Post-discipline transformative arts practice: ceramics processes, digital fabrication technologies and innovative cultural content appropriation

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Declaration of independent work

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Abstract

The aim of this study is to investigate the integration of digital fabrication technologies within ceramics practice to re-envisage the appropriation of cultural content in a post-discipline transformative innovative visual arts PLR inquiry. Graeme Sullivan's (2010) Framework of Visual Arts Research is utilised as a practice-led reflexive methodology that facilitates the shifting between dissimilar bodies of knowledge.

Extensive ceramic surface experimentation is undertaken through the appropriation of the Driekopseiland cultural heritage petroglyphs in conjunction with the application of digital fabrication technologies and ceramics processes. Throughout the study all experiences, processes, influences, outcomes and thoughts regarding practice are documented in a creative process journal which serves as primary data.

The study shows that the application of a post-discipline transformative visual arts PLR inquiry adequately facilitates the innovative appropriation of cultural content through incorporating digital fabrication technologies with ceramics practice, enabling the promotion and preservation of cultural heritage. Transformative knowledge generation occurs when interpreting, transforming and reconstructing "lived" experiences recorded in a creative process journal.

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List of abbreviations

CAD	Computer-aided design
3D	Three dimensional
TET	Template experimentation tile
CET	Colour experimentation tile
SA	South Africa
IKS	Indigenous knowledge systems
NRF	National Research Foundation
UoT’s	Universities of Technology

Introduction

I.I Context of the study

The technology-driven post-disciplinary nature of this study reflects a strategy adopted by most Universities of Technology within South Africa, this being to encourage inter-disciplinary and trans-disciplinary tertiary practice and "[…] to promote relevant research and development and to assist with the transfer of appropriate technologies [...]" (SATN, 2012). This qualitative study is based on exploring the integration of dissimilar fields of knowledge that inform a post-disciplinary Visual Arts (Ceramics) practice-led research (PLR) inquiry. The study's ontological stance and real-world practical relevance take a subjective constructivist approach to building new knowledge around integrating technology within visual arts practice.

Epistemologically new knowledge is gained from the emergence of a post-disciplinary research environment through the application of digital fabrication technologies for the appropriation of innovative cultural content within traditional ceramics practice. Post-disciplinary practice within this study includes visual arts research that is explored within, as well as beyond the ceramics disciplinary boundary, thus stimulating an environment where theory and practice interchangeably inform each other (Rikakis, 2010:1; Sullivan, 2010:111).

The study applies Graeme Sullivan's (2010) Framework of Visual Arts Research as a practice-led reflexive methodology that accommodates the arts practitioner, as the research undergoes disciplinary shifts. A post-disciplinary research environment is created as the practitioner moves between three dissimilar bodies of knowledge, namely 1) visual arts practice as reflexive inquiry, 2) innovative cultural content appropriation, and 3) the integration of digital fabrication technologies.

The methodological inquiry applied to this study allows for the mapping of new ways of knowing and doing that arise when combining these dissimilar bodies of knowledge, thus stimulating a post-discipline transformative inquiry. For many years there has been much debate surrounding the role of visual arts practice as research inquiry, largely in response to educational and social change (Jones, 2009:31; Kälvemark, 2010:3,4). Arts-based research has shifted the role of the arts practitioner from a linear form of inquiry to adopting a reflexive approach where artists do not search for specifics but create them, thereby encouraging reflection on studio practice (Leavy, 2009:1-3; Marshall, 2010:81; Sullivan, 2010:25,244).The reflexive nature of practice-led artistic research becomes an essential feature when writing up the creative research process. As problems, questions and challenges arise from practice it is important to have a research methodology that supports an ongoing reflexive analysis and problem-solving approach that is diverse and open-ended (Haseman, 2007:147,148). Arts practice as a research methodology has the potential to break down set disciplinary boundaries creating an environment where the artist explores what is unknown in order to confront what is known (Sullivan, 2010:244). This approach differs from traditional empirical research, which builds upon the known to explore the unknown (Babbie, 2010:51; Babbie & Mouton, 2012:273; Sullivan, 2010:36; Yin, 2011:21).

The underpinning aspect of a PLR methodology is the gathering of evidence, which records the creative process by entwining various theoretical orientations, methodological inquiries, and applicable context classifications (De Freitas, 2007:7). The outcome of this type of research inquiry, therefore, lies in recording detailed responses to anticipated and unexpected experiences during the creative process, and the reflexive analysis thereof (Sullivan, 2010:57).The methodology is also based on establishing inter-disciplinary links or identifying key constructs (Marshall, 2010:84), which requires that the "practice" in PLR is comprised of two roles, namely arts practitioner and researcher, which alternate in a cyclical research process (Nimkulrat, 2007:2). Sullivan (2010:100) claims that "[t]he Frameworks of Visual Arts research therefore are flexible and evolving systems of interlocking and unfolding inquiry, whose structures move from a stable or unstable state to a fluid form, as new possibilities emerge". For continuity, throughout the writing up of this project, the roles of "arts practitioner and researcher" are collectively referred to as "arts practitioner", acknowledging that the two are interchangeable at various stages of the research process.

The making of inter-disciplinary-driven visual artworks as transformative research inquiry unifies the role of the artist as studio practitioner and textual researcher, bringing about a post-discipline research environment (Sullivan, 2010:112). A post-disciplinary research environment refers to the actual cross-over of boundary parameters, and the merging of both established and new knowledge between dissimilar disciplines (Rikakis, 2010:4; Sullivan, 2010:117). In support of this "cross-over", Sullivan's (2010) framework as a PLR method outlines empiricist, interpretivist and critical practices as the three broad areas of the research inquiry, facilitating the arts practitioner as researcher to engage beyond existing boundaries, recorded as post-disciplinary research (Sullivan, 2010:101).

Throughout this inquiry the arts practitioner develops an awareness of visualised relationships and structures. This transpires through the interconnected exploration of digital fabrication technologies and the use of innovative cultural content appropriation within the discipline of ceramics. By way of extensive surface experimentation the arts practitioner innovatively appropriates geometric petroglyphs (cultural content) from the extinct Khoe-San and/or Xam peoples cultural heritage site located at Driekopseiland, Kimberley, in the Northern Cape region. Knowingly, the arts practitioner, being a decedent of a white African heritage, appropriates the petroglyphs from a dislocated "outsider" position (Young, 2010:136).

Farber (2010:303) claims that the post-colonial "outsider" positioning of an artist has the advantageous potential to prompt a dialogue between 'self' and 'otherness'. The innovative surface effects achieved in this study emerge within the arts practitioner's position of 'self', which is considered in relation to the 'otherness' of the extinct cultural practice.

The practice-led inquiry undergoes rigorous experimentation and descriptive detailed recordings of the empirical processes affiliated with achieving innovative surface effects. Unavoidably, the surface experimentations are imbued with the arts practitioner's personal perspective regarding selection and manipulation of the petroglyph, surface texture and colour palette. Subsequently, the appropriation of cultural heritage petroglyphs in conjunction with the application of digital fabrication technologies and ceramics processes bring about visualised relationships and structures to anticipated and unexpected experiences, reading as post-disciplinary research.

I.II Problem statement

Since democratic freedom (1994), the South African government has published several documents, which lay a foundation for the reclaiming of cultural heritage. The Department of Science and Technology's Bill (2014), published in the *Government Gazette* (No. 38574), regarding indigenous knowledge systems (IKS) of South Africa aims to "[…] provide for the protection, promotion, development and management of indigenous knowledge systems […]". In support of this, the Department of Arts and Culture (2015:8) aims to […]" promote, preserve and develop our heritage resources […]" to emphasise the fundamental role that cultural heritage plays in nation building and social unity. The notion of sustainable heritage preservation is further supported by the Arts and Culture White Paper (1996), which specifically promotes the cross-pollination of ideas and art forms through dynamic interaction that places emphasis on artistic expression through technology access and transfer.

Within today's creative environment digital technologies open up new ways of creating, innovating and producing (Bishop, 2012:436; Hanessia, 2010:65). Integrating digital technologies not only has the potential of enhancing creative practice, but also contributing to generating new thought processes, resulting in innovative artworks. Creating a post-discipline research environment is regarded as an optimal platform for the cross-pollination of dissimilar bodies of knowledge, allowing for innovative thought processes to emerge (Sullivan, 2010:111, 117).

Suited to an arts-based post-disciplinary study is the application of a reflexive methodology such as practice-led research; which offers a set of methodological processes that are reflexive and open-ended in structure (Leavy, 2009:1; Sullivan, 2010:56). Applying this methodology adequately facilitates the merging of visual arts (ceramics) practice with digital technologies for the promotion and preservation of cultural heritage. This study supports the increasing use of emerging technologies in contemporary arts practice. Specifically, it makes a contribution to the promotion of cultural heritage and increases accessibility through technology integration and the innovative appropriation of petroglyphs, while remaining authentic in its artistic representation.

I.III Aim of the study

The aim is to investigate the integration of digital fabrication technologies within ceramics practice to re-envisage the appropriation of cultural content in a post-discipline transformative innovative visual arts PLR inquiry.

I.IV Research questions and objectives

I.IV.I Primary research question

To what extent can the use of digital fabrication technologies in ceramics practice enhance the innovative appropriation of cultural content in a post-discipline transformative visual arts PLR inquiry?

I.IV.II Secondary research questions

I.IV.II.I Which aspects within a PLR methodology adequately facilitate a post-discipline transformative visual arts practice inquiry?

Traditional qualitative research has a historical dominance within research paradigms. It is generally data-driven, and does not facilitate the reflexive and explorative nature of artistic research (Smith & Dean, 2009:2). Consequently, a shift is needed to accommodate the needs and advancement of arts-based research. The main thrust of arts-based research is generating new knowledge through applying a non-linear process, ensuring in-depth descriptive explanation, applying a continual reflexive process "in practice" and "on practice" (Leavy, 2009:4). A PLR methodology accommodates a non-linear, reflexive open-ended process, which allows the arts practitioner to obtain new knowledge and generate new perspectives on existing knowledge (Leavy, 2009:5, 9; Sullivan, 2010:56).

I.IV.II.II Which surface experimentation techniques innovatively integrate digital fabrication technologies with traditional Ceramics, as inter-disciplinary studio practice?

Internationally and within South Africa the use of digital fabrication technologies have increasingly been integrated within visual arts practice. For example, prominent South African artists such as Marco Cianfanelli, Michaella Janse van Vuuren and Willem Boshoff regularly use digital fabrication technologies like laser cutting, 3D printing and water jet cutting to produce distinctive artworks. Arts practitioners who use digital technologies engage in interdisciplinarity, which is propelled by a new approach to integration, collaboration, complexity, critique and problem-solving (Klein, 2010:16). A key aspect of interdisciplinarity is that practitioners explore and forge connections unique to each circumstance, allowing a cross-pollination of disciplinary styles and characteristics (Godin, 2013:164).

In this study, the inter-disciplinary integration of digital fabrication technologies within Arts practice encourages the practitioner to shift disciplinary boundaries when digital laser-cutting, surface-engraving, vinyl-cutting and plasma-cutting techniques are combined with the chemical fuming of ceramics, generating a unique cross-pollination of surface effects.

I.IV.II.III Does the creation of a post-discipline transformative PLR inquiry within Visual Arts practice allow for the innovative appropriation of cultural content?

Applying a PLR methodology facilitates the crossing of disciplinary boundaries and in so doing, creates a post-discipline research environment. Engaging with dissimilar disciplines exposes the Arts practitioner to new knowledge, as well as expands on existing knowledge. Throughout the study both textual and visual decision-making regarding anticipated and unexpected experiences are recorded in a creative process journal (CPJ) in which writing, drawing (digital and analogue), and theory combine as reflexive inquiry. New knowledge is created through the innovative combination of traditional ceramics processes, the authentic appropriation of cultural content and the application of digital fabrication technologies, as inter-disciplinary practice.

I.V Research objectives

- To apply a PLR as a suitable methodology to a post-discipline transformative visual arts practice inquiry

- To experiment with select techniques suited to the integration of digital fabrication technologies in ceramics as inter-disciplinary studio-practice
- To produce innovative ceramics surface effects inspired by the authentic appropriation of cultural content and reflexive experimentation

I.VI Delimitations of the research

- The post-discipline transformative inquiry for this study is delimited to actions taken within the arts practitioner's studio environment and recorded as reflexive response in a CPJ.
- Appropriated cultural content is delimited to geometric petroglyph motifs recorded from the Driekopseiland cultural heritage site, Kimberley, South Africa made available by the McGregor Museum, Kimberley, Northern Cape (Addendum 1).
- The creation of distinct surface effects is determined by select chemical fuming processes applicable to traditional ceramics combined with select digital fabrication technologies.
- In order to ensure validity, the majority of the ceramic surface experiments within this study are produced using hand-made bisque tiles approximately equal in size, and fired in an electric kiln at predetermined temperatures.
- Digital fabrication technologies used in conjunction with ceramics are delimited to laser cutting and engraving technologies (Trotec Speedy 500 CO_2 flatbed 1245 mm x 710 mm), vinyl cutting (Ronald GX-24 CAMM-1 SERVO) and plasma cutting (Tradeweld Cut 60H Plasma Cutter 380v).

  The inquiry delimits all "reflection in practice" and "reflection on practice" to an explanation of the creative process across the three practice areas outlined within Sullivan's framework (2010), extended sub-frameworks is not applied.

I.VII Significance and expected outcomes of the research

- It promotes arts practice as both visual and textual research.
- It explores relevant research and development for inter-disciplinary technology integration and collaborative working practices.
- Provides renewed studio practice working methodologies for the ceramics practitioner.
- Endorses the visual arts as a context for the preservation of tangible cultural heritage knowledge and value.

I.VIII Research design

I.VIII.I Research paradigm: Qualitative

A qualitative research approach is applicable to the explanatory nature of the research aim and primary research question. The subjective stance taken in the study aims to generate new knowledge that contributes towards a PLR inquiry. This serves as a valid evidence-based research methodology embedded with the visual and textual recording of the arts practitioner's inter-disciplinary creative process.

I.VIII.II Research methodology: Practice-led research

A PLR methodology accommodates the comprehensive textual requirement of visual arts practice as research output. As outlined in the context of the study, a PLR approach constantly engages the arts practitioner as researcher in a participatory reflexive research method of inquiry, within which the actual making and the data recording thereof drives the overall research process (Marshall, 2010:81; Sullivan, 2010:244, 245).

The function of theory is to explain phenomena of how we understand the world (Sullivan, 2010:105). Various approaches can be applied to answer different research questions within social sciences and humanities (Borgdorff, 2010:57, 60). Explanatory approaches answer basic "why" or "what" questions within research. Descriptive approaches are analytical in nature and assist in solving the "what" research question. Interpretive approaches cautiously combine bodies of information to help unravel the "how" research question (Babbie, 2013:17,18; Leavy, 2009:12; Newbury, 2010:383; Sinner, Leggo, Irwin, Gouzouasis & Grauer, 2006:1251). All three approaches are employed within this research study, assisting in answering the various research questions.

I.VIII.III Research method: Sullivan's Framework of Visual Arts Research

The study applies Graeme Sullivan's (2010) Framework of Visual Arts Research to accommodate the reflexive cyclic nature of a post-discipline transformative research inquiry where the three key areas of practice (empiricist, interpretivist and critical) are adjoined. Within a reflexive arts research inquiry the position of practitioner and researcher continually shift between areas, as different practices, linkages and bodies of knowledge are explored (Nimkulrat, 2007:2). Furthermore, Sullivan's (2010) framework allows for three operational aspects identified as *structure, agency* and *action.* These active features encircle and drive the overall inter-disciplinary creative process.

Within the centre of the framework (visual arts practice) research problems, issues and unexpected challenges originate. These are continuously explored by the arts practitioner through a range of cyclic acts involving creation and reflection (Sullivan 2010:101, 102). Cyclic acts, together with the disciplinary practice, form relational features within both theory and practice, which can be accessed by navigating within, across, between or around the various areas of practice. Therefore, it can be said that theory informs practice, and practice informs theory when engaging a post-discipline transformative visual arts research inquiry (Freedman & Stuhr, quoted by Marshall, 2010:79; Sullivan, 2010:104).

I.IX Data collection methods

- The application of Sullivan's (2010) framework guides the gathering of evidence and recording of the overall PLR inquiry. Select laser-cut or engraved, vinyl-cut and plasma-cut petroglyph templates have been combined with chemically fumed ceramic surfaces in order to develop innovative surface effects.
- All experiences, processes, influences, outcomes and thoughts regarding practice are documented in a CPJ.
- An extensive range of surface experimentations serve as primary data, recording the use of digital fabrication technologies in conjunction with various ceramics processes.
- Secondary data sources for the theoretical analysis affiliated with this research consist of books, articles, academic journals and exhibition reviews, etc.
- Archival documentation of the geometric petroglyphs recorded from the "Driekopseiland" cultural heritage site has been obtained from the McGregor Museum, Kimberley, Northern Cape.

I.X Measuring quality

Credibility/Internal validity

- Data recorded in the arts practitioner's CPJ is regarded as a first-hand reflexive instrument for analytical inference.
- The majority of the ceramic surface experimentations were replicated in order to validate surface effects.

I.XI Limitations

- The authenticity of the geometric petroglyph data is reliant on the accurate archival documentation obtained from the McGregor Museum, Kimberley.

- Experimentation and manipulation of laser-cut or engraved motifs are dependent on reliable vector file translation, the parameters of machine specifications and material types.

I.XII Ethics

- The arts practitioners use of cultural heritage symbols and motifs were appropriated in accordance with the Department of Science and Technology's Protection, Promotion, Development and Management of Indigenous Knowledge Systems Bill (2014), published in the *Government Gazette* (No. 38574).
- Permission was granted from the McGregor Museum, Kimberley, Northern Cape, South Africa to use the documented archived Driekopseiland geometric petroglyphs. These were provided in PDF format from the museum collection. The McGregor Museum is acknowledged for providing imagery and granting permission for the use of the archival data (Appendices 1).

Chapter 1

Theoretical positioning and literature review

1.1 Introduction

Artists constantly seek new ways of translating the world and in so doing, often shift beyond discipline-specific methods and techniques. In art-making, digital technologies bring about new possibilities or pose a threat when considering the decline of traditional processes and the dematerialisation of the object through computational or signal data (Manovich, 2001:132-135). Technology-based creative engagements have become multifaceted, thus requiring more than one or two disciplinary problem-solving methods. As soon as the complexity of a problem increases, so does the need for inter-disciplinary practice and possible cross-disciplinary collaboration (Krohn, 2010:31, 32, 46).

Visual arts practice, as reflexive cross-disciplinary research inquiry, necessitates the conscious exploration of various bodies of knowledge that strategically map knowledge as input, which in turn, determines the creative output (Mafe & Brown, 2006:5). To facilitate this, the arts practitioner should be knowledgeable of the fact that research questions originate within practice, and are determined by the reflexive visualisation of relationships and structures within and across disciplinary boundaries (Nimkulrat, 2007:3).The reflexive cross-disciplinary approach undertaken in this study is an important practice-led research methodological characteristic when generating new knowledge around the synthesis of digital fabrication technology, cultural appropriation and ceramics practice. Applying a practice-led research method allows me as the arts practitioner to explore the association between the experience of making the work and its overall textual explanation in an intuitive manner.

The study is located within postmodern and post-postmodern theory within which culturalism and post-colonial discourse form a contextual basis for cultural appropriation. Key methodological aspects concerning practice-led research within the post-discipline transformative inquiry are informed by interdisciplinarity, hybridity and mimicry as underlying theoretical constructs. Contemporary art-making presents an environment of postmodern and post-postmodern cultural influences, negotiating meaning between layered spaces. Within art theory discourse, postmodernism initiated a substantial paradigm shift that undermined the problem-solving strategies of determinism, dualism and absolute truth, favouring integrative approaches and reflexive methodologies to solve creative problems (Jameson, 1985; Sullivan, 2010; Welch, 2003). Since the 1990s, the term *post-postmodernism* has emerged, with theorists offering no clear distinction between the latter and postmodernism. Some recognisable characteristics of post-postmodernism are the rise of art as commodity, the functions of galleries, globalisation and an increased dissemination of information, a focus on intermedia artistic practices, the overwhelming meta-mentality of artists, and a re-emergence of select traditional artistic practices (Hartness, 2009).

Post-postmodernist artists continue to integrate the ideologies of modernism and postmodernism where past artistic practice, theory and philosophy become triggers for inspiration. Hybridity of thought, action and practice appear to further intensify post-postmodern work, finding artists recontextualising and reworking recognisable images (Heartney, 2001:41). Arts practioners engaging with post-postmodernist concerns often rely on digital technology to cross the divide between both inside and outside the discipline origin, fostering hybridised communities of practice. Artists such as Takashi Murakami (Japan), Gajin Fujita (Japanese American) and El Anatsui (Ghana) explore intermediate artistic practices that blend cultural reference with cartoons, graffiti, hip-hop and discarded everyday objects, bringing about a hybridised contemporary object and subject.

Arts practice resulting in commodification through the use of accessible digital technology and recontextualised subject and object is termed *remix* (Lessig, 2008:76). Previously referred to as *postproduction* (Bourriaud, 2002:9). As digital media become less expensive and available, it becomes easier for arts practitioners to combine/collage existing elements of culture to construct new meaning, making its representation accessible to a wider audience. Examples of arts practitioners working in this mode are Jeff Koons (America), Lionel Dean (Britain), Shepard Fairey (America) and Marco Cianfanelli (South Africa).

Within arts-based research, Sullivan (2010:166) emphasises that the arts practitioner should develop an authentic awareness of “making” in relation to communities, systems and cultures within an interactive context. Through changing sites, patterns and processes the practitioner manifests innovative ways to represent new knowledge in a visual form (Sullivan, 2010:155, 156). The “remix” interaction between communities, systems and cultures in relation to the positioning of the artist when “making” initiates an essential dialogue around the concept of “otherness”. Acknowledging “otherness” leads to the exploration of the relationship between objects and their subjective cultural context, a predominant concept within post-colonial theory (Ashcroft et al., 2000:169-173).

1.2 Culturalism

Culturalism within this research study, refers to an approach that emphasises the subjective lived experience; focusing on the making of and response to culture (Bullock & Tromely, 2000:190). Many contemporary artists provide social commentary on controversial and topical issues, therein using the arts to promote cultural awareness. Central to the discourse of culturalism is the location of culture within post-colonial theory, which should be seen within the context of its construction (Yazdiha, 2010:32).

Post-colonialism critically investigates issues regarding cultural hybridisation, which include the actual or constructed "other". *Othering*, a term coined by Gayatri Spivak (1985), describes the various ways in which colonial discourse produces its subjects (Ashcroft et al., 2000:171). "Post-colonial" generally refers to the period after the end of an imperial power colonising a country. It not only deals with national culture, societies and issues relating to it, but includes all culture influenced by the colonising process (Ashcroft, Griffiths and Tiffin, 1989; Sawant, 2012). The post-postmodern arts practitioner is constantly engaged with "othering" subjects and with that, producing a cultural hybrid that has the potential to empower the marginalised and deconstruct boundaries, reclaiming and re-imagining a cultural space (Yazdiha, 2010:36).

1.2.1 Hybridity and mimicry

When adopting or engaging in a culture from a position of "otherness", the concepts of "mimicry" and "hybridity" emerge. Before the concept of "hybridity" is reviewed, one should understand that a distinct culture is informed by the origin of people, and that geographic mapping embodies knowledge or truth about its people (Yazdiha, 2010:35). Edward Said's text *Orientalism* (1979) states that culture is defined in relation to other cultures, often resulting in nations appropriating from others to define or redefine themselves. In *The Predicament of Culture*, ethnologist James Clifford (1996) cautions that cultures are constructed and are often mythical narratives. He posits "who has the authority to speak for a group's identity". Originally This question has been posited in Spivak's (1985) seminal text, *Can the Subaltern Speak.*

Homi Bhabha, who is widely acknowledged as a post-structuralist theorist and for his contribution to post-colonial theory, provides the critical vocabulary by which culture, hybridity and hybridisation in art-making can be discussed. The process of hybridisation is central to the discourses on post-colonialism. Hybridisation takes place continually within cultures in their different forms, each time requiring specific contextualisation (Huddart, 2010:66). Hybridity is the process by which the colonial authority assumes to translate the identity of the colonised (other) within a singular universal framework (Bhabha, 1994; Yazdiha, 2010:31). A new hybrid identity emerges from the process of elements entwining between the coloniser and the colonised (Bhabha, 1994). With this assertion, one can therefore argue that the hybrid identity is located in the "third space". In the seminal text, *The Location of Culture*, Bhabha (1994:247) articulates the "third space" as an interrogative space whereby new forms of cultural meaning take place. Subsequently, these meanings blur the limitations of existing boundaries and call into question established categorisations of culture and identity (Meredith, 1998:2).

The "third space" is emphasised as an in-between space and a site of hybridity, giving rise to a liminal space of translation and negotiation (Bhabha, 1994:341). Liminality can be regarded as a transitory space where representations are mediated, enabling diverse cultures to collide. One can argue that the transformation during this phase can be compared to Bhabha's idea of hybridity (Huddart, 2010:62). This study is a constant interrogation between the researcher as artist and retaining the identity of the Khoe-San/Xam culture, through the innovative appropriation of petroglyph motifs.

Within post-colonial theory, mimicry does not merely refer to imitation; mimicry is also the exaggeration of the copying of ideas, language, manners and culture by the dominant culture that subsequently differentiates it from mere imitation. Mimicry has the ability to normalise the colonial subject through uncertainty, which positions the colonial subject as an 'incomplete presence', producing a gaze of "otherness" (Bhabha, 1994:122, 125-129). In response to Bhabha's notion of mimicry, the content and context of this research depends on reworked and recontextualised images constructed through the innovative appropriation of petroglyphs from the Khoe-San/Xam culture; thus, creating the liminal space for the preservation of a cultural heritage through a personal gaze of "otherness".

In the post-postmodern/post-colonial context there exists more than one discourse and value system, each of which communicates an aspect of reality. Therefore, the mimicry of culture is no longer viewed as unsettling or limited by appropriation (Imbert, 2003:22). The term *mimesis* is derived from the ancient Greek word *mīmeisthai*, "to imitate". However, its meaning has, with time, become much broader and more complex than mere imitation. Depending on the historical context, mimesis reveals itself in different ways and the following related terms may refer to a version of mimesis: emulation, mimicry, dissimulation, doubling, theatricality, realism, identification, correspondence, depiction, verisimilitude, resemblance (Potolsky, 2006:1).
Derrida (quoted in Kelley, 1998:236) asserts that mimesis aims at "influence, appropriation, change, repetition, or the new interpretation of existing worlds". Mimesis in both traditional and modern societies, as the anthropologist Michael Taussig (1993:19) argues, has never been simply the production of the 'same', but a mechanism for producing difference and transformation: "the ability to mime, in other words, is the capacity to 'Other'" (Mitchell 2005:25).

“Difference” and “transformation” (Taussig 1993:19) best describe the qualities sought for my personal mimetic surface experimentation processes. Detailed recorded datasheets demonstrate incremental evolution and change driven by open-ended enquiry, which served as an instrument for producing “difference” and “transformation” (Taussig 1998:19). Each surface (each mimetic iteration) has produced unexpected degrees of difference and transformation when tacit knowledge combines with the archival petroglyph data, bringing about the hybridisation or mimetic appropriation.

1.2.2 Cultural appropriation

Since 1994, South Africa’s focus has been to restore indigenous histories and cultural heritage concerns such as the preservation of heritage sites, which have most often been neglected under colonial rule (Meskell, 2005:72). Many of the commemorative cultural heritage public art projects initiated in democratic South Africa prompt reflection on our relationship to past and present memory.

In recent years, there has been significant global focus of applicable cultural heritage knowledge transfer, and the implementation of innovative and purposeful heritage preservation strategies for its future conservation. In areas where indigenous cultural heritage knowledge is lacking, it is important that such people be informed of the value that cultural heritage holds. When such indigenous knowledge is appropriated, it is presented in a manner that will not only speak of that culture’s heritage, but also of the colonised (insiders) as subjects (Loulanski & Loulanski, 2011:612, 628).

There has been much discussion about the ethical and aesthetic issues that arise when artists’ appropriate images, motifs, symbols and/or texts (Young, 2006:459; Burgard, 1991:487; Raditlhalo, 2006; Nettleton, 1996). When dealing with the appropriation of cultural content, there are several concepts that need to be considered. These are (Young, 2006:456-458, 462, 465, 467-474):

1. the innovative or non-innovative approach to content appropriation
2. The authorship of the artwork/artefact and its relation to being a member of a specific culture/people (insider) or a non-member of that culture/people (outsider)
3. the authenticity of the artwork/artefact in relation to provenance, personal style and/or existentialist authenticity
4. the cultural experience of the particular culture’s content that is being appropriated
5. the aesthetic properties and the cultural context in which the artwork is created

Discussion surrounding cultural appropriation and artistic practice often questions the possibility of artworks being inauthentic due to limited evidence of colonial artists’ cultural experience and their existentialist authenticity as “outsider” (Young, 2006:459; Burgard, 1991:487; Raditlhalo, 2006;

Nettleton, 1996). As indicated, the concepts of "hybridity" and "otherness" are central to post-colonial discourse and, therefore, they are key factors when appropriating cultural content (Ashcroft et al., 1989:77; Bhabha, 1994:112,113). Although the colonial experience will always be imprinted within colonised indigenous 'minority' groups, they are given the political and cultural freedom to re-establish or reconstruct 'lost' pre-colonial identities, as well as an autonomous culture free from colonial influence (Slemon, 1995; Childs & Williams, 1997; Sawant, 2012; Farber, 2010).

The appropriation of indigenous knowledge, images and motifs by artists has brought about much discussion on the topic of cultural appropriation and its authenticity by critics who regard this borrowing as either inauthentic or, in some instances, as authentic. For many years, the dialogue between Pablo Picasso's (1881-1973) creative practice and the African continent has been central to this debate (Burgard, 1991:379). The debate emerged once more in 2006 with the *Picasso and Africa* retrospective exhibition hosted by the Johannesburg Standard Bank art gallery. At the time, the journal, *Art South Africa*, published various critiques regarding this issue (O'Toole, 2006:31-40).

Commemorative public art projects have become an important platform for the intersection and negotiation of culture, identity and citizenship, intended to stimulate public memory and contribute to social reconstruction and nation-building. In response to this government-endorsed commemorative public art, visual strategies that promote ease of understanding are usually required. These works of art should hold significance for a multicultural public (Marschall, 2010:78-81). This requires that heritage values be reflected in clear definable meanings and interpretations, allowing the broader public to engage with the knowledge and not merely the material substance of the commemorative monument or site (Holtorf, 2011:8). Examples of popular South African commemorative public art projects that employ an "accessible" aesthetic visual strategy are Brett Murray's humorous bronze painted sculpture "Africa", erected in 1999 in Cape Town and Clive van den Berg's stylised monumental concrete "Eland", located in Braamfontein, Johannesburg (2007).

Figure 1. Brett Murray, *Africa* (1999). Bronze and paint, 350 cm x 150 cm x 150 cm. Cape Town.

Figure 2. Clive van den Berg, *Eland* (2007). Concrete and steel, 550 cm. Johannesburg.

More recently, the National Heritage Monument is an extensive urban public development and prominent South African heritage initiative, located in the City of Tshwane. Upon completion it will consist of a monumental parade of more than 400 realistic life-size sculptural bronze representations of individuals across all social spectrums who have contributed to South Africa's struggle for democracy and liberation, from the 1600s up to 1994. The project was first conceptualised in 2010 by Dali Tambo, Chief Executive Officer, National Heritage Project Company. It is led, driven and funded by the Department of Arts and Culture with the aim of it becoming one of the leading heritage sites in the country (Goulkan, 2015).
Existentialist authenticity implies that the artist is fully committed to the artwork that is being created and has reliable knowledge of the original meaning or context within which the symbols or imagery

have been created (Young, 2010:50). Young (2006:475; 2010:136) argues that cultural appropriation by "outsiders" may result in works of high aesthetic value when artists engage in innovative content appropriation; therefore, should not be classified as inauthentic appropriators of style or content.

Content appropriation can be divided into two groups, namely style appropriation and motif appropriation. Style appropriation occurs when an artist appropriates stylistic elements of a culture rather than reproducing an artwork made by a member of that culture. It may be argued that, for an artist to engage in style appropriation, it is necessary to have an in-depth understanding of that culture's style and to be fully committed to succeed in appropriating it. In view of this scenario, my repeated visits to the Driekopseiland site, accompanied by specialist archaeologist, David Morris, combined with valid archival material and extensive literature, furnished me with reliable knowledge to engage with the cultural content.

