College of Arts and Social Science
Research School of Humanities and the Arts
SCHOOL OF ART

VISUAL ARTS GRADUATE PROGRAM
MASTER OF PHILOSOPHY

MATT HIGGINS

Chemical Potential: The Darkroom Upside Down
Exploring the Chemigram

EXEGESIS SUBMITTED IN PART FULFILMENT FOR
THE DEGREE OF THE MASTER OF PHILOSOPHY
OF THE AUSTRALIAN NATIONAL UNIVERSITY

OCTOBER 2015
Declaration of Originality

I, Matt Higgins ……………………………………… hereby declare, that the exegesis here presented is the outcome of the research project undertaken during my candidacy, that I am the sole author unless otherwise indicated, and that I have fully documented the source of ideas, references, quotations and paraphrases attributed to other author.
Acknowledgements

I thank my supervisors, Denise Ferris and Helen Ennis as well as my advisor Martyn Jolly for their dedication and support throughout my research. I would also like to extend this gratitude to technical officer, Jason O’Brien. I thank Pierre Cordier, Douglas Collins and Nolan Preece for generously sharing their knowledge and continual support. Finally, I thank my family and most of all my partner, Sophie, who has been there every step of the way.
# Contents

Abstract ix  
List of Illustrations x  
Introduction 1  
Outline of Exegesis 5  

## Chapter One: The Chemigram World 6  
Chemigram without localizing product 10  
(First category)  
Chemigram with localizing product 12  
(Coated by hand second category)  
Photo – chemigram 15  
Fellow chemigrammers 21  
Photographic artists 27  
Conclusion 32  

## Chapter Two: Exploring the Chemigram 34  
Introduction 34
The Fundamentals

Light

Chemistry

Emulsions

Resin coated (RC) black and white photographic paper

Fibre based (FB) black and white photographic paper

Film

Black and white glass plates

Ilfrochrome and Cibachrome paper

Chemigrams with Resists

Wood varnish

Apple stroop

Epoxy enamel

Aerosol can spray paint

Nail polish

Oil paint varnish

3D printer
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other resists</td>
<td>53</td>
</tr>
<tr>
<td><strong>Straight chemigrams</strong></td>
<td>53</td>
</tr>
<tr>
<td>Thiourea and sodium hydroxide</td>
<td>53</td>
</tr>
<tr>
<td>Ilfosol 3 film developer</td>
<td>55</td>
</tr>
<tr>
<td>Conclusion</td>
<td>56</td>
</tr>
<tr>
<td><strong>Chapter Three: Evaluating Practice</strong></td>
<td>57</td>
</tr>
<tr>
<td>Introduction</td>
<td>57</td>
</tr>
<tr>
<td>Making judgments, contrasting chemigrams</td>
<td>58</td>
</tr>
<tr>
<td><em>Untitled 281-4</em></td>
<td>58</td>
</tr>
<tr>
<td><em>Untitled 254-5</em></td>
<td>60</td>
</tr>
<tr>
<td><em>Untitled 178-4</em></td>
<td>61</td>
</tr>
<tr>
<td><em>Untitled 179-4</em></td>
<td>62</td>
</tr>
<tr>
<td><strong>Evaluating different types of Chemigram</strong></td>
<td>63</td>
</tr>
<tr>
<td><em>Untitled 321-5</em></td>
<td>64</td>
</tr>
<tr>
<td><em>Untitled 198-3</em></td>
<td>66</td>
</tr>
<tr>
<td><em>Untitled 1-2.5</em></td>
<td>67</td>
</tr>
<tr>
<td><em>Untitled 98-4</em></td>
<td>69</td>
</tr>
<tr>
<td>Section</td>
<td>Page</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
</tr>
<tr>
<td>Untitled 256-3</td>
<td>71</td>
</tr>
<tr>
<td>Conclusion</td>
<td>72</td>
</tr>
<tr>
<td>Conclusion</td>
<td>74</td>
</tr>
<tr>
<td>Bibliography</td>
<td>78</td>
</tr>
</tbody>
</table>
Chemical Potential: The Darkroom Upside Down
Exploring The Chemigram

Abstract

This exegesis discusses my practice-led research into the chemigram. The chemigram is a cameraless photographic technique in which light, photographic chemistry and paper are alone responsible for the visual results of chemical reactions on the photographic emulsion. On one hand the chemigram is a rebel, breaking all the rules of photography as it is commonly understood. On the other, it sees a return to photography’s most fundamental principle: a fascination with creating images with light. In this paper, I survey the many different forms the chemigram can take. I concentrate in particular on the chemigram with resist which draws upon the most unlikely list of substances found in the most unusual places, everywhere from the kitchen to the hardware store. I reflect upon my own experimental practices and images. I argue that previous definitions of the chemigram as a practice are too narrow and that it is in fact far broader than understood to date. I further contend that at the heart of chemigram lies the balance between multiple contending factors, the interplay of which makes every chemigram utterly unique.
List of Illustrations

All images not otherwise attributed are of the author’s own work

Fig. 1. Chemigram Summit, Manhattan Graphics Centre 02/06/2013.
    Photo by Jeanne Chambers

Fig. 2. Pierre Cordier, *Chimigramme*, unique gelatin silver chemigram, 50 x 60 cm 1961. Cordier, *The Chimigramme / The Chemigram* p.70.

Fig. 3. Pierre Cordier, Chimigramme Zigzagramme 12/1/82, unique gelatin silver chemigram, 46.5 x 46.5 cm 1982. Cordier, *The Chimigramme / The Chemigram* p.167.

Fig. 4. Pierre Cordier, (detail) Chimigramme Zigzagramme 12/1/82, unique gelatin silver chemigram, 46.5 x 46.5 cm, 1982. Cordier, *The Chimigramme / The Chemigram* p.169.

Fig. 5. Pierre Cordier, *Photo-Chimigramme 9/3/79 Hommage à Marey* 1975, unique gelatin silver chemigram, 60.3 x 50.8cm, 1979. Cordier, *The Chimigramme / The Chemigram* p.133.


Fig. 7. The Victoria and Albert Museum, London, 2011. My picture.

