurgens 2009).

Coffin (2000) argues that there existed – throughout time – movements to both promote and argue against this preciousness of valuable small editions. Coffin (2000) states that during the twentieth century the idea of the print as a unique art object rather than the endless mechanical repeated multiple, has contributed to the self-conscious notion of the 'original print'. This marked the popular and highly marked desirable small, collectable editions. The contradiction lies therein that a small run makes invaluable the theoretical essence of a print, and a high volume multiple, in order to disseminate information to a large audience, makes it of little or no value at all.

If the only pre-requisite for printmaking is the multiple, as many authors such as Thorburn claim (2011), then printmaking should, and now does, include computerised 3D modelling machines and Computer Numeric Control Cutters (CNC) that are used in the engineering industries. The implication of this view is that any inanimate object, a machine-cut piece of furniture, a ceramic sculpture, plastic bag or engine block can thus be considered a print. Three Dimensional Computer "print" practices are now the focus of many art institutes, such as the Centre for Fine Print Research at the University of West England. It is now possible, with new computer technologies, to create prints that have sculptural qualities (Noyce, 2010). Therefore the definition of printmaking seems unclear and the multiple, although a powerful feature of printmaking, does not seem to qualify nor disqualify an object's entry into the field of printmaking. Drucker and McVarish (2013) put the power of the multiple as the reason for a shared knowledge base and a revival of the classical learning in an humanistic inquiry that fostered the development of science and exploration.

**The matrix** Linked to the multiple is its enabler, the matrix. Coldwell (2010) believes that the idea of the matrix is still a revolutionary one and boldly states this as "a foundation of a sophisticated culture". The concept of the 'matrix' as the womb – its literal Latin meaning – is where another is formed. This term has lately become popular, especially in printmaking.

The matrix simply implies a reservoir of information to be transferred to a recipient. It could, however, also be a situation or substance within which something else originates, develops, or is contained. The implication of the matrix is the notion of transference. No printmaking is without the concept of transferal of information, and it is this aspect that often creates an unknown result. Didi- Hubermann (1999) calls this transfer of data 'a deception', the 'fiction', the 'exchangeability' of the imprint. Compared to Didi- Hubermann, Fishpool (2009:19) states that "nothing can match the thrill of pulling the printed proof away from the fully inked plate to reveal the image for the first time. The sensation of 'wait for it' is still the same now as it was the first time I did it".

Pelzer-Montada (2001) merely mentions that print techniques always contain their own dissimilarity, their own opposition in the form of the plate. For Coldwell (2012), the anticipation of the unknown of the matrix is a favourable quality. He describes it as a kind of magical moment when the result is revealed. He mentions that the printmaker must understand the shift of control. The printmaker controls the process, but the process controls the final aesthetic outcome. It is about shifting the level of control and if one has made the right decisions beforehand (planning) then technology will complete that idea (Coldwell 2012). On this topic, Coldwell and Laidler (2012) state that technology can never control humans because humans make technology.

Although exact, or at least near exact, replicas of prints are listed as a requirement for printmaking, Grabowski and Fick (2009:11) mention that the idea of the infinite variable, can also play an important part with only a resemblance being the

unifying factor between different prints of the same matrix. This notion is arguably the strongest contestant to overthrow the definition of printmaking because it is a great issue of contention, among even the most liberated printmakers. The universally accepted idea of the matrix is that the information contained therein is static and should yield the same results in a consistent manner.

To address the problem of a variable matrix, the generative matrix is put forward (Grabowski and Fick 2009). An advantage of the generative matrix is the ability to share information between different artworks or different states of a series of artworks from one communal matrix. Sequential traits are recorded in the prints as the plate develops. Grabowski and Fick (2009:8) list this as an important aspect of recording the working process and not just creating an outcome. It is with this definition that the practical works in this dissertation follow a process of recording important states of the development of the matrix. Camnitzer (as found in Brodsky 2011) mentions that in the 1970s there was a shift in emphasis from creation to dissemination of print artworks and, hence, the matrix was seen only as an intermediary step. The value of the matrix is, therefore, the sum of the prints pulled from that matrix.

Recently, the discussion centred round computer generated matrices. With ever increasing 'invisible' technology all around us, as well as in printmaking itself, the particular involvement of human and machine in printmaking retains the element of touch. This aspect may not be always evidenced in the make-up of the final product but it nevertheless forms its symbolic matrix. As Didi-Huberman (1999:13) says: "Technology does not just - mean "progress" and "novelty": it points in all temporal directions." This leads the researcher's argument towards technology although one other troublesome aspect has first to be addressed, namely that of authenticity in printmaking.

**Authenticity** Authenticity of the print is another difficult topic of discussion. The whole binary concept of authenticity versus inauthenticity (the single, original, hand-made versus the technically produced multiple) has a long history, dating from the Renaissance (Pelzer-Montada 2001). According to Pelzer-Montada (2001) there exists an obsession with authenticity in printmaking. She argues against the unhealthy level of attention that the medium of printmaking receives in terms of what constitutes authenticity. This argument is strengthened by the title of the 2nd Impact Printmaking conference: *Material and Meaning* (2001). The literature shows a growing awareness of the issue of authenticity and it can be concluded that questions regarding digital technologies might be an instigating factor (Pelzer-Montada 2001). Authenticity became 'undone', not abolished, as a result of the reproduction of art, which was mainly the result of photography and, more especially, film (Benjamin 1936).

Pelzer-Montada (2001) claims that a re-definition of authenticity exists and it can no longer be described in terms of a dichotomy between the real/unique and the false; it should rather be seen as embracing both. The traditional opposition between the 'handmade' in art and design, as evidence of authorial presence, guaranteeing the commodity value of the product, and the reproductive indicative of technology, is not existent anymore. Authenticity has banished printmaking practice to a marginal position according to Pelzer-Montada (2001). This change has occurred despite numerous efforts –for example, the concept of the 'limited edition', or the destruction of the plate – to establish mechanisms to safeguard the notion of uniqueness and authenticity. A crucial fact remains that within any edition, one print is as authentic or inauthentic as the other. Each print is authentic in the sense that it derives its existence from the same 'original' matrix, and each print is inauthentic in the sense that there are multiple copies from that same matrix – however much they may vary. Hence no one print is a unique original. Wyss 1977 (in Hirner 1998) clearly expresses this concept when he claims that etching has been referred to as the 'simulacrum of originality', namely 'a mass-produced expression of uniqueness'.

Benjamin (1936) was not in principle opposed to the notion that originality and quality rested in the rarefied object of a single artwork. He states that standards of authority in artworks must change as a response to a world in which modes of reproduction are a frequent occurrence in everyday life. Benjamin (1936:8) describes the tools of the mechanical age as liberating "the work of art from its parasitical dependence on ritual...[allowing it] to be based on another practice – politics". Benjamin (1936:12) further argues that "...the whole sphere of authenticity was outside of technical, of course not only technical

reproducibility“. He did not see craft as of any importance. The ability of any artwork to bring about social change should give it importance. Ivins (1948) echoes this and states that it is not the quality of the medium itself, but the qualities of the mind and hand that users bring to it.

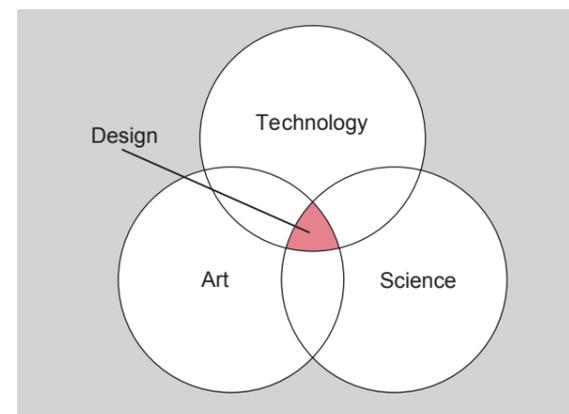
One key aspect of digital simulations for printmaking is its inability to be authentic. The single purpose of a simulator is to mimic or to reproduce to another’s standard. In this sense, digital printmaking cannot be authentic as long as it is made to look like a counterpart, traditional technique. Unless digital can have its own voice and identity within printmaking, it will always be classified as a state of ‘hyper-reality’ (Baudrillard in Connor 1997). Baudrillard claims that “all of contemporary life has been dismantled and reproduced in scrupulous facsimile, but therefore, unoriginal and unauthentic” (Baudrillard in Connor 1997:56). To complicate this problem, Pelzer-Montada (2001) claims that simulation has always been part of printmaking if one considers its emulation of painterly techniques. Many fine art printmakers are extremely vocal about the claim that printmaking should not be seen as a reproduction of a painting or drawing, but rather a creative enterprise in its own right.

Within printmaking there is an awareness of the importance of surface, especially in light of printmaking’s intersection with digital media., accompanied by a renewed flaring-up of the question of the ‘originality’ of the print (buried since the 1960s). Literature on printmaking seems to be lacking in the obvious discussion of the great space created for unethical practices by digital media because the printmaking medium provides no agreeable answer to the question of authenticity.

Grabowski and Fick (2009) list four aspects of intaglio printmaking in their definition. This is a clever and cautious notion not to venture into the heated arguments surrounding the formulation of a strict definition to establish an identity for printmaking. The aspects listed, namely delay, layers, the multiple and function, address the aspects of uniqueness in printmaking. The first aspect of delay describes the matrix as an intermediate step between the idea and the final realisation. Choices such as paper, colour of ink, and sequence, all have the potential to interpret the matrix differently. Furthermore, the space of the delay offers some conceptual possibilities. As the matrix only leaves a sense of its existence – similar to the impression of lipstick on a collar, or finger-marks on skin – a meta-narrative exists (Platzker and Wyckoff 2000). Nash (1997) cautiously warns against this view that print is an end result. Printmaking is an act of ‘doing’ and is not made to replicate something else. Nash (1997) states that printmaking is wrongfully attributed as an end result, a reproduction after a painting or drawing has been made. On the one hand it is difficult to dispel the confusion in the public’s mind between limited edition fine art printmaking and open edition commercial printing. The importance of this distinction when defining printmaking is that printmaking as action can, and should be linked to the creation of a design product. The design activity and the materialisation of the design artefact are of equal importance although dissimilar.

Layering as another hallmark of intaglio, deals with the accuracy (of registration) to create an illusion. Grabowski and Fick (2009) mention that considerations of hierarchy (which layer is dominant and which is submissive) is the most important aspect of intaglio printmaking. What is not mentioned as important, however, is the redefining of information, as any given surface area on the print is affected by its matching area on another plate. As different matrices put down their various coded information one over the other, the total may be more, or less, than the sum of the individual plates.

The most valuable argument in the defining of printmaking is that of Grabowski and Fick (2009:14) when they argue for the acceptance of method and technique, no matter where in the continuum between tradition and innovation. They maintain that criticism of printmaking method should be based on the perspective of both the artist and the viewer. What is acceptable criticism at one point is wholly inappropriate at another. Brodsky (2011:23) mentions that print has become so pervasive in daily visual culture that people pass it by without notice. According to Hecker (in Brodsky 2011:23) “Installation, performance and video art, photography and new-media technology have expanded artistic vocabularies”. Artists are often drawn back to printmaking because it enables further exploration into the multiple, developmental and spatial structures of these other mentioned mediums. What makes the definition of printmaking so difficult to establish is the inextricable linkage between process and content. Process requires, and has distinctly different criteria to, that of the product and the combination seeks an ever better definition.



**Figure 3.7:**  
Bauhaus model of Art, Science and Technology  
(Findeli 2001)

**3.4.2. THE TECHNOLOGY DEBATE** It is no longer enough to speak about art and science, an ongoing discussion for centuries that has therefore reached a certain maturity. The reciprocal relationship between these two fields must be acknowledged and more closely defined: which art and which technology and how do they interact? With this imperative in mind, the Bauhaus model is cited, namely that technology is applied science and the area of overlap with art, creates design (Figure 3.7).

Despite artfulness of graphic work, it was not considered high art such as painting or sculpting. This debate still affects designers today because client-driven commissioned work is made with very different constraints than art pieces created primarily to express a personal view. Yet the mass production and consumption of images and text are an important part of the larger culture in which modern art functions and the rich production of graphic designs play at least as significant a role in mediating the values of modern life, as the works of fine artists. The two have a complex, highly synergistic relationship to each other, inherited as part of the cultural legacy of early modern attitudes (Drucker and McVarish 2013).

If Bauhaus set the idea, it was the accessibility of the commercial computer that launched the era of *Science and Art: a New Unity* (Droste 2002). During the 1960’s the rapid growth of computer-related art forms occurred. A multi-disciplinary magazine on Art Science and Technology, aptly called *Leonardo*, was founded in 1967. The computer arts society was established in London in 1967 to promote the “creative use of computers in the arts” (Ingold 2001:9). Bulletins such as *Page* carried heated debates on the topic. The EAT (Experiments in Art and Technology) centre in New York was founded in 1966 (Reichardt 1970). From here the pop artists of the day took their cue. Jasper Johns, Robert Rauschenberg, Andy Warhol and the others all seized the new technological breakthrough that infiltrated everyday life (Candy and Edmonds 2002). Since then, the opening of Centres for Art and Technology have exploded. From Japan to the Americas, many important organisations have been established with the mandate to research art and technology. Artists in Science and Technology in California, the Artist Initiative in Rotterdam, the Ars Electronica and Museum of the Future in Linz, Austria, the NTT-Inter Communication Centre in Tokyo and the Media Integration and Communication Centre at MIC, have all opened their doors since 1980 (Candy and Edmonds 2002).

**Science, technology, art and design** Science and art are two close disciplines and the distance between them, varies according to circumstances (Noyce 2010). Since the issue was first raised, a tension existed between some artists and technologists, and this tension does not grow weaker, but simply moves its boundaries (Nake 2010). Experiments in Art and Technology (EAT) addressed the collaborative nature of printmaking but failed to fill the “impossible gap between technology and art” (Candy and Edmonds 2002:16) Kluver, the founder of the EAT centre maintains that art and science have nothing in common and only art and technology can be intertwined. He saw art as the idea and technology as the physical expression of the project.

The Age of Reason was the era that saw scientific endeavours, more than religious beliefs, as governing the new theme for art. Not only was science shown, science was used. The technological driven wars of the 20th century also saw the close linkages between art and design. Dada as ‘anti-art’ or ‘destruction art’ was born of the World Wars and arguably reached a climax as

nuclear destruction showed the other side of science. Jean Tinguely produced two self-destructing sculptures, *Homage to New York* (1960), and *Study for an End of the World No. 2* (1962) (Candy and Edmonds 2002). Since then, art, science and imagination, or rather, scientifically inspired entertainment has blurred the lines even more. H.R. Geiger's science-fiction artworks are now used in major 'blockbuster' (commercially viable populist) movies (Noyce 2010).

As early as 1930, not anticipating the advent of the computer, Paul Valery said that the arts, much like design, could no longer escape the influence of modern science and technologies. Great innovations would change all techniques of the arts influencing creativity and perhaps going so far as to transform the concept of art itself (Jarry 1996). The subsequent computerised, commercial application of art was labelled 'design'.

In 1965 Max Bense housed an exhibition for a fellow mathematician, George Nees (Candy and Edmonds 2002). Their algorithmic experiments of six computerised line drawings as claimants of art (aesthetic objects) were rooted in Shannon and Weaver's (1948) concept of information and entropy. Many artists rejected the exhibition and claimed that it could not be regarded as art on the basis that it lacked inspiration, intuition and the creative act, all elements computers do not possess. To bring calm to a crowd of outraged artists, Bense claimed the drawings to be 'artificial art'. Somewhat ironically, four years later in 1969, Nees published his doctoral dissertation, the first ever on computer art (Candy and Edmonds 2002).

According to Jarry (1996) Andy Warhol not only advocated the use of modern technology in design, but commented that he would actually like to be a machine. Warhol was unperturbed about his reliance on machines and his soup cans and Coke bottles, both in their everyday subject matter and mechanical methods of execution are prime examples of an artist and designer working with, and reacting to, the technology afforded him by the time in which he worked.

**Technology in printmaking** Printmaking technology is modular, bringing segmentation to processes that were organically integrated in traditional crafts and, consequently, this practice embodies and disseminates standardisation (Drucker and McVarish 2013). Printmaking cannot be confined to any particular use and the entertainment value of graphic art has thus come to the fore once again. According to Platzker and Wyckoff (2000) there are two important variables in the approach to modern printmaking technology. They mention that technology cannot fully explain the development, as well as the artist's temperament and his/her fine disregard for authority and tradition. Platzker and Wyckoff (2000:27) state that: "artists' attitudes toward printmaking, as well as their abilities to use printmaking technologies in ways that are both visually interesting and that expand the boundaries of acceptability, are considered to be at least as important as the availability of the technology itself".

Generally speaking, designers invest more in their time than in their hardware. Coldwell (2012) wonders how many artists and designers have the technology available to experiment and become proficient in new processes. This might impact on the democracy of technology, especially that of the digital printmaking studio that requires high-end machines such as Iris Printers, Rapid Prototyping Machines and Computer Numeric Cutters, all of which greatly increase the overall production costs. The running costs of these new advances in printmaking can usually not be afforded by smaller art schools, and are thus completely out of reach for the individual novice printmaker. These economic restrictions limit the playful exploration needed to become a 'digital native' Coldwell (2012).

Tallinn Print Triennial (2007) in Estonia showcased technology and showed the changing and mutating global print culture (Thorburn 2008). Thorburn argues that as the extensive debate over what constitutes a print has long been expired, a case can be made for the inclusiveness of new technology as a valid medium in printmaking. Evidently this is a complex issue that needs some re-addressing. Presently academics and printmakers alike, differ greatly on this topic. Concurrently, the 5th Impact Conference in Tallinn (2007) raised the inevitable debates about digital technologies, but generally printmaking's expanded processes and technologies puts it in an advantageous situation (Thorburn 2008). Printmaking now creates linkages across divides, to communicate, filter and create associations within our contemporary visual culture.

Just as printmaking is an activity afforded by practice-specific tools, so too computer technology becomes critical in the application of design artefacts. Computers are critical tools in the modern design studio and much of the working designer's

life will be spent in front of one of these machines. As this study seeks to explore the relationship between an 'Old World' printmaking technique and modern computer technology, it is necessary to investigate the use of such technology in a broad sense with particular emphasis on its social advantages and disadvantages. Several authors on printmaking are not only sceptical, but decidedly negative in their description of modern media, always linked to computer technology, as 'polluting agents'. Some of these arguments are listed below.

**Computers and modern media** Social, political, religious and territorial conflicts are prevalent in South Africa today with the reality of the difference between the rich and poor. However, because there exists a wealth of channels for information – relatively easily available to everyone, rich and poor alike. According to Noyce (2010) much of modern people's knowledge of the world comes to them through computers and they rely more and more on computers to share information with others. The willing submission of the present generations to a wired-up electronic dependence is intensifying. Noyce (2010:14) further states that: "We confuse reality television shows for reality and the report of filtered news has a great impact on our perception of the world." Computers and media have become an outlet for human entertainment. Noyce (2006) notes that thought provoking informative material on the arts as well as programmes that discuss the importance of culture in our lives, are few and seemingly of little importance.

Media exposure drives opinion, and a keen interest in adrenalin-generating adventure activities has become standard entertainment. Unfortunately, none of these factors develops the refined and purposeful hand skills which are so critical to art and design-making activities (Cadle 2009). Design shapes communication and communication systems exert an enormous force in constructing the worlds people believe in (Drucker and McVarish 2013).

The broadcast media "dump information on a docile compliant public that is becoming less informed and less educated" (Hoskins 2013:8). Noyce (2010:11) sarcastically notes that the old cliché "when I hear culture, I reach for my gun" has mutated to "when I hear culture, I reach for my chequebook" and even beyond that: "when I hear culture, I reach for the TV remote control". Waits (2014:1) eloquently sums up this situation: "We are buried beneath the weight of information, which is being confused with knowledge; quantity is being confused with abundance and wealth with happiness. We are monkeys with money and guns". Artist Barbara Kruger illustrates the American-instilled culture of consumerism in her artwork *I shop, therefore I am* (Figure 3.8).

Counter arguments regarding the influence of media and computers can just as easily be made. People choose what they want to use the computer – an inanimate device – for. In the same sense computers and mass media have profound power to enlighten and educate humanity. In a society preoccupied with visual imagery and a system that prefers outcome over process, it is quite understandable why computer technology has become an ideation and production tool (Yeoh 2006). Computers and computer technology are often used for consumption of data rather than what is proposed in this study, namely the creation of data. The argument here is not that computers and the media are the culprits of societal knowledge 'dumb-down', rather a case is made for not blaming the spoon for being overweight.



**Figure 3.8:**

Barbara Kruger  
*Untitled*  
1987  
Silkscreen  
2820mm x 2870mm  
Mary Boone Gallery, New York  
(Noyce 2010)

Computers may overwhelm some people, especially the older generation user who often feels intimidated by new technology. Krugg (2006) mentions that many people who were educated before the 'information highway' era, often feel frustrated, scared and alienated towards an unsympathetic onslaught of modern-day technology. Two reasons can be stated for this: firstly the often exclusive way in which technology is presented, resulting in the assumed user being seen as highly capable, skilled and knowledgeable. Secondly, the user's inability, or rather unwillingness, to learn because fixed patterns of thought and problem solving sets in with age. The response to a new problem, often technological in nature, is met with an embedded thought pattern or way of solving problems. The longer someone is exposed to such a habitual pattern of problem solving, the more difficult it is to break that pattern with a new thought paradigm (Bourdieu 1977).

In the printmaking studio, time investment and close understanding of, and familiarity with, the tools at hand are essential. This state is, by definition, the product of many hours of labour and intense observation and learning. The question, therefore, exists whether the digital studio will, or can ever, produce the mastery of skill akin to traditional printmaking practices. Coldwell (2012) makes the important observation that the current digital generation's inability to develop a long-term intimate relationship with their devices results from the fact that most digital objects are obsolete within a few years. Selber (2004) notes that students and other users need to be more informed questioners of technology and that computers that act as cultural artefacts need some critique. Selber (2004) advocates that students ultimately must become reflective producers of technology.

The hypothesis of this study namely that computers can be used in an effective manner for planning purposes in the intaglio process, draws on the strength of computers to facilitate positive results. Mass media, such as the internet, has also had a profoundly positive influence on this study. The sharing of information and insights pertaining to this study could be achieved by accessing countless perspectives from across the globe. Information and background research to this study relied on internet discussions, telephonic interviews, email discussions and even television programmes. What is proposed in this study is that by not being complacent to mass media messages; the individual has the power to shape his or her own input options. Furthermore, this study proposes a return to the strong roots computers and software possess – not as purely entertainment devices with social media being merely outlets for boredom – but possessing the capacity for tremendous educational activities including recording, calculating, computing and planning. In order to achieve this goal, the professional use of software needs to be reinvigorated.

**3.5. DIGITAL PRINT TECHNOLOGIES** Online literature on mixed media, or rather mixed method printing (known as hybrid) is plentiful. On the world wide web, several blogs and websites, or portals to websites, exist that mainly focus on new printing methods and techniques. *Tradigital* (<http://hybridigitaltraditionalprints.blogspot.com>) focuses on mixing digital with traditional technology. Other websites such as *Inkteraction* (<http://inkteraction.com/>) and *Printeresting* (<http://www.printeresting.org/>) serve as resources to unite printmakers for the purpose of sharing information. Due to the nature of printmaking as an innovative activity, and its new-found fields of exploration in the digital realm, it would only make sense to use a digital environment such as the internet as soundboard. Examination of these online resources offers proof that digital print technologies are valid interpretations, although they are often seen as something separate and new rather than an integral part of mainstream printmaking.

Online discussion on the different allowances and considerations that are embedded in digital technologies but not always acknowledged is often prevalent. The substitution of a digital printer for a mechanical press brings different considerations for the printing process, such as the characteristics of the image file, the printer and ink system, and the substrate used for output (Tillman 2012). Some strong arguments for and against digital documentation, whether as final product or part of planning a document, are made.

**3.5.1. DIGITAL DOCUMENTS** Digital documents exist in a space that theoretically can be shared with anyone with access to a computer. This makes the digital document and the printout thereof, the least valuable of all printmaking 'artworks'. Too combat an unlimited reproduction of intaglio prints (the open edition), the plate or matrix is usually destroyed or damaged deliberately to prevent further reproduction. A single proof is then pulled to show the damaged state as a declaration that this

edition has officially ended. In digital media, this indication of completion cannot be attained. There exists little or no means of proving that the electronic document does not exist somewhere else. Furthermore, copies of the original can become originals themselves to be copied again, a process that cannot be replicated with other forms of printmaking.

There is an argument made by Benjamin (1936) that an artwork, or a series of limited prints exists in a single space of time and place. With infinite numbers of an object, the 'aura' is depleted to a state of non-existence. Digital documents exist always and once online, at no specific location. A key principle of the internet is that users can access information but no user can cut off or destroy that very information and, therefore, render that information inaccessible to others. This means that the digital print has the incredible power of spreading its message to nearly the entire world, at a fraction of the cost when compared to the typically 30 or so printed artworks from a standard intaglio edition. The computer term 'viral' is now often encountered and used for online information that is spreading beyond control.

**3.5.2. DIGITAL PRINTMAKING** There can be no denial about the explosive resurgence digital media and digital printmaking has had in the last decade (Fishpool 2009). Digital print technologies make home-based printing an almost daily occurrence, whilst digital printing shops are now common. Ganter (in Brodsky 2010), expresses a reservation: digitally produced and printed images which appear to adopt the syntax of, say, a woodcut or a lithograph, still only look like the real thing and function merely as a quotation of said techniques. More importantly, in such digital prints, Ganter (in Brodsky 2010) notes how few of the more subtle coding and unique syntax that the traditional modes allow, exist in their digital counterparts. In contrast, the impact of large-scale woodcuts of printmakers such as Thomas Kilpper and Emma Stibbon are closely affiliated with the exploitation and foregrounding of the technique's material semiotics (Coldwell 2010).

If the above view of Ganter is accepted, namely that digital processes are often used as reproductive methods of other existing artworks such as painting or drawings, the digital print is but a reproduction of an existing self-sustained entity and, thus, it (the digital print) cannot claim to be original. However, when digital software constitutes the tools for producing, and the artwork does not have materiality before it is digitally printed, it can claim to possess both originality and authenticity. The above argument, often cited by proponents who are against digital printmaking, applies to the tactile quality of digital components in printmaking. Much of the research carried out by the Centre for Fine Print Research (CFPR) in Bristol, United Kingdom, has been concerned with the adaptation or alteration of commercial technology, such as digital printers, to suit the needs of artists, both in the scale and quality of the output (Coldwell 2010). The exhibition *Committed to Print* in 2007 at the Royal Academy of the West of England in Bristol, curated by Dr Paul Thirkell from the Centre for Fine Print Research (CFPR), demonstrated the 'tactility' of digital prints which are currently often almost indistinguishable from traditionally printed work (Coldwell 2010). With Iris and Giclee printers becoming an industry standard, it is clear that quality is no longer a justifiable notion to disregard digital output devices in printmaking.

Not only the tactile nature of prints but also their lack of tactility is described by Peltzer-Montada (2001). In the digitally printed image, the construction of surface through layering that is so familiar to printmakers, becomes virtual and assumes a greater dematerialisation than ever before. The immateriality of the digital artefact, both matrix and product of the matrix, is the biggest stumbling block experienced by printmakers. Shiff (in Pelzer-Montatda 2001) comments towards the end of his essay that while new materials 'unmask the imperfections' of the previous ones, 'touch returns'. Proponents of both sides of the argument regarding the quality of digital prints claim victory.

At the *Fourth Impact Printmaking Conference* in Berlin-Posznan, Germany/Poland, Sept 5–10, 2005, a demonstration of a wax silk screen technique which creates beautifully rich and dense surfaces implied a traditionalist approach. Not only the technique, but also the name of the workshop, *Hand Print Workshop*, is indicative of a return to authentic hand processes (Pelzer-Montada, 2008). This was strongly opposed to Gollifer's (2005) report on the conference that showcased the thrust of new technologies in printmaking. Gollifer (2005) reported that digital printmaking and photography remained the main topic of what was the result of postmodern tendencies and showcased examples of printmaking which were created beyond traditional confines.

Artists want printmaking to be regarded as an artistic endeavour, classic and limited in edition, reserved for an exclusive audience. However, they also like to claim that the power of commercial printing is democratic and powerful due to the multiple. Different technologies have different variables and allowances which mean that some aspects are strengthened and others are weakened, when a comparison is made between the traditional intaglio print and a digital print. Although such a comparison is not the primary focus of this study, it is important to highlight both output mediums to establish the view that there are inherent aspects of both good and bad in both. Table 3.1 was derived from information contained in several online resources. The most valuable discussions to inform the table were found at:

- <http://inkteraction.ning.com/>
- <http://www.artofdemocracy.org/>
- <http://hybridigitaltraditionalprints.blogspot.com/>
- <http://www.printeresting.org/>
- <http://www.brodskycenter.org/>
- <http://nzprintmakers.blogspot.com/>

**Table 3.1:** A comparison between intaglio printmaking and digital printmaking.

INTAGLIO PRINTMAKING	DIGITAL PRINTMAKING
<b>Superior quality</b> usually exists in intaglio due to higher quality inks, paper and the physical pressure applied to the paper to embed the ink.	<b>Inferior quality</b> of the digital print that has received much attention. There has been a noticeable shift in quality but at a high cost. Inferior ink shows quicker discolouration compared to intaglio inks.
<b>The highly laborious</b> process of intaglio is one of the primary reasons why so many novice printmakers exit this technique upon introduction. With the usual vast amount of time spend to develop the matrix, comes a high expectation of skill.	<b>Instant results with less effort required</b> is one of the strongest attributes of digital technologies as electronic printers and shop assistants trained in operating those machines are burdened with the printing
<b>High authenticity value</b> is the hallmark of intaglio printmaking due to the use of a physical matrix. Only with the matrix itself – which exist as an object that cannot be reproduced – copies of the print can be made. In general practice the matrix is destroyed after a limited edition.	<b>Lack of authenticity</b> due to the theoretical limitless editioning that a digital file allows. The information highway also means that the digital artwork can be easily plagiarised when published online. Anyone who can access the digital document can print the artwork.
<b>Inaccessible</b> to many as a complete studio setup is required to practice this process.	<b>Accessible</b> to anyone with a computer and digital printer
<b>High cost</b> is a hallmark of printmaking compared to digital printing. Material and presses that may run into thousands of Rands is required.	<b>Low cost</b> of digital prints makes this a strong feature. Digital prints can cost as little as 20cents with hundreds of print shops available.
<b>Limited editioning</b> of a typical intaglio run of around 30 to 40 prints of the same plate are an industry standard. This makes the value thereof higher due to the limited edition.	<b>Open editioning</b> is theoretically, an unlimited number of a digital document can be printed. As digital printing constitute a large number of prints of often unknown quantity.

A reason why digital printmaking attracts so much interest with new printmakers is the speed at which the process occurs (Fishpool 2009). Results are almost instantaneous, a major difference to intaglio when the result is only visible after many hours of working the plate. This specific instant gratification of printing via ink-jet printers and other computerised solutions is often what the traditionalist resents so much. Grabowski and Fick (2009) mention that the direct involvement by the artist with the print media is an important and necessary condition for authenticity. In this study it is argued that it is mainly the lack of proof of this direct engagement that makes many artists, publishers and collectors sceptical about the authenticity of digital printmaking.

**Computers' function, data, information and creativity** Computers produce and organise data to become information. Humans create knowledge from the data by means of absorption and classification. With an integrated base of knowledge, people create wisdom (Rochester 1993). The computer has a methodical, precise and efficient organisational capacity. As a computer helps to organise data it can contribute significantly to the whole design process (Yeoh 2006).

For most people, computers have a poor reputation when it comes to creativity (Candy and Edmonds 2002). Until the birth of the world wide web, computers were used mainly for calculations and word processing. However, since the beginning of commercially accessible computers, people have been interested in using computers to create art. The 1963 edition of Computers and Automation launched a competition for computer-generated art, and since then this notion has grown exponentially (Candy and Edmonds 2002). An early exploration of computers as having an art making tool's ability was shown at the Institute for Contemporary Art in London at the Cybernetic Serendipity Exhibition. The exhibition showed the collaboration of artist and technologist with no clear distinction made between the two of them. Reichardt (1970) mentions a new movement of computer art and concrete poetry exponents that is both socially and artistically significant even though its members have hitherto no masterpieces attributable to them. When commenting on this exhibition Reichardt (1970) wrote that the salient points in these movements are that they are international and that they are motivated by the use of media, technique and method, rather than ideology.

In Malevich's essay in 1915, *On new systems in art*, he discussed the law for the constructional interrelationship of forms. His work comes at a time much earlier than that of computers but it was part of an important investigation into mathematical laws of finite sets that is crucial to the way computers function. The making of all art involves technology, it is not a new and contemporary issue. However, what is new to the debate is that digital technologies are mathematically based as opposed to previous technological advances which were materially based (Coldwell 2012). Jurgens (2009) writes that every source and every idea is reduced to the same level of calculation. In the end all pixels are equal.

Computers are logical machines, working with finite sets of objects (Rochester 1993). As printmaking is also an endeavour of limited variables and technique affordances, these two systems of information share a common method of logical functioning. These two systems, therefore, share a certain way of working that is not very different. Just as the thick intaglio ink is replaced by electrostatically charged ink, the copper plate matrix is replaced by a binary code matrix. Both however, share similar constituents to produce a machined output by utilising human input.

**Computers as printmaking tools** According to Encyclopaedia Britannica (2013) a tool is an implement or device used directly on a piece of material to shape it into a desired form. A tool is an instrument that entails the purposes, culturally and naturally for which it was made. A tool also encompasses a skillset, technique and knowledge to operate that tool for its desired usage (Ellul and Merton 1964). It can be an object, a system or a computer programme that allow manipulation and creation (Salomon 2009). In itself, a tool has little value, it is in the application that the tool serves as the mediator that creates the value.

For a long time computers were seen as machines and not tools. A machine is a more autonomous instrument, where a tool needs skilful operation and guidance (Ellul and Merton 1964). From this perspective, the software applied in this project, is a tool with some limited aspects of autonomy. However, a machine also needs some initial guidance, programming and skilful setup by an external force to become autonomous. Does this fact mean that all machines are tools first? These questions can

lead to a myriad of new perspectives and views. In this practice of the experiment, the computer and software utilised as a tool, based on the above definition, is considered. Salomon (2009) makes the claim that computers serve as cognitive tools inasmuch as they serve students in their own creative thinking, allowing them to move beyond their own cognitive reasoning to higher ideas than they would be capable of otherwise. Such a bold claim is not defended or argued in this research, but the validity of computer and computer software as tools is undisputed.

Until the 1990's computers proved to be an elusive and limited tool for printmakers (Fishpool 2009). Although, since the 1960's – when computers stepped in and were still a limited research commodity – artists had a fascination with the new wave of technology (Platzker and Wyckoff 2000). Computers were expensive and access was limited. This fact, coupled with the lack of available software and the necessary skills to program computers to create art, made the use of computers less than ideal for utilisation by the artist. A point that the literature on printmaking fails to mention is that computers were never intended or designed as artistic or even creative entities. Too compute means too reckon, enumerate, determine, assess or quantify (Rochester 1993). When computers entered the printmaking studio as word processors, the first barrier was overcome, and, with the advent of high-quality professionally designed software such as the Adobe and Corel range of software applications, printmakers were now enabled to make use of these computing machines (Grabowski and Fick 2009).

Artists use the computer in the same fashion as the sketchbook, namely for recording ideas, reworking and resolving old ones. It becomes a space for documentation as well as ideation. “You can effect innumerable visual changes and combinations at one sitting, saving each layer as you go, to be returned to again and again for reference. In the long run, it's as quick as using a sketchbook” (Fishpool 2009:19). What printmaking has always understood best is how to balance the use of time – the quick efficiency of commercial attitudes set against the glorious step-back in time evoked by traditional printmaking techniques (Fishpool 2009). Learning to handle any type of printmaking tool, be it a drypoint needle, etching needle, roulette or software program, to use in the creation of an image, is vital to the mark-making act becoming second nature. Familiarity can lead to complacency, and artists sometimes stop connecting with their tools, when the marks they make cease to stimulate them (Fishpool, 2009).

It is therefore assumed that the hypothesised intaglio simulator, as a tool for learning, is equal to the computer as a tool for planning printmaking. The computer can simulate the expressive (if one thinks of all the different paint effect options) as well as generate the non-expressive (Peltzer-Montada 2011). The purpose of the tool is not to create, but to act as agent to facilitate the human creative endeavour. Stones and Cassidy (2010) confront this view by stating the existence of ambiguity levels between conventional paper-based sketches and digital tools. They suggest that, while students are capable of reinterpreting the digital marks as other forms, they are less successful at turning these new digital forms into new ideas. It would appear that whilst not causing reinterpretation, paper based sketches, more than digital tools, can support the vital process of reinterpretation that generates new ideas.

**3.5.2. FOUR CASE EXAMPLES** The seamless integration of digital technologies with printmaking is highlighted in following four case examples of contemporary printmakers.

**Randy Bolton** uses both traditional darkroom and computer methods to plan and construct images. Since the early 1990s darkroom techniques slowly made way for digital image editing (such as Adobe Photoshop). For Bolton process and content are intrinsically linked. Bolton (in Grabowski and Fick 2009:49) uses the motto: “a bird needs two wings to fly” The one wing refers to the idea and the other to the process. There is a constant flow between these two, back-and-forth, to produce an outcome that is part of both. A good print only ‘flies’ as equilibrium of both is reached. Bolton sees the future of printmaking in a positive light with an expansive definition of what constitutes a print. If a print can be described as a matrix or process that can produce something that can be repeated then we must consider a sneeze, an echo, a ripple in a pond also as a print. “I think printmaking will have a strong connection between its old and its new, or a kind of concurrent sense of time where the past is always present” (Bolton in Grabowski and Fick 2009:50).



**Figure 3.9:**  
Randy Bolton *Yes, Maybe, No*  
2010  
Silkscreen  
Schmidt/Dean Gallery  
(Grabowski and Fick 2009)



**Figure 3.11:**  
Jo Ganter  
*Duskman*  
2012  
Intaglio  
Private collection  
(Grabowski and Fick 2009)



**Figure 3.10:**  
Nathaniel Stern *Concentration*  
2011  
Pigment on watercolour paper  
Private collection  
(Smith 2007)



**Figure 3.12:**  
Davida Kidd *HOT!*  
2009  
Digital Print  
O'Born Gallery  
(Noyce 2006)

**Nathaniel Stern** is an experimental printmaker who uses a digital scanner strapped to his body recording images as he moves. These images are often reinterpreted as traditional woodcut prints and lithographs. Michael Smith comments on his work as follows “...the entire process expands to encompass fairly traditional printmaking techniques, and a great tension is established by this” (Smith 2007:23). These tensions are described as a result of the traditional processes mixed with modern technology.

**Jo Ganter** is impressed with the slow processes and quality of mark-making. Through accidental corrosion a richness of surface was created that could not be produced by any other medium. She creates a matrix by using digital printing methods and photography. She often uses digital images to directly set the design on the matrix. As a teacher she sees a new generation of students for whom etching, lithography and screen printing is more interesting than creating digital images, since they do not experience these processes until they study fine arts. This type of printmaking is something they cannot produce at home and, unlike digital printing, they have to consider and be self-conscious about their actions therefore engaging on a higher cognitive level which she considers to be extremely valuable in education (Grabowski and Fick 2009).

**Davida Kidd** Kidd's work provides another example of mixed media incorporating digital technologies. She uses an array of techniques from different disciplines to produce a final digital print (Noyce 2006). Aspects of software manipulation, coupled with sculpting and darkroom techniques, allow Kidd to create an image that is ultimately digitally printed, but whose development extends far beyond the mere use of a digital camera and printer.

**3.6. THE PLANNING PROCESS** Although a computer is a valuable planning tool because it can evaluate the result before production (Yeoh 2006), the planning of an intaglio print cannot be compared to planning another design or art activity such as a poster or a painting. Although many critics may claim that this hypothesis has been applied by many other artists in different fields, the nature of intaglio does not allow those methods to be successfully reproduced. Unlike many other creative mediums, such as drawing, painting and computer design, intaglio printmaking does not allow the reversal of mark-making. What is more, intaglio seeks a high level of both hand-skill and reasoning. The process requires a high level of understanding of theoretical knowledge and the subsequent ability to envisage the product of such processes. Like a research activity, intaglio requires formulation of the problem, investigation of a possible solution and then the narrowing and application thereof. However, the luxury of adapting the theory and reworking previous aspects in order to attain a different outcome is often not afforded in intaglio printmaking. Planning is therefore crucial.

Hoskins (2013) mentions the adoption of the earlier mechanical processes within digital technology that have made the transition from one technology (mechanical) to another (digital) run more smoothly. However, the rapid development of digital technology has created a divide, culturally, and often socially, between the current generations. Artist and printmakers alike, born before 1980 have come to know the world through mainly mechanical technology. Those born after 1980 know little of the origin of the world before the digital revolution and, therefore, have no allegiance to the physical application of things. It is this later generation that embraces the medium's inherently non-object status and, thus, prefers the ease of digital printmaking. This divide determines two distinct ways of working and, therefore, utilises different tools for the planning of a print artefact.

Planning the printmaking typically happens either as a purely cognitive process with no materialisation, or it can happen with pen and paper or any other physical medium. Robertson and Radcliffe (2006) found that there were several ways in which software influenced the creative process, including enhancing visualisation and communication, premature fixation, circumscribed thinking and bounded ideation. Johnson (2005) showed that other tools, for example verbalisation, rather than freehand sketching, was the major conceptual tool utilised in the initial stages of ideation. Johnson (2005) also claims that the computer has emerged as an ideation tool across design domains. Appiah and Cronje (2013:13) note that design educators are "glued to the view that there can be no creative work without thumbnail sketches". It is this view that has been challenged in recent times and research has shown that students of design disciplines make less use of hand drawn sketches for idea forming and more of computer ideation.

Another study by Tanga et al (2011) compares the design processes of designers in both digital and traditional sketching environments, where the digital environment emulates the traditional face-to-face, pen-and-paper environment. The results indicate that the design processes in the two environments were not statistically different in terms of their distributions and transitions. The higher-level cognitive activities were not affected by the use of this change of mediums.

The simulator for the iterative design experiment is, therefore, put forward as a solution to amalgamate both hand processes and computer technology into a single activity of planning. The simulator's properties, fidelity and alignment to the real-world problem of the intaglio design artefact, are discussed in detail in Chapter 4 of this study.

**3.6.1. COLLABORATION IN PRINTMAKING** Printmaking is often a collaborative activity involving two parties who work together on a single project. This necessitates the clarification and materialisation of a structured workflow methodology. Similarly to other collective design projects, successful planning and execution relies on a clear and available process map. Although literature discusses the general collaborative nature of this process, no mention is made of the mechanics of this important aspect.

Hoskins (2013) mentions a crucial factor of the collaborative print process, namely the communication between artist and printer; where the printer transcribes the artists' ideas and aspirations for the work. To achieve this, a common understanding of the making process must exist between the two parties. A former traditional printmaker, David Adamson, now working with digital print technology, cites his success in collaborative digital printmaking as being partly due to his background in traditional techniques. Adamson (in Hoskins 2013) notes that he speaks the same language as the artist, establishing trust and in building a rapport. This collaborative strategy has produced an array of successful digitally-mediated prints with highly established artists. The title of master printer implies a deep technical understanding of processes and tools and master printers tend to form an intimate relationship with their equipment, often resulting in the press becoming an extension of their own hand (Olen 2013). Dorta et al (2010) evaluates the collaborative ideation space and compares the use of traditional to digital tools in such a space. The use of both traditional and digital tools seems to enhance the collaborative ideation process.

Important questions for this study that arise from the above evaluation are as follows: Does Adamson's success lie in speaking the same language as the artist? What is the language of the digital native? What is the profile and role of the digital master printer? In its distinct essence, digital printmaking leaves one to question whether traditional printmaking will have any appeal in the generations to come.

This position leaves one to ponder whether printmaking will have less appeal to the concerns of emerging artists and what kind of facilitation strategy might be required by the digital master printer, or what the language is of 'making' universal prints? Hoskins (2013) questions what the model of a collaborative studio might be, what it might look like and how it might be found in the future, what defines a master printer in a digital age, and what constitutes a print for a master printer and artist to collaborate with? Olen (2013) answers these questions by stating that in order to be respected as a digital master printer, one must not only hold the technical skills relevant from past mechanical processes, but also obtain the knowledge of the virtual attributes that accompany the computing and electronic aspects of digital printing.

Many claimants argue that the title of digital master printers does not carry the same weight as their traditional counterparts. Olen (2013) refutes this claim by stating that it is the ability to make the equipment (for digital printmaking) an extension of the self, by obtaining the knowledge of the processes and consumables, and developing technologies in order to produce prints of a high quality, that makes the digital master printer akin to his traditional contemporaries.

**3.6.2. AN HISTORICAL CASE EXAMPLE** Albrecht Dürer (1471 – 1528) can be considered an important role-player in the birth of intaglio printmaking because he was the first person to apply known engraving techniques to a piece of paper for printing the multiple (De la Croix et al 1991). Dürer was at the forefront of innovation and so it would be worthy to study his planning and ideation techniques, although little literature exists on how exactly Dürer planned his etchings, drypoint and engravings. What is known about his technique is that he made numerous accurate background sketches which he would combine to form the final matrix.

One of the best documented works of Dürer in terms of his processes is the portrait of *Frederick the Wise, Elector of Saxony* (Figure 3.13). Winkler (in Strauss 1973) describes the many preparatory drawings Dürer completed before making the final plate. Panofsky (in Strauss 1973) mentions a common mistake in printmaking namely, the reversal of text due to the mirroring affect when printed. Dürer's attempt to rectify the reversed D in his monogram is clearly visible.

It is believed that Dürer used a thin oil for the preliminary drawings in order to view the image in mirror and then trace it onto the plate (Candy and Edmonds 2002). X-ray research has also revealed that Dürer reworked his artworks in order to substantially change the image. It is also believed that Dürer used the later common method of a mirror to view his drawings in order to visually reflect the image when engraving the plate (Candy and Edmonds 2002). Some light is shed, although by coincidence, about this planning process. For what is considered to be the first 'pain map', Dürer used a mirror to draw himself from the waist upwards (Figure 3.14). The purpose of the drawing was to create a document to send to an out of town medical practitioner for a diagnosis of his pain. The phrase reads: "*Do der gelb fleck ist und mit dem finger drawff dewt do ist mir we*", or, "Where the yellow spot is and where I am pointing with my finger, that is where it hurts" (Schott 2004).



**Figure 3.13:**  
Albrecht Dürer  
*Frederick the Wise, Elector of Saxony*  
c 1524  
engraving  
188mm x 122mm  
Clarence Buckingham collection  
(Strauss 1973)



**Figure 3.14:**  
Albrecht Dürer  
*The Sick Dürer*  
c 1500  
pen and ink  
Kunsthalle, Bremen  
(Schott 2004)

Another contemporary method employed by Dürer was that of the drawing machine (Figure 3.15). Dürer makes mention of this innovation in his work *Underweysung der Messung* (1525) or *Instruction in Measurement*. During the Renaissance period this tool was a common method of planning and transferring images from one medium, such as a drawing, to another. The ‘machine’ consists of a wooden frame with horizontal and vertical threads stretched at regular intervals. When the artist looks through the frame of threads onto his subject matter, the image plane is broken into equal rectangles to establish the visual relationship of objects to one another. This method is still widely used today, although the pocket calculator, accurate ruler and transparent film overlay has made this process easier.

Dürer’s studies into perspective, human form and proportion were carefully planned in drawings. Arguably the zenith of Dürer’s oeuvre, *Adam and Eve* (1504) had a tremendous amount of preparatory drawings showing the individual parts of this artwork as well as some compositional elements (Figure 3.16). Although there have been a substantial comments on Dürer’s work, describing him as a renaissance man of innovation, art and commerce, his planning and preparation seems to attract little literary attention (Strauss 1973).

Hockney (2001) embarked on a study to follow a suspicion that the great masters such as Raphael, Dürer, Holbein, Vermeer and Ingres used drawing aids to help create masterworks. Although his conclusions have been questioned, Hockney insisted that a camera obscura, or similar ‘living projections’ were used in many cases to create lifelike and naturalistic representations of figures. In doing so, Hockney did not question the drawing ability of these artists, but rather suggested that it was the use of optical devices that enabled them to draw and paint. He makes special mention of Albrecht Dürer’s *Draughtsman Drawing a Reclining Nude* (Figure 3.17) that relied on optics to create such ‘living projection’. This employment of technological interference to aid the artist in recording, enabled a new movement in drawing conventions from proto-realism to photographic illusionism, within the narrow margins for error of the historical timeframe.



**Figure 3.15:**  
Albrecht Dürer  
*Draughtsman Drawing a Reclining Woman*  
1525  
woodcut  
Graphische Sammlung  
Albertina, Vienna  
(Strauss 1973)



**Figure 3.16:**  
Albrecht Dürer  
*Adam and Eve (left)*  
1525  
woodcut Graphische  
Sammlung Albertina,  
Vienna  
Preparatory drawings  
for *Adam and Eve* top  
middle and bottom  
middle. Right bottom  
shows the 2nd state of  
the plate. (Strauss 1973)



Hockney (2001) labelled this conclusion ‘secret knowledge’ and, due to its nature, received highly contested opposition. However, his proposal showed a specific sort of knowing that arises through the handling of tools in practice. This form of tacit knowledge provides a way of understanding the world, one that is grounded in material practice or “material thinking” rather than in conceptual thinking (Bolt 2006). Material thinking argues for the conception that materials are not just passive objects to be used instrumentally by the artist, but rather that the materials and processes of production have their own intelligence that comes into play in interaction with the artist’s creative intelligence (Bolt 2006). This material thinking, the acknowledgement of the affordances of the medium, is crucial in the application of the planning instrument (simulator) examined in this study.

**3.7. PRINTMAKING IN SOUTH AFRICA** Hobbs and Rankin (1997) state that although printmaking is widely practised in South Africa, it receives little attention in the literature, and only one outdated work exists to document the history of printmaking in South Africa. They also state that almost all major art collections and exhibitions focus on painting and sculpting as ‘dominant’ art forms. In the public’s minds, printmaking exists only in a marginal and limited space.

Hobbs and Rankin (1997) attribute the marginalisation – even if only perceived – partly to the procedure of printmaking and printmakers themselves. Craft secrets as safely guarded valuables coupled with the complexities of printmaking, especially when amplified by those practitioners who wish to keep their practice exclusive, set barriers between the art form and its audience. This strongly contradicts Noyce’s (2006) view which describes printmaking as the most democratic of all art forms. Noyce (2006) argues that print is more accessible to everyone than other forms of image making. This empathy can only occur when the printmakers themselves promote such a democracy, both in skill and accessibility of material and resources.

As is the case in South Africa as well as in the rest of the world, many printmaking artists are firstly known as painters and sculptors and then as printmakers. Rembrandt van Rijn, Francisco de Goya and, later, Pablo Picasso, Henri Matisse and Joan Miro are commonly known as European masters in the art world as painters. All of these artists, however, also had a seldom mentioned but well established printmaking career. Likewise in South Africa, classic printmakers such as Jacobus Pierneef, Walter Batiss and Gregoire Boonzaier are known firstly as painters. It was only in the Pop Art movement of the 1960 that artists such as Claes Oldenburg, Jasper Johns, Roy Lichtenstein and Andy Warhol became famous as printmakers (Platzker and Wyckoff 2000).

Hobbs and Rankin (1997) list about 800 printmakers in South Africa and 41 printmaking studios, both private and at universities. Since publication of that list in 1997, many of the studios have closed down and the remainder offer limited possibilities. Only a handful of practitioners listed can be considered primarily fine art printmakers, whilst the majority are artists who have also ventured into printmaking. Names like Woodborne, Diedericks and Vorster are well known intaglio printmakers, but few students of fine art would recognise these. A group of artists exist who are better known in the public eye as printmakers due to their success as artists in other mediums. Jo Ratcliffe with photography, Judith Mason with her paintings and Dianne Victor, all are well known in the contemporary South African art scene, with a strong acknowledgement of their printmaking careers. Geustyn (2013)<sup>2</sup> describes the South African contemporary printmaking scene as “alive and kicking” but admits it consists of a small number of highly skilled individuals. Despite this, printmaking is breaking into new ground and more artists are experimenting with the notion of venturing into the arena of printmaking. It is, however, observed by the researcher that printmaking is, still exclusive and limited to a small community of practitioners. The extremely limited literature on printmaking in South Africa bears testimony to this.

**3.7.1. RORKES DRIFT PRESS AND CAVERSHAM PRESS** An Arts and Craft Centre in South Africa was established in Rorkes Drift in 1963 in the Natal Midlands. Little and contradictory formal records and publications exist on this centre because its placement and its practitioners were contested for a long time due to the strong political landscape of the time (Hobbs and Rankin 1997). Rorkes Drift as it became known, was a centre set up for mainly black South Africans to voice their emotions through art, but was established and maintained by European missionaries. This eclectic mix of missionaries as teachers and politically oppressed black South Africans, established a distinct style at the centre. The most important literature on this centre was by Hobbs and Rankin (1997) in their seminal work on South African printmaking *Printmaking in a transforming South Africa*. The main thrust of this work is the political background as an uneven but fertile landscape for the artists at Rorkes Drift Press.