When an artist is influenced by the art of a culture and he makes use of its imagery but does not directly apply that culture's style, it may be said that the artist is engaged in motif appropriation (Young, 2010:6). Therefore, innovative content appropriation is reliant on the following aesthetic properties from both "insider" and "outsider" positions: the cultural experience affiliated with the artist, the interpretation and evaluation of the cultural context within which the artwork is produced and the authenticity of content, image, motif or object.

Willem Boshoff's sculpture titled "Thinking Stone" (2012) culturally appropriates motifs taken from geometric petroglyphs found at the Driekopseiland site produced by hunter-gatherers, of the Khoe-San and/or Xam culture from the Northern Cape region (Morris, 2012:187-189, 191). Boshoff, a white Afrikaans-speaking South African, is culturally positioned as "outsider". In the work, he applies individual artistic expression and the innovative appropriation of an authentic style by transferring engraved petroglyph motifs combined with specific Afrikaans, English and Sotho text sandblasted on purposefully sourced black granite from Belfast, Mpumalanga in South Africa. Belfast black granite is one of South Africa's most sought after granites and was specifically sourced for its rich black colour that, when polished, is similar to the submerged Driekopseiland stone found in the Riet River bed, thereby demonstrating authentic interpretation and evaluation of the cultural context by the artist (http://www.willemboshoff.com/documents/artworks/thinkingstone.htm).

Figure 3. Willem Boshoff, *Thinking stone* (2012). Belfast black granite, 32 ton. Bloemfontein.

Comparable to the work of Boshoff (2012), this study has applied digital laser-cutting and -engraving, vinyl-cutting and plasma-cutting technologies combined with ceramics to achieve the innovative appropriation of cultural content through a practice-led methodology. Experimentation with technology stimulated inter-disciplinary practices between ceramics and digital fabrication. This distinctive form of arts practice inquiry has the ability to facilitate innovation within a post-discipline transformative practice-led inquiry.

1.3 Interdisciplinary: Art and technology

Technology has rearranged all aspects of human life, giving rise to the emergence of a “digital humanities”, which involves representation, analysis, manipulation, interpretation and the investigation of humanistic knowledge (Davisdon, 2010:207). Embedded within the “digital humanities” is post-humanism and techno-humanism, both terms refer to inter-disciplinary fields that symbolise the ability of humanists to explore concerns of an era through technology. Practitioners engaging within these theoretical frameworks emerge from fields such as engineering, computational sciences, industrial design, natural sciences, business, law, medicine and the arts (McAlister, 2010:127). The concept is evident in the work of African artists who engage with technology more frequently, not only as a medium, but also through content that expresses current concerns. The exhibition, “Post African Futures” (2015), held at the Goodman Gallery in Johannesburg reveals this: curated inter-disciplinary artworks from across the African continent critically engage with the position of technology within contemporary African culture. The innovative works on display reveal a rich and complex relationship between technology and culture (Bristow, 2015) in a post-human/techno-human era.

For interdisciplinarity, the key is that practitioners not seek some overall universal academic method to use in relating two dissimilar disciplines, but to forge connections unique to each circumstance. This allows the practice of interdisciplinarity to bring over the style and characteristics from one discipline to another (Godin, 2013:164). Engaging with emerging digital technologies stimulates collaboration, which leads to new questions, new challenges, retooling and redesigning concepts to implementation. Artists who engage with digital technologies through collaboration often find that projects transcend from an interdisciplinarity to a post-disciplinary state (Klein, 1996:214).

Ricoeur's viewpoint of interdisciplinarity can be described in terms of translation, where the meanings of terms, concepts, ideas or theories from one disciplinary context are restated in another disciplinary context (Reynhout, 2013:152-155). Bal (2009:19) proposes that interdisciplinarity is based on an interactive relationship between subject and object, one that is not based on a vertical and binary opposition between the two. "Interactivity", therefore, implies that concepts are not fixed; they travel between disciplines, scholars, historical periods, and between isolated academic communities and systems. It can be assumed that an "interactive" system is transformative in nature; it alters and adapts as environments change and interactions vary. Such dynamic systems revolve around the relationship between cause and effect, differing from static systems, producing effects that are mostly unpredictable due to external influences and interactions with the surrounding environment (Sullivan, 2010:161). These viewpoints indicate that inter-disciplinary working would disrupt the autonomy of traditional creative practice, bringing about new questions and challenges that ultimately generate new knowledge.

The increased integration of digital fabrication technologies within contemporary sculpture demonstrates the growing potential for technologies to merge with other traditional arts practices. To date, there is limited evidence of ceramicists employing digital fabrication technologies for the production of artworks. American ceramicist, Jay Jensen, combines low-end technology with ceramics processes by generating designs using computer software and digital laser cut cardboard templates for the assembly of maquettes and the stencilling on clay slabs for the construction of complex ceramic form and decoration (Jensen, 2012). Another approach is the use of low-tech commercial digital engraving technologies, which have the capacity to engrave the surface of bisque ceramic tiles; however, surface experimentation is limited when the ceramic surface is glazed. This limits experimentation when developing unique ceramic surface effects, using digital engraving technologies.

Suitable high-end industrial digital cutting and engraving technologies do exist, although they are often not accessible to the day-to-day ceramicist. Most industrial applications are able to cut or engrave ceramics and a wide array of other materials effectively; however, these costly machines are scarce and more suited to lucrative once-off projects or mass production applications. This study experiments with digital fabrication technologies that are accessible and cost-effective for the day-to-day ceramicist.

Even though research reveals that limitations exist, when using low-end digital cutting and engraving technologies, the potential lies in the exploration of these technologies as part of a post-discipline transformative inquiry to combine dissimilar disciplines innovatively. Most technology-based processes are usually guided by their predictability. However, when materials and processes that involve digital fabrication are combined with ceramics processes (particularly during the kiln-firing process), the outcome is determined by unexpected variables that aid innovation. This reflexive inter-disciplinary inquiry follows an inductive approach to generating new knowledge through a practice-led methodology. Applying a practice-led research inquiry allows for various skills and knowledge from select disciplines to combine, allowing me the opportunity to generate innovative surface effects, which would not have been possible when engaged in a discipline-specific inquiry.

Chapter 2

Methodology

2.1 Background to arts-based research

Qualitative research can be characterized as a combination of various methods and methodological practices. It is usually characterized by interpretivist or constructivist research approaches, which are informed by subjective theoretical groundings (Leavy, 2009:6). As previously mentioned, the “shift” towards arts-based practice as legitimate academic research continues the debate surrounding issues of trustworthiness, authenticity and validity. In order to attain trustworthy authentic research results, the researcher should define the research in relation to its real-world relevance and proposed problem-solving strategy, which includes credible evaluation criteria (Leavy, 2009:16; Sinner et al., 2006:1252). Leavy (2009:6, 15, 16) claims that evaluation methods should focus on the research purpose and how well the chosen methodology has assisted the process of achieving the research objectives. Therefore, when reporting research findings, the emphasis should be on the reflection of new knowledge gained from practice.

For arts-based practice to be considered as research, prerequisites such as experimentation and explanation should be evident. The term “praxis” is an age old term used by Greek philosophers such as Aristotle (Greenhalgh, 2010:497), and in today’s context it is regarded as a flexible and evolving term (Marshall, 2010:78). Currently, the term “praxis” refers to the reflexive creative practice. It is accompanied by the textual documentation and explanation thereof, previously termed “exegesis” (Bolt, 2006:12,14; Mafe & Brown, 2006:1, 2; Millward, 2013:123). Collectively, the textual documentation constitutes the PLR outcome. It is clear in its structure, process and research objective. The knowledge produced is transferrable and valuable to other research contexts (Mafe & Brown, 2006:1, 2; Millward, 2013:123).

The purpose of documenting is to reflect on the arts practitioners’ tacit knowledge, and generate new knowledge by documenting and reflecting on realizations made while engaged in practice (Bolt, 2006:12, 14). Tacit knowledge presents a specific understanding and view of how the world works. It is also known as “material thinking”, embedded knowledge or prior knowledge, and is often difficult to articulate and express (Bolt, 2006:5; Millward, 2013:125, 130). Tacit knowledge is the process of attaining and refining knowledge over a period of time through experience and engagement in practice (Carabine, 2013:33; Mareis, 2012:62).

Unlike traditional approaches to empirical research, arts practitioners now explore the unknown to confront what is known (Babbie, 2010:51; Babbie & Mouton, 2012:273; Sullivan, 2010:36, 244; Yin, 2011:21). Within arts-based research, questions are cross-disciplinary due to the fact that numerous perspectives can be accessed and represented simultaneously. Consequently, the unknown is explored using a reflexive strategy (Leavy, 2009:12, 15). The fact that arts-based research is not discipline-specific allows for a varied audience to be reached; new knowledge that is produced is transferable to other research environments (Leavy, 2009:13, 14). Therefore, engaging in arts-based research has the potential to raise consciousness and cultivate understanding by promoting dialogue through the visual interpretation of the arts practitioners' ideas.

2.2 Practice-led research

For many years arts-based research within higher education has become a formalised research output. Changes are evident within the structuring of university departments and specifically within postgraduate and doctoral studies. Various key universities in the United States of America (USA)[1], United Kingdom (UK)[2] and Australia[3] have structured academic programmes to promote an arts-based research culture. Presently there are several terms to describe arts-based research when undertaken within an academic setting, namely practice-led research, practice-based research, research-led practice, creative research or practice as research. In various contexts these terms are used to distinguish creative practice as legitimate academic research. Within each compiling a textual documentation is imperative, whether it be research that originates from the actual making of an artwork or research that originates from the documentation, evaluation and reflection of that creative work (Elkins, 2009:147; Gillham & McGlip, 2007:178; Marshall, 2010:78; Millward, 2013:125; Nimkulrat, 2007:2, 3; Smith & Dean, 2009:1, 2).

Within arts-based research the artwork as creative output becomes the research, whereas in PLR the focus is on practice leading to theory and new research insights (Smith & Dean, 2009:5; Nimkulrat, 2007:2). Smith and Dean (2009:2) argue that PLR and research-led practice are interwoven processes that should not function alone, and therefore, claim that the artwork produced, as well as the process in which it is created forms the research. Brook (2010:3), Mafe and Brown (2006:2, 3) and Bolt (2006:14) agree with this general claim; however, Bolt indicates (2006:14) that there should be greater emphasis on the generation of new knowledge and how it came to be through the handling of materials, processes and ideas. Sinner et al. (2006:1252) agree

[1]School of the Art Institute of Chicago in Chicago, Teachers College: Columbia University in New York, Boston College in Boston, Curry College in Milton, North-eastern University in Boston, University of Rhode Island in Kingston, Maryland Institute College of Art in Baltimore.
[2]University of Leeds in Leeds, University of the Arts London in London, Loughborough University in Loughborough.
[3] Victoria University Melbourne, in Melbourne.

that the aesthetic evaluation of an artwork should be based on the quality of research that it represents, as well as in the way in which it cultivates new knowledge. Mafe and Brown (2006:2, 3) are opposed to this view. They state that it is only the knowledge produced when the arts practitioner is creating the artworks that is research and not the artwork itself. However, audiences and evaluators should to be aware that artworks produced within a PLR environment are not pure artistic creations, but rather visual research texts, and should be evaluated with this concept in mind (Leavy, 2009:17).

Applying a PLR methodology to creative practice usually follows an inductive constructivist approach, which begins with making observations and ends with general conclusions from which theory emerges (Sullivan, 2010:36). Marshall (2010:78, 80) proposes a practice-led model that outlines the arts practitioner inquiry as cyclic acts. Acts within the textual representation consists of observing, describing and analysing. The reflexive creative practice encompasses acts of creating, reflecting and responding. This cyclic process is spontaneous and the arts practitioner constantly shifts between the two in order to reflect on new realisations. The design of this process shifts according to the research inquiry; however, it aspires to unify both within the PLR inquiry. Various non-visual arts practitioners explain and evaluate their practice by engaging in a PLR methodology; similarly they present their findings as valid textual documentation. For example, designers of musical instruments meticulously record their creative process to further explore new knowledge gained from the lived experience and identify how their tacit knowledge has informed that experience (Sylleros, De la Cuadra & Cádiz, 2014:87, 88). Healthcare and nursing practitioners frequently utilise PLR as a fundamental tool for the "transferral of new knowledge" in medical education research (Ahluwalia & Launer, 2012:317; Greenhalgh, 2010:498; Scallan, 2014:299). PLR has brought about a new pedagogical phenomenon that has resulted in PLR inquiries that focuses on the transferral of new knowledge, gained from tacit knowledge through practice.

As methodology, PLR creates an awareness of the unknown; through this it empowers the arts practitioner, as well as other practitioners within the field of study (Mafe & Brown, 2006:4, 14, 15; Smith & Dean, 2009:5, 6, 9). This form of creative research allows for elements of the artists' lived experience to become evident and, therefore, engages viewers on a deep emotive and responsive level, which deepens a sense of understanding. Arts practitioners using a PLR methodology are not only discovering new research processes; they are also developing existing ones. Simultaneously creating a space within formalised research structures allows academia and creativity to merge (Leavy, 2009:1, 3).

Aspects essential to understanding how PLR becomes an inquiry include: an understanding of the process in which creative works are produced, stimulating a dialogue between practice and theory, showing an ability to solve problems that arise when producing the work, and the further exploration of ideas through continuous reflexive analysis (Millward, 2013:123). PLR contexts shift and become more complex, it is often required of the arts practitioner to move within and beyond existing disciplinary boundaries. Seeking the expertise of specialists from other disciplines creates a post-discipline environment in which the unknown is explored (Leavy, 2009:18; Mafe & Brown, 2006:4; Sullivan, 2010:111). As a result, cross-disciplinary interaction occurs, maximizing the validity and reliability of the research inquiry.

A post-disciplinary research environment creates a platform where the arts practitioner explores new knowledge, bringing about transformative learning (Sullivan, 2010:111, 117). The concept of "transformative learning" was first identified by Jack Mezirow in 1978 (Brock, 2010:123). According to Ryan (2012:208), transformative learning occurs when a person reflects on an experience and then reinterprets that experience in order to change perceptions. Transformative learning is, therefore, a process whereby an individual's world view changes through the transformation of concepts, beliefs and values (Mezirow, 2000:19). The process of transforming existing thought, knowledge and experiences into new perspectives is a reflexive practice facilitating change (Dirkx, Mezirow & Cranton, 2006:124). This suggests that, when engaged in a PLR inquiry, transformative learning occurs as the arts practitioner creates, reflects and responds to gaining new knowledge.

2.2.1 Knowledge generation

The arts practitioner has access to a wide range of information or experiences, which are interpreted and transformed to generate new knowledge (Pennington, Simpson, McConnell, Fair & Baker, 2013:570, 571; Smith & Dean, 2009:3; Sullivan, 2010:245). For a creative work to be seen as research, it needs to contain new knowledge that is appropriately transferrable to other contexts, some degree of disciplinary or conceptual transformation should occur during the transfer of the knowledge (Smith & Dean, 2009:7). Knowledge is often unstable and indefinite; therefore, it cannot always be transferred with reliability; it takes on various forms and has different levels of accuracy, which need to be taken into account when producing a creative work (Smith & Dean, 2009:3, 4, 7). Bolt (2006:7) mentions that new knowledge cannot be searched for intentionally, as it is impossible to have knowledge of what is new in advance. Consequently, within artistic practice, new knowledge emerges when the arts practitioner is involved with materials, processes, methods and ideas of practice in an innovative manner. As new knowledge is discovered the arts practitioner decides on which aspects to focus, which to discard or retain to be explored at a later stage.

When compiling the textual documentation, the selection process is based on empirical data or theory that is applicable. In practice, the selection criteria can be based on intuition, technical knowledge or random decision-making (Smith & Dean, 2009:19). Millward (2013:125, 130) is opposed to this view and states that the textual documentation is important, but if the practice has led the research process accordingly, then the artwork becomes the dominant text. Contrastingly, the research within this study is constituted by placing equal emphasis on the textual documentation and the reflexive creative practice as outcome (De Freitas, 2007; Elkins, 2009; Millward, 2013; Sullivan, 2010). Engagement with the practice of this study culminates in a research output that is largely driven by applying tacit ceramics and digital fabrication knowledge, which is informed by new ways to manipulate materials and processes giving rise to innovative surface effects and generating new knowledge.

2.2.2 Data gathering, reflection and meaning-making

The reflexive nature of PLR suggests that there is no definite starting point and no predetermined ending within the creative research process. This allows new knowledge to emerge and the arts practitioner to alter preconceived ideas easily during the research process (Smith & Dean, 2009:3, 23).

The process of making, reflecting, image-making and an awareness of internal dialogues become essential elements that drive the reflexive process (Leavy, 2009:240). As mentioned previously, the inquiry is led by the “practice” within PLR allowing the “process of producing” equal importance. It can, therefore, be assumed that the combination of practice and the arts practitioners’ engagement with practice become the essential drivers of a PLR inquiry (Millward 2013:123). Engagement with arts practice naturally discloses transformative qualities, which are apparent within the creative experience (Sullivan, 2009:51). While engaged in practice, the transformative qualities become noticeable as the arts practitioner develops or transforms ideas and concepts due to gaining new knowledge and experience; therefore, the arts practitioners’ creative output not only serves as data, but also represents data that has undergone some form of transformation. It can, therefore, be stated that a successful work of art does to some degree have embedded knowledge, which conveys the idea of discovery, exploration, understanding and transformation (Millward, 2013:123). The processes of “reflection-in-practice” and “reflection-on-practice” support the creation of meaning. The arts practitioner has the ability to look back and identify where ideas and concepts have undergone transformation. This way of thinking prompts further exploration of materials and processes, as well as the transformation and development of concepts and ideas as new embedded knowledge gained through experience. Therefore, meaning-making becomes a cyclical process of experience, reflection and transformation, which is continuously evolving.

2.2.3 Data gathering

Data gathering entails creating rich descriptive text through written or visual forms of reflective documentation. This informs the arts practitioners' insights, processes and decisions made within practice (Sullivan, 2010:56). Artworks created within a PLR inquiry are mostly regarded as sources of data used to generate meaning or new knowledge by way of reflecting on data (Leavy, 2009:231). Reflection facilitates a broader understanding of processes, materials and theory when the arts practitioner enters cycles of art-making (De Freitas, 2007:6).

Within practice, the arts practitioner intuitively shifts between past (what is known) and present (the current state) experiences in order to develop. These shifts are a habitual way of making and thinking, and are usually performed as automatic responses and actions. When attention is paid to documentation the arts practitioners' habitual way of making and thinking is broken, and results in a process of enhanced reflectivity, which enables the arts practitioner to return to the documented data and further develop knowledge gained in that practical or theoretical instance (De Freitas, 2007:8, 10). Nimkulrat (2007:5) confirms that documentation is one of the driving elements of PLR and adds that if an artwork is produced without documentation of the making process, there is no evidence to induce the research. Therefore, active documentation facilitates the recording of the interactions and effects that practice has on theory and theory has on practice, thereby ensuring the reliability (Nimkulrat, 2007:3). Documentation can consist of text, images, sketches etcetera. Therefore, it is important for the arts practitioner to develop a system that effectively gathers and represents the recorded data (Farrah, 2012:998, 999; Singh, 2011:36, 37). Data recording and reflection activities within the CPJ can either be hand-written or compiled digitally (Gillham & McGlip, 2007:180). The main objective is to represent the key moments that have or data that has added value to the making process in a manner that allows noteworthy actions or thoughts to become evident throughout the process of reflection. Rigorous documentation of the making process enhances the quality and validity of the PLR inquiry; therefore, it continuously facilitates the reflexive process.

2.2.4 Reflection

Reflection is defined as a process where knowledge is gained and expanded on through examining experiences (Bolton, 2010:14). These experiences are then further developed by analysing theory and data gained within the research inquiry. Reflection entails re-living, reinterpreting and analysing past experiences. Questions such as "What?", "How?", "Why?" and "When?" during the re-lived experience originate through an internal dialogue.

In the Humanities, reflexivity is a form of constructivism, which affects the researcher as well as the researched, as new knowledge is gained and expanded (Alvesson & Sköldberg, 2009:23; Sullivan, 2010:52). Reflexivity encompasses the analysis and evaluation of new knowledge, gained from understanding and lived experiences (Bolton, 2010:14). When the researcher pursues a methodological research approach that is reflexive in nature; it enables the arts practitioner to depict a broader view of processes and actions taken. Many of these processes and actions include pre-sketches, text, visual images, thoughts and ideas. Pre-sketches become pivotal elements of reflection and should not be added as appendices but incorporated in the textual documentation to promote understanding (Sullivan, 2010:52). Through reflection, the arts practitioner is able to adjust and adapt as new knowledge is gained.

2.2.5 Meaning-making

The process of doing research, particularly qualitative research, always involves a meaning-making activity (De Freitas, 2007:6; Leavy, 2009:231). Meaning emerges when various concepts are identified, linked, categorized and further developed to recognise relationships and structures that generate theory from practice (Leavy, 2009:10). Concepts generally come to light when the arts practitioner draws on a range of pre-sketches, thoughts and ideas developed in conjunction with the theory. Within the visual arts the meaning-making process incorporates the artwork, artist, viewer and the artist and viewers' world views as dynamic interactive forces, bringing about an aesthetic engagement (Van den Berg, 1994:6).

Aesthetic engagement through experience generates the ability to form interactive dialogues and generate debates (Sullivan, 2009:50, 51). When viewers evaluate artworks they enter into a dialogue with the works, which then becomes an important aspect for the construction of meaning. Due to the reflexive nature of PLR it is possible for both the arts practitioner and the viewer to engage in a process of evaluation and exchange. This process is mediated by the artwork, which usually results in the transformation of preconceived ideas and thoughts (Sullivan, 2009:50).

The arts practitioner manipulates concepts through artistic expression in the form of signals or visual clues for the viewer on which to pick up. This strategy can also be used as a "validity checkpoint" where the arts practitioner enters into an internal dialogue to evaluate actions (Leavy, 2009:18). Within the inquiry, the aesthetic quality of the artwork becomes a secondary aspect to the more dominant features of the methodology (Leavy, 2009:227, 228).

2.3 Research method: Sullivan's Framework of Visual Arts Research

As briefly outlined in chapter one, Graeme Sullivan's (2010) Framework of Visual Arts Research makes allowance for the reflexive exploration of a post-discipline transformative research environment. The research environment is comprised of three operational aspects identified as structure, agency and action. These features encircle the overall idea of the research (Figure 2). Within the centre of the framework (visual arts practice), research problems, issues, contexts and unexpected challenges originate. These are explored by the arts practitioner through a range of iterative acts that entail a reflexive approach to creation.

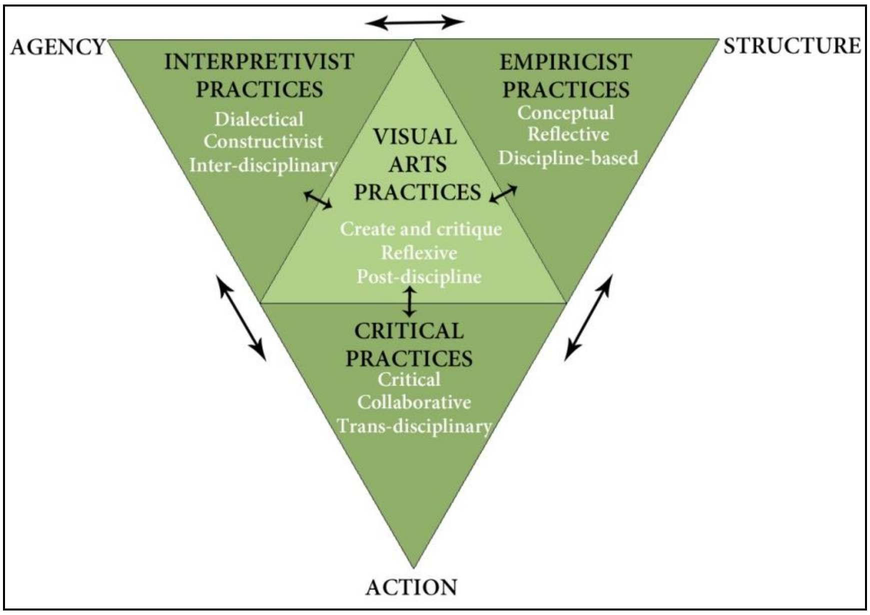


Figure 4. Sullivan's Framework of Visual Arts Research

Empiricist, interpretivist and critical research practice categories are located on the borders of the framework, each defining and reflecting on research behaviours and methods. The empiricist practice reflects the general focus of the research which is mostly discipline-based and data-driven, and generated by way of experience and observation (Sullivan, 2010:44).

Within this study, the *empiricist practice* records firsthand engagement with discipline-specific aspects such as the chemical fuming experimentations within ceramics practice. These are combined with the digital cutting and engraving of select templates. *Interpretivist practice* is structured around the interpretation of the experience and is usually associated with an inter-disciplinary investigation. Consequently, a dialogue regarding outcomes is introduced. This area records actions and experiences regarding interdisciplinarity as the arts practitioner engages with aspects relating to cultural content appropriation, digital fabrication technology and ceramics practice by interpreting, transforming and reconstructing empiricist experiences, derived from theory and practice. The integration of these practices brings about new knowledge by way of experimentation.

The remaining category within the framework is the *critical practice* which includes the transdisciplinary examination of existing systems, structures and practices to attain change by engaging in strategic shifts, moving forward and backwards between discipline boundaries (Sullivan 2010:101-105). Trans-disciplinary working occurs as the arts practitioner moves in and between the three dissimilar areas of study. Throughout documentation the CPJ serves as fundamental information which is interpreted, transformed and developed for further investigation. It enables the arts practitioner to reflect on how the knowledge gained can be developed to bring about new possibilities.

Within the centre of Sullivan's framework (visual arts practice) the arts practitioner makes use of a CPJ to organize the data gathered while engaged in the creative process. The CPJ consists of four divisions to document various aspects, reactions and reflections on the creative process. The four divisions are: 1.) initial intention, 2.) knowing-in-action, 3.) reflection-in-action and 4.) reflection-on-action. These divisions are completed at various stages of the creative process. Organising the CPJ facilitates a structured manner in which to gather noteworthy data from the range of surface experiments. Recording and data gathering do not only consist of descriptive rich text, but also visual explorations and representations of ideas and thoughts through sketches, imagery etcetera. The first division of initial intention is completed before the arts practitioner starts the creative process, and records the ideas and thoughts on how the creative process could possibly unfold.

The second division, knowing-in-action, is completed as the arts practitioner engages in the making process. This is a spontaneous action and no planned thought is recorded. The spontaneous exploration of ideas and thoughts are of utmost importance in this division of the CPJ. The arts practitioner documents the "what" and the "how" regarding the activity. Although some of the data in this division may not be of significant importance, it is essential to reflect continuously and document every step of the creative process in order to not misplace relevant data.

The third division, reflection-in-action, is a representation of the actual outcomes; it is an analytical and well thought through reflective activity. The arts practitioner comments on what has been discovered, new ideas and concepts that have emerged, etcetera. In this division, the arts practitioner explains and describes the lived experience.

The last division, namely reflection-on-action, consists of an internal dialogue in which the arts practitioner engages. The arts practitioner responds to the creative process by accentuating noteworthy data, and reflecting on new possibilities and problems that surface within the creative process. This division is in essence a summary of the first three divisions. It can be seen as a post-project evaluation, looking back and assessing which aspects to explore further.

2.3.1 Dimensions of practice *between* theory

The features within the various research practices (empiricist, interpretivist and critical) can be read individually or collaterally, which enable them to cut across various disciplines and their practices; these can be altered to fit a specific research inquiry (Figure 2). If features are read individually, visual arts practice demonstrates the capability to create and critique occurrences through reflexive thinking (concept identification, pre-sketching, theory, personal exploration, inter-disciplinary exploration) suited to a post-discipline transformative research environment (Sullivan, 2010:104). Reflexive thinking entails the capability to stand back from existing frames of reference, beliefs, structures and think from within experience. Reflexive strategies include internal dialogue, critically examining experience, and maintaining a curious and inquisitive frame of mind in order to constantly question and evaluate experiences and new discoveries (Bolton, 2010:14).

Figure 3 illustrates how Sullivan's Framework of Visual Arts Research can be evaluated and interpreted when exploring the interaction between theory and practice within a post-disciplinary inquiry. Visual arts practice and critical practice are linked by a variety of processes of creating and critiquing theoretical aspects. Meaning-making links interpretivist and visual arts practice by attempting to convey understanding within dissimilar bodies of knowledge. Empiricist practice and visual arts practice converse through finding problems, and exploring ideas and concepts within a creative context. Relationships between theory and practice are not static and can be altered, as different inquiries have different facets of theory that link them to a particular practice (Sullivan, 2010:105, 106).

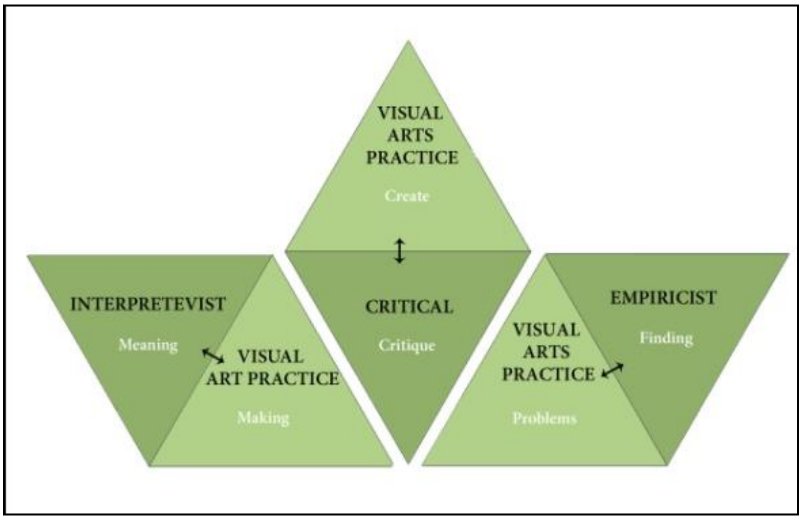


Figure 5. Dimensions of Practice *Between* Theory

When features within the various research practices (empiricist, interpretivist and critical) are read collaterally, they are represented on three levels, which communicate the assimilation of theory and practice within the research inquiry (Figure 4) (Sullivan, 2010:104, 106).

The first level is *theoretical and conceptual.* Here, problems and ideas are confronted, which assist with the establishment and conceptualisation of research questions; e.g., to create and critique. The second level is *operational and methodological.* This level facilitates the interpretation of problems and concerns to refine ideas for further exploration. The last level depicts *contexts and settings* of the various practices of research in which the arts practitioner is engaged (Sullivan, 2010:104). As the arts practitioner engages in visual arts practice, an awareness of these levels assist in reflection and development. It is possible that the arts practitioner does not engage with all aspects of each level or that all levels are utilized in each artwork. These levels are flexible and evolving; they can be adjusted to suit specific needs or inquiries in the iterative process between theory and practice.

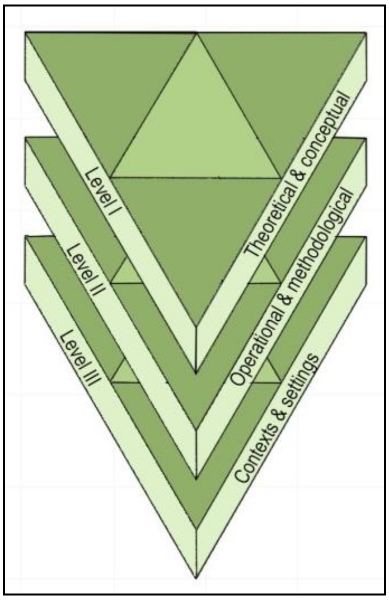


Figure 6. Collaterally Read Levels

2.3.2 Domains of practice *around* inquiry

Sullivan's Framework of Visual Arts Research (Figure 2) incorporates methodological strategies to assist with merging visual arts practice and theory. When identifying the various practices (empiricist, interpretivist and critical) within the framework (Figure 5), the methodological approach becomes more intricate.