Fig. 8. Pierre Cordier and Gundi Falk, *Chemigram Impair-Pair*, unique gelatin silver Chemigram, 49.85 x 49.85cm x 2, 2001.

Fig. 10. Pierre Cordier, *Chimigramme 30/12/81*, unique gelatin silver chemigram, 50 x 50 cm, 1981. Cordier, *The Chimigramme / The Chemigram* p.178.

Fig. 11. Nolan Preece, *Chemigram texturology*, digital archival pigment print, 40.64 x 50.8 cm, 2013. [http://www.nolanpreece.com/](http://www.nolanpreece.com/)


Fig. 13. Mark D Roberts *Opus-XIX*, unique gelatin silver chemigram, 40.64 x 50.8 cm, 1980. [http://markdroberts.net/portfolio/chemigrams-holocaust-series#ad_image-14](http://markdroberts.net/portfolio/chemigrams-holocaust-series#ad_image-14)

Fig. 14. Wolfgang Tillman *Forever In Love* I, unique C-type print, 50.8 x 61 cm, 2007. Tillmans, *Wolfgang Tillmans Abstract Pictures* p. 43.

Fig. 15. Edward Mapplethorpe, *Untitled No. 15*, archival pigment print, 185.42 x 299.72 cm, 2013. [http://edwardmapplethorpe.com/gallery_Variations2013.html](http://edwardmapplethorpe.com/gallery_Variations2013.html)


Fig. 17. (Detail), Museum of Modern Art New York, June 2013. My picture.

Fig. 18. Bill Henson, *Untitled*, gelatin silver photograph lead sheet, 60.7 x 101.2 cm, 1977/87. Henson, *Mnemosyne* p. 209.

Fig. 19. Pablo Picasso and Andre Villiers *Le magicien aux taureaux I*, gelatin silver photogram, 30 x 16 cm, 1962. Fontcuberta, *The Artist and The Photographer* p. 22.
Fig. 20. Floris Neusüss, *Untitled (Körperbild, Kassel)*, gelatin silver print with painted developer and fixer, 232 x 102 cm, 1966. Barnes, *Shadow Catchers Camera-Less Photography* p.33.

Fig. 21. (Detail) *Untitled 134-5*, unique chemigram on gelatin silver paper, 50.8 x 60.96 cm, 2014.

Fig. 22. (Detail) *Untitled 289-3*, unique chemigram on Ilfochrome paper, 30.48 x 40.64 cm, 2013.

Fig. 23. (Detail) *Untitled 26-2*, unique gelatin silver chemigram, 20.32 x 25.4 cm, 2011.

Fig. 24. Applying apple stroop 2012. My picture.

Fig. 25. Marked out areas, 2013. My picture.

Fig. 26. Lecture theatre / darkroom 2013. My picture.

Fig. 27. Thin markings 2013. My picture.

Fig. 28. Long shot 2013. My picture.

Fig. 29. Cracked nail polish 2014. My picture.

Fig. 30. (Detail) *Untitled 623-2*, unique gelatin silver chemigram, 20.3 x 25.4 cm 2014

Fig. 31. Maholy-Nagy, *Diagram of Forces*, gelatin silver print, 20.2 x 25.2 cm, 1939. Squires, *What is a Photograph* p. 46.

Fig. 32. (Detail) *Untitled 394-5*, unique gelatin silver chemigram, 50.8 x 60.96 cm, 2014.
Fig. 33. 3D printer as a resist 2014. My picture.

Fig. 34. Untitled 301-3, unique gelatin silver chemigram, 30.48 x 40.64 cm 2013.

Fig. 35. (Detail) Untitled 527-2, unique gelatin silver chemigram, 20.3 x 25.4 cm, 2013.

Fig. 36. (Detail) Untitled 568-2, unique gelatin silver chemigram, 20.3 x 25.4 cm, 2013.

Fig. 37. Untitled 281-4, unique gelatin silver chemigram, 40.64 x 50.8 cm, 2014.

Fig. 38. Untitled 254-5, unique gelatin silver chemigram, 50.8 x 60.96 cm, 2014.

Fig. 39. (Detail) Untitled 178-4, unique gelatin silver chemigram, 40.64 x 50.8 cm, 2013.

Fig. 40. (Detail) Untitled 179-4, unique gelatin silver chemigram, 40.64 x 50.8 cm, 2013.

Fig. 41. Untitled 321-5, unique gelatin silver chemigram, 50.8 x 60.96 cm, 2014.

Fig. 42. Untitled 321-5, unique gelatin silver chemigram, 50.8 x 60.96 cm, 2014.

Fig. 43. Ma Yuan (1160 – 1225), Facing the Moon, 149.7 x 78.2 cm (Date unknown.)
http://www.chinaonlinemuseum.com/painting-ma-yuan-1.php

Fig. 44. Untitled 198-3, unique gelatin silver chemigram, 30.48 x 40.64 cm, 2013.

Fig. 45. (Detail) Untitled 1-2.5, unique gelatin silver chemigram (glass), 35.56 x 35.56 cm, 2014.

Fig. 46. Untitled 98-4, unique gelatin silver chemigram, 40.64 x 50.8 cm, 2012.
Fig. 47. *Untitled 256-3*, unique gelatin silver chemigram, 30.48 x 40.64cm 2014.

Fig. 48. Lay out of body of work (larger pieces), 2014 My picture.
Introduction

It starts with light. It needs to be a material receptive to light. It could be a sealed box of fresh new photographic paper. It could also be an old, opened, fogged scrap of photographic paper that no one else wanted. I get paint, vanish, glue. I get rollers, blades, rulers. I paint the photographic paper. Sometimes in the dark. Sometimes in the light. I might let it dry. I might leave it wet. The possibilities are endless. This is the darkroom upside down where the very elements of photography, light, chemistry, paper, are the stars of the show, rather than a scene optically captured by a camera. This process is the chemigram, which as I will argue here, is far broader than existing definitions have allowed for.