The Caversham Press was founded in 1985 in the Caversham Valley of KwaZulu-Natal to afford South African artists access to a professional collaborative printmaking studio for the production of traditional limited edition prints (Caversham Press 2014). The Press was the first comprehensive facility of its kind in Southern Africa and has become highly regarded for its reputation as an accessible and collaborative art centre. Due to South Africa’s turbulent political past, the Caversham Press set their foundational ethos as offering accessibility and skills transference, and to nurture emergent artists from disadvantaged backgrounds and other countries (Hobbs and Rankin 1997). To date their list of professional printmakers are, of necessity, artists with a strong political oeuvre, or emerging artists from black communities (Caversham Press 2014). The Caversham Press follows strongly in the Polly Street and Rorkes Drift tradition and does not seek, primarily, to push technology or to adopt a clear stance on non-political printmaking debates.

**3.8. THE FUTURE OF PRINTMAKING** The rate of change in printmaking is exponential in growth. In the last 50 years growth has been several times faster than in the preceding 200 years. What it will look like at 2050 is beyond safe estimation (Noyce 2010:16).

Printmaking has shown a noticeable shift in theme over the past few years. It has been described as a vibrant link between the museum and the market place, the elite and the everyday people (Tala 2009). It is expanding its position from something which is more of aesthetic value to move into the arena of social and often political comment. Due to the nature of print, its repeatability and, therefore, ability to engage with a larger audience, graphic printmaking has had a long history of social and

political engagement (Noyce 2010). To predict the future of printmaking, based on past evidence, is an uncertain endeavour (Hoskins 2013). No specific predictions can be made, but the recognition of general patterns is likely. In this regard three topics need to be addressed, namely the attitudes of printmakers, the public and art critics alike, that govern the use or non-use of technology, process, material and technique (Tala 2009).

**3.8.1. ATTITUDES IN PRINTMAKING** New technological advancements have often been met with scepticism and controversy. The birth of the letterpress caused a rift in the Christian Church resulting in the Reformation because knowledge became non-exclusive (Eisenstein 1980). So too modern plate lithography is still, by many print studios, regarded as an unaccepted medium because it allows for more and quicker editions of prints. These differing attitudes can be seen as an indication that printmaking will lead into the future with mixed agendas (Noyce 2010).

Despite some negative sentiments, print “continues to shape shift with alacrity and take on numerous alternative forms” (Noyce 2010:24). An increasing number of contemporary artists are returning to print in its varied, mutated and synthesised forms since the late 1970s and early 1980s in what is described as the print renaissance (Thorburn 2011). Saunders and Miles (2006:27) point out in their 2006 survey of the contemporary art print, “Print is now a central part of many artists’ activity, the equal of their output in other media, conceived as integral or complementary to it”. Such popularity of printmaking notwithstanding, in critical writing on prints the printed nature of the work is often taken for granted (Pelzer-Montada 2008).

Early print history is marked by conventions and standardisation (Drucker and McVarish 2013:65). Today, commercial printing abides by both these rules and new conventions as a natural evolution of the needs of printed design. However, artistic printmaking seems to have stopped developing these practical conventions and are fixed in a cultural of classic printmaking style as determined by the conventions set at the high point in printmaking. To revolt against this ‘classic style and convention’ all traditions are abandoned and a *laissez-faire* attitude is adopted, resulting in printmaking that accepts anything from video art to driving with a steam roller over a substrate to make an impression such as Drive-By-Press. These attitudes, as described in Chapter 6 of this study, are not only the major factor, but the origin to guide all other factors of printmaking. It is this aspect that guides the field to a new definition. Printmaking is a design activity and design is always a human activity, and so what the practitioners imagine, they will do, and what they do, will become convention.

**3.8.2. TECHNOLOGY IN PRINTMAKING** The questions posed by Hoskins (2013) as to the *raison de-etre* of the digital master printmaker and the collaborative digital printmaking studio drive home an earlier point that digital technologies, unless well-defined and constrained within a framework for a working model in printmaking, muddle the murky waters even more in terms of the troublesome definition of printmaking. There is a call for concise and well defined parameters to not contain printmaking, but to give it a solid foundation to survive the electronic age of rapid change, rapid prototyping and all other speedy changes. This is important because printmaking, by its nature, needs a serious investment of time to hone the skills needed to become proficient.

**3.8.3. MEDIA OF PRINTMAKING** Media specificity calls for printmaking practice to be defined by the media and, therefore, technique and process as afforded by that media. The concept of material thinking offers a way of considering the relationships that take place within the process or tissue of making. During this conception the materials are not just passive objects to be used by the artist, but rather these materials and processes of production have their own intelligence that come into play in interaction with the artist’s creative intelligence (Nelson and Stolterman 2012).

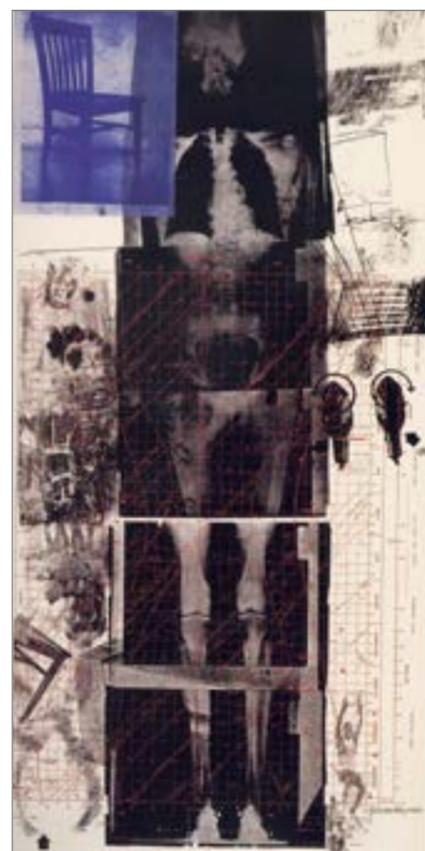
The steady, albeit slow, introduction of new material and processes have tipped the scale to a point where traditionalists can no longer agree to the inclusivity of printmaking. Although innovation calls for new energies to be instilled, many printmakers see this opening of borders as an attempt to undermine skill. Consequently, two sides of the argument exist, both with valid reasons. To describe this Platzker and Wyckoff (2000:32) mention the notion of transgressive printmaking.

Transgressive printmaking is a radical departure from subversive printmaking and as Platzker and Wyckoff (2000) describe it, is an unbounded area of exploration. The hybrid print or even more extreme, the hybrid artwork, containing some printmaking techniques, seems to be the logical next step (Platzker and Wyckoff 2000). John Cage used fire and smoke to establish a printing matrix in his work *Dramatic Fire* (1989), whilst Ruscha used nail polish, chocolate syrup, spinach, coffee and mustard, Worcestershire sauce, motor oil and mouthwash as ink for his portfolio prints titled, *Stains* (1996). Even more extreme is Swiss American artist, Not Vital who uses two freshly slaughtered lambs as an impression in an intaglio print named *Kiss* (Figure 3.17).

Mixing of techniques such as lithography and screen-printing as found in the work *Booster* (Figure 3.18) of Robert Rauschenberg was considered wholly unacceptable at the time of publication in 1967 (Platzker and Wyckoff 2000). Today the mixing of two or three printmaking techniques is commonplace, even among purists. Time and conditioning seems to make more and more extreme practices acceptable. The new surge of revolt against the open-media approach is, hence, understandable because it contributes to the marginalisation of printmaking and printmakers even more.



**Figure 3.17:**  
Not Vital  
*Kiss*  
1996  
lift ground aquatint  
86mm x 1625mm  
Edition of 28  
Banon/Boisante, New York.  
(Platzker and Wyckoff 2000)



**Figure 3.18:**  
Robert Rauschenberg  
*Booster*  
1967  
5-colour lithograph and screenprint 1  
828mm x 852mm  
Edition of 38  
Robert Rauschenberg Foundation and Gemini  
G.E.L.VAGA, New York, NY/Published by  
Gemini G.E.L.  
(Platzker and Wyckoff 2000)

### 3.9. CONCLUSION

The above overview shows the evolution of printmaking as a purpose driven activity of effort and labour with a far reaching influence. The history of print is also the history of communication and of innovation (Thorburn 2011). This literary review also highlights the poli-directional and poli-disciplinary influences that gave birth to modern printmaking. Printmaking has developed from hand impressions to a myriad of new technologies, including a plethora of digital matrices and output options. Traditional intaglio is positioned about halfway in between these extremes.

Printmaking is alive with contradictions and inconsistencies. From the difficult position it occupies as fine art medium, or not, depending on the viewer, to the lack of a working definition, printmaking is always changing its face. Printmaking is so unclear, presumably because it has such a high value of perceptions. Common agreement exists in terms of paintings and drawings but printmaking has no such uniformed collective opinion. There exists both printing and printmaking, just as there exists an old world approach to process and technique compared to the new wave of innovation and technology. Some authors claim that print has experienced a crisis in its claim to be accommodated in art schools, whilst others celebrate the massive interest in printmaking. In the researcher's opinion deciding what to believe or whose views to trust is no easy matter.

The unclear history of the origin of printmaking is the first problem area that needs to be addressed because, the fact that it cannot provide a solid foundation for further research, raises the question of ethics of practice. Printmaking seems to want to embrace all of the positive comments but none of the negative opinions associated with either end of the spectrum. Printmaking wants to be both exclusive and inclusive, mass disseminated and the limited art object, the product of both artist's and artisan's creation. It is because of this reason that the current state of printmaking is such an undefined discipline and 'printmaking-like' artefacts are more commonplace than printmaking.

In this second decade of the 21st Century, the editor in chief of *Wired Magazine* made an appropriate remark. The quote is from an editorial article published in February 2010. (Anderson, 2010:5) "Here's the history of two decades in one sentence. If the past have been about discovering post-institutional models on the web, then the next years will be about applying them to the real world". Printmaking is a creative design activity, often media specific and always influenced by technology, thus, what is true for the web will be true for the printed image.

With so much ambiguity, the response to academic research has been twofold, either an acknowledgement that there exists gaps with vast amounts of research input needed, or a belief that the lack of certainties limits the scope of academic rigour. This research piece, therefore, acknowledges these research shortcomings and highlight surrounding debates and issues to give the researcher's perspective thereof. The issue of intaglio printmaking planning by means of computer is set out as an experiment to add to the limited literature in this regard. The design experiment in this research further contributes to developing reasons why some digital practices are successful, whilst others are not. Those successful practices can be developed further, both practically and as a means of contributing to the literature on intaglio printmaking. Such successful computer planning practices also highlights solutions to traditional practice problems in other design disciplines.

<sup>1</sup> Interview with Christian Diedericks on 20 January 2013. Diedericks is a master printmaker and has exhibited in more than 100 exhibitions, both locally and internationally. He is also a printmaking and design educator with more than 17 years of teaching experience locally and abroad. Diedericks holds a Bachelor of Fine Arts as well as Master's of Fine Art and currently enrolled for a PhD. Diedericks has held printmaking residencies and attended workshops in France, Belgium and Canada and has had his work exhibited in more than 10 countries and 30 collections.

<sup>2</sup> Interview with Eunice Geustyn on 11 April 2013. Geustyn is an artist and academic and has been the Executive Head of the Ruth Prowse School of Art NPC since 2002. Geustyn was Chairman on the Association of Visual Artists from 2006 to 2009 and a Board Member of VANSAWC (Visual Arts Network of SA- Western Cape) from 2010 to 2011. She holds a Master's of Fine Art Degree, a Postgraduate Advanced Diploma in Fine Art, a Bachelor of Fine Art Degree and a Diploma in Fine Art. Her work is featured in many collections, including those of Absa Bank, Boland Bank, Citibank SA, the South African Reserve Bank, the Kochi National Gallery and the University of Cape Town, as well as the Katrine Harries Print Collection and the Sasol Museum Art Collection.

# CHAPTER 4: METHODOLOGY

**4.1. RESEARCH DESIGN APPROACH** The method of inquiry and the research process are both presented as practical artworks – defined as artefacts in answering the research problem on a practical level – as well as on a theoretical level. The problem statement was transcribed to a research design approach of iterative design experimental investigation. To serve as background for the experiment, to build evidence and to inform theory, interviews were conducted to establish a background to the problem, within the practical field of intaglio printmaking. This chapter describes and discusses both the design of the research as an investigation into experimental design, as well as interviews to contextualise the experiment. Secondly, the research design approach and theme of the practice as experiment are described and presented.

The aim of the practical work is to create artefacts to illustrate how knowledge has been produced and reproduced. This study entails the exploration of a process through experimentation. Process innovations are new or improved ways of completing activities, not necessarily to improve or change the end products, but to improve the process or the way in which the end products (in this case artefacts) are created. It is within this practical activity that the research, exploration and innovation lie. James and Baldwin (in Arnold 2012:11) state that as long as all research involves critical enquiry, the strenuous intellectual activity of collecting and sifting of information, the manner of presentation of that knowledge cannot be dismissed as ‘wrong’. It is important to understand that the two parts – both dissertation and body of work – must inform and speak to one another in order to form a holistic body of research.

Schön’s concept of reflection-in-action (see Chapter 2 p8) is useful for the experiment undertaken by the researcher, in that art production can be regarded as cyclical through adaptation, change and improvement. This reflection-in-action as learning model supports the objective of this study in that mastery of the intaglio skill must be learned, by repetition, reflection and adaptation. Sullivan (2010:106) refers to this cyclical reflection as “create and critique”. The proposed methodology (not that of this study per se, but that of computer and software informed intaglio processes) follows the same flow of create and critique or reflect whilst executing. Grabowski and Fick (2009:11) lend a perspective: namely that as a printmaker becomes a choreographer on the stage of the press bed, he/she has to move and order, combine, amplify, subdue and reconsider in order to respond to the affordances of the matrix. The nature of this workflow is reflective as applied in the experiment using Cronje’s Build, Test, Learn model (2011). Figure 4.1 shows the conceptual model used in the methodology employed in this study

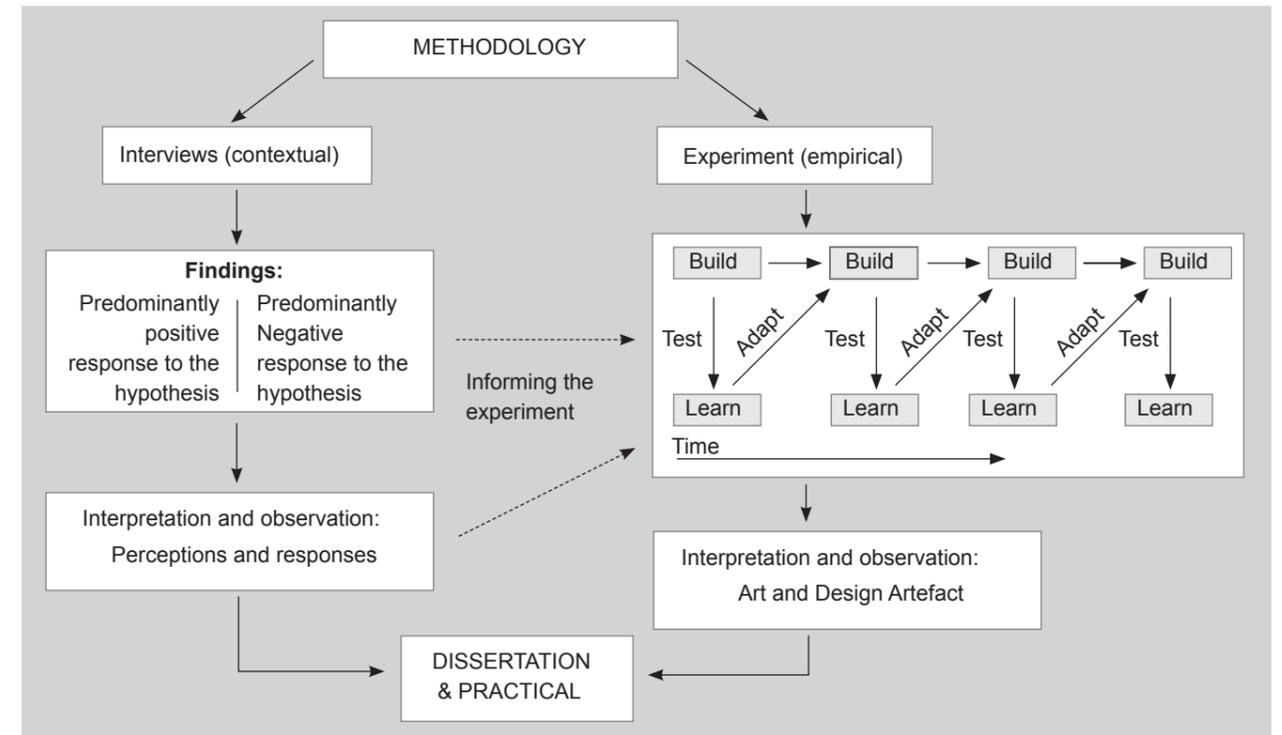


Figure 4.1: Methodology of the study with Cronjé’s (2011) Build Test Learn model incorporated. (Author’s construct)

**4.2. THE EXPERIMENT AS SCIENTIFIC METHOD** The fundamental premise of science is that there are absolute truths to be discovered. These truths are independent of our opinions of them (Popper 1959 in Field and Hole 2003). There are two ways in which researchers can measure these absolute truths: they can observe what happens in the natural world without acting as interfering factor (correlational or observational), or they can manipulate some factor of the environment to observe its effect (experimental). This study focuses on experimental research – obtrusive in nature – as described by Field and Hole (2003). Requirements for experimental research are that evidence must be measured to be accurately replicated by others and that it aims towards an objective answered result.

This experimental research is based on David Hume’s (1739-40) theory of cause and effect (causality). Hume (in Field and Hole 2003) discusses the basic idea of cause preceding effect and that effect can only be the result of an appropriate cause. However, the indeterminate character or the tertium quid brought another dimension to causality. Tertium quid refers to a third factor outside cause and effect that acts as an interfering agent to alter the effect. Using computers to plan the intaglio process has an effect. However, there exists an ontology that determines the quality and number of the computer applications used to plan the print and, therefore, the effect is a result of both cause and the tertium quid. It is this third aspect of non-scientific personal subjectivity, that determines the depth of the applicability of the hypothesis. That is, computers can act as agent for the accurate planning and idea forming of intaglio printmaking.

The variables of this experiment are measured on a ratio data level. This implies that there exist ratios between two things measured but the interval of the scale of continuous measure is of less importance. Discrete variables (non-overlapping categories) are not valuable for this study because the entire premise of the hypothesis relies on the liminal space between the two compared fields: intaglio printmaking and computer technology. This measurement process is broken down to measure the four practical applications: planning the composition, colour, textures and tonal values for an intaglio print that makes use of computer software.

This practical application of the hypothesis used in this study is based on classical ideas of inductive reasoning (Hill 1998). There is, however, critique on this method. The main argument is that the use of this approach to collect evidence to corroborate a theory is logically flawed. Hume's (in Field and Hole 2003:23) critique of inductive reasoning is summed up in his words "just because we observe that night always follows day in the past, does not prove that night will follow day again in the future". He further states that neither action causes the other and that a third aspect – the rotation of the earth – is the real cause. The problem with this line of thought is that nothing then can be measured scientifically. Nothing can be certain and researcher can spiral deeper and deeper into the true cause by questioning what makes the earth spin, what causes that entity and so forth.

To combat this problem, as discussed by Popper (1959), Duhem (in Field and Hole 2003) devised a system of thought where the hypothesis must be altered to fit the observed evidence (effect) if it does not correlate with the causal relationship initially proposed. Duhem believes the scientist should be left to his/her own expert opinion to objectively alter the hypothesis to fit the evidence. Both Bacon and Duhem realised the acknowledgement of the outside influencing factor (*tertium quid*).

Both theory and fact exist in this research project. Often scientists and researchers wrongfully use these concepts in the same context. Theory is an interpretation of data based on a belief system. The data is often fact but the interpretation thereof, in other words what the data means, is theory. If that theory can be repeated by others with the same data and produce the same result, that is it can be tested to be reliable and consistently yield the same result under the same conditions, then it becomes fact or law. This process is known as empiricism. An example of Duhem's (in Field and Hole 2003) above mentioned belief, is evidenced in the work of two esteemed natural scientists. Both Richard Dawkins and Ken Hovind agree on facts although they stand as polar opposites in their interpretation of that data as a result of their view of the natural world. They both use the same observable data but draw completely different conclusions from this. However, both scientists defend their theory and acknowledge their belief system as the inherent starting point from which they build their argument. The factual evidence is never a point of disagreement.

Field and Hole (2003) state that people draw inferences based on their confidence in a certain set of results. As the probability of the result occurring by chance decreases, their confidence in the result being authentic increases.

**4.3. THE RESEARCH INSTRUMENT** Two instruments were used to conduct the research described in this study. Discussions were held with eight printmakers – some of whom were both artist and printmaking educators – to contextualise the hypothesis and to gain an understanding of strengths and weaknesses of the proposed study. Secondly a simulation was designed, and applied in practice to test and record the hypothesis.

**4.3.1. INTERVIEWS** A purposive sample of known and established printmakers and printmaking educators were chosen and telephonic or personal semi-structured interviews were conducted. The aim was not – in a strict sense – the collection of quantitative data but rather to gain an understanding of the perceptions, workflow ethics and techniques used in the interviewees' respective planning practices. The results of the interviews are shown in Table 5.1 p33. Five of the respondents were master printmakers.

A master printmaker, as already mentioned in Chapter 3, is someone who has reached a level of skill and knowledge in producing an edition of prints that shows high levels of mastery and understanding. It is someone who above all, has the patience and skill to apply the mainly linear process of printmaking in a dedicated and accurate fashion. Therefore, the skill of a master printmaker has less to do with artistic talent, and more to do with process application.

**4.3.2. THE PRINTMAKING SIMULATOR** When printmaking is linear and precise, with exact tolerances and variables, planning and ideation is multi-directional, intuitive and loose. It is this planning that computers excel at. Two issues are discussed here: firstly planning with computers as a mediating artefact and secondly, the fidelity value of these computer or partly-computer generated ideas for the purpose of making the printing matrix align with the final hand printed image.

Ideation is seen as generation, development and the communication of ideas, when the idea is the basic unit of thought that can be either concrete or abstract (Jonson 2005), presented in any fashion (visual, audio etc). It is the movement of half-formed or incomplete ideas between nodes to give greater meaning, to complete, and to make sense of those ideas to give shape to solutions, or, in the view of Schön (1983), to move to a more desired state of a system from a less desired, unordered state. This study's application of the computer as simulator follows the assumption that the printmaking students' thinking processes and problem solving can be traced, modelled and corrected, using computers. This is broadly known as the Intelligent Tutoring System popularised in the 1980s. There are researchers who believe this model cannot be used because it is not feasible to construct adequate cognitive models. One alternative view is that students can be encouraged to record, evaluate and diagnose their own learning and problem solving through the use of well-designed cognitive systems such as computer software (Rochester 1993).

Vygotsky (1978) believed that students must gain a self-regulatory (self-diagnostic) capability, via their tutors from a specialised form of tutoring known as cognitive-apprenticeship. This approach implies sharing the problem solving experience between the novice and master practitioner, or a more advanced peer, or a computer. A mentor provides advice, direction and support (scaffolds) only in those areas that the student has difficulty with. As the student advances his skills and knowledge base, scaffolds fade and are replaced by the already mentored problem solving capabilities. Derry and Lajoie (2009) argue that computers can promote shared problem solving without steering it directly. This means that in the building of scaffolds, and the replacement thereof, computers are often more effective than a human teacher. It is from this theoretical understanding that the claim is made by the researcher that computers can act as extremely powerful tools to facilitate procedural knowledge transfer.

**The purpose of the intaglio simulator** Schön (1983) states that there are three ways of acquiring knowledge. The first is self-instruction, but this is unusual. The second is via apprenticeship or Work Integrated Learning. This latter approach involves learning in the real world or as Schön puts it "on-line". He states that both these methods are inefficient and can have serious negative effects. The best and standard method is, therefore, learning in the practicum. This implies an offline but simulated real world practice and problem solving. The learner is exposed to a series of problems and gets coached by a master practitioner (Waks, 2001). This proposed simulator has the benefit of a real life cause without the real life effect. It implies that the repercussions of mistakes are softened and, therefore, the candidate has more freedom and willingness to make mistakes. The simulator also allows the data to be evaluated before application. Robinson (2011) notes that one cannot be truly creative if one is not prepared to make mistakes. Yeoh (2006) as well as Robinson (2011) argue that the fear of the wrong is the greatest inhibiting factor to creativity. An accurate simulator is, therefore, an appropriate tool for learning.

Parallels can be drawn between the above mentioned pedagogical simulator and the intaglio simulator used in the experiment of this study. Both have the advantage of real life problems and solutions without the cost and time of real life mistakes. This prompts the student to be more daring and open to experimentation, an attitude that is not easily promoted in traditional intaglio printmaking.

**Serendipity** The 'happy accident', as often described by printmakers, can be seen as serendipity: the occurrence and development of events by chance in a happy or beneficial way. Some arguments exist as to the undesirable minimising of this happy accident because it is considered more prone to take place when hand drawings and thumbnail sketches are used, instead of computer imagery. However, with the freedom and chance for the happy accident, also comes the chance for the unhappy accident. As intaglio printmaking is a skill that earns a printmaker a title as master printmaker, limiting chance, or rather understanding and identifying variables, is of key importance. As this study aims to show that computer software can act as a legitimising factor to understand these variables better when planning a print, what is really at stake is the accuracy of the software and the output device of this planning document.

The extent of serendipity as unknown outcomes (although favourable) is equal to the unfavourable outcomes. 'Happy' and 'sad' mistakes both exist and, by their nature, cannot be pre-determined. The problem with making allowance for this condition is the lack of learning anything of value. Empirical value, therefore, lies in being able to do something well that can be

repeated. For this purpose, these unknown variables that cause ‘accidents’ need to be identified and isolated to be studied and understood in an attempt to manipulate them.

Besides a simulator, there exists another alternative to the above mentioned serendipity problem. The most accurate planning method for intaglio would be intaglio itself where repeated tests are made and recorded until an appropriate recipe and result is attained. The practicality of this is wholly unsuitable because intaglio is a laborious process with too many variables that have to be considered. Planning intaglio printmaking by means of intaglio printmaking is circular reasoning and, hence, illogical. A computer simulated intaglio process is designed to limit the values of the distinct variables as much as possible, as well as to record the variables and their values.

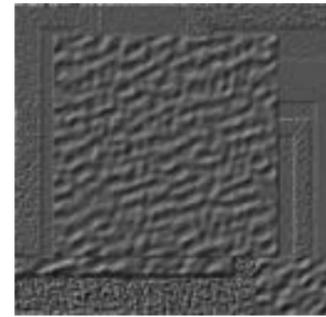
**The nature of the simulator** Based on Hume’s cause and effect and Hills’ inductive reasoning, the simulator designed for this study follows a process in inclusive causal variables. Field and Hole (2003) mention that an independent and dependant variable must be established for scientific inquiry. The dependant variable refers to the outcome measured: the effect. The independent variable refers to the cause of that outcome, or the variable that can be manipulated. With measured outcome as dependant variable: the level of accuracy of using computer software to plan and ideate an intaglio print can be measured. The independent variable becomes the use of computer software. The most basic and most valuable way of manipulating the independent variable is simply to have it present or absent. In that sense the use of software to plan the intaglio process should be both executed and omitted. It is, however, the case that enough material, examples and lived experience exist on the omitting of the variable in the experiment. It then logically follows that the control of the experiment (the omitting of the variable in a second control experiment) can be found elsewhere.

The causal relationship between the two nodes: computer software and intaglio printmaking planning are then tested with a simulation. The deductive reasoning behind this setup is that if computers are not used in the planning of the intaglio print, it will be less successful. However, as stated above, an inductive method is used to gather evidence to show the hypothesis could be true rather than to prove the opposite. Based on Schön’s (1983) concept of knowledge acquisition – in that this study, as in all research, is about uncovering some truth – the simulator becomes the tool of choice.

**Strengths of the simulator** The developed simulator has two inherent strengths. Firstly, a mistake made on the simulator does not have the implications of a real world mistake, thus promoting a safe learning environment. Secondly, when compared to the intaglio process, it is relatively easy to make a change or alteration to the design. A computer is a valuable planning tools because it can evaluate the result before production (Yeoh 2006).

A computer has limitations as a planning simulator. It is, however, less constricting than alternative forms of planning. Computers show no biased thinking patterns and, thus, the result of using computers for planning is superior to either a cognitive only planning process, or a paper based planning process. These mediums have an even greater disconnection between themselves and the intaglio process. All imagery in intaglio printmaking needs to be mirrored (left to right reversal). Whether it is the use of the mirror to reverse the image or pencil and paper only, the human embedded bias as to how things appear mirrored is the constricting factor. Writing one’s name in reverse is a mental, not physical exercise. Using a mirror to see what one’s name looks like mirrored makes it somewhat easier, but still needs some practice and a great deal of time and concentration to record this mirrored image accurately. Computer software accomplishes this task effortlessly without the need for its operator to contemplate and imagine what the mirrored image would look like.

**Limitations of the simulator** Plaztker and Wyckoff (2000) state that although computer technologies are now accepted in the printmaking studio, there is one final barrier to be overcome, that of getting what is presented on the computer screen to a stable printed output format. This is the single point that still haunts so many novice designers and other computer users alike: the great disconnect between the digital computer screen and printed page. Printmakers such as Peter Halley circumvented this problem with his artwork *Superdream Mutation* (Figure 4.2). Halley used the digital raster format GIF (Graphic Interchange Format) as medium. Pre-world wide web, he used a system known as ‘The Thing’ that was employed by the City of



**Figure 4.2:**  
Peter Halley  
*Superdream Mutation*  
1993  
Electronic GIF image  
Variable dimensions  
The Thing  
(Fishpool 2009)

New York as a bulletin board, to display and sell his digital artwork. This artwork was possibly the first artwork created by, and disseminated solely by computer technologies for online viewing.

The above solution to answer the problem of the disconnect between computer screen and printed sheet is only applicable should both computer software and hardware be used to create and to output prints. The application of this research is to use a traditional process as output and contemporary computer technology as input.

The tools embedded in software allow inspiration of application but people who are not proficient enough in using the computer software experience a sense of frustration (Yeoh 2006). The implication is that such users are often intimidated which stands in the way of expression and creation and thus results in paralysis of innovation (Nelson and Stolterman 2012). Another factor to be considered is the limitation of computers due to the indirect translation of people’s ideas from the brain to the computer screen (Yeoh 2006).

Such limitations are the input hardware of the computer which translates the human hand movement to the computer cursor. Understanding and moving between these two different mediums seamlessly, suppressing their respective weaknesses and promoting their strengths is fundamentally important in the simulator. Hodge (2009) argues against computer formed ideas because he prefers working on paper first, transforming his ideas to a computer at later stages. However, it must be said that what Hodge refers to is complex Computer Aided Design (CAD) and modelling packages that have a greater number of settings and tolerances that have to be accounted for before he can sketch on the computer. The nature of the CAD software (3-dimensional technical drawing software used in disciplines such as architecture, interior design, product design, and engineering) does not allow such loose idea forming as is used in this intaglio planning simulator.

There are two reasons why computers cannot fully simulate the intaglio process. Firstly, the computer allows a non-destructive and multi-directional workflow where intaglio does not. The second key reason is the disconnect, on several levels, between the computer screen and intaglio printed sheet. To describe this condition, three factors (listed below) have to be considered when planning takes place in Phase 1 (Figure 1.3 p3) in terms of colour, size/perception of size, and resolution/quality.

In all instances the alignment of colour, size and resolution on both computer screen and intaglio matrix are impossible. What is possible is a close attempt to make these aspects appear similar. It might not be the same colour or size or quality, but understanding the software and the digital realm, it can be manipulated to appear the same as on the intaglio matrix.

**Colour as perception** In order to understand the disconnect between computer monitor and intaglio print, a short description of the different colour spaces at work in the colour application of the simulator has to be given. Colour spaces refer to descriptions of available colour for a specific device (Fairchild 2005). This study will focus only on the three models used, namely RGB (Red, Green and Blue) Colour space, HSV (Hue, Saturation and Value) Colour space and CMYK (Cyan, Magenta, Yellow and Keyline) Colour space.

Colour is so complex a phenomenon that even a concise explanation would fill a few books’ worth of method, mathematics and light science. Richards (1935) stated in his seminal work on physics that colour is a fascinating, important but difficult field of study.

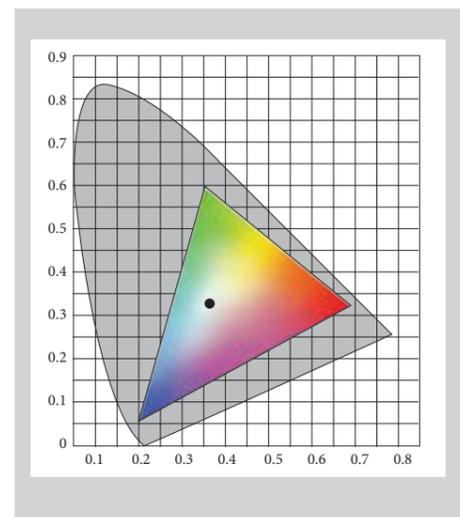
Richards (1935) mentions that the human eye (or rather the optical nervous system) does not have the ability to analyse light, merely perceive it. From this observation the first important declaration is that colour is a perception. Expensive and complicated methods of spectrophotometry are used to describe the quality and quantity as well as the illumination of light. True scientific measured colour is irrelevant for this study because, in its simplest form, colour can be described accurately by means of the frequency of that colour in the electromagnetic spectrum. What is important for this study is only what colour is perceived as being correct.

As any designer will know, colour is a variable that is extremely difficult to predict when comparing computer displayed colour to printed colour. The reason is simply the differences in kinds of light and different colour spaces. Computer monitors display tens of thousands of tiny light beams into the eye to create colour. This kind of light called luminescent or transmitted light is by its nature more vibrant and saturated than reflected light seen as colour on a printed paper (Verhoeven 2008). Besides the disconnect between computer monitor and physical printed paper, the human eye and its ability to perceive only certain colours, is the third variable that creates misalignments between colour spaces.

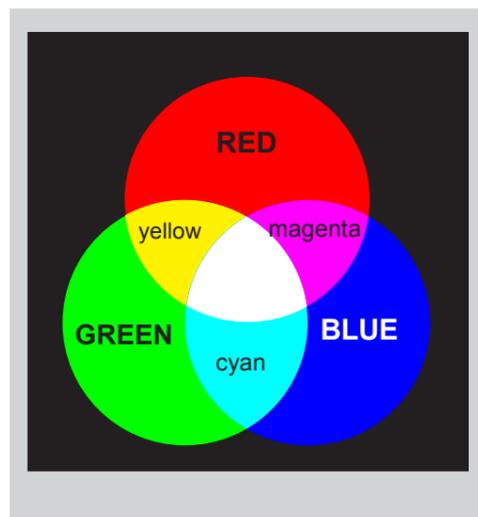
Purposefully excluded from this study are explanations and interrogations on the boundaries and beyond the visible spectrum of human vision in the electromagnetic range (this study will consider only visible light), personal colour perception because every person sees colour slightly differently to others according to the colour of the iris, spot colours and the emotive qualities of colour. Refraction, accommodation and persistence of vision and all other topics that deal with light-bending properties and moving imagery will also not be discussed.

**Colour disconnect between monitor and intaglio** Devices for creating and displaying colours vary, and thus limitations for colour are defined. The discrepancy is due to the way light is either reflected and/or emitted. Colour spaces can be represented as three dimensional models with the periphery of these models representing the limitations of what that colour space can produce. For example, a black and white television set has a colour space that only allows 256 shades of grey. When a full colour video signal is displayed on such a television set, the two colour spaces are not equal in size and shape. The missing colour information is described as 'out of gamut' where gamut refers to an accurate display of a colour space. So too, printed black on a page appears far darker to the human eye than a black image on colour television screen. In this sense colour on a computer screen versus colour on a printed substrate, such as paper, uses different colour spaces (Eckstut and Eckstut 2013).

Therefore, there exists a region of colours that cannot be reproduced by the computer screen and software but can be reproduced in intaglio print. The opposite is, therefore, also true. Some colours can be produced on a computer screen but not in intaglio printmaking. This problem cannot be overcome, only limited. Computer monitors of all kinds display emitting light in the RGB (Red Green and Blue) colour model. All types of printed substrates use colour models such as CMYK, Pantone Colour System or similar.



**Figure 4.3:**  
The visible spectrum  
(Author's construct)



**Figure 4.4:**  
RGB colours  
(Author's construct)

There exists some colours that cannot be created by either intaglio inks and/or computers that are visible to the human eye. Figure 4.3 shows the disconnect between the visible spectrum of light (what humans can see) in grey, and the RGB colour space. It is clear that computer monitors can only produce a percentage of visible colours. Not taking into account some extreme light sources, sunlight serves as the light source with the widest range of visible light to the human eye and, therefore, contains the most wavelengths applicable to illumination. Another very important fact is that sunlight's wave length of maximum energy on the earth's surface is about 500μm, a green colour (Richards 1935). The human eye ranging in visible light from 400μm (violet) to 800μm (red) is most sensitive to the range of 500μm to 555μm. Humans, therefore, see more green than any other colour, a phenomena that many biologists believe to be a function of micro-evolution, that is: the human ability to adapt the eye to the most principal light source (Kumar 2008). The importance of this capacity is that electronic output devices are not aligned with the human ability to see more greens. Green is, therefore, given special attention in the second iteration that deals with colour.

**RGB colour space** This colour model uses transmitted light to create colour and, therefore, has white as culmination of all the visible spectrum of colours (as seen in a rainbow) reduced to three primary colours: red, green and blue (Figure 4.4). It is the obvious choice of colour space for computer monitors because it is the closest colour space to the way the human eye sees colour (Eckstut and Eckstut 2013). Digital devices such as monitors, mobile cellular devices and projectors, mix three colours in full intensity to produce white, a process known as the additive model.

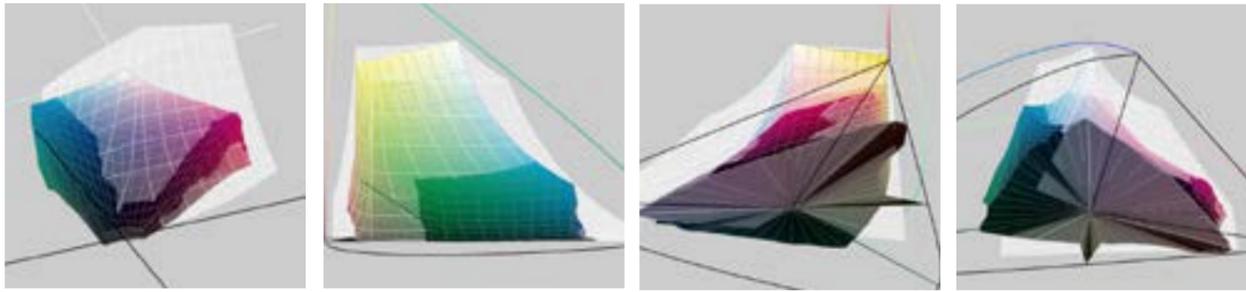
Most colours are a composite of colours and, therefore, all the wave lengths included, as well as, the distribution of the total energy among these wave lengths have to be specified (Watkinson 2001). Such an example in the RGB space is white. When looking at the model above it can be logically concluded that the RGB model's secondary colours are the primaries of the CMYK colour space, where K (black) is the absence of all RGB. It would, however, be wrong to conclude that these two colour models are equal in size and shape. RGB as a colour model is considerably larger than the CMYK colour model.

The practical application of this phenomenon is that computer users find themselves perplexed every day: the screen colour does not match the printed colour, and often the screen colour looks more vibrant, more saturated than the relatively dull printed page. It is not a simple matter of calibration. The RGB model can show significantly more colours than the CMYK model can produce. Therefore, a large percentage of RGB colour is out of gamut when printed CMYK. This problem is accounted for in the simulator by clipping the RGB colour value to the closest corresponding CMYK value.

**CMYK colour space** CMYK refers to Cyan Magenta Yellow and Keyline (black) which is known as the process colours or subtractive colour space. CMYK colour space is used by designers to specify any printed colour and, therefore, it relies on reflected light to show its colour properties. The colour of the object, or in the case of this study, the colour of the printed intaglio artwork at any given area, is defined by two properties: the material from which that object (ink and paper) is manufactured, and the composition of light that falls onto that object (Richards 1935).

Figure 4.5 shows the gamuts of RGB (in white) and CMYK (in colour) at various angles. It is noticeable that RGB contains more colours than CMYK. However, a darker black can be produced by CMYK compared to RGB. Also note that some colours in the cyan and green range, as well as the extreme magenta, is out of gamut when CMYK is represented in RGB. The coloured curved line represents the spectrum of visible colours to the human eye (Figure 4.3)

**HSV colour space** The HSV (Hue, Saturation and Value) model is one of the most widely used ways to display the RGB colour space. It should not be seen as a third colour space but rather a different model to display RGB. HSV or often called HSB where B is referred to as brightness is the most standardised, easy to use and therefore robust colour model for transmitted light (Tozer 2004). HSV colour space is represented as a round tube as seen from the top, a circle. The depth of the tube determines the value or brightness of that colour. The position of the point selected away from the centre axis (that is the radius) sets the saturation and the angle measured from the centre axis determines the hue. This model is used in the second iteration of the experiment to define colour as well as to recalculate the colour from the computer screen to a colour printing ink.



**Figure 4.5:** A comparison between RGB colour space, CMYK colour space and the visible spectrum (Author's construct using ColorSync Utility software)

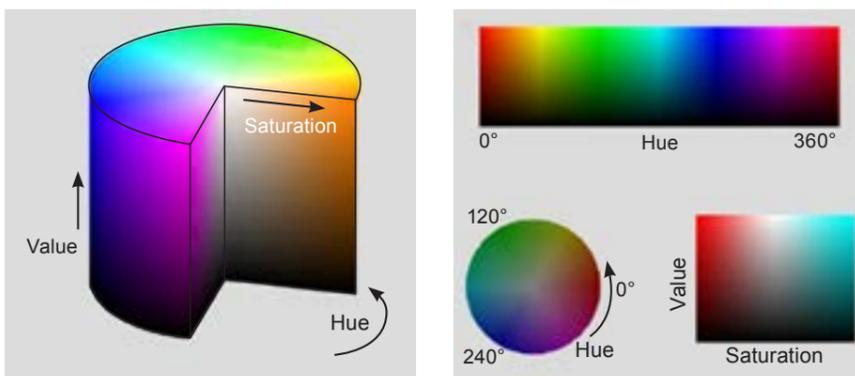
Figure 4.6 shows the HSV colour space. Hue refers to the intensities of the RGB values that are not the same. The hue is simply the colour, red or blue or orange or green and so on. Saturation is a function of the difference between the strongest and the weakest of the intensities of the primary colours employed. When all the primaries are equal, the result is zero saturation or a value of white to grey to black. When the difference in primaries is maximum, saturation of that hue is also at its maximum. Value or brightness is determined by the cumulative amount of light transmitted and, therefore, is in a range from black, no light to white, maximum light intensity. As an example an HSV colour of process, cyan, is described as follows:

Hue (H)=196°

Saturation (S)= 100%

Value (V)=94%

**Size and perception of size** Size and the perception of object size is dependent on the view setting of the software. A hundred per cent view on screen has little value when describing the level of detail and actual size when printed. As is the case with different colour spaces in digital images compared to print, size on the electronic output device cannot be compared or matched to the printed substrate. Software allows the user to zoom in and out, almost to levels of infinity irrespective of the size of the screen. Any seasoned designer will insist on judging a printed piece on material rather than on screen display because he/she knows that what is viewed on screen with regard to size, might be highly deceptive. Measurements on screen use pixels or point and picas as defining units; printed matter uses millimetres and centimetres, or inches and feet. These two modes of measure cannot be aligned. A one millimetre thick line on screen may measure 100 pixels thick when zoomed in or 1 pixel when zoomed out and is, therefore, a relative measurement. On paper however, the measurement is absolute.



**Figure 4.6:** The HSV colour model (Eckstut and Eckstut 2013)

**Quality and resolution** Quality is the most abstract of measurements. However, when a standard is set and a ruler is provided, quality becomes measurable and undisputed. On computer screen resolution is usually described as a quality of display. Resolution refers to the number of pixels per square inch of that display. In digital photography, resolution is measured on cameras as megapixels where mega means a million. The size of the image is not described, just the number of coloured dots or pixels that comprise the image. On screen there exists an inverse direct relationship between the number of pixels and the image size. More pixels means a smaller image should the resolution be constant. The resolution can be altered on screen, and

thus the quality and size may differ. On digitally printed imagery on paper, resolution is constant. In intaglio printing, resolution in that sense does not exist and a comparison between intaglio print and computer quality cannot be made.

The fact that these misalignments exist, does not exclude the computer and software as legitimate simulators. The alternative is either hand drawn ideas or purely an imaginative exercise with no material planning document. Thompson's (2014) study into the meaning making and multi-modal approaches of intaglio printmakers list these traditional methods of planning. She describes how most students of printmaking are surprised or disappointed by the printed result due to the lack of efficient planning. The processes used are often only a mental activity, or an inaccurate pencil or pen drawing, that then acts as planning agent.

**4.4. RESEARCH PROCESS** A sample chosen for the interviews undertaken for this research project has snowballed from various sources. These include a published list of South African printmakers, a desktop study and various local art magazines. The size of the population was not determined, but rather kept open-ended until such time as data saturation was reached. Only a small number of printmakers were located in Cape Town (where the researcher is situated). Six of the printmakers were interviewed one-on-one. Two respondents were contacted telephonically due to geographical location in different parts of South Africa. The aim was to limit the respondents to South Africa because it is a key aim of this study to seek a research answer within the local printmaking community.

The areas to investigate for the practical intervention were selected from a printmaking curriculum for 2nd year printmaking students, which is, in turn, based on literature on intaglio printmaking (Adam and Robertson 2007). These four aspects of intaglio (layout, colour, textures and tonal values) chosen to be investigated were combined in a fifth iteration (synthesis). These five investigations, represented as cycles of experiments, are considered to be some of the major issues students struggle to master within the first contact sessions they have in the printmaking studio (Thompson 2014).

**4.5. LIMITATIONS OF THE EXPERIMENT** Two limitations exist in the way that this experiment was designed and executed. Firstly, the act of producing a design artefact is highly subjective and, therefore, the experiment itself cannot claim to be free from bias. Despite this, computers as tools are not responsive to emotion and, therefore, act as inanimate objects without subjectivity. However, the way in which the computer is used can lead to some bias, although the researcher's intention was to minimise this.

The second limitation of this experiment is the lack of a control group. The independent variables – in the simplest case – need to be omitted to show that the opposite is true, that is, when computer technology is excluded from an ideation process in intaglio printmaking, the planning is less successful and more prone to mistakes. However, because lived experience has shown the opposite to be true, the control is not applicable in this study. Furthermore, personally administering the control cannot be undertaken in an scientific manner as bias will be too strong. Others cannot be asked to conduct the control either because the problem of the researcher's planning and design making would have to be aligned with theirs. The fact that the planning of intaglio is as troublesome and laborious as shown in the literature, acts as a valid control.

**4.6. THE ITERATIVE DESIGN EXPERIMENT** To describe the design experiment as intaglio artefacts, a theme for the artwork was established. Webster (2013) describes a theme as a setting or ambience to a venue or activity. The selected theme of this study, entropy (see Chapter 2), is a lens or point of view from which the artwork should be viewed. The theme is topical to the broader concept and ideas of the study and set to enhance and compliment the research question, namely: **To what extent can computer technologies be used for the ideation and planning in intaglio printmaking?** The most valuable embedded topics in the theme are that of process and the problem of degeneration. A solution to this is offered in technology to act as agent to counteract such negative processes, either slowing them down or reversing them.

The five iterations are designed to cumulatively answer the research questions as established by the literature on the subject. Topics regarding legitimacy of usage of technology in the intaglio process as well as material and process are problematised

from the literature. The design experiment, therefore, answers the questions set out and explains how the computer and its enabling software offer solutions to the problem of planning in the intaglio print. Intaglio artwork as artefact has to be created and tested against the simulator at each stage of production. Reflecting the outcome (at any given stage of production) and realigning the reality of that outcome with the simulator keep the disconnect between these two fields to a minimum. This balance is necessary to establish the fidelity of the simulator across all five iterations and, therefore, tests its accuracy.

The artefact created is both the result and critical component of the design experiment. Five successive intaglio planning issues are addressed and tested resulting in the creation of five sets of artefacts. The results from this experiment are analysed and concluded to describe the strengths, weaknesses and value of the simulator.

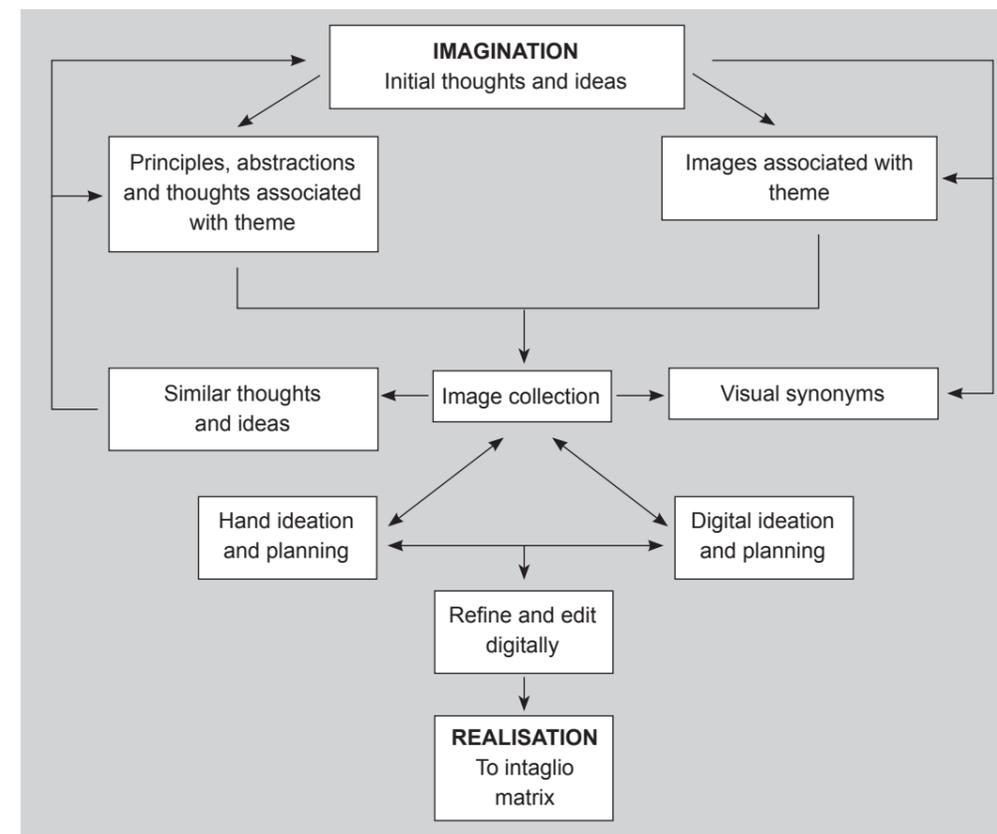
**4.7. WORKFLOW OF THE PRAXIS** The design process takes place in processes of preparation, incubation, inspiration and verification (Wallas 1926). Although Wallas's model have been described as outdated (Hill 1998), many other authors still use Wallas's model as classic basis for design education (Culley and Dekoninck 2008, Howard-Jones 2002).

In Wallas's model, all but the last of these stages, namely verification of the creative process, is a mental activity. All humans think differently and thus the researcher can only describe a recording of his personal preferred workflow model. Such a linear workflow model does not promote creative thinking but rather a divergent, repetitive review and adaptation in multiple directions that resonates with personal experience of how to create ideas and, ultimately, design or make artwork. This is not to say Wallas' design model is not applicable, rather it is the order and linear sequence that is questioned, more than the processes itself.

As stated above, although not strictly linear or exclusive to a category, the planning for the practical artwork created for the purpose of this study involves the phases outlined in Figure 4.7. The first three phases of design (cognitive, physical and technical) are cyclical and, therefore, repeat themselves until a desired final planning document exists. Once the final phase of outcome (production of the final intaglio print) is entered only a limited amount of alteration can be made and, therefore, the planning serves as a blueprint where the production serves as a building activity based on that blueprint. Figure 4.8 shows these phases as the flow of ideas, labour and energy from initial *Imagination* to final *Realisation*. This model is applied to the serve as the method for the creation of the design artefact (the experiment). The cycle is repeated because there are different states of the intaglio matrix. What may be the *Realisation* at one state may serve as *Imagination* in the next state.