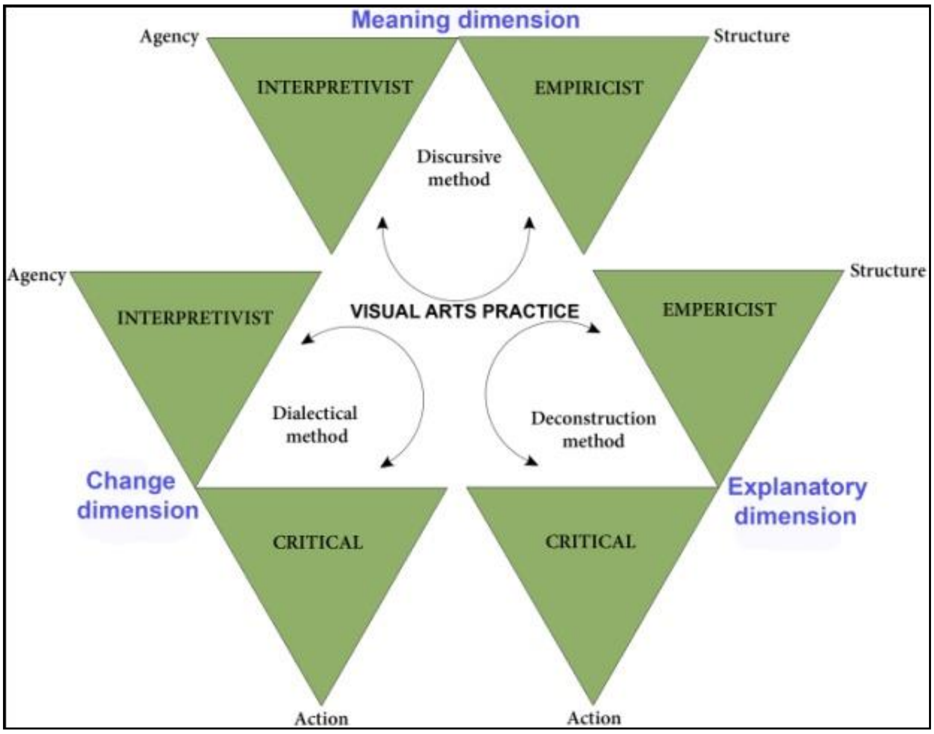


Figure 7. Domains of Practice *Around* Inquiry

Sullivan (2010:107, 108) proclaims that, when discursive methods are applied, the empiricist focus is on structure, and the interpretivist focus is on agency. The empiricist practice questions what kinds of structures are present, whereas the activity of the interpretivist practice explores how it came to be.

Discursive methods involve the shift from one topic to another, usually in an unmethodical way. When applied to theory, these methods help to establish various patterns and resemblances in information, using conceptual and investigative techniques. In visual arts practice, images, objects and concerns are employed to stimulate the process of meaning-making. Therefore, when the empiricist and interpretivist practices are linked they become an area were meaning and concepts materialize through the application of various unmethodical approaches to theory and practice.

Dialectical methods convey the interpretivist logic as agency and the critical practice as action. Dialectical methods focus on the use of logical reasoning, usually as dialogue. Dialogue is used within dialectical methods to evaluate the efficiency of arguments, actions and statements within theory. Within the area of visual arts practice, dialogue can be enhanced by employing language structures such as metaphors and juxtaposed symbols or signs, which are used as means to bring about change, and challenge concepts and ideas (Sullivan, 2010:108). Consequently, dialectical methods are mostly used within the interpretivist and critical practices where arguments are formed and assessed in theory and dialogues transpire, as various visual stimulants are explored in order to challenge and change situations within visual arts practice (Sullivan, 2010:108).

Deconstruction methods depict critical practice as action and empiricist practice as structure. These methods focus on the critical analysis of areas of significance and exclusion within theory and practice in order to create meaning. Deconstructive methods are employed within critical and empiricist practices of research to evaluate social and cultural problems. They often use visual arts practice as a tool to form constructive responses as problems are solved (Sullivan, 2010:108).

2.3.3 Transformative reflexive practices

Transformative knowledge generation can be seen as a process where perceptions of existing bodies of knowledge are transformed and renewed (Pennington et al., 2013:570). For transformative knowledge generation to occur, the researcher undergoes three phases, namely:

1) Encountering a disorientating situation where the researcher finds himself in an unfamiliar environment. This usually happens when the researcher has to deal with situations/problems that are beyond the scope of his/her discipline. Within the context of this study, this phase represents inter-disciplinary working where my engagement with unknown cultural heritage territory and digital fabrication technology becomes an integral part of gaining new knowledge, developing new ideas and solving unforeseen problems.
2) The critical reflection phase where situations and problems are evaluated.
3) The researcher enters a phase where a reflective dialogue around the situation/problem takes place (Pennington et al., 2013:571). This phase evaluates how the knowledge gained from being in an inter-disciplinary setting enhances or alters existing thought processes and existing knowledge.

An important aspect of Sullivan's Framework of Visual Arts Research (Figure 2) is that it is not only a guide for approaches and methods for visual arts research, but it also allows for transformative reflexive research practice (Sullivan, 2010:110). The transformative disposition of visual arts practice can be identified by its reflexivity and post-discipline composition, which Sullivan (2010:110) explains as revealing "braided" or "self-similar" structures. As the researcher is engaged in transformative knowledge generation, he/she also engages in transformative learning as world views and perspectives are questioned and transformed (Ryan, 2012:208).

In reflexive practice, different methods are used to confront existing systems, theories and practices in order to see occurrences from a new perspective (Dallos & Stedmon, 2009:4; Forrest, 2008:229, 230). Sullivan (2010:110) identifies four approaches (self-reflexive, meta-analytic, dialogic and questioning reflexive practice) that can be applied to Sullivan's Framework of Visual Arts Research (Figure 2). *Self-reflexive practice* focuses on the arts practitioners' personal interests and innovative perspectives on phenomena, which are informed by discipline expertise and research capabilities.

Empiricist practice focuses on gathering data from personal experience in the research; reflection within this area is *meta-analytic* and is centred on evaluating data to review the conceptual approach used to disclose new perspectives and approaches.

Credibility of research findings is assessed by the arts practitioners' ability to engage in discourse with data and present it in an easily transferrable manner. Issue-driven inquiries such as PLR queries, content and context as problems areas become known within certain situations. This reflexive method aids the identification of problems and the generation of an accessible environment where the arts practitioner needs to adapt to possible changes. Reflexivity arises when dissimilar aspects or levels are confronted with one another; thus, employing self-reflexive, dialogical and questioning reflexive approaches that inform one another (Sullivan, 2010:111). These are valuable processes for the arts practitioner when engaged in an inquiry that is explanatory, post-disciplinary and transformative, consisting of multiple practices and theories.

Sullivan's Framework of Visual Arts Research (2010) provides further possibilities to break down the PLR inquiry. This expanded part of the framework is based on the concept of self-similarity (Figure 7). It means that transformative arts research has the capability to deal with challenges and concerns on multiple levels of theory and practice (Sullivan, 2010:116). Structures of self-similarity originate from the entire Framework of Visual Arts Research (Figure 2) which breaks up in a replicated manner. Each section that breaks up or shifts away then becomes a framework of its own, conveying the idea that knowledge is repositionable and open to further dissection. This form of exploration is found to be too expansive for this study, as the study investigates aspects relating to bodies of knowledge with defined parameters.

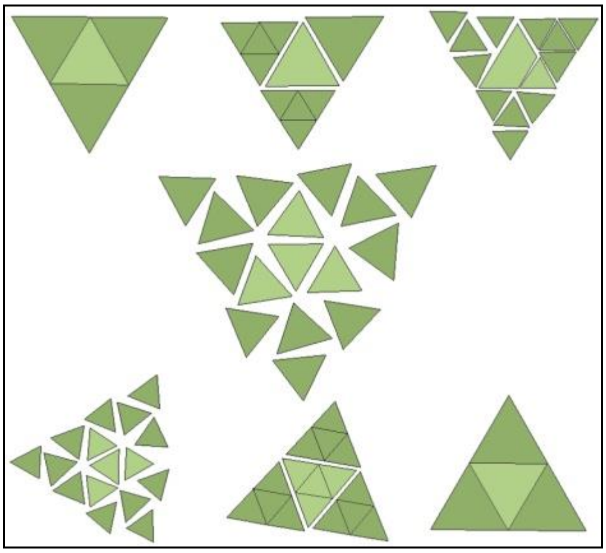


Figure 8. Visual arts Research: Self-Similar Structures

2.4 Conclusion

This chapter has outlined various perspectives regarding arts-based practice as research. It has also introduced PLR as an appropriate methodology for a post-discipline transformative visual arts inquiry. It has examined Sullivan's Framework for Visual Arts Research (2010) as a methodology suited to combining three dissimilar bodies of knowledge.

Key to the study is that the framework allows for the arts practitioner to employ a reflexive process to engage with emerging concepts, theories, disciplinary practices and the generation of new knowledge. The study structures all "reflection in practice" and "reflection on practice" within and around the areas (empiricist, interpretivist, critical, visual arts) of practice. Areas within the framework are supported by operational aspects, structure, agency and action. The former facilitate continued exploration of new theories and development of innovative ideas that inform the research inquiry. New discoveries are possible through the first-hand descriptive documentation of the creative process recorded in the CPJ. The process of revisiting past experiences, information and discoveries enables the arts practitioner to engage in a reflexive process and provides a platform of rediscovery where creative concepts and ideas continually develop. Audiences and/or evaluators need to be made aware that artworks produced within a PLR environment are not pure "artistic" creations, but rather visual research texts and should be evaluated with that concept in mind (Leavy, 2009:17).

The following chapter explores the practice-led integration of digital fabrication technologies within ceramics practice by conducting various in-depth surface experimentations, while innovatively appropriating geometric petroglyphs from the Driekopseiland cultural heritage site.

Chapter 3

Surface experimentation

3.1 Introduction

This chapter constitutes the descriptive rich textual documentation of my creative practice, which consists of a range of innovative surface experimentations, forming the focus of this research. As outlined in the introductory and methodology chapters, I apply Sullivan's Framework of Visual Arts Research as appropriate research method to outline my reflexive practice-led engagement during "making". Throughout, well-documented evidence of the reflexive engagement is recorded on datasheets and in my CPJ, intended to bring about meaningful research. Both data gathering sources record primary data derived from my "reflection in practice" and "reflection on practice". In this manner "firsthand" data is collated, using Sullivan's Framework, denoting the three key areas of practice (empiricist, interpretivist and critical). Within these three areas, I schematically map noteworthy creative intentions, influences, shifts and decision-making processes suited to each set of surface experimentations. These changing actions are informed by *structure, agency* and *action* as fluctuating operational features that encircle and drive the overall interdisciplinary engagement.

My intention to appropriate petroglyphs from the Driekopseiland site was to promote this overlooked cultural heritage site, to "re-present" it as innovative cultural content, viewed within a contemporary context. Several visits to the site and the retrieved archival material from the McGregor Museum, Kimberley were used as inspirational sources throughout the innovative surface experimentation. During "making", I chose distinct petroglyph motifs to embed within the ceramics tile/panel surfaces; these were intended to evoke a familiar memory of geometric petroglyphs we may have seen. As arts practitioner within a contemporary context with limited knowledge regarding the actual meanings of the petroglyphs, my position as "outsider" was affirmed repeatedly. Being aware of this, allowed me to contemplate "making" in relation to ritualistic actions, approaches to image-making and an understanding of the notion of site as "space or place".

There are several sites within South Africa where petroglyphs on glacial rock surfaces can be found, but little documentation where the glacial rock surface lies within a river bed, as it does at Driekopseiland (Morris, 2012:194, 195). At the site, there are over 3 500 engraved petroglyphs, more than 90% of them geometric or non-representational motifs. The distinctiveness of the site is the much debated ethnicity or cultural identity of the makers of the engravings (Morris, 2010:13). The significance of "place" at Driekopseiland is imbued with mystery regarding ethnography on rites and beliefs (Morris, 2010:39, 47). Acclaimed archaeologist David Morris suggests that the petroglyphs located within the river bed at Driekopseiland can be interpreted as a form of ritual mark-making, where each petroglyph was done by an individual and can be interpreted as an act of assertion of individuality (Morris, 2012:187, 193, 194). These factors are embodied within my practice.

Figure 9. Driekopseiland site

Figure 10. Driekopseiland site: detail

Throughout my surface experimentation the act of "mark-making", whether digital or analogue, has asserted innovation by regarding line and mark as abstract pictorial elements, which have the facility to evoke associated memories and responses. The outcome of this surface experimentation is reliant on communication and "meaning-making" in relation to how line and mark are used as essential structures of drawing. When applied to Sullivan's Framework (2010), line and mark-making become significant drivers of *structure, agency* and *action* as operational features between computer software and digital laser-generated line in conjunction with the following creative features: spontaneity, speculation, experimentation, directness, simplicity, expressiveness, immediacy, personal vision, diversity, fragmentation, discontinuity, unfinishedness and open-endedness (Craig-Martin 1995:9-10).

At the onset of this engagement an extensive range of chemical fumed surface colour experimentations were conducted in response to the site. An extensive colour pallet was achieved; colours, tones and hues which represent, as well as contrast the surrounding arid vegetation and glacial rock surface. The next stage was to conduct technical experimentation regarding the integration of laser-cutting/-engraving, plasma- and vinyl-cutting as digital fabrication technology, which included the digital cutting of copper, steel, hardboard and copper vinyl tape templates. Results from these were thereafter combined with select chemical fuming techniques, producing innovative surface effects.

The integration of petroglyph motifs in traditional ceramics practice required that suitable vector graphic files from the archived petroglyph motif images were drawn, using Adobe Photoshop and Adobe Illustrator (Graphics Suite 6) and CorelDraw® (Graphics Suite X7) software programs. These software programs have inter-operable features, which are suited to most laser-cutting and -engraving machines. Vector graphics are defined as images or "graphics", which are made up of points, lines, curves and polygons. The lines or "paths" within a vector graphic are made up of multiple control points or "nodes", which are easily manipulated to create a desired curve. Vector graphics are resolution independent, meaning that scaling does not cause pixilation/distortion as in JPEG or Bitmap images, and always presenting sharp curves and edges (Orzan, Bousseau, Barla, Winnemöller, Thollot, & Salesin 2013:101, Marks 2009:230, Wonka 2013:100). The use of computer-aided design (CAD), as opposed to hand-drawn and digitally scanned petroglyph motifs enhances accuracy and, therefore, the validity of the appropriated petroglyph motifs.

When engaging in practice, Sullivan's Framework allowed that I position myself at any of the defined areas within the Framework. Visual arts practice is at the core of any practice-led research and, therefore, was a familiar area for me to commence this engagement. At first I spent time considering the body of knowledge I have already acquired regarding ceramics practice, prior (tacit) knowledge.

Simultaneously I familiarised myself with the integration of technology within contemporary visual arts practice. I engaged with relevant theory and focused on readings regarding appropriation and cultural heritage from a modernist to a post-postmodernist ideology. Once I was assured of the direction my study would take, it allowed me to position myself in relation to both practice and theory within Sullivan's Framework.

3.2 Framework for surface colour experimentation

After completing all the surface colour experimentations, I retraced my steps, applying Sullivan's Framework. I created a flexible schematic of the Framework (Figure 11) by interactively inserting various keywords and phrases depicting the relived experience to trace my engagement. For this, my CPJ was used as an essential source of data, which I continually consulted to retrieve relevant data, and new discoveries emerged. Recording my lived experience within my CPJ simplified the process of reinterpreting and reliving actions taken.

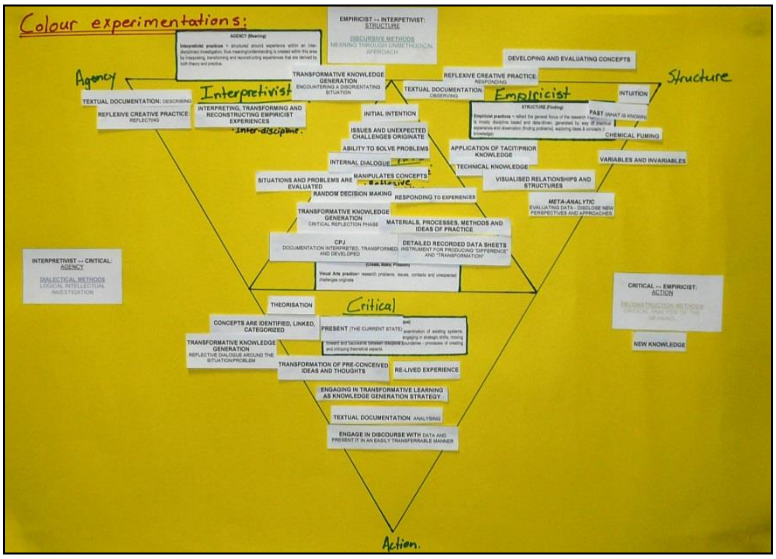


Figure 11. Interactive flexible schematic for surface colour experimentation

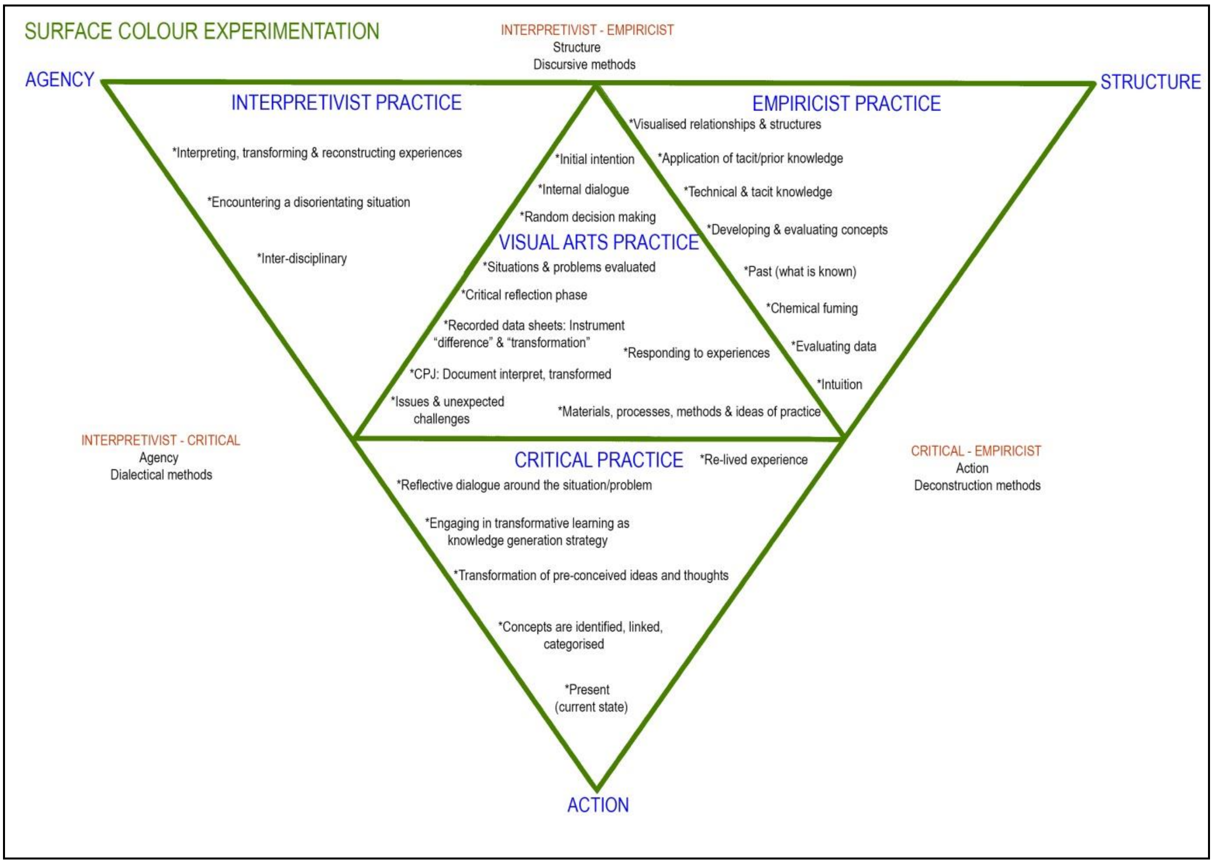


Figure 12. Schematic for surface colour experimentation

As previously mentioned in the methodology chapter, my CPJ consisted of four divisions. The divisions facilitated a manner in which data derived from my actions could be ordered. This enabled me to reflect easily and find relevant data at a later stage. The four divisions were: *initial intention, knowing-in-action, reflection-in-action* and *reflection-on-action*.

Throughout the creative process, *knowing-in-action* materialised through spontaneous reaction on a situation or problem and not from predetermined thought (Schön, 1983:54; Yanow & Tsoukas, 2009:1340). My engagement in interpretivist practices resulted in *reflection-in-action* as dialectical method used to reflect on experiences. *Reflection-in-action* is an analytical and meditated process of distinct reflection and/or evaluation of the knowledge/experience gained in *knowing-in-action* (Schön, 1983:56). Within *reflection-on-action,* reinterpretation or a post-intervention reflection transpires as shifts are made between empiricist, critical and interpretivist practices. When internal dialogues surfaced, I again entered the visual arts practice area and reflected on processes and experiences derived from *knowing-in-action* and *reflection-in-action*, resulting in a transformation of my worldview of that experience/outcome (Schön, 1983:61). Consequently, transformative learning occurred within this practice-led research inquiry as I reflected on experiences and processes, materialising in interpretivist, empiricist and critical practices linked to my visual arts practice.

At the start of the surface colour experimentations I focused on my visual arts practice, located at the centre of the framework and a familiar context for me to be positioned in. I explored various areas of interest regarding chemical fuming to narrow down the experimentation possibilities for this study. Concurrently, I continued to explore theories regarding the integration of digital fabrication and cultural heritage as interpretivist practices. Shifting back to empiricist practice I came across various prominent South African artists using digital fabrication technologies within visual arts practice, such as Marco Cianfanelli, Michaella Janse van Vuuren and Willem Boshoff. However, none of them worked in ceramics and, therefore, I searched for artists combining digital fabrication technologies and ceramics practice. As I was gathering information regarding chemical fuming and interdisciplinary practice, I discovered three international ceramics artists who had made success use of digital manufacturing technologies, namely Michael Eden (United Kingdom), John Balistreri (United States of America) and Steven Thurston (United States of America).

The practice of Michael Eden particularly fascinated me and further stimulated interest regarding the appropriation of cultural content. Using digital technology and ceramics, Eden thematically explores the wedgewood tureen as an object symbolic of the first Industrial Revolution (Figure 13), the tureen being a familiar British soup serving dish (http://www.lanciatrendvisions.com/en/article/identikit-of-the-perfect-maker). Eden's contemporary re-evaluation through digital re-engineering and the 3D ceramic printing of these objects are considered forms of appropriation. I was particularly intrigued by Eden's interest in how tacit knowledge that develops through years of ceramics practice can influence the digital design and making process (http://www.michael-eden.com/new-gallery-1/).

Figure 13. Michael Eden, *Wedgwoodn't Tureen*, 2010. Plaster, gypsum material, non-fired ceramic coating, 410 cm x 260 cm. Crafts Council.

From empiricist practice, a shift was made back to visual arts practice where I explored the various colours, tones and hues representing the surrounding arid vegetation and glacial rock petroglyph surface. When appropriating, motifs, line and mark were used as abstract pictorial elements. In order to develop a colour pallet within which the linear motifs could be integrated, I started experimenting with various chemical fumings. Having previously done several ceramic smoke-firing experimentations equipped me with a broad range of tacit knowledge. Throughout the smoke firings I relied on familiar as well as newly discovered materials, processes and methods within my ceramics practice. This entailed the creation of a saggar for chemical fuming, chemical application, determining firing temperatures and the post-processing of the chemically fumed ceramics. Working with unfamiliar materials and processes during the chemical fuming brought about unexpected challenges. Interdisciplinary working brought about several disorientating situations; this is regarded as the interpretivist area of my practice. One of the challenges was creating lively colours that could be used in contrast to the Driekopseiland surrounding vegetation and glacial rock surface. My thoughts returned to my visual arts practice to critically reflect on the impact of this challenge in order to solve it. Interpretation and reflection resulted in my engaging in critical practice, which enabled a critical examination and reflective dialogue of the situation and approach to solving the problem. By employing reflexive methods and continuously shifting within and between the various areas of my practice, I could find solutions.

Transformative learning occurred within this part of the PLR inquiry as I reflected upon experiences and processes materialising within my visual arts practice. The reinterpretation of my experiences through reflection resulted in the development of new knowledge and ideas, which altered my worldview (Ryan, 2012:208). Gaining new knowledge enabled me to transform and modify data, which could be applied to further experimentation. Detail regarding my “lived experiences” during practical experimentation was recorded in my CPJ, while technical data was documented on accessible and easily transferrable datasheets. All gathered data was regarded as new knowledge, which, in this batch of experimentations, was predominantly interpreted, transformed and reconstructed as interpretivist practice (Figure 12). Continual reflection within this area of my practice allowed for preconceived ideas, intentions and thoughts regarding the surface colour effects to be transformed. By engaging in transformative learning as knowledge generation strategy I could easily adapt and apply the new knowledge to expand on chemical fuming and colour generation in further surface experimentations.

3.3 CPJ documentation pre-colour experimentation: "reflection in practice"

In the following section, "reflection in practice" is presented by divisions "initial intention" and "knowing-in-action" in my CPJ journal. In the pre-surface colour experimentations, a dry run was done with seven randomly chosen chemicals, various combustible materials, firing temperatures and saggars. Chemical fuming was used to create coloration on the ceramic surfaces. The chemical fuming process entailed the firing of a ceramic object in a saggar, which contained combustible materials and chemicals applied to the surface of the object.

A saggar (Figure 14) could be described as an outer casing, usually made from a coarse clay body. Originally it was used to protect the internal ceramic ware from direct flames, gases or a sudden temperature change during the firing process (Taylor, 2011; Hamer & Hamer, 2012). Within contemporary Ceramics practice saggars are used to contain fumes around the ceramic ware so that surface colour can be created from the fumes (Von Dassow, 2009). Within the pre-surface colour experimentations ceramic, as well as aluminium foil saggars were used to determine the type of saggar that best suited this study.

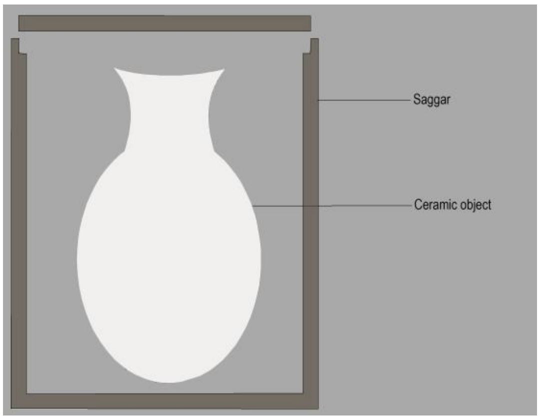


Figure 14. Saggar line drawn diagram

Chemicals: cupric, sodium carbonate, ferric, sodium, potassium, lithium and cupric chloride were used in the chemical fuming process. Due to my past experiences with smoke-firing it was decided to use two varying mid-range firing temperatures (900 °C, 980 °C). As the saggars contained combustible materials, I assumed that a smoke-firing temperature range would suit the process. Two different types of saggars (clay, aluminium) were used in combination with the seven chemicals. Various combustible materials (sawdust, wood, cow dung) were used in these experimentations in order to establish which combustible material was suitable for further experimentation. The chemicals were scattered, sprayed or painted on the ceramic surfaces. I took the decision to only scatter the chemicals, as scattering allowed for good coverage of the surface.

Experimentation with various methods and techniques informed the outcome of the pre-surface colour experimentation process, which assisted in determining specific variables and invariables for further surface experimentations. Invariables included only using a grey clay body for all the colour experimentation tiles, and the chemical type and method of application, which were scattered randomly. Variables for the surface colour experimentation included combustible materials, firing temperature for the chemical fuming and the type of saggars used for the chemical fuming. All the tiles were bisque-fired up to 900 °C in an electric kiln.

I have seen ceramics practitioners using various saggar types such as clay, aluminium, oil drums, metal containers or clay pots. Due to the fact that clay saggars break after about seven to ten firings I decided to build sufficient rectangular clay saggars with lids (Figure 15). I also used existing bisque-fired clay pots for some of the firings, but these disintegrated fairly quickly. The clay saggars were bisque-fired up to 900 °C before they could be used for chemical fuming. Within one chemical fuming I would place approximately four bisque-fired clay saggars with different chemicals applied in each kiln. The surface colour effects that were produced within the clay saggars varied from the effects created with aluminium saggars.

Figure 15. Clay saggars

3.4 Pre-surface surface colour experimentation: Chemical fuming

3.4.1 Datasheet 1: Sodium chloride 01

Datasheet no: 01	**Colour experimentation tile no:** 04	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Sodium chloride, salt	**Combustible materials:** Sawdust, wood, cow dung		
Method: Clay saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Pink/red, matt black **Reflection:** I started by placing the CET vertically in the clay saggar so that I can create layers of combustible materials and chemicals. A predominant matt black colour was created on the one side of the CET. This was caused by a lack of oxygen at the bottom of the clay saggar due to an excessive amount of combustible materials. On the left top and bottom of the tile a pink/red colour formed. The vertical placement of the tile in the clay saggar confirms the assumption of a lack of oxygen as the predominant black colour appears on the side, which was at the bottom part of the clay saggar.	

3.4.2 Datasheet 2: Sodium chloride 02

Datasheet no: 02	**Colour experimentation tile no:** 06	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Sodium chloride	**Combustible materials:** Sawdust, wood, cow dung		
Method: Clay saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Matt black **Reflection:** A second experiment was done to determine if the assumption regarding excessive amounts of combustible materials had been correct. Again it resulted in an overpowering matt black surface as in 3.4.2 CET 04 as a result of a lack of oxygen in the clay saggar. Due to the fact that even more combustible materials were used in this experiment, the matt black colour covered the whole ceramic surface. If less combustible materials are used the amount of black coloration should decrease.	

3.4.3 Datasheet 3: Sodium chloride 03

<table>
<tr><td>Datasheet no: 03</td><td>Colour experimentation tile no: 07</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Sodium chloride</td><td colspan="2">Combustible materials: Sawdust, cow dung</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Orange, white, silver/grey</td></tr>
<tr><td colspan="2">Reflection: In this experiment, an aluminium saggar was used to determine what kind of effect it would produce compared to a clay saggar, as in 3.4.4 CET 11. I was extremely excited when I saw that more vibrant colours emerged. Less combustible materials are required when using an aluminium saggar and more oxygen is able to pass through the saggar towards the end of the firing process. The aluminium saggar disintegrates towards the end of the firing due to the combustible materials burning. As the aluminium disintegrates, oxygen enters the saggar “atmosphere” and so enhances the intensity of colour produced. In this experiment, the sodium chloride chemical fuming resulted in a surface with varied vibrant orange, white and silver/grey colours.</td></tr>
</table>

3.4.4 Datasheet 4: Sodium chloride 04

<table>
<tr><td>Datasheet no: 04</td><td>Colour experimentation tile no: 11</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Sodium chloride</td><td colspan="2">Combustible materials: Cow dung</td></tr>
<tr><td colspan="2">Method: Clay saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Yellow/orange, blue/grey, rusty red, black, white</td></tr>
<tr><td colspan="2">Reflection: The third experiment (3.4.3 CET 07) with sodium chloride was done at 980 °C, which resulted in vibrant orange, white and silver/grey colours. In this experiment, the temperature was lowered to 900 °C, only cow dung was used as combustible material and the chemical fuming was done in a clay saggar. A purposeful change of invariables totally altered the colours created on the ceramic surface. This is most probably due to the change in temperature, as well as combustible material.</td></tr>
</table>

3.4.5 Datasheet 5: Sodium chloride 05

<table>
<tr><td>Datasheet no: 05</td><td>Colour experimentation tile no: 33</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Sodium chloride</td><td colspan="2">Combustible materials: Cow dung</td></tr>
<tr><td colspan="2">Method: Clay saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Rusty red, blue/grey</td></tr>
<tr><td colspan="2">Reflection: In this experimentation with sodium chloride, the same rusty red and blue/grey colours emerged as in the fourth experimentation (3.4.4 CET 11). It was noted that if the same chemical, firing temperature, saggar and combustible material were used, the colours and patterns generated do vary to a degree. Although the same type of rusty reds and blue/greys emerged, the surface patterns created differed. The variation in colour and pattern occurred due to the fact that chemical and combustible materials were not placed in exactly the same manner, area or amount. Therefore, one can presume that sodium chloride creates a certain range of colours, but variations do occur from one experimentation to the next.</td></tr>
</table>

3.4.6 Datasheet 6: Ferric chloride 01

<table>
<tr><td>Datasheet no: 06</td><td>Colour experimentation tile no: 03</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Ferric chloride, salt</td><td colspan="2">Combustible materials: Sawdust, wood, cow dung</td></tr>
<tr><td colspan="2">Method: Clay saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Pinkish/red and matt black</td></tr>
<tr><td colspan="2">Reflection: The same effects occurred in this experimentation as in 3.4.1 CET 04. As the tile was placed vertically into the clay saggar, again a predominant black colour manifested on the bottom half of the ceramic tile. As experienced previously, an excessive amount of combustible materials in the bottom half of the saggar caused a lack of oxygen in the saggar “atmosphere”, which resulted in the matt black surface.</td></tr>
</table>

3.4.7 Datasheet 7: Ferric chloride 02

<table>
<tr><td>Datasheet no: 07</td><td>Colour experimentation tile no: 05</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Ferric chloride</td><td colspan="2">Combustible materials: Sawdust, wood, cow dung</td></tr>
<tr><td colspan="2">Method: Clay saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Matt black</td></tr>
<tr><td colspan="2">Reflection: This experimentation provided the exact same outcome as in 3.4.2 CET 06. A relatively uniform matt black surface manifested, which was most probably due to an excessive amount of combustible materials. As the combustible materials burnt, it consumed all the oxygen, which then resulted in a murky matt black ceramic surface.</td></tr>
</table>

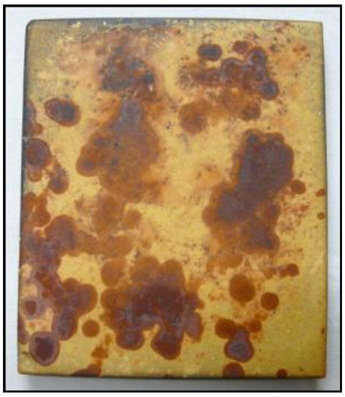
3.4.8 Datasheet 8: Ferric chloride 03

<table>
<tr><td>Datasheet no: 08</td><td>Colour experimentation tile no: 08</td><td>Temperature: 900 °C</td><td>Chemical application: Sprayed</td></tr>
<tr><td colspan="2">Chemicals: Ferric chloride</td><td colspan="2">Combustible materials: Cow dung</td></tr>
<tr><td colspan="2">Method: Clay saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Orange, black, grey, yellow/green</td></tr>
<tr><td colspan="2">Reflection: In CET 08, an unforeseen variation of black/grey and orange colours manifested in the chemical fuming process. In this experimentation, two variable elements were altered. The temperature was lowered to 900 °C and only cow dung was used as combustible material. Due to the variables, less black colouration appeared and a vibrant orange colour manifested over the majority of the ceramic surface instead of a murky black ceramic surface (3.4.7 CET 05).</td></tr>
</table>

3.4.9 Datasheet 9: Ferric chloride 04

Datasheet no: 09	**Colour experimentation tile no:** 10	**Temperature:** 900 °C	**Chemical application:** Sprayed
Chemicals: Ferric chloride	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Light orange, white, grey **Reflection:** In this experimentation, the majority of the ceramic surface fired to a light orange colour with select areas of white and black. In contrast with the previous experiment (3.4.8 CET 08) with ferric chloride at 900 °C, a much lighter orange/yellow tone originated. A slightly lighter matt black colour as in the previous experimentations (3.4.6 CET 03, 3.4.7 CET 05 and 3.4.8 CET 08) manifested where the firing temperature was 980 °C. I then realised that when the firing temperature is lowered to 900 °C using an aluminium saggar, the colours created are much lighter.	