This is a technical and visual investigation into the chemigram using a practised-led approach to research. This means that my process of inquiry was directly informed by and responsive to observations and reflections made on my artistic practices which were largely intuitive. This has involved the production of approximately 2000 chemigrams in many separate series. The main thrust of the experimentation carried out since 2011 focused on the use of organic and non-organic compounds that, when applied onto the surface of photographic emulsion, become a resist to the photographic chemistry, reaching and reacting with the silver halide grains. This experimentation is at the heart of my methodology and it involved continuous researching, thinking, making and reflecting.

What exactly is a chemigram? Well, ‘chemi’ (or ‘chemo’) refers to chemistry and gram, when used as a suffix, comes from the Greek meaning ‘something written’ or something drawn’. I think here it had better mean something drawn. A chemical drawing. At its core a chemigram, just like all darkroom practices, involves the use of light sensitive emulsion, photographic darkroom chemistry and imagination, but what is different about the chemigram is that these combinations don’t just make, the picture, they are the picture.

---

Developer and fixer, the key components in all darkroom practices, are alone responsible for creating the image. Tones can also be achieved by varying the amount of light but the application of developer and fixer onto the emulsion is the main determining factor. There is no turning back after the developer has darkened the silver halide grains black, nor is there when they have been removed in the fixer. There are, however, a lot of results that can happen in-between the two.

The introduction of resists onto the surface of the emulsion also informs where the individual processes, development or fixation, can take place. It helps to think of the chemigram with resist as being very similar to Indonesian batik patterning on fabric. As in batik, in the chemigram the resist applied onto the surface determines what is accessible for the dye or photographic chemistry to react to.

The research that I am presenting here is a large body of work that explores the possibilities of the interactions between photographic paper and photographic chemistry, developer and fixer. What excites me about the chemigram is how much like alchemy it is. You search combination after combination forever trying to find the hidden secrets of the paper or whatever light-sensitive emulsion you are using. Because my focus is so resolutely on the materials, light-sensitive emulsion, photographic chemistry and light, and on the process, the art movement that has most inspired me is ‘Concrete Photography’. Its key figure is Gottfried Jager who literally wrote the ‘credo’ on the topic.² Other significant artists include Arthur Siegel, Otto Steinert, Heinz Hajek-Halke and Roger Humbert, all of these artists have work in the permanent Concrete Photography exhibition at the Museum Im Kulturspeicher, Würzburg Germany. The most important characteristic of Concrete Photography is that it is non-representational. This means that the picture does not mean anything beyond the elements that are composing it.

Concrete Photographs are not a semantic medium, but esthetic objects; they are not represented, but presented, not reproduced, but produced. They are objects made of photographic material. They do not want to illustrate

anything; they do not want to present anything; they do not want to represent anything.³

In terms of the chemigram, it is quite literally a visual result of chemical reactions. This means that I don’t have much to say (in my chemigrams) about Australian identity or politics, for example, but this is not to say that other people cannot interpret whatever they wish to from the works that they view. In fact, this principle is an integral part of the aesthetic philosophy that I have come to develop through this process.

Whilst the principles of concrete photography have guided the production of my various series, in terms of my personal style I must acknowledge the inspirational debt from Jackson Pollock and the broader Abstract Expressionism movement that emerged in North America during the late 1940s. You might think that the chemigram is the ideal medium in photography for Abstract Expressionism, however, as I found, the amount of technical processing, planning and concentration that goes into a single chemigram dramatically inhibits a total submergence in free expression. So, whilst my preferred aesthetic is drawn from Abstract Expressionism, I do not identify with it as a movement. That said, Pollock remains a strong influence, I first saw Pollock’s Blue Poles, (1952) in the National Gallery of Australia at the age of ten. I have never lost the sense of joy, movement and freedom which that painting provoked in me. Although my own practice is often far more controlled and makes use of strong outlines such as grids, I have tried to retain some sense of that motion and energy in many of my works.

Inspired by these two movements, Concrete Photography and Abstract Expressionism, I have come to develop a broadly defined aesthetic approach that attempts to synchronize key factors from both. From Concrete Photography I have drawn a strong physicality in my work. My chemigrams, as Jager said, are ‘esthetic objects’ in their own right, signifying nothing beyond their own physical being. Within this, however, I have developed a personal means of judging my work, based largely on principles of complexity and also harmony.

³ Ibid, p. 15.
Amongst the works that I have produced, the ones that I assess as being most successful are those in which there is a richness of content, a multiplicity of elements co-existing within the single chemigram, brought into agreement, or ‘fit’ with one another. In other words, that there is some level of balance achieved amongst the different component parts. I often judge this balance almost ‘mathematically’, the means by which the space is filled, the contested frontiers between negative and positive space. But, as can be found in Abstract Expressionism, I also look for a freedom, an exuberance and energy, defiant of any clinical aesthetic calculus. These apparently contradictory qualities of control and coherence, but also chaos and defiance, lie at the core of my chemigrams. Ultimately, there is no single formula, nor convenient descriptive vocabulary for pinning down the points at which these have, in my eyes, best come together in my work. It is perhaps fundamentally judged by a feeling, a little kick in the gut, a smile that I can not suppress.

There is, however, another side to the artistic philosophy that I have come to evolve through my research, and that is concerning the experience for the viewer. I aim to create images that are engaging, intriguing ‘esthetic objects’, but, beyond that, I impose no further rules. Whilst not necessarily a specific intention, and certainly not a fully conscious motivation in the making process, I aspire to create chemigrams that make the viewer work hard, that suggest, tease and imply but never affirm, that call from memory to mind’s eye a ready stock of similes or analogies (‘it’s just like…’ ‘it reminds me of…’) with which to enter into dialogue with the work. In this sense, the audience assumes the lions share of the responsibility for meaning-making. As an artist, I hope that I have provided sufficient stimulus for them ‘to think with.’

During the course of my research I have, on several occasions, strayed outside of the darkroom both in order to exhibit my work to a wider audience and also to explore the work of other practitioners in the field. In 2011, I attended Pingyao International Photography festival in China where I first exhibited some of my own early chemigrams. In 2011-2012, I travelled to the UK and to Germany to view original works by other chemigram practitioners. This included viewing works from the Shadow Catchers exhibition held at the Victoria and Albert Museum from October 2010 to February 2011. It also involved viewing original works at the Hackelbury
Fine Art Gallery, in London. In Germany, I visited the Museum Im Kulturspeicher, and saw the Concrete Photography collection. In 2013 I undertook a great adventure to North America to meet with a large number of contemporary practitioners and devotees of the chemigram who all descended upon New York for the opening of a new exhibition at the Von Lintel Gallery and took the opportunity for an informal convention and continual online networking with chemigramists.