Phase 1	Imagine theme Imagine imagery associated with that theme	<b>COGNITIVE</b>
Phase 2	Collection of imagery associated with that theme Visual synonyms collection Sketch by hand (scamps) to ideate composition	<b>PHYSICAL</b>
Phase 3	Digitise images Digitise scamps Digital Colour correction and contrast Inverse image; set size, layers and guides	<b>TECHNICAL</b>
Phase 4	Print image (digital print) and transfer to intaglio plate	<b>OUTCOME</b>

**Figure 4.7:**  
Design phases  
(Author's construct)



**Figure 4.8:**  
The Planning process  
from Imagination to  
Realisation  
(Author's construct)

**4.8. CONCLUSION** The method of the iterative design experiment is described as obtrusive. This indicates the cause is controlled and altered to measure the effect thereof. The application of this cause (the experiment) is recorded in the next chapter with continual observations at every step. The data gathered from that is analysed in Chapter 6. The experiment was informed by the interviews and has a topical theme of work ethic, work method and the legitimacy of the hypothesis of this study. Several aspects of research methodology were applied and adapted to a research design that fits within the constraints of this study. Although strictly speaking the methodology can be described as iterative and experimental, some aspects of practice-led research surfaces. Such aspects include the value of design artefact as product of research and the process application of that creation.

# CHAPTER 5: APPLICATION AND FINDINGS

**5.1. INTRODUCTION** As the research design is two pronged – interviews as well as an iterative design experiment – the application of the experiment and the findings described in this chapter, are divided into two sections. Table 5.1 shows the findings of the eight semi-structured interviews. The topics of discussion in the interviews are shown in the top row of this with the respondents’ comments listed below.

The five iterations of the design experiment follow after Table 5.1. The experimental part of this study, that is the practical artefact creation, was recorded in a systematic manor of ‘do and record’. At every stage or state of creation a photographic recording was made of the artwork and the process was written down to show the workflow and adaptations to address variables as they arose. The findings are listed in this chapter while the discussion and analysis follows in the next chapter.

**5.2. INTERVIEWS** Table 5.1 show the respondents’ reactions. The recording of the interviews was kept as close as possible to the interviewees’ own words and sentiments.

**Table 5.1:** Responses from semi-structured interviews

Respondent	Profession	Method of planning	Approach to computers in printmaking planning	Strengths of hypothesis	Problems of hypothesis	Comments on skill, practice and learning of printmaking
Respondent A:	She is a professional print-maker with a studio that prints high quality intaglio for various artists and is well known for quality. She has been formally educated in Europe on intaglio printmaking.	She is not an artist but she helps artist to visualise their prints with a big selection of previous test plates and paper based planning	General negative attitude. She mentions that the difference between computers and intaglio is too great to use computers effectively	None	Computers are not appropriate tools in the intaglio studio. The modes of operation are too different although she does know of artists who use computers successfully	“The only way to learn is to do it yourself. Computers cannot be used as teaching tool.”
Respondent B:	She is a well-known master printmaker with a studio at an art institute where she is principal and printmaking educator.	She plans by drawing on paper, cutting and pasting images with scissors and glue to an acceptable level regarding composition. She then draws directly on plate. She intuitively plans and applies design decisions further on the plate. Her understanding (experience) of the methodologies limits the need for very accurate planning	Concept is the key in any artwork, the method to produce the print is of lesser importance.  “Printmaking has always been involved in the latest technology, as it was a way to industrialise art”.	This study should be very valuable for beginner printmakers. Students often acknowledge that they don’t know what it (the final print) is going to look like.  “Realised outcomes gets closer aligned with expected outcomes as skillset improves”.	She describes “alchemy”: the magic and uncertainty when perceived images appear as first proof on paper. Computers cannot recreate that uncertainty.	Printmaking requires knowledge, skill and experience. Good printmakers are committed, methodical, meticulous, thorough, and willing to go the extra mile and apply more time and effort. Intaglio printmakers are inherently purist.  Low new student intake in printmaking is due to the ‘instant gratification’ generation. Computers offer click of the button solutions to print, compared too many hours it takes to make an intaglio print.  There is a collaboration between master printmaker and artist that offer cross disciplinary learning
Respondent C:	She is a well-known artist and has been invited to international printmaking residencies. She does not print her own work but has a lot of experience as artist working with master printmakers.	She prints photographed images digitally and then composes on paper.  She prints a keyline black plate to get outlines an apply colour with pastels to see what colour would look like.  She also works directly on plate to explore the unknown outcome. Her soft ground came out as complete surprises. She describes a vast array of unknown possibilities in intaglio.	She is aware of a South African printmaking studio that considers any new method sacrilegious although she does not agree with this view.	The translation between drawing and print was not satisfactory to her. She seeks a better link between drawing and intaglio printmaking. New technologies might offer that..	The proposed simulator might work, but she is unsure. Unless its applied and tested, one will never know.	Often, but wrongfully, you as artist think you have enough knowledge to successfully execute an intaglio print. Artist must always be willing to learn more.  Intaglio is a long process of hit and miss. She was often very disappointed when proofed her work  She used a master printmaker to experiment and develop a new method to suit her needs.

Respondent	Profession	Method of planning	Approach to computers in printmaking planning	Strengths of hypothesis	Problems of hypothesis	Comments on skill, practice and learning of printmaking
Respondent D:	He is a well known intaglio printmaker and artist. He prints his own work and lectures on printmaking.	He formulates his ideas mentally first and then draws that idea on paper  He also uses digital photography as planning medium. He photographs subjects and then uses software to edit and make up digital compositions. He then transfers the image to plate only after he has a final digital design  He uses only one software application (Adobe Photoshop) to plan and finalise his designs.	He is very open to technology and wants to learn more/new software applications. He acknowledges that computers as inanimate tools have tremendous value. He says it does not make sense not to use computers as a tool.  He mentions that generally, artists are lazy, not keeping up with technology. Artists are also overwhelmed with technology that intimidates them	He agrees with the hypothesis. He expresses opening of possibilities and layered approach to use computers as tools in printmaking planning.  He also argues that computers can help to plan intaglio much faster than drawing can.	The dialogue between hand and print can only be controlled to a point. The plate has a life of its own and therefore a print cannot be planned fully	He argues that digital print cannot be considered printing because there is no matrix. Digital output is also not printmaking as it is an open edition (not valid for true artist printmaking).  Time and experience does not limit accidents on the plate; good or bad.  He mentions that serendipity has nothing to do with computers.
Respondent E:	She is a master printmaker and artist.  She runs her own studio and is well known as academic and lecturer at various universities.	She formulates her ideas and then sources material from books.  She plans very thoroughly on paper and then works directly on the plate.	She is generally negative towards the idea of computers in printmaking. She says one must like the laborious hand process to be a good printmaker.  She also mentions that printmakers have to be able to draw (by hand).	None	Computers are not an easy solution. It takes lots of skill to use software. Computer is flat, intaglio has recesses, visually and metaphorically, there is a disconnect.  Computers lack subtlety and sensitivity of the intaglio process.	She notes that students do not have the work ethic or perseverance needed for intaglio processes anymore. Students are too result orientated, they are not prepared to work the plate.  She mentions that others (artists, printmakers), are horrified when we do things differently and are therefore opposed to computer technology.
Respondent F:	He is an artist and printmaker.	He draws his design on paper and then uses a mirror to redraw the image in reverse.	He is not interested in computer technology whatsoever. He acknowledges that he manages without computers	None	He is not keen to include computers in any manner whatsoever.	None
Respondent G:	He is a professor of fine arts and well known author on printmaking.  He is also an artist and well known printmaker.	He conceptualises mentally (envisages) first then uses drawing, photography and photocopying to design a final layout.  He does mock-up in pen and paper, or strip images together for layout, scale and composition	He is of an older generation, more comfortable with the medium of drawing and not used to digital technologies. He does, however, promotes digital planning to his students, especially for digital proofing before the final print is made.	None	None	He says that in a teaching environment, using digital technologies works well as it provides instant gratification to students and therefore a sense of accomplishment.
Respondent H	She is a professional and master printmaker and artist. She is well known as printmaker and focuses mainly on intaglio processes..	She uses a sketchbook and works on detailed figurative drawings before she works on the plate. She often reverses her images by means of photocopy.	Respondent H has done hybrid printmaking using digital printing combined with intaglio processes but does not use digital processes for planning. She is not opposed to this but it is unfamiliar to her and she is more comfortable with drawing on paper only.	In principal, she is not opposed to the idea but too unfamiliar with computers to make any other comment.	She is concerned about the lack of creativity when using computers in the intaglio process. She acknowledges that much of the creative process happens on the plate.	She often teaches printmaking to university students who have majored in printmaking but have never done printmaking.  She claims that students are not interested in printmaking due to the investment of time.

**5.2.1. KEY POINTS** Two very distinct paradigms emerged from the interviews conducted: those printmakers who are opposed to modern intervention in intaglio printmaking and those who are in favour of it. The amount of time spent as practitioner or age did not have a substantial influence on the individual's stance. The issues are more deeply rooted in personal preference and the responses evoked quite strong opinions. The researcher attributes this attitude to the indication of this study, or rather the perceived indication that they (the interviewees) are 'doing it wrong', and 'I have a better method'. Some of the interviewees also saw the intervention of computer technology as an attempt to undermine their master skill developed and crafted over years.

Emotive responses, rather than factual evidence were a hallmark of the responses by eight interviewees on the hypothesis of this research piece. What emerge here are the limitations and territory of software and computers as perceived and argued by the respondents. It seems that all the interviewees agree that a computer printout cannot replace an intaglio print: the difference is too great. They also suggested that a simulation of intaglio prints on a computer is not acceptable and one should not pretend they look the same. However, for planning purposes, computers and software can play a vital role. The analysed data from these interviews is discussed in detail in Chapter 6.

## 5.3. ITERATION 1: IMAGE REVERSAL, COMPOSITION AND LAYOUT

**5.3.1. RATIONALE** The aim of the first artwork (Figure 5.1) is to develop and show the functionality of the software and its ability to change colour spaces, from colour to greyscale (black and white) and serve as a layout tool for purposes of image composition planning. A deliberate attempt was made to use typography in the first series to illustrate the computer's superior ability to handle such typographical elements in the process described.

**5.3.2. THEME OF THE ARTWORK** This image reflects an almost certain human condition associated with the aging process – the depreciation of 20/20 vision. Cataracts, the clouding of the eyes' lens is a condition that escapes few people in old age and is the primary cause of blindness. This process of deterioration is an automated process within the system, (that is entropy) that needs interference to counteract this process. More than just physical seeing, people use the term 'vision' as a synonym for forward looking and planning, and in a sense, having direction. In the same way perspective deals with the angular properties of vision and light reflection of objects back to the eye, but also refers to people's ability to position an idea within a broader context.

Vision is man's primary survival sense so it is no surprise that so much technology and research has been devoted to restoring human vision. Technologically advanced artificial lenses of all sorts bend light outside the eye to restore and improve vision. All sight enhancing instruments work on this basis: changing the colour and angles of light. The science of optometry, or the mathematical formulations of seeing, uses modern glass and plastic composites shaped in curves and angles to bend light to an individual eye's requirements, controlling the angles and qualities of the light to strike the retina correctly and improve vision.

**5.3.3. TECHNIQUE, PROCESS AND MATERIAL** The intaglio technique used for the first set of artworks (Figure 5.1 to Figure 5.21) is drypoint, which refers to hand made indentations or depressions on the printing plate to make up the matrix. A clear acrylic plate (Perspex) of 260mm x 410mm was used for this iteration because it allows the researcher to put the design at the back of the plate and view the design through the Perspex to trace it. This choice of medium also allows very fine scratches and marks to be created on the plate to accommodate great detail. Perspex serves well in this regard but has a very limited lifespan and deteriorates quickly. It is also prone to scratches if not handled with great care. The first iteration consists of a series of five progressive reworked prints.

The first step in the printing process was to digitise all the images. Both vector and bitmap data was used. Vector data was created in Adobe Illustrator and imported to the Adobe Photoshop document as a 'smart object'. A smart object serves as foreign object in an application of another format. The purpose of this method is that the smart object can be edited independently, in its own native software application and is simply linked to the foreign document and involves using the functionality of vector images and manipulation in a bitmap editor.

All imagery had to be converted to a grayscale colour space (black and white images) because the image will be printed with black ink only. Adobe Photoshop Actions was used to automate and apply the procedures as described in Figure 5.2. The Adobe Photoshop Actions recorded and used in this first iteration were used to prepare all the subsequent images for all of the other 4 iterations to follow. Once the above mentioned functions were completed, all the images were combined in a single layered Adobe Photoshop document where each image could be moved and worked on independently. From this, the first image was generated. Because the ideation process needs to revise old ideas and borrow from them to inform new ones, Adobe Photoshop allows different points of work to be saved in a single document. It also allows the researcher to see some earlier versions or ideas of the same document in different points in time.

An edition of five to eight prints, plus artist proofs, were made of each stage, totalling 33 final prints. The paper used to print on was a 285gsm Fabriano Rosapina and the ink used was Coates 50/50 combined with clove oil, to change the viscosity and drying time of the ink.

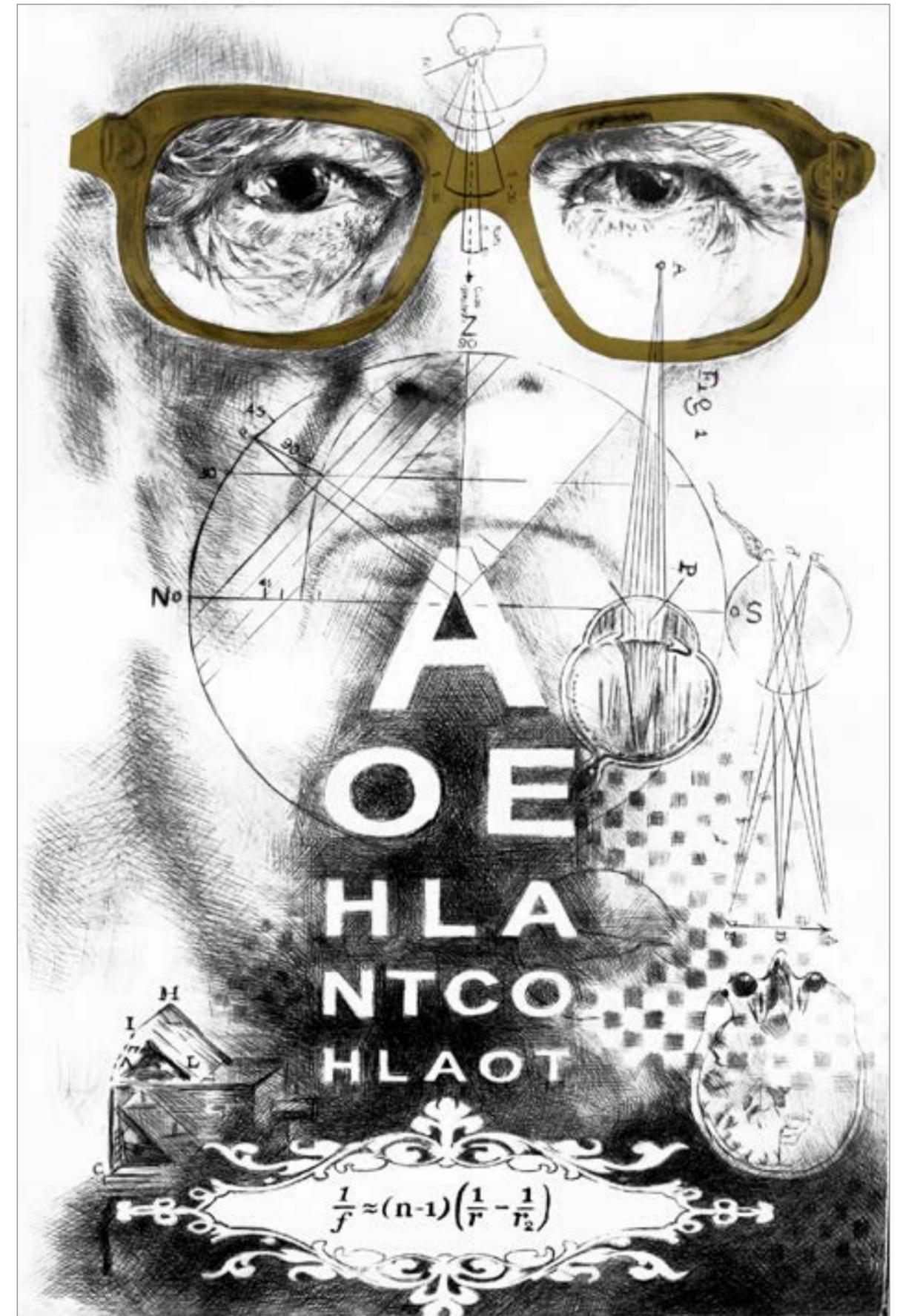


Figure 5.1: The final artwork of this iteration.

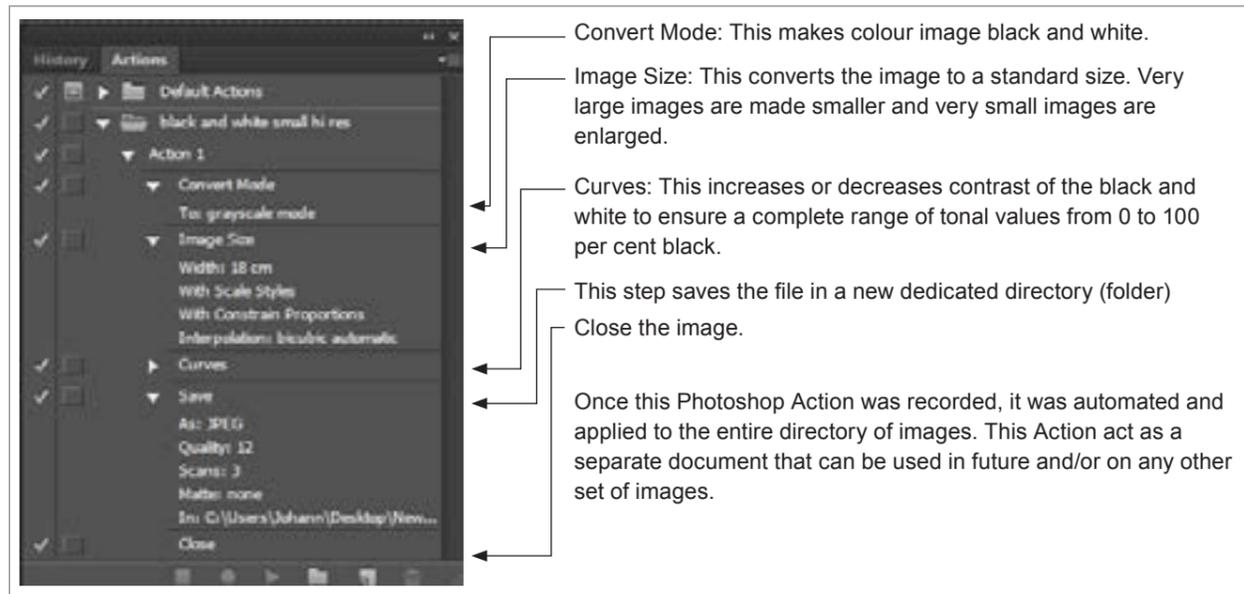


Figure 5.2: Adobe Photoshop Actions. (Adobe Photoshop Software generated image)

**Step 1** Figure 5.3 shows the most important thumbnail sketches and images collected for this iteration. Hand sketches were informed from several medical handbooks and journals. Digital images were found on Google images, and ffffound.com  
 Keywords or phrases used for internet searches were: vision, human vision, sight, cataracts, blindness, seeing is believing, technology and sight, optical instruments, optical, glasses, 20/20 vision, bad eyesight, optometry and nyctalopia (night blindness).

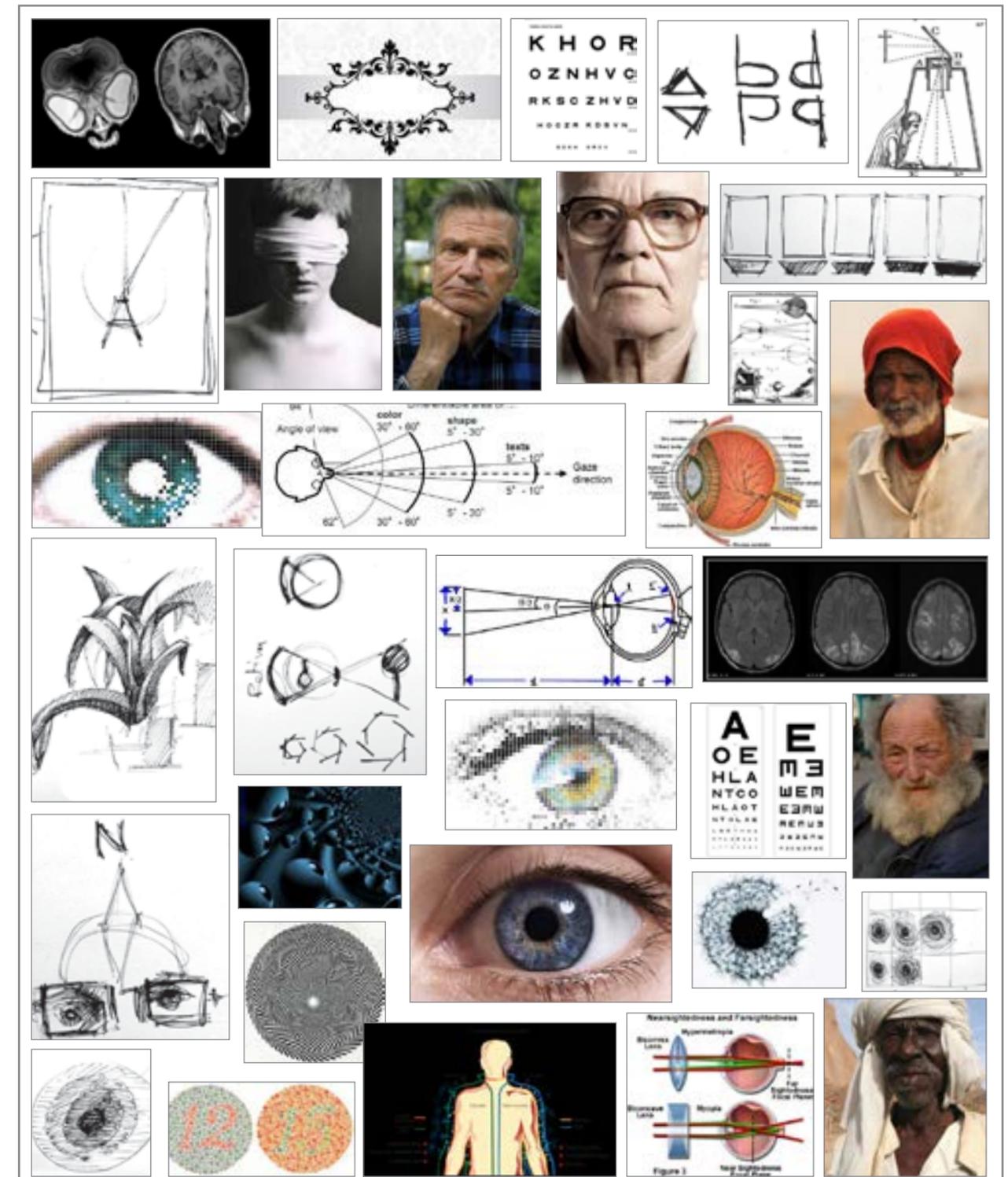


Figure 5.3: The most important images collected. (Author's images from selected sources)

**Step 2** Figure 5.4 shows the workflow and the most important points in the ideation process from the first 3 images (top) to the final digital image (bottom) up to the point before final intaglio printing.

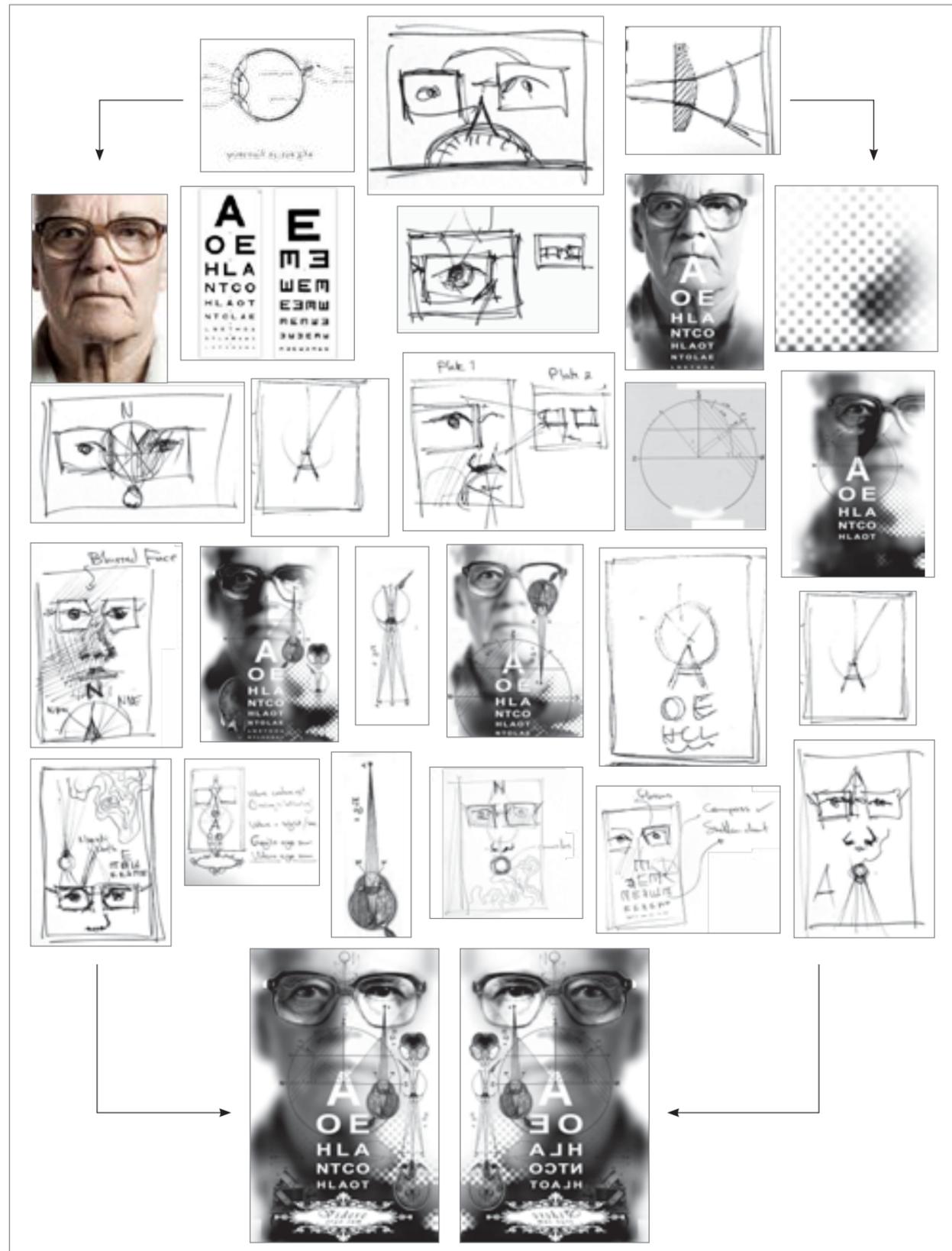


Figure 5.4: Planning of the artwork. (Author's construct)

**Step 3** This step consisted of breaking down the final design into five plates. Adobe Photoshop was used by working backwards from the final plate to the first plate. By hiding progressively more layers and using channels, it could be observed if white would replace black on any given area of the plate or if black would replace white. To limit the disconnect between bitmap continual tone data as displayed on screen and real printed intaglio lines, the digital file was adapted with filters to display what the final print might look like.

Figure 5.5 shows the different planning documents at their respective states of printing

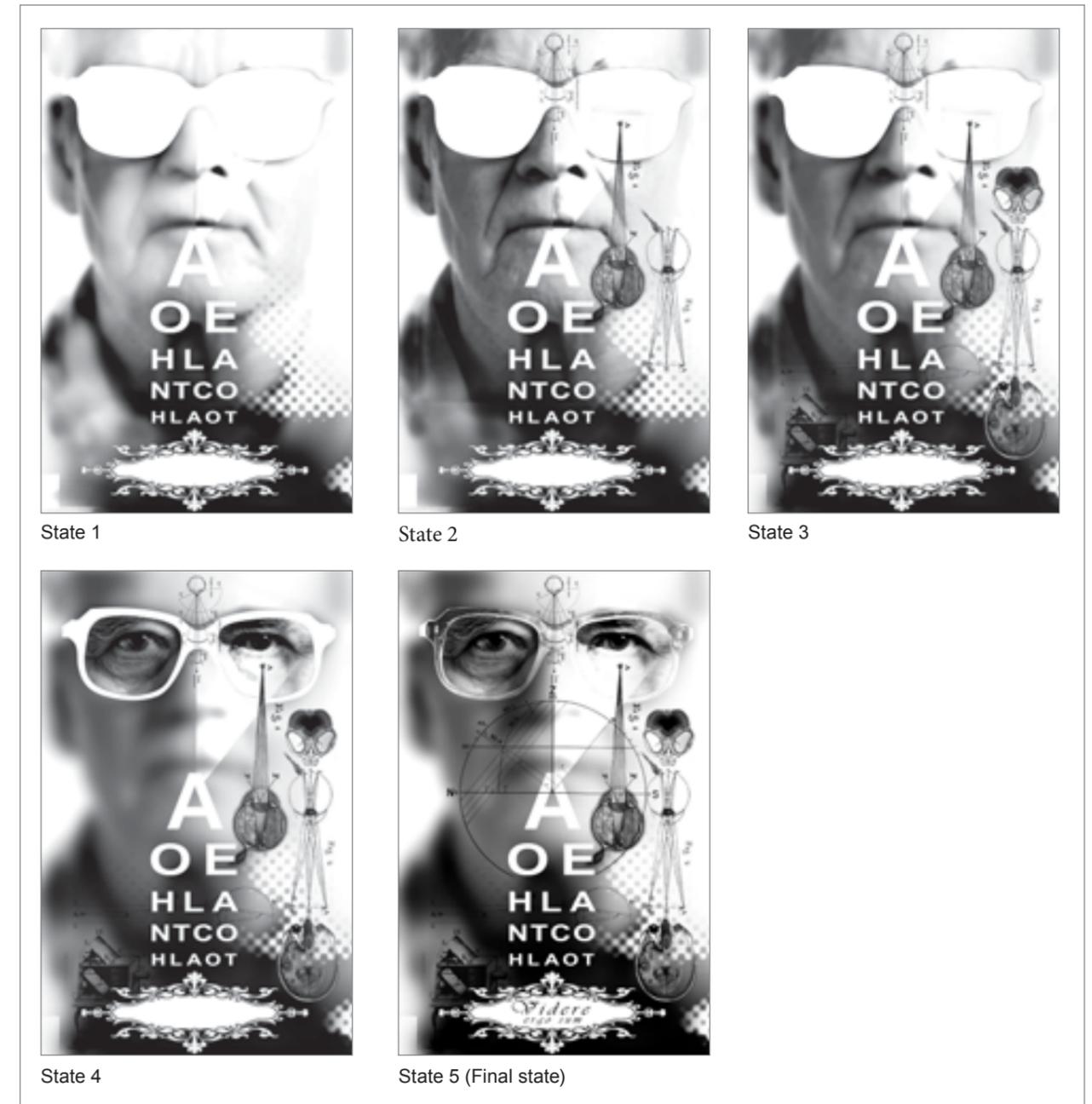


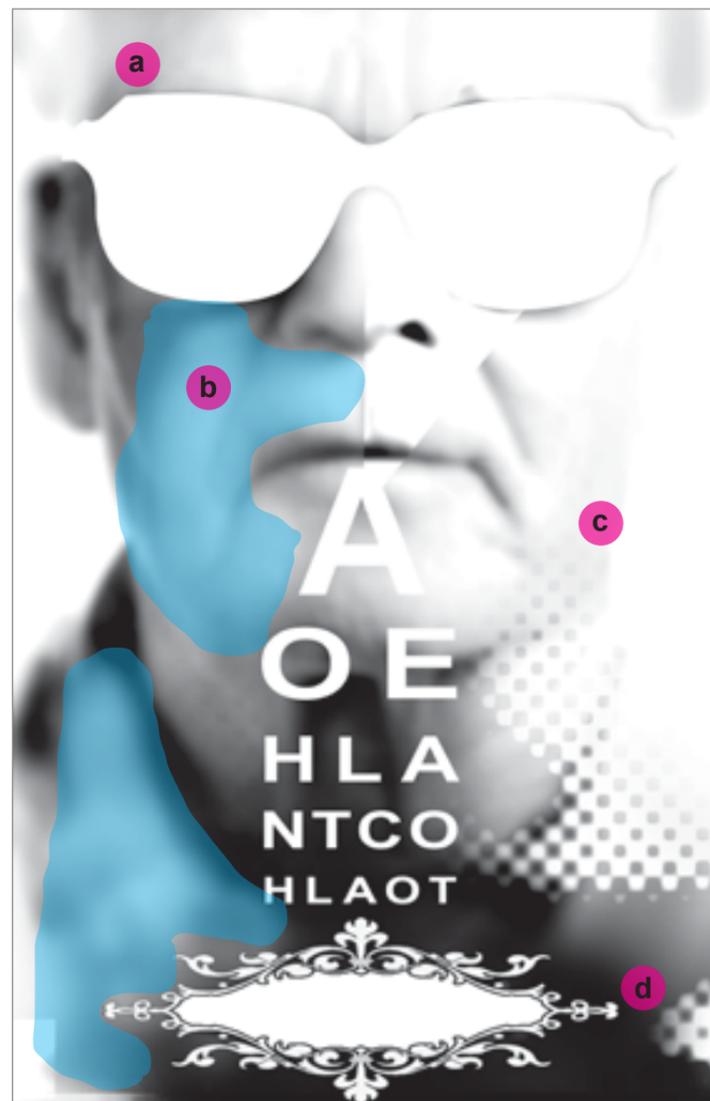
Figure 5.5: Digital states of the plate. (Author's construct)

**Step 4** After the image was digitally finalised, certain components and aspects of the image was reduced in four states to produce the five states (final image plus four reductive designs) of the plate and, therefore, the series of five prints. State 1 of the plate was saved as a separate electronic document and the plate was made according to this digital image (Figure 5.6).

The hand printed image (Figure 5.7) differed to the electronic version mainly in the extent of light grey coloured areas that are missing and are highlighted in blue. This omission was not purely intentional also not purely unforeseen as the plate developed. The researcher decided that this factor would be remedied in later stages.

To demonstrate the differences in the extent of black, State 1 (digital) shows four points of measure (a, b, c, and d) on the digital document (Figure 5.6) compared to the same points on the printed page: State 1 (Figure 5.7). The value in magenta shows the value of the digital document and the value in cyan shows the corresponding value of the printed artwork.

Figure 5.6 shows the digital document finalised to inform the first state of the plate. Figure 5.7 shows the printed image. An edition of five prints was made with two artist proofs.

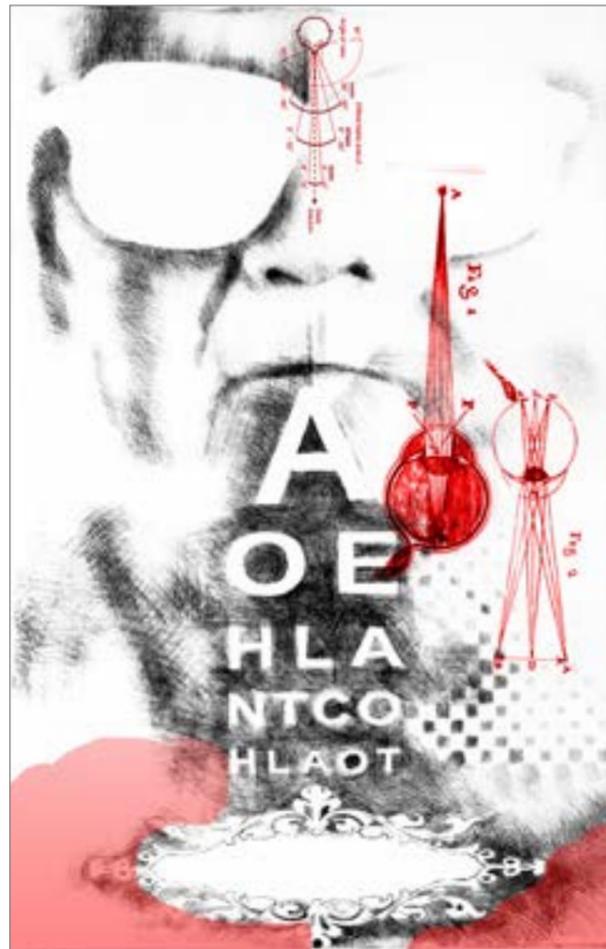


**Figure 5.6:** The digital planning document at the first state.  
(Author's construct)

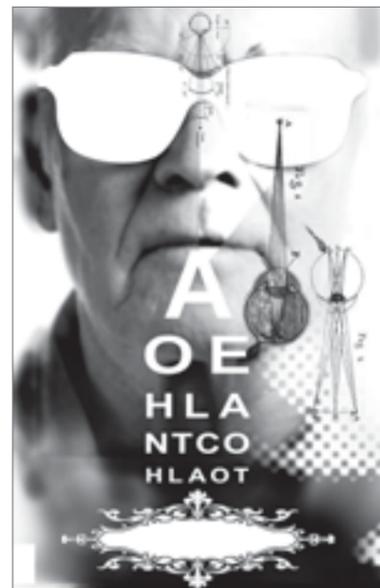


**Figure 5.7:** The intaglio print at the first state. (Author's construct)

**Step 5** The planning of State 2 of the plate as a digital document is shown in Figure 5.8. The areas marked in red shows the computerised planning of the second stage. This includes three images added to the plate and two areas (bottom left and right) where the plate was worked to increase the tonal value. Figure 5.9 shows the initial digital version of the second state and Figure 5.11 shows the intaglio printed image at this state.

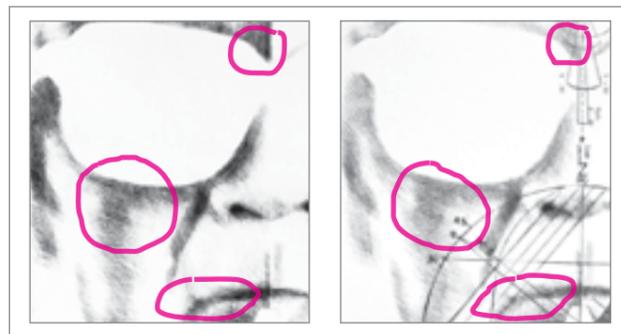


**Figure 5.8:** The digitised intaglio print with the detail to add in the second state. (Author's construct)

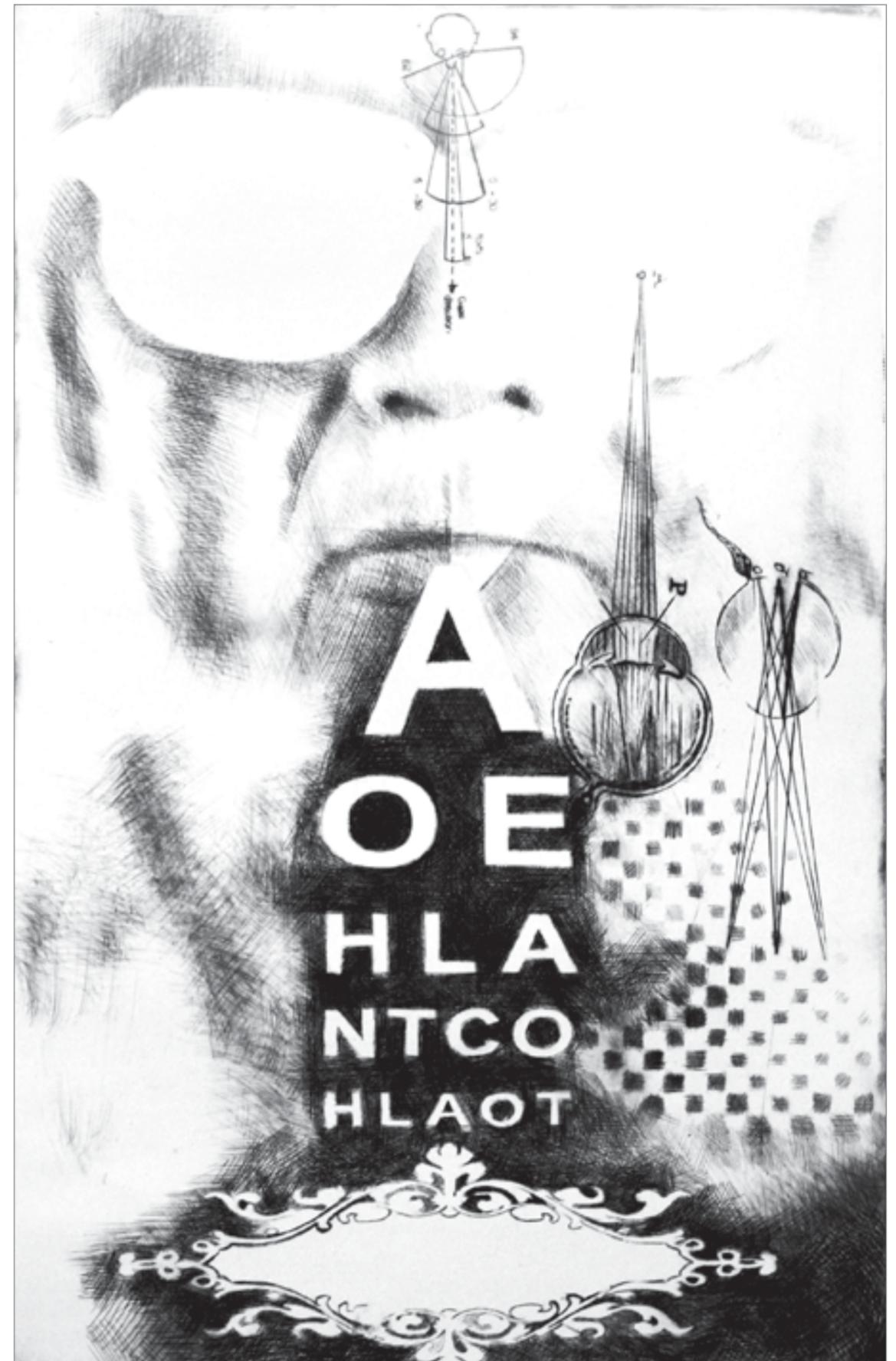


**Figure 5.9:** The digital planning document at the second state. (Author's construct)

**Observation and adaptation** During the second state it became evident that the plate degenerates faster than expected as it is inked, wiped, printed and cleaned. Great care was taken to make sure the plate was inked consistently and, therefore, cleaned consistently. This process meant strong oil based solvents had to be used to remove as much of the excess ink as possible after a print was pulled, which, in turn, meant limiting the lifespan of the plate and the number of available prints because the mechanical forces exerted on the plate reduced the depth of the intaglio grooves and the print became progressively lighter and less detailed. The red outlined areas in Figure 5.10 show the difference in degree of detail between the first state and the third state.



**Figure 5.10:** Differences in the first and third state. (Author's construct)

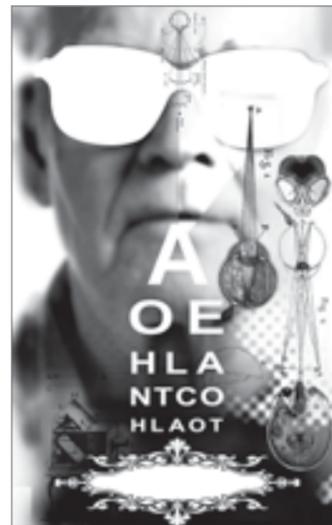


**Figure 5.11:** The intaglio print at the second state. (Author's construct)

**Step 6** When the plate started to degrade, several areas were reworked to hold the ink better and increase tonal value to a darker black. The areas marked in blue (Figure 5.15) were reworked to create at least the same tonal value of earlier prints. An edition of five copies was printed with two proofs, bringing the total number of times the plate had to be inked to 21 at the end of this state. The areas marked in red (Figure 5.12) show the computerised planning of the third state. This planning includes 3 images added to the plate and changes made to one area (bottom right) where the plate was worked to increase the tonal value. Figure 5.13 shows the initial digitally planned document.

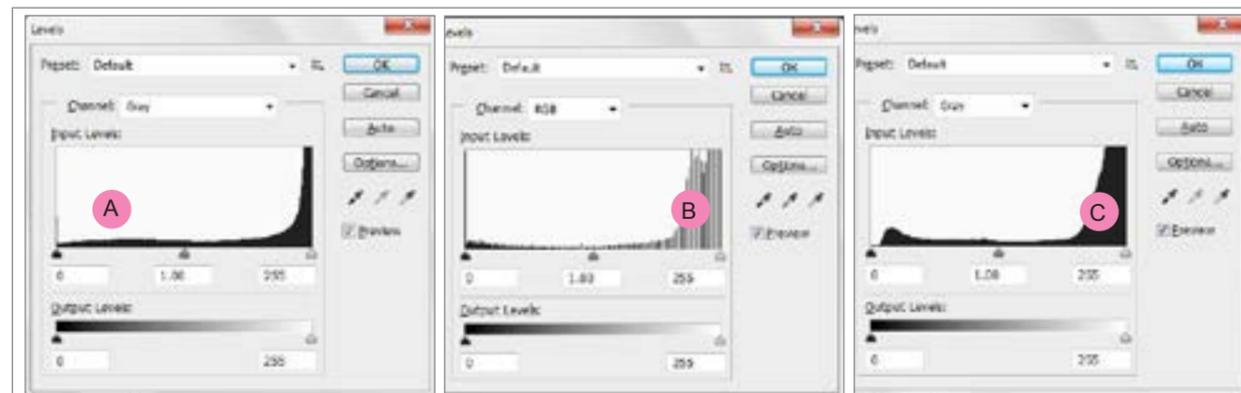


**Figure 5.12:** The digitised intaglio print with the detail to add in the third state. (Author's construct)



**Figure 5.13:** The digital planning document at the third state. (Author's construct)

**Observation and adaptation** It became evident to the researcher that the darkest areas on the plate were losing quality the fastest. To test and analyse this occurrence, the intaglio prints were digitised at every state and, with the use of a histogram, (Figure 5.14), the rate of degeneration of certain tonal values could be measured.

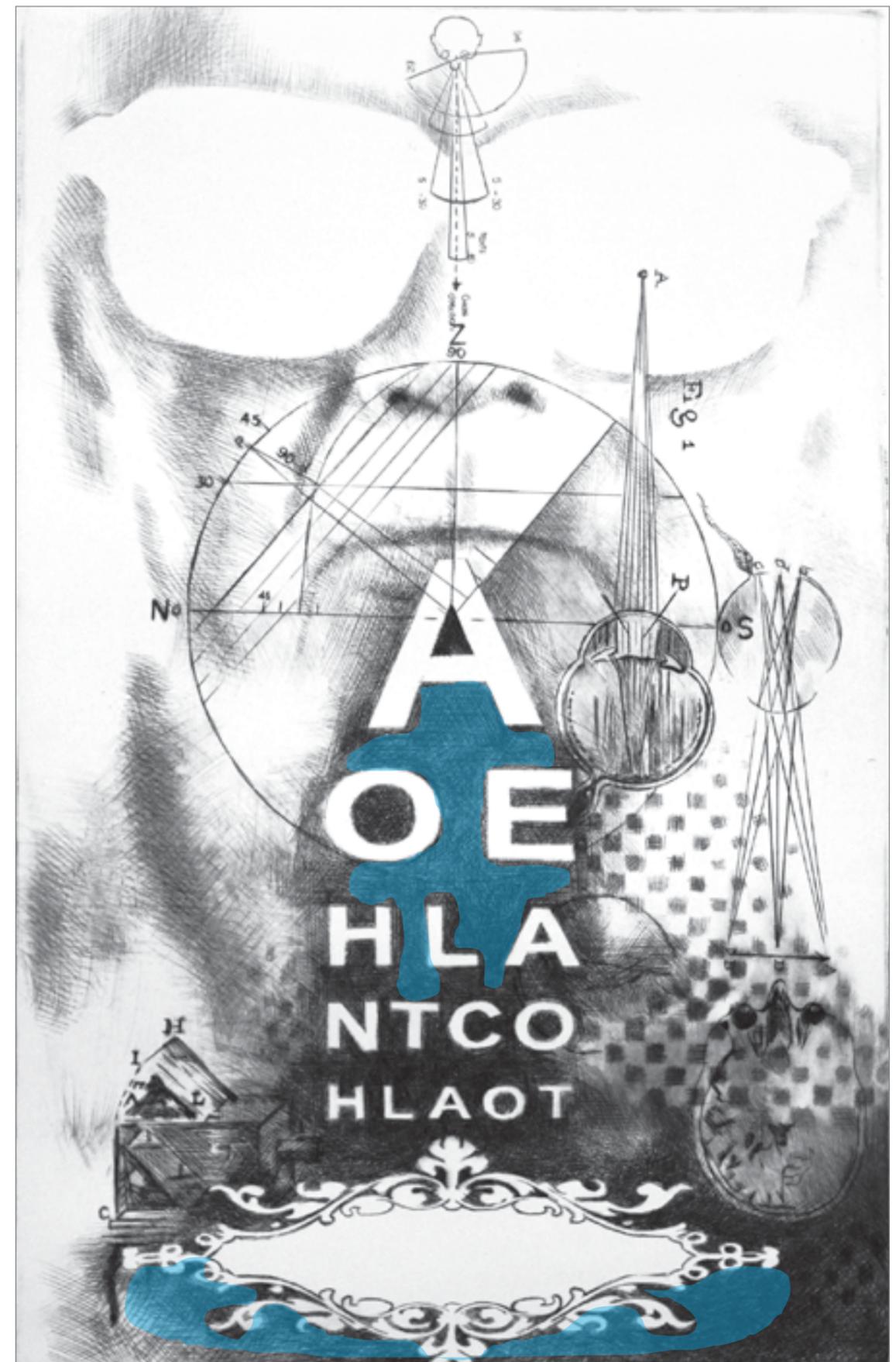


The histogram of the first state shows the difference in values between the first state and the third state as indicated at A. This shows more medium dark present in the third state, but less solid black than the first state.

The histogram of the second state shows fragmented light areas (B). This is a clear indication that the fine tonal values are being degraded.

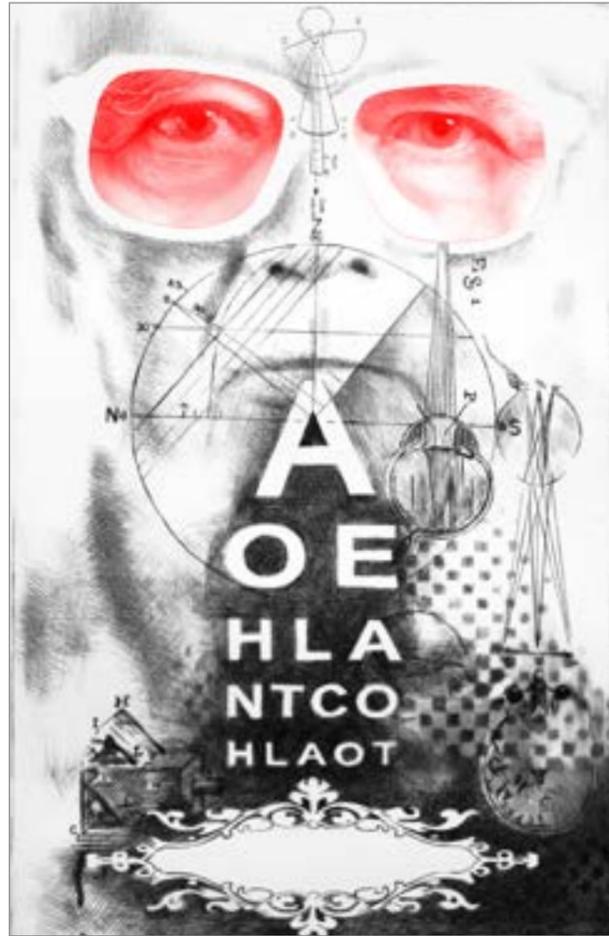
The histogram of the third state shows the cumulative effect of continual wiping and inking of the plate as the light areas (C) increased much more than on the previous states.