3.4.10 Datasheet 10: Ferric chloride 05

Datasheet no: 10	**Colour experimentation tile no:** 31	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Ferric chloride	**Combustible materials:** Sawdust		
Method: Clay saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Yellow/orange, red, grey **Reflection:** An interesting discovery was made regarding different types of combustible materials and firing temperatures. In 3.4.8 CET 08 cow dung was used at a firing temperature of 900 °C. This resulted in an overall orange ceramic surface with select black areas. Therefore, I decided to repeat the experiment, but with sawdust as combustible material and at a firing temperature of 980 °C. This change in variables resulted in an outstanding surface colour. In this experiment, the higher firing temperature and lighter combustible material, with more oxygen in between the wooden shavings, generated surface colours that are much more vibrant and lively. This surface colour can be employed in the extended surface experimentations to enhance the	

	focus on the motifs that are to be incorporated. When the motifs are presented in a vibrant and lively colour, it would be as if they had come to life and stimulated interest in the content presented. This would enforce and enhance an awareness of the cultural content used.

3.4.11 Datasheet 11: Cupric chloride

<table>
<tr><td>Datasheet no: 11</td><td>Colour experimentation tile no: 13</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Cupric chloride</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Brown, black</td></tr>
<tr><td colspan="2">Reflection: I decided to do an experiment with an aluminium saggar, but at a lowered temperature of 900 °C. The result was an overall brownish colour that varied in intensity in certain areas. A small number of black areas manifested on the ceramic surface. The black burnt areas could be due to a reaction between the sawdust and cupric chloride within the firing process. This was the first experiment where brown colouration had occurred. The brown and black colours made me think of the select dry grass patches between the glacial rock bed at the Driekopseiland site. I visited the site in February 2013 and it was extremely hot (40 °C). Although the vegetation next to the river was green, there were patches of grass that were dry, which almost looked as if it could burst into flames from the extreme heat.</td></tr>
</table>

3.4.12 Datasheet 12: Lithium chloride

<table>
<tr><td>Datasheet no: 12</td><td colspan="2">Colour experimentation tile no: 14</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Lithium chloride</td><td colspan="3">Combustible materials: Sawdust</td></tr>
<tr><td colspan="3">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="3" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Red, black, cream, grey</td></tr>
<tr><td colspan="2">Reflection: The experimentation with lithium chloride at a firing temperature of 900 °C verified that vivacious colours could be generated at a lower firing temperature. A range of varied reds, cream and black emerged in this experimentation, resulting in an alluring combination of colours and patterns. When I walked over the rock bed that was covered with petroglyphs, I noticed that all the petroglyphs were the same dull grey colour. The scorching sun baked the black/grey glacial pavement to the point that we could no longer stand on the rock bed. It was as if the heat had prevented me from interaction with the petroglyphs.
When reflecting on that experience, I realised that I could use the varied colours from this experiment (red, cream, black) to innovatively appropriate the cultural content (petroglyphs). I could create a ceramic landscape that not only represented the extreme heat, which I had experienced at the site, but also create a significant contrast to the dull grey colour of the petroglyphs as they are at Driekopseiland. By representing the petroglyphs in a “landscape” format which is totally unlike the one at Driekopseiland, it would stimulate interaction and so cultivate new knowledge and an awareness of this “lost” cultural content.</td></tr>
</table>

3.4.13 Datasheet 13: Potassium chloride

Datasheet no: 13	**Colour experimentation tile no:** 12	**Temperature:** 900 °C	**Chemical application:** Scattered
Chemicals: Potassium chloride	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Red, orange, black	
		Reflection: The experimentation with potassium chloride created vibrant orange and red colours similar to the experimentations with ferric chloride (3.4.10 CET 31) and lithium chloride (3.4.12 CET 14). I noticed that all the chloride chemicals created a range of red and orange colours of which potassium chloride created the most vibrant orange and red colours. I decided that when doing the extended surface experimentations, one or all of the three chlorides (ferric, lithium, potassium) should be used within the ceramic landscapes. The vibrant red and orange colours would be ideal to represent the extreme heat experienced at the Driekopseiland site. The patterns and colouration would also create a great contrast with the existing dull grey/black glacial pavement, which is a solid lifeless mass of information waiting to be discovered. By incorporating some of the petroglyph motifs, interest would be stimulated, giving viewers the chance to start discovering this extensive body of information.	

3.4.14 Datasheet 14: Cupric carbonate

<table>
<tr><td>Datasheet no: 14</td><td>Colour experimentation tile no: 16</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Cupric carbonate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Brown, black</td></tr>
<tr><td colspan="2">Reflection: The experimentation with cupric carbonate created the same brown and black colours as in the experimentation with cupric chloride (3.4.12 CET 13). Both chemical fuming’s done at the same firing temperature and with sawdust as combustible material. Therefore, I assumed that when cupric chemicals were used in a chemical fuming some sort of brown colour would materialise. I thought about the possibilities that these neutral browns could offer when innovatively appropriating the petroglyphs. If they were to be used in the extended surface experimentations they would create resemblances to vegetation at the Driekopseiland site. It would be interesting if I could use the brown colours to represent the landscape, creating an atmosphere of an aged forgotten site. Then using the reds and oranges from the various chlorides to appropriate and give life to the petroglyph motifs. This combination would create an attention-grabbing visual representation of the Driekopseiland cultural heritage site, encouraging interaction and interpretation of the motifs, and so reinforcing and promoting this “lost” heritage.</td></tr>
</table>

3.4.15 Datasheet 15: Sodium carbonate

<table>
<tr><td>Datasheet no: 15</td><td>Colour experimentation tile no: 18</td><td>Temperature: 900 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="1">Chemicals: Sodium carbonate</td><td colspan="3">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Orange, white</td></tr>
<tr><td colspan="2">Reflection: The experimentation with sodium carbonate created white clusters, which looked like a ceramic glaze that had only partially melted. It could probably be the sodium carbonate which had formed clusters as the temperature rose, but could not entirely dissolve and evaporate due to a higher evaporation point than 900 °C. Used in the correct context, this could give a very interesting surface texture. The white clusters which formed in this experimentation made me think of the clustered petroglyphs at Driekopseiland. Clusters of similar, but not identical petroglyphs can be found at different parts of the site. When the white clusters were used within a ceramic landscape it could be manipulated to create symbolic “clusters”. The motifs could also be covered by these clusters, which could represent a “hidden” or “buried” jewel that needed to be revealed to the world.</td></tr>
</table>

3.5 CPJ documentation pre-colour experimentation: "reflection on practice"

In the following section, "reflection on practice" is presented by divisions "reflection-in-action" and "reflection-on-action" recorded within my CPJ. After randomly experimenting with various chemicals and firing methods and techniques in the chemical fuming process, it was decided to set specific invariables in place for the rest of the surface experimentations in order to create some form of uniformity to the experimentations. Invariables included clay type (grey clay body), firing temperature (980 °C), kiln type (electric), saggar type (aluminium) and combustibles (sawdust).

Chemicals used in the pre-surface colour experimentation were cupric and sodium carbonate, ferric, sodium, potassium, lithium and cupric chloride. From the various pre-surface colour experimentations I discovered that the chemical fuming process required sufficient oxygen and a mid-range firing temperature of 980 °C to generate lively surface colours and interesting patterns (Figure 16). After the various experimentations with different combustible materials, I decided to only use sawdust as combustible material, as it allowed sufficient oxygen to flow between the wooden pieces and provided exceptional lively colours. By doing various experimentations with clay saggars I noticed that a saggar could be used for seven to ten firings after which it cracked to the extent that it totally broke apart. This observation led me to question issues of durability when using a clay saggar.

Figure 16. CET 12

Using clay saggars is not an efficient working method when taking into account the time it took me to build one clay saggar. The dimensions of the ceramic pieces within the extended surface experimentations were much bigger and building saggars to fit them would be a time consuming activity. Therefore, I decided to rather make use of aluminium saggars. They are simple to make, are cost-effective and have no size restrictions or durability issues. The aluminium foil saggar still effectively represented a fuming chamber within which the ceramic piece was placed and fired. Experimentation with lithium, cupric and potassium chloride, as well as cupric and sodium carbonate was done at a firing temperature of 900 °C, using sawdust as a combustible material. Only lithium chloride (3.4.12 CET 14) and potassium chloride (3.4.13 CET 12) revealed interesting surface colours at the lower temperature (900 °C). As a result, it was decided to use the above mentioned invariables for the remaining surface colour experiments.

Various noteworthy technical aspects were identified in the pre-colour experimentations. In order to create lively surface colours and patterns sufficient oxygen had to be present within the fuming chamber (sagger). Those saggers had to be fired at a mid-range firing temperature of 980 °C. Furthermore, the use of aluminium saggers as fuming chambers provided a practical and effective solution for further experimentation which included larger ceramic pieces. These technical aspects were applied to further surface colour experimentations, which resulted in an array of unique surface colours and patterns.

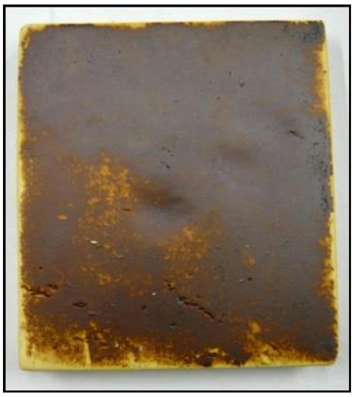
3.6 CPJ documentation colour experimentation: “reflection in practice”

In the following section, “reflection in practice” is presented by divisions “initial intention” and “knowing-in-action” in my CPJ journal. A diverse range of surface colour experimentations was completed in order to create a colour pallet from which further exploration could develop. The focus of the surface colour experimentations was largely based on supporting the integration of laser-cut, plasma-cut and vinyl-cut templates into the ceramics process.

Various chemicals such as chlorides, nitrates, carbonates, sulphates and oxides that had been used frequently in ceramics practice were randomly chosen to conduct the surface colour experimentations. The discipline of ceramics has an extensive range of 3-dimensional construction methods, firing techniques and various post-processing procedures. Therefore, I established set parameters including various variables and invariables. Invariables for the surface colour experimentations again included only using a grey clay body for all the surface experimentation tiles, which were all fired in an electric kiln up to 980 °C. All the chemical fuming was done in aluminium saggars, using only sawdust as combustible material. The variables included the chemical type and method of application, which were randomly scattered, sprayed or soaked. Datasheets below reflect specific details regarding each colour surface experimentation.

3.7 Surface colour experimentation: Chemical fuming

3.7.1 Datasheet 16: Cupric carbonate

Datasheet no: 16	**Colour experimentation tile no:** 36	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Cupric carbonate	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Brown, light yellow **Reflection:** When cupric carbonate is used in a chemical fuming firing at 900 °C, a light brown ceramic surface is created (3.4.14 CET 16). When the experiment is repeated, but at a higher firing temperature (980 °C), a richer brown colour is created. This supports the assumption that more vibrant and interesting colours are generated at a higher firing temperature.		

3.7.2 Datasheet 17: Ammonium chloride

Datasheet no: 17	**Colour experimentation tile no:** 38	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Ammonium chloride	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Light and dark oranges **Additional comments:** Very interesting darker orange speckles occurred on the surface of the tile. This could be the result of the sawdust absorbing the chemical in the firing process and then leaving these darker orange imprints on the surface as the sawdust started to burn away.		

3.7.3 Datasheet 18: Strontium chloride

<table>
<tr><td>Datasheet no: 18</td><td>Colour experimentation tile no: 23</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Strontium chloride</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Dark purple, white, orange</td></tr>
<tr><td colspan="2">Reflection: The experimentation with strontium chloride offered unforeseen but captivating surface effects. In previous experimentations with chlorides (3.4.10 CET 31, 3.4.12 CET 14, 3.4.13 CET 12), variations of reds and oranges usually manifested. In this experimentation, a majority of dark purple can be seen with a small area of purple and white marks mostly on the outside of the purple area. Although there is a small orange area to the right of the ceramic surface, which is related to the previous experimentations with chlorides.</td></tr>
</table>

3.7.4 Datasheet 19: Zinc chloride

<table>
<tr><td>Datasheet no: 19</td><td>Colour experimentation tile no: 39</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Zinc chloride</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Yellow, peach, orange, white</td></tr>
<tr><td colspan="2">Reflection: An assortment of peach colours and two distinct yellow spots with dark peach around them manifested in this experimentation. A few other white spots can be seen. These spots are most likely where there were more chemicals touching the surface of the tile than sawdust, creating more intense coloration in that area. The soft subdued surface is a contradiction to the previous experimentations with chlorides (343.10 CET 31, 3.4.12 CET 14, 3.4.13 CET 12), which offered bright and vibrant reds and oranges. This soft pastel peach colour may be used as a representation of the river water at Driekopseiland, covering the petroglyphs like a soft protective blanket.</td></tr>
</table>

3.7.5 Datasheet 20: Potassium carbonate

<table>
<tr><td>Datasheet no: 20</td><td>Colour experimentation tile no: 29</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Potassium carbonate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Light orange</td></tr>
<tr><td colspan="2">Reflection: A slight change in the colour of the tile can be seen, as well as a small amount of light orange speckles. In the experimentation with potassium chloride intense coloration emerged (3.4.13 CET 12). Rich and vibrant reds, oranges and blacks manifested in that experiment, which is contradictory to the neutral select orange coloration in this experiment. The cause of the light coloration in this experimentation may be due to an insufficient amount of potassium carbonate.</td></tr>
</table>

3.7.6 Datasheet 21: Ammonium carbonate

<table>
<tr><td>Datasheet no: 21</td><td>Colour experimentation tile no: 37</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Ammonium carbonate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Light orange</td></tr>
<tr><td colspan="2">Reflection: Even less coloration appeared in this experiment than with potassium carbonate (3.7.5 CET 29). Light orange speckles can be seen at the top of the ceramic surface, but almost no coloration occurred on the rest of the surface. As in (3.7.5 CET 29) this reaction may also be due to an insufficient amount of ammonium carbonate scattered over the surface.</td></tr>
</table>

3.7.7 Datasheet 22: Lithium carbonate

<table>
<tr><td>Datasheet no: 22</td><td>Colour experimentation tile no: 25</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Lithium chloride</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Yellow, brown, orange, white</td></tr>
<tr><td colspan="2">Reflection: Unanticipated surface effects were generated in this experimentation. An orange background can be seen with areas of yellow and white coloration. There are some distinct brown patches with white dots more to the centre of the tile. The chemical also created a sort of texture over the entire surface as if it did not totally melt and vaporised, but rather fused onto the surface. Within ceramics practice lithium carbonate is used as a flux and colour enhancer. Fluxes are used to lower the melting point of the glass formers in glazes in order to lower the overall melting point of the glaze. Lithium carbonate is usually used as a colour enhancer for other compounds such as iron oxide. The textured surface is most likely a reaction due to the direct application of the lithium carbonate. Experimentation with adding lithium carbonate to other chemicals or compounds that creates subdued colours such as zinc chloride (3.7.4 CET 39) may offer more vibrant colours.</td></tr>
</table>

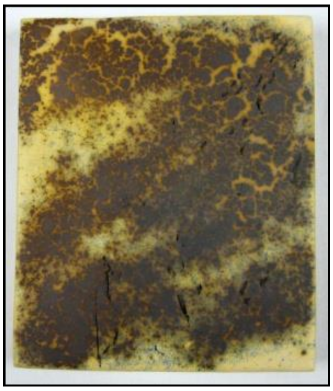
3.7.8 Datasheet 23: Cobalt carbonate

Datasheet no: 23	**Colour experimentation tile no:** 30	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Cobalt carbonate	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Blue, brown/green **Reflection:** Various blues can be seen on the ceramic surface. Some brown patches are also visible, which may be where there was more sawdust than the other areas where it is predominantly blue. The application of this captivating surface effect in combination with the petroglyph motifs, on a ceramic landscape panel may result in a refreshed representation of the cultural content. The captivating colouration is used to grab the viewer's attention and enhance exposure to the cultural content.	

3.7.9 Datasheet 24: Barium carbonate

Datasheet no: 24	**Colour experimentation tile no:** 50	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Barium carbonate	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Orange, black **Reflection:** This experimentation offered a unique surface effect with intense vivid coloration. Very dark and light orange and black areas can be seen as well as multiple textured "glaze" pockets. The "glaze" pockets are probably due to the direct application of the chemical on the ceramic surface. The orange colours that originated in this experiment related to the oranges that had manifested in the experiment with lithium carbonate (3.7.7 CET 25). Barium carbonate is also a flux and colour enhancer like lithium carbonate, and typically used within glazes. Yet, the barium carbonate formed "glaze pockets" rather than a crust-like texture as in 3.7.7 CET 25.	

3.7.10 Datasheet 25: Copper carbonate

Datasheet no: 25	**Colour experimentation tile no:** 47	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: Copper carbonate	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Brown, green **Reflection:** In this experiment, copper carbonate was scattered by hand onto the surface of the tile. Dark brown coloration occurred where the chemical landed on the ceramic surface. Also noted were green speckles around the dark brown areas, creating an outline or drop shadow.		

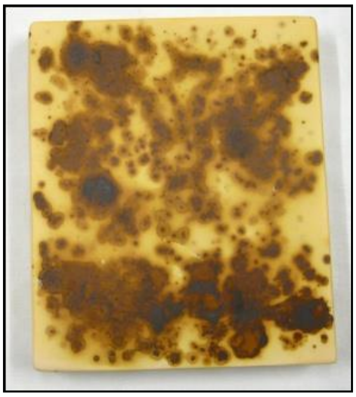
3.7.11 Datasheet 26: White lead carbonate

Datasheet no: 26	**Colour experimentation tile no:** 59	**Temperature:** 980 °C	**Chemical application:** Scattered
Chemicals: White lead carbonate	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Orange **Reflection:** Light orange coloration can be seen at the top and bottom part of the ceramic tile. The coloration is not very prominent, but some degree of coloration has occurred. This chemical is also used as a flux in glazes, but disintegrates at 400 °C, which is why not much coloration has occurred in this experimentation.		

3.7.12 Datasheet 27: Ferric nitrate

<table>
<tr><td>Datasheet no: 27</td><td>Colour experimentation tile no: 49</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Ferric nitrate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Red, metallic blue</td></tr>
<tr><td colspan="2">Reflection: Ferric nitrate was loosely scattered by hand onto the ceramic surface. Vibrant red colours manifested with some areas that had a metallic blue sheen. The areas which did not come into contact with the chemical did not discolour at all. The chemical fuming created a blotchy effect as the entire ceramic surface was not covered in ferric nitrate.</td></tr>
</table>

3.7.13 Datasheet 28: Cupric nitrate

<table>
<tr><td>Datasheet no: 28</td><td>Colour experimentation tile no: 34</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Cupric nitrate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Brown</td></tr>
<tr><td colspan="2">Reflection: In the experimentation with cupric nitrate a range of bright brown colours emerged. When cupric carbonate (3.4.14 CET 16) and cupric chloride (3.4.11 CET 13) were used in the chemical fuming process, various browns manifested. It could, therefore, be assumed that a chemical substance containing cupric would, to some degree, result in some tonal brown coloration.</td></tr>
</table>

3.7.14 Datasheet 29: Potassium nitrate

<table>
<tr><td>Datasheet no: 29</td><td>Colour experimentation tile no: 26</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Potassium nitrate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Orange, white, brown</td></tr>
<tr><td colspan="2">Reflection: Potassium nitrate had quite a peculiar surface effect. An overwhelming orange coloration appeared with white blotches and some select black areas. The chemical did not only create a crust-like texture resembling the experimentation with Lithium carbonate (3.7.7 CET 25), but it also resulted in areas where it seemed as if the chemical had melted and created a glazed-like effect on the ceramic surface. Potassium nitrate is also a flux used in glazes, which would possibly explain the glazed-like effect. It seemed as if chemicals used as fluxes had created some form of orange coloration and formed a crust-like or glazed-like texture.</td></tr>
</table>

3.7.15 Datasheet 30: Strontium nitrate

<table>
<tr><td>Datasheet no: 30</td><td>Colour experimentation tile no: 21</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="2">Chemicals: Strontium nitrate</td><td colspan="2">Combustible materials: Sawdust</td></tr>
<tr><td colspan="2">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Green, black, white</td></tr>
<tr><td colspan="2">Reflection: CET 21 illustrates predominant green coloration with some grey areas, and single white and black marks. One can also see that the chemical has created some sort of texture on the surface and not only coloration.</td></tr>
</table>

3.7.16 Datasheet 31: Cupric sulphate

<table>
<tr><td colspan="2">Datasheet no: 31</td><td colspan="2">Colour experimentation tile no: 28</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="3">Chemicals: Cupric sulphate</td><td colspan="3">Combustible materials: Sawdust</td></tr>
<tr><td colspan="4">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="4" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Brown</td></tr>
<tr><td colspan="2">Reflection: A dark brown colour has manifested in the experimentation with cupric sulphate. An overall speckled pattern is visible, which may possibly be the sawdust that has been etched onto the surface, leaving these marks.</td></tr>
</table>

3.7.17 Datasheet 32: Potassium sulphate

<table>
<tr><td colspan="2">Datasheet no: 32</td><td colspan="2">Colour experimentation tile no: 24</td><td>Temperature: 980 °C</td><td>Chemical application: Scattered</td></tr>
<tr><td colspan="3">Chemicals: Potassium sulphate</td><td colspan="3">Combustible materials: Sawdust</td></tr>
<tr><td colspan="4">Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="4" rowspan="2">CET effect
</td><td colspan="2">Colour/tones generated: Orange, green, black</td></tr>
<tr><td colspan="2">Reflection: Overall coloration of orange can be seen in CET 24. An interesting black area formed in the centre of the tile with green areas in between. This may have happened due to a reaction between the sawdust and the potassium sulphate or a concentrated amount of the chemical has been scattered in that area.</td></tr>
</table>

3.7.18 Datasheet 33: Ammonium sulphate

Datasheet no: 33	**Colour experimentation tile no:** 40	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Ammonium sulphate	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** None **Reflection:** As Ammonium sulphate did not create any coloration in the firing process no further experimentation was done with it.		

3.7.19 Datasheet 34: Magnesium sulphate

Datasheet no: 34	**Colour experimentation tile no:** 20	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Magnesium sulphate	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Orange **Reflection:** There are two small areas of orange coloration which can be seen on the bottom half of the ceramic tile. The rest of the ceramic surface shows no colouration. The experimentation with Cupric sulphate (3.7.16 CET 28) and Potassium sulphate (3.7.17 CET24) created lively brown and orange colours so I was quite surprised by the minimal colouration in this experiment with a sulphate and the previous one (3.7.18 CET 40).		

3.7.20 Datasheet 35: Cobalt oxide

Datasheet no: 35	**Colour experimentation tile no:** 22	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Cobalt oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Blue **Reflection:** The experimentation with Cobalt oxide shows an overall blue and brown colouration of the ceramic surface. The intense blue colour is most probably due to the fact that the ceramic surface was covered by a concentrated amount of Cobalt oxide. If I added more sawdust and less Cobalt oxide a more opaque blue would probably have appeared. This type of colouration made me think of the glacial pavement at the Driekopseiland site and could be used to represent such a surface in the extended surface experimentations.	

3.7.21 Datasheet 36: Copper oxide

Datasheet no: 36	**Colour experimentation tile no:** 27	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Copper oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Brown **Reflection:** The dark brown colouration with speckled patterns is quite similar to the experimentation with Cupric sulphate (3.7.16 CET 28). Both chemicals created brown coloration of the ceramic surface with a kind of speckled pattern. The patterns could have been caused by the burnt sawdust etching onto the surface and leaving these marks.	

3.7.22 Datasheet 37: Manganese dioxide

Datasheet no: 37	**Colour experimentation tile no:** 35	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Manganese dioxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Black/brown **Reflection:** In the experimentation with Manganese dioxide a speckled black/brown colour appeared all over the ceramic surface. The colour is quite subtle, but still noticeable. If applied in a ceramic landscape with petroglyph motifs it could create an ambience of mist over a landscape.		

3.7.23 Datasheet 38: Yellow ochre

Datasheet no: 38	**Colour experimentation tile no:** 32	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Yellow ochre	**Combustible materials:** Sawdust		
Method: Aluminium saggar	**Kiln:** Electric		
CET effect 	**Colour/tones generated:** Orange **Reflection:** Is scattered a substantial amount of Yellow ochre by hand over the ceramic surface. The result was a vibrant orange surface with select areas of lighter orange/yellow coloration. Manganese dioxide (3.7.22 CET 35) created the same tone of coloration, but in a soft brown with a yellow background.		

3.7.24 Datasheet 39: Brown chrome oxide

Datasheet no: 39	**Colour Experimentation Tile no:** 60	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Brown chrome oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Orange, brown **Reflection:** The experimentation with brown chrome oxide resulted in a yellow background with dark orange on the right side of the ceramic tile. The dark orange colouration could possibly have formed due to an excessive amount of brown chrome oxide being scattered in that area.	

3.7.25 Datasheet 40: Green chrome oxide

Datasheet no: 40	**Colour Experimentation Tile no:** 41	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Green chrome oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Brown, yellow **Reflection:** An overall yellow coloration manifested on the surface with single orange spots. The effects created with brown chrome oxide (3.7.24 CET 60) also created orange colouration, but much more intense. The minority of orange colouration in this experiment is probably because much less green chrome oxide was scattered over the ceramic surface.	

3.7.26 Datasheet 41: Iron oxide

Datasheet no: 41	**Colour Experimentation Tile no:** 43	**Temperature:** 980 ˚C	**Chemical application:** Scattered

Chemicals: Iron oxide	**Combustible materials:** Sawdust
Method: Aluminium saggar	**Kiln:** Electric
CET effect 	**Colour/tones generated:** Orange, Brown, Yellow **Reflection:** I was extremely excited by the interesting dark orange and brown coloration of the ceramic surface. The coloured areas almost look like a rusted surface and create a feel of "burning". It could be that less Iron oxide was scattered to the middle left of the ceramic tile, as the coloration is less intense there than in the other areas.

3.7.27 Datasheet 42: Nickel oxide

Datasheet no: 42	**Colour Experimentation Tile no:** 45	**Temperature:** 980 ˚C	**Chemical application:** Scattered

Chemicals: Nickel oxide	**Combustible materials:** Sawdust
Method: Aluminium saggar	**Kiln:** Electric
CET effect 	**Colour/tones generated:** Brown/orange **Reflection:** The experimentation with Nickel oxide provided a brown/orange coloration with various darker areas. The darker orange/brown areas probably manifested due to the oxide coming in direct contact with the surface. The darker coloration that appeared in the experimentation with Iron oxide (3.7.26 CET 43) is quite similar to the darker orange/brown areas in this experiment, just more dense.

3.7.28 Datasheet 43: Tin oxide

Datasheet no: 43	**Colour Experimentation Tile no:** 46	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Tin oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Orange **Reflection:** As in (3.7.26 CET 43 and 3.7.27 CET45) the same orange/brown appeared in the experimentation with Tin oxide. Although in the experimentation with Tin oxide it was not only coloration, but the oxide created a textured surface. It seems as if the oxide did not completely disintegrate as it should in order to create optimal fuming of the ceramic surface. Rather it fused with the ceramic surface and created rounded protrusions which almost look like small balls or raindrops. If this textured surface effect is applied in a ceramic landscape with motifs it could possibly be used to represent the intense heat to which the petroglyphs are exposed to in the summer months. The surface texture resembles a “boiling substance”, in this case the motifs used.	

3.7.29 Datasheet 44: Zirconium oxide

Datasheet no: 44	**Colour Experimentation Tile no:** 56	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Zirconium oxide	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** None **Reflection:** Zirconium oxide is an opacifying compound. An opacifying compound is added to a material or substance to transform the substance to opaque. In Ceramics practice Zirconium oxide are used to produce opaque colour glazes. No coloration occurred on the ceramic surface due to the abovementioned characteristics of the chemical. If the chemical are combined with a chemical such as Cupric carbonate (3.7.1 CET 36) which creates dark brown solid colouration, it might result in a more opaque colour.	

3.7.30 Datasheet 45: Potassium dichromate

Datasheet no: 45	**Colour Experimentation Tile no:** 44	**Temperature:** 980 ˚C	**Chemical application:** Scattered
Chemicals: Potassium dichromate	**Combustible materials:** Sawdust		
Method: Aluminium saggar		**Kiln:** Electric	
CET effect 		**Colour/tones generated:** Brown, green, white **Reflection:** The experimentation with Potassium dichromate created fascinating surface effects. It generated two prominent colours; brown and green. In most of the previous surface colour experimentations only one prominent colour formed per CET so this experiment is quite unique. In the experimentation the majority of the surface is either alight or darker brown colour. Distinct light and dark green areas can be seen with a few select white patches. The moss-like feel of the surface effect can be used to represent a surface or motif that has been near or partially submerged in water for an extended period of time. Emphasising the value of this timeworn cultural content and the need for preservation thereof.	

3.8 CPJ documentation colour experimentation: "reflection on practice"

In the following section, "reflection on practice" is presented by the divisions "reflection-in-action" and "reflection-on-action" recorded within my CPJ. The colour palette for the surface experimentation consists of a diverse range of colours, some embodying the ambience of the Driekopseiland site and surroundings, and others representing contrasting lively colours. After all the surface colour experimentations had been completed, it was evident that no two chemicals resulted in the same colour fuming. Significant technical aspects included the scattering and/or spraying of chemicals over the templates and bisque fired tiles. Due to the choice of chemicals a large number of the experimentations resulted in shades of brown and orange. Further experimentations explored to what extent the use of digital fabrication technologies in ceramics practice could enhance a post-discipline transformative visual arts PLR inquiry. Experimentation was based on the use of laser-cut templates, which were introduced into the chemical fuming process; using successful results from the above surface colour experimentation results.

Three digital cutting technologies were used, namely laser-, plasma- and vinyl-cutting. Hardboard and metal templates were laser-cut, while copper sheet and metal were plasma-cut. The copper vinyl tape was cut with a vinyl cutter. Incorporating digital fabrication in my ceramics practice by using digitally designed and cut templates enhanced my working methods, specifically when dealing with intricate design possibilities.