Fig: 1. Manhattan Graphics Centre, 02/06/2013

From left to right: Matt Higgins (Australia); Eva Nikolova (USA); Paul Kleinman (USA); Gundi Falk (Brussels); Douglas Collins (USA); Pierre Cordier (Brussels); Jett Sarachek (USA); Nolan Preece (USA); Franco Mariani (USA); Norm Sarachek (USA); Richard Turnbull (USA).

Outline of Exegesis

I shall first consider the background and history of the chemigram and discuss other practitioners in the field. The key figure here is Pierre Cordier whose involvement and coinage of the name chemigram has put him at the forefront of my research. I shall discuss in detail his contribution as well as his chemigram definition. I will also be referring to other significant works by artists working within the broadly defined chemigram field. I will then detail my own chemigram explorations in the darkroom and finally discuss the key findings of my research and evaluate my chemigrams for their technical and aesthetic qualities.
Chapter One
The Chemigram World

How can the chemigram be viewed within the broader realm of photography? Arguably, there are two ways of looking at it. Right from the earliest experiments, photography has been used to explore the hidden worlds lurking in unseen chemical reactions and practitioners have tried to draw out their possibilities. Within photography a particular branch of this has become known as ‘alternative photography’ which can generally be understood as forms of photography that are consciously intended to be unconventional or to differentiate themselves from the prevailing taste and technologies of the day.\(^4\) Within this, there is a strand that involves cameraless photography,\(^5\) which means that those involved don’t even worry about taking their camera along with them. Examples of this include cliché verre, luminograms and photograms. The chemigram is a form of cameraless alternative photographic practice.

On the one hand, the chemigram along with other practices that boldly mix up the rules and eschew the sacred totem of the camera\(^6\) is one of the rebels in the photography family. Furthermore, the chemigram’s shameless flirtations with painting and drawing seem to position it on the very edges of what could reasonably be called photography.

On the other hand, the chemigram is also a traditionalist; an ancient great aunt wheeled out every Christmas to explain to the bored younger generations that things were different in her day. The chemigram’s stubborn fidelity to the darkroom and the very core transactions of concealed chemicals puts it more in line with the very earliest pioneers of photography\(^7\) whose rudimentary chemical experiments and

---

\(^4\) Also known as Alternative Processes, they encompass a large range of silver and non-silver based techniques, more often than not, camera-based.

\(^5\) For example, see László Moholy-Nagy, *Photogram Hand*, 1927. Where objects replace the negative in casting the shadow onto photographic paper. Or Fredrick Sommer, *Paracelsus*, 1959. Where he paints on cellophane and then exposes it onto photographic paper.

\(^6\) The majority of photography pursuits are linked to optics, hence the importance of a camera.

burning desire to create pictures out of light directly enabled and assisted the birth of photography. In its time, the chemigram has been both chic progressive rebel and enduring ancient ancestor. This is something that I shall address in my review of contemporary practitioners that follows.

Having introduced the chemigram as a practice, I am now going to discuss the contemporary practitioners in this field. In doing so, I am drawing upon insights gained from my reading, research trips and personal experimentation. I will provide some context for the practitioners discussed and consider the technical components of their work: how materials have been used, the composition and balance of the overall visual result and the levels of skill and precision in evidence.

In any discussion about the chemigram as a photographic practice, there is one man who must take a prominent position: Pierre Cordier. I personally have been greatly influenced and inspired by him. This is largely because he, more than anyone else, has done the most to make the chemigram into a distinct and unique art form.

In 1956 Cordier (1933-) was a young Belgian amateur photographer undertaking his compulsory military service and attempting to woo his latest amour, Erika. In his pursuit he thought of a novel way to gain her admiration. He wrote on a piece of photographic paper with nail polish, discovering in the process that the polish acted as a resist to the chemicals in the fixer and the developer. Cordier, the son of industrial chemists (who made cosmetic products, including nail varnish), was already familiar with the creative potential of chemicals. He was intrigued. Also, for a young man passionate about jazz music, close friends with the French poet and musician George Brassens, and keen to escape from the routine of military service, it must have been exciting to experience the seductive anarchical chaos of those early chemical reactions. From these simple beginnings, Cordier sensed the possibility of magic. He later named his discovery the ‘chimigramme’ and patented it in March 1963 and in English the ‘chemigram’ 1979. Cordier came to define the chemigram as follows:

8 See Batchen G, *Burning with Desire: The Conception of Photography* (Massachusetts Institute of Technology, USA 1997.). Batchen sets out the case for this desire as a major underpinning principle in photography as a medium and discusses the work of some of the earliest pioneer ‘photographers’.


[The Chemigram] [C]ombines the physics of painting (varnish, oil, wax) and the chemistry of photography (photosensitive emulsion, developer, and fixer), without the use of a camera or enlarger, and in full light.\(^1\)

As I implied at the beginning, I feel Cordier’s definition needs to be expanded on because I’ve found you can achieve what he says working in the dark, or with safe lights on this also produces some incredible effects. But I’ll come back to that later; at the moment, I’m telling Cordier’s story.

Over the following decades, Cordier continued his dedication to the chemigram, experimenting intensely. His experiments came in stages; chromatic research (1961) photo-chemigram (1963) and magical varnish in (1972). His chemigrams have been exhibited in over 200 exhibitions including an exhibition at the Museum of Modern Art, New York, *A European Experiment*, 1967; and many years later a retrospective was held at the Museum of Fine Arts, Belgium, 1988. In 2011, he was one of the five cameraless photographers exhibited at the groundbreaking *Shadow Catchers* exhibition at the Victoria and Albert Museum London. Most recently, he was included in *Concrete and Generative Photography 1960-2014*, at Photo Edition Berlin.