**Figure 5.14:** Histograms of the first three states. (Adobe Photoshop software generated image)

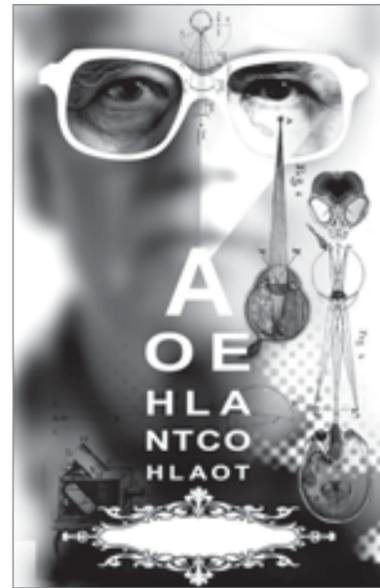


**Figure 5.15:** The intaglio print at the third state. (Author's construct)

**Step 7** The red areas in Figure 5.16 show the eyes that were added on the fourth state of the print. Digital manipulation was used to sharpen the focus and increase the contrast because the eyes had to be a point of focus. Figure 5.17 shows the initial digital version of the fourth state and Figure 5.18 the final print of this state.

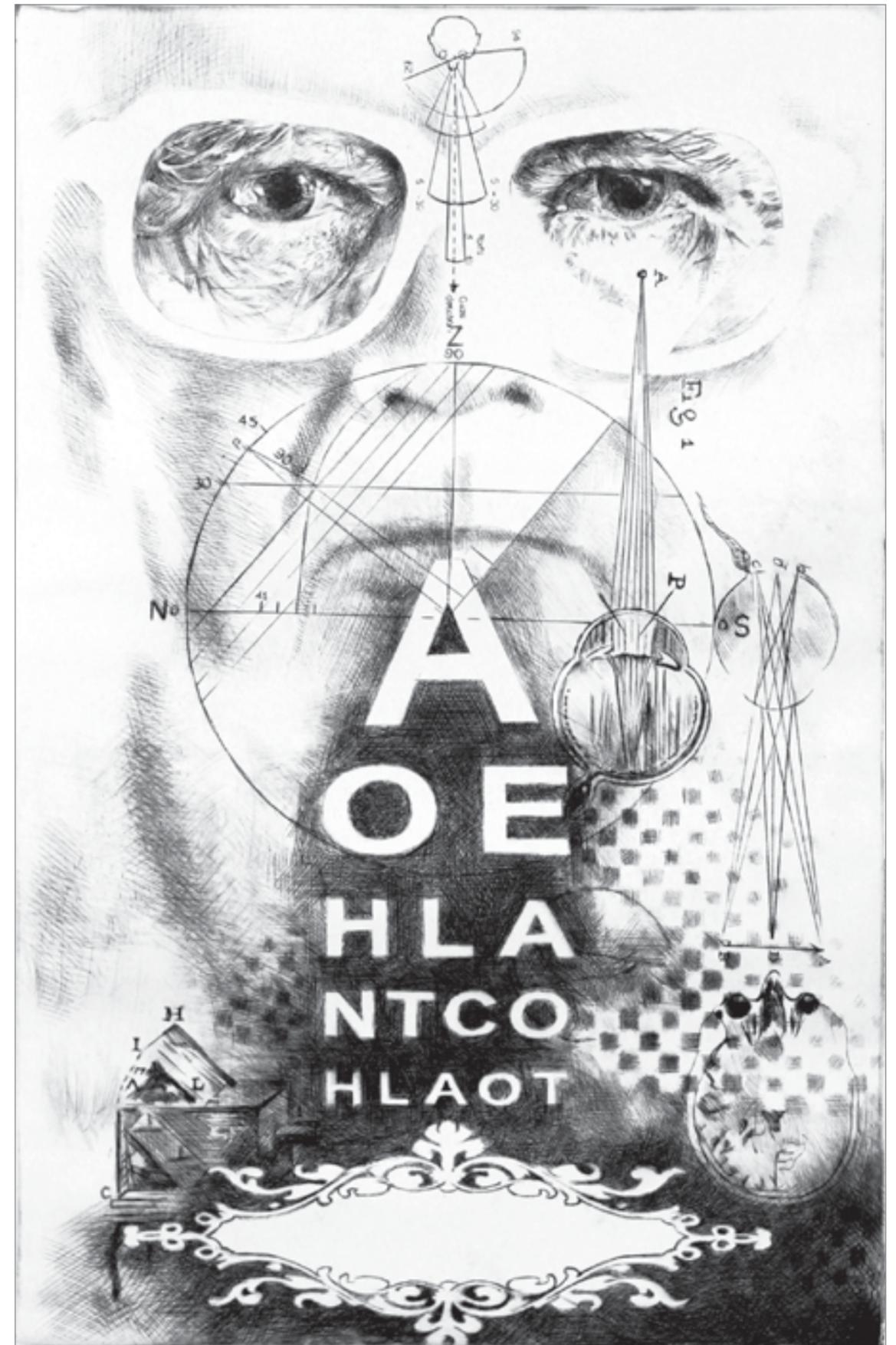


**Figure 5.16:** The digitised intaglio print with the detail to add in the fourth state.  
(Author's construct)



**Figure 5.17:** The digital planning document at the fourth state.  
(Author's construct)

**Observation and adaptation** The biggest problem encountered on this plate was trying to keep the finer tonal values from degrading. Even though tonal values were not the focus of this first series of prints, the problem could not be ignored although it was later addressed in iteration 4.



**Figure 5.18:** The intaglio print at the third state. (Author's construct)

**Step 8** The last state shows the spectacles added. To highlight this, a chine collé (coloured paper technique) was used. Chine collé is a simple but precise technique. It involves cutting the coloured tissue paper in the desired shape or motif and by using non-acidic water based glues, the paper is treated. When the intaglio plate is inked, the tissue paper is added to the plate and the pressure from the press and the dried glue, fuse the tissue paper with the heavier paper.

Since the process is non-reversible and time consuming, the colour used had to be satisfactory. To plan this, Adobe Photoshop was used to add seven different colours in the shape of glasses to the digital file (Figure 5.21). This helped the researcher to visualise what colour to use.

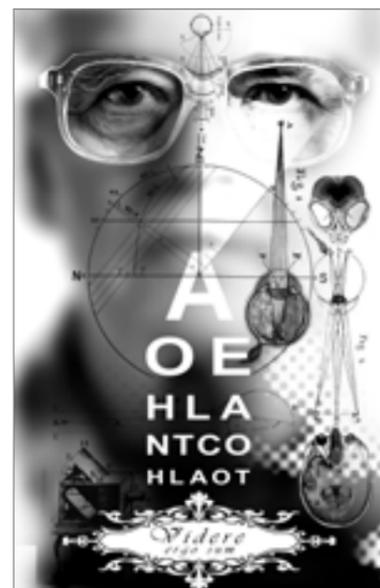
The first step was digitally to match the colours of the seven available tissue papers to the digital document. The paper was placed on a neutral grey surface and the colour on computer optically matched to the true colour. Once these seven colours were optically created and matched between the real tissue paper and the digital document, the shape of the glasses was digitally cut out and overlaid on the digitised intaglio print at the fourth state. A series of non-destructive adjustment layers was placed on the background layer and the colour could be visualised by a simply clicking on an icon to hide or show that particular coloured adjustment layer.

A test chine collé intaglio print was made with all the colours on one print to discover how accurate the computer simulation was and to calibrate the digital planning document to the highest possible level.

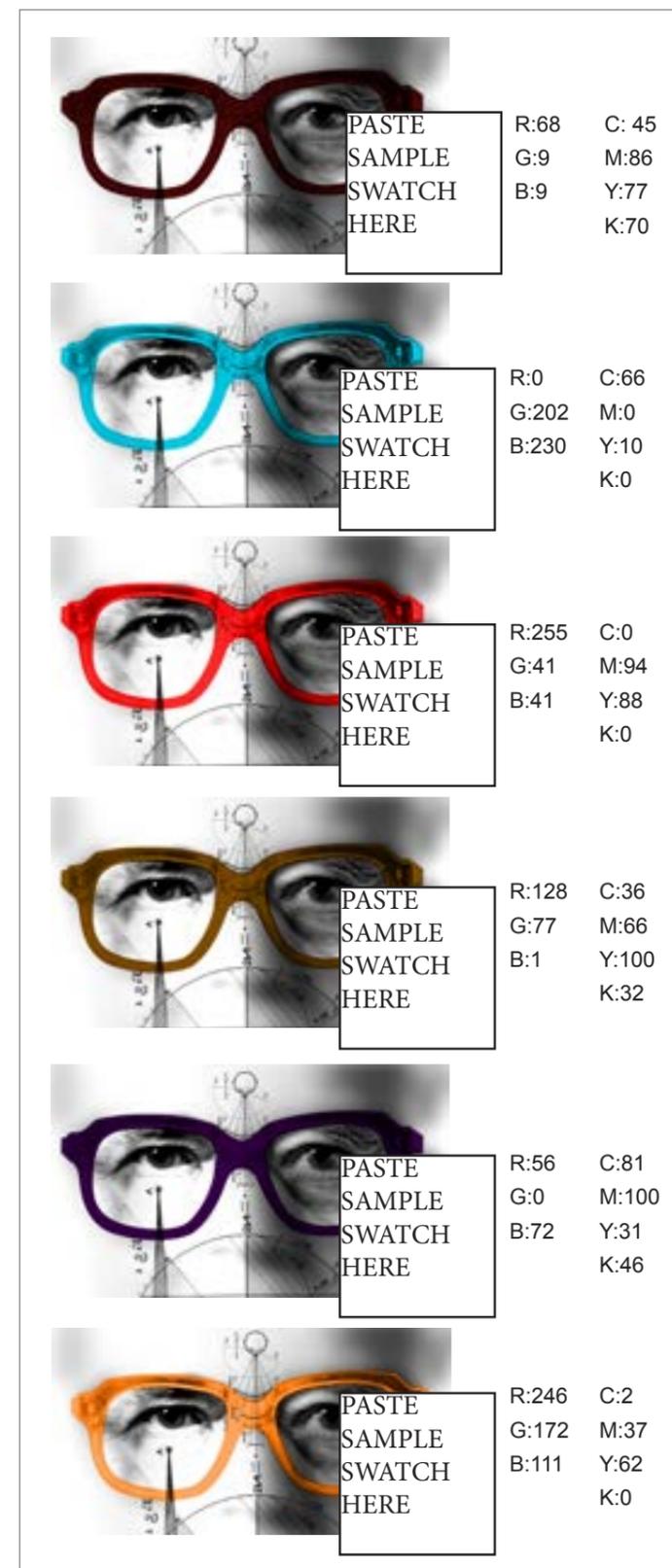
The planning of the last state of the plate is shown in Figure 5.19. Besides the glasses being introduced, other areas were reworked to make up the final state. Figure 5.20 shows the initial digital version of the last state. Note the text planned in the decorative frame at the bottom. This text was changed to what is known as the 'lens makers equation': the basic formula for cutting a lens to restore vision.



**Figure 5.19:** The digitised intaglio print with the detail to add in the final state. (Author's construct)



**Figure 5.20:** The digital planning document at the final state. (Author's construct)



**Figure 5.21:** Colour options. (Author's construct)

Option four – a metallic gold – was chosen by the researcher to apply colour to the spectacles in the final state. Coincidentally, a real gold, like other metallic colours, is the most difficult colour to simulate on computer. The complexities of light behaviour to display a metallic colour to the human eye cannot be replicated by any means other than the real or similar coloured metal. The only matter which truly looks like gold, is gold. All computer screens use a replicated colour of gold that falls far outside this gamut (see p34). There exist several generic and standardised colour breakdowns to display gold on screen. None of these were chosen as all of them attempt to look like gold on calibrated standardised computer monitors. However, the colour breakdown chosen here is aligned to look as close as possible to the real gold tissue paper on the monitor used to plan the artwork.

Next to the coloured swatch, the RGB colour value is described with the closest CMYK value. The final artwork can be seen on p35.

## 5.4. ITERATION 2: COLOUR

**5.4.1. RATIONALE** The second set of printed artworks, concerns itself with colour in the intaglio process. Although this series of prints proved to be both knowledge and time intensive and, therefore, might seem to contradict this study's hypothesis of accessibility and a faster and more controlled, understandable planning workflow model for intaglio printmaking, the purpose of this practice was twofold. Firstly to explore, within reason, the boundaries of colour as applied in this process and, secondly, to set up an experiment or test, not necessarily to be replicated, but rather to serve as foundation for future research. In this sense one can only reduce the complexity and effort, if the entire process is manufactured at least once.

This series relies on the underlying montage character in favour of a simulation of organic unity approach.

**5.4.2. THEME** *In-vitro Fertilisation (IVF)* has helped thousands of women to fall pregnant (Davies et al 2012). It is considered a fairly simple procedure outside the human body that has massive implications. The term *in vitro* is Latin for in glass because early experiments were conducted in glass tubes. Today this practice is a highly successful procedure (Hansen 2013) for which Robert Edwards received the Nobel Prize for medicine in 2010.

This second series of artworks created for this study explores bio-interfering agencies in the form of medical technological advancements on life. A simple needle and Petri dish is used to inseminate a human egg that is implanted back into the human body (Davies et al 2012). By means of meiosis and mitosis, cells duplicate and start to form, firstly the spinal cord and central nerves system of the new zygote. IVF becomes the agent to, in a limited sense, facilitate new life. However, because the human body, as an organism, grows and matures, the natural process of entropy is always at work, running down the complex systems that make up the physical body.

A typical and often signature event of mature age in humans is that the largest joint, the hip, starts to decay and often deteriorates to a point when it needs artificial replacement. The never ending breakdown is always present compared to the limited growth period of that single human as organism.

**5.4.3. TECHNIQUE, PROCESS AND MATERIAL** The intaglio technique used for this second set of artworks is a combination of softground etching and hardground etching on 40 different copper plates. This medium was chosen to accommodate different textures and effects and allow the plates to be reworked multiple times over. After the design was finalised, each cell was cut out as an individual piece of copper plate. The spinal cord and the hip respectively were also cut as separate copper plates.

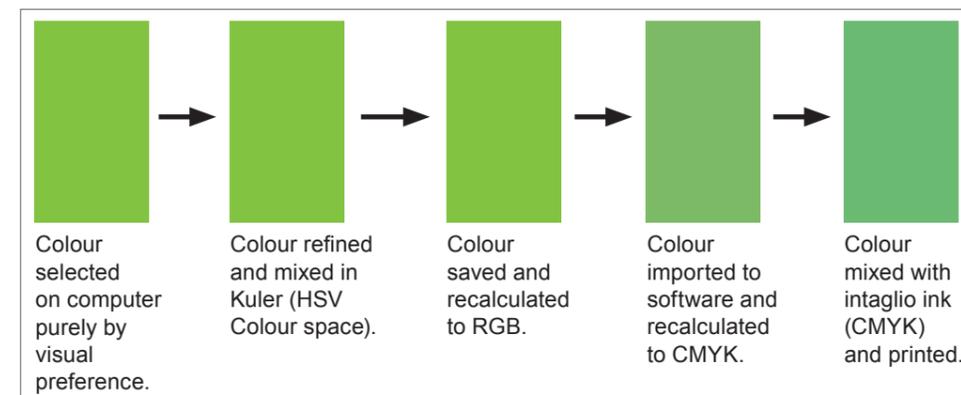
There exists three basic ways of using colour in intaglio printing: *Chine collé*, *A la Poupée* and using coloured ink (as opposed to traditional black). *Chine collé* uses a thinner coloured paper to print onto which the heavier base paper is fused. *A la Poupée*, a French term refers to a dabber to apply several different colours ink onto the plate in strictly demarcated areas (Woods, 1996). The third option is simply to use a single coloured ink mixed to the required colour applied to the entire plate. Since the plates are moderately small in this set of artwork, the application of multiple colours per plate was not viable. *Chine collé* and coloured ink was, therefore, used with the focus being on mixing the inks to a required colour.

Only one series of artist proofs was made because no two prints are the same with regards to colour. A total of seven final prints were made with four proofs of either coloured cells or spine or hip or combinations. The paper used for printing this series was a 285gsm Fabriano Rosapina and the ink used was Coates 50/50 in the four process colours, combined with clove oil to retard the drying time of the ink.

**Adobe Kuler** Adobe Kuler, is an online software application that was used to create and break down a colour series. Kuler uses an HSV (Hue Saturation and Value) model to display Red Green and Blue (RGB). Triadic colour was used in all instances to create four combinations colour series (Figure 5.22). A triad colour series is a five colour combination with a base colour and



**Figure 5.22:** Adobe Kuler Workspace.  
(Adobe Kuler software generated image)



**Figure 5.23:** Applied colour.  
(Author's construct)

two other main colours. These three main colours are set at 120 degrees on the HSV model so become complementary of each other. The first setting is the brightness of the entire set of colours. The base colours' saturation is set to adjust the other two main colours' saturation accordingly. Two secondary colours are also included. These colours are the same hue and value as two of the main colours but less saturated. These two secondary colours' saturation is unrelated unlike the linkage of the base colours to the other two main colours. Kuler allows this set of five colours to be exported to vector based computer applications when colour can be recalculated into the Cyan, Magenta, Yellow and Keyline (CMYK) space in order to mix coloured ink for the intaglio print. Figure 5.22 shows the Adobe Kuler colour instrument being used to select a set of five colours. This set can be exported to various software applications where it can be applied and recalculated to the CMYK colour space.

Figure 5.23 above shows a summary of the workflow with regards to colour. This figure illustrates the misalignment of exact colours as it gets applied through the various modes of its existence. The model above is representational and, therefore, is not colour accurate.

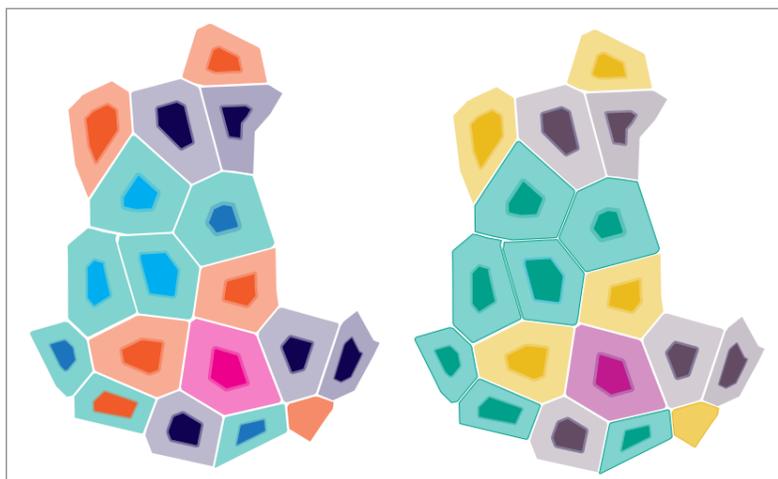


**Step 3** The design on p44 (Figure 5.25) shows the final planned layout with colour applied. However, the colour at this point is just a quick indication that serves as a rough guideline for what the final colours should be used. Step 3 of this iteration is the application of the precise colours and the calculation of the breakdown of the colours to use in intaglio printing. Adobe Kuler was used to create a range of colours based on a selected colour. Figure 5.26 shows the five-colour sets mixed with Adobe Kuler. From these trial sets, four final sets were chosen to arrive at twelve colours (some colours were repeated in different sets).

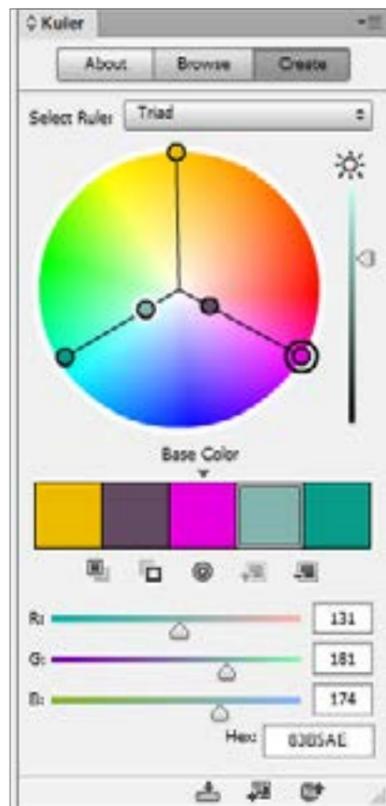


**Figure 5.26:** Adobe Kuler colour combinations. (Adobe Kuler software generated images)

Figure 5.28 shows magenta as chosen base colour. Even though this colour is used as the smallest percentage in the design, it is an extremely strong colour in print and, therefore, it was decided to base the model around it. Adobe Kuler was used to mix the remaining four colours as triad complementary colours based on magenta. Kuler showed that the hue of the initial chosen cyan had to become much greener (higher saturation and a more pure hue) and the orange had to become yellower (closer to the yellow hue). Figure 5.27 shows the original rough colour (left) and the changed colour according to Adobe Kuler (right).

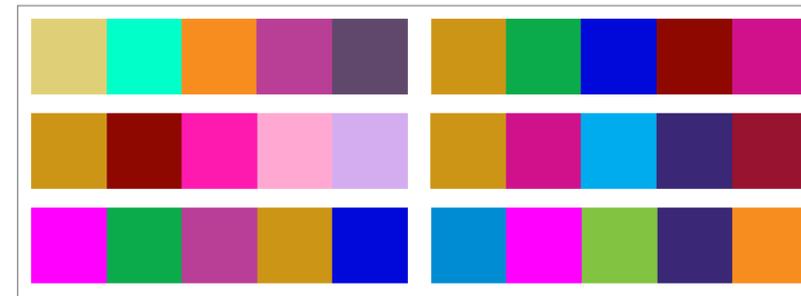


**Figure 5.27:** The adapted colours. (Author's construct)

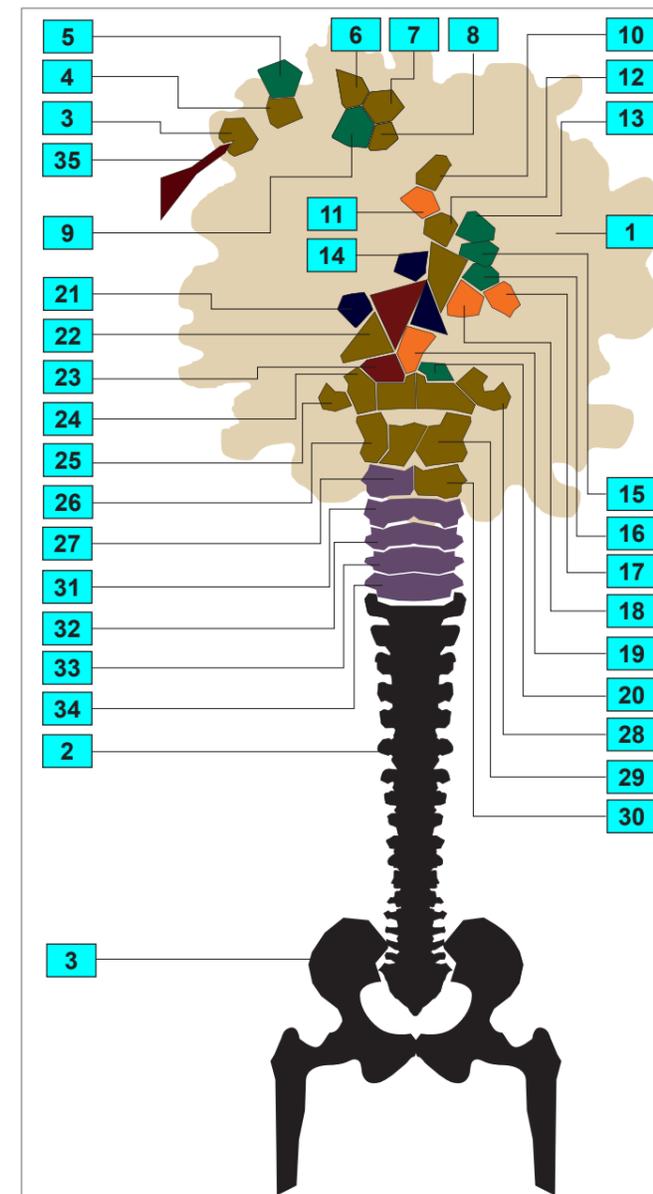


**Figure 5.28:** Adobe Kuler panel. (Adobe Illustrator software generated images)

**Step 4** From Adobe Kuler the following sets of colours (Figure 5.29) were saved, exported to a vector base illustration software application and applied to the digital design of the artwork (Figure 5.30). These colours were selected based on the larger previous selection in Step 3. The final design was adapted according to these colours selected. At this point all colours only exist on screen as RGB colour values and have not been calculated to CMYK for printing purposes. From this design a template was made and the copper plates were cut by hand. A number (displayed here in the cyan square) was assigned to each copper plate to mark its position on the register for intaglio printing purposes.

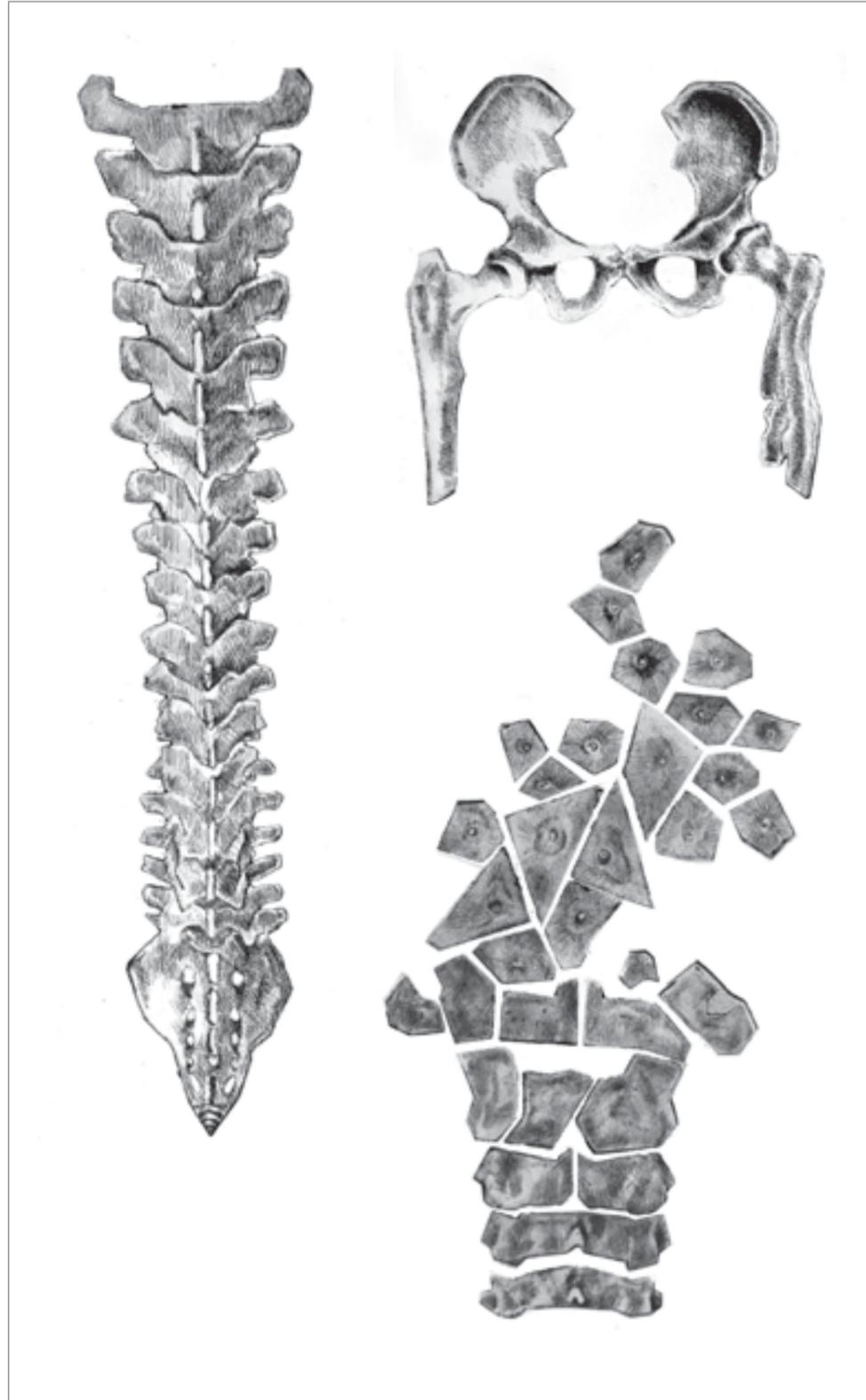


**Figure 5.29:** The final sets of colours. (Adobe Kuler software generated images)



**Figure 5.30:** The final design in digital format. (Author's construct)

**Step 5** This is the first step of this iteration where traditional intaglio methods replaced the electronic computer planning phase. The artwork, therefore, moved into a physical dimension in this step. Copper plates were cut and polished, thereafter, a ground was applied and etched in ferric chloride. A set of proofs in black ink was printed to see if the plates are etched sufficiently. Some areas of certain plates was grounded a second and even third time and etched again to acquire sufficiently dark areas and detail. Figure 5.31 shows the final states of the plates printed in black ink.

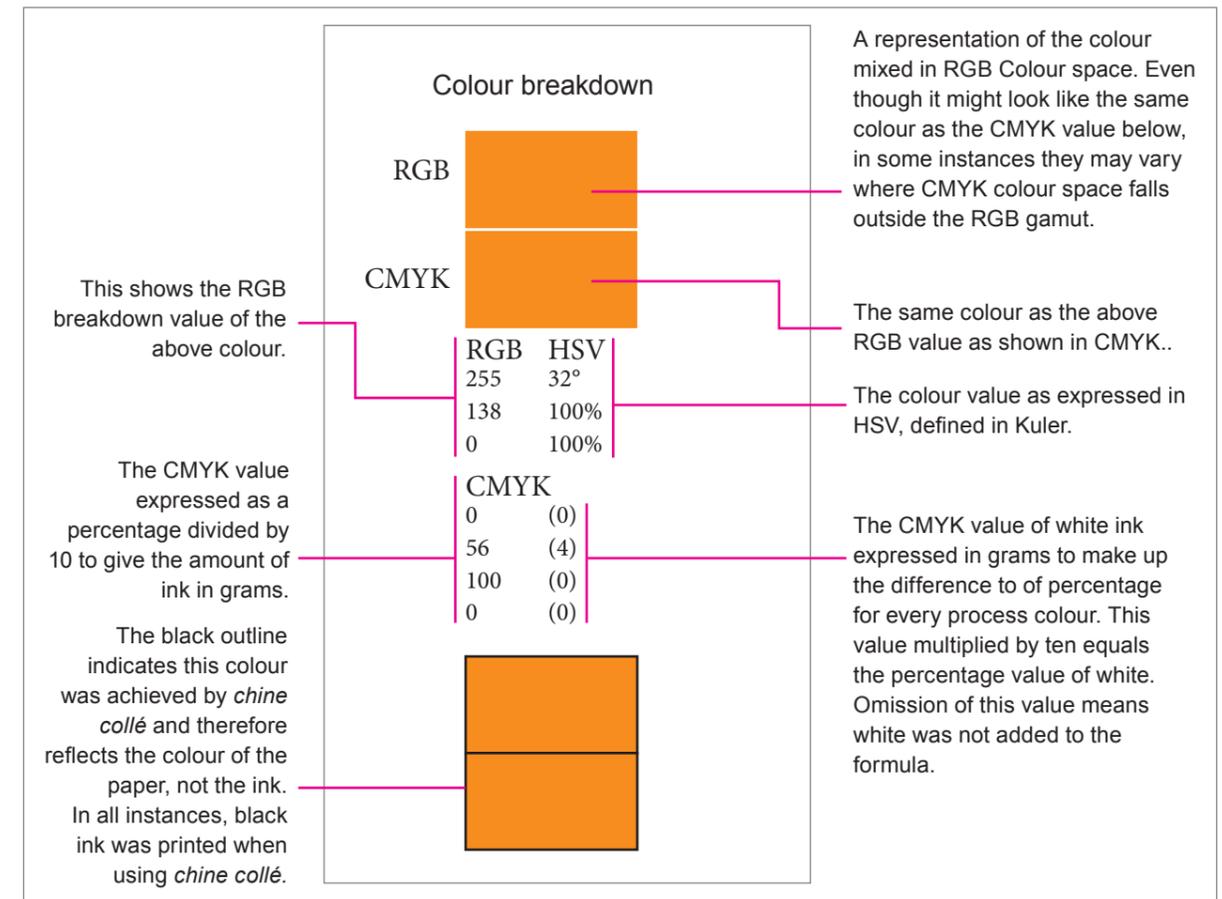


**Figure 5.31:** The first set of proofs. (Author's image)

**Step 6** After the required result was obtained in Step 5, the process followed a practice of the printing of colour in intaglio, not discussed before. This method involves the transfer from RGB to CMYK not on a digital device but the actual transfer of colour definition from the computer's electronic domain to the actual intaglio print: the physical realm.

Besides the disconnect previously discussed (Chapter 4 p29), two other disconnects exist that need to be compensated for. In commercial CMYK printing, a percentage of any one of the four process colours is defined by the size of the halftone screen dot (Dots Per Inch (DPI) or resolution) and its distance from another halftone dot of the same process colour expressed as the Lines Per Inch (LPI). Intaglio printing does not make use of a halftone screen, and therefore, for example, 35 per cent cyan, cannot be printed, White ink was substituted for the difference between any of the process colours percentage and 100 per cent of that colour. A cyan of 35 per cent was therefore mixed as 35 per cent cyan with an added 65 per cent white ink.

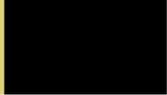
The CMYK colour values were adapted to grams where 10 per cent colour on screen was equated to 1 gram of ink of the same colour. The electronic defined colours were, therefore, adapted for intaglio print. Figure 5.32 below shows the colour breakdown model used throughout the remainder of this document. Each one of these models represents a single colour used. The HSV (Hue Saturation and Value) value (from Adobe Kuler) was recalculated to a RGB (Red Green and Blue) value that was, in turn, recalculated to CMYK (Cyan, Magenta, Yellow and Keyline).



**Figure 5.32:** The colour breakdown model. (Author's construct)

**Step 7** Plate 1 (the background cell), plate 2 (the spine) and plate 3 (the hipbone) were intaglio printed. This final print (Figure 5.35) serves as the first of the seven final prints. Figure 5.34 shows the final design as planned without the coloured cells. The purpose of this print is to execute the background cell and the spine and hipbone with the two colours applied at **1** and **2** as shown in the colour breakdown (Figure 5.33).

Colour breakdown:

	<b>1</b>	<b>2</b>			
RGB					
CMYK					
RGB	223	52°	RGB	0	36°
	208	47%		0	100%
	119	87%		0	0%
CMYK	14	(8)	CMYK	0	(0)
	12	(9)		0	(0)
	65	(3)		0	(0)
	0	(0)		100	(0)

**Figure 5.33:** The colours used for the first artwork.  
(Author's construct)



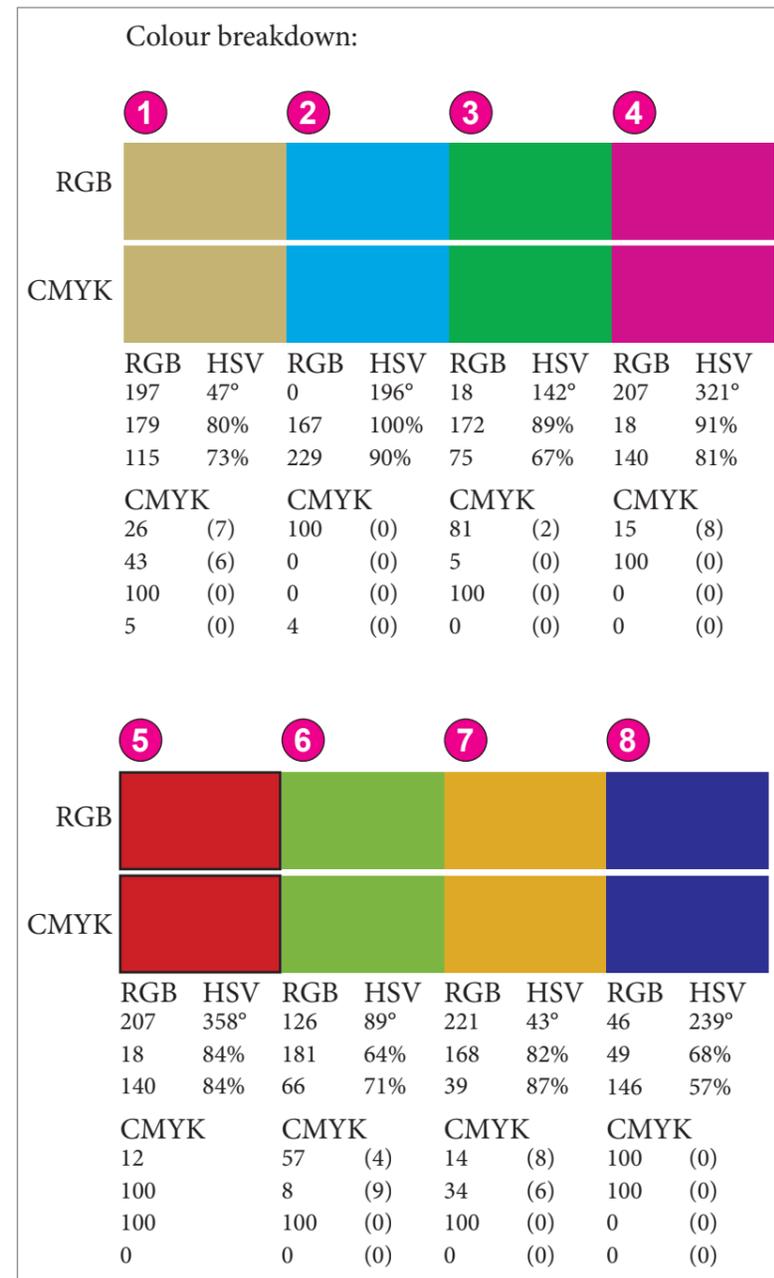
**Figure 5.34:** The digital planning document for the first artwork  
(Author's image)

**Observation and adaptation** White ink was mixed with cyan, magenta and yellow to obtain the colour **1**. The result obtained was what is commonly referred to as an impure colour. Pure colours contain two hues with little or no third hue and have no white or black (Drew and Meyer 2008). However, because impure colours lack saturation, it was decided to limit the use of white as substitute for the lack of a tint value that a halftone screen would produce.

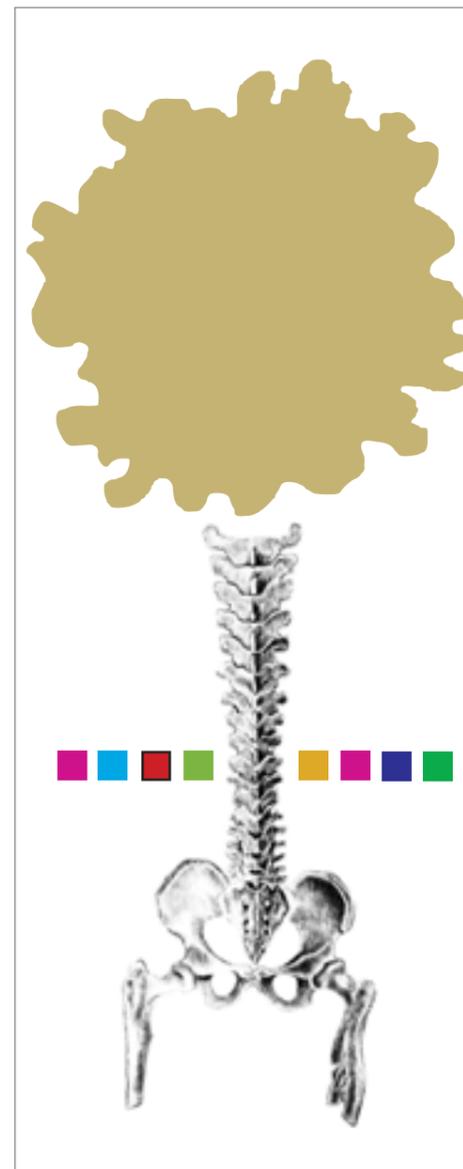


**Figure 5.35:** The first of the final intaglio prints.  
(Author's image)

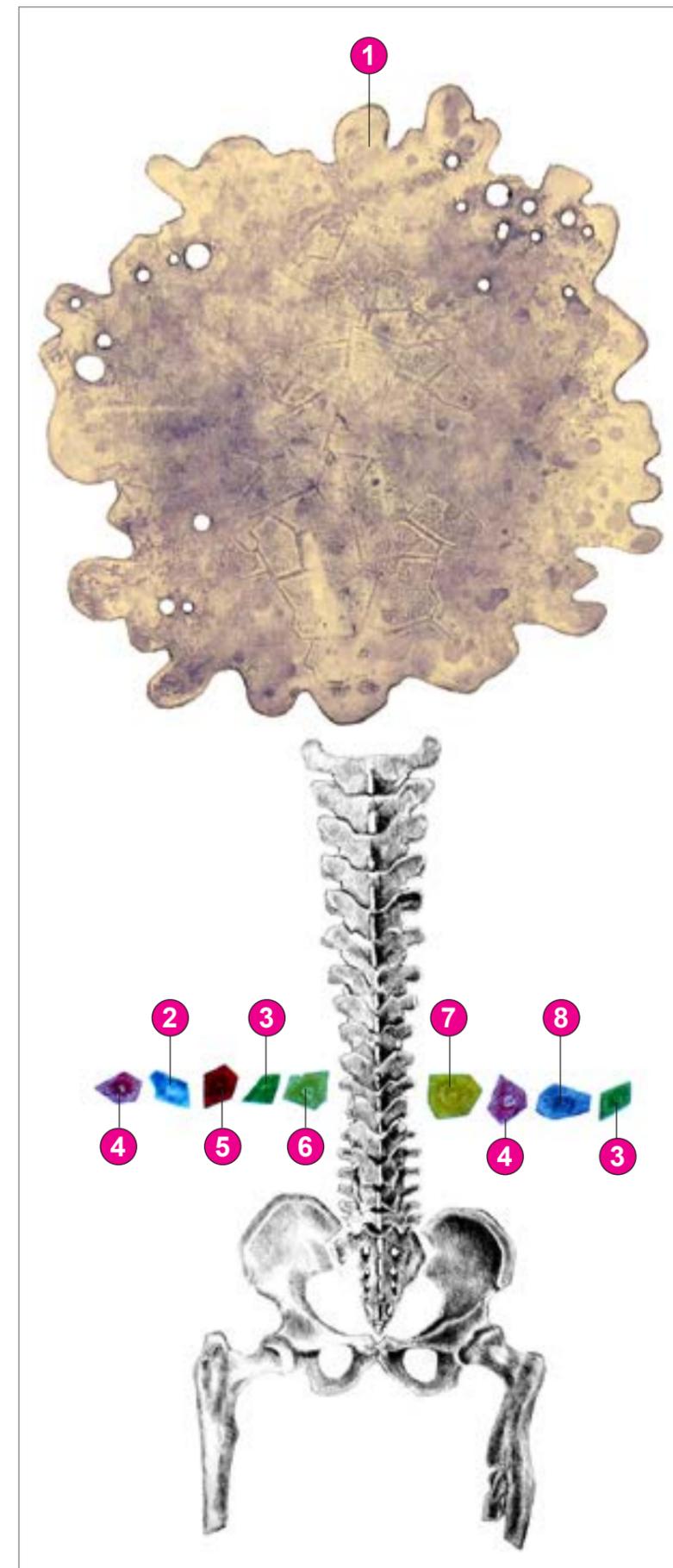
**Step 8** This step is the first of the final intaglio colour prints that has several colours applied and, therefore, the most experimental and uncertain up to this point. The colours selected (shown in the colour breakdown) (Figure 5.36) were selected across the spectrum to test the most extreme of colours in print. Figure 5.37 shows the colours applied to the digital document. Figure 38 shows the final intaglio print at this step.



**Figure 5.36:** The colours used for the second artwork. (Author's construct)



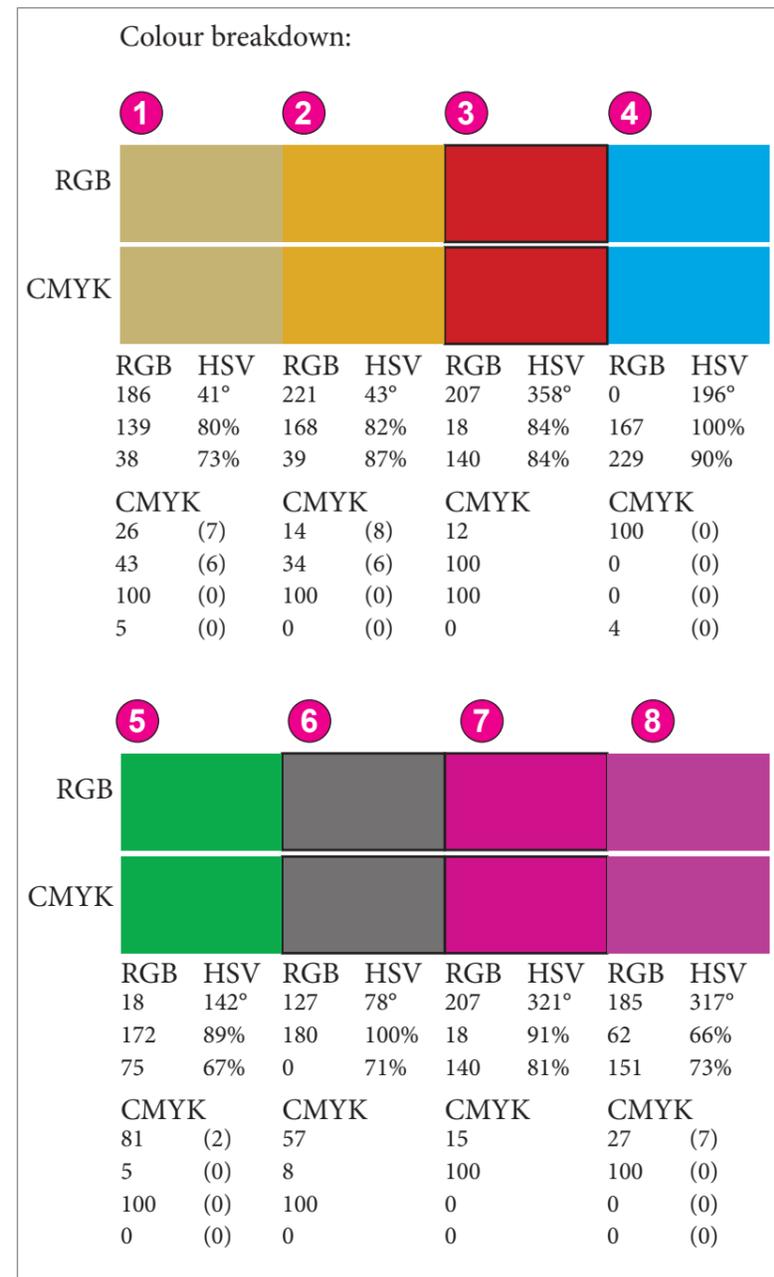
**Figure 5.37:** The digital planning document for the second artwork. (Author's image)



**Figure 5.38:** The second of the final intaglio prints. (Author's image)

**Observation and adaptation** The amount of illumination or light is measured in candle-over-square foot ( $\text{lm}/\text{ft}^2$ ) (Wyzecki and Stiles 1982). The sample size determines a great deal in terms of colour perception. The relatively small size of the cells printed required the colours to be overly bright because the area of illumination is small and, therefore, the candle/foot amount of light per cell is quite small. The result of this reduced size is that the cells appear less bright and lower in saturation compared to the same colour printed over a bigger area. For the above reason, it was necessary to mix the following set of colours with little or no black in order to obtain optimal saturation and brightness.

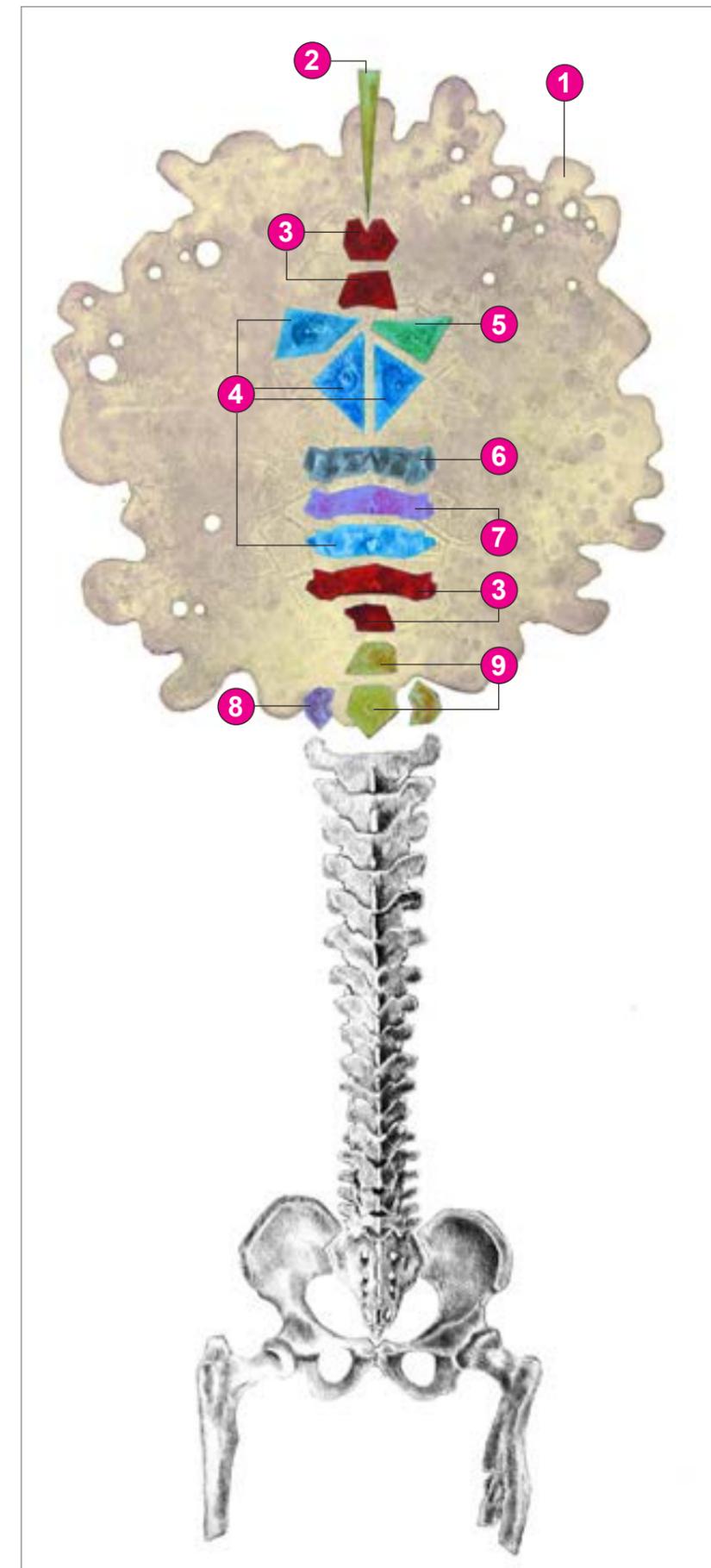
**Step 9** Figure 5.41 shows the third of the artworks in this iteration with a focus on the application of a background colour. The purpose of this action is to determine the colour perception when, as opposed to the Step 8, colour is not only viewed on a white background, but against another base colour. The background colour, **1** as shown in the colour breakdown (Figure 5.39), and applied to the digital planning document (Figure 5.40), was adapted to become brighter and less saturated.



**Figure 5.39:** The colours used for the third artwork. (Author's construct)



**Figure 5.40:** The digital planning document for the third artwork. (Author's image)



**Figure 5.41:** The third of the final intaglio prints. (Author's image)

**Observation and adaptation** The colours applied onto the background cell, appeared somewhat random and confusing. It was, therefore, decided to apply a set of complementary colours to an appropriate background colour in the next step. The following step would also test the colours viewed against a white background compared to that colour set viewed against the chosen background colour.

**Step 10** Following the previous step, this step experiments with a set of five split complementary colours, which are ② to ⑤ then viewed against another complementary background colour ① and compared to those same colours viewed against white. Figure 5.42 shows the colour breakdown whilst Figure 5.43 shows the digitally planned document. The viewer is invited to draw his or her own conclusion as to the aesthetics of this print pertaining to colour in the final artwork of this step (Figure 5.44).