3.9 Framework for template experimentation

Upon completion of the template experimentations, I again retraced my steps by applying Sullivan's Framework. Using Sullivan's Framework (Figure 17), initially presented as an interactive schematic, allowed me to carefully map keywords and phrases that best represented my creative (lived) experience. As with the previous experimentations, I had recorded my firsthand experiences within my CPJ, which facilitated the process when reinterpreting and mapping actions taken. After interactively engaging with the schematic, I again redrew the schematic (Figure 18) digitally, using Adobe Photoshop CS6 software.

The previous surface colour experimentations resulted in a great deal of new knowledge being gained during the chemical fuming process. When considering technical aspects and procedural actions, I could confidently draw on this tacit knowledge. At the start of this engagement I found myself positioned within the interpretivist practice area of the framework, driven by digital technology as interdisciplinary investigation, also a key construct of this study. This facilitated an environment where select digital fabrication methods and materials could be explored. Simultaneously, I reevaluated the three fundamental elements making up a chemical fuming experiment: selecting appropriate chemicals, preparing a porous ceramic surface and sourcing a suitable combustible material.

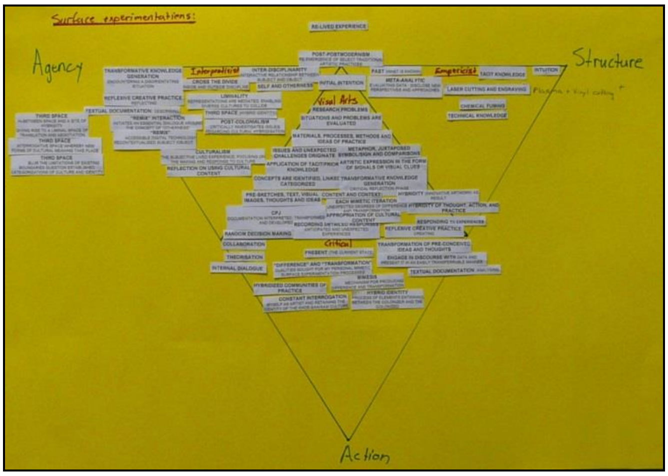


Figure 17. Interactive schematic for template experimentation

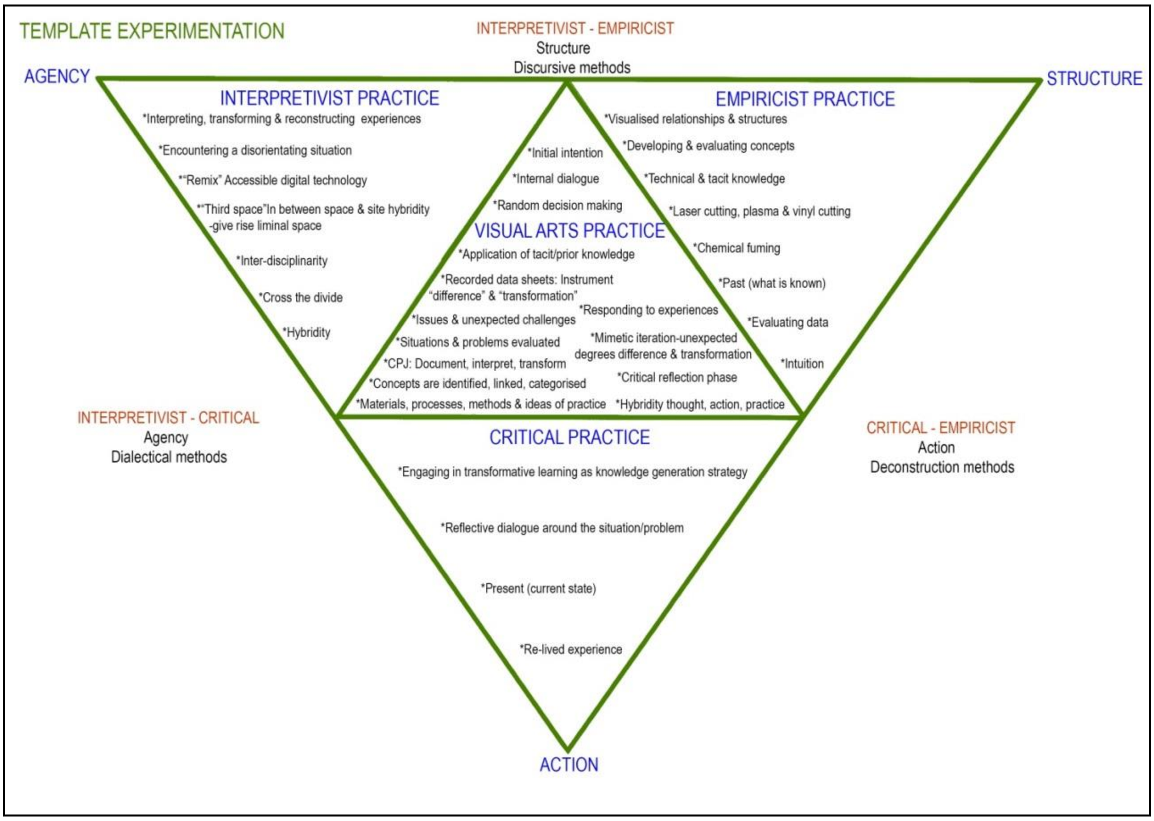


Figure 18. Schematic for template experimentation

With this batch of experimentations, I introduced various templates that left an imprint on the ceramic surface during the chemical fuming process. This interdisciplinary approach to exploring technology allowed me to consider different possibilities on accurate digital cutting of templates using hardboard, steel, copper sheeting and copper vinyl tape.

The first completed tests were cut from hardboard, which had been manufactured using different types of highly combustible compressed wood. When fired, this distinctly created some form of imprint. Prior to this, I consulted with the Central University of Technology's FabLab technician located in Bloemfontein regarding the technical aspects of laser-cutting hardboard. The FabLab is a grant-funded facility where the public (at no cost) can consult with qualified practitioners from engineering and design fields when developing a product or prototype. Access to this facility informed me regarding laser-cutting machine logistics and the successful conversion of the petroglyph archival data into a file format suited to laser-cutting and -engraving technology.

Various disorientating situations occurred as I shifted between several familiar and unfamiliar practice areas regarding methods and materials. Unexpected technical problems included the digital laser- and/or plasma-cutting of hardboard templates to accurately align with the tile size and format, limitations regarding the laser cutting of copper sheet metal and the unpredictable effects of warping when freehand plasma-cutting steel or copper sheeting.

Firstly, small (120 mm x 100 mm) hardboard motifs were cut to fit onto the bisque-fired tiles (Figure 19). Some of the areas were relatively thin (Figure 20) causing the heat of the laser to burn right through. Another problem was that the laser did not always cut through certain areas of the template (Figure 21). This occurred due to hardboard consisting of variable types of processed wood, which means that some areas are softer than others.

Figure 19. Hardboard laser-cut templates

Figure 20. Hardboard laser-cut template: High power 1

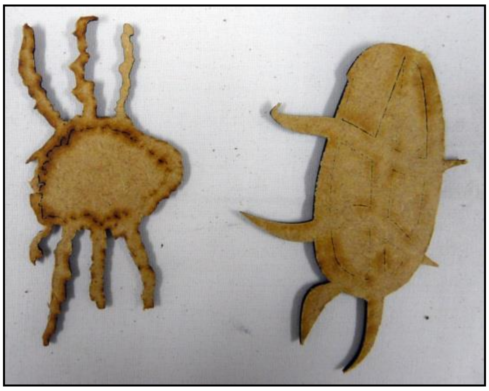


Figure 21. Hardboard laser-cut template: Low power

Reflection on my practice prompted me to question my role as creator when engaging in interdisciplinary collaboration or using automated technology. Awareness led me to think about the past and what it meant to be the manual creator in relation to the possibility of the machine becoming the digital author of my empiricist practice. Regardless of the answer to this open-ended question, within both contexts I still depended on technical and tacit knowledge as I evaluated and developed solutions to the problems through continual experimentation. I encountered unexpected restrictions regarding the capabilities of the Trotec 500 CO_2 laser-cutting machine to cut steel and copper sheeting. During "making" I then purposefully selected petroglyph motifs that did not contain extremely delicate lines or shapes in order to avoid further technical limitations. Actions and data surrounding technical limitations were interpreted, transformed and reconstructed, resulting in a strategy to manipulate steel and copper templates. I first laser-cut a hardboard template of the motif, and then traced the desired motif onto the steel and copper sheeting. Subsequently, this was cut using a handheld plasma cutter even though it left an unwanted bur on the metal template edge (Figure 22, 23).

Figure 22. Handheld plasma-cut copper templates

Figure 23. Handheld plasma-cut steel templates

After cutting a range of templates from the various materials, I again shifted the focus to my practice where I experimented with various chemical applications in conjunction with the cut templates. Throughout my intention was to create mimetic iterations of each motif, which resulted in unexpected degrees of difference and transformation as a result of the template material and type of chemical used.

Reflecting on the tacit and technical knowledge gained from previous chemical fuming experiments guided my selection of chemicals to use in conjunction with the templates. Methods of chemical application included spraying, scattering and directly painting the chemical onto the template and remaining ceramic surface. While experimenting with the hardboard templates, I followed my intuition and decided to pre-soak some of the templates in the chemicals for a set period of time. The results from these template experimentations revealed unexpected and fascinating surface effects. This approach to experimentation was successfully facilitated through maintaining an awareness of visualised relationships and structures regarding the pictorial use of the motif in conjunction with the achieved surface effect.

The integration of digital fabrication technology with my ceramics practice prompted a fusion of thoughts and actions regarding my practice. I often engaged in critical practice to allow for a reflexive dialogue concerning the new knowledge acquired through my “lived” and “re-lived” experience. Critical reflection on current actions brought about transformative learning, which resulted in an accessible knowledge generation strategy. This in-depth reflection on my “lived” and “re-lived” experience enabled the identification, linking and categorising of concepts, thoughts and actions essential to interdisciplinarity. At this point I again shifted to my empiricist practice where I reflected on my “past” technical experience and new knowledge that I had gained. Being aware of this during “making” stimulated an internal dialogue regarding the effective use of materials, processes and methods that I had employed.

3.10 CPJ documentation copper templates: “reflection in practice”

In the following section, “reflection in practice” is presented by the divisions “initial intention” and “knowing-in-action” in my CPJ journal.

This range of experiments required the use of CAD to trace vector lines of the archival photographic images taken from the Driekopseiland petroglyphs. The traced vector graphics were translated to a suitable file format (Adobe Illustrator file), to be read and cut from 3 mm hardboard by a Trotec Speedy 500 CO_2 laser cutting machine. The range of hardboard templates cut was used to transfer the motif onto 0.45 mm copper sheet. Laser-cutting 0.45 mm copper sheet is extremely difficult and expensive due to the reflective nature of the material. Additional mirrors are needed to deflect the laser beam away from the laser head, therefore the motifs were laser-cut out of 3 mm hardboard and traced onto the 0.45 mm copper sheet. The motifs were then cut by a handheld plasma cutter (Tradeweld Cut 60H Plasma Cutter 380v) and loosely placed (Figures 24,25) on tile surfaces before taken through to the chemical fuming process. The results from the various surface experimentations were descriptively recorded on individual datasheets inserted below.

Figure 24. Plasma-cut copper template 1

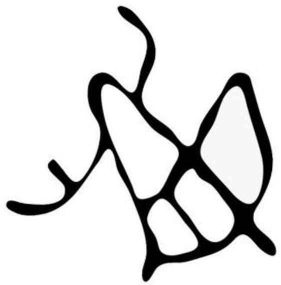
Figure 25. Plasma-cut copper template 2

3.11. Copper templates

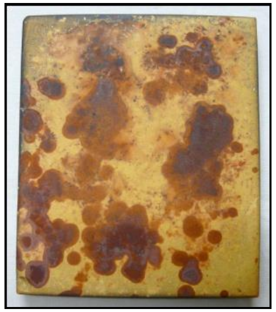
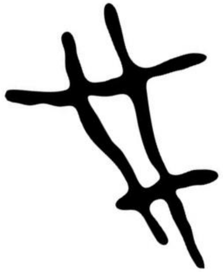
3.11.1 Datasheet 46: No chemical 01

<table>
<tr><td>Datasheet
no: 46</td><td colspan="2">Template experimentation tile
no:66</td><td>Temperature:
980 ˚C</td><td>Chemical application:
None</td><td>Chemical:
None</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2">NONE</td><td></td><td></td><td colspan="2">Reflection: The first template experimentation tile (TET) experiment I did using a copper template was to determine if it would at all create a surface effect if fired in an aluminium saggar at 980°C. No chemical was added in order to determine the effect that copper will have on the raw ceramic surface. The copper template left an almost exact copper/orange brown imprint on the surface. With two areas where some of the copper template fused with the ceramic surface.</td></tr>
</table>

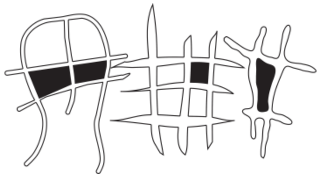
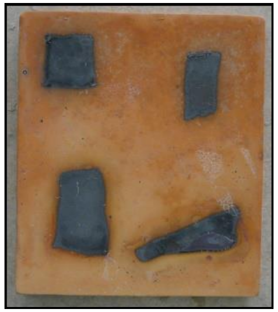
3.11.2 Datasheet 47: No Chemical 02

<table>
<tr><td>Datasheet
no: 47</td><td>Template experimentation tile
no: 69</td><td>Temperature:
980 ˚C</td><td>Chemical application:
None</td><td>Chemical:
None</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td>NONE</td><td></td><td></td><td colspan="2">Reflection: I replicated the experiment as in (3.11.1 TET 66) in order to confirm that the copper template does indeed leave an imprint on the surface. In this experiment the result of the imprint was not as clear as in (3.11.1 TET 66), the copper template however did leave an imprint which allows for the assumption that if copper is introduced in the ceramics chemical fuming it will leave an imprint. Copper is mined from Sulphide ores which consists of copper and sulphur, it is most probably the gaseous fumes which the sulphur creates when in the firing process that creates the copper-brown colouring and blurring of the template form where the template was placed.</td></tr>
</table>

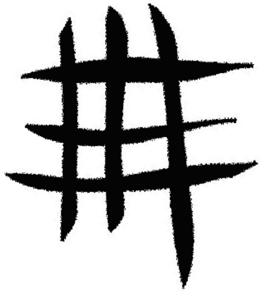
3.11.3 Datasheet 48: Ferric chloride

<table>
<tr><td>Datasheet
no: 48</td><td colspan="2">Template experimentation tile
no: 63</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 31</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment a solution of 30 ml Ferric chloride to 250 ml water was sprayed over the copper template positioned on the tile surface. This was done in order to achieve an even surface coverage. The copper template left an orange/brown imprint of the template and also influenced the overall tile surface coloration. This technique allowed for a more evenly orange/brown colour distribution instead of the darker red/brown patches achieved with the scattered Ferric chloride colour experimentation (3.4.10 CET 31).</td></tr>
</table>

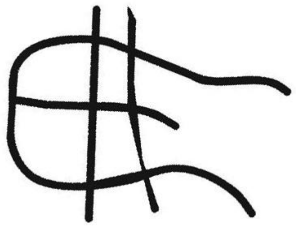
3.11.4 Datasheet 49: Sodium chloride

<table>
<tr><td>Datasheet
no: 49</td><td colspan="2">Template experimentation tile
no: 61</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Sodium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 07</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: This surface experiment explored the use of the solid negative spaces plasma cut from the copper template motif. The objective was to determine whether a larger surface area would create a defined surface imprint other than what was achieved with the more delicate templates. The solid negative space cut outs created a distinct imprint of the cut out form. Although the copper template had an influence on the overall surface colouration created, the orange/brown coloration of the ceramic tile surface still resembles the initial colour experimentation done using Sodium chloride (3.4.3 CET 07).</td></tr>
</table>

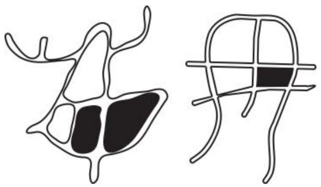
3.11.5 Datasheet 50: Cupric chloride

<table>
<tr><td>Datasheet
no: 50</td><td>Template experimentation tile
no: 68</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cupric chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 13</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: The imprint made by the copper template in this experiment created a similar mottled effect around the motif imprint as seen with the effect achieved on (3.4.10 CET13). The imprint left by the template shape was very dark with lighter coloration on the outer tile surface area; possibly due to the burn off of the chemical. The imprint edge is not clearly defined, this could have occurred due to some of the chemical seeping underneath the template. This probably happened because to too much chemical was sprayed on during application. The template could also have warped/lifted from the tiles' surface as the chemical fuming temperature is only 104°C below the melting point of Copper, which is 1084°C.</td></tr>
</table>

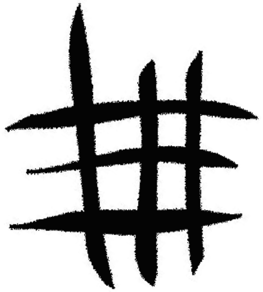
3.11.6 Datasheet 51: Lithium chloride

<table>
<tr><td>Datasheet
no: 51</td><td colspan="2">Template experimentation tile
no: 77</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Lithium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 14</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper template had to be cut thicker than the tile’s parameters as the vector drawing were very delicate and plasma cutting such a small template successfully is extremely difficult. Although the template is very delicate and did lift from the surface in certain areas, a definite brown imprint was created. The surface colour that emerged is light orange which can also be seen in the colour experimentation (3.4.12 CET 14) with Lithium chloride.</td></tr>
</table>

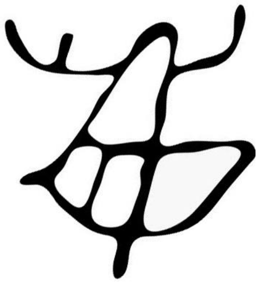
3.11.7 Datasheet 52: Potassium chloride

<table>
<tr><td>Datasheet
no: 52</td><td colspan="2">Template experimentation tile
no: 74</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Potassium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 12</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Darker defined imprints again manifested when solid negative spaces plasma cut from copper template motifs were used, the same as in (3.11.4 TET 61). The coloration of the rest of the surface is an orange/pink colour which has some strong resemblances to the orange coloration, which appeared on the outer areas of the tile, in the colour experimentation with Potassium chloride (3.4.13 CET12). A solution of 30 ml Potassium chloride to 250 ml water was sprayed over the tiles' surface which resulted in the orange/pink coloration being more evenly dispersed over the tiles' surface and not as vigorous as in (3.4.13 CET 12) which was scattered by hand.</td></tr>
</table>

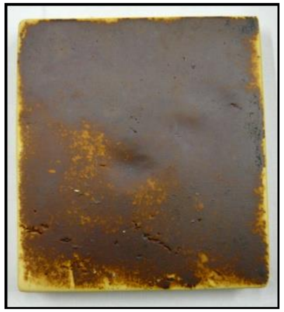
3.11.8 Datasheet 53: Zinc chloride

<table>
<tr><td colspan="2">Datasheet
no: 53</td><td colspan="2">Template experimentation tile
no: 73</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Zinc chloride</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 39</td><td colspan="2">Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td><td colspan="2">Reflection: The copper template created a very dark black-brown imprint with some mottled areas adjacent to the templates' imprint. The mottled imprints look like imprints made from the sawdust that was in contact with the template. The outside areas of the tiles' surface shows a peach colour which does resemble to the colour experimentation (3.7.4 CET 39) with Zinc chloride. As the chemical was sprayed with a 30 ml Zinc chloride to 250 ml water solution over the tiles' surface and not scattered by hand as in (3.7.4 CET 39) the surface colour is more evenly dispersed and not blotchy as in the colour experimentation with Zinc chloride.</td></tr>
</table>

3.11.9 Datasheet 54: Strontium chloride

Datasheet **no:** 54	**Template experimentation tile** **no:** 83	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Strontium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 23	Original vector drawing	TET effect	**Template type:** Copper 0.45 mm	
			**Reflection:** In this experiment I had to plasma cut the copper template larger than the tile's parameters due to the intricacy of the vector drawing. A dark brown imprint was created by the copper template with some speckled imprints surrounding the imprint left by the copper template which is probably from the sawdust that was situated near the template. Some areas of the imprint are darker with a copper-brown sheen; these areas are most likely darker since the copper template was probably very close to the tiles' surface. The light orange coloration of the rest of the tiles' surface does resemble the orange coloration which manifested on the outside areas of the tiles' surface in the colour experimentation with Strontium chloride (3.7.3 CET 23).	

3.11.10 Datasheet 55: Cupric carbonate

<table>
<tr><td>Datasheet
no: 55</td><td colspan="2">Template experimentation tile
no: 70</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cupric carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 36</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment I also had to cut the copper template larger than the tile’s parameters as the vector drawing is very delicate. A solution of 30 ml Cupric carbonate to 250 ml water was sprayed over the copper template, which were placed on the tiles’ surface, as well as over the rest of the tile. The copper template created a brown imprint, as well as some brown coloration on the rest of the surface. In the colour experimentation with Cupric carbonate (3.7.1 CET 36) the chemical was scattered by hand and not sprayed. The brown coloration which occurred on the outside areas of TET 70 is most likely where more chemical was applied and therefore created a darker brown colour than on the rest of the tiles’ surface. Two areas can be seen where parts of the copper template could not be removed from the tiles’ surface. It could possibly be that the copper template was in direct contact with the tiles’ surface in those areas and due to the extreme heat of the firing process part of the template fused with the ceramic surface.</td></tr>
</table>

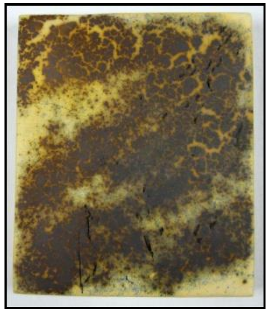
3.11.11 Datasheet 56: Cobalt carbonate

<table>
<tr><td>Datasheet
no: 56</td><td colspan="2">Template experimentation tile
no: 75</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cobalt carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 30</td><td>Original vector drawing:</td><td colspan="2">TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td colspan="2">Reflection: In this experiment I sprayed the chemical over the tiles’ surface using a solution of 30 ml Cobalt carbonate to 250 ml water. The copper template created an intriguing dark red-brown imprint on the tiles’ surface and not solid brown as in previous experimentations. A solid blue colour formed on the rest of the tiles’ surface, whereas in the colour experimentation (3.7.8 CET 30) with Cobalt carbonate, where the chemical was scattered by hand over the tiles’ surface, it was more of a mottled blue-brown colour. It was therefore deduced that if the chemical is sprayed over the tiles’ surface it should result in a more even solid blue colour, whereas scattering the chemical by hand results in a more speckled colour effect. It was also noted that Cobalt oxide changes the colour of the copper templates’ imprint on the ceramic surface which is probably due to a chemical reaction between the copper and the Cobalt carbonate.</td></tr>
</table>

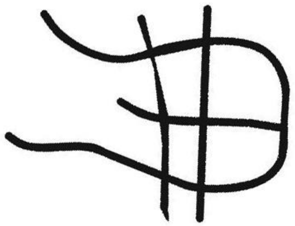
3.11.12 Datasheet 57: Lithium carbonate

<table>
<tr><td>Datasheet
no: 57</td><td colspan="2">Template experimentation tile
no: 72</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Lithium carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 25</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Unexpected surface effects emerged out of this experiment, the copper template created a dark brown-black imprint on the tiles' surface. Some parts of the copper template could not be removed from the tile as it fused with the ceramic surface. A peach-orange colour manifested on the rest of the surface with select green and white speckles near the imprint. The green and white speckles are most likely due to a chemical reaction between the copper and Lithium carbonate. The peach-orange colour which can be seen on the outside areas of the tile is a darker orange than the orange-yellow colour which manifested in the colour experimentation (3.7.7 CET 25) with Lithium carbonate.</td></tr>
</table>

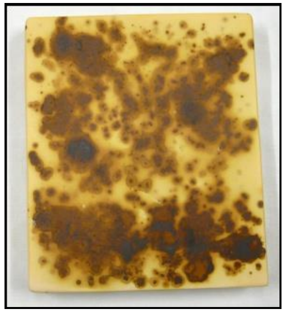
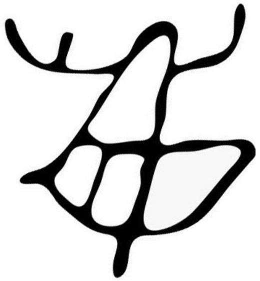
3.11.13 Datasheet 58: Copper carbonate

<table>
<tr><td>Datasheet
no: 58</td><td colspan="2">Template experimentation tile
no: 71</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Painted & scattered</td><td>Chemical:
Copper carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 47</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: I discovered that Copper carbonate does not totally dissolve in water. If the solution of 30 ml Copper carbonate to 250 ml water is not continuously stirred the chemical and water separates; leaving a thick layer of Copper carbonate at the bottom of the spray bottle and water at the top. Consequently, the semi-dissolved chemical was painted, as well as scattered over the tiles' surface and copper template. The outcome was a very dark brown-black imprint created by the copper template. The rest of the surface shows dark brown and green-blue coloration which results in the motif not being very prominent. Although most of the surface is very dark select areas on the outer vicinity of the tiles' surface shows a light green-blue coloration which also occurred in the colour experimentation (3.7.10 CET 47) with copper carbonate. For further experimentation one might get a more prominent imprint if the chemical is only scattered over the surface.</td></tr>
</table>

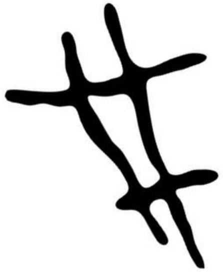
3.11.14 Datasheet 59: Potassium dichromate

Datasheet **no:** 59	**Template experimentation tile** **no:** 65	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Potassium dichromate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 44	Original vector drawing	TET effect	**Template type:** Copper 0.45 mm	
			**Reflection:** As previously mentioned some of the vector drawings were too small and delicate to be plasma cut within the size parameters of the tiles' surface. A larger template was therefore plasma cut in order to produce an adequate template. The copper template left a brown imprint with lighter and darker areas. As the chemical was sprayed over the tiles' surface and not scattered a more evenly dispersed colour effect emerged. In the colour experimentation (3.7.30 CET 44) with Potassium dichromate a combination of browns and greens emerged, although when the copper template was introduced in the experiment with Potassium dichromate only brown colours emerged. Therefore, when a copper template is introduced into chemical fuming in combination with Potassium dichromate it should have an effect on the overall coloration as well.	

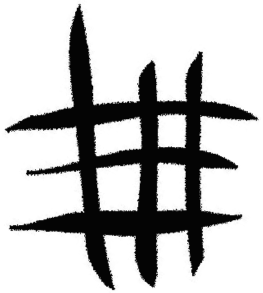
3.11.15 Datasheet 60: Cupric nitrate

<table>
<tr><td>Datasheet
no: 60</td><td>Template experimentation tile
no: 76</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed & scattered</td><td>Chemical:
Cupric nitrate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 34</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: Cupric nitrate also did not totally dissolve in water, so the semi-dissolved solution of 30 ml Cupric nitrate to 250 ml water was sprayed and scattered over the surface. In this experiment the opposite occurred as in the surface experimentation with copper carbonate (3.11.13 TET 71), where overall colouration occurred on the outer areas of the tiles’ surface. A defined imprint was created by the copper template with select brown spots on the rest of the surface. As the chemical did not totally dissolve in the water the solution which was sprayed over the tiles’ surface was diluted and therefore not much coloration occurred on the outer areas of the tiles’ surface. The few brown blotches which can be seen on the outer area of the tiles’ surface are possibly the result of the chemical which was also scattered over the surface.</td></tr>
</table>

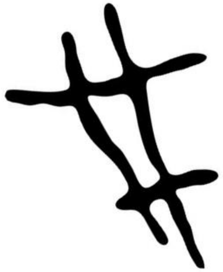
3.11.16 Datasheet 61: Ferric nitrate

<table>
<tr><td>Datasheet
no: 61</td><td>Template experimentation tile
no: 87</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric nitrate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 49</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: A rather unexpected surface effect emerged when I introduced a copper template in the experiment with Ferric nitrate. It was expected that the experiment would result in an evenly dispersed red surface colour with a brown imprint left by the copper template. Although a defined dark brown imprint was created by the template, no background colour manifested in the experiment. This is probably because the chemical was sprayed and not scattered as in the colour experimentation (3.7.12 CET 49) with Ferric nitrate. For further experimentation a stronger solution than 30 ml Ferric nitrate to 250 ml water should be used which should result in more intense surface coloration.</td></tr>
</table>

3.11.17 Datasheet 62: Potassium sulphate

<table>
<tr><td>Datasheet no: 62</td><td>Template experimentation tile no: 78</td><td>Temperature: 980 ˚C</td><td>Chemical application: Sprayed & painted</td><td>Chemical: Potassium sulphate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 24</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: Similar to copper carbonate, Potassium sulphate also does not totally dissolve in water. The chemical and water separates if the mixture is not continuously stirred. The chemical was sprayed and painted on the tiles’ surface to ensure surface coloration. The copper template did leave a light brown imprint, but it is not very prominent. As in the colour experimentation (3.7.17 CET 24) with Potassium sulphate, a darker area manifested in the centre of the tile, however when copper was introduced in the experiment the marks changed from black and green to a combination of black, grey and white. These marks could possibly be due to a chemical reaction between the copper template and the Potassium sulphate.</td></tr>
</table>

3.11.18 Datasheet 63: Cobalt oxide

<table>
<tr><td>Datasheet
no: 63</td><td colspan="2">Template experimentation tile
no: 79</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 22</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper 0.45 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Although Cobalt oxide does not completely dissolve in water it was possible to spray the semi-dissolved solution of 30 ml Cobalt oxide to 250 ml water over the tiles' surface. The chemical was sprayed in order to create an evenly distributed surface colour. The template left an unanticipated red-brown imprint with an evenly dispersed blue colour on the rest of the tiles' surface. The same surface effects emerged when copper was combined with Cobalt carbonate (3.11.11 TET 75). It can therefore be deduced that a chemical including Cobalt in combination with a copper template would probably result in a red/brown imprint with blue coloration on the rest of the ceramic surface.</td></tr>
</table>

3.11.19 Datasheet 64: Lithium carbonate

Datasheet **no:** 64	**Template experimentation tile** **no:** 108	**Temperature:** 1200 ˚C	**Chemical application:** Scattered	**Chemical:** Lithium carbonate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 25	Original vector drawing	TET effect	**Template type:** Copper 0.45 mm	
			**Reflection:** In the colour experimentation with Lithium carbonate (3.7.7 CET 25) the chemical did not totally evaporate in the firing process and so created a textured surface effect. It was therefore decided to do this experiment in combination with the copper template at a higher temperature (1200 ˚C). It was expected that the chemical would totally evaporate and that the copper template would fuse to the ceramic surface. As coppers' melting point is only approximately 1084 ˚C the copper template melted completely and covered the majority of the tiles' surface. Some coloration occurred, but the chemical still did not totally evaporate and again created a textured surface.	

3.11.20 Datasheet 65: Potassium sulphate

Datasheet no: 65	**Template experimentation tile no:** 105	**Temperature:** 1200 ˚C	**Chemical application:** Sprayed & scattered	**Chemical:** Potassium sulphate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 24	Original vector drawing	TET effect	**Template type:** Copper 0.45 mm	
			**Reflection:** This experiment was also done at a higher temperature (1200 ˚C), in order to see if the black and green marks, which manifested in the colour experimentation (3.7.17 CET 24) with Potassium sulphate, in the centre of the tiles' surface would disappear. The copper template totally melted and is not recognisable; some light brown-orange coloration does appear where the copper did not cover the tiles' surface, but as the copper template melted over the majority of the tile it is difficult to see what coloration occurred. It would therefore be recommended to rather do the experiment at a lower temperature (980 °) which would probably provide the desired surface effects.	

3.12 CPJ documentation copper templates: "reflection on practice"

In the following section, "reflection on practice" is presented by the divisions "reflection-in-action" and "reflection-on-action" recorded within my CPJ. From the range of surface experiments done I realised that introducing a copper template mostly left a brown imprint on the ceramic surface. Gradually, as various chemicals were combined with the copper templates, it was noted that the intensity of the colour of the imprints differed from one experiment to the next, which was most probably due to the surface reaction each chemical had. I also noted that a lighter imprint was created in the areas where the template did not lay flush on (came in contact with) the ceramic surface. The copper template warped when plasma-cut, which allowed the chemical to seep under the template and affecting the intensity of the imprint. This technical aspect was worrying at first, but then resulted in interesting surface effects.