Throughout this period, Cordier was also forging links with important figures in art photography, such as the German photographer Otto Steinert, the founder of the Subjektive Fotografie movement.\(^2\) Rather than use photography to document external realities, Steinert attempted to use it to explore the inner, subjective, realms of the subject. The chemigram, with its cheerful disregard for external objects and its expressive use of hidden chemicals, was an obviously compatible form.

Ten years later in 1968 Cordier collaborated with Jager, Kilian Breier and Hein Gravenhorst in founding the Generative Fotografie movement,\(^3\) which, in this

---

\(^3\) See Ibid, p.55.
instance, referred to the repeated use of geometric shapes in an attempt to create artworks that had an ‘autonomous’ form. In other words, they took on a life unto themselves.

Cordier’s working relationship with the American photographer Aaron Siskind in 1977 and onwards was also fruitful as he describes:

He arranged a series of interviews between me and his former students, curators, and collectors throughout the United States, mainly in locations related to the New Bauhaus founded by Moholy-Nagy in Chicago… The art critic of the French newspaper Le Figaro had written an article claiming that Aaron had copied the works of abstract expressionist painters. I wrote to him saying the opposite was true: Aaron’s photographs inspired them. This strengthened our friendship and I considered him to be my spiritual father.\textsuperscript{14}

The chemigram kept evolving in the experimental postwar years. Cordier continued to refine his ideas and practices of the chemigram, determined to make it a serious form to be reckoned with and, in the process, to position himself as the key practitioner of that form. Arguably, he has had some success in this. French journalist Philippe Dasnoy said of Cordier in 2007:

[O]ther photographers and filmmakers had attempted comparable experiences. Thirty years before, Man Ray had made his rayographs using his photogram technique. Norman Maclaren had made cartoons without using a camera. However these were isolated, short-lived experimentation, and no one had ever seriously thought about exploring in depths and systematically the resources offered by random physical-chemical reactions on photosensitive paper.\textsuperscript{15}

\textsuperscript{14} Cordier, \textit{Le Chimigramme / The Chemigram}, 2007, p. 61.
Now I am going to look more closely at his work, initially considering his three categories and then turning some of his later work and collaboration since 2011 with Austrian-born artist/painter Gundi Falk.\textsuperscript{16}

**Chemigram without localizing product (First Category)**

The chemigram by Cordier shown below (fig. 2) is what I would call a ‘straight chemigram’, it is where developer and fixer can be drawn, painted or splashed, in any order: developer/fixer or fixer/developer onto the surface of the photographic emulsion.

Fig. 2. Cordier, *Chimigramme* 1961

This process is the most basic form of the chemigram and the usual first foray into the chemigram world, as an undergraduate, I first started to play around with left-over pieces of photographic paper and chemistry. The process’s credibility is described by Cordier this way:

From a technical viewpoint, painting could be compared to walking, photography to an automobile and the computer to a plane. The chemigram

\textsuperscript{16} http://www.gundifalk.com, Accessed 1\textsuperscript{st} November 2014.
could be compared to the bicycle: simple, fast, and cheap. People satisfied simply by drawing with the developer and fixer on a photosensitive emulsion make me think of a cyclist who walks alongside his bike.  

Cordier’s reference to ‘a cyclist who walks alongside his bike’ implies that the straight chemigram is beneath him. In my research, I have found that not only is it an extremely fast process it also playful, fun and very expressive. There are several artists who use the straight chemigram technique, interestingly they often do not acknowledge the chemigram in their practice; I discuss this further on.

Chimigramme 1961 (Fig. 2) is more technically sophisticated than it might first seem. The image is 50cm by 60cm, the standard size for large sheet photographic paper (20 x 25”). This would suggest that it was made using a single sheet and not cropped from a larger piece of random experiments. The image is also more under Cordier’s control than the notion of splashing around of chemistry would predict. Liquid free falling down a page will take the quickest route but as you can see in this chemigram, multiple applications of chemistry have been applied by layering of liquids altering the freewheeling of the original and therefore controlling the movement of the fall more precisely.

The mixing of the chemistry has also created a tonal range and balance; for example, developer oxidizes the silver halide grains turning them dark and fixer removes the remaining silver halide grains in the photographic paper turning it white. In this picture both partial and full development and fixation processes have occurred. There has been a melding of the chemistries, where part of the silver has been taken away (the light brown areas in the top of the chemigram) and there is a grading scale. When you look at the rest, there is presence of pure white and presence of pure black but overall it’s a melding of the two processes in the emulsion.

I chose Chimigramme 1961 as it is the only straight chemigram Cordier has published, in either his book or website. However below you will see that this is not

---

actually a straight chemigram, the use of *slightly oiled photographic paper*\textsuperscript{18} impacts on the free movement and acts as a partial resist to the chemistry.

**Chemigram with localizing product (Coated by hand. Second category)**

This is where all manner of substances can be used to block the chemistry from reaching the emulsion. Honey, varnish, paint anything that will adhere to the surface of the paper long enough to withstand immersion into either fixer or developer one time or many times. Chemigram with resist is how I like to call it. It is broken into these two groups:

*Soft resist*: These are usually wet organic compounds that do not adhere well and lift off the emulsion relatively easily.

*Hard resist*: These are often non-organic compounds that are usually soft to begin with, but when allowed to dry they become hard and can then be scored or cracked to allow the chemistry to enter into the emulsion.

In his first chemigram and the majority of his more than 2000 personally cataloged chemigrams, Cordier has used some sort of localizing product on the surface of the paper. In his book, he shares his knowledge of his practice, explaining techniques and resists used. He has said:

I obtained the best results with a varnish that protects metal (vm). This ‘magical’ varnish, coated on photosensitive surface (paper or plate), regularly comes unstuck from its support when it is plunged into a liquid.\textsuperscript{19}

This is a particularly strong example of the chemigram with resist. The photographic paper is coated by hand with the magical varnish, allowed to dry then scored with a

\textsuperscript{19} Cordier, \textit{Le Chimigramme/ The Chemigram}, 2007, p. 236.
razor blade. The dominant squiggly black and white lines are the lines in which he has scored the varnish/photographic paper.