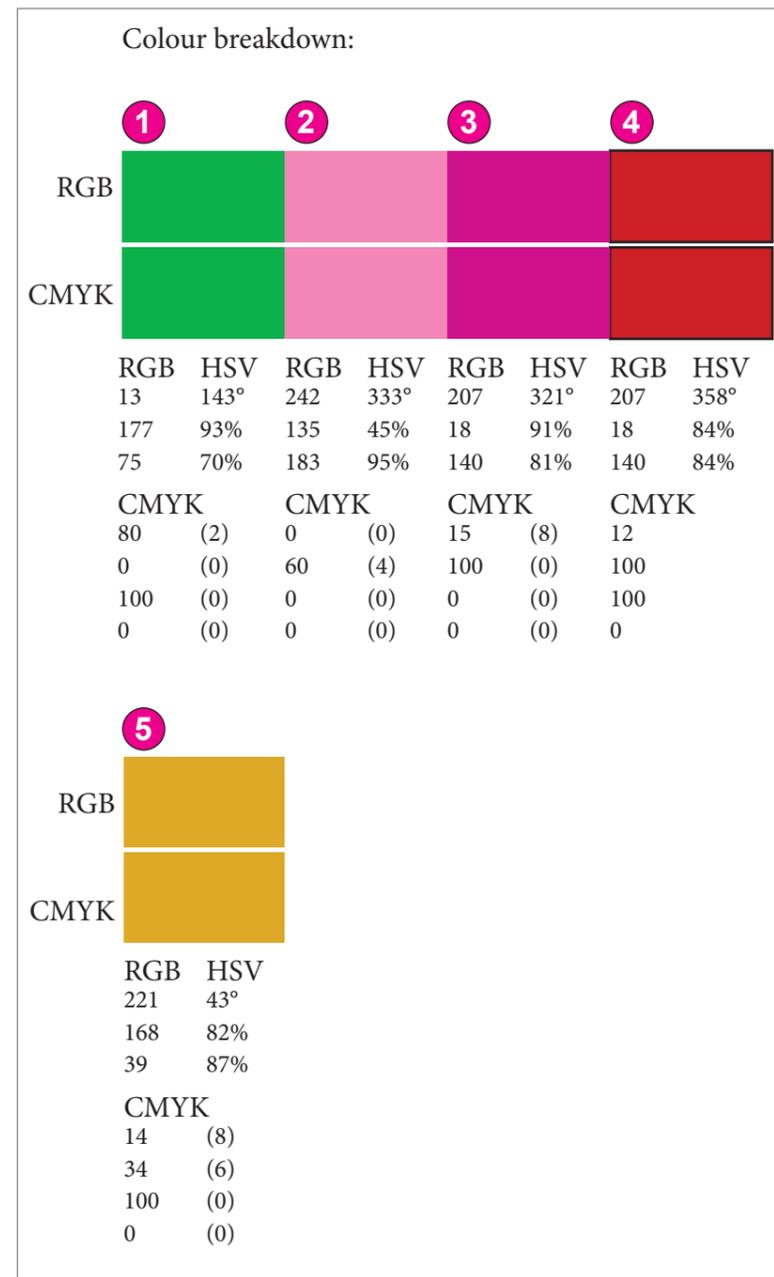


Figure 5.42: The colours used for the fourth artwork. (Author's construct)



Figure 5.43: The digital planning document for the fourth artwork. (Author's image)

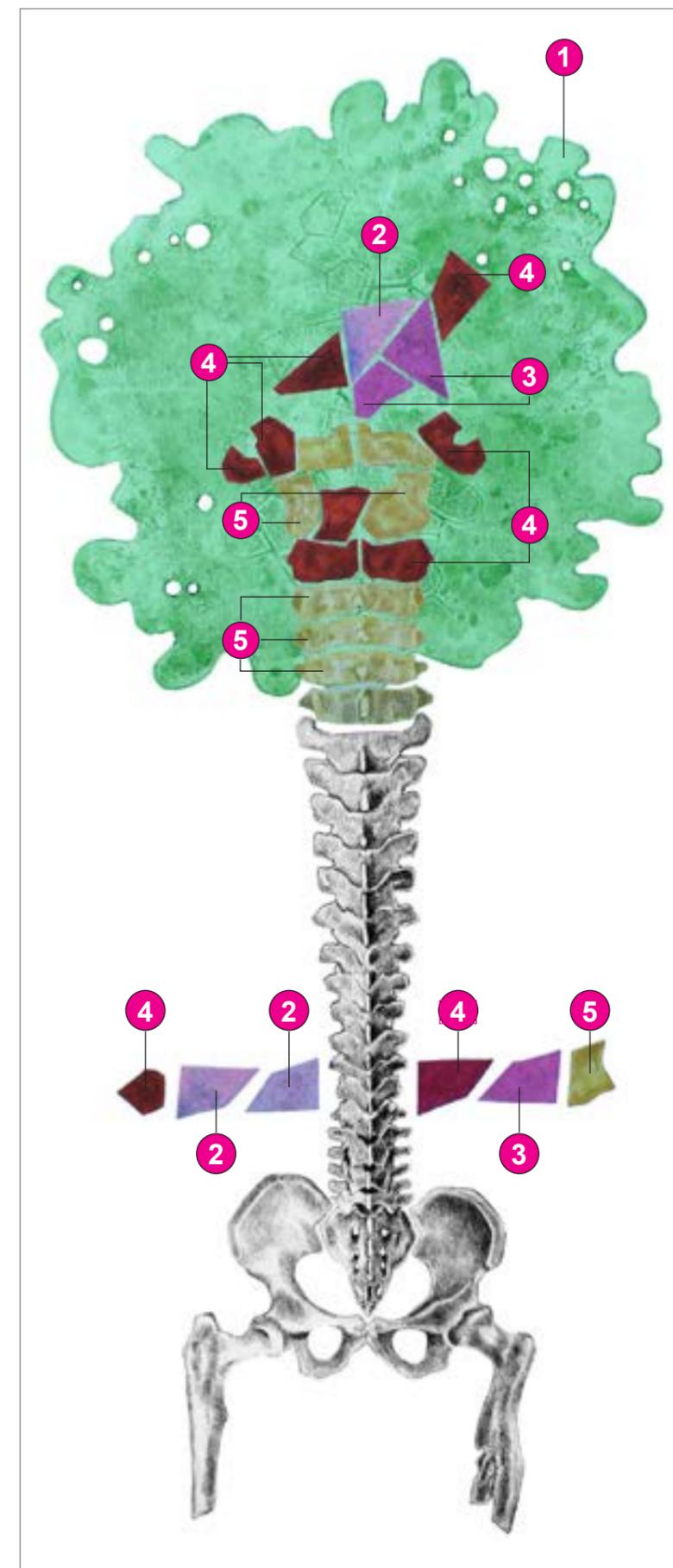


Figure 5.44: The third of the final intaglio prints. (Author's image)

**Observation and adaptation** The hue of the colour chosen at ① was unsatisfactory. It was, thus, decided to revert to the previous background colour, as applied at Step 9. The saturation and the brightness were not considered because these two variables would be adjusted according to the hue. It appears that the colour ⑤ is more vibrant (vibrancy is described as a combination of saturation and contrast) viewed against ① compared to that colour against the white. The limited number of colours, was found to be aesthetically appealing to the researcher.

**Step 11** A reduction of the applied colours was the aim at this step, because the print at Step 10 (Figure 5.44 p50) appeared less confusing and more ordered with fewer colours compared to prints produced at earlier steps. It was decided to use, primarily a blue colour **3** because this is the complement of the colour **6**. Despite the fact that eight colours were used, the amounts of colours applied was adapted to give the impression of more blue. This was also the first of the prints to show the cells flowing from the femur in the final design. Figure 5.45 shows the colour breakdown whilst Figure 5.46 and Figure 5.47 respectively show the digital planning document and final print

Colour breakdown:

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
RGB				
CMYK				
RGB	186	207	0	46
HSV	41°	321°	196°	239°
	139	18	167	49
	80%	91%	100%	68%
	38	140	229	146
	73%	81%	90%	57%
CMYK	26	15	100	100
	(7)	(8)	(0)	(0)
	43	100	0	100
	(6)	(0)	(0)	(0)
	100	0	0	0
	(0)	(0)	(0)	(0)
	5	0	4	0
	(0)	(0)	(0)	(0)

	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>
RGB				
CMYK				
RGB	242	221	207	126
HSV	333°	43°	358°	89°
	135	168	18	181
	45%	82%	84%	64%
	183	39	140	66
	95%	87%	84%	71%
CMYK	0	14	12	57
	(0)	(8)		(4)
	60	34	100	8
	(4)	(6)		(9)
	0	100	100	100
	(0)	(0)	(0)	(0)
	0	0	0	0
	(0)	(0)	(0)	(0)

Figure 5.45: The colours used for the fifth artwork. (Author's construct)

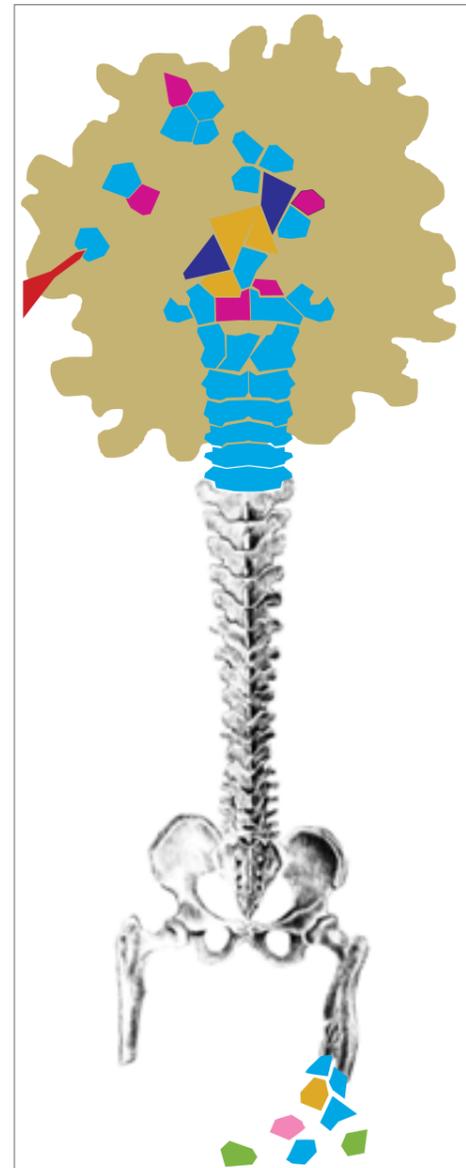


Figure 5.46: The digital planning document for the fifth artwork. (Author's image)

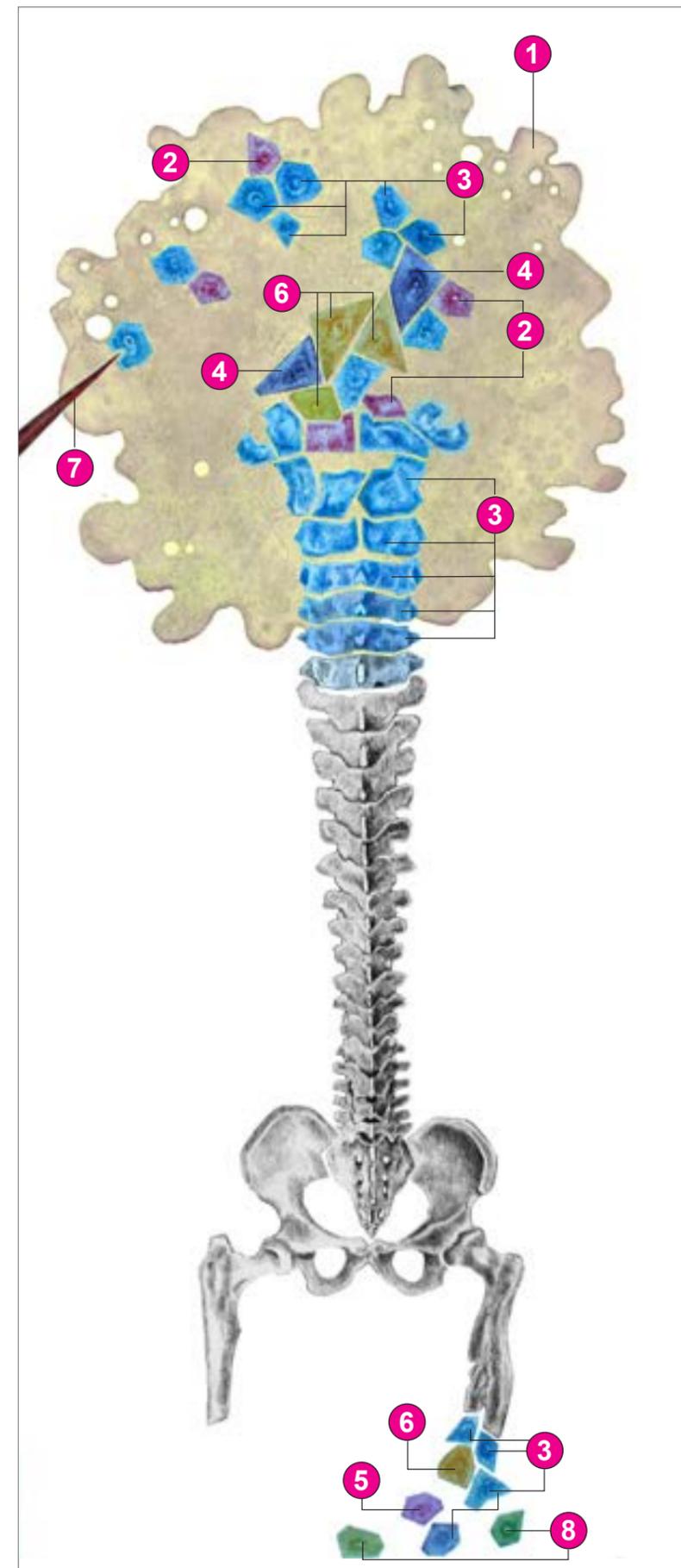
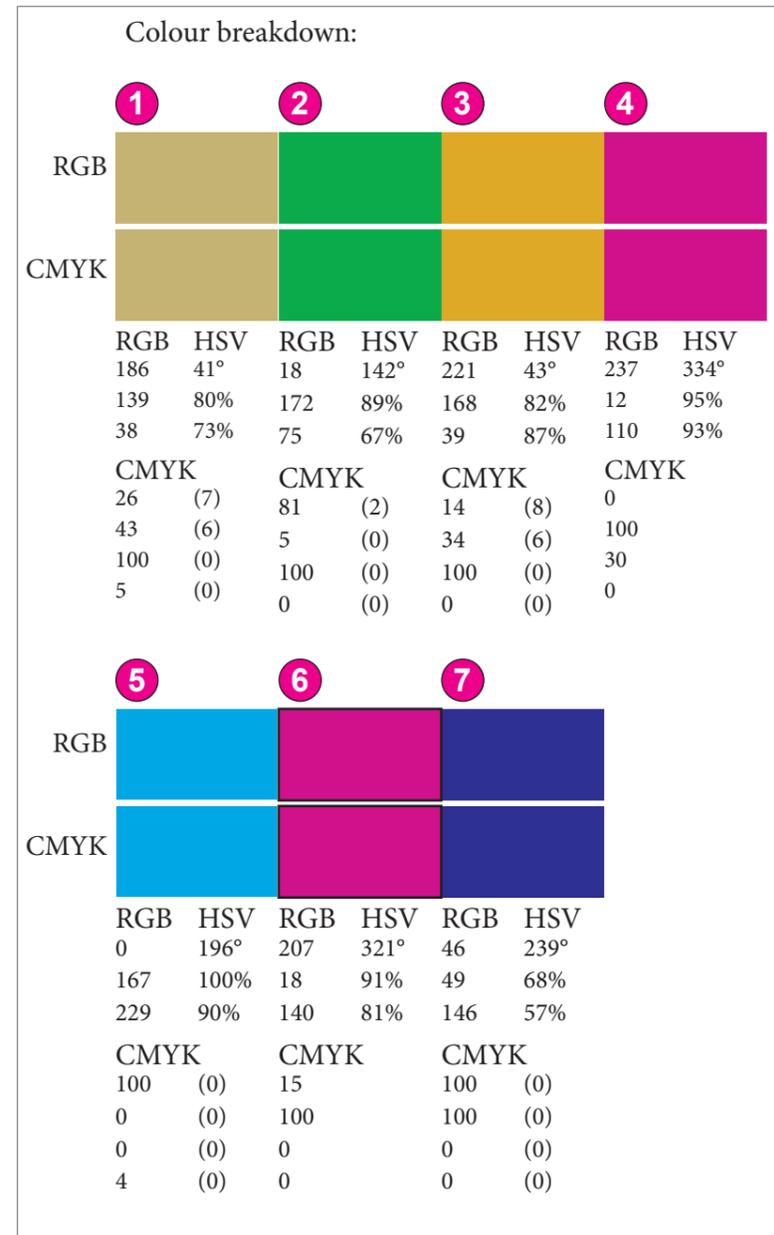


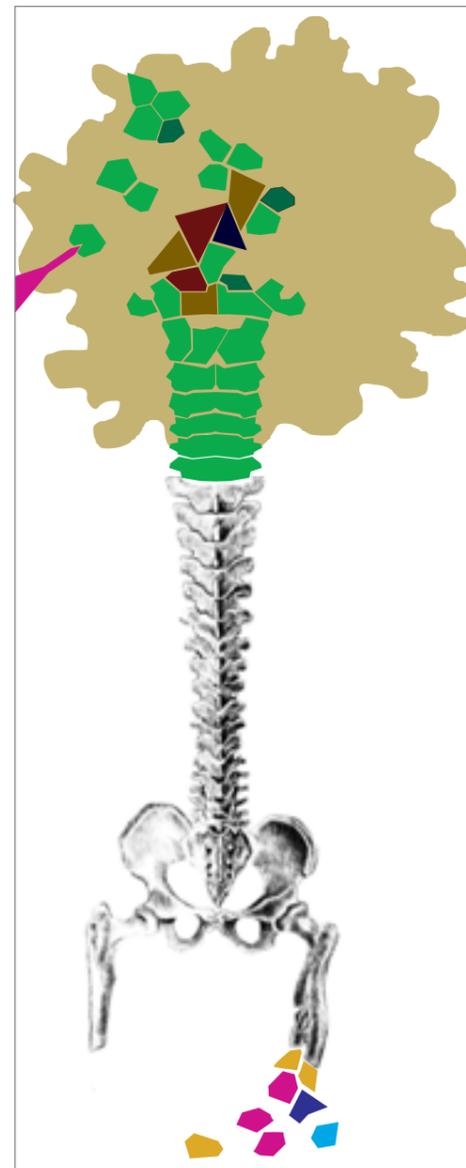
Figure 5.47: The fith of the final intaglio prints. (Author's image)

**Observation and adaptation** It was decided that colour distribution was correct and, therefore, would be applied to the rest of the following artworks. The primary colour **3** used here would be changed to a green hue with the same saturation level in the next step. As an experiment, the green **8** to be used in the next step, was tested on a white background in this step.

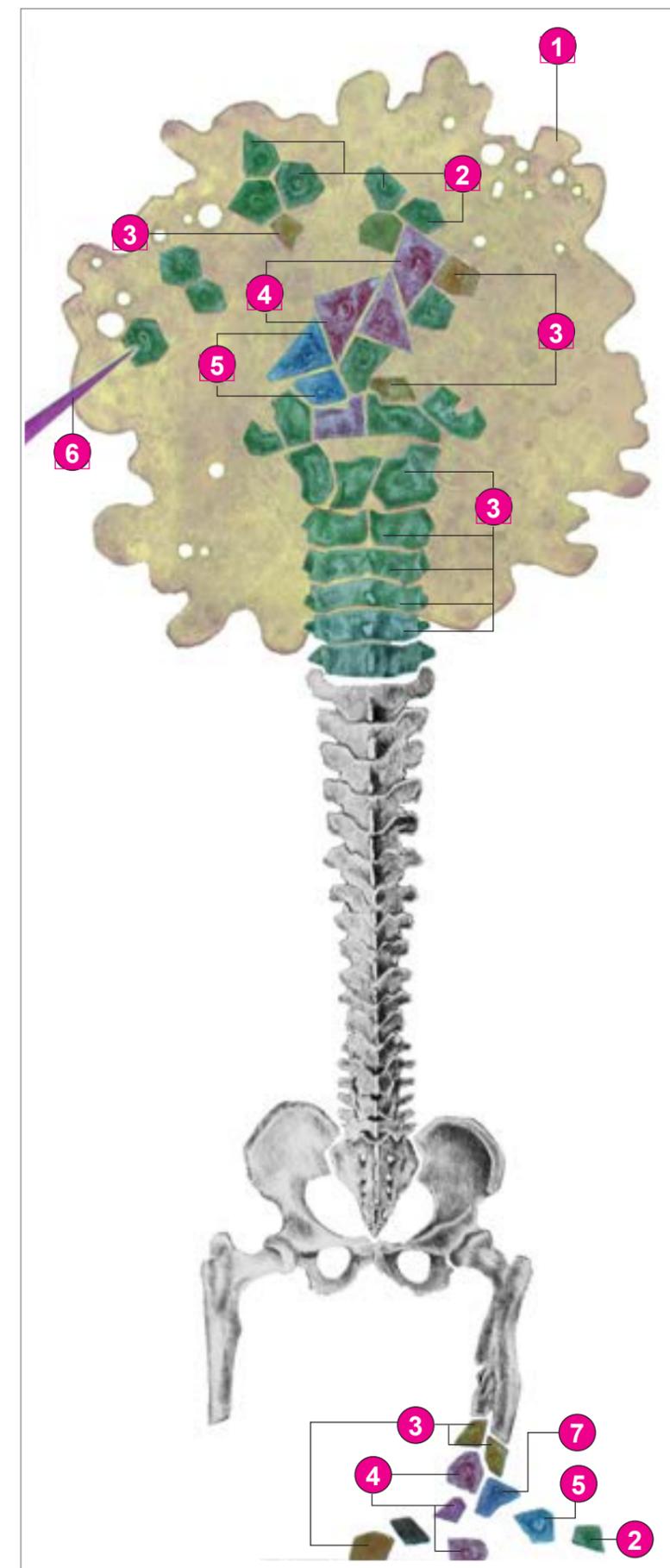
**Step 12** Complex colour mixing, as described by Drew and Meyer (2008), is being explored in this set. This term refers to each colour being not only complementary to each other but also containing some amount of the colour's complement in itself. The primary colour **2** contains some of the hue at **5** and in the same fashion, **4** contains some of the hue used in **3**. These two sets are colour complementary to **6** and **7** respectively. All of these colours are set against the most neutral complementary background colour of **1**. Figure 5.48 shows the colour breakdown whilst Figure 5.49 and Figure 5.50 respectively show the digital planning document and final print.



**Figure 5.48:** The colours used for the sixth artwork. (Author's construct)



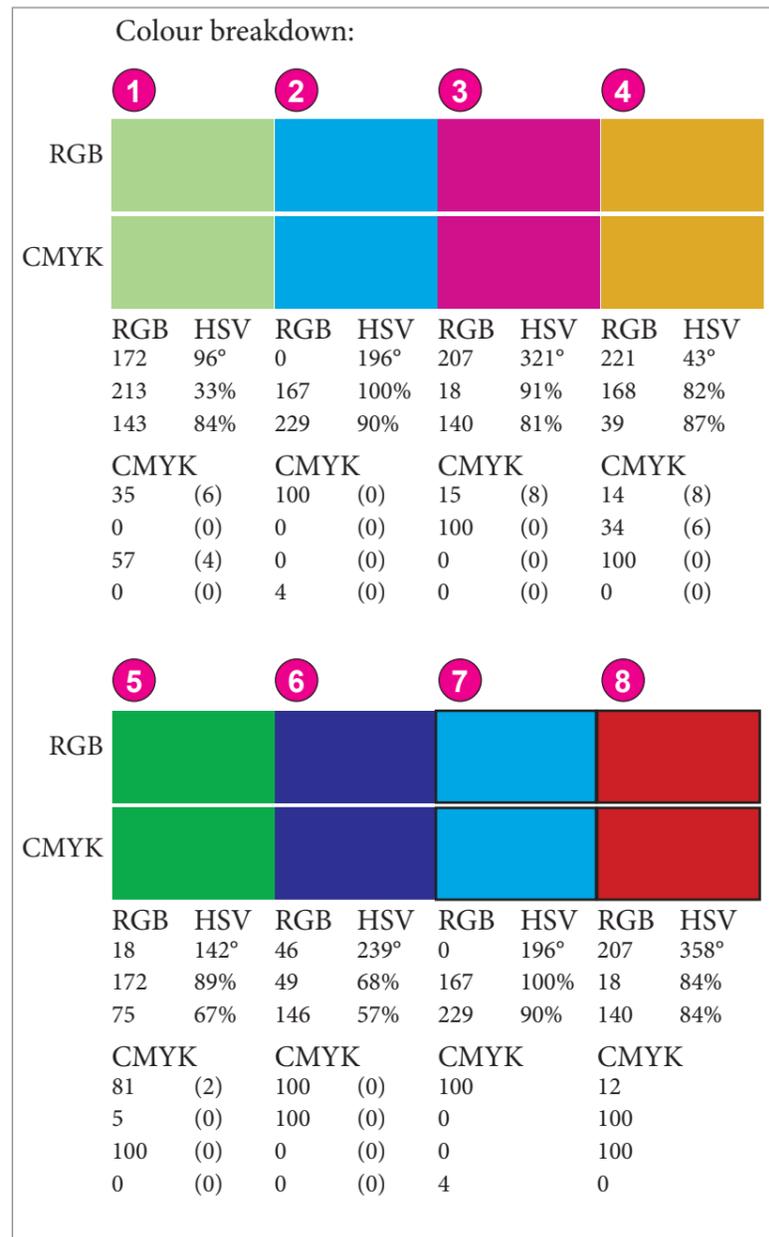
**Figure 5.49:** The digital planning document for the sixth artwork. (Author's image)



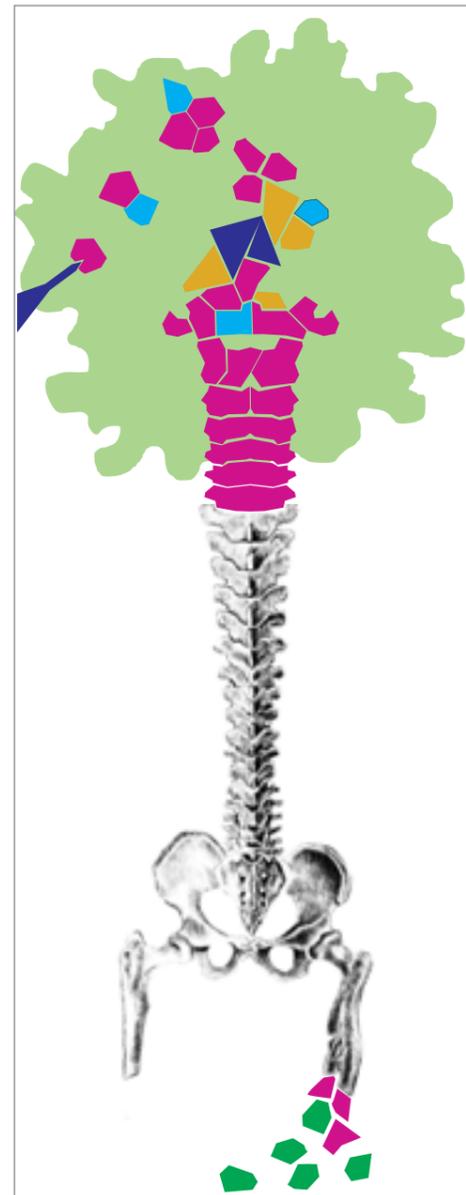
**Figure 5.50:** The sixth of the final intaglio prints. (Author's image)

**Observation and adaptation** Retinal fatigue is a condition caused by prolonged fixation of the eye on one colour. Humans can see more variants of green relative to other colours. The contrast between red/magenta and green used in this image causes the eye to move constantly, reducing the prevalence of retinal fatigue and the associated after-image. The warm colour at **1** can easily cause fatigue due to the lack of contrast. For this reason the next artwork background was adapted to green with a high contrast of magenta: **4**.

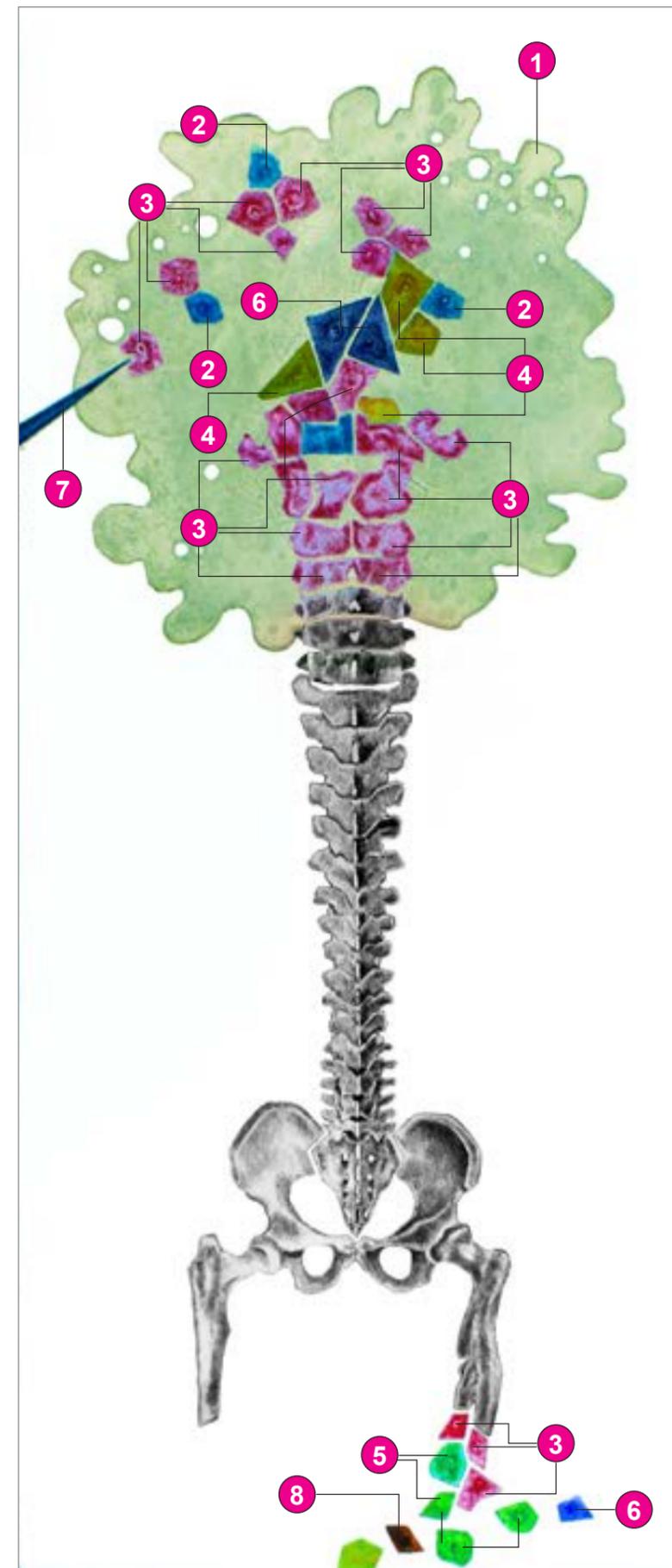
**Step 13** After taking into consideration all of the previous steps and colour combinations, a high contrast, complex colour mixing set was formulated for the final step. Two different hues of green **1** and **5**, contrasted to **3** was used with another set of complementary colours **6** and **4**. The final print (Figure 5.53) serves as accumulation and adaptation of previous sets to a simple and striking final set of colours applied. Figure 5.51 shows the colour breakdown and Figure 5.52 shows the digital planning document for the final print.



**Figure 5.51:** The colours used for the final artwork. (Author's construct)



**Figure 5.52:** The digital planning document for the final artwork. (Author's image)



**Figure 5.53:** The sixth of the final intaglio prints. (Author's image)

## 5.5. ITERATION 3: TEXTURES

**5.5.1. RATIONALE** Although the paper of this artwork only has one true texture, softground etching is used to visually simulate textures of all kinds. The aim of this set is to establish how accurately software can predict the outcome of such textures. Texture is the stimuli of the touch sensation of different surfaces of objects leading to haptic perception. This haptic perception is defined as the combination of tactile, kinaesthetic and proprioceptive functions, the way humans experience touch both on the surface of and inside of their bodies. In haptic visuality, the eyes themselves function like organs of touch. Haptic visuality, a term contrasted to optical visuality, draws from other forms of sense experience, primarily touch and kinaesthetic (Paterson 2009).

**5.5.2. THEME** The Rorschach test, also commonly known as the inkblot test, was developed to assess psychological deviations. Herman Rorschach's test was ranked eighth in a U.S. national survey for psychological instruments and is requested in 25 per cent of psychiatric forensic assessments (Gacano and Meloy 1994). This test measures perceptions of inkblots exhibited by patients who are reluctant to describe their thinking process openly. Using complex algorithms, the interpretations are used to determine thought disorders. The test of 10 official nearly symmetric inkblots is shown to the subject in different phases to collect data on motivation, needs and conflicts.

Psychology, as the study of mental functions and behaviours, is, according to the American Psychological Association (2010), set out to ultimately benefit society. Post 1994, the Human Sciences Research Council's mandate has shifted from a focus on the individual as subject to a larger focus on societal issues. Healthcare in South Africa is a highly debated issue, with public healthcare in a near dismal state, consequently, mental healthcare has suffered even more so with state mental hospitals receiving less funding. Disadvantaged communities – often most at risk – have almost no access to such facilities.

This artwork (Figure 5.54) illustrates the mental conditions measured with a perception tool and the influence of medication on people with these disorders. The Rorschach test serves as a means to measure and assess mental conditions, while modern psychiatric medicine plays a vital role in the treatment of mental disorders. The use of mental or mood stabilisers have become so common that a growing number of non-psychiatric patients are taking these drugs (American Psychiatric Association 2011).

The mind can go into a deep depression, often advancing from a hollow to a pit, as shown in this set of artworks by a progressive build-up of softground textures to illustrate the darkening and morbid effect of depressive disorders. Combatting this state of mind, are drugs often referred to as "happy pills". The prescribing of these drugs is a modern and highly scientific approach to chemically alter the mood to a more positive and/or stable state. Despite the negative effect that mental disorders have on an individual, society as whole suffers even more due to the numerous resources required to treat a patient and the extensive sphere of negative influence one subject has. In this sense this artwork (Figure 5.54) comments on the state of society, exploring issues of mental degeneration counteracted by scientifically formulated drugs.

**5.5.3. TECHNIQUE, PROCESS AND MATERIAL** The third series of artworks are designed to mainly use softground drawing and softground impressions as intaglio technique. String of all kinds, cloths, paper, soft organic matter such as plant leaves, hair, or any other reasonably soft object is placed onto the grounded plate when passed through a heavy metal press. The object pushes into the ground leaving behind the impression. When the plate is bitten the impression serves as area where the ground is removed and becomes etched.

This set of artworks is based, in part, on the Michaelis School of Fine Arts published work to show intaglio processes and textures. The textures used in this series of artworks are either researched from the publication mentioned above, or from computer simulated textures from digital images as shown in Figure 5.55.

An edition of five to seven proofs was pulled of each stage, excluding artist proofs, totalling 40 final prints. The paper used was a 285gsm Fabriano Rosapina and the ink used was Charbonell, combined with clove oil to change the viscosity and drying time of the ink.

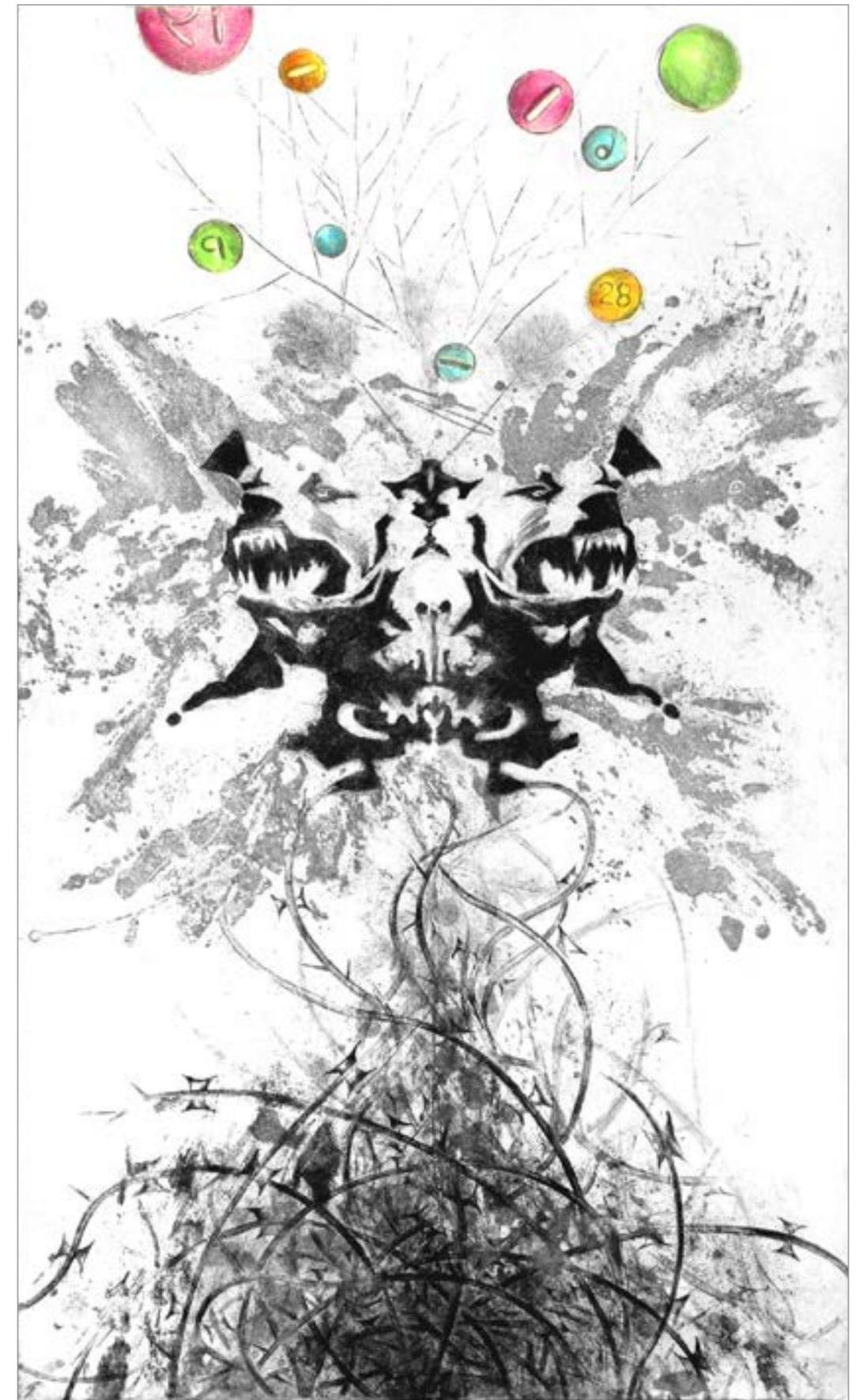


Figure 5.54: The final artwork of this iteration. (Author's image)



Step 3 Figure 5.57 shows the ideation process from the first rough image to the final digital artwork (bottom right). This design was further reworked after initial difficulties arose in the final preparation to platemaking. Figure 5.58 shows the inclusion of official Rorschach tests and floral matter in two new versions.

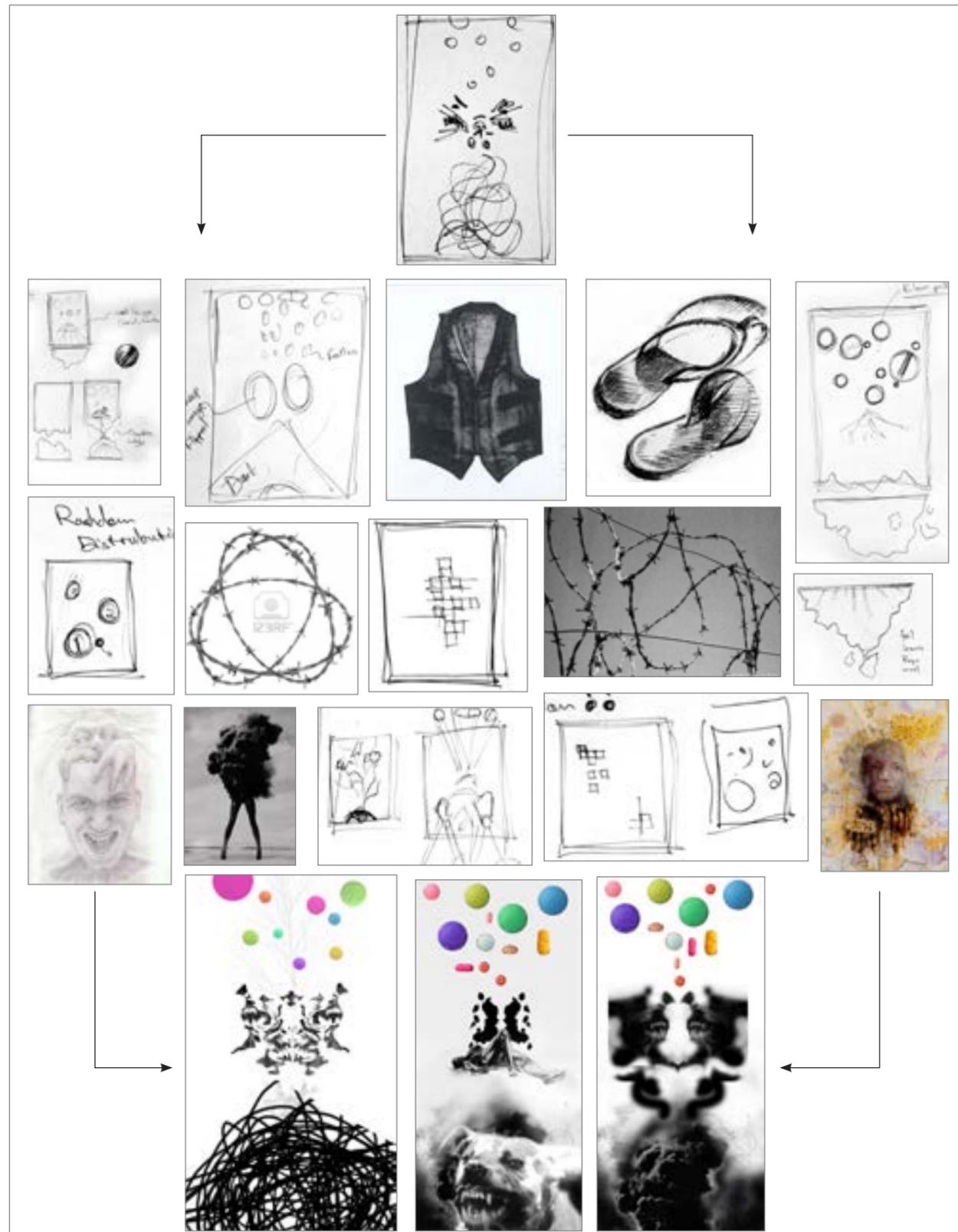


Figure 5.57: Planning of the third set of artworks. (Author's construct)

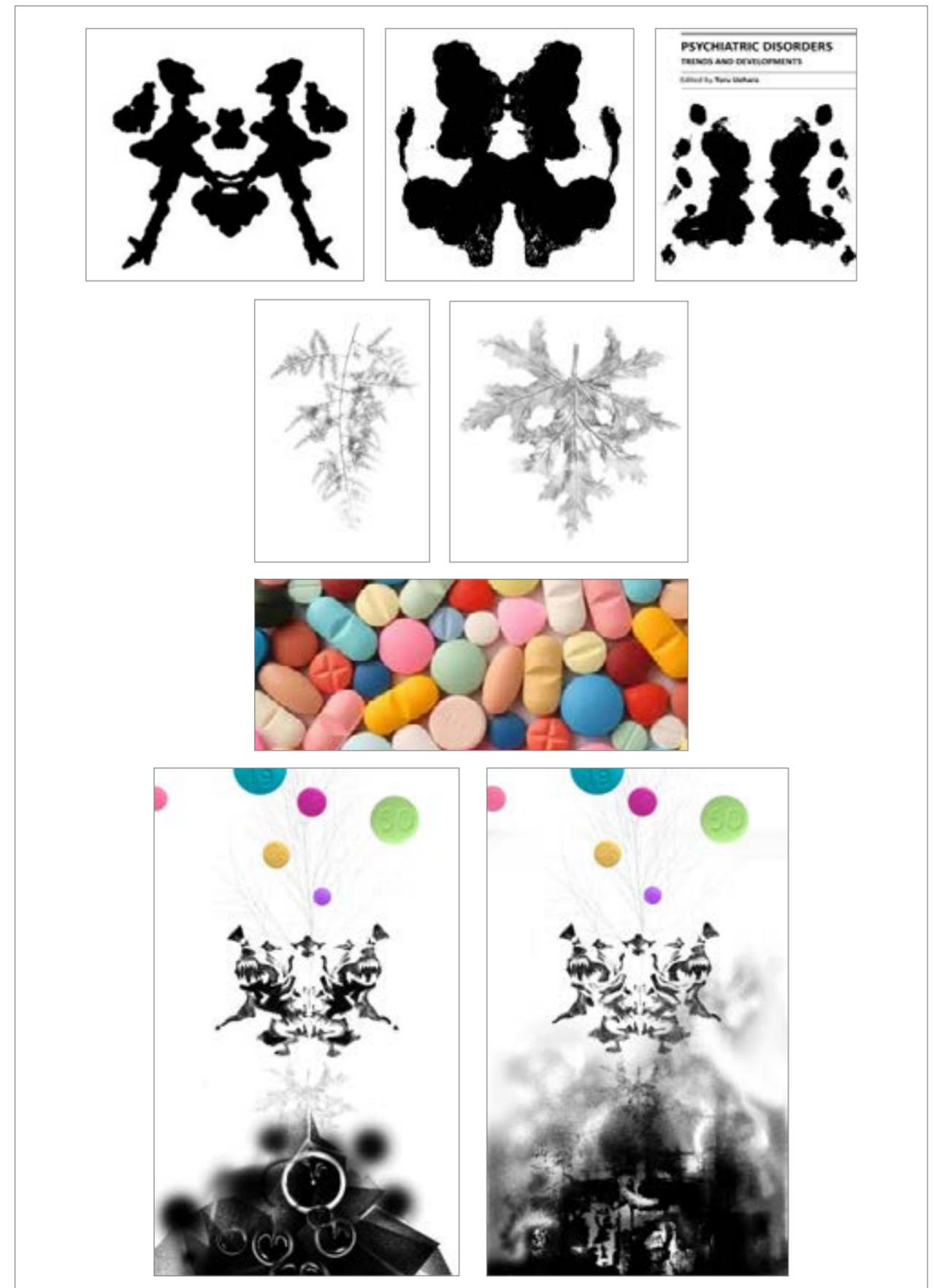


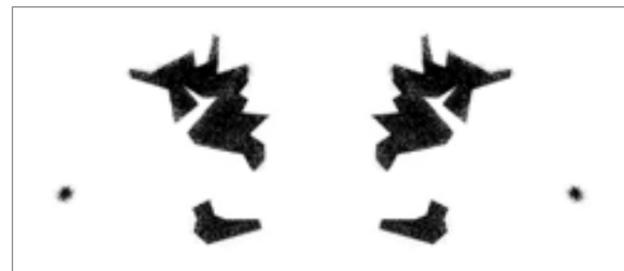
Figure 5.58: Final versions of the artwork. (Author's construct)

**Step 4** The full colour image of the dog was digitally manipulated to a black and white high contrast image. The image was then duplicated and mirrored to produce the Rorschach image (Figure 5.59). More detail was added to increase the complexity of this image (Figure 5.60). A software blending mode of Multiply was digitally used between the two images which creates an interplay of high contrast between the black and white content of the two images. This entire process was done digitally using both vector and bitmap editing software.

From the document described above, the design was printed on paper with a laser printer, cut out by hand and then placed on top of the softground prepared plate. The paper cut-out acted as lift ground to create an area of no resistance for the corrosive action of the ferric chloride to etch the plate.

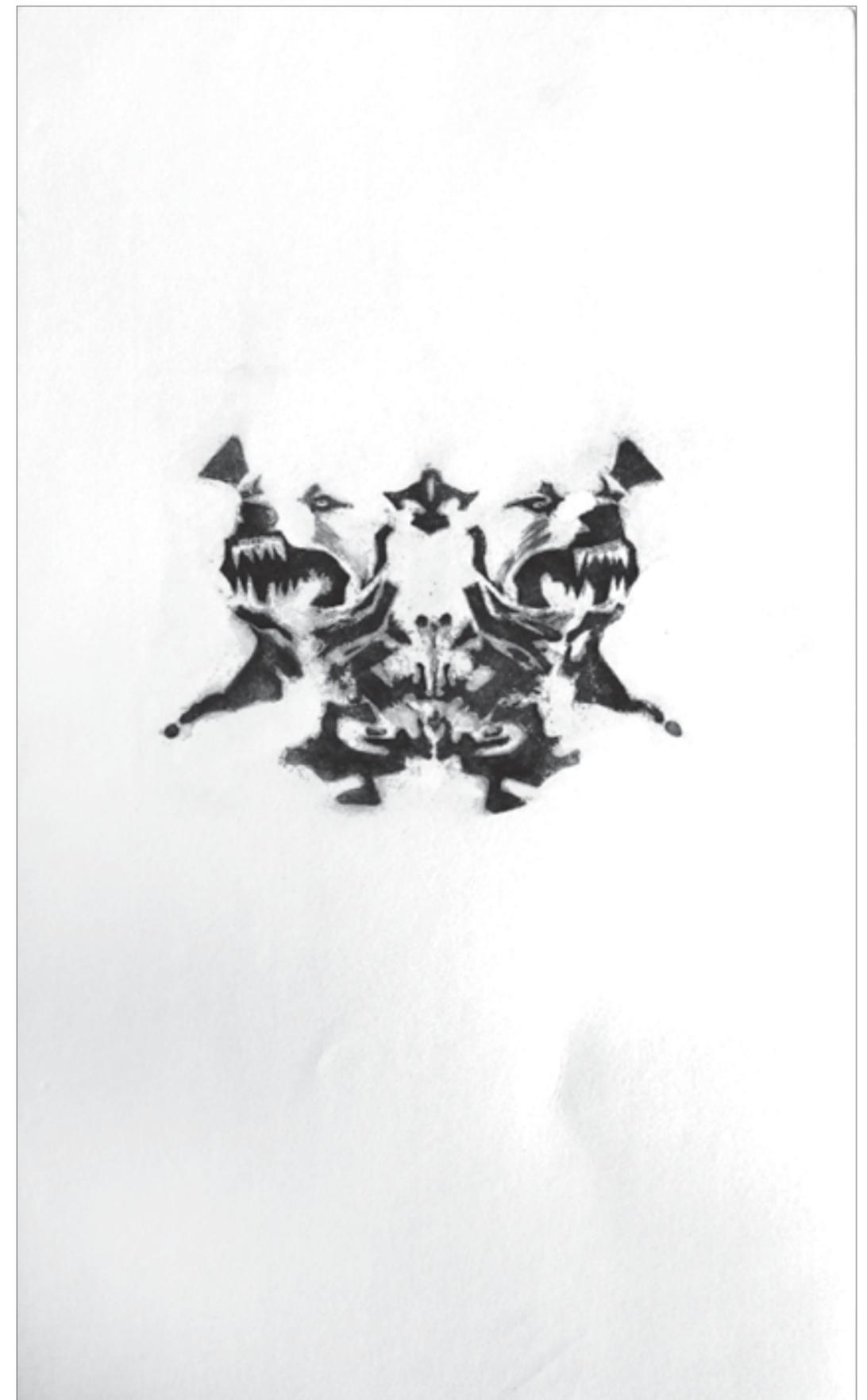


**Figure 5.59:** The Rorschach image. (Author's construct)



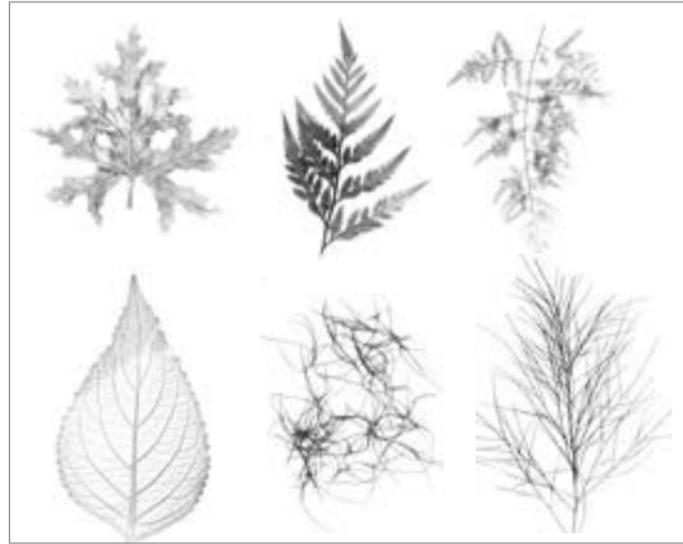
**Figure 5.60:** Detail added to the Rorschach image. (Author's construct)

**Observation and adaptation** The paper cut-out of the Rorschach image to act as agent to remove the softground coating from the plate, was irregular. The paper did not remove the softground in an even, regular manner as planned but rather made variations of softground removal and, therefore, the image etched and printed was not a homogenous solid black (Figure 5.61). It is clear that fine nuances in the application of the softground and press pressure had an amplified effect on the amount of ground removed and, therefore, depth of recess which resulted in uneven printing. Using paper to act as softground removal did not prove very successful. This irregularity could not be accommodated by the simulator and therefore, the digital image had to be re-aligned with the end result at this step.