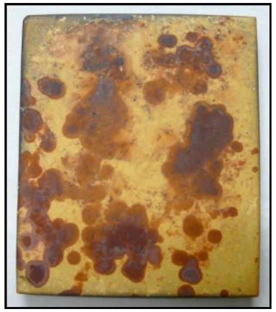
When combining chemicals with the copper sheet during the fuming process, the original chemically fumed colour changed. The majority of the copper templates in combination with various chemicals produced a brownish imprint. However, when a copper template was combined with cobalt carbonate/oxide or copper carbonate, the imprint changed to a dark brown/red imprint. One could, therefore, deduce that copper heated to 980 °C will emit chemical fumes that will alter the original surface coloration test where no template had been introduced.

3.13 CPJ documentation steel templates: "reflection in practice"

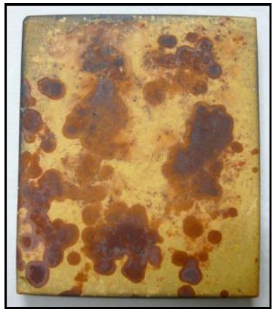
In the following section, "reflection in practice" is presented by the divisions "initial intention" and "knowing-in-action" in my CPJ journal. In this range of surface experiments I used the same CAD-drawn vector files to experiment with plasma-cut 2 mm thick steel templates. These templates were again used in combination with various chemical fumings. The objective was to determine what surface effects could be created when introducing steel templates into the chemical fuming process. As the majority of the copper templates warped due to the heat of the plasma-cutting, it was thought that a thicker and harder material would be a better material option to create templates that lay flush on the surface.

3.14 Steel templates

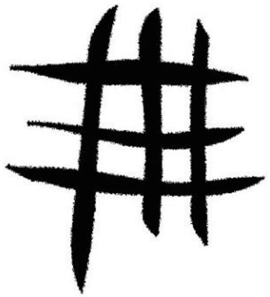
3.14.1 Datasheet 66: Ferric chloride

<table>
<tr><td>Datasheet
no: 66</td><td colspan="2">Template experimentation tile
no: 81</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 31</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: I was quite surprised by the interesting and unforeseen surface effect which manifested in this experiment. A solution of 30 ml Ferric chloride to 250 ml water was sprayed over the steel template positioned on the tile surface. The aim was to achieve an even surface coverage with a negative imprint created by the steel template. Instead the template created a “ghost like” red/peach imprint with very little coloration on the rest of the surface. It could possibly be that the steel template lifted from the tiles’ surface and some of the chemicals flowed underneath. Therefore, creating a positive imprint as the Ferric chloride reacted with the steel template when the temperature rose during the firing process.</td></tr>
</table>

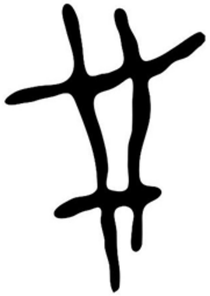
3.14.2 Datasheet 67: Ferric chloride 02

<table>
<tr><td>Datasheet
no: 67</td><td colspan="2">Template experimentation tile
no: 91</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 31</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Additional comments: A second experiment was done with Ferric chloride to see if the steel template will again create a “ghost like” imprint. An increased amount of the 30 ml Ferric chloride to 250 ml water solution was sprayed onto the tiles’ surface, as well as the steel template, which again resulted in a “ghost like” imprint. The rest of the surface does show more of an orange/red coloration as in the first experiment (3.14.1 TET 81), but the imprint in the first experiment is much darker. In this experiment the imprint made is more transparent with a darker orange outline in some areas. The effect which emerged in this experiment is most probably due to an increased amount of the Ferric chloride solution sprayed on to the tiles’ surface.</td></tr>
</table>

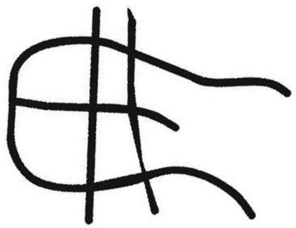
3.14.3 Datasheet 68: Sodium chloride

Datasheet no: 68	**Template experimentation tile no:** 85	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Sodium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 07	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** In this experiment the opposite occurred as in the previous experiment. A solution of 30 ml Sodium chloride to 250 ml water was sprayed over the tile, as well as the steel templates' surface. The steel template created a prominent black/red imprint with a copper sheen in some areas of the imprint. The rest of the surface shows an evenly distributed orange/brown coloration which does bear a resemblance to the colour experimentation done with Sodium chloride (3.4.3 CET 07). It can therefore be assumed that different chemicals most probably will react differently when steel is introduced into the chemical fuming process. Thus creating dissimilar positive or negative imprints and impacting on the original colour which the chemical produced in the colour experimentations.	

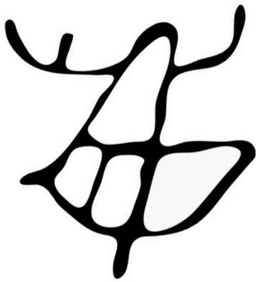
3.14.4 Datasheet 69: Lithium chloride

<table>
<tr><td>Datasheet
no: 69</td><td colspan="2">Template experimentation tile
no: 95</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Lithium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 14</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: The experiment with Lithium chloride and a steel template created a partially negative and positive imprint. A solution of 30 ml Lithium chloride to 250 ml water was sprayed over the tile, as well as the steel templates' surface in order to create uniform colour distribution over the surface. The range of orange/brown colours which emerged was more evenly distributed than in the colour experiment (3.4.12 CET 14) with Lithium chloride. It was also noted that no red colours emerged which covered the majority of the tiles' surface in the colour experiment with Lithium chloride. When cleaning the tile it appeared that various parts of the steel template fused with the ceramic surface and could not be removed, leaving certain areas with a black crusty texture. The area where the template was placed presents lighter coloration than on the rest of the surface, therefore displaying a negative imprint, but when looking at the crusty black textured areas and the upper left of the imprint a positive imprint emerges.</td></tr>
</table>

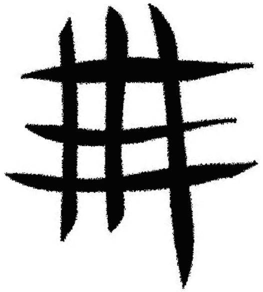
3.14.5 Datasheet 70: Potassium chloride

Datasheet **no:** 70	**Template experimentation tile** **no:** 90	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Potassium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 12	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** In this experiment the steel template left a very obscure imprint which is hardly recognisable. Light orange coloration did however appear over the whole surface of the tile which also emerged in the colour experimentation (3.4.13 CET 12) with Potassium chloride.	

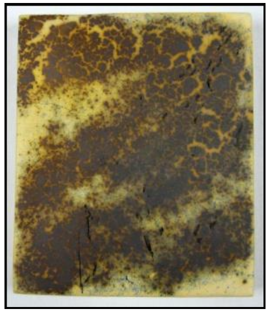
3.14.6 Datasheet 71: Cobalt carbonate

Datasheet **no:** 71	**Template experimentation tile** **no:** 99	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Cobalt carbonate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 30	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** Cobalt carbonate is a very strong chemical used to colour ceramic glazes and does not dissolve in either hot or cold water. It was therefore decided to scatter the Cobalt carbonate by hand over the surface of the tile and steel template. The template left a very indistinct, but identifiable negative imprint on the ceramic surface. The rest of the surface shows blue/green and orange coloration which displays a lighter representation of the colours which manifested in the colour experimentation with Cobalt carbonate (3.7.8 TET 30).	

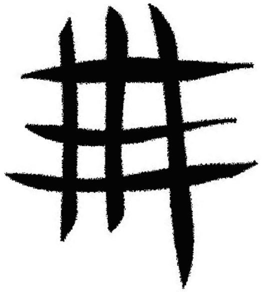
3.14.7 Datasheet 72: Lithium carbonate

Datasheet **no:** 72	**Template experimentation tile** **no:** 96	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Lithium carbonate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 25	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** Lithium carbonate also does not totally dissolve in water and was therefore scattered by hand over the tile and templates' surface. A very vague light orange imprint can be seen to the centre of the tile which is almost totally covered by darker orange and white blotches that emerged on the ceramic surface. In the colour experimentation (3.7.7 CET 25), as well as the surface experimentation with Lithium carbonate the coloration which appeared has a sort of crusty quality to it. It seems as if in both experiments that the Lithium carbonate did not totally burn away in the chemical fuming, but created white textured areas on various parts of the tiles.	

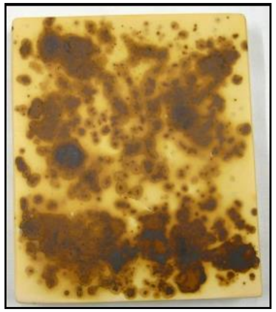
3.14.8 Datasheet 73: Copper carbonate

<table>
<tr><td>Datasheet
no: 73</td><td colspan="2">Template experimentation tile
no: 97</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Copper carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 47</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: The vector drawing used in this experimentation is very delicate and therefore the steel template had to be cut bigger than the tiles' parameters. This caused that only a part of the template could be used. In the chemical fuming the steel template, to a certain degree, fused with the ceramic surface and could not be removed without breaking of a part of the tile. The Copper carbonate was scattered by hand over the template and tiles' surface which created the same brown and green colours that emerged in the colour experimentation (3.7.10 CET 47) with Copper carbonate.</td></tr>
</table>

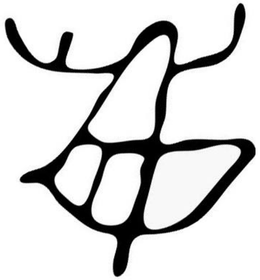
3.14.9 Datasheet 74: Potassium dichromate

<table>
<tr><td>Datasheet
no: 74</td><td colspan="2">Template experimentation tile
no: 98</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Potassium dichromate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 44</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Very similar to (3.14.4 TET 95) some of the steel template fused with the ceramic surface and could not be removed without breaking the tile. A solution of 30 ml Potassium dichromate to 250 ml water were sprayed over the template and tiles' surface in order to create even surface colour distribution with a negative imprint where the template was placed. The template left a "ghost like" negative light brown imprint. The rest of the ceramic surface shows light and dark brown coloration which does to a certain degree resemble the browns that emerged in the coloration experiment (3.7.30 TET 44) with Potassium dichromate. No green areas manifested as in the colour experimentation, this could be due to the fact that the Potassium dichromate was sprayed and not scattered.</td></tr>
</table>

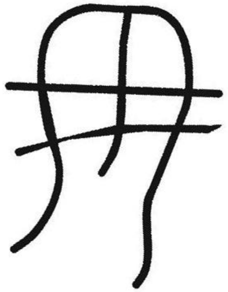
3.14.10 Datasheet 75: Cupric nitrate

<table>
<tr><td>Datasheet
no: 75</td><td colspan="2">Template experimentation tile
no: 92</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cupric nitrate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 34</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment a solution of 30 ml Cupric nitrate to 250 ml water was sprayed over the template and tiles’ surface in order to create a uniform surface colour. As in (3.14.8 TET 97) the steel template also fused to the ceramic surface and could not be removed without breaking the tile. Instead of a uniform surface colour emerging, as thought would happen, distinct orange spots formed underneath and near the template. Various brown speckles are visible which could have been made by sawdust absorbing the chemical and leaving the speckled imprint.</td></tr>
</table>

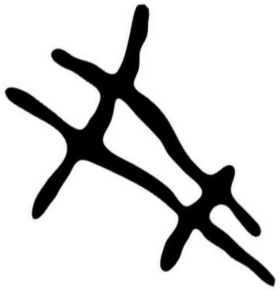
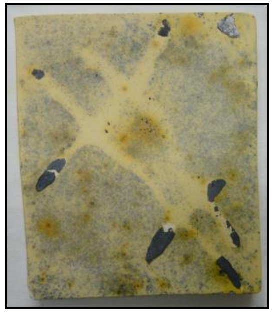
3.14.11 Datasheet 76: Ferric nitrate

Datasheet no: 76	**Template experimentation tile no:** 104	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Ferric nitrate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 49	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** A solution of 30 ml Ferric nitrate to 250 ml water was sprayed over the template and tiles' surface. The template left a negative imprint which can only be seen when examined from close up. This is probably due to the chemical being sprayed in a diluted form rather than scattered by hand. Light orange areas emerged on the rest of the surface, but do not relate to the vibrant reds that emerged in the coloration experiment (3.7.12 CET 49) with Ferric nitrate. If the Ferric nitrate was to be scattered by hand over the template and tiles' surface a clear negative imprint should be obtained.	

3.14.12 Datasheet 77: Potassium sulphate

Datasheet no: 77	**Template experimentation tile no:** 101	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Potassium sulphate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect:24	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** Similar to (3.14.2 TET 91) the steel template left a “ghost like” negative imprint. The solution of 30 ml Potassium sulphate to 250 ml water, which was sprayed over the template and tiles’ surface, resulted in light and darker oranges emerging on various parts of the ceramic surface. In one area the steel template fused with the ceramic surface and could not be removed.	

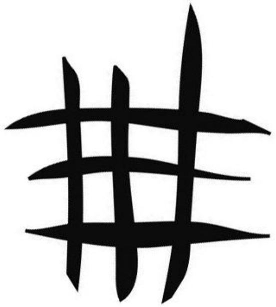
3.14.13 Datasheet 78: Cobalt oxide

<table>
<tr><td>Datasheet
no: 78</td><td>Template experimentation tile
no: 107</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 22</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Steel 2 mm</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: As Cobalt oxide does not totally dissolve in water, the chemical was scattered over the surface by hand. A defined negative imprint formed with select areas where the steel template fused with the surface and could not be removed. The rest of the surface shows blue/green and light orange coloration which looks like a lighter variation of the colours that emerged in the colour experiment (3.7.20 CET 22) done with Cobalt oxide.</td></tr>
</table>

3.14.14 Datasheet 79: Lithium carbonate

Datasheet **no:** 79	**Template experimentation tile** **no:** 102	**Temperature:** 1200 ˚C	**Chemical application:** Scattered	**Chemical:** Lithium carbonate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 25	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** As Lithium carbonate mostly gives a textured surface effect it was decided to do this experiment at a higher temperature (1200 ˚C) in order to see if the chemical will totally evaporate. The Lithium carbonate was scattered over the template and tiles' surface due to the fact that it does not dissolve in water. The steel template totally fused to the ceramic surface with a very rough black surface effect over the rest of the tile's surface. The chemical therefore did not totally melt, but aided as an adhesive for the template to fuse to the ceramic surface.	

3.14.15 Datasheet 80: Potassium sulphate

Datasheet **no:** 80	**Template experimentation tile** **no:** 106	**Temperature:** 1200 ˚C	**Chemical application:** Sprayed & scattered	**Chemical:** Potassium sulphate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 24	Original vector drawing	TET effect	**Template type:** Steel 2 mm	
			**Reflection:** This experiment was also fired at 1200 ˚C. Instead of the chemical evaporating and colouring the surface, it formed a textured crust like surface. The steel template did not leave a distinct negative imprint, except for one small section, at the top right of the tile, the rest of the surface is covered with light and dark browns.	

3.15 CPJ documentation steel templates: "reflection on practice"

In the following section, "reflection on practice" is presented by the divisions "reflection-in-action" and "reflection-on-action" recorded within my CPJ. In the above plasma-cut steel template experiments results revealed either positive or negative indistinct imprints of the original vector drawings. The positive or negative representations depended on the chemical used, as well as the manner in which it was applied. When scattering a chemical over the steel template and the ceramic surface, it created a negative imprint, whereas when the chemical was diluted with water and sprayed it created a positive imprint.

The 2 mm thick steel templates also did not lay flush on the surface due to the heat of plasma-cutting causing the steel to slightly bend and again allowing the chemical at times to flow underneath the template. As with the copper template fuming results, the chemical seeped underneath the steel template, which created a positive imprint due to the reaction between the chemical and the iron during the firing process. When the chemical ran underneath the steel template, it was in direct contact with the ceramic surface, which is why a positive imprint was created and not just an overall coloration of the surface. Furthermore, in various experimentations the steel templates totally fused with the ceramic surface which could not be removed. Some of the templates only partially fused, which caused a vague imprint combined with the fused metal. Technical aspects significant to the metal templates included the demarcation of scattered chemicals, as well as allowing chemicals to seep underneath the template surface when sprayed on.

3.16 CPJ documentation hardboard templates: "reflection in practice"

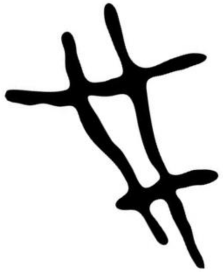
In the following section, "reflection in practice" is presented by the divisions "initial intention" and "knowing-in-action" in my CPJ journal. In this batch of surface experiments, the same vector files were used to laser-cut and chemically fume 3 mm thick hardboard templates. The copper and steel templates both bent when cutting, therefore it was thought to use a material that would not be influenced by the heat produced when laser cutting. The objective was to see what kind of surface effects the hardboard templates would create when pre-soaked and fumed.

3.17 Hardboard templates

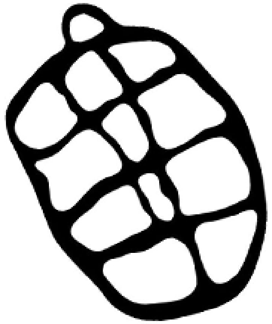
3.17.1 Datasheet 81: Sodium chloride

<table>
<tr><td>Datasheet
no: 81</td><td>Template experimentation tile
no: 02</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Sodium chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Clay saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 11</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: The colour experimentation (3.4.4 TET 11) with Sodium chloride was done in a clay saggar and therefore, out of curiosity I decided to do an experiment with a hardboard template in a clay saggar as well. The introduction of the soaked hardboard template offered some intriguing surface effects. The template left a light brown “ghost like” imprint with various oranges, browns and reds on the rest of the surface. Although the colours generated are not exactly the same as in the colour experimentation (3.4.4 TET 11) some similarities can be seen.</td></tr>
</table>

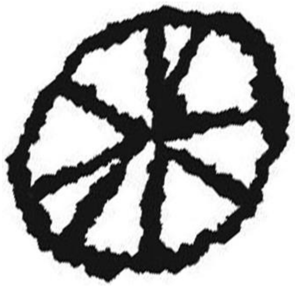
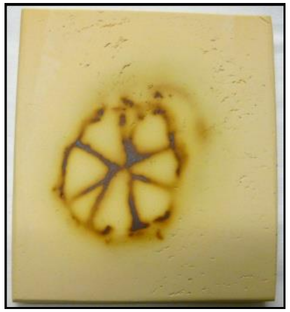
3.17.2 Datasheet 82: Sodium chloride 02

<table>
<tr><td>Datasheet
no: 82</td><td>Template experimentation tile
no: 19</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Sodium chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust, cow dung</td><td>Method: Clay saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 11</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked two days)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: For interests’ sake, I did a second experimentation with Sodium chloride. Cow dung was added as an extra combustible material in order to distinguish if it has an effect on the intensity of the imprint or colours generated. Again a “ghost like” imprint formed but more transparent as in the previous experiment. The overall coloration of the surface did change to more neutral browns and oranges. It can therefore be said that the type of combustible material used does impact on the intensity of colour and imprint formed.</td></tr>
</table>

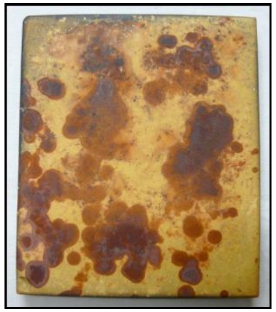
3.17.3 Datasheet 83: Sodium chloride 03

<table>
<tr><td>Datasheet
no: 83</td><td colspan="2">Template experimentation tile
no: 54</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Sodium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 07</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: The third experiment with Sodium chloride was done in an aluminium saggar and only with sawdust as combustible material. This was done in order to establish if a different type of saggar will affect the imprint’s intensity and colours generated on the rest of the ceramic surface. A glowing dark brown imprint formed where the template was placed with dark orange colouration around the imprint. Lighter orange colouration occurred on the rest of the ceramic surface. It could be deduced that not only do different types of saggars have different effects on the imprint and colours generated, but also the kind of combustible material used and the period of time which the template soaks in the chemical.</td></tr>
</table>

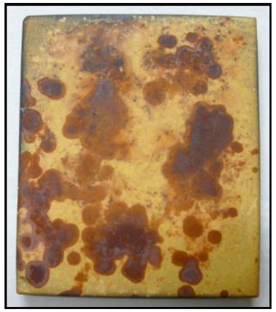
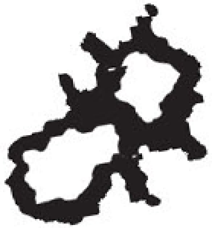
3.17.4 Datasheet 84: Cupric chloride

Datasheet no: 84	**Template experimentation tile no:** 52	**Temperature:** 980 ˚C	**Chemical application:** Soaked	**Chemical:** Cupric chloride
Combustible materials: None			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 13	Original vector drawing	TET effect	**Template type:** Hardboard (Soaked for four days)	
			**Reflection:** As hardboard consists of processed wood and thus a combustible material on its own, it was decided to do an experiment where no combustible material was added, only the hardboard template. As can be seen the template did leave a semi-precise brown imprint, but no coloration appeared on the rest of the surface. Therefore, it can be said that for the chemical to have an effect on the ceramic surface, where the template was not placed, it needs some kind of combustible material.	

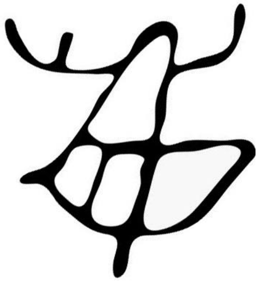
3.17.5 Datasheet 85: Ferric chloride

<table>
<tr><td>Datasheet
no: 85</td><td colspan="2">Template experimentation tile
no: 53</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 31</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment the hardboard template left an exact transparent light orange “ghost like” imprint similar to the experiment with Ferric chloride and a steel template (3.14.1 TET 81). The imprint formed by the hardboard template is barely visible and hardly any coloration appears on the rest of the surface.</td></tr>
</table>

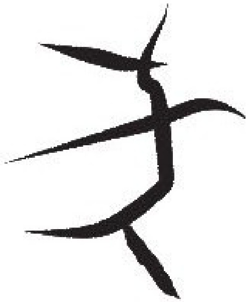
3.17.6 Datasheet 86: Ferric chloride 02

<table>
<tr><td>Datasheet
no: 86</td><td colspan="2">Template experimentation tile
no: 161</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 31</td><td>Original vector drawing</td><td colspan="2">TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td colspan="2">Reflection: In this experiment the imprint formed by the hardboard template was not as easily identifiable, although it does show a resemblance to the original vector drawing. Light yellow, white and orange colours emerged where the template was placed. On the rest of the ceramic surface a light transparent peach colour can be seen. Thus, when the hardboard template is only soaked in the chemical for one day it does make a difference in the colours generated and the accuracy and intensity of the imprint.</td></tr>
</table>

3.17.7 Datasheet 87: Potassium chloride

<table>
<tr><td>Datasheet
no: 87</td><td colspan="2">Template experimentation tile
no: 58</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Potassium chloride</td></tr>
<tr><td colspan="4">Combustible materials: None</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 12</td><td colspan="2">Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td></td><td colspan="2"></td><td></td><td colspan="2">Reflection: The surface effects obtained in this experiment bears a strong resemblance to the experimentation with Sodium chloride (3.17.3 TET 54). Although no combustible material was used in this experiment it still offered an intriguing imprint and surface colouration. Because the template soaked for four days in the chemical it was still able to form an almost precise dark brown imprint. Glowing orange coloration occurred around the area where the template was placed and creates a sort of “halo” around the imprint.</td></tr>
</table>

3.17.8 Datasheet 88: Potassium chloride 02

<table>
<tr><td>Datasheet
no: 88</td><td>Template experimentation tile
no: 156</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Potassium chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 12</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: A second experiment was done with Potassium chloride were the hardboard template was only soaked for one day. The template left a blurred peach and orange imprint which is quite different from the first experiment (3.17.7 TET 58), where the imprint was dark brown and relatively accurate. In this experiment the imprint did not leave a distinct imprint which might be due to the fact that sawdust was incorporated in the experiment or that the template was only soaked for one day in the chemical.</td></tr>
</table>

3.17.9 Datasheet 89: Lithium chloride

<table>
<tr><td>Datasheet
no: 89</td><td colspan="2">Template experimentation tile
no: 55</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Lithium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 14</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: The soaked hardboard template left a distinct, but not precise imprint on the surface. As in the first experiment with Potassium chloride (3.17.7 TET 58) an orange area can be seen around the area where the template was placed. The rest of the ceramic surface does not really show much coloration.</td></tr>
</table>

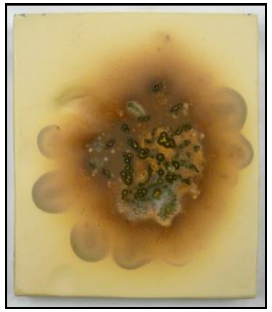
3.17.10 Datasheet 90: Lithium chloride 02

<table>
<tr><td>Datasheet
no: 90</td><td colspan="2">Template experimentation tile
no: 138</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Lithium chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 14</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: A second test was done with Lithium chloride where the hardboard template was only soaked for one day. The surface effects created totally differs from the previous experiments’ (3.17.9 TET 55). There is a vaguely resemblance between the imprint created by the template and the vector drawing. A light orange and white area manifested where the template was placed with an orange border, the rest of the surface shows light purple coloration which is not visible in the previous experiment.</td></tr>
</table>

3.17.11 Datasheet 91: Cupric carbonate

<table>
<tr><td>Datasheet
no: 91</td><td>Template experimentation tile
no: 57</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Cupric carbonate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 16</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the hardboard template did not leave a precise imprint, but the original template is recognisable. The template left a brown/orange ghost-like imprint, whereas the rest of the ceramic surface shows overall light brown coloration with select brown speckles.</td></tr>
</table>

3.17.12 Datasheet 92: Potassium dichromate

<table>
<tr><td>Datasheet
no: 92</td><td>Template experimentation tile
no: 51</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Potassium dichromate</td></tr>
<tr><td colspan="3">Combustible materials: None</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 44</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for four days)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: I was quite surprised and fascinated by the surface effects that manifested in this experiment. The hardboard template did not leave a recognisable imprint, but it created an interesting surface effect. In the centre of the tile light green and dark brown areas can be seen which is similar to the greens and browns that manifested in the colour experimentation (3.7.30 TET 44) with Potassium dichromate. This vague, ghost-like imprint could possibly be the result of a shortage of combustible materials, as none was used.</td></tr>
</table>

3.17.13 Datasheet 93: Potassium dichromate 02

<table>
<tr><td>Datasheet
no: 93</td><td>Template experimentation tile
no: 163</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Potassium dichromate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 44</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: A second experiment was done with Potassium dichromate, but the hardboard template was only soaked for one day and sawdust was added as combustible material. The template left an imprint that to a certain degree does resemble the original template, but the imprint was again very unclear. The same browns and greens can be seen where the template was placed. The rest of the surface shows a light brown/pink coloration and not orange as in the previous experiment.</td></tr>
</table>

3.17.14 Datasheet 94: Ferric nitrate

<table>
<tr><td>Datasheet
no: 94</td><td>Template experimentation tile
no: 166</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Ferric nitrate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 49</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the soaked hardboard template left a very vague orange ghost-like imprint. The rest of the surface shows light peach coloration which does not at all relate to the colour experimentation (3.7.12 TET 49) with Ferric nitrate.</td></tr>
</table>

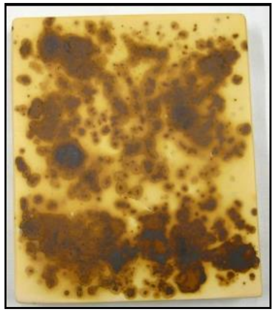
3.17.15 Datasheet 95: Sodium chloride

Datasheet **no:** 95	**Template experimentation tile** **no:** 135	**Temperature:** 980 ˚C	**Chemical application:** Soaked	**Chemical:** Sodium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 07	Original vector drawing	TET effect	**Template type:** Hardboard (Soaked for one day)	
			**Reflection:** The surface effects demonstrated in this experiment were quite mesmerising and unique. A white area manifested where the hardboard template was placed, instead of the template leaving a positive imprint on the surface. Darker red/peach coloration is noted around the area where the template was placed with lighter red/peach coloration on the rest of the surface. The template did not leave a positive imprint, but the form of the original template can be identified where the template was placed.	

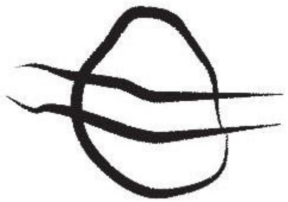
3.17.16 Datasheet 96: Zinc chloride

<table>
<tr><td>Datasheet
no: 96</td><td>Template experimentation tile
no: 139</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Zinc chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 39</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the imprint left by the soaked hardboard template can hardly be seen. The rest of the surface shows light pink, orange and white coloration. The vague imprint left by the template might be due to the short period that it was soaked in the chemical. If the template is soaked for a longer period it appears to leave a more distinct imprint.</td></tr>
</table>

3.17.17 Datasheet 97: Cupric nitrate

Datasheet no: 97	**Template experimentation tile no:** 141	**Temperature:** 980 ˚C	**Chemical application:** Soaked	**Chemical:** Cupric nitrate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 34	Original vector drawing	TET effect	**Template type:** Hardboard (Soaked for one day)	
			**Reflection:** The soaked hardboard template left a recognizable, but not an exact imprint of the template. A lighter brown area can be seen around the imprint area with light pink and white coloration on the rest of the ceramic surface. The brown imprint colour does resemble to the colour experimentation (3.7.13 TET 34) done with Cupric nitrate, but the light pink and white coloration was not expected. If the hardboard template is soaked for a longer time period more brown coloration should appear.	

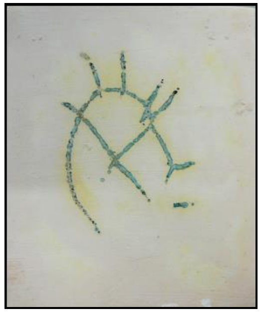
3.17.18 Datasheet 98: Potassium sulphate

<table>
<tr><td>Datasheet
no: 98</td><td colspan="2">Template experimentation tile
no: 164</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Soaked</td><td>Chemical:
Potassium sulphate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 24</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard (Soaked for one day)</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment the soaked hardboard template left a semi-recognisable light pink and orange imprint. Four black marks can be seen with areas of green coloration, which were also present in the colour experimentation (3.7.17 TET 24) with Potassium sulphate. The rest of the surface shows light peach coloration which is not present in the colour experimentation. The indistinct imprint could be due to the fact that the template was cut very small and/or only soaked for one day.</td></tr>
</table>

3.17.19 Datasheet 99: Cupric chloride

Datasheet **no:** 99	**Template experimentation tile** **no:** 159	**Temperature:** 980 ˚C	**Chemical application:** Soaked	**Chemical:** Cupric chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 13	Original vector drawing	TET effect	**Template type:** Hardboard (Soaked for one day)	
			**Reflection:** In this experiment the soaked hardboard template left a precise brown imprint on the surface. In the colour experimentation with Cupric chloride (3.4.11 TET 13) similar brown coloration occurred on the ceramic surface. The rest of the surface shows a light pink coloration which does not have any resemblance to the colour experimentation, but does create a unique contrast to the brown imprint.	

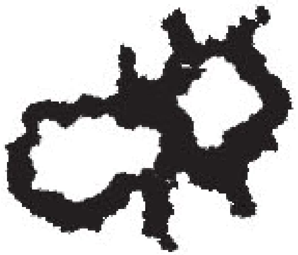
3.17.20 Datasheet 100: Strontium chloride

Datasheet no: 100	**Template experimentation tile no:** 160	**Temperature:** 980 ˚C	**Chemical application:** Soaked	**Chemical:** Strontium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 23	Original vector drawing	TET effect	**Template type:** Hardboard (Soaked for one day)	
			**Reflection:** The soaked hardboard template left a semi-accurate green imprint with light pink and white coloration on the rest of the surface. In the colour experimentation (3.7.3 TET 23) purples, orange and whites are present, but no greens, it was therefore quite interesting that the template left a green imprint. The areas where the hardboard template was very thin did not leave an imprint, which might be because the template burned away before the chemicals could leave an imprint via the template.	

3.17.21 Datasheet 101: Cobalt oxide

Datasheet no: 101	**Template experimentation tile no:** 154	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Cobalt oxide
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 22	Original vector drawing	TET effect	**Template type:** Hardboard	
			**Reflection:** As Cobalt oxide does not completely dissolve in water I decided to use the hardboard template to create a negative imprint instead of soaking it. The template was placed on the ceramic tile and Cobalt oxide was scattered over the surface. The negative imprint is not very clear but is recognisable. If more Cobalt oxide is used the negative imprint should be more prominent and the blue colouration on the rest of the ceramic surface would probably be darker.	