Fig. 4. Cordier, (Detail) *Chimigramme 12/1/82 Zigzagamme*, 1982

The coated and scored photographic paper has begun in the developer and the consequent lines can be counted like tree rings indicating how many times Cordier went from developer to wash to fixer.

This ‘magical’ varnish allowed Cordier to create an optical illusion with intricate detail. It shows an amazing control over the ways he has scored the lines with a blade, creating the zigzag form. Another element of control this demonstrates is the chemical reaction: the resist has been lifted off equally between each submergence in chemistry baths, creating a more or less equal distance between the fixer and the development. It initially started with a very black tone, outlining the overall zigzag lines, and gradually faded to light brown over the 14 times it went into developer and the same
for the fixer. The white in the image is mostly retained although slightly contaminated, this is due to the fast acting pace of fixer which quickly pulls the silver out of the paper at a possible ratio of about 1:3 times faster than developer. Developer has a slower reaction, it starts off black but gradually turns to a light brown which would indicate some partial fixing occurred or Cordier may have used a second, weaker tray of developing solution.

**Photo - Chemigram**

This is where there is a photosensitive emulsion, which is bonded to a silkscreen, then exposed with a negative or photogram and processed. Then a resist is squeegeed through onto underneath photographic paper. This creates the boundaries of the image, text or pattern. Once the resist has dried, it can then be processed according to the resist’s capacity.

![Photo-chemigram](image)

*Fig. 5. Cordier, Hommage à Marey 1975, 1979*
The silkscreen allows Cordier to replace his hand and a razor blade as the tools, to set out where the uplifting off the resist begins and interchange it with photographic emulsion on the silkscreen. This allows the resist to be laid down when squeegeed in the negative or positive areas. Once the resist has dried, the above resist by hand process is proceeded.

In *Hommage à Marey*, the use of colour couplers in development has been utilized. This is black and white paper that was initially put into the fixer, producing the dominant white that is present around the borders and in the images. Then into the developer and after that into a colour couplers bath of green, then fixed, then blue and fixed, and finally red and fixed. When a resist is in the liquid baths it incrementally lifts away, as in the straight chemigram, partial development and fixing can occur, at the edge of the resist, this is possible and occurs more often in the fixing stage. This is why little white is seen on the overall image after the first bathing in fixer.

Cordier’s homage to Etienne-Jules Marey, a nineteenth century pioneer in still motion photography, is a collage of portraits of Marey and his photographic achievements. The silkscreen gives Cordier a greater amount of control in defining the outlines of a normal photographic image. Whilst not all the internal panels are recognizable enough to interpret, the significance of both Cordier’s and Marey’s work is apparent, Marey’s recording human and animal motion and Cordier’s ability to combine abstraction with representation.

The images above have demonstrated the techniques and defining principles that Cordier outlined in his book on what a chemigram is. The following two chemigrams come from near the end of Cordier’s solo work at the turn of the century and from his most recent collaborative work with artist Gundi Fulk in 2011.

---


Fig. 6. Cordier, *Chimigramme 31/07/01 Hommage à George Perec*, 2001

Fig. 7. The Victoria and Albert Museum viewing room, 2011
Chimigramme 31/07/01 Hommage à George Perec (Fig 6) was one of Cordier’s chemigrams that was in the Shadow Catchers show. He donated it to the V&A museum and it was the first original chemigram by Cordier I had seen; this was when I visited the V&A museum in late 2011. When I first saw it there was several things that I noticed instantly. The size was a shock, only 14.8 x 14.9 cm. I thought it was much bigger than that, my own naivety at looking at it online and not reading the details about the work. Then I noticed the chemigram that I had viewed numerous times online and also in the V&A’s catalogue and website was significantly cropped. The digital version focused on the ten by ten squared grid and the maze inside it, whereas the framed Hommage à George Perec had a scored square frame about one cm out from the grid followed by another one bordering the edge of the photographic paper. This cropped-out part showed several areas of the paper where the unknown resist Cordier used did not lift off as equally as the rest, resulting in areas that were predominantly white and not covered with concentric lines.

As I studied the chemigram closer I noted how deeply he had scored through the resist, emulsion and photographic paper, either side of the scored lines the paper had raised up about 1mm before receding flat. I was also able to count the number of times it went into the developer - seven. The dominant abstract line that is inside the grid is like a puzzle, it is one continuous line with a start and finish crossing through every square. I later found out that the 10 x 10 grid was actually in reference to Perec’s famous novel, *Life A User’s Manual*,\(^{22}\) and it related to the occupants of an apartment block and the intricate connections between each of them. I was a little disappointed at first, I thought that Cordier was still showing signs of abstraction later into his career and it turns out to be a copy of Perec’s 10 x 10 *Knights Tour*, with every square inside the grid drawn through, except for the bottom left hand corner one; which Cordier does connect with. Reading further into Perec’s career as a novelist I found that he was a great word player. *La Disparition,*\(^{23}\) is written without the letter ‘e’ in it and in another novel, *Les Revenentes,*\(^{24}\) the letter ‘e’ is the only vowel used. I was baffled by Perec’s quests and other explorations in his writings, and

---

\(^{22}\) Perec, G. *Life A User’s Manual* (Hachette Literatures, France 1987)

\(^{23}\) Perec, G. *La Disparition* (Gallimard, France 1969)

\(^{24}\) Perec, G. *Les Revenentes* (Gallimard, France 1972)
saw a relationship between Perec, Cordier and myself. What draws us all together is the desire to make art from the tools of our trade.