**Figure 5.61:** The intaglio print at the first state. (Author's image)

**Step 5** Floral matter (Figure 5.62) and feathers (Figure 5.63) were collected and photographed. These images were converted to grayscale and the contrast set to simulate how they would appear when printed on an intaglio plate. With these images a digital design (Figure 64) was created and then placed on the prepared plate to be etched and printed.



**Figure 5.62:** Floral matter. (Author's image)

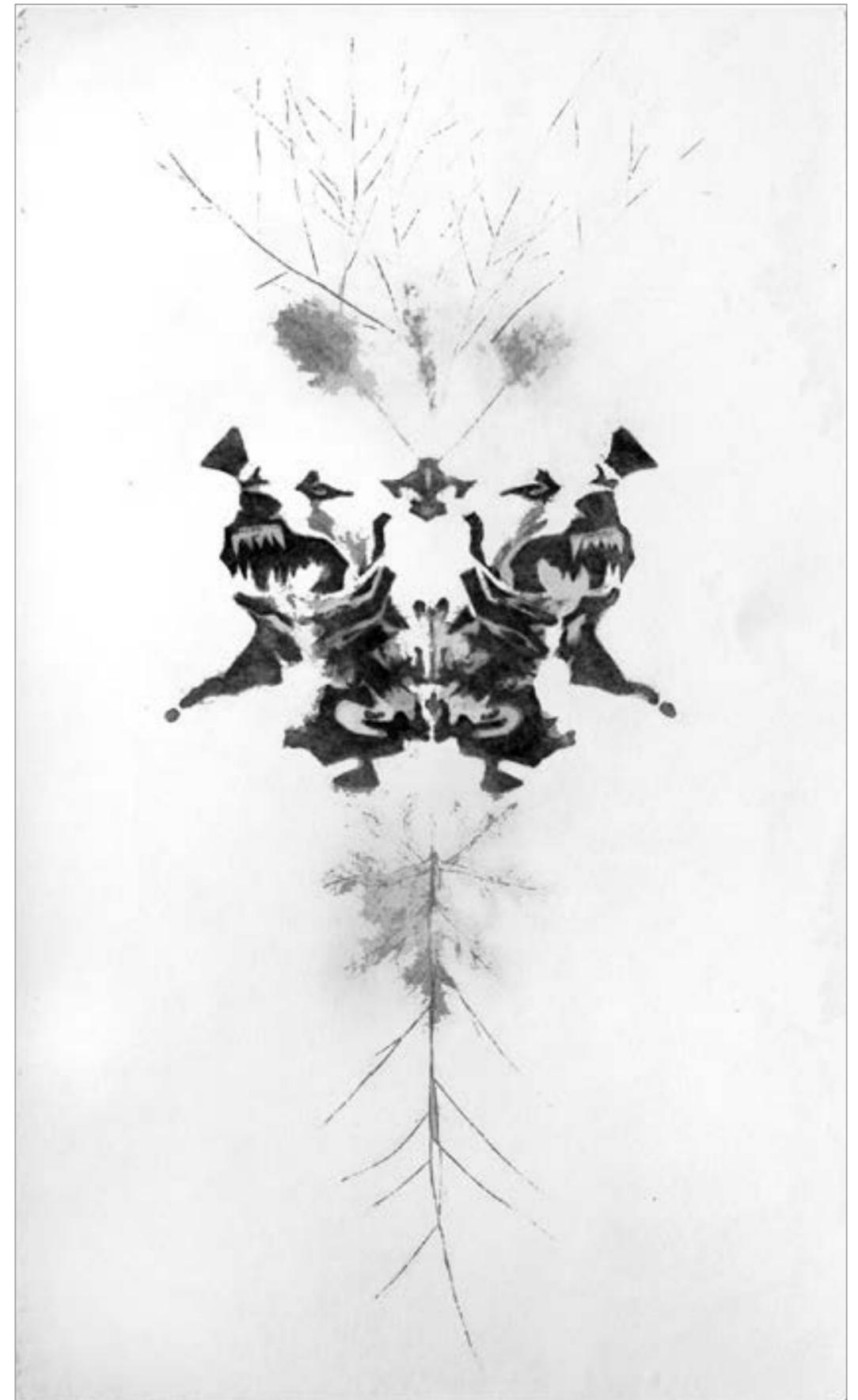


**Figure 5.63:** Feathers. (Author's image)



**Figure 5.64:** The digital planning document for the second state. (Author's image)

**Observation and adaptation** 'Foul biting', although considered a mistake, is often not removed and in some cases even seen as favourable because it is indicative of the intaglio process. Foul-bite or 'over-biting' is common in etching, and is the effect of minuscule amounts of etchant leaking through the ground to create minor pitting and burning on the surface. At this step of printing, substantial foul biting was an accidental result and, even though unintended, it added texture to the design (Figure 5.65). However, as the foul bite was not planned, the simulation had to be re-aligned to the reality of an unplanned effect.



**Figure 5.65:** The intaglio print at the second state. (Author's image)

**Step 6** Some texture was added by randomly placing pieces of cut-out paper on the plate prepared with another layer of soft ground. A deliberate attempt was made to press the papers unevenly and to touch the softground with bare hands to make finger-marks. The computer planning for this step was absent because the very act of placing objects randomly on a plate cannot be pre-determined or planned.

At this stage there exists both unwanted and wanted (although unplanned) textures present on the matrix (Figure 5.67). The cyan coloured blocks on Figure 5.66 shows the placement of the paper cut-out shapes. The impression made by the paper on the softground is impossible to predict and the result was completely random but not unwanted.



**Figure 5.66:** The digital planning document for the third state showing areas of textures both planned and unplanned.  
*(Author's construct)*

**Observation and adaptation** The Magenta coloured areas on Figure 5.66 shows unwanted and, by definition, unplanned texture. This is the result of the ground not resisting the ferric chloride adequately and, therefore, the mordant etch areas not being planned. Significant time and effort was spent to partially remove this texture, which amplifies the considerable difficulties experienced during intaglio printmaking (excluded mezzotint) when attempting to remove mark data from the matrix.

What could be simulated via computer software was the time factor involved in the etching and, therefore, the tonal value of the textures. A tonal value chart and simulated computer colour model was developed in the following iteration.



**Figure 5.67:** The intaglio print at the third state. *(Author's image)*

**Step 7** Some hand-drawn elements were introduced because the random application of textures proved unsatisfactory. The barbed wire was added by means of hard ground etching and the final appearance and tone of this element was developed over three stages of continually adding more data (Figure 5.69).



**Figure 5.68:** The digital planning document for the fourth state showing areas of wear.  
*(Author's construct)*

**Observation and adaptation** Some of the textures produced in the step 5 proved short-lived because they wore out quickly due to the repetitive printing and wiping of the plate. This fact indicated another variable that needed to be accommodated in the computer simulator. The shallow marks left on the matrix by a softground, or similar technique, has a lifespan, usually shorter than that of the required edition. The areas noted above in Figure 5.68 in green disappeared after approximately four prints. The rate of this decay is very difficult to predict unless recorded beforehand and applied to other similar cases.



**Figure 5.69:** The intaglio print at the fourth state. *(Author's image)*

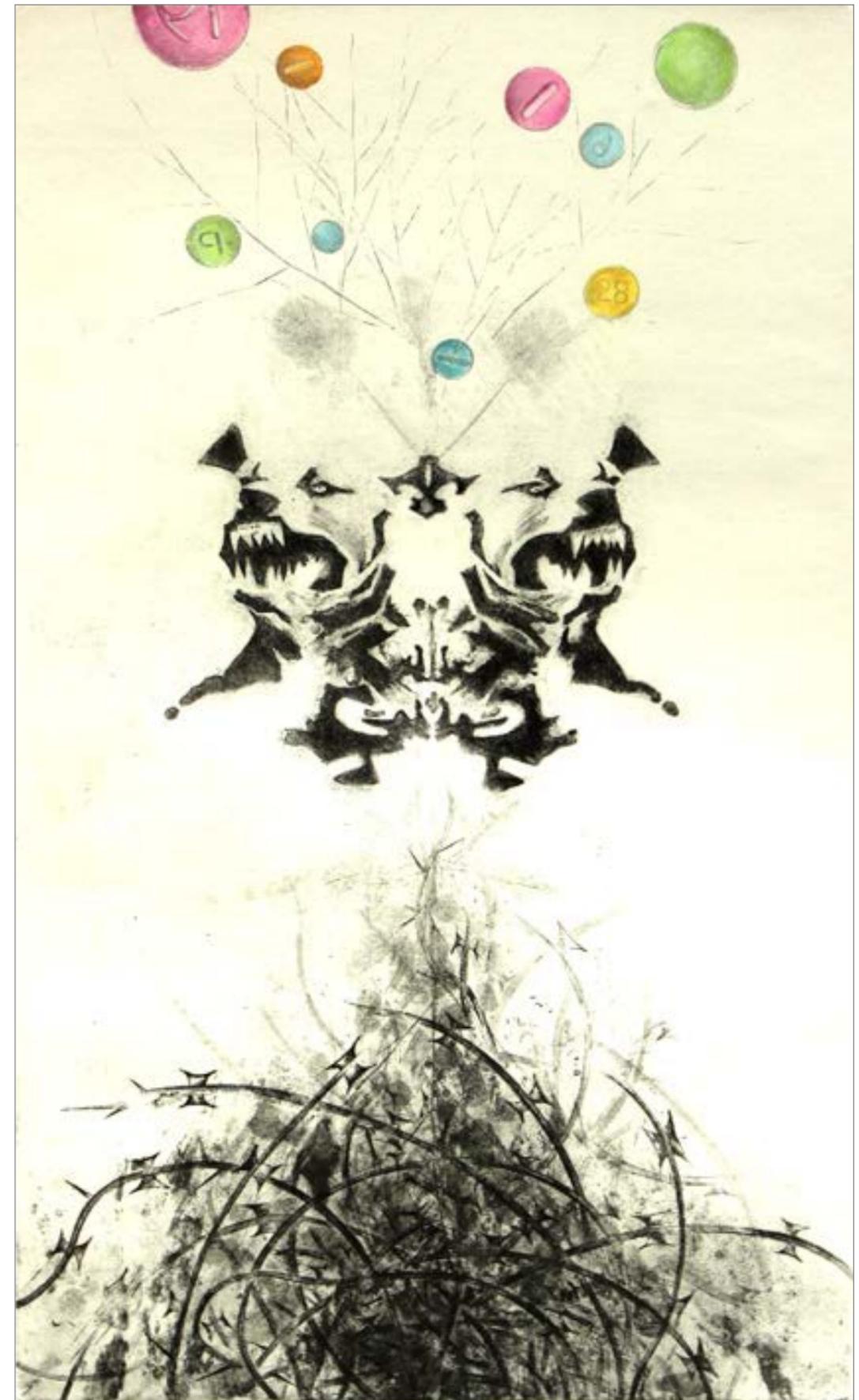
**Step 8** The coloured pills were digitally introduced first before being applied to the intaglio plate as elements of soft ground drawing (Figure 5.70). Textures produced by this technique of hand-drawing on a paper overlay on a softground prepared plate proved very satisfactory and the researcher found this technique to be the most interesting although challenging. The hand colouring was planned, based on the previous iteration.

More barbed wire was also introduced (Figure 5.71) after the computer visualisation had been made (Figure 5.70).



**Figure 5.70:** The digital planning document for the fifth state. (Author's construct)

**Observation and adaptation** Operational error, or rather the lack of application of previous lessons learned, highlighted an unforeseen and irreversible problem. Text added to the pills was not reversed digitally and, therefore, its addition to the plate was incorrectly implemented. The mirroring effect of the intaglio print, however, reversed these texts. The text was not part of the planning but only added as an afterthought, consequently, it highlights the valuable use of the simulator to reverse images.

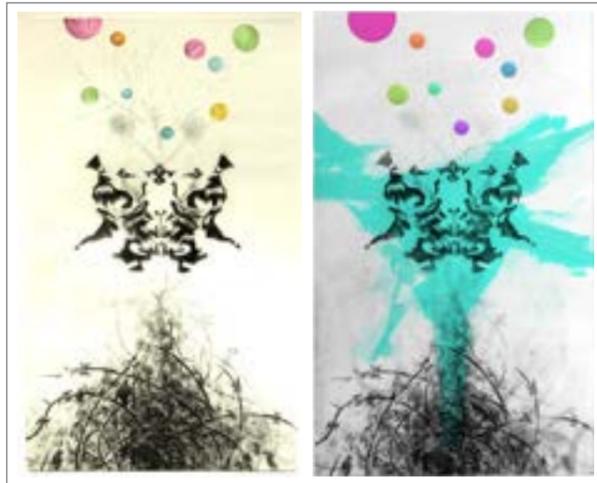


**Figure 5.71:** The intaglio print at the fifth state. (Author's image)

**Step 9** The final stage of the print was produced by adding some texture by means of sugarlift. Too a limited extend, the layout more than the texture was planned digitally. Figure 5.72 shows the original image on the left and the digitally planned sugarlift area to be printed in cyan on the right. This design was rejected because the colour was to stark. Another attempt of digital planning was made and the design was adapted to a new digital design (Figure 5.73).

Although the technique of sugarlift can accommodate accurate areas of application, the method used demands some randomness of application. The viewer is invited to judge for himself/herself how accurate the brush effect on Figure 5.73 was translated in the final artwork (Figure 5.75).

Some areas of the barbed wire, as well as areas on the Rorschach image were amplified and more detail was added to bring the artwork to a concluding state. The areas in red in Figure 5.74 show the added detail.



**Figure 5.72:** The digital planning document for the fifth state showing a cyan coloured sugarlift. (Author's construct)



**Figure 5.73:** The digital planning document with a grey coloured sugarlift. (Author's construct)



**Figure 5.74:** The intaglio print digitised with digitally planned detail added. (Author's construct)



**Figure 5.75:** The final intaglio print. (Author's image)

## 5.6. ITERATION 4: TONAL VALUES

**5.6.1. RATIONALE** Large areas of subtle tonal values were explored in this iteration. Computer software allows complex editing of tonal values thus allowing for the testing of the obvious notion that software is able to accurately predict tonal values. The design selected for this part of the experiment had to accommodate the gradual build-up of tones to make up a final image.

**5.6.2. THEME OF THE ARTWORK** No more blatant example of human degeneration exists than that of the physical body aging. It is safe to assume that innumerable resources are annually spent on the endless quest to better appearance. One cannot think of a single culture, or even a person, who is not concerned – at least to a small extent – with appearance. Even at death, great attention is given to burial attire and coffins and caskets which are on public display during funeral ceremonies.

Contradictory to this practice, beauty is also about concealing and covering up. Since the beginning of time, to cover what is less aesthetic is juxtaposed with the almost excessive focus on adornment that is pleasant to look at. Great effort is given to cover, and even more, to enhance and even amplify faces, lips and eyes. In both male and female, shoes and toenails up to the most elaborate hairstyles are considered important, whilst clothing both as protection against the elements as well as aesthetic embellishment is commonplace on nearly everyone.

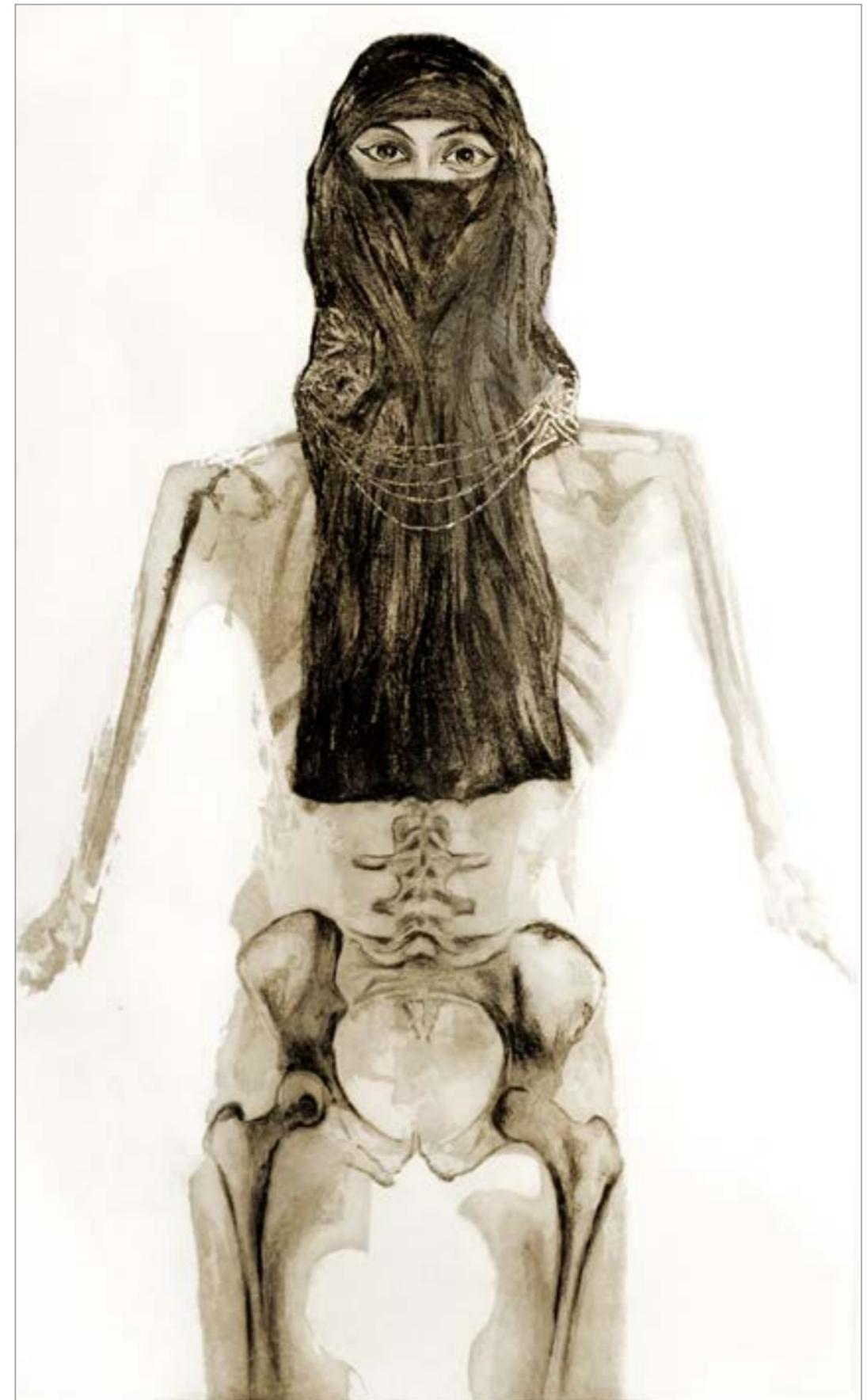
Beauty is, therefore, about covering up certain parts of the human morphology and revealing others. Conversely, however, the extremities of these two practices as co-inhabitants in the individual is shown. Elisabeth Eybers, (in Brink 2000) a South African poet wrote on beauty that nothing shows so innocently and impeccably the human form of perfection as that of the Röntgenfoto (X-ray). Always flawless with the true essence and, like any great artwork, the x-ray image does not hide anything.

### **Röntgenfoto**

Bekyk haar goed – die strak gesig  
wat stip sy blik na buite rig  
stel mens gerus, want geen portret  
vlei meer as dié van die skelet...

...die hele blink struktuur van been  
met weefsel skemerig daaromheen  
is keurig inmekaar gepas,  
en, deur die tyd onaangetas,  
soos elke ware kunstenaarswerk  
tot die essensie ingeperk.

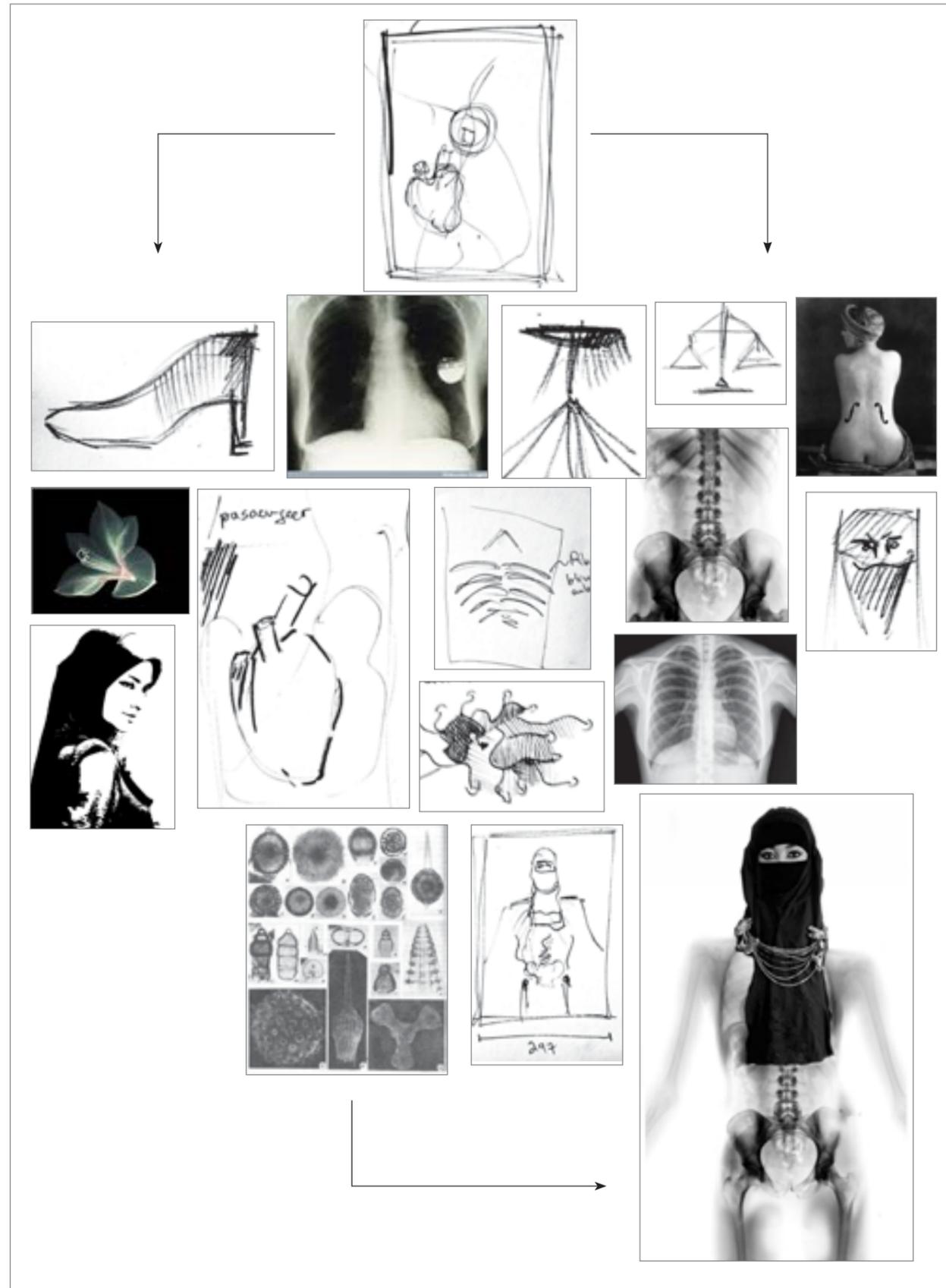
Die res, wat blote bysaak is,  
dryf omtrekloos deur 'n dun mis:  
die hart, met sy vertakkings, hang  
dof agter traliewerk gevang;  
kanale – bloed en limf en klier  
en ingewande – wieg soos wier  
en dié wat drif en droombeeld huis  
swem wasig bo die bekkensluis  
wat onintiem sy naaktheid toon  
en soetheid van geslag verloën...  
Al die verdriet en vreugde en vrees  
was dus 'n hersenskim gewees?



**Figure 5.76:** The final intaglio artwork. (Author's image)



**Step 2** Figure 5.78 shows the Ideation, planning and refining process of the first state of the design.



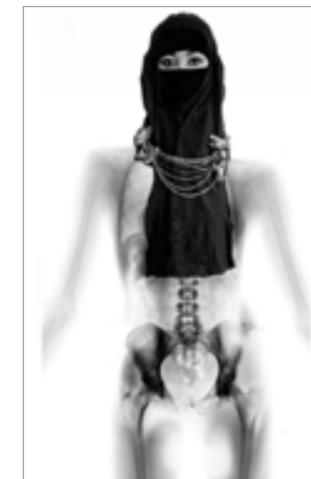
**Figure 5.78:** Planning of the fourth set of artworks. (Author's construct)

**Step 3** Adobe Photoshop and Adobe Illustrator software applications were used to firstly compose the final planned image and then to disassemble it into layers, representing a fixed tonal value. This feature is known as 'posterisation' and the software allows the user to choose the number of steps. Figure 5.79 shows the final digital design and Figure 5.80 shows the hijab removed with the image posterised as a digital bitmap layered compound image.

From these two images the layered compound image was split into separate electronic documents for each layer (Figure 5.81).

Each one of these documents was vectorised to simplify the shapes and, as vector shapes, filled with a black colour so as to print clearly on the laser printer. Each shape was physically cut out from the paper. In many cases digital tools in vector editing software were used to further simplify the shape to make it easier to cut out.

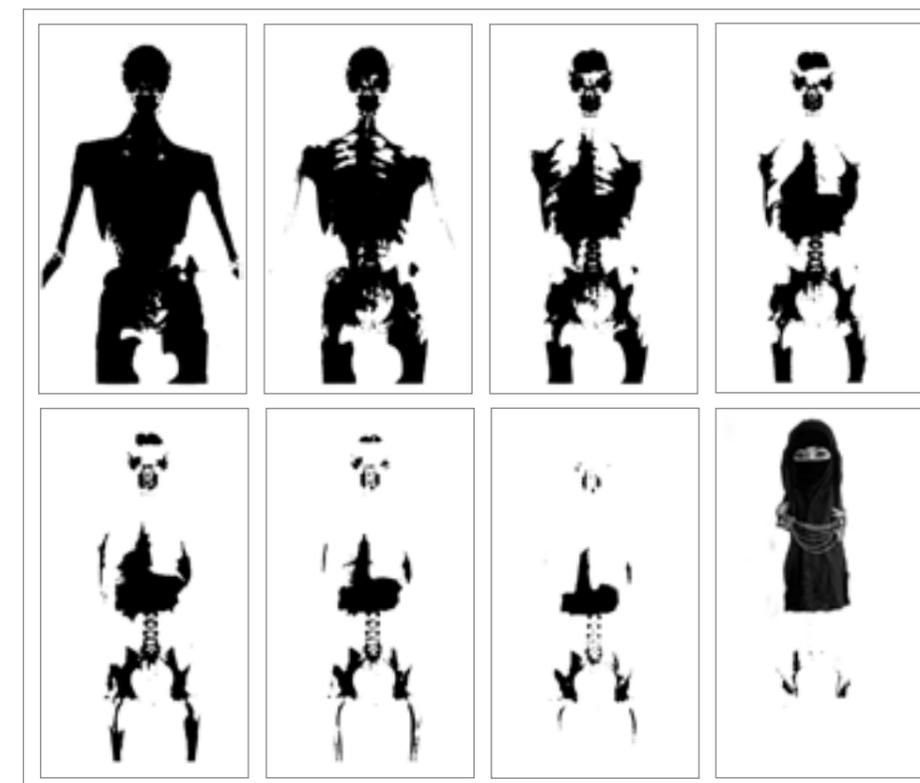
The above paper cut-outs was used as a mask on the copper plate when it was coated with a resist and, hence, when removed, the plate was left exposed to the corrosive action of the ferric-chloride to etch the area displayed there as black.



**Figure 5.79:**  
The digitally planning image.  
(Author's construct)

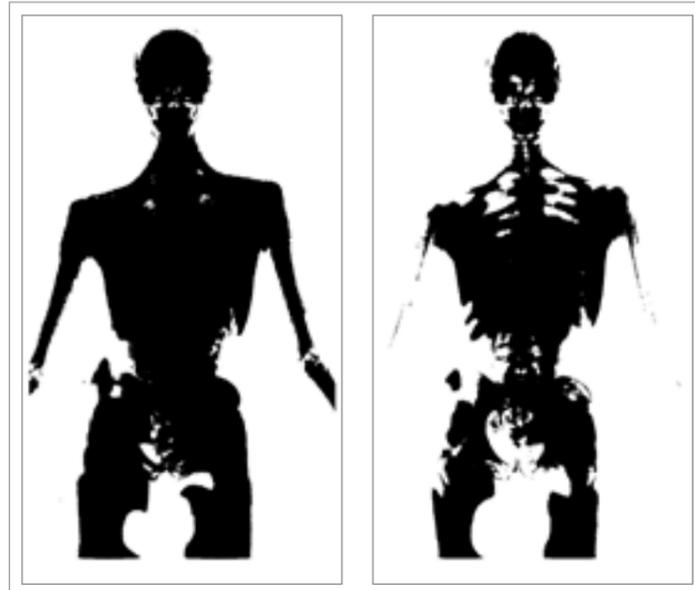


**Figure 5.80:**  
The posterised image with the hijab removed.  
(Author's construct)



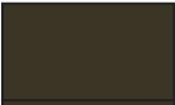
**Figure 5.81:**  
The separated layers of the compound image.  
(Author's construct)

**Step 4** The first stage of printing (Figure 5.84) involved the first two tones to be overlaid (Figure 5.82). A valuable and very accurate method of producing the cut-outs would be a computerised cutter such as used in various packaging industries. These machines access the data (the cut pattern) directly from a vector computer document and, consequently, the cut-out mask is more accurate than a hand cut-out. Cost and availability of such machines made this option not unviable for this study.



**Figure 5.82:** The first two posterised layers.  
(Author's construct)

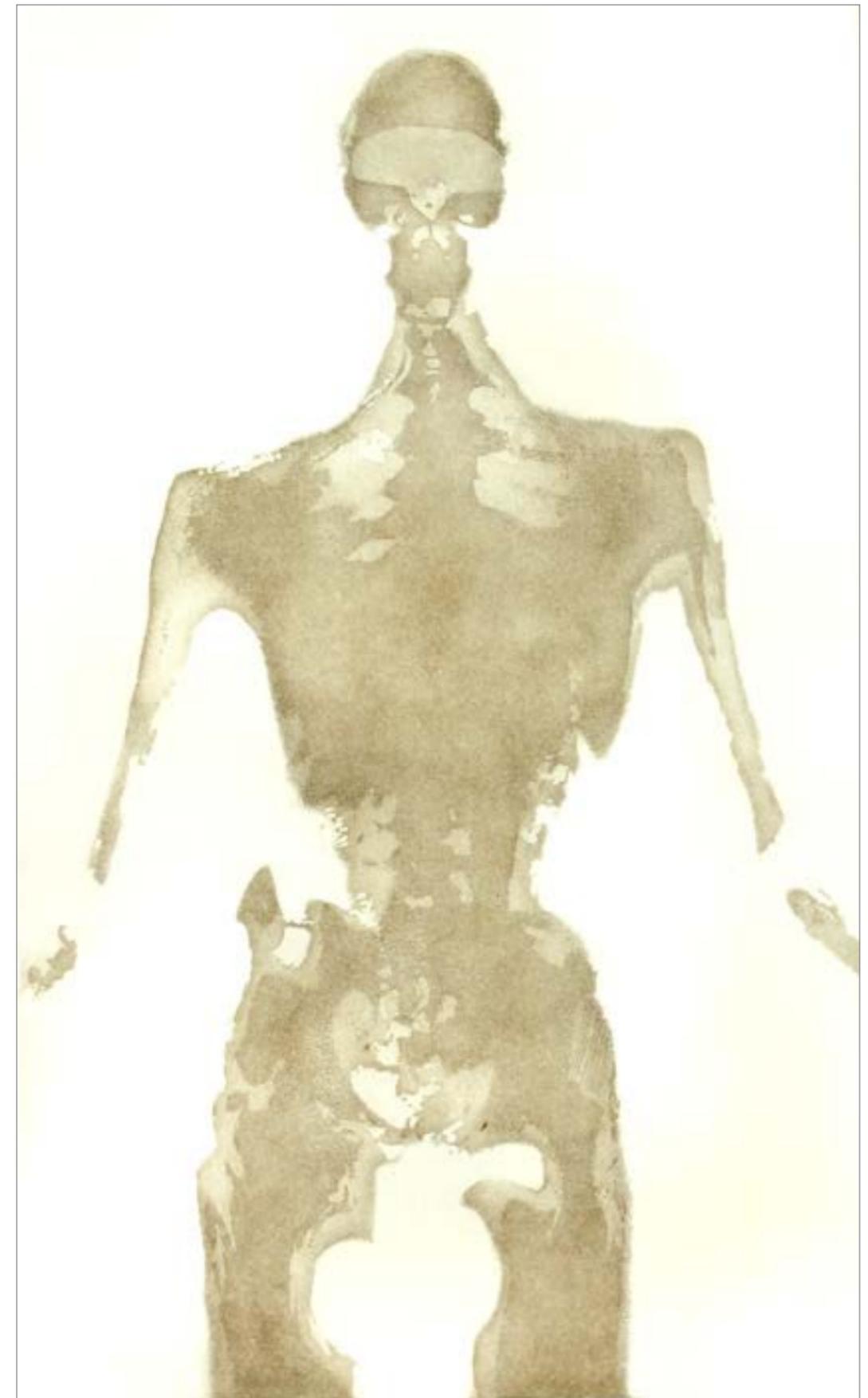
Based on the second iteration of colour, a coloured ink was mixed with the colour breakdown as shown. The colour was digitally applied to the electronic planning document (Figure 5.83).

RGB	
CMYK	
RGB	HSV
56	44°
51	34%
37	22%
CMYK	
0	
5	
30	
90	



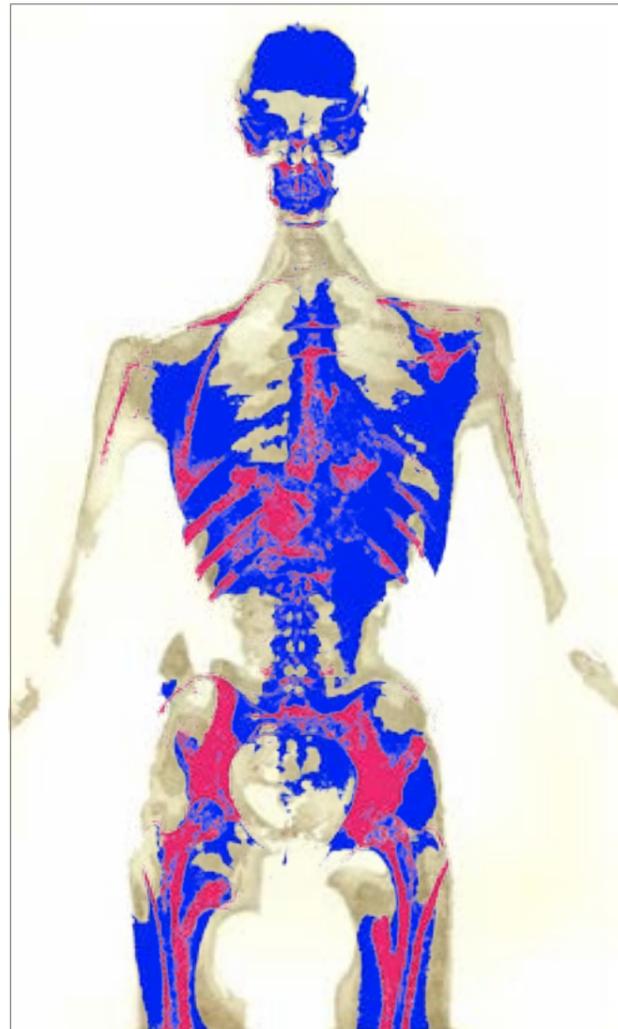
**Figure 5.83:** Colour digitally applied.  
(Author's construct)

**Observation and adaptation** The alignment between digital planned and intaglio prints proved accurate. Because of the accuracy no changes were made and the next step was executed in the same fashion with no adaptation.



**Figure 5.84:** The first intaglio print. (Author's image)

**Step 5** After the first intaglio print, two more layers of aquatint was added (Figure 5.85). The first layer shown in blue indicates the third layer of tonal values. A fourth layer, shown in magenta, was added, mainly by drawing on the ground because the shape thereof proved to be complex to cut out. Figure 5.86 shows the digital planning document in the proposed colours. The result of the plate etched another two times is shown in Figure 5.87.

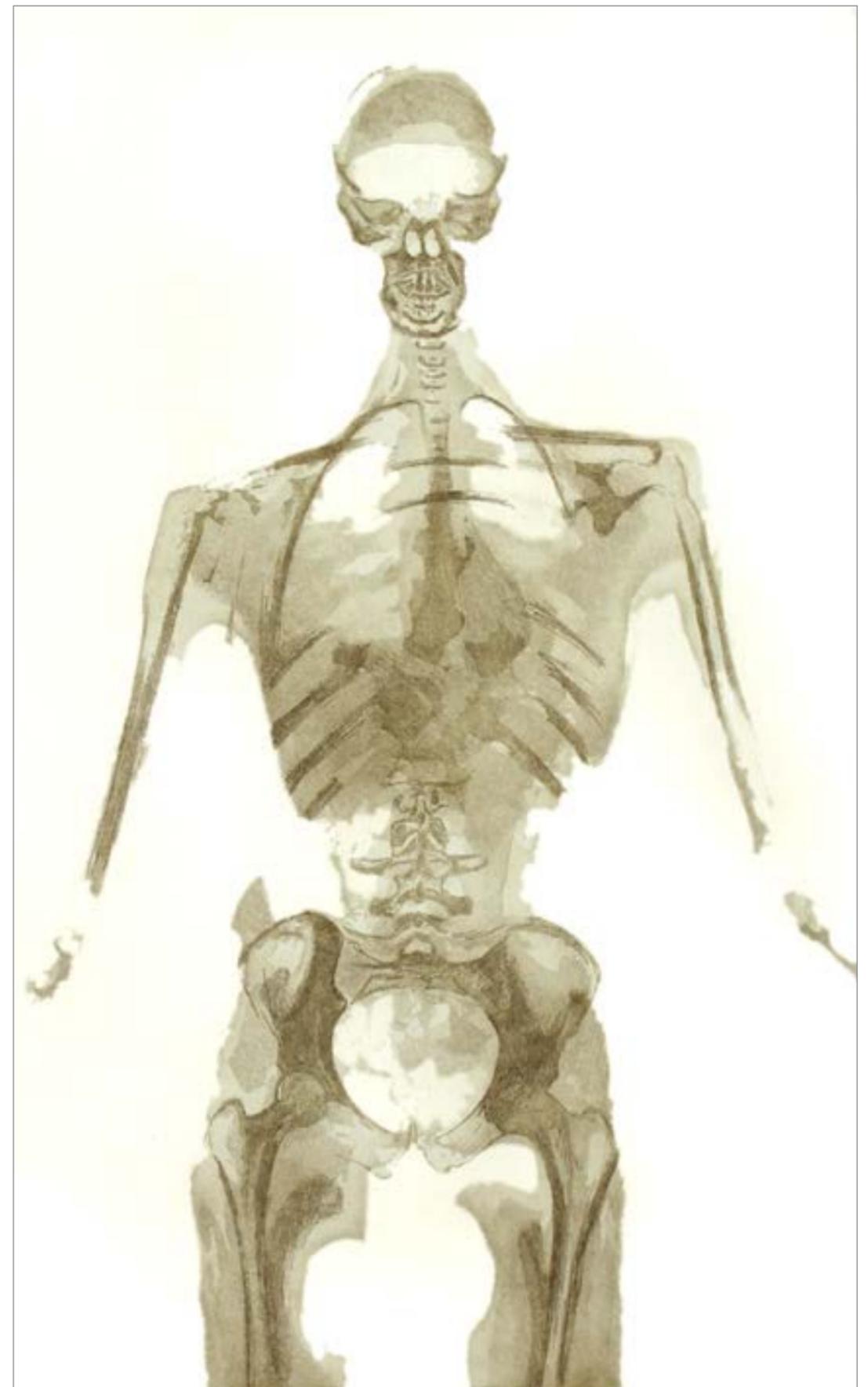


**Figure 5.85:** The digital planning document for the second state showing the added layers. *(Author's construct)*



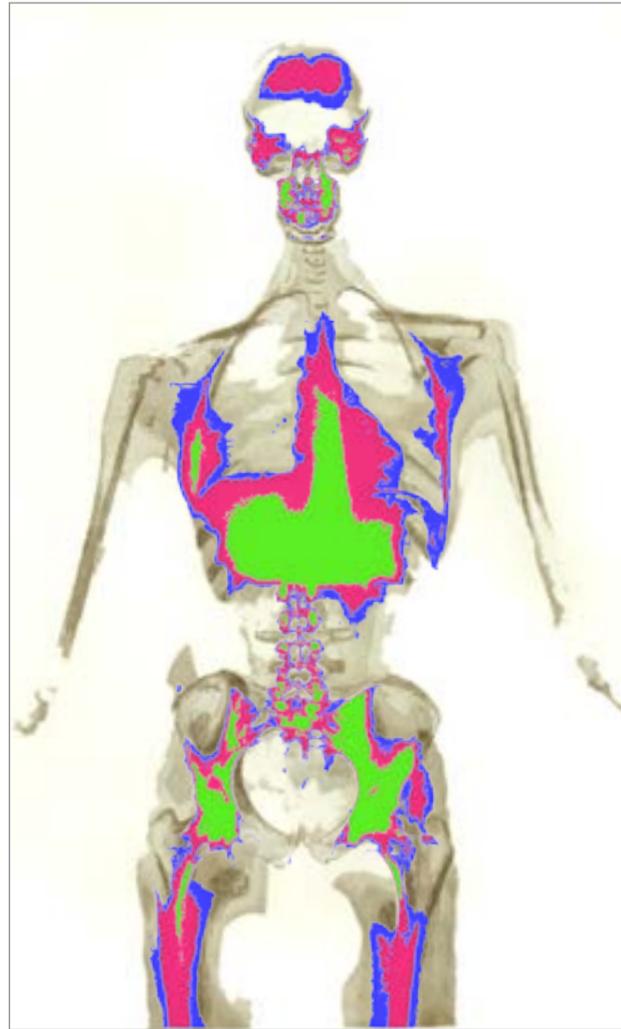
**Figure 5.86:** The digital planning document showing the added layers in the proposed colour. *(Author's construct)*

**Observation and adaptation** Subtle differences in tonal values were observed on the actual intaglio print. Such minimal differences were not present on the digital document and, therefore, the intaglio print as this stage was digitised to use as basis to plan digitally for further application of the aquatint. This proved very accurate as incremental differences between real and planning were arrested as they arose.



**Figure 5.87:** The second intaglio print. *(Author's image)*

**Step 6** Progressively, another three aquatint layered tonal values were added in their respective order: blue, pink and green (Figure 5.88). In some areas limited linework was added for definition. Figure 5.89 shows the digital planning document in the proposed colour. The final intaglio print at this stage is shown in Figure 5.90.

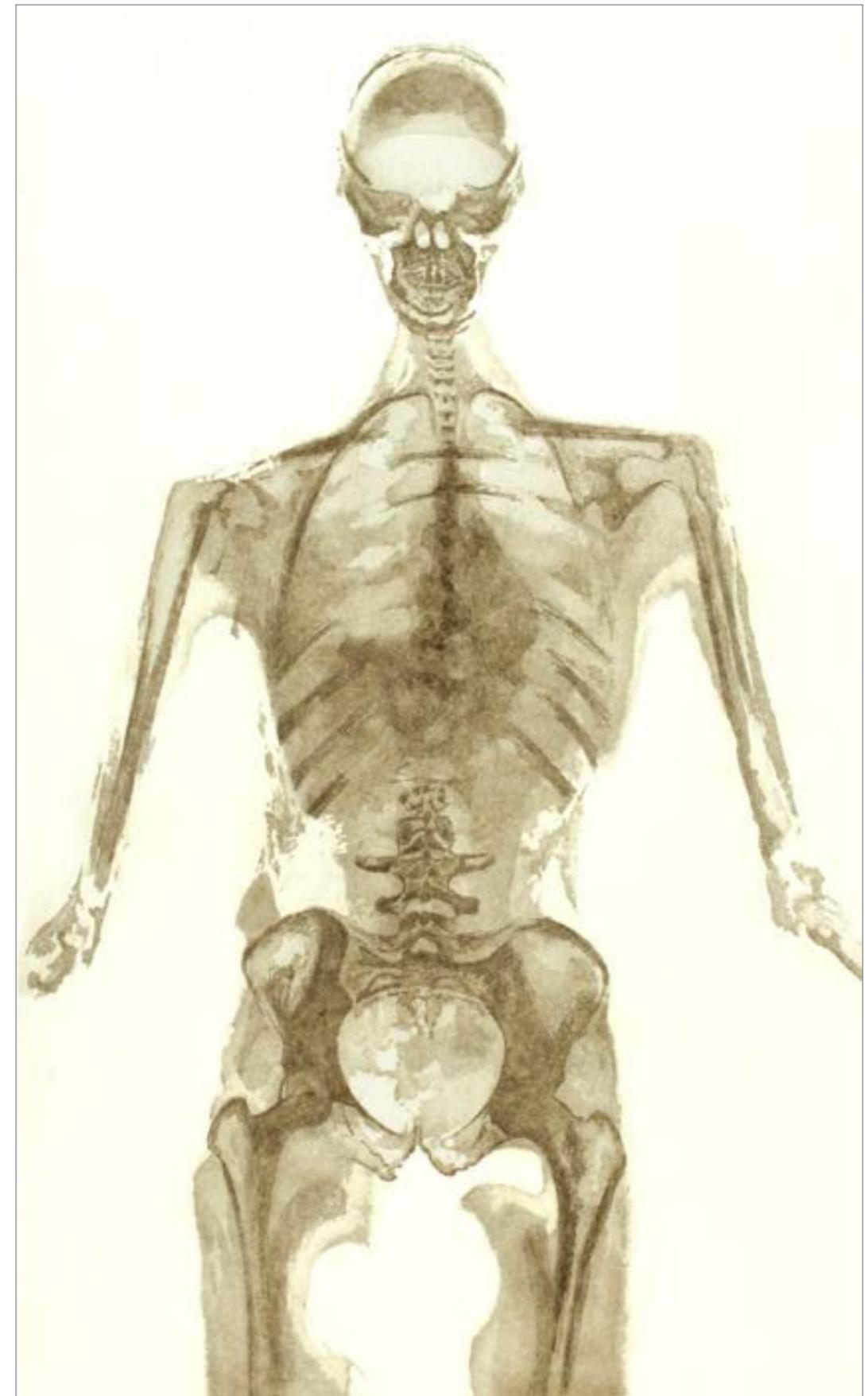


**Figure 5.88:** The digital planning document for the third state showing the added layers. *(Author's construct)*



**Figure 5.89:** The digital planning document showing the added layers in the proposed colour. *(Author's construct)*

**Observation and adaptation** Some of the tonal values had to be reworked by re-applying another application of aquatint to the plate. As the planning was done digitally first before every application of aquatint, a very accurate view was obtained on how the outcome would look. The same method was followed as in the previous steps of this iteration.



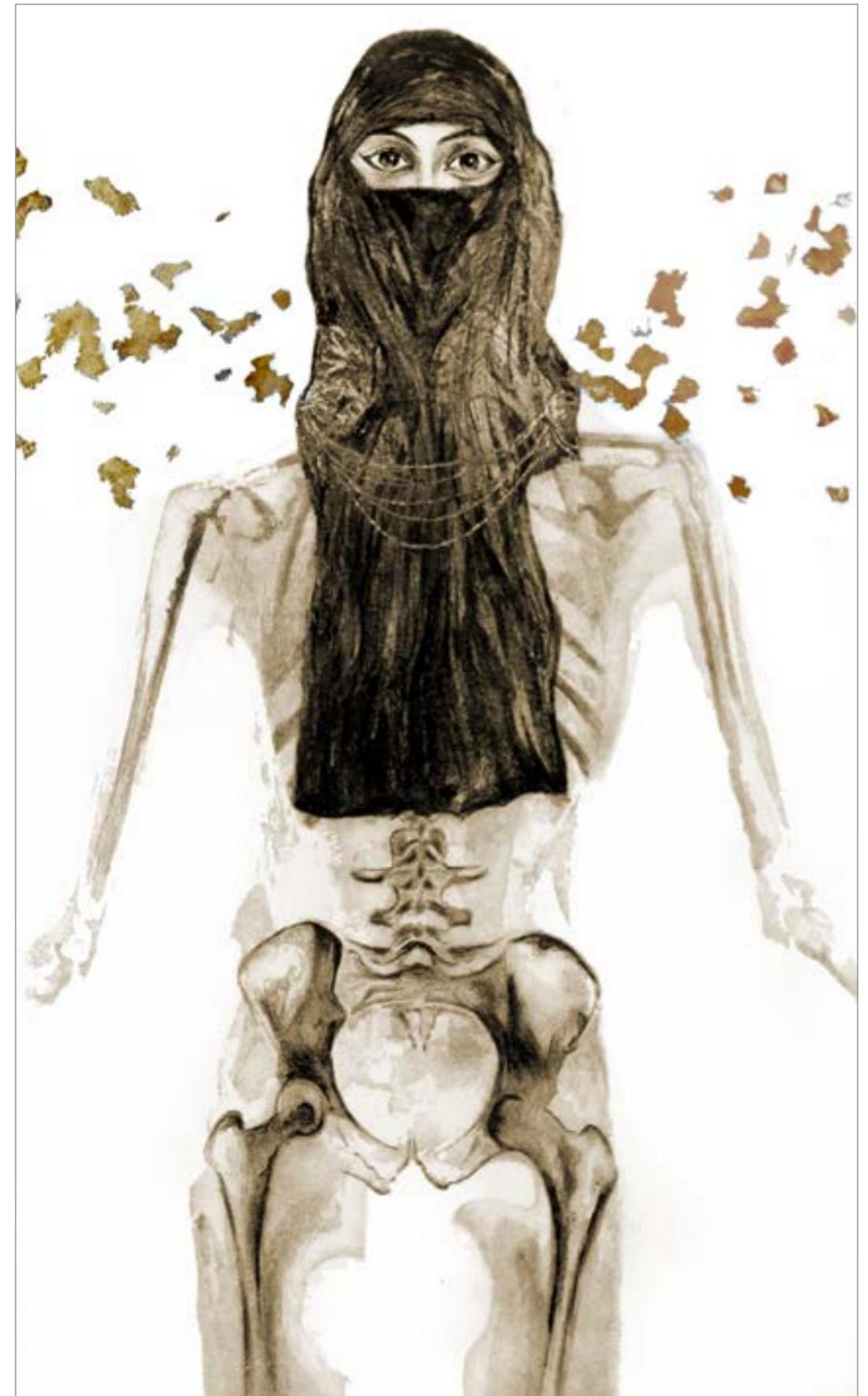
**Figure 5.90:** The third intaglio print. *(Author's image)*

**Step 7** The hijab and eyes was added to the existing design in the final step (Figure 5.92). This took several applications of aquatint to build up a sufficiently dark tone. A softground impression pre-empted the application of aquatint to establish a texture. Although this step required several intermediary steps of planning and applications, the detail thereof is not listed here as it mainly followed the same methods previously employed and discussed. Figure 5.91 shows the digitally planned document.

Hand detailed gold leaf was added. The colour, therefore, is nearly impossible to simulate on computer due to metallic substance properties. The shape or area of the application of the gold leaf was, however, digitally planned and executed with the help of computer produced templates for cut-outs.



**Figure 5.91:** The digital planning document for the final state. (Author's image)



**Figure 5.92:** The final intaglio artwork. (Author's image)

## 5.7. ITERATION 5: SYNTHESIS

**5.7.1. RATIONALE** The purpose of this iteration was to combine all the previous sets: to synthesise an artwork by breaking down the previous artworks, either the plates or the prints. The nature of synthesis is to make whole from previously separated components (already analysed). This final set concludes a new idea by knowledge gained from the previous sets.

**5.7.2. THEME OF THE ARTWORK** This last set of artworks was finalised at a late stage in the entire research project. The researcher, therefore, used some of the findings of this study as inspiration. Such findings include the cultural capital and the corporate paradigm of a community of practitioners that altogether may move in any new direction. Such an advance of practice must always be preceded by a new thought.

If such a new idea is introduced and can be granted some room for fertilisation and growth, it may come to affect the entire population or gather enough momentum to pull components resilient to change along with it. The researcher has, thus, surmised such a flow of action as illustrations of thought in five Afrikaans verbs (Figure 5.93)

**VERDINK** (to suspect: opening up to the possible new idea);

**BEDINK** (to think: this indicates that the idea has been confirmed and established);

**OORDINK** (to consider or contemplate: the above idea is nurtured and incubated to maturity);

**ONDINK** (to un-think: this is a radical departure from the idea in order to allow a new thought to enter);

**HERDINK** (to re-think: where a new idea or solution replaces the old. The cycle can now be repeated),

**5.7.3. TECHNIQUE, PROCESS AND MATERIAL** Two processes were applied in this final iteration and then combined to serve as a single set of artworks. Firstly, nine individual plates were prepared with a combination of softground, open-bite, and hardground techniques. These nine plates were ultimately printed together on a single sheet to arrive at five background images for the five artworks. Secondly, one print of each of the previous plates was made to serve as components to be cut up and reassembled as foreground for the last set.