3.17.22 Datasheet 102: Iron oxide

Datasheet no: 102	**Template experimentation tile no:** 153	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Iron oxide
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 43	Original vector drawing	TET effect	**Template type:** Hardboard	
			**Reflection:** As Iron oxide does not totally dissolve in water I decided to also use it to create a negative imprint. A ghost like imprint can be seen, but instead of leaving a negative imprint, peach/orange coloration appeared in the area where the template was placed with two darker orange patches in the negative areas of the template. The rest of the surface shows light orange coloration and not the expected darker orange. The peach/orange imprint could possibly have formed due to an excessive amount of iron oxide scattered on to the template.	

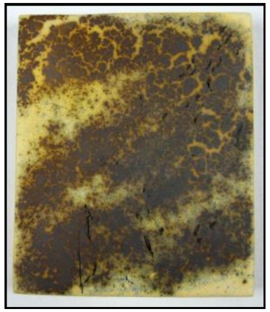
3.17.23 Datasheet 103: Yellow ochre

<table>
<tr><td colspan="2">Datasheet
no: 103</td><td colspan="2">Template experimentation tile
no: 152</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Yellow ochre</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 32</td><td>Original vector drawing</td><td colspan="2">TET effect</td><td colspan="2">Template type: Hardboard</td></tr>
<tr><td colspan="2"></td><td></td><td colspan="2"></td><td colspan="2">Reflection: As Yellow ochre also does not dissolve in water I decided to rather scattered it over the hardboard template to potentially create a negative imprint. The negative imprint of the template can only be partially seen. This could be the result of not enough ochre scattered on the outside areas of the tile. The outside areas of the surface show light peach coloration, yet the same orange colour manifested in the centre of the surface as in the colour experimentation (3.7.23 TET 32) with Yellow ochre.</td></tr>
</table>

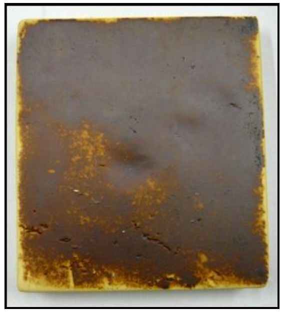
3.17.24 Datasheet 104: Cobalt carbonate

<table>
<tr><td>Datasheet
no: 104</td><td colspan="2">Template experimentation tile
no: 142</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 30</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experimentation the Cobalt carbonate was also scattered over the hardboard template as it showed difficulty dissolving in water. An almost precise negative imprint formed on the ceramic surface where the template was placed. On the rest of the surface light blue and brown coloration can be seen.</td></tr>
</table>

3.17.25 Datasheet 105: Copper carbonate

Datasheet no: 105	**Template experimentation tile no:** 146	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Copper carbonate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 47	Original vector drawing	TET effect	**Template type:** Hardboard	
			**Reflection:** Due to the difficulty of Copper carbonate dissolving in water it was scattered over the hardboard template. A precise negative imprint formed on the surface where the template was placed with some areas showing brown coloration. This could be areas where the template burned onto the surface in the firing process. The rest of the surface shows similar brown coloration as in the colour experimentation (3.7.10 TET 47) with Copper carbonate.	

3.17.26 Datasheet 106: Cupric carbonate

<table>
<tr><td>Datasheet
no: 106</td><td colspan="2">Template experimentation tile
no: 155</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cupric carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 36</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Hardboard</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment Cupric carbonate was also scattered over the hardboard template. The template produced a semi-precise light brown and white negative imprint on the ceramic surface. The rest of the surface shows dark brown coloration that is similar to the brown coloration in the colour experimentation (3.7.1 TET 36) with Cupric carbonate.</td></tr>
</table>

3.18 CPJ documentation template experimentation: “reflection on practice”

In the following section, “reflection on practice” is presented by the divisions “reflection-in-action” and “reflection-on-action” recorded within my CPJ. Two technical approaches were followed with the hardboard template experimentation: 1.) soaking the hardboard templates for a period of time in a mixed solution of the chemical and water, and 2.) scattering the chemical directly over the dry hardboard template and the rest of the bisque-fired ceramic surface. Results revealed that, when the templates were soaked for one day, the imprints created by the hardboard templates were feint, producing a feint surface imprint and light coloration. When the templates were soaked for four days, the imprints created were more defined representations of the original vector drawings, and the coloration of the surface and the imprint was darker.

As some of the chemicals did not completely dissolve in water, I again decided to rather scatter them over the template and the remaining surface of the ceramic tile. This approach mostly created distinct negative imprints of the laser-cut hardboard templates, but in some experiments positive imprints were formed. Furthermore, it was noted that much smaller and complex designs could be laser-cut in hardboard than in steel or copper sheet. This enabled me to create more detailed complex design solutions. To create such small and complex designs by hand would be very time consuming, if at all possible.

3.19 CPJ documentation copper vinyl tape templates: “reflection in practice”

In the following section, “reflection in practice” is presented by the divisions “initial intention” and “knowing-in-action” in my CPJ journal. To laser-cut copper sheet is extremely expensive, as the reflective surface can damage the head of the laser cutter. A special mirror attachment is needed to divert the laser beam that reflects the conductive properties of the copper sheet away from the head of the laser cutter. Most companies are reluctant to laser-cut copper sheeting, as it holds a high risk to their equipment and there is not much demand for this process. Consequently, I decided to do a group of experiments exploring cutting copper vinyl tape templates and using the Ronald GX-24 CAMM-1 SERVO vinyl cutting machine. Copper vinyl tape is predominantly used within electrical circuit board applications. The copper vinyl tape has an adhesive backing, which firmly adheres to a ceramic surface.

This detailed cutting machine allowed me to use more complex vector drawings, as well as drawings which consisted of multiple parts (Figure 26). Due to the adhesive qualities of copper vinyl tape an advantage was that no chemical could run underneath the template, resulting in a more defined chemical imprint.

Figure 26. Copper vinyl tape motif

3.20 Copper vinyl tape

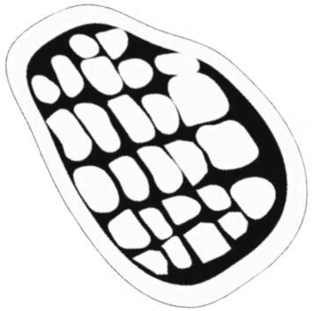
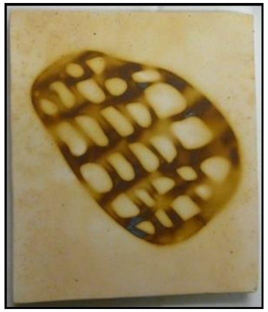
3.20.1 Datasheet 107: Strontium chloride

Datasheet **no:** 107	**Template experimentation tile** **no:** 133	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Strontium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 23	Original vector drawing	TET effect	**Template type:** Copper vinyl	
			**Reflection:** In this experiment the chemical was sprayed over the copper vinyl template and the remaining surface. The template left a precise dark brown imprint on the surface due to the chemical not being able to run underneath the template. Some areas have lighter brown coloration which could be the result of the template not totally adhering to the ceramic surface in those areas. The rest of the surface shows no coloration.	

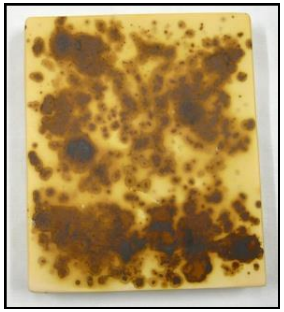
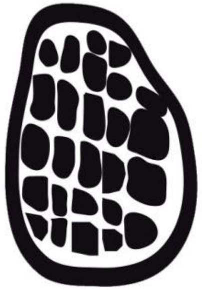
3.20.2 Datasheet 108: Cupric chloride

<table>
<tr><td>Datasheet
no: 108</td><td colspan="2">Template experimentation tile
no: 150</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Cupric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 13</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper vinyl template again created a precise dark brown imprint on the surface, similar to the experiment with Strontium chloride (3.20.1 TET 133). No coloration occurred on the rest of the surface although; in the area around the brown imprint speckles of brown coloration formed.</td></tr>
</table>

3.20.3 Datasheet 109: Potassium sulphate

<table>
<tr><td>Datasheet
no: 109</td><td>Template experimentation tile
no: 143</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Potassium sulphate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 24</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper vinyl tape left an exact brown imprint on the surface with light orange coloration on the rest of the surface. The imprint varies in intensity of colour, not like the solid brown imprint which manifested in the experiment with cupric chloride (3.20.2 TET 150).</td></tr>
</table>

3.20.4 Datasheet 110: Cupric nitrate

Datasheet no: 110	**Template experimentation tile no:** 145	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Cupric nitrate
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 34	Original vector drawing	TET effect	**Template type:** Copper vinyl	
			**Reflection:** In this experiment the copper vinyl tape left a brown imprint on the surface. Variations in the colour intensity can be seen on the imprint and the rest of the surface shows speckled brown coloration. Using transfer plastic it was possible to transfer the loose design segments as they were cut. One can see that the spacing between the positive parts in the vector drawing replicate the spacing in the TET effect.	

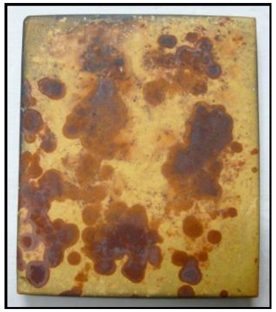
3.20.5 Datasheet 111: Potassium chloride

<table>
<tr><td>Datasheet
no: 111</td><td>Template experimentation tile
no: 140</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Potassium chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 12</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: Intriguing surface effects manifested in this experiment. The copper vinyl template created a precise dark brown/black glowing imprint on the surface with light peach and brown coloration on the rest of the surface. The colour intensity of the imprint is much higher than those of the previous experiments with copper vinyl.</td></tr>
</table>

3.20.6 Datasheet 112: Ferric nitrate

<table>
<tr><td>Datasheet
no: 112</td><td colspan="2">Template experimentation tile
no: 158</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric nitrate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 49</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper vinyl template created an exact brown imprint on the surface. Variations in the colour intensity on the imprint can be seen with light peach coloration on the rest of the surface. If the Ferric nitrate is scattered and not sprayed over the surface more intense colouration should occur.</td></tr>
</table>

3.20.7 Datasheet 113: Ferric chloride

<table>
<tr><td>Datasheet
no: 113</td><td colspan="2">Template experimentation tile
no: 137</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Ferric chloride</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 31</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: The copper vinyl template created a dark glowing brown/black imprint on the surface which is similar to the imprint in the experimentation with Potassium chloride (3.20.5 TET 140). The rest of the surface shows light peach/brown coloration.</td></tr>
</table>

3.20.8 Datasheet 114: Potassium dichromate

<table>
<tr><td>Datasheet
no: 114</td><td>Template experimentation tile
no: 144</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Potassium dichromate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 44</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: I was astonished with the surface effects in this experiment. It was quite unique and different from the other experiments' surface effects. The copper vinyl template created a precise, but "ghost like" brown imprint on the surface which varies in colour intensity. The colouration of the imprint is much more subdued than those of the previous experiments and creates a much more tranquil feel to the tile. The rest of the surface shows light brown coloration that creates an interesting contrast with the darker brown imprint.</td></tr>
</table>

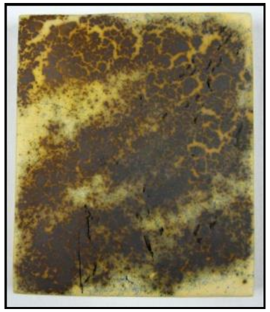
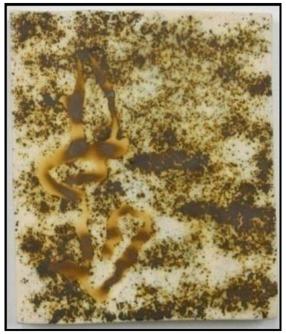
3.20.9 Datasheet 115: Sodium chloride

<table>
<tr><td>Datasheet
no: 115</td><td>Template experimentation tile
no: 151</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Sprayed</td><td>Chemical:
Sodium chloride</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 07</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper vinyl template left a semi-precise dark brown/black imprint on the surface which is similar to the experiments done with Ferric chloride (3.20.7 TET 137) and Potassium chloride (3.20.5 TET 140). The rest of the surface shows variations of orange coloration that are similar to the oranges which formed in the colour experimentation with Sodium chloride (3.4.3 TET 07).</td></tr>
</table>

3.20.10 Datasheet 116: Lithium chloride

Datasheet **no:** 116	**Template experimentation tile** **no:** 147	**Temperature:** 980 ˚C	**Chemical application:** Sprayed	**Chemical:** Lithium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
CET effect: 14	Original vector drawing	TET effect	**Template type:** Copper vinyl	
			**Reflection:** In this experiment the copper vinyl template left an almost precise solid dark brown/black imprint on the surface. The rest of the surface shows variations of light peach, brown and red which are similar to the colours that manifested in the experimentation with Sodium chloride (3.20.9 TET 151).	

3.20.11 Datasheet 117: Copper carbonate

<table>
<tr><td>Datasheet
no: 117</td><td colspan="2">Template experimentation tile
no: 157</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Copper carbonate</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 47</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Copper carbonate does not completely dissolve in water and was therefore scattered over the copper vinyl template and remaining surface. The template created an exact brown imprint on the surface with various intensities in colour. The rest of the surface shows brown and green coloration, similar to the colour experimentation done with Copper carbonate (3.7.10 TET 47). With the imprint not being a solid brown, it blends in with the rest of the surfaces' colour; this forces the viewer to move closer to the surface in order to study the imprint in more detail.</td></tr>
</table>

3.20.12 Datasheet 118: Cobalt oxide

<table>
<tr><td>Datasheet
no: 118</td><td colspan="2">Template experimentation tile
no: 148</td><td>Temperature:
980˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 22</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: Cobalt oxide also does not totally dissolve in water and so I decided to scattered the chemical over the template and remaining surface. The copper vinyl template left a brown ghost like imprint on the surface which varies in colour intensity. The rest of the surface shows a variety of speckled blue and brown coloration. Similar to the experimentation with Copper carbonate (3.20.11 TET 157) the imprint blends in with the rest of the surface and creates an intriguing surface effect that forces the viewer to further engage with the surface.</td></tr>
</table>

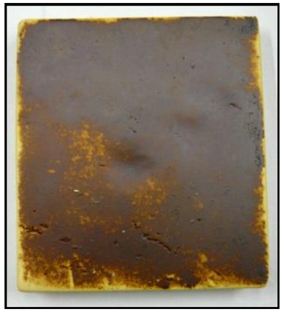
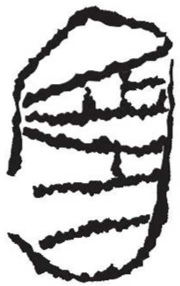
3.20.13 Datasheet 119: Yellow ochre

<table>
<tr><td>Datasheet
no: 119</td><td colspan="2">Template experimentation tile
no: 165</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Yellow ochre</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 32</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td></td><td></td><td colspan="2">Reflection: As Yellow ochre has difficulty completely dissolving in water the chemical was rather scattered over the template and remaining surface. The copper vinyl template left an exact brown imprint on the surface. The rest of the surface shows light orange coloration that is similar to the coloration in the colour experimentation with yellow ochre (3.7.23 TET 32).</td></tr>
</table>

3.20.14 Datasheet 120: Iron oxide

<table>
<tr><td>Datasheet
no: 120</td><td>Template experimentation tile
no: 162</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Iron oxide</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 43</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: In this experiment the copper vinyl template left an exact brown imprint on the surface with variations in colour intensity. The rest of the surface shows light pink coloration with areas which are darker. After the firing process some of the Iron oxide was still present on the surface; the ceramic tile was cleaned with water and when it was dried with a cloth the Iron oxide made the darker pink marks on the surface. If the Iron oxide is painted on the surface one should get darker pink and/or orange coloration on the surface.</td></tr>
</table>

3.20.15 Datasheet 121: Cupric carbonate

<table>
<tr><td colspan="2">Datasheet
no: 121</td><td colspan="2">Template experimentation tile
no: 149</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cupric carbonate</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">CET effect: 36</td><td colspan="2">Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td><td></td><td colspan="2">Reflection: The copper vinyl template did leave a brown imprint on the surface, but as the rest of the surface shows very dark brown and black coloration it is difficult to see the imprint. The dark brown coloration is similar to the coloration in the colour experiment with Cupric carbonate (3.7.1 TET 36). If less Cupric carbonate is scattered over the surface one might get lighter brown coloration and a better contrast between the imprint and the rest of the surface.</td></tr>
</table>

3.20.16 Datasheet 122: Cobalt carbonate

<table>
<tr><td>Datasheet
no: 122</td><td>Template experimentation tile
no: 131</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt carbonate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>CET effect: 30</td><td>Original vector drawing</td><td>TET effect</td><td colspan="2">Template type: Copper vinyl</td></tr>
<tr><td></td><td></td><td></td><td colspan="2">Reflection: The copper vinyl template left a precise brown imprint on the surface with variations in colour intensity. The rest of the ceramic surface shows light blue and brown coloration. The surface effects in this experiment show similarities to the surface effects in the experiment with Cobalt oxide (3.20.12 TET 148) except that Cobalt carbonate created more speckled blue coloration.</td></tr>
</table>

3.21 CPJ documentation copper vinyl tape templates: "reflection on practice"

In the following section, "reflection on practice" is presented by the divisions "reflection-in-action" and "reflection-on-action" recorded within my CPJ. When chemically fuming the copper vinyl tape templates, it resulted in exact representations of the templates. The surface imprints were mostly brown due to the copper component present in the templates, with dissimilar colour effects created on the remaining ceramic surface. Results showed that all the chlorides with which had been experimented (sodium, potassium, ferric and lithium) had created darker brown/black imprints on the surface.

The adhesive backing of the copper vinyl tape prevented the chemicals from seeping underneath the template. When the copper vinyl tape did not totally adhere to the ceramic surface, the imprint was indistinct in those areas. Furthermore, by using transfer plastic, very complex and small designs could be cut and transferred to the ceramic surface with ease. The characteristic of the copper vinyl tape enabled me to create very fine and complex designs on the ceramic surface. If these fine designs were to be cut by hand, it would be immensely time consuming and achieving accuracy would be difficult.

On the whole, I was very satisfied with the surface effects created with this batch of experiments. These were the first experiments that left a precise imprint due to the copper vinyl tape adhering to the ceramic surface. The application of this technique would be very effective on a larger scale work where specific detailed line work is required.

3.22 CPJ documentation laser-engraving: "reflection in practice"

In the following section, "reflection in practice" is presented by the divisions "initial intention" and "knowing-in-action" in my CPJ. In this range of experiments, the vector drawings were used to explore the possibility of laser-engraving on the bisque fired and chemically fumed ceramic tiles. The objective was to see if the Trotec Speedy 500 CO_2 flatbed (1 245 mm x 710 mm) laser machine could adequately engrave directly on a handmade ceramic tile surface and capture the desired detail (Figure27-31).

There are three settings that can be altered when cutting and engraving on the Trotec Speedy 500:

1. Power
2. Velocity (speed)
3. Z-offset (height)

The Z-offset (controlled de-focus) is used to increase contrast when engraving. The higher the Z-offset is set, the darker the engraved images. However, when using the Z-offset, a decrease in engraved detail occurred. Forty-nine (49) laser-cutting and laser-engraving experimentations were done on a bisque-fired tile to explore the effects that the different settings would produce. Thereafter, settings producing the most desired effects were used to engrave and/or cut selected vector drawings onto chemically fumed tiles. Datasheets listed below reflect experimentations with the various machine settings on bisque-fired ceramic tiles.

3.23 Laser-engraving

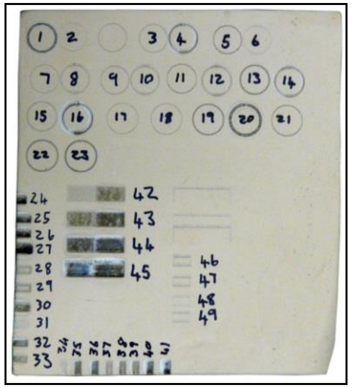


Figure 27. TET 123: 1-49

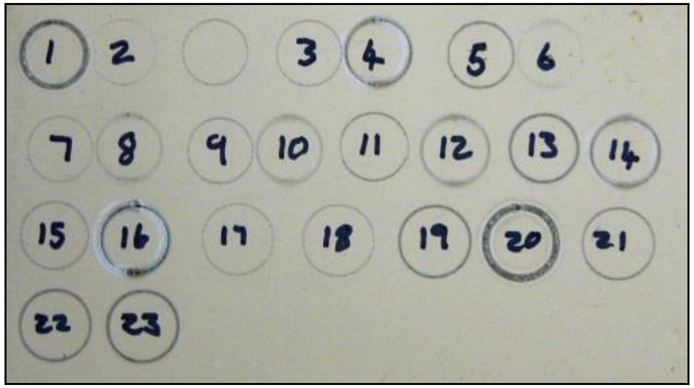


Figure 28. TET 123: Detail 1-23

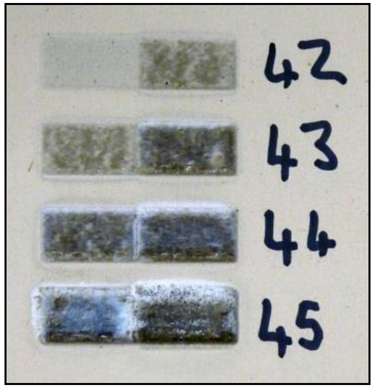


Figure 29. TET 123: Detail 42-45

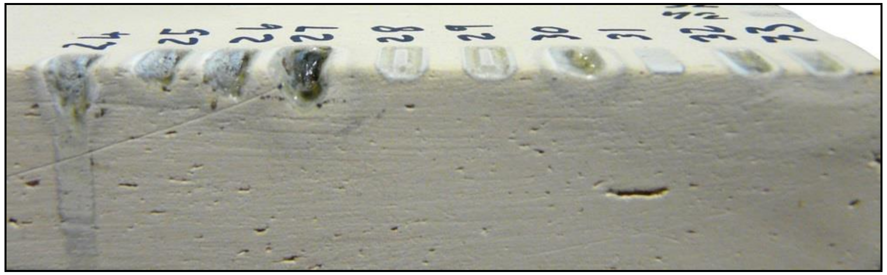


Figure 30. TET 123: Detail 24-33

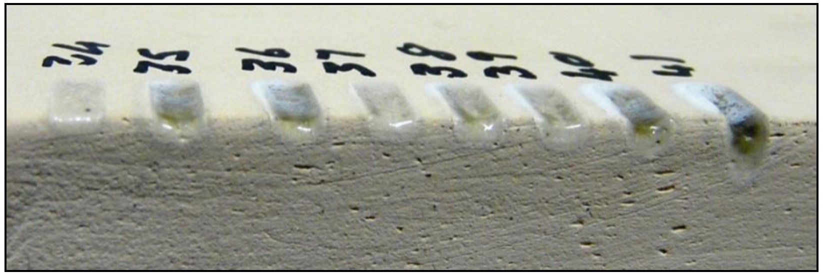


Figure 31. TET 123: Detail 34-41

3.23.1 Datasheet 123: Un-fumed

Datasheet no: 123	**Template experimentation tile no:** 123	**Temperature:** 980 °C	**Chemical application:** None	**Chemical:** None
Combustible materials: None			**Method:** None	**Kiln:** Electric

Laser-cutting and laser-engraving settings

Experiment no:	Cut	Engrave	Power %	Velocity %	Z-offset	Time
1	X		80	0.20	0	0:34
2		X	100	1	0	
3	X		80	1	15	8:00
4		X	100	0.20	15	
5	X		100	2	15	1:38
6		X	80	2	15	
7	X		70	10	15	1:51
8		X	100	1	15	
9	X		80	7	15	2:09
10		X	100	0.80	15	

Reflection: In this experiment, the laser-cutting and -engraving were done on an un-fumed ceramic tile, exploring the various settings available on the Trotec Speedy 500. On this tile, there are 49 different explorations of settings of which numbers 1 to 23 are discussed in this datasheet. In CorelDraw, I drew two circles, each 10 mm in diameter, to explore various engraving and cutting settings.

One circle was used for engraving and another for cutting, which were cut and engraved together in one "job". Engraving takes a lot longer than cutting due to the fact that the laser needs to continuously move from side to side (horizontally). The Trotec software "cuts" the file up into multiple layers, which are then engraved by the laser from top to bottom.

Ceramic is a very hard material to cut through; therefore, the cutting settings could be manipulated to cut into the ceramic tile, but not right through. In cutting experiments 1 and 20, the power setting was too high (80%) in relation to the velocity that was extremely low (0.20% and 0.10% respectively). This resulted in the ceramics melting and creating a bubbling effect. When these two experimentations were compared to the other cutting experimentations, their line width seemed thicker. The extremely slow velocity of the laser caused a

11	X		100	4	15	3:29
12		X	100	0.50	15	
13	X		100	1	15	5:40
14		X	100	0.30	15	
15	X		100	8	15	20:47
16		X	100	0.08	15	
17	X		70	8	15	0:04
18	X		80	10	15	0:04
19	X		80	1	15	0:04
20	X		80	0.10	15	0:04
21	X		80	2	15	0:02
22	X		80	1	15	0:02
23	X		80	0.70	15	0:02

bigger area of the ceramics to melt and created a thicker "bubbling" line. Cutting experimentations 3, 7, 9, 15, 17 and 18 only lightly etched the ceramic surface due to the fact that the velocity in all of them was too high in relation to the power, which was between 100% and 70%. The remaining cutting experiments (5, 11, 13, 19, 21, 22 and 23) resulted in visible but very shallow cut lines that could also be touch felt. Engraving experiments 2, 6, 8, 10 and 12 only lightly etched the ceramic surface, which could not even be touch felt. In all of these experiments, the power was very high (100% or 80%), but the velocity was extremely low, ranging between 0.50% and 1%. In order to engrave deeper, the velocity would have to be even less than 0.50%, which could be seen in engraving experiments 4 and 14. With a velocity of 0.20% and 0.30% respectively, and the power at 100%, these two engraved lines were much deeper. A white residue could be seen around the circles. This was ceramic dust that melted due to the intense heat from the laser; it again fused to the tile surface in some areas. Engraving experiment 16 created an even deeper engraved line than the previous two experiments. In this experiment, the power was still on 100%, but the velocity was exceptionally low at only 0.008%. It could, therefore, be stated that, when engraving, the power should be high and the velocity extremely low in order to create a relatively deep engraving. When engraving deep into the ceramics, it becomes extremely time consuming. So, making use of cut lines in certain areas instead of engraving the whole image would be a faster option.

3.23.2 Datasheet 124: Un-fumed

Datasheet no: 124	**Template experimentation tile no:** 123	**Temperature:** 980 °C	**Chemical application:** None	**Chemical:** None
Combustible materials: None			**Method:** None	**Kiln:** Electric

Laser-cutting and laser-engraving settings

Experiment no:	Cut	Engrave	Power %	Velocity %	Z-offset	Time	Depth mm
24		X	100	0.2	15	1:10	4.6
25		X	100	0.5	15	0:29	2.3
26		X	100	0.3	15	0:47	3.3
27		X	100	0.08	15	2:53	5.1
28	X		80	0.7	15	0:01	0.5
29	X		80	0.7	15	0:01	0.5
30		X	80	0.5	15	0:31	0.5

Reflection: After doing the laser-cutting and -engraving experimentations with a 10 mm x 10 mm circle, it was decided to use a select few of those settings and do more experimentations in a 2 mm x 5 mm rectangle to investigate the various depths. The tile was placed so that the rectangle would slightly protrude over the edge of the tile. This meant that the laser would start cutting or engraving adjacent to the tile and then on the ceramic surface. This was done in order to actually see how deep the cutting or engraving was, as one could not see it in the experimentations done with the circles.

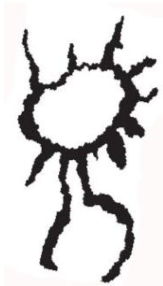
The settings from cutting experiment 23 were used to do the two rectangle laser-cutting experimentations, which cut 0.5 mm deep into the ceramic surface. This depth of cutting is fast and ideal for outlining images, deep enough to be touch felt and clearly visible. Engraving experiments 24 and 26 were done using the settings from engraving experiments 4 and 14. There is only a

31		X	40	5	0	0:06	0	0.1% difference in velocity; yet the depth of experiment 24, which is slower, is much more. Engraving experiments 25 and 30 differ 20% in power, which resulted in a 1.8 mm difference in depth. It can, therefore, be stated that the higher the percentage power used, the deeper the engraving when using the same velocity. A depth of 3.3 mm was engraved in engraving experiment 26 and a white residue formed along the sides of the engraved area similar to experiments 4 and 14. The velocity in engraving experiment 27 was extremely slow and time consuming, but the engraving reached a depth of 5.1 mm, which was not expected. Engraving experiments 31-39 were all particularly shallow engravings, but they could still be touch felt and were clearly visible. The velocity of engraving experiment 40 was twice as fast as that of engraving experiment 41; yet the depth of engraving did not differ that much. This confirms the importance of an extremely high power when deep engravings are to be done on a ceramic surface. Engraving experiments 42-45 were done to illustrate the change in colour of the ceramic surface as the depth increased. The deeper the engravings, the darker the surface.
32		X	60	1	0	0:17	0.3	
33		X	40	1	0	0:17	0.5	
34		X	20	1	0	0:17	0	
35		X	60	1	0	0:17	0.3	
36		X	40	0.5	0	0:52	0.6	
37		X	60	2	0	0:18	0.2	
38		X	80	2	0	0:18	0.23	
39		X	100	3	0	0:15	0.3	
40		X	80	1	0	0:30	1.3	
41		X	80	0.5	0	0:52	1.1	

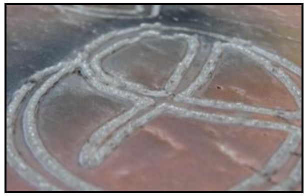
3.23.3 Datasheet 125: Copper oxide

<table>
<tr><td>Datasheet
no: 125</td><td>Template experimentation tile
no: 27</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Copper oxide</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td>Power %: 70</td><td colspan="2">Velocity %: 10</td><td>Time: 0 min 22 sec</td><td>Engrave line:</td><td>Cut line:
X</td></tr>
<tr><td>CET effect: 27</td><td>Original vector drawing</td><td>TET effect</td><td rowspan="2" colspan="3">Reflection: In this experiment, the ceramic tile, which was used in the colour experimentation with copper oxide (3.7.21 SET 27) was used to experiment with laser-cutting. Only the outline of the original vector image was cut, using the laser-cutting settings from cutting experiment 7 (3.23.1 SET 123). Due to the fact that the velocity was quite fast (10%), the cut line hardly etched the ceramic surface. Although it could be touch felt on the ceramic surface, it was hardly visible. If the speed was to be decreased and the power increased, it would improve the visibility and depth of the engraving.</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

3.23.4 Datasheet 126: Cobalt oxide

<table>
<tr><td>Datasheet
no: 126</td><td colspan="2">Template experimentation tile
no: 22</td><td colspan="2">Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 100</td><td colspan="3">Velocity %: 0.5</td><td>Time: 3 min 57 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>CET effect: 22</td><td colspan="2">Original vector drawing</td><td colspan="2">TET effect</td><td colspan="3" rowspan="2">Reflection: In this experiment, the laser-engraving settings from engraving experiment 12 (3.23.1 SET 123) was used to experiment on the ceramic tile, which was used in the colour experimentation with cobalt oxide (3.7.20 CET 22). The engraving took much longer than the laser-cutting in the previous experiment, but it is clearly visible, precise and the line is deeper etched into the ceramic surface. The precision that was achieved when using a laser cutter to engrave on a ceramic surface could not be done with a handheld engraver, especially if the engraving were to be deeper than just etching the surface.</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

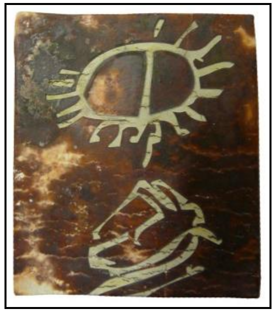
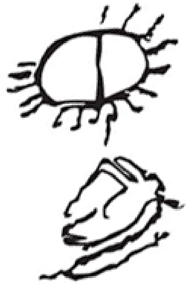
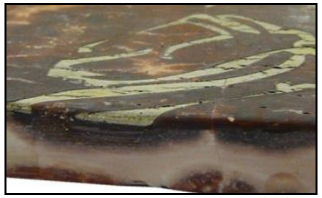
3.23.5 Datasheet 127: Ferric chloride

<table>
<tr><td>Datasheet
no: 127</td><td>Template experimentation tile
no: 08</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 100</td><td>Velocity %: 0.20</td><td>Time: 2 min 22 sec</td><td>Engrave line:</td><td>Cut line: X</td></tr>
<tr><td>TET effect</td><td>Original vector drawing</td><td>TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, the ceramic tile used for the colour experimentation with ferric chloride (3.4.8 CET 08) was used to laser-cut the outline of a vector drawing. A relatively slow velocity was used, which resulted in the ceramic surface melting due to the extreme heat of the laser. As the laser moved extremely slowly, the melted surface started boiling and created a protruded surface. This was a quite unforeseen surface effect, as I expected that an indented line would form in the ceramic surface.</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

3.23.6 Datasheet 128: Cupric chloride

<table>
<tr><td colspan="2">Datasheet
no: 128</td><td colspan="2">Template experimentation tile
no: 13</td><td colspan="2">Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="6">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="3">Power %: 40</td><td colspan="3">Velocity %: 1</td><td>Time: 20 min 19 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td colspan="2">Original vector drawing</td><td colspan="3">TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, it was decided to do a cut line for the outline of the vector drawing and only engrave the negative areas. The power was significantly reduced in relation to the previous experiment. The engraved areas were more or less 0.5 mm deep and a white residue formed in those areas. As the CET (3.4.11 CET 13) used to engrave on, did not have solid overall colouration, the engraving was not extremely prominent. The engraving blended with the coloration and stimulated interest to further engage with the ceramic surface.</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="3"></td></tr>
</table>

3.23.7 Datasheet 129: Lithium chloride

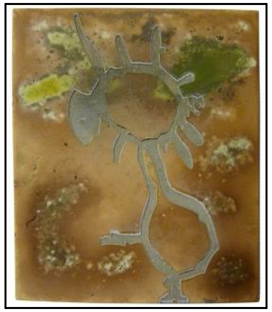
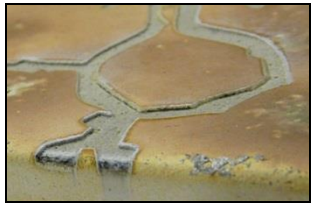
<table>
<tr><td colspan="2">Datasheet
no: 129</td><td colspan="2">Template experimentation tile
no: 14</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="3">Power %: 20</td><td colspan="2">Velocity %: 1</td><td>Time: 74 min 28 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td colspan="2">Original vector drawing</td><td colspan="2">TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, the full vector drawing was engraved on the tile used for the colour experimentation with lithium chloride (3.4.12 CET 14). The power used for the previous experiment was cut in half and resulted in a shallow, but touch felt and clearly visible engraving. In this experiment, no white residue appeared on the ceramic surface, which was possibly due to the low power output of the laser. The engraving represented an exact replica of the vector drawing and was quite striking.</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

3.23.8 Datasheet 130: Cupric carbonate

<table>
<tr><td>Datasheet
no: 130</td><td colspan="2">Template experimentation tile
no: 36</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 20</td><td colspan="2">Velocity %: 1</td><td>Time: 12 min 15 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td colspan="2">Original vector drawing</td><td>TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, only the small rounded areas were engraved and the rest of the vector drawing outlines was laser-cut. The cut settings were at power 80% and velocity 0.70%, the same as the cut settings in 3.23.6 SET 13. The tile used to engrave on had prominent solid brown overall coloration, which created an impressive contrast to the engraving.</td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
</table>

3.23.9 Datasheet 131: Potassium dichromate

Datasheet no: 131	**Template experimentation tile no:** 44	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Cobalt oxide
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
Power %: 40	**Velocity %:** 1	**Time:** 61 min 59 sec	**Engrave line:** X	**Cut line:**

TET effect	Original vector drawing	TET effect detail	**Reflection:** In this experiment, the tile used to engrave on, did not have solid overall coloration, but because the whole vector drawing was engraved it could be seen clearly. The power setting was twice as high as in the previous experiment, which resulted in a deeper grey engraving. The engraving time was 61 min 59 sec, which was quite long, but the accuracy obtained and absolute level surface created would not be doable with a handheld engraver.
			