Fig. 8. Cordier and Falk, Chemigram Impair-Pair, 2011

Cordier, now in his eighties, has made his re-entry into the art world in partnership with Gundi Falk. This partnership has seen him shift even more emphatically towards a conceptual focus in his art practice, using the chemigram as a means to explore themes of chaos and order. *Impair-pair* (Fig. 8) were two chemigrams displayed side-by-side at the *Unique* exhibition at the Von lintel Gallery that I visited whilst in New York in July 2013. The chemigram on the left has a white border which was achieved by bleaching away the emulsion whilst the resist, whatever was used was still on; this was a very effective technique that allowed the image to stand apart from the border, the bleaching left the surface rough compared to the smooth, although scored image. This was in complete contrast to the black border, which was equal with image. I suppose this in keeping with the French title, which translates to odd and even. This also can relate to tight concentric lines within the individual squares that balance well with the other random shapes in the other squares. Cordier’s collaboration with Falk since 2011 has brought him back to producing chemigrams and exhibiting again; I can understand the chemigram’s attractiveness for expressing themes of chaos, order, memory and confusion, not only can they fairly represent this, they are also present when creating a chemigram.
In my research into the chemigram I have often felt the absurdity of someone wanting to patent an artistic practice\textsuperscript{25}, I feel this makes the form inhibitive, a rulebook of do’s and don’ts and which is such a contrast with the play of chemistry on photographic paper that characterises the process. I believe that Cordier’s significant involvement with the chemigram will always be acknowledged. However in my opinion the defining feature of the chemigram that Cordier stresses are that it must be done \textit{in full light}.\textsuperscript{26} This is a standout comment he has repeatedly used. It also represents an assault on traditional photographic practices. To drastically differentiate his technique from other photographic techniques that insist on controlling light, Cordier is throwing out the fundamental rule of photography, the controlled capturing of light onto light sensitive emulsion. The consequent results of prolonged exposure of light on photographic paper are described by him as:

\textbf{Photolysis:}

Usually, the decomposition of a chemical product by the effects of light. In the chemigram, the photographic paper turns blue, mauve, brown, reddish, or ochre depending on the emulsion used.\textsuperscript{27}

An interesting way to understand the need to broaden the definition of the chemigram and illustrate photolysis in action is to consider Cordier’s signature piece (Fig. 9) and the way in which it was arrived at:

![Fig.9. Cordier, (detail) Chimigramme 30/12/81, 1981](image)


\textsuperscript{26} Cordier, \textit{Le Chimigramme/ The Chemigram}, p. 234.

\textsuperscript{27} Ibid, p. 239.
(Detail) Chimigramme 30/12/81 (Fig.9) was used by Cordier on the dust cover of his book *The Chimigramme/The Chemigram* and is currently used on the home page of his website, [www.pierrecordier.com](http://www.pierrecordier.com) it is a detail of a much larger chemigram. The background is beige/white and concentric lines are black/blue, but compare this to the original:

![Chimigramme 30/12/81](image)

**Fig. 10. Cordier, *The Chimigramme*, 30/12/81, 1981**

It is actually the complete opposite, the background is dark and the concentric lines are light. This is photolysis in action, the direct effect of the lights being on during the process. I find it surprising that Cordier champions the full light in his definition and widely embraces photolysis with great brilliance in his practice but when it comes to his signature piece he disguises it. I have found in my research that controlling light has its benefits.

**Fellow Chemigrammers**

Whilst Cordier is the first to coin the term chemigram, many artists discovered the technique independent of him and before he was even born. The scientific exploration of chemical reactions on light sensitive materials, as I have suggested above relates to, the very first experiments in photography.
I will now go on to present a few contemporary artists (many of whom I encountered in person during my travels to New York), chosen in order to show the diversity in the field. Some of these practitioners acknowledge Cordier in their use of chemigram techniques, others, significantly, do not. Of those whose personal work I have not surveyed here, it is important to recognize Doug Collins. He is the main author of the [http://www.nonfigrativephoto.blogspot.com](http://www.nonfigrativephoto.blogspot.com), a crucial source of information, discussion and debate about all things relating to the chemigram. Collins has also run frequent workshops on the chemigram technique from his New York base.

Nolan Preece is an American photographer who has been practicing and teaching photography for over forty years. He states his main interests as ‘understanding and mastering the earliest photographic techniques’ whilst also engaging with new ones. In 1980 Preece began using a technique he termed the ‘chemogram’, but after encountering Cordier he abandoned this title in favour of ‘chemigram’. One of his first explorations into chemigrams was through his knowledge of photographic toners; thiourea, which is an ingredient in sepia bleaching that removes the silver, and the household drain cleaning product, sodium hydroxide that can develop the silver.

---


As the title above image (Fig.11) suggests, this is an arrangement of components. Whilst there are no examples of Preece’s chemical wizardry with drain fluid in *Chemigram texturology*, it does show evidence of his exploration of chemigrams. It contains straight chemigrams and chemigrams with both soft and hard resists (discovered through years of experimenting). What is also present is the more contemporary use of Photoshop: this is a digital file, 21 chemigrams in one image. The framework containing the segments is most likely to be oil paint varnish, something that sticks to the photographic paper initially but falls away after several baths. You can see this as the straight lines gradually become circular: what follows are 20 selected crops from individual chemigrams on photographic paper.

The first thing to know about Eva Nikolova is that she is much younger than Preece or Cordier. This is significant because it changes the context of her relationship with the chemigram technique. The second is that she identifies as a printmaker and not a photographer. Nikolova, originally from the Balkan region of Eastern Europe but now living in New York, uses chemigram techniques as part of her exploration of
memory and ruptured identity caused by both the Balkan civil war (1992-1995) and her removal from Europe. She was introduced to the chemigram technique by attending workshops run by Collins in New York.\footnote{\url{http://www.evanikolova.com} Accessed 1\textsuperscript{st} November 2014.}

![Fig.12. Nikolova, *Untitled VII*, 2012](image)

These two chemigrams (Fig.12) are from her *Ordinary Disappearance* series. As stated above, Nikolova uses a soft resist technique (peanut butter and guava paste) and obviously feels that the hazy, organic qualities offered by the chemigram are a good fit for expressing the intangible and unreliable realms of the memory. She is not looking to make a splash and a stand in the photographic world. In contrast to Cordier, whom she acknowledges, she is the product of a generation detached from the securities of a homeland and deeply preoccupied with emotions of loss and lack of belonging. Chemigrams here become a tool for navigating back rather than advancing a new form of photography.