**The background** The nine individual plates were separately prepared and printed. These designs were digitised to serve as images to digitally plan a layout. Once these background options were finalised as digital files, they were mirrored and used as mapping guides to print the plates in that respective order on the intaglio press. The five intaglio printed background images were digitised to serve as an electronic background layer to the final design.

**The foreground** All of the previous plates used in the previous iterations were printed individually. These designs were digitised and digitally cut into 15mm x 15mm squares, using advanced website photo-editing software (Adobe Fireworks). Each individual square was saved as a separate electronic file and ordered according to colour and/or tonal value, using software capabilities to measure and order according to colour.

The individual blocks were then digitally combined with the background images to arrive at the five final digital designs. The final intaglio designs were then created strictly according to the digital planning document.



Figure 5.93: The intaglio artworks of the final iteration. (Author's image)

**Step 1** Figure 5.94 shows the most important images collected to inform the last set of artworks. The following keywords: ideas, thinking and contemplation, were researched visually from fffound.com as well as online publications at Issuu.com. Although almost none of the images below were used, the results of the search set a pattern of thought and illuminated some ideas on the topic.

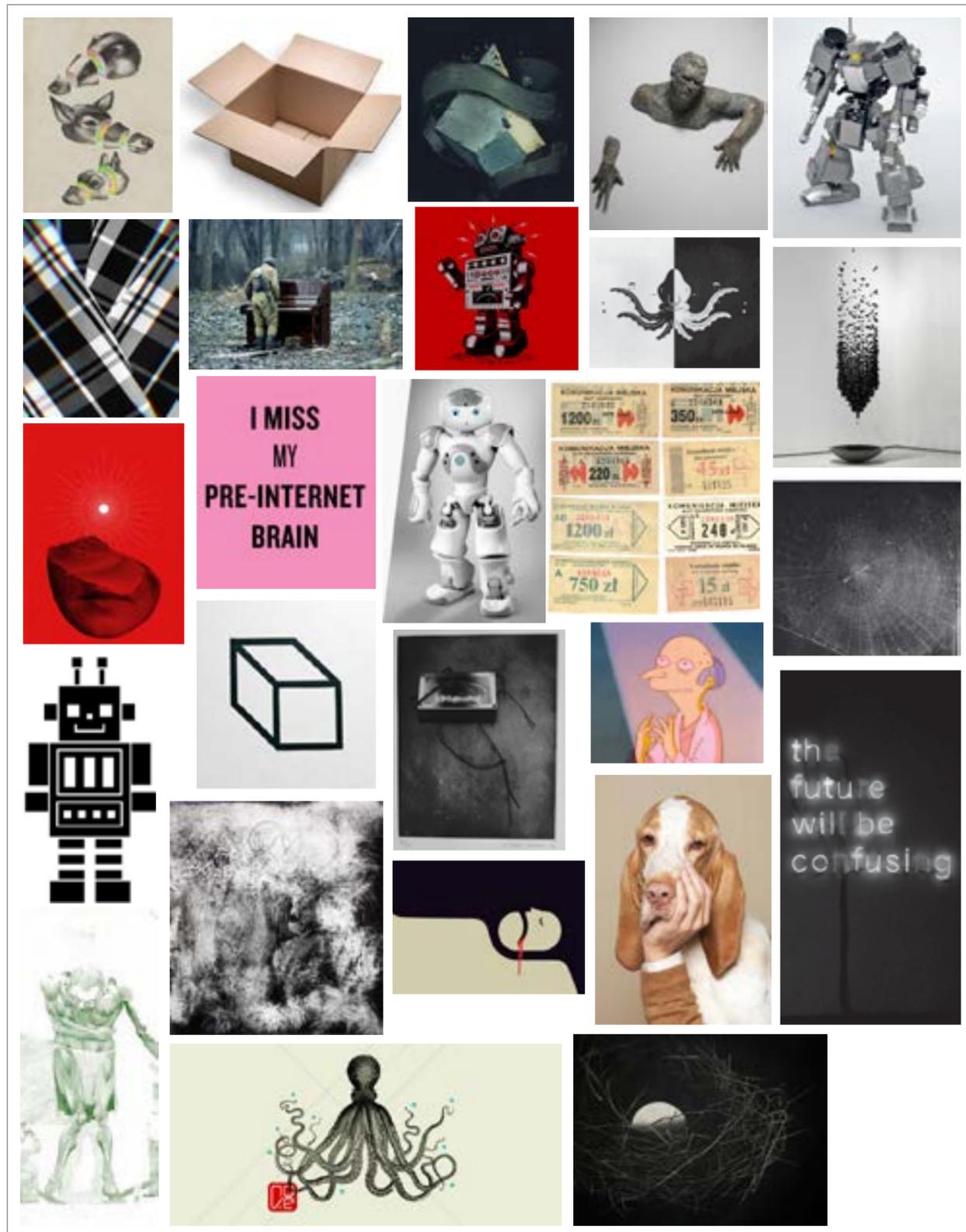


Figure 5.94: The most important images collected for this iteration. (Author's images from selected sources)

**Step 2** From the images in Figure 5.94, some hand drawn ideation sketches were made. These sketches were digitised and reworked together with new digital images to create the final design. Figure 5.95 below shows the workflow of partial planning for the final artwork. Final planning was made when the background was printed.

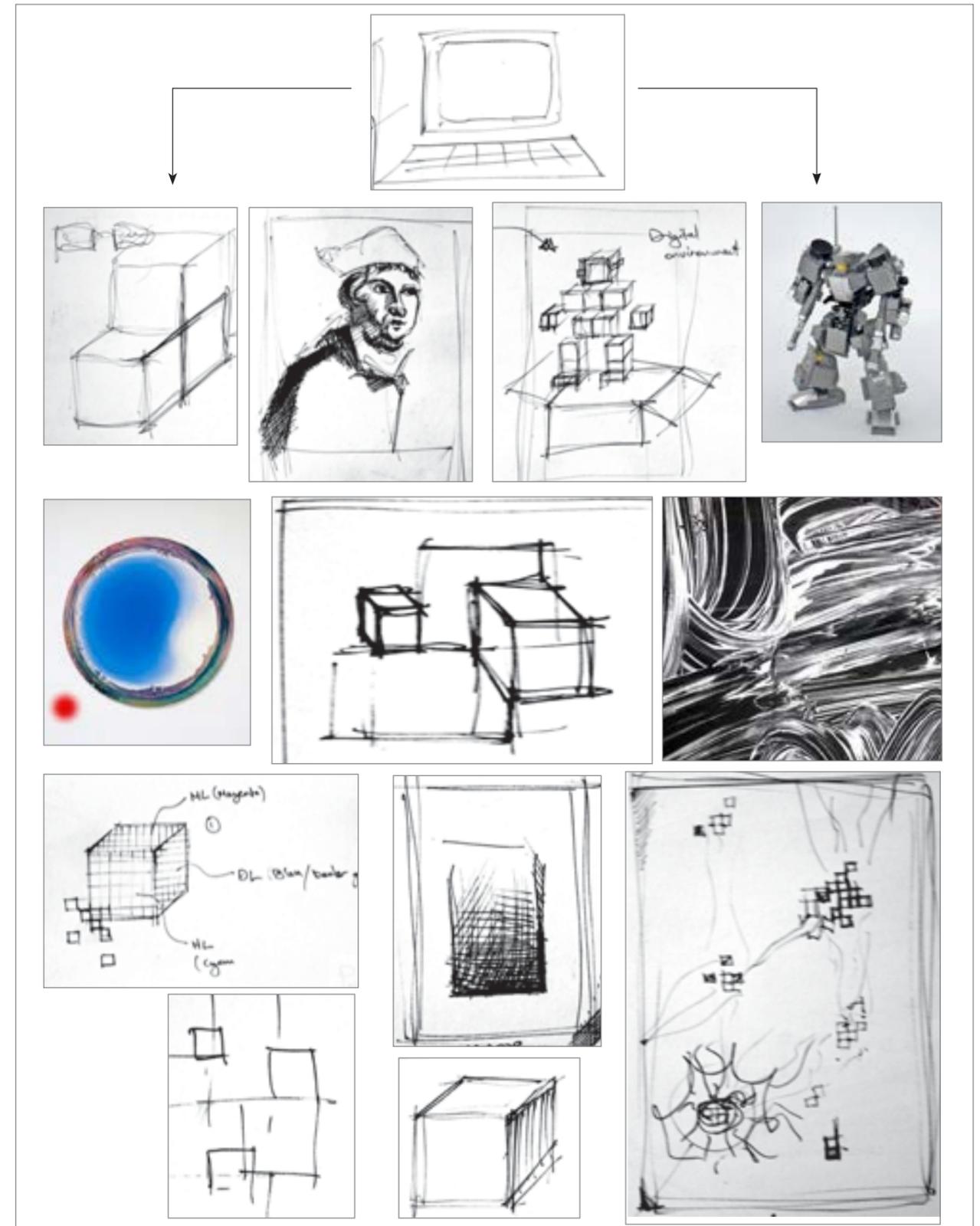
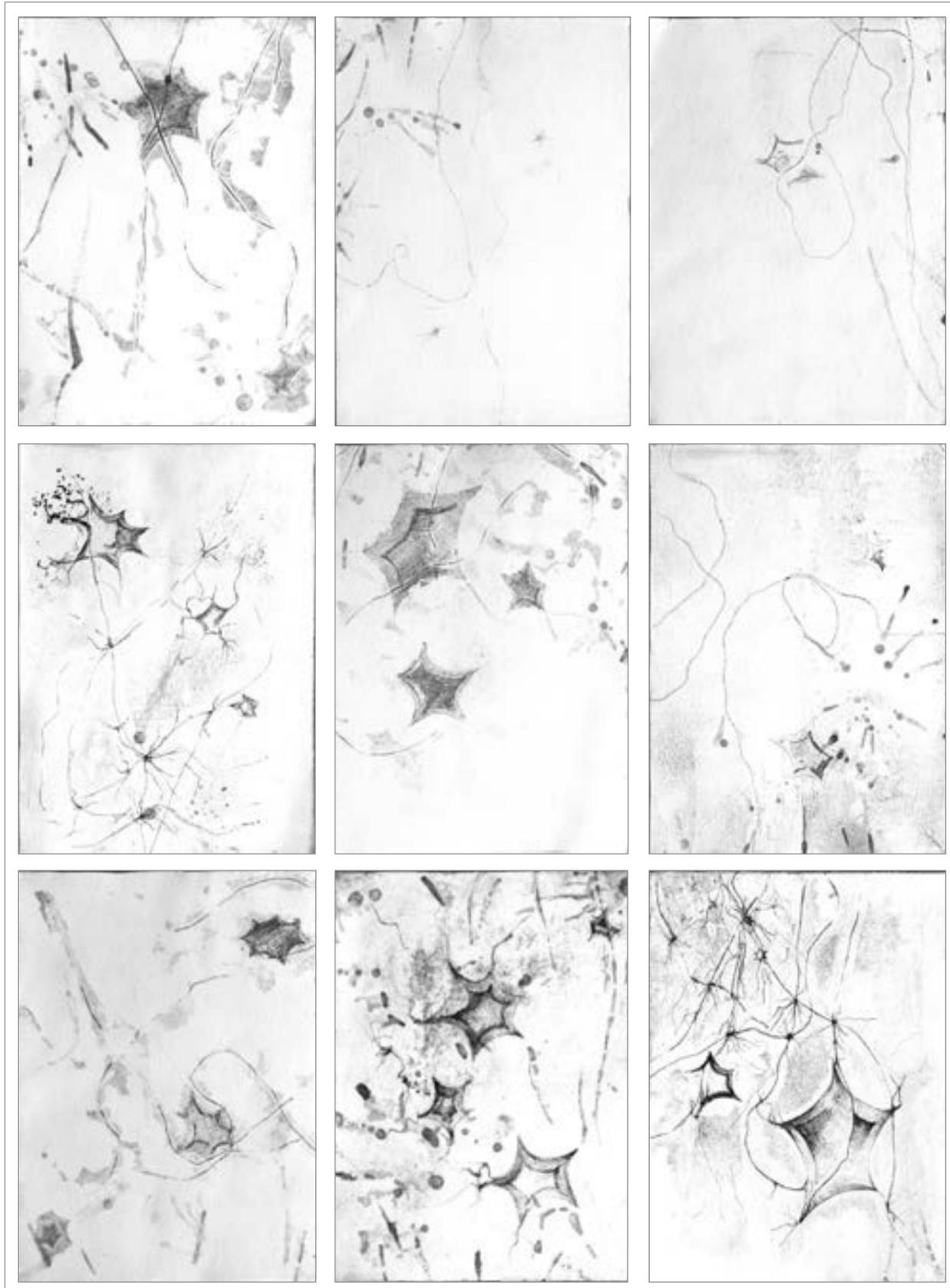


Figure 5.95: Planning of the final set of artworks. (Author's construct)

**Step 3** Nine intaglio plates of 190mm x 135mm were prepared and printed individually (Figure 5.96).



**Figure 5.96:** Nine intaglio plates for the background of the final iteration. (Author's images)

**Step 4** These nine intaglio prints (Step 3) were digitised and from the digital documents, combinations were made up by digitally placing the images in different combinations using layout software (Adobe InDesign). Five final combinations were chosen. The final digital documents were digitally mirrored and used as a map to print the corresponding intaglio background sheets (Figure 5.97).



**Figure 5.97:** Five intaglio printed background combinations. (Author's images)

**Step 5** Figure 5.98 below shows the final digitally planned document on the left with the corresponding intaglio print on the right. The individual squares of the planning document were digitally applied to each digital background as a separate layer to ease the planning process and experiment with various combinations.

Although a laborious exercise, the digital document as map, served its purpose as a strict and accurate planning blueprint. The final artwork was constructed from this digital map with nearly 100 per cent accuracy (what was planned, was executed).



**Figure 5.98:** The final set of artworks planned and executed (*continue on next page*). (Author's images)



**8. CONCLUSION** This chapter constitutes a recording of the interviews and the five design iterations. The workflow is recorded from the initial idea to the final designs via a process of digital planning.

The imagery forming the basis was collected and placed in a directory that would contain all images associated with the appropriate theme. Hand-drawn idea sketches were made based on these images as well as pure imaginative ideas. These images were refined and computerised to further adapt the hand ideation drawings to a final layout, although these hand drawn sketches did not necessarily pre-empt the computer ideations. These two processes were to a large extent intertwined: a conglomeration rather than amalgamation. Where hand ideation is quicker, computer ideation is more accurate and therefore both systems have value.

The workflow, therefore, follows a multi-directional pathway with multiple points of entry and conclusion. These various points of conclusion serve as start points for another cycle of refinement. This iterative process is duplicated until such time as only one point of arrival is left. Once the final design is established the process becomes linear and reductive, in that its constituents are separated but no new design idea enters the process at this time.

# CHAPTER 6: ANALYSIS OF THE DATA

**6.1. INTRODUCTION** The data observed in Chapter 5 of this study is analysed in this chapter to find meaning from that data within the constraints of the research topic. The interview data showed a strong duality of response that both validated and disqualified the hypothesis of the study.

The data was primarily the design experiment, and thus the limitations, strengths and weaknesses of the experiment are analysed in this chapter to show the varied range of fidelity of the simulator. Data gathered from the experiment is, therefore, interpreted as ratio data. This interpretation does not reveal a simple yes or no answer but rather a level of success or failure for each iteration within the research hypothesis: **computer technology can be used to successfully execute the planning and ideation of the intaglio printmaking process.**

**6.2. DATA ANALYSIS OF THE INTERVIEWS** The data of the interviews was used to inform and enlighten the experiment and to validate this study. During this analysis, a pattern of thought was observed to position the study within a local printmaking school of thought and to respond to the conventions as set out by that school.

**6.2.1. KEY POINTS** The eight interviews delivered results to establish highly personal and often emotive responses, rather than factual evidence. Most of the interviewees agree that a computer printout cannot replace an intaglio print. The respondents also suggested that a simulation of an intaglio print on computer is not acceptable. Often the issue of digital planning was ignored because an immediate stance was taken to defend their view. This perspective highlights the need for just such critical discourse to academically discuss ideation in intaglio. Many respondents reiterated the limitations and shortcomings when printmakers attempt to replace intaglio with computer printouts such as Respondent G:

***“Digital prints should be seen as a separate print technology with its own limitations, weaknesses and strengths”***

Referring to computer interaction in the learning process, Respondent A (who has a printmaking education in the classic school of the French fine art printmaking establishment from the Frans Masereel Centrum in Belgium) said:

***“I have trained printmaking for years, and your plan won’t work. The only way to learn is to do it yourself”.***

Respondent B confirms this stance:

***“Why do you want to change such a beautiful age old process with computers?”.***

Interviews with other master printmakers (Respondent F) revealed the same negative attitude. One of the interviewees, a well-informed printmaking academic (Respondent B), changed her initial scepticism when the detail of the hypothesis was explained. When asked why she was initially against the hypothesis of the study, she explained that in printmaking,

***“Intaglio is the only process that is still a pure hand skill and has not been compromised by computers”.***

Based upon the above responses, it appears that many printmakers easily become upset by the notion of mixing intaglio with computers, that would lead to the same commercialisation of woodcut, lithography and silkscreen printing. What was encountered during these interviews is not only a rift but a tension often driven by perception of the value and skill of the artistic process. While the light table used by almost all traditional intaglio printmakers is deemed acceptable and a legitimate part of a pure hand process, the computer is regarded as a polluting agent that strips printmakers of their hard earned skill developed over time. Respondent B stated:

***“Printmakers perceive digital practice as having no skill required”.***

Digital prints are also perceived as being vastly inferior to hand printed artworks. Owing to the fact that computerised methods of printmaking in categories other than intaglio have become a mainstream commercial means of reproduction, a new set of names has emerged to distinguish hand printed art from commercially machine produced prints. Respondent F does not want

intaglio to become such a commercial process. Respondent D argues for digital technologies and attributes the negative attitude of many other printmakers as laziness:

***“Artist are lazy to learn new things, they are complacent and refuse to live in the real world”. He further states:***

***“It does not make sense not to use computers. Why spend months on end drawing? It’s not about being a slave. Artists are overwhelmed by technology that intimidates them”.***

Respondent E comments on technology that:

***“Printmaking is more than any other medium a technological process”.***

Respondent B makes the following comment on this topic:

***“Concept is the key. Printmakers will use whatever technology is available to them”.***

The reoccurring theme that printmaking educators mentioned during the interviews is the instant gratification that students expect. Such is the push-button solutions that have become their world with electronic devices. They can offer a world of technological solutions for every life question but are lacking in effort and patience, as well as the quality of solutions the previous generation was accustomed to. Respondent E states:

***“It might be a dying art the way we do it. Students do not have the concentration and perseverance. They (the students) are result orientated. There is a problem with their work ethic”.***

Based upon the above comments, the internet as source of images for referencing is not acceptable to these educators because it has too many limitations, but mostly that of quality. When interviewed, most of the responses concerning the drawbacks of technology in printmaking, described the internet as the mostly used, but inadequate, form of finding source material. The obvious issue of plagiarism was not the main concern. What these educators find to be the biggest drawback of students using the internet to access source images is the lack of effort and, therefore, originality and creativity, required, as well as the poor quality of images used. Respondent E comments on the effort required:

***“If you don’t like the laborious process then you will never be a printmaker”.***

Respondent E also mentions the lack of drawing skills associated with using the internet as a source for images. She maintains that drawing skill and, therefore, hand drawing one’s own reference material is crucial because printmaking relies on hand drawing skills. Of bigger concern here is the fact that students who use digital technology in printmaking arrive at the print studio with a ‘quick-fix’ mentality that is not present in the intaglio printmaking studio. Respondent E refers to previous methods of planning:

***“In old times, we made test plates”.***

The easy and seamless computer planning, therefore, can create a false sense of ease of effort when students move from planning to execution. Respondent B makes mention of the personality traits of a skilled printmaker:

***“It takes a special kind of person to be a printmaker. They must be committed, methodical, meticulous and thorough”.***

Respondent E sees this perceived lack of effort on the part of students as the biggest concern. Respondent G agrees but also, admits ironically, that students who embrace computer technologies are more prone to veer towards printmaking because it has some elements the student can identify with and can see solutions instantaneously (print on demand) and, therefore, experience a sense of achievement.

To facilitate digital printmaking as a valid technique necessitates welcoming a large number of amateur and novice printmakers. It appear, however, that many Master Printmakers (of traditional methods) perceive this computer intervention, not so much as a threat, but as a mockery of their careful honed skills and dedication. Respondent A responded:

***“Come speak to me later, I will teach you how to do it right”.***

Respondent B gives a reason to this antagonism:

***“Your study is tapping into old school printmakers who have had drilled into their heads the process but, it has never been academically debated. They perceive digital as not real printmaking”.***

The discussion that arises from the scrutiny of the responses of the printmakers/educators is the legitimacy or the personal bias in the rationalisation of method and technique. A response is, therefore, given to describe this phenomenon as found in this interview data.

**6.2.2. ACCEPTABILITY AND RATIONALISATION OF METHODS** Printmaking is about innovation but also about contradiction. Self-labelled traditionalists often produce work that engages with modern themes and express their belief that method is inferior to the desired result. As the message becomes their main focus, method and technique of production are adapted to accommodate the result. This stance, per definition, implies non-traditional advances and methods that often are justified in the (limited) amount of new technology used. Consequently, several known master printmakers reject the computer as a legitimate printing implement but use electronic instruments to measure ink density and computerised scanners and digital cameras as tools in their process. The answer to the problem is not whether one chooses a diehard traditionalist approach compared to an embrace of new advances, but whether one believes there is a problem of old versus new.

Printmaking has been described as liberating and democratic (in that the results are achievable by everyone and processes vary from a basic potato print to a vastly complex stone lithography (Noyce 2007). However, a contradiction lies in the fact that some processes takes years to master and thus ‘democracy’ is reserved for the elite master printmaker. It is specifically due to this nature, that innovation becomes a key player in printmaking. Young and less established printmakers explore and adapt mainly to achieve the goals set by printmaking conventions.

Another apparent paradox is the ever-growing electronic medium – the internet – that printmakers use as voice. The outcome of printmaking is a non-electronic object or, put differently, printmaking is about moving information into/onto a physical substrate (usually paper), hence the use of electronic media to promote printmaking somewhat defies the claim that printmaking makes as effective communication medium.

**Cultural Capital** People make sense of their surroundings based on their position in time and location. Bourdieu (1977) says a thinker is linked to his period (space and time) and uses a conditioned background of problem solving as his method of thinking. The culture people exist in, or chose to accept, is made up of a set of shared goals, attitudes, values and practices that characterises an institution, organisation or group (Noyce 2010). Culture is, therefore, described as an integrated pattern of human knowledge, belief and behaviour that depends upon the capacity for symbolic thought and social learning (Taylor 1974). The scope of semiotic resources thus depends on the cultural capital of a social group (Bourdieu 1991).

Drucker and McVarish (2013) mention that technology influences cultural systems although design choices are nearly always constrained by cultural conventions and, therefore, the design artefact is a product of both designer and a complicated cultural system. Such social institutions and cultural attitudes situate designed artefacts within specific networks of use and circulation. Institutions are constantly being modified by cultural changes in technology and other factors (Drucker and McVarish 2013). However, technology does not determine social or formal change, but rather merely operates within changing cultural circumstances. Digital processes do not create acceptance in printmaking. An inviting attitude exists and, therefore, digital technologies are accepted. Contemporary artists such as Kiki Smith, Sarah Charlesworth and the yBas (young British artists), use this tension in printmaking to comment on wider cultural concerns, such as technology and the media (Pelzer-Montada 2001).

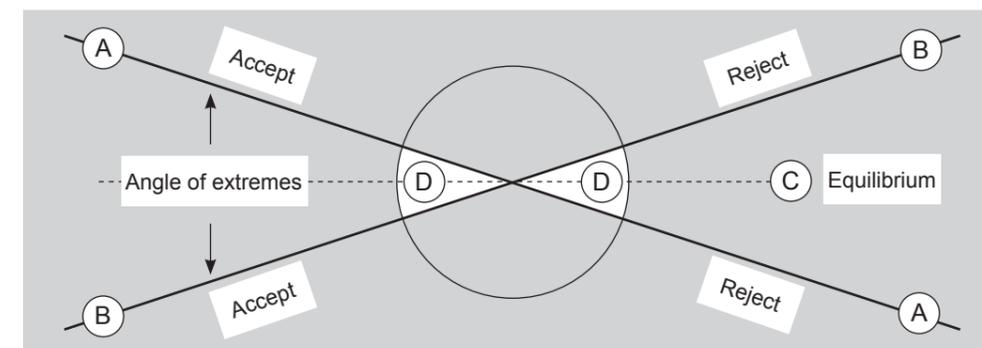
In the researcher’s view digital technologies, or rather the creators thereof, are much more adept and willing to accommodate novice users because they have a monetary expectation and, therefore, make their products as accessible as possible. Intaglio printmaking has shown little desire, if any, to accommodate such notions. As a fine art method, intaglio wants to keep a safe distance from an overly commercial aim.

The contradiction expressed above can be concluded with two views, namely that of Hoskins (2013) who states that with quality and craftsmanship as the strongest weapons to justify its existence. Intaglio printmaking refuses to adopt a push button solution as a convenience for even the most lazy artist. On the other hand Fishpool (2009) claims that digital technologies will absorb traditional methods, thus bringing printmaking within the reach of everyone. What is lacking is an acceptable middle ground view that acknowledges both perspectives. Based on Kuhn’s (1970 in Field and Hole 2013) premise that paradigms are dynamic and change over time, the following hypothesis is put forward to explain a phenomenon observed in this study and illustrated with two case examples.

**6.2.3. OLD VERSUS NEW: SEESAW HYPOTHESIS** Kuhn (1970 in Field and Hole 2013) states that there exists a period of confusion when scientific communities disagree about scientific issues, methodological, theoretical or otherwise. In time extreme outlooks, usually two opposites are formed that reach some level of agreement. In this state of equilibrium some abnormalities and limitations are discovered and, when these become too great, a new paradigm emerges and a fresh extreme is born to rival the existing paradigm. Personal allowances and acceptability, as shaped by a corporative consciousness, often disregard a valid argument for an extreme opposite due to an excessive promotion of the former.

Such a phenomenon of extreme opposites can be observed in almost any field. What are witnessed, are the extremities that seem to dominate human thinking. If one system is wrong, people need to move to the other extreme, only to find that the previous structure had some value. A return to a previous system of thought is almost always the case, with a limited acceptance of some of that system’s values. Another generation of thought arises and reverts back to the original side of the argument, with a greater acknowledgement and understanding of the limitations of that system. In time equilibrium is reached, although this may take several generations of thought. Meyer (2003) describes this duality as a threshold concept. It is a differentiation between those who perceive events in a new way and those who do not. This concept is strongly linked to what Perkins (1999) describes as troublesome knowledge – knowledge that is conceptually difficult, counter intuitive or alien. Meyer describes the threshold concept as a gateway to conceptual knowledge and maintains that this threshold has to be overcome in order to move into knowledge of the unknown other. The mechanism for this transition is exposure, acknowledgement and acceptance.

A classic example of this condition, linked to scientific inquiry, may be the age of church rule and the age of science with the Enlightenment as turning point. Until science was put forward as a new paradigm of thinking, religious doctrine determined reason. Enlightenment implies the existence of the Dark Ages before empirical scientific answers were explored. The danger of this implication is that, just as religious doctrine tried to answer scientific problems, so science tried to answer religious problems. The same problem exists in intaglio printmaking. The researcher describes this phenomenon as a seesaw (Figure 6.1): a complete acceptance of everything in multiple as print (A) versus a blind refusal of technology on the one hand (B). Some authors now accept all technology and reject the concept of the multiple. Between A and B is the angle of extreme views. It is in this liminal space between the views (D) that an established definition and equilibrium of the paradigm must be reached to establish what is legitimate printmaking and what is not (C). Many artists and educators have moved from the ‘old’ world view, but not far and the researcher proposes that the argument needs to ride the seesaw a few more times before equilibrium will be reached. The angles of the extremes decrease with every movement of the axis to accomplish this.

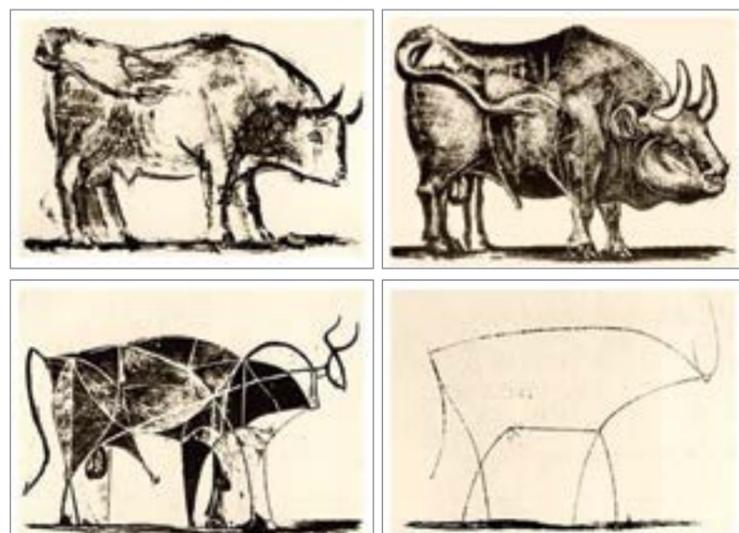


**Figure 4.1:**  
The SeeSaw model.  
(Author’s construct)

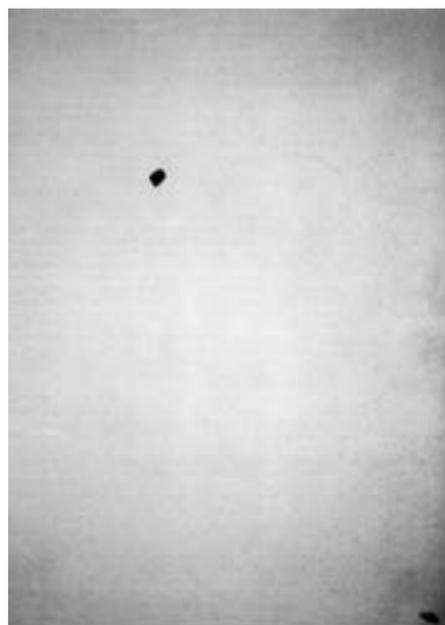
The proposition is made in this study that one's personal position on any subject is greatly linked to one's educational background. Education in this sense refers equally to not only formal and informal learning but also to cultural, political and social norms passed down and embedded by previous generations. Central to this idea is one's capacity to gain knowledge and to perceive life in a new way (Meyer 2003).

**Case examples** Picasso, as quoted by Mourlot is often credited with being the archetype of rogue printmakers. Mourlot (in Melot et al 1991:184-185) stated that Picasso often "did the opposite of what he had been taught, and it worked. ...the way in which he worked the lithographic stone was not merely contrary to custom, but contrary to the most basic rules of the craft". Such an example is Picasso's Bull series of 11 successive lithographic prints from the same stone. Unlike the common convention of an increase of matrix data, Picasso reduced his design until he reached the 'essence of the bull'. Figure 6.2 shows the first, third, sixth and final stages of the artwork.

Another example of blind disdain for authority on the one hand, and a promotion of technology on the other, is the case of Bruce Conner at Tamarind Print Studio (Platzker and Wyckoff 2000). Conner was invited for a two month residence at the studio who soon made him feel 'oppressed and claustrophobic' by the studio's management approach. Conner was told that he could not use photographic methods and had to stick to non-mechanical methods that were mandated by the studio, based on traditional French fine art print shops. Conner saw these limitations as an affront to his creative possibilities and sought a new approach to both the studio's idea of 'master printer' and printmaking itself. Conner acknowledged 'technological constraints' and, within these limitations, created an artwork on the studio's largest litho stone consisting of only his fingerprint (Figure 6.3). This was a bold, although clichéd declaration of identity whilst asserting his own voice as artist when the constraints of the authority were drowning his voice. Soon after this print, Conner was asked to terminate his visit. Interestingly, the studio's mandate was soon altered to include not only photographic techniques but also a myriad of new technologically advanced processes when the studio became part of the University of New Mexico in Albuquerque. Platzker and Wyckoff (2000) state that Conner represents a group of artists whose inclination is to challenge, or subvert, the traditional printmaking method and also to question the connoisseurship of the 'fine art print'.



**Figure 4.2:**  
Pablo Picasso  
*The Bull. State 1, 3, 6 and 11.*  
1965  
Lithograph  
305mm x 444mm  
The Museum of Modern Arts  
New York  
(Melot et al 1991)



**Figure 4.3:**  
Bruce Conner  
*Thumb print*  
1965  
Lithograph  
1050mm x 750mm  
(Platzker and Wyckoff 2000)

**6.3. THE ITERATIVE DESIGN EXPERIMENT** What many printmakers interviewed for this study perceived as the impossibility of predicting the 'life' or 'personality of the plate', the researcher defines as a variable that is hard or difficult to predict because all the factors that impact on that variable are either not known or not understood. For the purpose of academic discussion he will steer away from personification. This unpredictability is the primary problem when computer software is used to plan the print. However, the researcher found that a continual adaptation to align, as close as possible, the planning and the actual print, greatly limited this unpredictable outcome. Rather than finalising the planning and printing process and reflecting on it, continual change to the electronic document in order to simulate the original, proved efficient in the successful execution of the print at each state. This result constitutes a link with the original methodology theme of 'reflection-in- action' described on page 8 of this study.

In this sense, two aspects were considered: what aspects have become a misalignment between digitally planned documents and must, therefore, be rectified (digitally), and what aspects need to be adapted on the actual plate to move to the next state. This reflection and adaptation shows the limitations of the digital planning process: a single digital document cannot be created that will serve the purpose of planning. Continual change to the digital file has to be made to facilitate this process. Each iteration is discussed, followed by a synopsis of the strengths and weaknesses of the process.

**6.3.1. ITERATION 1: LAYOUT AND MIRRORING** The simulator proved most valuable in this first iteration. Even seasoned printmakers often fail to fully accommodate or remember the aspect of mirroring when designing their motif for printing. To combat this failure, software can be employed that has this feature automated so that even if the user forgets to mirror the design before application to the printing matrix, the mirroring function will be executed.

Furthermore, the reduction of layers and data of the final image can be achieved effortlessly on computer whereas a similar workflow is almost impossible in intaglio. This reduction helps to break down the complex procedure into smaller 'bits' that are often less confusing and easier to navigate. The similarity of the digital document and the intaglio plate with regards to the application and build-up of layers is similar in all but one aspect and, therefore, valuable to the printmaker. The ordering of layers can be implemented at any time on the digital document. This affordance is not accommodated in the intaglio process and, consequently, calls for complete digital planning before the plate is made.

Crucial to understanding printmaking is the aspect of layering. Computer software accomplishes an acceptable similarity of this function, albeit on a digital level, to make an accurate alignment to an intaglio print. An all-embracing approach to understanding layering and the compound effect of subsequent data – digital or on the printing matrix – is invaluable. A set of blending modes exists as part of the software's capabilities to interpret data, based on the layer of data below it. If the correct blending mode is applied to the digital document, an accurate interpretation can be obtained as to how the same data, on the intaglio printing matrix, would respond to the respective layer underneath.

The element of contrast was another aspect of how the computer planning showed superior performance to hand drawn planning. Extremely fine nuances of colour and contrast could be created on a digital document and controlled, not only in terms of the amount, but also where colour should be applied on the image because this visualisation can be forecast far more accurately than by any human hand on paper. In addition, modern imaging software allows non-destructive editing, thus changes made to the digital document can be undone and redone with great ease.

Non-destructive editing is a digital design philosophy that has changed the way design via software is practised. It simply refers to a workflow method where the original image is placed as a fixed layer of information and more layers are added to make the original image appear in a certain fashion, without changing the properties and values of that original image. It is the analogy of painting a room green compared to putting on a pair of sunglasses that make the room appear green. Sunglasses can easily be removed and replaced. Repainting the entire room is not as easy. The term 'non-destructive manipulation' highlights the fact that the original image remains unaltered and the information it contains is not destroyed or transformed, only made to appear different. Almost any visual property, including colour manipulation, filters, effects, contrast or other factors that change the

appearance of the image can be changed non-destructively, making certain aspects of computer ideation vastly superior to hand drawn sketching which always follows a destructive editing work path.

The primary disconnect in the first iteration exists between the lightly toned areas in the digital image compared to the printed image. Where the digital image is blurred and appears to have much more light grey values, the intaglio print shows a much more defined design with less tonal values. This problem of haziness was, however, addressed in the fourth iteration.

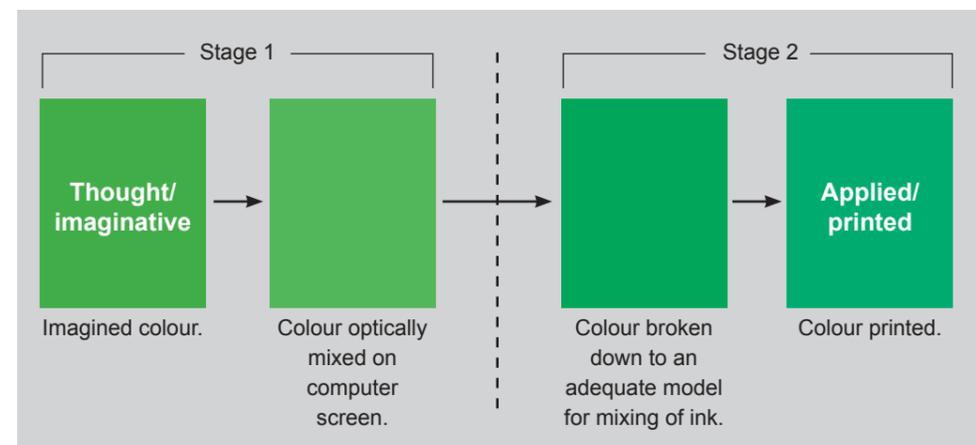
**6.3.2. ITERATION 2: COLOUR** The planning and digital prediction of colour for use in the intaglio process proved accurate. A high level of success was achieved in terms of accuracy but the method used has some aspects, good and bad, that needed to be considered. As colour issues were investigated, more and more variables and uncertainties revealed themselves. It took serious consideration to delineate this iteration since there exist numerous laws and phenomena pertaining to colour, purposefully not discussed in terms of the series of prints created for this study

It became evident that exact colour reproduction from the computer screen to intaglio print, needs to be conducted with an extreme degree of accuracy and stringency to keep the values of the variables as constant as possible. The success of this iteration can only really be judged by comparing the electronic design to the original intaglio print. In this sense, this document serves no use for optically colour testing the validity of this process. Ultimately, the final artwork has to be judged against the computer screen and a highly biased decision of acceptability has to be made. Although trying to measure and equate what looks aesthetically pleasing through light science is possible in a broad sense, ultimately it is an opinionated matter. Most people agree on striking colour combinations and on what are considered to be warm and cold colours. Putting science behind the physiology and sensory phenomenology became the next step of this investigation.

Colour is a visual perception biased and individually defined to each person. A final colour applied in this series had to be traced back from an intaglio printed sheet to the coloured ink mixed and then back to that colour defined electronically and, finally, backwards to the colour imagined. Figure 6.4 shows the starting point of any colour as a purely mental thought or imaginative idea with no physicality of the application of that colour whatsoever, through the steps to applied colour.

It is between stage 1 and stage 2 that a serious disconnect may or may not exist, based on the specific colour in question. As discussed in Chapter 4, certain colours can be replicated by both print colour models such as CMYK, as well as digital screen models such as RGB or HSV. Reds and blues in general, fall in this category. Different blacks and greens are more prone to disconnect between stage 1 and stage 2. Therefore, no commonplace rule can be made to cover all of the colours when discussing the accuracy of the colour simulator.

What the simulator can achieve to a high degree of accuracy is showing the disconnect of colours and although it cannot accommodate the differences of colour printed in intaglio versus colour mixed on screen, the simulator can acknowledge and accurately define this disconnect, described as 'out of gamut', (also discussed in Chapter 4).



**Figure 6.4:**  
Applied colour.  
(Author's construct)

An aspect that can be seen as a drawback or an advantage of this part of the simulated process is the required pre-knowledge. To apply the work method employed in this study, a complete understanding of colour models and aspects of colour theory has to be present. The artist using the simulator requires training not only in the intaglio process but also in the affordances of the simulator and the variables with which it functions. This process may be seen as counterproductive, although an argument is made that it requires a new knowledge and the accurate and successful application of this knowledge (wisdom). Through application of this wisdom a new skill is learned that has benefits in all aspects of computer disciplines that require the use of colour.

Another aspect that might be considered negative is the investment of time and the precise nature that is required to apply simulation accurately. This might contravene the initial hypothesis that time can be saved by using a simulator. However, as high levels of fidelity of the simulator exist and can be translated to high levels of accuracy, the time aspect was not considered to be such an important negative aspect. Furthermore, repetitive application will speed up this simulated process of planning colour because a library can be built with previous colours models electronically saved. The amount of time spent to accurately predict an outcome may also serve as a valuable lesson for other aspects of the intaglio process.

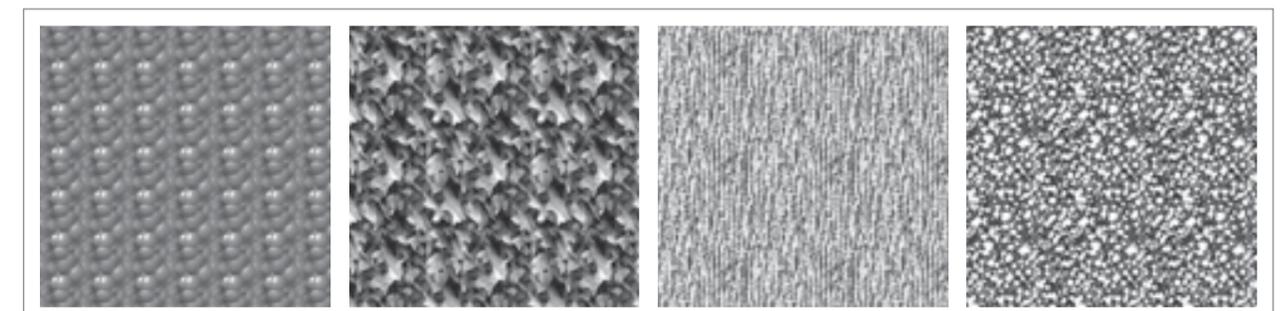
**6.3.3. ITERATION 3: TEXTURE** Texture proved troublesome to plan and replicate digitally due to the main disconnect of computers, as algorithmic machines, versus the human neuro-motoric action of mark making that is not based on such mathematical models.

As intaglio matrix relies on a recess made by either a mechanical means or a chemical process and there are four aspects that determine the ink deposit on the printed image to the corresponding area on the matrix. Those four aspects of the recess, when found in correlation to another recesses – in adequate quantities – will produce a texture. These four aspects are:

- The shape of the recess;
- The depth of the recess;
- The size of the recess;
- The proximity of the recess to another recess.

In a digital space, texture is applied by means of a texture map, a technique invented in 1974 by Edwin Catmull (Pattanaik et al 1998). A texture map is an applied (mapped) image to the surface of a shape or polygon. The texture itself is the product of an algorithm that has a unit size (swatch) that is duplicated exactly on all its sides to form a single infinite sheet. The simpler the unit of repetition, the easier the unit and, therefore, a repetitive pattern is identified when the unit is duplicated. Figure 6.5 shows some computer generated textures. The first two textures on the left of the image show an apparent repetition whilst in the last two the unit of repetition is more complex and, thus, the unit itself is more obscure. The textures made by impressions and chemical or physical interference on the intaglio matrix surface now shows an apparent unit of repetition.

Intaglio textures – unless produced by mechanical or photographic machined means – do not have a single unit of repetition that is duplicated. The four aspects listed above are, therefore, less similar on one area to the same aspects on another area so that no exact replica exists elsewhere on the plate. There is thus a generous difference between computer generated textures compared to those made by hand on an intaglio matrix.



**Figure 6.5:** Textures created by computer software. (Adobe Photoshop CS6)

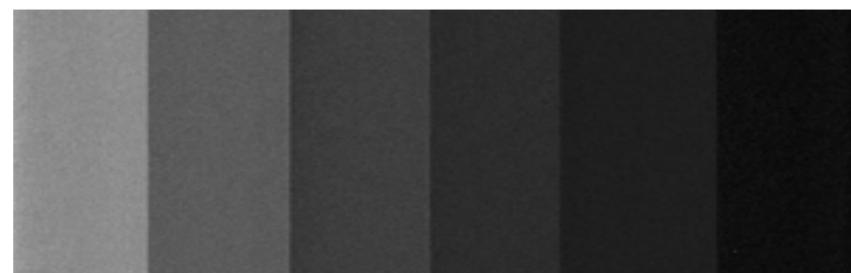
This disconnect implied that in no small measure did texture prove troublesome to predict, with or without the interference of computer technology. Texture proved the most extreme on the scale of serendipity on the one hand versus a mistake on the other. Therefore, the only true way in which computers can act as a viable method to predict textures in intaglio printmaking, is by careful documentation of the creation of an actual intaglio plate with the relevant texture. Such a real world example, with all its variables and values carefully listed and the recipe documented diligently, can then be digitised to be used in an electronic manner for future planning. The creation of such a library of techniques and textures will serve as a fascinating study, although a lifetime commitment, when new materials and impressions need to be added.

In the researcher's opinion one should not indiscriminately dismiss the value of computers for the planning and idea forming of textures, but it must be pointed out that an intaglio sample will have to be created as well, on a smaller acceptable scale, and then digitised for mapping areas on a proposed print in a digital manner. This highlights the computer's inability to accurately create a digital outcome from digital resources to be used in a printed realm. The chemical process of corrosion of the printing plate and a mathematical algorithm to create a digital picture are too difficult to measure against one another. Unless accurate, original input is entered, the computer is obsolete in this simulation. This process highlights the constraints and limitations of using computer software as simulator for certain textures but also shows the freedom and planning capabilities of software in general and the accommodation of other textures that can be digitally simulated to an acceptable level.

The misalignment of the simulator for texture is, therefore, considerable and shows the unreasonable response of a software application compared to the aesthetically influenced creation of the artist. However, although this problem was partially identified before the practice commenced, the hypothesis still needs to be tested and the level of the misalignment explored. Furthermore, other possible problems and solutions need to be investigated. In vector and bitmap design software, simulation of textures exists to be used in a digital document. Huge libraries of these textures can be found online and used in a layered fashion, that is, the previous texture affecting another texture applied in one document. One perceived strength of this type of software is its ability to control different aspects of an applied texture. With each available texture a series of variables is available to alter its consistency. Although this is a valuable feature for electronic documents, it has little value for the reality of the intaglio process as textures are acquired by means of real objects. Such objects cannot be altered in the same fashion as in digital textures. While the size of a leaf can be easily altered with digital software, the size of the real object is fixed.

**6.3.4. ITERATION 4: TONAL VALUES** Aquatint as an intaglio technique to create usually large areas of tonal value, has specific and well recorded materials and methods. Since the variables are known and strict but also measurable on a logarithmic scale, computer planning proved very successful. A test plate had to be created serving as a measurement instrument that could be digitised and used in a digital fashion in the planning documents (Figure 6.6). This instrument proved accurate to a high level provided the strict workflow method of aquatint was adhered to. The understanding of the software can be transcribed to intaglio, and vice versa, which indicates the acquisition of knowledge in software from intaglio.

The unknown outcome is, therefore, limited which saves cycles of aquatint being applied, thus reducing expenditure of time and resources. In normal practice, the printmaker would be inclined to use aquatint in a series of conservative applications of the rosin to create a tint normally aiming at too light a tint rather than too dark a tint because one cannot go lighter, but only darker. With computer interaction in this planning, a sufficiently accurate digital visualisation could be made to apply aquatint less conservatively and, consequently, needing fewer applications to acquire the same result as without the computer planning agent.



**Figure 6.6:**  
The aquatint tonal value test  
(Author's image)

**6.3.5. ITERATION 5: SYNTHESIS** Based on the previous cycles of the design experiment outlined in this study the strengths of the simulator were further exploited in this iteration.

The failure of accurate texture prediction by means of computer simulator for the intaglio process, as found in the third iteration, was put forward as a reason why not to include such a simulation again in this final iteration. However, colour was applied in this iteration, based on the same method followed in the second iteration. The success of this application made the use of colour in the intaglio process highly predictable although laborious.

The tonal values, by means of aquatint, were accurately simulated in the fourth iteration and, thus, it was not repeated in this iteration because the design did not accommodate such large areas of tonal values. The most valuable aspect of this entire simulation, across all four previous iterations, is that of the breakdown of the design into desirable segments, as well as image mirroring and planning of the design and layout. This affordance, as pioneered in the first iteration and repeated in the latter, was repeated in this last cycle.

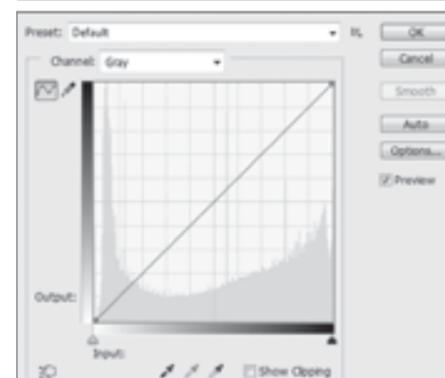
This aspect of layout and planning was expanded to more a complex application in this last iteration when an average of 200 intaglio printed segments, combined with a background comprised of between six and nine individual intaglio matrices combined on a single sheet, were applied. As described in the previous chapter, the background was treated separately from the foreground in terms of planning. For both of these phases, the use of software to effortlessly move, reorganise, rotate and combine digitised intaglio printed data proved invaluable.

In order to accommodate small segmented pieces of intaglio artwork for the foreground, web design software was used. The similarity of online image data to that of this iteration stage is that large images are being broken down into small 'bits', known as slices, viewed on screen as a single unit, not unlike a puzzle. The software allows images to be broken into smaller single images that are individually saved as a new document. The software further allows similarities of these smaller segments, such as colour or tonal value, to be grouped together and, therefore, the software can organise vast amounts of data with little effort.

Figure 6.7 shows the original image with slices indicated on the left. The middle image of Figure 6.7 shows the individual slices as separate documents in their respective position and on the right, Figure 7 shows the slices ordered according to tonal values as determined by a histogram.



**Figure 6.7:**  
Slicing of the image (top) and the histogram (left) showing the tonal range of the entire image to sort the segments (slices) into groups.  
(Adobe Fireworks CS6 and Adobe Photoshop CS6)



**6.4. STRENGTHS OF THE SIMULATOR** The simulator proved valuable and highlighted that mistakes in the digital planning realm do not have the same implications on the real intaglio matrix. Variables which exist initially did not exist in the simulator, such as press pressure, ink viscosity, paper absorbency, quality of the ground and the etching solution and other factors that impact on the final print. A great strength of the simulator is the ability to be calibrated effortlessly to allow, not so much these variables, but the result thereof.

The computer simulator's ability to adapt to these variables when they do affect the intaglio plate, makes for a continually more robust simulator. The third iteration on texture was a good example of unplanned variables on the intaglio matrix that could serve as input data to re-calibrate the simulator to align with the intaglio print at any given state. The most important strength of the simulator is its ability to continually adapt. Other strengths are described subsequently.

**6.4.1. TIME, COST AND EASE** The intaglio print was easily digitised and used to plan further. This was done to limit the incremental dis-juncture between digital and intaglio when the process progressed to the next states. This highlights the power of digital technology to easily digitise any flat sheet of paper. Highly accurate scanners and scanning software makes the electronic reproduction a near perfect facsimile of the original. The process is, however, not reversible. Intaglio cannot easily emulate what appears on the computer screen and so the alignment was often one directional.

However, the software functionality of layout and composition, mirroring and planning of the typography proved valuable and without any drawbacks which are considered noteworthy. The use of software to mirror images to reduce a complex design to simpler constituents, for application to the intaglio plate, makes the simulator very successful in the first iteration.

The biggest asset of the computer software is its ability to edit these single constituents of the final design individually but can also display the interaction when all the elements are added together. The implication of this ease of use is the time saving allowance. A well-planned design will show a more accurate alignment to the final print and, thus, the costly and timely intaglio process will be more successful and does not have to be repeated as often. This implies a further saving of cost and effort.

Another factor is the ease and adaptability of input devices to simulate mark making. The further ease of editing of that data, compared to hand processes, makes computer technology very attractive. Although mark making is the most basic form of graphic expression but also the most individual (Drucker and McVarish 2013), computers cannot facilitate this identity fully, although the new generation of input hardware and the recording computing software has made this gap much smaller. Pressure sensitive electronic pens make this mark making very similar to a traditional pen and paper coupled with the added ease of adapting the electronic mark. These adaptations are superior to pen and paper methods because pen and paper always follows a path of destructive editing. Editing imagery with computer software is mostly a non-destructive process (see p77).