3.23.10 Datasheet 132: Potassium sulphate

Datasheet no: 132	**Template experimentation tile no:** 24	**Temperature:** 980 ˚C	**Chemical application:** Scattered	**Chemical:** Cobalt oxide	
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric	
Power %: 20	**Velocity %:** 1		**Time:** 21 min 20 sec	**Engrave line:** X	**Cut line:**
TET effect	Original vector drawing	TET effect detail	**Reflection:** In this experiment, the same laser-engraving settings were used as in 3.23.8 SET 36. The top part of the vector drawing was fully engraved, with a cut line inside, outlining the vector drawing. If the top part had not been fully engraved, the engraving time would have been significantly less. Yet, due to the placement of the engraving on the CET the full engraving became an interesting motif, which stimulated further investigation of the ceramic surface.		
					

3.23.11 Datasheet 133: Sodium chloride

<table>
<tr><td>Datasheet
no: 133</td><td colspan="2">Template experimentation tile
no: 07</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 60</td><td colspan="2">Velocity %: 1</td><td>Time: 54 min 22 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td colspan="2">Original vector drawing</td><td>TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, a fairly deep engraving was done on the tile, used in the colour experimentation with sodium chloride (3.4.3 CET 07). When looking at the vector drawing, there should have been two non-engraved areas, but it was decided to fully engrave the whole area. A cut line was done to outline the areas that should not have been engraved, giving a fascinating dimension to the engraving. A white substance could be seen on the edges of the engraved area, which was ceramic. It melted from the extreme heat of the laser and again fused with the ceramic surface as it cooled down.</td></tr>
<tr><td></td><td colspan="2"></td><td></td></tr>
</table>

3.23.12 Datasheet 134: Lithium chloride

<table>
<tr><td>Datasheet
no: 134</td><td colspan="2">Template experimentation tile
no: 32</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 80</td><td colspan="2">Velocity %: 1</td><td>Time: 130 min 44 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td>Original vector drawing</td><td colspan="2">TET effect detail</td><td colspan="3" rowspan="2">Reflection: An extremely deep engraving was done in the majority of the vector drawing. The dots that were not connected to the rest of the drawing were only outlined with a cut line. As the CET was covered in an orange speckled colour, the engraving became very prominent and stood out from the rest of the surface. The ceramic that melted, again fused with the edges of the engraved areas as in 3.23.11 SET 07. When looking at the engraving from a slightly more horizontal view, one could clearly see the white fused ceramic, which looked like foam covering the edges. As the engraving was done so deep and at a slow velocity, it took extremely long when considering the size of the vector drawing, but it had created an astonishing surface effect.</td></tr>
<tr><td></td><td></td><td colspan="2"></td></tr>
</table>

3.23.13 Datasheet 135: Lithium chloride

<table>
<tr><td colspan="2">Datasheet
no: 135</td><td colspan="2">Template experimentation tile
no: 47</td><td>Temperature:
980 ˚C</td><td>Chemical application:
Scattered</td><td colspan="2">Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="5">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td colspan="2">Kiln: Electric</td></tr>
<tr><td colspan="2">Power %: 80</td><td colspan="3">Velocity %: 1</td><td>Time: 46 min 23 sec</td><td>Engrave line: X</td><td>Cut line:</td></tr>
<tr><td>TET effect</td><td colspan="2">Original vector drawing</td><td colspan="2">TET effect detail</td><td colspan="3" rowspan="2">Reflection: In this experiment, the same laser-engraving settings were used as in 3.23.12 SET 32. A full engraving was done, including the two inside areas that should not have been engraved. As in 3.23.11 SET 07, the areas which should not have been engraved were outlined with a laser-cut line. When looking at the engraving from a horizontal view, the depth of the engraving could be seen clearly, as well as the white ceramic that had fused with the ceramic surface at the edges of the engraved area. The white ceramic looked like foam that spilled over the edges of the engraved area.</td></tr>
<tr><td></td><td colspan="2"></td><td colspan="2"></td></tr>
</table>

3.24 CPJ documentation laser engraving: “reflection on practice”

In the following section, “reflection on practice” is presented by the divisions “reflection-in-action” and “reflection-on-action” recorded in the CPJ. Surface experiments using the Trotec Speedy 500 CO_2 flatbed (1 245 mm x 710 mm) laser machine allowed me to produce various engraving depths, some reaching up to about 5.1 mm deep. I also experimented with a range of cut lines and discovered that an array of effects could be produced by using the cut line machine feature. Effects ranged from lightly etching the surface to melting the fired ceramic, creating a protruding “bubbling” effect.

Shallow vector engravings did not take that long and these presented an absolute accurate and intriguing surface effect, whereas the deeper engravings were also accurate but took longer. When the engraving was done at a depth of 0.3 mm and deeper, the velocity (speed) of the laser was extremely slow. This resulted in the heat of the laser melting the ceramic and forming a white dust on the engraved areas, which again fused with the ceramic surface as it cooled down. The melted white ceramic that fused to the engraved edges looked like “foam” spilling over the edge (3.9.14 TET 47). This created the effect of ceramics “melting” away, leaving the engraved/motif area prominently exposed.

By using CAD and laser engraving and/or cutting I could achieve complex designs on the ceramic surface. The accurate transferral of these intricate designs at various depths would not be possible to achieve by a handheld engraver. Laser engraving and cutting show promise for the production of larger ceramic surface experimentations or public murals/artworks. Other technical possibilities include the engraving of bisque-fired ceramics and then adding chemicals to the engraved areas instead of cutting templates for the chemical fuming. Furthermore, instead of hand-drawing designs on bisqueware for decoration, cut lines that only lightly etch the surface can be used to outline designs and save time, ensuring the accurate hand-drawn transferral of a painted design. Therefore, the use of CAD and laser engraving and cutting within ceramics practice opens up a wide array of new possibilities, both for myself and other arts practitioners.

3.25 Conclusion: Surface experimentation

The use of digital laser cutting and engraving on ceramic tile surfaces successfully and innovatively assisted me in appropriating the petroglyph motifs. This was achieved by accurately digitally drawing intricate and complex petroglyph vectors to be directly or indirectly transferred as pictorial elements onto the ceramic surface. Individual ceramic surfaces explored line and mark-making as pictorial elements, permeated with distinctive chemically fumed surface effects. Experimentation with various laser-cut and -engraved templates using different materials offered surface experimentation results that enhanced inter-disciplinary actions and possibilities when using digital fabrication technology.

The various batches of experimentations within this study resulted in gathering a substantial amount of technical and visual data regarding chemical fuming and the laser cutting and engraving on a range of templates. Repeated data recording and reflection “in” and “on” practice prompted continual dialogue around the research problem. Dialogue largely included interpreting, transforming and reconstructing empiricist experiences. In many instances technical actions and results were informed by the application of new and prior knowledge. Surface experimentations revealed intriguing results, which were mostly guided by maintaining an awareness of visualised relationships and structures during the creative process. Being aware of disorientating situations, unexpected challenges (e.g. surface warping and shrinkage, technology issues) and the unpredictable nature of ceramics as medium influenced my response to experiences around “making”.

The surface experimentation results affirmed that using CAD and supportive technologies to create digital templates was an effective and faster working method compared to “hands-on” processes. The merging of traditional ceramics practice with digital fabrication technologies allowed me to engage with transformative learning as knowledge generation strategy within my practice, from which a database of innovative ceramic surface effects was generated.

The next chapter represents extended surface experimentation where I have explored the knowledge gained on a larger ceramics format in order to explore chemical coloration changes, enhanced surface effects and fundamental technical problems regarding ceramics as medium in conjunction with the integration of laser surface engraving

Chapter 4

Extended surface experimentation

4.1 CPJ documentation: "reflection in practice"

In this range of extended surface experiments I explored the application of my tacit and technical knowledge gained from engaging with previous colour and template experimentations on larger scale ceramic panels, as all the previous experimentations were done on small-scale (130 mm x 110 mm) ceramic tiles. I wanted to know if similar effects could be produced on larger scale surfaces.

4.2 Ceramic panels

My inspiration for the panels came from the photographs that I took of the Driekopseiland site, surrounding area and petroglyphs at one of my visits to the site. Five photographs were chosen from which I digitally created possible designs for the panels. After digitally drawing the designs, construction templates (Figure 33) were laser-cut in order to assist in easily creating the different sections of a panel.

Figure 32. Construction templates (ceramic panel 2)

I selectively chose various petroglyph motifs from the archival data for the incorporation in each panel. Templates for the chemical fuming were laser-cut and presoaked in the selected chemicals. All the panels were bisque-fired up to 900 ºC and afterwards chemically fumed in combination with the templates. Numerous unexpected challenges and issues originated within the process of creating the large scale panels. When creating ceramic panels on a large scale (±1 200 mm x 450 mm), shrinkage and cracking are the two biggest concerns. Although the panels did not shrink as much as I had anticipated, cracking still occurred. Some of the panels formed hairline cracks before the bisque-firing and then broke during the bisque firing. A section of the first ceramic panel exploded in the bisque firing, which meant that the whole panel had to be remade. I could not only remake the section that had exploded, as recreating the texture of that specific section would be impossible and unpredictable shrinkage would possibly cause the section to not align with the rest of the panel components. I also encountered an unforeseen technical fault with the electric kiln used for the bisque firing, as well as the chemical fuming. The kiln not reaching a high bisque-firing temperature (900 ºC) resulted in the panels breaking into numerous pieces during the chemical fuming. All these issues and challenges were overcome through critical reflection and problem-solving approaches. The panels that broke, unfortunately, had to be glued together and then attached to a 12 mm hardboard backing.

Overall intriguing surface effects were created within all the panels. I discovered that recreating a specific surface effect or colour when chemically fuming larger works was extremely difficult. The same range of colours as in the template and surface colour experimentations developed, but the patterns, colour distribution and imprint left varied. Imprints that were left by the template varied in intensity, colour and prominence. As experienced with the template experimentations, if the shape of panel or template surface inhibited contact with the ceramic surface, the imprint was unclear and less noticeable. This limitation, together with the unpredictable nature of ceramics, brought about unique results.

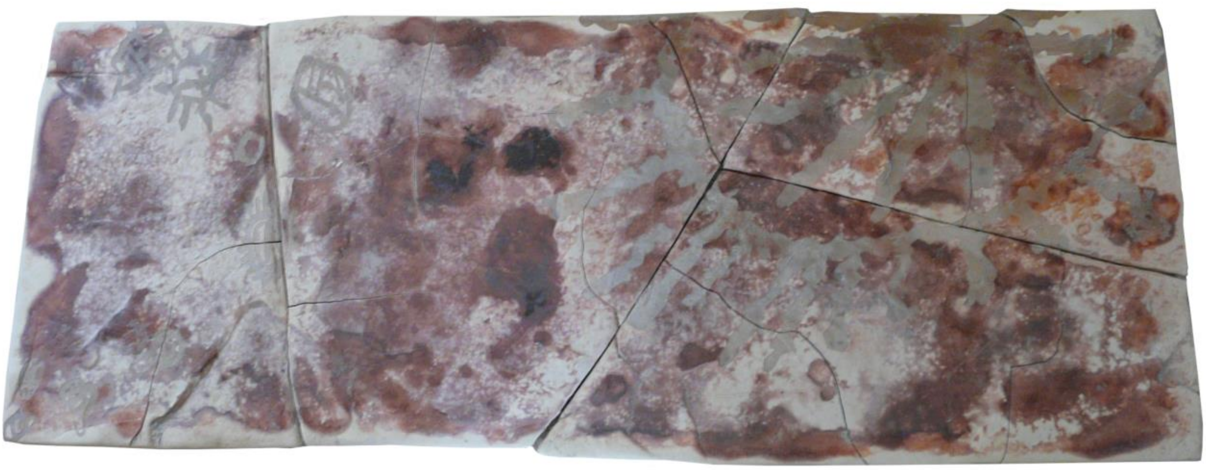


Figure 33. Ceramic panel 1

Figure 34. Ceramic panel 2

4.3 CPJ documentation chamotte forms: “reflection in practice”

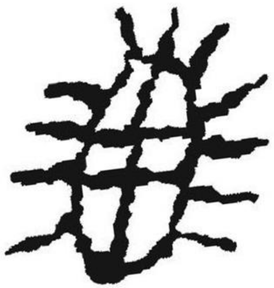
This group of experiments aimed at using digital fabrication technologies to explore the three dimensional (3D) potential of constructing innovative ceramic forms, when working with hardboard templates and refractory ceramic based material. 3 mm Hardboard templates were laser-cut from the existing vector graphic drawings, which were in this instance used as an inner structure/template from which 3D ceramic chamotte forms were developed.

Ceramic chamotte or calcined clay is used within Ceramics practice to add thermal stability to clay bodies, enabling the production of larger more complex ceramic forms. Calcination is the thermal treatment process where clay is fired in a rotary kiln with limited supply of air or oxygen at high temperatures of 1 400 ºC – 1 600 ºC. The result is a very stable material called ceramic chamotte. After the calcination process the chamotte is crushed and sorted into specific refractory and grain size parameters (http://www.imerys-ceramics.com/Texts.asp?I1_ID=3&I2_ID=38&I3_ID=58&I4_ID=; Hamer & Hamer, 2012:170).

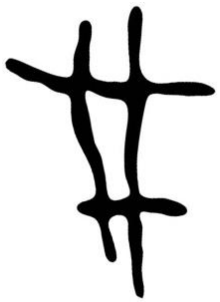
Petroglyph motifs were selected and several duplicate inner hardboard template structures were laser-cut and dipped in a ceramic chamotte (0.25mm - 2.5mm) mixed with a slurry binder comprised of colloidal silica and 200# zircon flour. Repeated layer by layer dipping resulted in several delicate 3D ceramic forms being constructed. Once dried the forms were chemically fumed in an electric kiln within which the hardboard inner structures burnt away leaving a chamotte fossil-like surface equivalent to the strength of a 900 ºC bisque firing.

4.4 Ceramic chamotte

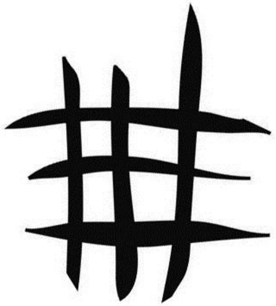
4.4.1 Datasheet 136: Ceramic form: Chamotte fine 01

<table>
<tr><td>Datasheet no: 136</td><td colspan="2">Temperature:
980 ˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
None</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: In this experiment, the laser-cut hardboard template was used to explore the surface effect that would come about when fine ceramic chamotte (0.25 mm - 0.7 mm) was used in the bronze casting ceramic shell mould-making method was introduced. Numerous layers of slurry binder and fine ceramic chamotte were applied to the template surface until most of the negative spaces on the template were no longer visible. As I constructed the ceramic shell form, layer by layer the original template became less recognisable, but still resembled the overall form of the vector drawing. No chemical fuming technique was applied in this experiment; the objective was to determine what the fired colour of the ceramic form would be. A range of white tones was visible after the firing.</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

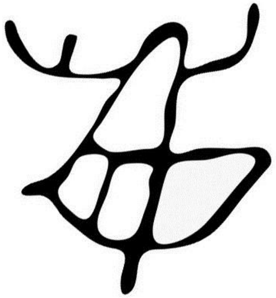
4.4.2 Datasheet 137: Ceramic form: Chamotte Fine 02

Datasheet no: 137	**Temperature:** 980 ˚C	**Template:** Hardboard 3 mm	**Chemical application:** Scattered	**Chemical:** Sodium chloride
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
Original vector drawing	Ceramic form		**Reflection:** In this experiment, the ceramic shell mould-making method was again used with fine ceramic chamotte (0.25 mm - 0.7 mm) and a laser-cut hardboard template. As the hardboard burned away in the firing, a part of the ceramic form broke off. This was because the ceramic form constructed around the hardboard template was not thick enough. It would, therefore, be better to create a rather thick ceramic form to ensure that it did not break in the firing process. Sodium chloride was added in the chemical fuming and created red/pink and yellow/brown colours on the ceramic form. In this experiment, the hollow ceramic form had strong resemblances to the hardboard template, which was used.	
				

4.4.3 Datasheet 138: Ceramic form: Chamotte fine 03

Datasheet no: 138	**Temperature:** 980 ˚C	**Template:** Hardboard 3 mm	**Chemical application:** Scattered	**Chemical:** None
Combustible materials: Sawdust			**Method:** Aluminium saggar	**Kiln:** Electric
Original vector drawing	Ceramic form		**Reflection:** In this experiment, fine ceramic chamotte (0.25 mm - 0.7 mm) was also used in combination with a laser-cut hardboard template. As in the first experiment with the fine ceramic chamotte (4.4.1, a thicker ceramic form was created in order to prevent breakage. A good representation of the original template was created, as there was ample space for the ceramic form to be constructed around the hardboard template. It is thus important to use either bigger hardboard templates or templates with big enough negative spaces to construct a substantial ceramic form.	
				

4.4.4 Datasheet 139: Ceramic form: Chamotte medium 01

<table>
<tr><td>Datasheet
no: 139</td><td>Temperature:
980 ˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
None</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: In this experiment, medium-sized ceramic chamotte (0.7 mm - 1.2 mm) was used. The hardboard template had very thin surface areas to which the ceramic chamotte had to adhere. I was quite surprised that the hardboard template did not break due to the weight of the ceramic shell. I noticed that it was extremely important to be very careful with the template when I dipped it into the slurry binder, as it could easily break when it became wet and heavy. A sturdy ceramic form could be constructed without creating a solid form. It was noted that fewer layers were needed with the medium-sized ceramic chamotte than with the fine ceramic chamotte. No chemical was used in the chemical fuming in order to determine its original colour after being fired, which was also white.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
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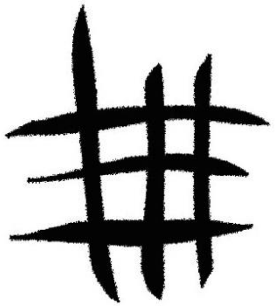
4.4.5 Datasheet 140: Ceramic form: Chamotte medium 02

<table>
<tr><td>Datasheet
no: 140</td><td>Temperature:
980 ˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt carbonate</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">Original vector drawing</td><td>Ceramic form</td><td colspan="2" rowspan="2">Reflection: For this experiment, a hardboard template was used with ample surface to which the medium-sized ceramic chamotte (0.7 mm - 1.2 mm) could adhere. The medium-sized ceramic chamotte created a ceramic form that was a comparable representation of the original template. Cobalt carbonate was added in the chemical fuming, which created light blue speckles on select areas of the surface. If more chemicals were added or painted onto the surface, it would have enhanced the intensity of the colour.</td></tr>
<tr><td colspan="2"></td><td></td></tr>
</table>

4.4.6 Datasheet 141: Ceramic form: Chamotte medium 03

<table>
<tr><td>Datasheet no: 141</td><td>Temperature:
980 ˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
Cobalt oxide</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: Layer by layer a dense ceramic form was created around the hardboard template, which almost filled all the negative spaces within the template. Cobalt oxide was added in the chemical fuming, but did not show much coloration, similar to the second experiment (3.10.6) with medium-sized (0.7 mm - 1.2 mm) ceramic chamotte. Even though the negative areas of the template were almost filled with chamotte, the template used was still recognisable.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

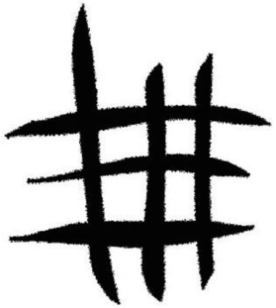
4.4.7 Datasheet 142: Ceramic form: Chamotte medium 04

<table>
<tr><td>Datasheet
no: 142</td><td colspan="2">Temperature:
980 ˚C</td><td>Template:
Hardboard 3mm</td><td>Chemical application:
Scattered</td><td>Chemical:
None</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: An almost solid mass of medium-sized (0.7 mm - 1.2 mm) ceramic chamotte was constructed over the hardboard template in this experiment. This occurred due to the fact that multiple layers were needed in order to create a sturdy structure around the template. Although solid areas could be seen, the ceramic form was still a comparable representation of the original hardboard template. No chemical was added in the firing process, which led to a white surface.</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

4.4.8 Datasheet 143: Ceramic form: Chamotte coarse 01

<table>
<tr><td>Datasheet
no: 143</td><td>Temperature:
980 ˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
None</td></tr>
<tr><td colspan="3">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td>Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: In this experiment coarse ceramic chamotte (1.2 mm – 2.5 mm) was used. Two pieces on the left of the hardboard template broke off in the slurry binder dipping procedure due to the small surface areas that could not support the weight of the chamotte. The coarse ceramic chamotte created a ceramic form that was a pale white and grey colour. This ceramic form constructed with coarse ceramic chamotte had a much rougher surface than the ceramic forms constructed with medium-sized and fine ceramic chamotte.</td></tr>
<tr><td></td><td colspan="2"></td></tr>
</table>

4.4.9 Datasheet 144: Ceramic form: Chamotte coarse 02

<table>
<tr><td>Datasheet
no: 144</td><td colspan="2">Temperature:
980˚C</td><td>Template:
Hardboard 3 mm</td><td>Chemical application:
Scattered</td><td>Chemical:
None</td></tr>
<tr><td colspan="4">Combustible materials: Sawdust</td><td>Method: Aluminium saggar</td><td>Kiln: Electric</td></tr>
<tr><td colspan="2">Original vector drawing</td><td colspan="2">Ceramic form</td><td colspan="2" rowspan="2">Reflection: In this experiment, the hardboard template was cut bigger than the previous templates in order to determine if the template would be strong enough to support the ceramic form. Coarse ceramic chamotte (1.2 mm – 2.5 mm) was used to create a sturdy ceramic form. Although a rather robust ceramic form was constructed, it broke in the firing process. This probably occurred due to the fact that the hardboard completely burned away in the firing process, leaving the ceramic form hollow and creating structural problems. If wire were to be bound around the hardboard template and then dipped into the slurry binder, it would create extra surfaces to which the ceramic chamotte could attach itself. This would improve the strength of the ceramic form and prevent breakages.</td></tr>
<tr><td colspan="2"></td><td colspan="2"></td></tr>
</table>

4.5 CPJ documentation chamotte forms: “reflection on practice”

Experimentation with laser-cut hardboard templates and ceramic chamotte offered an array of interesting 3D forms and surface effects that could further be applied to artworks when exploring the innovative cultural content appropriation of Driekopseiland petroglyphs. The shift from using medium to fine chamotte allowed for experimentation with very small delicate templates, whereas larger templates with broader negative spaces required using medium-sized and coarse ceramic chamotte. The delicate ceramic forms presented a problem, as templates with narrow positive areas tended to snap easily due to the weight of the ceramic shell. This was prevented by binding wire around the hardboard template (Figure 38) prior to dipping, serving as a permanent reinforcement, as the wire did not burn away during the fuming process.

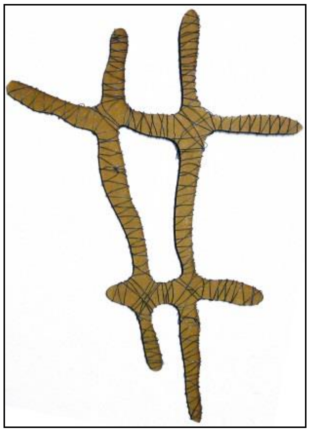


Figure 35. Wire-bound hardboard template

Chemically fuming the ceramic chamotte forms resulted in limited colouration. If an increased amount of chemical was used or a stronger solution of the chemical was applied to the surface more intense coloration would probably occur. This burn-out process also allows for the intricate bronze casting of laser cut and engraved textures on the hardboard template surface. Therefore, the use of digital fabrication technologies could not only be used to create templates, but could be used to create innovative 3D ceramic forms or the bronze casting of intricate artworks generated using templates.

Conclusion

With this study I set out to investigate the integration of digital fabrication technologies within ceramics practice to re-envisage the appropriation of cultural content in a post-discipline transformative innovative visual arts PLR inquiry. A post-discipline research environment was created as I moved between three dissimilar bodies of knowledge, namely 1.) visual arts practice as reflexive inquiry, 2.) innovative cultural content appropriation, and 3.) the integration of digital fabrication technologies.

This PLR inquiry facilitated a platform for technology integration and the innovative appropriation of archival recordings of petroglyph motifs from the Driekopseiland site, as cultural content. The literature reviewed assisted in the pre-exploration and understanding of the underlying theoretical concepts: the appropriation of cultural content, “self and otherness”, hybridity, mimicry and interdisciplinarity. This inquiry allowed for the cross-pollination of ideas, thoughts and actions as I shifted between various familiar and unfamiliar disciplinary practices.

The application of Graeme Sullivan’s (2010) Framework of Visual Arts Research as method for a PLR methodology adequately facilitated the inquiry. This enabled the complex process of combining dissimilar bodies of knowledge, which allowed me to generate not only new knowledge, but also to embrace new perspectives on existing knowledge. Research questions and objectives were addressed by engaging in continual recording, reflection, interpretation and analysis. Sullivan’s Framework was rather complex to comprehend, but due to the adaptable nature of the Framework and the use of a CPJ, I could apply it effectively by focusing on the aspects which best suited the needs of the study. The CPJ facilitated the in-depth collecting of evidence and recording of primary data during the inquiry. An extensive range of surface experimentations, merging the chemical fuming of ceramics with digitally cut and/or engraved templates, served as primary data. The application of disciplinary tacit and technical knowledge assisted in the effective outcomes of most surface and template experimentations. Throughout, descriptive rich text was used to record all surface experimentations, realisations and actions taken while engaged in practice. As a result, continued cyclic acts of creating, recording and reflecting gave rise to innovative problem-solving approaches, which stimulated the further development of ideas. Consequently, this brought about a transformative visual arts practice inquiry as a knowledge generating strategy.

Within Sullivan's Framework my actions continuously shifted between the four areas of practice (visual arts, empiricist, interpretivist and critical), each describing and responding to various research activities. My engagement with empiricist practice was mostly data-driven and discipline-based. It comprised aspects regarding the exploration of chemical fuming and the incorporation of digital cutting and/or engraving of select template motifs as pictorial elements. Sullivan's research exploration, categorised as interpretivist practice, was largely informed by the appropriation of cultural content and interdisciplinarity as key theoretical constructs. Interdisciplinary thinking and working methodologies associated with the various investigations and interpretation of experiences were driven by extensive technical research regarding digital fabrication technologies (laser cutting and engraving). Collectively, this area of practice determined the interpretation, transformation and reconstruction of various lived experiences, resulting in the sought after new knowledge.

Interdisciplinary thinking is driven by classifications such as integration, collaboration, complexity, critique and problem-solving. Being confronted with these, often resulted in various disorientating situations and problems. By using Sullivan's Framework I was able to overcome unexpected challenges and issues by continuously engaging in cyclic acts involving reflection "in" and "on" practice, as I shifted between the various areas of practice located on the Framework. Engagement with critical practice was characterised by the transdisciplinary investigation of existing systems, structures and practices facilitated by the critical analysis of my overall lived-creative experience. Crossing the divide between dissimilar disciplines and employing accessible digital technologies in combination with various ideas and practices allowed me to generate a "remix" of practices. Strategically shifting between areas of practice, knowledge and reflecting on my experiences, I was able to acquire new insights, which often resulted in the changing of my worldview.

The merging of my creative experience with that of the extinct Khoe-San and/or Xam through "making" not only resulted in what I believe to be innovative hybrid surface experimentations, which had contributed to the promotion and preservation of cultural heritage, but also transformative learning. Throughout the study, several instances led me to consider the beliefs and values of the Khoe-San and/or Xam people, and that possibly through their repeated rituals involving "making", the Driekopseiland site was created. Access to technology within my creative practice stimulated the interdisciplinary merging of ideas and disciplinary practices, which endorses the vision of the Department of Arts and Culture (2015:8) to use the visual arts as a context for the promotion and preservation of cultural heritage.

Therefore, the combination of digitally fabricated templates and traditional ceramics chemical fuming adequately facilitated the exploration of innovative surface experimentation methods and techniques. The creation of these innovative surface techniques and effects was only possible due to my engagement in a post-discipline transformative PLR inquiry, which enabled the cross-pollination of various practices. The post-disciplinary nature of the study resulted in the creation of renewed working methodologies for ceramic practitioners, prompting the exploration of unfamiliar technology within visual arts practice. Specifically, through the visual and textual representation of the outcomes I was able to contribute to the preservation of cultural heritage content by innovatively appropriating the Driekopseiland petroglyphs.

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Appendix 1

Provision of imagery and granting permission for the use of the archival data

Honouring Our Past, Celebrating Our Future
McGregor Museum 1907-2007

McGregor Museum

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Ms Elsabe Dalton
Central University of Technology
Faculty of Humanities

Images of Driekopseiland rock art site

Dear Ms Dalton,

I am happy to hear that you are proceeding with your project based on the rock art site of Driekopseiland.

We are delighted to have been able to provide you with images/documentation in PDF format from the museum collection, being part of the documentation of the site.

This letter serves to confirm that you may use these images from Driekopseiland, with due acknowledgement where appropriate in the event of images from the museum being used. We would ask in return if we may have a copy of the dissertation for our library?

With very best wishes

Dr David Morris
Head of Archaeology

A Province-aided museum
http://www.museumsnc.co.za