**6.4.2. LEARNING CAPABILITIES** The act of creating is always a learning experience. With the use of technology in the process of making a design artefact many unexpected effects can be produced. These can be critical to the creative process, enhancing freedom of choice. In turn, however, choice can be tyrannical, if it is not embedded in constraints, which may originate from an individual, group, and society. Johnson-Laird (1988) argues that freedom of choice occurs *par excellence* in acts of creation, but that the set of choices is constrained by largely tacit mental criteria that determines the genre, shared by other practitioners, and the individual style. The application of the intaglio simulator, therefore, becomes a personal learning tool with value to the applicator primarily, and secondly, to others who repeat and learn from that initial application.

Creativity involves learning the skills of the domain. Yet as Simonton (2002) argues, the multi-dimensional and configurational nature of the creative product (the interaction of different aspects) makes it extremely difficult for the creator to learn what reliably works. The creative domain defines constraints. This fact implies that creators cannot judge the value of their works in isolation from the rest of the world (Hayworth, 2005). To overcome this problem, Schon's (1983) real world simulator is put forward.

Planning is a process and this process involves interactions and discussions in various forms such as visual, verbal, concrete and often intuitively-based. Art schools and design organisations should be seen as a facilitating environment for creativity.

Heidegger (1966) sets out to examine the particular form of knowledge that arises from our handling of materials and processes. Heidegger argues that people do not come to "know" the world theoretically through contemplative knowledge in the first instance. Rather, they come to know the world theoretically only after they have come to understand it through handling. Thus the new can be seen to emerge in the involvement with materials, methods, tools and ideas of practice. It is not just the representation of an already formed idea, nor is it achieved through conscious attempts to be original. It would then stand to reason that the more tools, ideas and practice, as well as deviations from the traditional practice, the more the learning.

Merleau-Ponty (1962) argues that people's fundamental knowledge of the world comes through their bodies' explorations of it which constitutes an embodied lens for interacting with the world. Merleau-Ponty (1962:49) further mentions the embodied nature of creativity and consciousness and emphasises that an artist's style is not something developed consciously in order to depict the world, but is an "exigency that has issued from perception". The designers' tools for creative development therefore, needs to be considered as a mediator to the perception of this world. Computers, the burin, as well as the printing press, can act as valuable agent to facilitate this perception.

**6.4.3. SATISFACTION AND A SENSE OF ACHIEVEMENT** Although computers cannot solely create, through their software capabilities, they can act as a platform for printmakers to create. Despite previous claims that computers were never designed for artistic endeavours, modern hardware and software has developed the need for artists of all mediums to use computers, and their enabling technologies, very successfully. This illustrates the ability of technology – just as printmaking does – to be altered in order to meet a creative demand.

Often design problems are perceived as too big to solve, thus causing paralysis (Nelson and Stoltermann 2012). The solution to this opinion is to segment and redefine the problem to units of achievable solutions. Such method requires a design problem to be viewed with new insight and also segmented into working states to arrive at a summative answer made up of smaller simpler-answered units.

The ease and speed with which computer software establishes a computational problem makes it invaluable as tool for solving many of these smaller design questions. The answer to such a sub-problem is easier and quicker to obtain which creates a sense of achievement that can counteract the paralysis and, therefore, move the designer forward towards a state of solution. The satisfaction derived from quick adequate answers to smaller design problems also leaves the designer to contemplate more conceptual judgements and focus on the unifying of such design criterion segments. Paralysis is arrested which results in a sense of (design) victory.

Computers allow the result of adaptation to be viewed instantaneously. Compared to the delayed action of the intaglio plate, this aspect of a solution creates a positive attitude to completion that is often needed in the timeous and often laborious process of intaglio, with a solution to the design process only visible at the end. The computer simulator can create a milestone of achievement along the long path of intaglio printmaking.

**6.4.4. PROCEDURAL AND DISCIPLINARY KNOWLEDGE** Computers cannot reason but show the calculated result without subjectivity. It is this aspect of computation that helps to reduce the thinking patterns needed to solve the design problem, into smaller and easier segments. It is not suggested that the computer can replace human thought; on the contrary, it can only serve as a tool to isolate and clarify the design problem. An example of this is the commonplace use of layered data in both intaglio and design software.

The way that the software allows the build-up of layers that will inherently affect the layers of data underneath, is invaluable in the understanding of the intaglio process. Although some effort has to be made to effectively align the two ways layers interact

(the algorithm of the software compared to the intaglio plate), it nurtures the crucial understanding of layered data in either process. The simulator, therefore, allows the user to understand and experiment with layers, to see what would happen, but more importantly, sets a mode of thinking that is necessary to successful intaglio printmaking.

The value of this process reaches far beyond the intaglio studio. This application of colour prediction for intaglio should be seen as a case study that can serve as a lens for understanding and application in any field of design that experiences a disconnect between perceived colour on the computer monitor, compared to the printed outcome. The experiment proved valid insofar as colour can be predicted and planned accurately on computer for an intaglio print should the process described in the practice followed stringently.

## 6.5. WEAKNESS OF THE SIMULATOR

**6.5.1. DISCONNECT** The disconnect in operation between computerised calculations and human thinking is acknowledged. Just as affordances of tools and processes need to be understood and acted upon, in that strengths are exploited and weaknesses suppressed in the operating of that tool, so too computer limitations should be minimised.

The way computers function, that is a process set out by a set of mathematical rules to conclude an answer, is inherently different to design thinking in which solutions cannot be broken down into mathematically exact answers. The right colour, design layout or composition is not a function of maths but rather that of a perception of aesthetic rules set by cultural and historical conventions.

The multi directional flow of information and the way this information impacts on other information in the digital realm of design software is quite different to the information on the intaglio matrix to be transferred to paper via a press. The intaglio process is one directional: from hand to plate to paper, while the flow of digital information on a computer is infinitely exchangeable between software applications and files.

The way in which humans interact with computers, that is via input devices such as mouse and keyboard, serves as another difference to the way they interact with the intaglio process. Computer users are usually seated, with ergonomically designed input and output devices arranged in a fixed fashion. They use their hands with small motoric functions mainly for input and their visual sense for absorbing the output. The intaglio process, on the other hand, requires people to use an extended studio with presses and acids, water and other chemicals. Intaglio printmakers walk around and have to carry paper and plates, use pressure to turn the press and often use aggressive hand motions to prepare a plate. These input devices are more varied and require a much larger scope of effort, compared to that of the computer.

**6.5.2. INCONSISTENCY** Consistencies in intaglio print are a factor that cannot be accommodated in this study's computer intervention hypothesis. To ensure five identical prints, ink consistency (viscosity), inking amount, paper wetting and drying time and press pressure, are the most important aspects. This process requires a precise and consistent work ethic, an aspect that is replaced by a machine when a digital printout is made. The researcher agrees with some critics of this study, that these print tolerances cannot be informed or facilitated by computer. However, because the printing of the plate and its methods and techniques are not the focus of this study, the above mentioned critical comment is irrelevant.

Other inconsistencies are due to the variables and values of all the aspects involved in either computer design software or the intaglio process. While computer calculations are not subject to outside influences, such as small temperature changes or other minor climatic conditions, the intaglio process is quite sensitive to such aspects. Higher ambient temperatures may cause inks and other chemicals to evaporate more quickly, changing the viscosity of the ink which has serious implications when printing. Both the time that the paper is immersed in the water and the outside humidity may have a serious impact on the print. Press pressure, timing aspects and a series of variables pertaining to the chemicals involved in the intaglio process, complicate the intaglio process considerably more than that of the computer unit with software, input and output devices.

**6.5.3. PROCEDURAL KNOWLEDGE** In the digital realm, software guides the flow of information and systems are put in place to limit or cancel wrongful use of processes. Warnings are commonplace in design software that either advise against or do not permit certain procedures. The digital design world is guided by the affordances set out by the software as a gatekeeper to illegal processes. In the intaglio process, such higher authority may exist in the form of a tutor or master printer, but other than that, the printmaker is free to mix method, process in any way he or she likes. Although this may be highly disastrous, there is no gatekeeper that exists to constrain such methods even though it may fall outside conventions and logical thinking. Other than common sense, or embedded knowledge of the process, there exists no hindrance to alter or adapt the procedure or process in the intaglio studio. The implication of this is the disconnect between procedural knowledge of the two systems: intaglio and computer.

The order of things and what is allowed is thus different in the two opposed fields of intaglio and computer design. The simulator is situated in the liminal space between these two disciplines where similarity is either shared or in close proximity.

**6.6. CONCLUSION** The interviews conducted revealed two factions at the two extreme ends of acceptance versus rejection of computer technologies in the intaglio process. Limited middle ground views were found.

The tension between the two factions is mainly driven by personal perception of the value and skill of artistic process. Self-labelled traditionalists often fail their own test of purity when their own processes and methods are scrutinised. Media specificity, is often ignored by these 'traditionalists' which means an acceptance of new – and often digital media – is a factor of a modernist view in which message is more important than medium.

A valuable concern of those who are not in favour of computer technologies in the intaglio process is that of the attitude with which digital printmaking students exhibit in the intaglio studio. A push button solution and quick fix by means of software is often the biggest hindrance to success in the intaglio studio. On the other hand, such digital solutions also help to make the laborious intaglio process more palatable, by breaking a complex process into smaller units that create a sense of achievement.

The ease and speed with which computer software establishes a computational problem makes it invaluable as a tool for solving many of these smaller design questions. The answer to such a sub-problem is, therefore, obtained more easily and quickly and this creates a sense of achievement that can counteract the paralysis and move the design forward towards a state of solution. The contradiction can be concluded with two views, that of Hoskins (2013) who states that with quality and craftsmanship as the strongest weapons to justify its existence, intaglio printmaking refuses to adopt a push button solution at the convenience of even the laziest of artists. Fishpool (2009) argues that digital technologies will absorb traditional methods thus making printmaking within the reach of everyone. Based upon the above perspectives the simulator was employed to both solve the design problem of the intaglio motif design process as well as to address issues of learning without creating a false sense of ease.

Creativity involves learning the skills of the domain and Simonton (2002) argues that the interaction of different aspects of design artefact creation makes it extremely difficult for the creator to learn what reliably works because creators cannot judge the value of their work. To overcome this problem Schon's (1983) real world simulator is put forward. This simulator bridges the gap between troublesome learning in the real world and purely theoretical knowledge in the classroom with little empirical application.

In the printmaking process discussed in this study, the simulator proved valuable and highlighted that mistakes in the digital planning realm do not have the same implications as in the real intaglio matrix. Furthermore, this implies an easy adaptation of change to the simulated image to be applied and repeated. The application of the simulator, therefore, becomes a personal learning tool with value to the applicator primarily, and secondly to others who repeat and learn from that initial application.

The value of this simulator is that the process employed and learned reaches far beyond the intaglio studio. An example of this value of the learning process is the way that the software allows the build-up of layers that will inherently affect the layers of

data underneath. This creates a conceptual framework of understanding similar to that of the intaglio process. The simulator enables the user to understand and experiment with layers, to see what would happen, but more importantly, sets a way of thinking that is necessary to successful intaglio printmaking.

A disconnect between the intaglio process and the computer simulator is mainly due to inconsistencies in intaglio print that are dissimilar to computer technologies. Such factors include ink consistency (viscosity), inking amount, paper wetting and drying time, and press pressure. None of these factors are commonplace in the digital world of computer software.

Another problem of the simulator is a negative aspect of procedural knowledge. The process and order of process is not similar in the two opposed fields of intaglio and computer design. In the liminal space between these two disciplines where similarity is either shared or in close proximity, the simulator is situated. This means that the simulator can only partially solve the design problem of effective planning for intaglio.

To conclude the above discussion, the success or failure of the simulator in each iteration is summarised as follows:

- Iteration 1: Image reversal, composition and layout – highly successful and valuable, no noteworthy disconnect experienced.
- Iteration 2: Colour – successful but laborious and very time consuming. Repetitive application will, however, shorten this process without compromising quality of alignment.
- Iteration 3: Textures – unsuccessful and not applicable. A new method of application of the simulator will have to be developed and retested.
- Iteration 4: Tonal values – successful but only within the intaglio method (aquatint) used. Other methods may prove less successful.
- Iteration 5: Synthesis - highly successful as this iteration was a repetition and combination of successes of previous iterations.

The researcher's overall conclusion is that a binary *yes* or *no* answer is simply not sufficient in the application of the computerised simulator in the intaglio process. Rather, its weaknesses must be highlighted in order to use other appropriate methods or solutions at such points. Likewise, the strengths must be exploited to the full. Subsequent experiments with more extreme input criterion must be conducted to develop the fidelity of the simulator. This application and other further research leading from this study, is discussed in the next chapter.

# CHAPTER 7: CONCLUSIONS AND RECOMMENDATIONS

**7.1. INTRODUCTION** A summary of the research undertaken for this study is given below to describe this process from its inception as an idea, to the conclusion with the main findings summarised. The reflections given, both methodological and substantive, discuss the methods used in the research, as well as the main arguments and perspective found in the available literature on the research topic. From these main arguments the value of the study is concluded in order to lead to recommendations for curriculum design and future research.

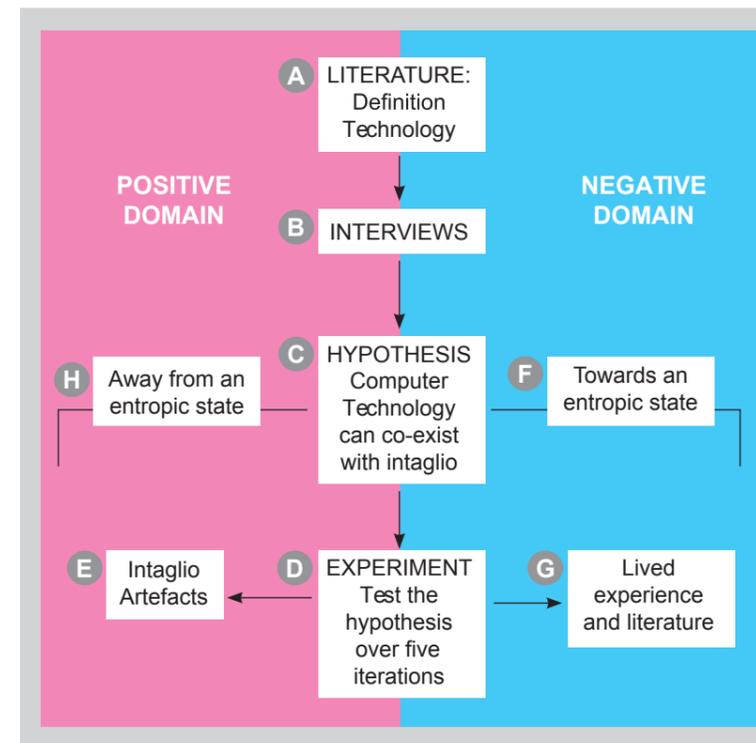
Main lines of thought from the literature review include the role of technology in intaglio printmaking, the unclear definition of printmaking and some questions regarding the direction in which the discipline is headed. The data gathered from the design experiment shows a strong duality of viewpoints with regard to the use of technology. Some of the interviews highlighted these attitudes towards academic printmaking as “a wasteful exercise as printmaking cannot be bound by limited academic thinking” (Respondent A). Most master printmakers, however, acknowledge the great void in academic discussion on printmaking.

The application of graphic and web design software to plan the intaglio process proved valuable as a whole. Although several misalignments exist between the digital domain and the intaglio print domain, a successful simulation with an adequate level of fidelity could be established. The simulation was tested over a series of five iterations being the typical processes found in intaglio printmaking. While the first iteration: layout and mirroring of images, was successfully planned with the simulator, the third iteration: texture, was less successful. Chapter 7 summarises the successes and failures of the simulator across the five iterations. The findings of the experiment show that the hypothesis of the research cannot be transcribed to a question with a binary answer of yes or no. Rather, some aspects of computer planning for intaglio were more successful whilst others were less successful.

**7.2. SUMMARY OF THE RESEARCH** The research hypothesis: the extent to which computer and its facilitating software can be used to inform, plan and ideate the intaglio process, was explored from a platform of scientific investigation of process as a practical iterative design experiment. Justification for the study is found in the lack of investigation in art and design research in general, but more specifically at universities of technology that offer graphic design courses but fail to adequately address traditional processes to the desired extent.

Figure 7.1 shows the summative conceptual model of the study. The problem was conceptualised by literature **A**, that shows a problematic landscape in academic discussion regarding printmaking. Two debates which were explored in detail formed the basis for discussion. These two debates, namely the lack of a clear definition of printmaking and the contentious issues surrounding new technologies in printmaking, seem to be topics that are not exhausted or resolved, although often ignored because little progress in these fields has been made. Media specificity and authenticity in printmaking are other uncertain issues that position the discipline uncomfortably in the arts. Furthermore, printmaking has largely lost its initial mandate as purely a utilitarian means of information dissemination. Printing and printmaking have evolved into separate entities with limited overlap although both are highly susceptible to technological influences. The topics discussed in the available literature are positioned in both the positive domain (what is known, agreed upon and accepted) as well as the negative domain (what is omitted from literature, what is debated, what is unresolved).

Academic literature on printmaking is very limited in a South African context. Consequently interviews were conducted to establish legitimacy and a reason for the study and to gain expert opinion on practical issues associated with the topic. These interviews, **B** showed dichotomous views on the topic: those practitioners who were in favour of computer technology as a positive influence in intaglio and those who were opposed to the idea. The interviews were also necessary to gain an understanding of the work methods of professional practitioners.



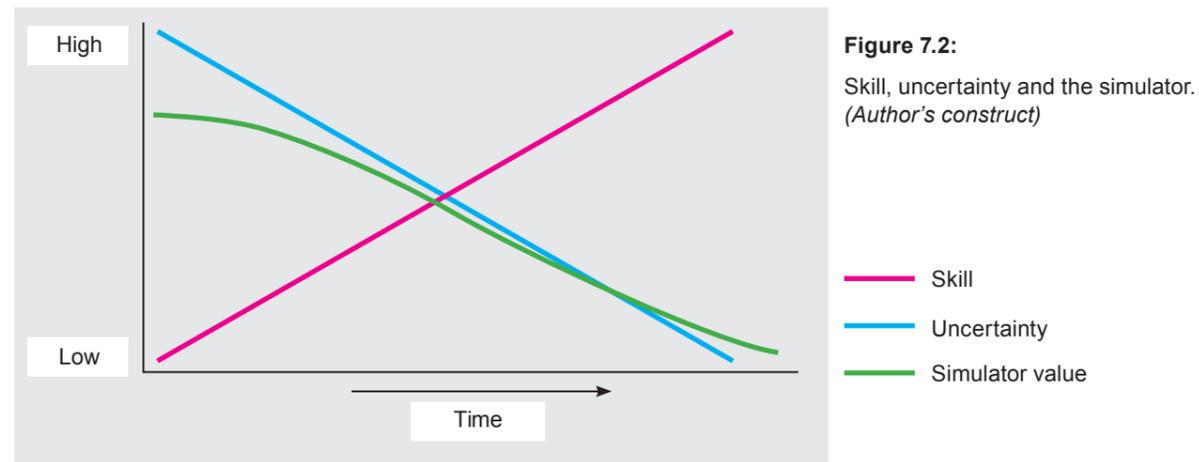
**Figure 7.1:**  
The conceptual model of the study.  
(Author's construct)

From the literature and interviews, the research hypothesis and research questions **C** were derived. To answer the research question, a computer software based simulation planning solution was applied. In the liminal space between these two disciplines, where similarity is either shared or in close proximity, the simulator, expressed as an experiment, is situated.

The experiment **D**, as well as intaglio artworks as artefact of the research **E**, are viewed from a scientific position. Should the hypothesis be false and the proposed computer technologies not be used in the intaglio process, the discipline of intaglio will move towards a higher state of entropy or disorder: **F**. The proof of the legitimacy of this hypothesis is both found in literature that claims the “growing crisis in printmaking” (Brodsky 2011:12) and “printmaking that needs to be saved” (Brown in Breuer et al 1997:67), as well as the researcher’s lived experience as a novice printmaker: **G**. Ultimately, the researcher concludes that computer technology, and specifically graphic design software, can be used effectively to plan and facilitate the ideation process in intaglio printmaking. This development would result in an injection of new technology and energy in an old process, enabling it to move it away from an entropic state **H**.

The model provided by this study, shows the input, namely literature and interviews, as being situated in both positive and negative domains. The conclusion from this input, namely that the hypothesis and experiment are also both positive and negative, in that a hypothesis is an argument, a proposition and, therefore, theory while an experiment is uncertain and based on presuppositions. The results of the experiment (the output) is, however, either negative or positive. Both have value and, therefore, on another level, both sets of results can be viewed as positive in that it adds to the literature and certainty of the value of the hypothesis. Consequently, the lack of experiment does not resolve this topic and has a negative or no value.

The success of this study’s hypothesised simulator and, therefore, the success of the study can only be judged by considering both the praxis and dissertation. A personal value judgement based on the alignment between the digital computer simulator and the real intaglio artworks is the only true test. Without such an examination the success of the simulator cannot be fully appreciated or judged.



**7.3. MAIN FINDINGS** The interviews, together with the experiment, highlighted that when skill in the intaglio process increases, uncertainties in the outcome decrease (Figure 7.2). This observation suggests that the computer simulator has more value to novice printmakers compared to more experienced printmakers. It also suggests that the rate of use of the computer simulator will decrease but never completely end. Should a practitioner explore a new technique and/or material, the rate of unpredictability is high and the simulator must be employed again until such time as sufficient skill has been gained to largely replace the computer simulator. It is, therefore, concluded that the simulator has a limited lifespan within one fixed category of planning. As new methods and techniques are developed and explored, the simulator becomes valuable again.

The findings of this study show that mistakes made on the simulator as a digital planning document do not have the same implications as mistakes made on the intaglio matrix. This observation implies ease of adaptation and change to the simulated image to be applied and repeated. The application of the intaglio simulator, therefore, becomes a learning tool with value primarily to the applicator, and secondly to others who repeat and learn from that initial application.

Negative factors of the simulator include the disconnect between the intaglio process and the computer simulator due to inconsistencies in intaglio printmaking that are dissimilar to computer technologies that do not function with similar inconsistencies. Such factors include ink consistency (viscosity), inking amount, paper wetting and drying time, and press pressure. None of these variable factors are commonplace in the digital world of computer software and can, thus, not be effectively simulated by software. This discrepancy implies that the simulator can only partially solve the design problem of effective planning for intaglio.

The further aspect of procedural knowledge in the disciplines of both the computer domain and intaglio proved advantageous as well as problematic. Some aspects of process, and order of process, are similar in the two opposed fields of intaglio and computer design that creates a high educational value in both fields. Other aspects that are dissimilar can cause confusion and a false sense of direction and accuracy when planning for an intaglio print.

**7.4. DISCUSSION OF THE RESEARCH** The following discussion (Substantive Reflection) concludes the research as a reflection on perspectives and data from the literature and interviews. This leads on to a Methodological Reflection to arrive at a discussion for creating new value. The intrinsic value of process as an educational activity is stressed in the Methodological Reflection.

**7.4.1. SUBSTANTIVE REFLECTION** Intaglio has evolved little since the days of the goldsmiths, although it was borne as a result of technology from those goldsmith and similar practices. As the definition of printmaking is unclear, the allowance for modern computer technologies has been highly debated in literature.

Media specificity in printmaking requires a definition of the discipline defined by the tools and material that create those

printmaking artefacts. When the use of computer technology, and its position in printmaking, is debated, the definition breaks down even further. This fact is particularly significant because academia acknowledges printmaking's development to be equal to that of innovation and technology. Sarton (1957:230) writes that: "The discovery of printing was one of the great turning points in the history of mankind and it was of special importance to the history of science. It changed the very warp and woof of history for it replaced precarious forms of tradition (oral and manuscript) by one that was stable, secure and lasting. It is as if mankind had suddenly obtained a trustworthy memory instead of one that was fickle and deceitful". The Bauhaus slogan of 1923 (Droste 2002:15) "Art and Technology: A new unity" is therefore as applicable now as it was then.

Literature on printmaking and printmaking itself is alive with contradictions and inconsistencies. Literature describes the existence of both printing and printmaking, just as there exists an old world approach to process and technique compared to the new wave of innovation and technology. Some authors claim that printmaking is experiencing, or has experienced, a crisis in its claim to be accommodated in art schools, whilst others celebrate the current massive interest in printmaking amongst students. These views are often situated within a small isolated community of printmaking practitioners with limited acknowledgement of a global or semi-global reality.

The first problem is the unclear history of the origin of printmaking that needs to be addressed, because this ambiguity cannot provide a solid foundation for further research, the question of ethics of practice also arises. With so much abstruseness, the response to academic research has been twofold, either an acknowledgement that there exist gaps with a vast amount of research input still needed, or a belief that the lack of certainties limits the scope for academic rigour.

**A duality of viewpoints** There currently exists two streams – once a single flow – of graphic work produced from a press bed. This once single stream was one of invention and both artistic and utilitarian prints were produced to serve as both mass communication and artistic artefact. With the influence of the industrial revolution and, the subsequent revolt, the stream split into two classes: fine arts printmaking and commercial printing. These two fields are very separate but are often treated as one subject. The concept of mass dissemination and democracy is used recklessly by fine art printmakers because they want their work to have the same power as their commercial counterpart. Contrary to this, they also want intaglio printmaking to be exclusive, beautifully displayed and available only at a high cost to the consumer in the form of a limited edition. In this sense these two fields stand as opposites in their character although they exist within the same discipline. Intaglio printmaking as fine art discipline seems to want all of the good qualities but none of the bad associated with either ends of the spectrum.

Intaglio printmaking wants to be both exclusive and inclusive, a product for mass dissemination and the limited art object, the product of both artisan's and artist's creation. It is because of this reason that the current state of printmaking is such an undefined discipline and printmaking-like artefacts have become more commonplace than printmaking. The two streams mentioned earlier have broadened their flows and expanded their banks, often integrating and assimilating each other's content but also finding their own path back again. The researcher concludes that it is these two world views of cohabitation and the presence of the interference of the other, that are either accepted or rejected in order to maintain a puristic integrity of either stream. Consequently, retaining banks are built to keep the waters separate. Intaglio printmaking is now almost exclusively part of the fine art stream and, therefore, many attempts are made to keep it there.

The researcher hypothesises, that it is this duality, which causes the strong disregard for digital technologies in printmaking by so many practitioners of intaglio. It is the belief (albeit false) that inferior methods of printmaking will pollute and ultimately destroy Old World techniques such as intaglio. However, as a planning tool, the computer and its facilitating software does not endanger intaglio. On the contrary, it can be used to provide a new insight and appreciation of the handmade matrix and hand pulled print. Yeoh (2006:180) sums it up in the simple statement: "technology is not the problem but rather how it is being used".

When discussing modern technological interventions in printmaking, the questions raised by print curator and art historian, Stephen Goddard (in Coldwell and Laidler 2012), are of value. He inquires whether the possibilities of a purely digital output as opposed to paper may indicate the potential emergence of a 'rift' within the printmaking community. He concluded in 2001

that it seems unlikely such a chasm would arise; a more likely development – for multiple economic, social and cultural reasons – would be the co-existence of both output modes and he predicted: “In all probability printmaking’s centre will hold...”, (Goddard 2001 in Coldwell and Laidler 2012:114) The researcher argues that subsequent developments appear to prove him right, provided that an agreement can be made as to the “centre”.

More than this, Weston (in Jarry 1996:21) said of photography as a printmaking activity: “Wouldn’t it be funny, if one could pierce the future, and find that [photography] was accepted as a great art form, because the mind – ‘intelligence’, that is – could be directed through a machine in a purer form, without the bungling interference of the hand!”. If this claim is true, then digitally machined applications of printmaking are purer, without the inherent flaws of the human hand but maybe also lifeless and without the aura that Benjamin (1936) claims to be the great shortcoming of machine made artefacts. “Computers add value and enhance personal productivity” (Rochester 1993:3). Such a broad statement covers all aspects of computer influences in any design activity and, therefore, can be easily be refuted.

The contradiction discussed above can be concluded with two views, that of Hoskins (2013) who states that with quality and craftsmanship as the strongest weapons to justify its existence, intaglio printmaking refuses to adapt to a push button solution even for the convenience of the laziest of artists. Fishpool (2009) argues against this criticism and claims that digital technologies will absorb traditional methods, bringing printmaking within the reach of everyone.

The tension between the two factions is mainly driven by personal perception of the value and skill of the artistic process. The self-labelled traditionalists often fail their own test of purity when their own processes and methods are scrutinised. Media specificity is often ignored by these ‘traditionalists’ and that means that an acceptance of new – and often digital media – is a factor of a modernist view where message is more important than medium. A reason that so many printmakers shun the concept of computer interaction, is the contemporary reality that high end electronic devices – from smart-phones to computers – are often more at home in the hands of teenagers playing games, than in the professional’s workplace.

Both material and process are in question. Fishpool (2009) contradicts her earlier statement when she claims that traditional processes have been absorbing digital process for many years. Currently the printmaking repertoire is enriched by many of them and in some cases, is made to suffer when people fail to understand that the instant processes offered by many commercial printing outlets cannot be equated with hand crafted printmaking processes, even when digital techniques are involved.

**Educational implications** An important concern of those who are not in favour of computer technologies in the intaglio process is that of the attitude which digital printmaking students exhibit in the intaglio studio. A push button solution and ‘quick-fix’ by means of software is often the biggest hindrance to success in the intaglio studio.

On the other hand, such digital solutions also help to make the laborious intaglio process more palatable by breaking a complex process into smaller units. The ease and speed with which computer software establishes a computational problem makes it an invaluable tool for solving many of these smaller design questions. When the answer to a sub-problem can be easily and speedily obtained this creates a sense of achievement that counteracts a sense of paralysis, moving the design forward towards a solution.

**Cultural capital** There has also been an argument for a more conceptually driven practice facilitated by digital media. But, as Haas (2006:67) argues: “debates over how an image exists within culture and how it signifies its meaning, have typically taken place outside the discourses of printmaking”. He also confirms an earlier point about the necessity for theorisation of print when he notes that, “despite the significant role printmaking has played in art throughout the 20th century and currently, it has not shared the outpouring of theoretical writing which has been devoted to photography in the last several decades”(Haas 2006:67).

Haas (2006) touches on the issue of cultural capital as a starting point for any design. Drucker and McVarish (2013) makes mention of the fact that aesthetic principles are often founded on belief systems and attitudes that have their roots in

classicism, romanticism and rationalism. Even fundamental values, such as clarity and legibility, or harmony and proportion, are fraught with cultural baggage. As a cultural phenomenon, graphic design is embedded in institutions. Design studios, advertising agencies, media companies, print shops, as well as schools and universities that provide training, are all shaped by cultural historical forces. Digital technologies in printmaking are often described as being “beyond traditional” approaches (Drucker and McVarish 2013:45).

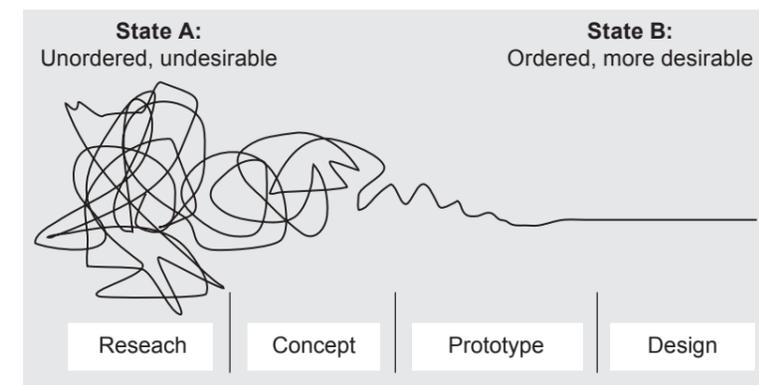
This term “beyond traditional” often used in literature is a troublesome term. If printmaking has never been standing still in its development, and always at the forefront of innovation, what then is traditional? Whilst some might argue for the Incunabula (the first 50 years of ‘high printmaking’) as being the traditional period, this period of high-printmaking is only considered traditional in retrospect. In years to come traditional might include what is now considered revolutionary, and so the problem persists.

What is evident is that the evolution of printmaking – as a purpose driven activity of effort and labour – has resulted in far-reaching influences. Printmaking has developed from hand impressions to a myriad of new technologies, including a plethora of digital matrices and output options. Traditional intaglio is positioned about halfway in between these extremes.

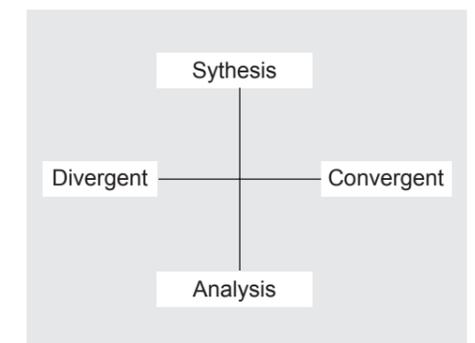
**7.4.2. METHODOLOGICAL REFLECTION** The research question was framed as a hypothesis and applied in a series of five practical design experiments informed by contextualising interviews. The premise of the study relies on the notion that computers can serve as valuable tools for ideation. In a broad sense this is true should a classic design thinking model be used. In such a model, ideation can be seen as encompassing several aspects of idea forming. Ryan and Conover (2004) describe ideation and refining ideas over at least three different stages, namely thumbnail sketches, rough work and comprehensive layouts. For the most part of the practice in this study, the computer proved of value as tool in the comprehensive layout stage. In the earlier, less defined and less certain stages, the computer usage was progressively limited because the variables that impact on those stages were less familiar. The implications are that computer planning and idea forming was used rather later than earlier in the design idea forming stages, although these stages have always been intertwined. Just as the entire process of design was cyclical, so to the individual parts of the process was cyclical.

Figure 7.3 shows the design thinking and solution finding on a linear path. Although displayed as linear, the first stages of this process are iterative. The model also shows Schön’s (1983) concept of different states of a design artefact. Schön describes state A of a design artefact as unordered and undesirable, compared to state B which displays order, or a more desirable state of that same artefact.

Figure 7.4 shows Brown’s (2009) design thinking model as four quadrants. Brown (2009) states that design is about a series of divergent and convergent steps. During divergence, choices are created and during convergence those choices are made. Problems are broken apart during analysis and solutions are put together during synthesis. It is during this aspect of Brown’s model that computer intervention acted as facilitator for analysis and synthesis in the experiment delineated in this study.



**Figure 7.3:** The design process. (Author’s construct based on Schön 1983)



**Figure 7.4:** Design thinking model. (Brown 2009)

The workflow used in this study follows a multi-directional pathway with multiple points of entry, as well as multiple conclusions. These various points of conclusion serve as starting points for another cycle of refinement. This iterative process is duplicated until such time as only one point of arrival is left.

Although strictly speaking the methodology can be described as an iterative experimental design, aspects of practice-led research were incorporated. Such aspects include the value of the design artefact as a product of research and the process application of that creation. The two tiers of the research method (interviews and experiment) were treated differently although the two sets of data were not unrelated. To clarify the hypothesis and, therefore, the experiment, interview data was used both to draw conclusions and to redefine aspects that need addressing in the experiment.

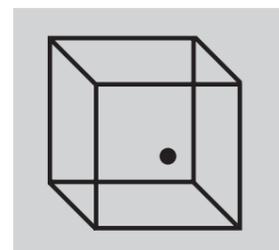
The accurate recording of the practice was, although laborious, necessary to reflect on actual data rather than imagined data. It also highlighted the temptation of application without sufficient computer planning. Such an omission of computer planning would create a greater uncertainty and the chances of surprises, both “good” and “bad” would escalate. Although it was previously argued that no creativity can occur without the willingness to make mistakes, such “bad” surprises occurring without proper planning, cannot be truly valuable for learning. The question of why the surprise was unfavourable, cannot be deduced (besides from a lack of planning) and, consequently, no corrective action can be taken to learn from these mistakes. A better sense of direction and outcome was, therefore, produced compared to a similar process where computer planning was not used.

The way in which the computer is used should be seen as a tool that becomes an extension of the brain, just as the microscope becomes an extension of the eye (Yeoh, 2006). The computer serves as extension of areas of ideation such as assessment and refinement, through elimination, to the final production of the artefact. The entire process becomes a closed consolidated environment where the tool is intrinsically part of process and not a separate factor for production.

This integrated process managed to combine seamlessly the digital domain and the traditional artisanal hand method and requires proficiency as a practitioner in both fields. It is in this (liminal) space between these seemingly contrary opposites that the process of innovation lies. The rejection of technology, based on the perception that it (computers) do not require skill and offers a simplistic push button solution, is discarded. At the same time, hand intaglio methods must be nurtured and reinvigorated to preserve the invaluable hand skill and artisanal value needed in an increasing technological society.

Despite the professional capabilities of the software applications, such as both the raster and vector based design and editing programmes utilised in this study, computers lack the ability to reason or truly create. An argument is made in this study that computers will never be able to reason in the manner humans do. Lack of insight, instinct and a high capacity for synthesis are still hallmarks of the most advanced computers, hardware and software available.

By definition, creatives such as printmakers and graphic designers create new ideas and artworks, born from their own minds. The individual thought process of humans can be opposed to the operations of computers which, as machines, replicate each other (provided their components match). This automatic response reiterates the limitation of computer simulation in the intaglio print. Where the computer software can accommodate certain factors, such as mathematical calculations and repetitive commands very well, some factors are nearly impossible to predict or plan for by means of software intervention. It is not suggested, however, that any other form of planning with paper and pencils will solve such problems. The problem of effective planning, or put differently, the disparity between the imagined and realised result, is the factor that is so evident in intaglio printmaking: ‘accidents’ happen due to enumerable variables that cannot always be accommodated.



**Figure 7.5:**  
The Necker cube  
(Ellis and Stark 1978)

To read reality from images (digital or intaglio) is to solve a running set of very difficult problems throughout active life - errors are illusions (Gregory 1953). Certain situations of visual presentation create special difficulties, giving rise to systematic errors that can serve as clues as to how the brain generally solves the problem of what objects are represented by which images. The problem of how the brain ‘reads’ reality from images is a severe one (Gregory 1953). This obstacle indicates the necessity for a ‘realistic’ simulation of the planning process to counteract the human brain’s biased view of reality. Gregory (1953) gives as an example the biological characteristics of objects: is it poisonous or food, hard or soft, heavy or light, sharp or blunt. These are not properties of images, although they are described by a visual system. The viewer cannot eat or be eaten by his/her images, and yet his/her life often depends upon interpreting them in terms of the quite different visual characteristics of objects. Seeing and thinking are, therefore, not separate entities. Consider the Necker Cube (Figure 7.5) which represents a visual conundrum to the human brain. To the computer this mystery is not a problem. The dot lies on a plane specified by the user and, to the software, the plane on which that object sits is a matter of fact, not perception.

This above example shows how an illusion, in print, is not recognised by the computer software as being the same image portrayed on screen. The implication can be either advantageous to the intaglio simulator or a great disadvantage. The advantage is that such an illusion of visual perception can be replicated and understood by dissecting the parts of the image on the computer screen to expose the ‘truth’, that is ‘what sits where’, ‘on what layer’ and ‘in what order’. The disadvantage is that this ‘truth’ cannot be replicated on the intaglio plate as layers. In the case of the Necker cube, the plane of the dot is absolute. The image replicated on the intaglio plate renders that value of the plane irrelevant to the viewer..

**7.5. VALUE OF THE RESEARCH** The value in this study of printmaking partly lies in its nature as a case study in the flow of effort. Designers across all disciplines face the same inevitable challenges, namely the extreme pace of technological advances in the design industry and the increasingly complex world for which they have to design. The fact that these problems are coupled with the increased expectancy of new knowledge as well as cross-disciplinary skills to keep up with technology, places high demands on designers. The massive amounts of energy and labour that is required not only to produce, but to find out what to produce (the design process) to a desirable outcome, are just some of challenges designers face on a daily basis. In that sense, the topic of intaglio printmaking is less important than the theme that can be imported to any design discipline. This study, therefore, seeks to find ways of innovative artefact creation and to show the flow of effort to that end. The value added aspect lies in the opening of a new field of computer application to develop knowledge, not only in that specified field, but also knowledge in application that can be expounded onto other design disciplines.

A further value of this simulator is that of the process employed and learned, reaches far beyond the intaglio studio. An example of this value learning of process is the way that the software allows the systematic build-up of layers that will inherently affect the layers of data underneath. This creates a conceptual framework of understanding, similar to that of the intaglio process. The simulator, therefore, creates understanding thus promoting experimentation with layer data, to see what would happen. More importantly, the simulator embeds a way of layered thinking that is necessary for successful intaglio printmaking.

To accomplish this new knowledge as an application of method, several themes are addressed in this study to highlight a liminal border space. The importance of this approach is the poli-disciplinary nature of learning, namely that of not being compartmentalised and isolated from other thoughts, fields and disciplines. In this sense, the eclectic mix of science and its application as technological problem solving agent, and the educational value of hand skills in age old artisanal methods, are shown.

Creativity involves learning the skills of a specific domain. Simonton (2002) argues that the interaction of different aspects of design artefact creation makes it extremely difficult for the creator to learn what reliably works because creators cannot judge the value of their work and thus the skill learned is unreliable. To overcome this problem Schön’s real world simulator is put forward. This technologically facilitated simulator bridges the gap between troublesome learning in the real world and purely theoretical knowledge in the classroom, with little empirical application. Yeoh (2006) mentions that a student can use technical proficiency to move towards a universally creative approach that supersedes technology and, therefore, is valuable as mode of creative problem solving beyond the constraints of technology.

### 7.5.1. DESIGN BRAVERY Design judgements are essential to successful design (Nelson and Stolterman 2012).

Nelson and Stolterman (2012) conclude that design wisdom can be defined as good judgment which enables right action, aimed at appropriate change. This method can only be applied by designers who intentionally change the world by facing design problems, instead of moving away from problems or situations of unease. Such action calls for an attitude of confrontation and bravery in addressing design issues. Judgement, not to be confused with decision making, should be solid. Inquiry resulting in wise actions lies at the heart of good design where judgement is the means and wisdom is the outcome. Technology and design are both concerned with the generation of artefacts that are intended to transform the world from what it is to something better. To this end design and technology in design, are both concerned with intervention, innovation and change (Scrivener 2000).

It is often this bravery that is lacking in many novice designers and artists alike. A major contributor of this deficiency is the prevalence of exclusivity and closed communities in the design and art world. Another factor is paralysis, and especially value paralysis, when value systems are not placed in hierarchical order and can conflict with one another (Nelson and Stolterman 2012). This paralysis and lack of decisive action is almost always the result of a lack of knowledge about the design problem and the tools available to solve such design problems. Knowledge and skill are necessary to combat paralysis. Such codified knowledge can become tacit when an effective technological interaction is used. The intaglio simulator is an example of such a technological solution to develop skill.

A certain level of skill is required in the application of the simulator for both intaglio printmaking as well as computer usage. This study seeks to establish a premise that computer usage requires as much skill and knowledge as intaglio printmaking. Printmakers often reject computer technology because they perceive its successful operation requires little skill or conceptual knowledge. Although the skills needed for computer usage and intaglio printmaking are different, some level of procedural knowledge exists that can help inform either side of the skill-set required. Furthermore, computer technology is more accessible than intaglio printmaking knowledge despite claims that printmaking is democratic and thought liberating (Noyce 2010). Computer technologies applied through the intaglio simulator can, therefore, serve as introduction to printmaking. A well-known tool, namely the computer, is used to familiarise novice printmakers with the printmaking discipline although such a specialised environment may be both alien and intimidating.

Such an alien milieu contains situations of troublesome knowledge – knowledge that is conceptually difficult and counter intuitive (Perkins 1999). Meyer (2003) mentions that this threshold has to be overcome to move into the knowledge of the other (unknown). The mechanism for overcoming such problematic knowledge, leading to paralysis, is by exposure, acknowledgement and acceptance.

## 7.6. RECOMMENDATIONS

**7.6.1. FUTURE RESEARCH** The simulator used and developed in this research piece was in a sense a preliminary investigation into software usage in intaglio printmaking. An in-depth study to explore other, more complex processes and techniques in intaglio, would be a logical future endeavour. A second series of similar iterations should also be completed to test the strength of the simulator. More and more extreme cases can serve as an input variable (cause) to determine at what point the simulator no longer serves as a valuable planning tool in the intaglio process (effect). Since intaglio processes are applied, the unplanned variables can serve as input to the simulator to accommodate progressively finer tolerances in the process. Therefore, the computer as a planning tool and simulator becomes more complex, with higher fidelity but better informed.

At each of the five iterations, questions and answers arose that need to be addressed in future research.

- The first iteration showed the value of the simulator for general layout purposes. Future research can use the value of this iteration for any form of computer design that has an outcome that is not digitally based.
- The value of the second iteration was especially significant because the problem of colour on screen versus that same colour in print was addressed. This common misalignment of colour perception and colour models is as relevant in other design disciplines as it is in intaglio printmaking.

- The third iteration of textures proved problematic and requires an in-depth research piece to discover if textures produced by hand on physical substrates, such as paper, cloth or plastics, can be simulated effectively with computer software. The iteration needs some critical evaluations in order to seek insightful answers into why it failed and how this failure can be overcome or limited.
- Layered applications of continuous tone aquatint was highly successful. These successes may be expanded in future research and applied to other hand-made artefacts that contain large enough areas of continuous tone. More extreme cases may also prove to what extent the software may accommodate successful planning of such tones.
- Analyses of the old to synthesise a layout of the new was also successfully simulated in the last iteration. This iteration can be seen as a more complex cycle of the first iteration and amplifies the success of that first iteration.

Critical channels in dialogue and academic discourse in the field of printmaking should be opened up. Future research on printmaking in South Africa, as both a design and fine art activity, is needed to establish the critical role printmaking can play in various other fields. Such debates need to be held not only to instil a new energy and value perception in printmaking but also in old world hand design. The 3rd Impact Printmaking Conference (2003) in South Africa had as its main focus, the political implications of printmaking, while critical debates such as technology in printmaking, skill and educational values of printmaking were not sufficiently addressed.

**7.6.2 POLICY AND PRACTICE RECOMMENDATIONS** Besides the future research needed to test a more extreme case of the simulator, further research is required to instil new interests and value in old world processes that have seemingly little contemporary value. It is the researcher's hope that this study may serve as basis for such arguments to establish the worth of such research. This future research is also critically needed to address the value and use of both computers and traditional artisanal hand processes as cultural tools. Although an emphasis has been placed on computer usage as tool for knowledge workers in the knowledge economy, the position of graphic design endeavours, in the form of an artistic point of view, is lacking.

The educational value of old world processes, such as intaglio printmaking is currently not explored sufficiently as can be seen in the current literature. There is a call by educators and curriculum designers to acknowledge such processes. In this regard, future research may prove valuable to inform such curriculum design in art and design schools. Curriculum designers would do well to explore topics addressed in this research in order to realise the value of artisanal hand processes. Such curriculum designer may also be informed by limitations and strengths of computer usage in various design disciplines. If one considers the Bauhaus model of Art, Science and Technology (p18), then printmaking as an artefact of design should surely be included in graphic design curricula.

New technology is often expensive and requires constant upgrading and re-learning (Yeoh 2006), thus careful consideration has to be given before implementing such technology. Ill-considered technological solutions cannot be used as a magic wand to offer solutions to the problems often encountered in the classroom or printmaking studio. However, computers can act as valuable tools should the limitations, thereof, be acknowledged. The aim of this study is to promote the use of computer technologies as both tool and medium, in situations where synergy between the limits of the mind and the potential of computer technology is carefully combined.

When computer technology such as the simulator is implemented correctly, it has the benefit of a real life cause without the real life effect. This implies that the repercussions of mistakes are softened and the design student has more freedom and willingness to make mistakes. The simulator also allows the data to be evaluated before application. Robinson (2011) notes that one cannot be truly creative if one is not prepared to make mistakes. Yeoh (2002), Robinson (2011) and Nelson and Stolterman (2012), argues that the fear of wrong decisions is the greatest inhibiting factor to creativity and more importantly, creative learning. The researcher, therefore, promotes the use of an applicable and accurate simulator as an appropriate tool for planning, ideation and, above all, for creative learning across many design disciplines.

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# APPENDICES

## APPENDIX A: ETHICS CLEARANCE FORM

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Faculty of Informatics and Design  
**Research Ethics Review Checklist**

All post-graduate students and researchers are required to complete this form before commencing with research. Post-graduate students are requested to please submit this form together with HDC 1.2 (proposal submission) to the Faculty Research Committee (FRC).  
*(Where applicable mark relevant boxes with an X)*

Project Title:  
**The software ideated plate: towards designing a new relationship of integration between digital technology and the intaglio process.**

<b>Applicant / Researcher:</b>	Title, name & surname: Mr Johann Booyens	Under-graduate	Post-graduate	X	Staff
	Office Telephone:	Cell: 084 380 1535	eMail: mrbooyens@gmail.com		

<b>Supervisor (if applicable):</b>	Title, name & surname: Alettia Chisin				
	Office Telephone: 021 469 1036	Cell: 073 509 2033	eMail: chisin@cput.ac.za		

Research Checklist:		Yes	No
1:	Does the study involve participants who are unable to give informed consent? Examples include children, people with learning disabilities, or your own students.		X
2:	Will the study require the co-operation of a gatekeeper for access to the research participants. Examples include students at school, members of self-help groups, residents of nursing homes — anyone who is under the legal care of another.		X
3:	Will it be necessary for participants to take part in the study without their knowledge and consent at the time? — e.g. covert observation of people in non-public places?		X
4:	Will the study with the research subject involve discussion of sensitive topics? Examples would include questions on sexual activity or drug use.		X
5:	Will the study involve invasive, intrusive, or potentially harmful procedures of any kind (e.g. drugs, placebos or other substances to be administered to the study participants)?		X
6:	Will the study involve testing on sentient subjects?		X
7:	Will financial inducements (other than reasonable expenses and compensation for time) be offered to participants?		X
8:	Will your research involve materials or processes that could damage the environment?		X

If you have answered '**No**' to all questions, submit the completed and signed form to the FRC together with the research proposal.

*If you have answered 'Yes'...*

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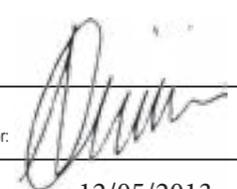
If you have answered '**Yes**' to one or more questions, kindly attach a report describing how you plan to deal with the ethical issues raised by your research. This does not mean that you cannot do the research, only that your proposal will need to be approved by the Research Ethics Committee. You will need to submit your plans for addressing the ethical issues raised by your proposal to the FID Research Ethics Committee.

**Declaration**  
As Researcher / Applicant I acknowledge that:

- It is my responsibility to follow the CPUT Code of Practice on Ethical Standards (which is currently being drafted) and any relevant academic or professional guidelines in the conduct of my study; and
- that this includes providing appropriate information sheets and consent forms and ensuring confidentiality in the storage and use of data.
- Furthermore that in the event that there are any significant changes in the design, or conduct over the course of the research, that I will notify my supervisor (where relevant) and inform the FID Research Ethics Committee if new ethics approval is needed.

By my signature below I declare that I am not aware of any potential conflicts of interest, other than those declared on THIS form, which may influence the ethical conduct of this study.

**Signatures:**

Researcher: 	Supervisor: 
Date: 03/03/2013	Date: 12/05/2013

**FID Research Ethics Committee comments:**


Approved	Referred back	Chair: Ethics Committee	Date:
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## APPENDIX B: QUESTIONNAIRE

JOHANN BOOYENS M-TECH INTERVIEW SHEET

NAME OF INTERVIEWEE .....

POSITION/TITLE/PROFESSION.....

DATE.....

PLACE.....

**AGREEMENT TO CONSENT:** I the interviewee, hereby agree to the publication of the content derived from this interview. Names and identities will be kept confidential.

.....  
SIGNED

.....  
DATE

Question 1. Do you agree that there exist a gap (given that outcome is dissimilar to planned document)?

Question 2. What are your comments on happy/unhappy accidents in intaglio printmaking?

Question 3. What is your opinion on computers in Old-World printmaking and printmaking in general

Question 4. How do you plan your intaglio prints?

Question 5. What are the typical problems you encounter in your planning problems?

Question 6. What are strengths of your planning process?

Question 7. What would you change in this planning process?

Question 8. How does your students plan? What are some of the educational issues in the printmaking studio?

Question 9. What is your perspective on educational value of printmaking?

Question 10. Do you think computers can be used in the planning for the intaglio process?

What other comments, perspectives or topics would you like to add, discuss?

## TECHNICAL SPECIFICATIONS

71685 words (Excluding Figure captions and Title page)

**Chapter Headings:** Titillium Text 15L 400 wt and 1 wt, 39pt Size, 42pt Leading, Optical Kerning with Opt Tracking.

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This document was designed and layed out using Adobe InDesign CS6,  
Adobe Illutrator CS6 and Adobe Photoshop CS6. Printed by Perfect Print, Somerset West

All artwork, design and layout, unless otherwise specified, by the author:

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