North American artist Mark Roberts studied with Cordier in 1982 and, before that, with North American photographer Ansel Adams.\footnote{See \url{http://markdroberts.net/about-us} Accessed 1st November 2014.} The significance of including him in this review is that he is the only artist I have come across that has incorporated a photograph with a chemigram with resist. This is not at all surprising though, considering his connections with Cordier and Adams.
Incorporating a photograph with a chemigram with resist is a technical challenge. It would seem that a piece of tape or other waterproof membrane was used to block out the space for the photograph at the point when the photograph was developed or when the resist was applied. In order to preserve this area of the emulsion Roberts needed to have controlled the lighting. The unknown resist used has released itself from the emulsion quickly. It’s similar to Preece’s border on Chemigram texturology (Fig. 11). What can also be seen is scratching all over the resist, this adds further texture to what is really a border, like a frame around the photograph.

*Opus-XIX* is from his *Vanished* series where he repeatedly utilizes the same photograph of a naked man, a captive, his head covered with a bag. This is done in various size-enlargements of the figure, with different chemigram effects. In this sense Roberts, like Nikolova, makes use of the chemigram’s nebulous and ephemeral qualities to explore issues of devastation, trauma and human breakdown.

The book *Wolfgang Tillmans Abstract Pictures*, 2011(Fig 14) has on its front cover a photo+chemigram of a pair of jeans that has colour photochemical spills all over it.
Tillmans describes his technique as:

They are made by feeding paper through a water-filled dirty processing machine. These have interferences of dirt marks, blemishes, and traces of silver salts, sometimes even leaving a slight metallic shimmer. This interrupts the depth of the image and there suddenly is a physical matter on the surface of the carrier, something you usually do not encounter on photographs.33

Arguably, In my view this is not one of his strongest works. If you contrast this with the use of the chemigram technique as seen in Nikolova or Roberts’ work, the chemigram’s ambiguity, it’s ethereal qualities, are made a prominent feature and used to explore topics like memory or traumatic experience which fits with the chemigram’s lack of solidity. I feel that the use of the chemigram technique here is too subtle, the rationale for its use is hard to grasp, how does the incorporation of the straight chemigram enrich or make more complex this image? Conceivably, the picture would be none the worse for not having it. Despite Tillman’s argument that this technique ‘interrupts the depth of the image’, giving an unexpected dimension to the work, the end result appears more like the straight chemigram has been simply stuck on rather than fully integrated into the end result.

33 Tillmans W & Kolbitz K (eds), Wolfgang Tillmans Abstract Pictures (Hatje Catenz Verlag, Germany 2011) p. 23.
Photographic Artists

Other prominent artists have used the chemigram technique heavily in their work but have not necessarily acknowledged Cordier or even distinguished the chemigram as a specific technique.

Since 2011, North American photographic artist Edward Mapplethorpe, the lesser-known younger brother of Robert Mapplethorpe, has been building up several series of works called *Variations*.34

![Fig. 15. Mapplethorpe, Untitled No. 15, 2013](image)

Mapplethorpe makes large straight chemigrams; these are over one metre in width. The photographic paper is emerged into a large tray of water, the chemistry is individually applied in a Pollock-like motion and it would appear to be coming out of something like a sauce bottle because of the long gestural lines. The presence of black and white indicates he initially started in safe lights but turned the lights on later to achieve the tonal range. After the Chemigram is produced, it has been scanned and worked into Photoshop. Tonal blocks either side; complementing the tones in the chemigram, form a triptych. Furthermore, a shadow is positioned under each segments of the triptych. I would prefer to see the original chemigram on it’s own. Notably, Mapplethorpe refers to his *Variations* as works on paper and clearly distances himself from the chemigram.

Similarly, North American photographic artist Mariah Robertson has gained prominence in the international photographic scene. I took the Fig.17. of her work at MOMA, New York. Robertson’s ability to combine photography, photograms and chemigrams on roll paper is remarkable. To work in the dark and enlarge multiple negatives, as well as lay objects for multiple photograms and to splash and pour chemicals around on 30 metres piece of Colour RA-4 paper and keep so much paper unexposed would be such a laborious task and she masters it well. Robertson calls this hybrid of techniques only a chromogenic colour print. Other exhibited pieces of her work are a lot smaller and use only chemicals. Robertson refers to these as unique chemical treatments on RA-4 paper, another example of an artist experimenting freely without feeling the need to acknowledge the term ‘chemigram’ or acknowledge Cordier.

I would also argue that well-known Australian photographer Bill Henson has made particularly strong use of a straight chemigram technique in several bodies of work
produced during 1979-80. These mostly involve his black and white series and one series in colour. Some of them are referred to as unique silver gelatin photographs and other just as silver gelatin photographs. They are straight chemigrams melded with photographs; sometime it is obvious, other times less so.

![Image](image_url)

**Fig. 18. Henson, *Untitled*, 1977/87**

The exact way in which this work was made is difficult to determine, however it is obvious that somewhere in the production of the image chemistry was poured/splashed onto the emulsion. This is clearly visible in the top of the picture; which is similar to sections of Cordier’s *Chimigramme* 1961 (Fig 2). It looks like there were two negatives, one straight chemigram sandwiched with the photo when enlarged; I say this because I can see detail in the developed and fixed areas that have had chemistry poured onto them implying separate exposures. The photograph of a

---

35 In 2005, Henson B, *Mnemosyne* (Scalo Verlag AG, Zurich 2005) was a book published in conjunction with a major retrospective of Australian photographic artist Bill Henson at Gallery of Art of NSW and the National Gallery of Victoria. I did not see the exhibition but the book contains some 493 images and I believe that at least 47, and possibly many more are chemigram+photo.
building is difficult to recognize as the chemigram competes with the overall image, it is also evident that chemistry has been applied mostly from the top of the image but also from the sides. The key point here is that the chemigram technique is being incorporated into Henson’s practice but it is not singled out as a particular feature of the work.

Whilst Mapplethorpe, Robertson and Henson have all used a substantial amount of straight chemigram technique in their work, other artists have utilized these techniques less often though to notable effect. Pablo Picasso, one of the greatest artists of the twentieth century, even gave it a go. Working in collaboration with French photographer Andre Villiers in 1962, they incorporated a photograph with a photogram and a straight chemigram.⁶

![Image](image.png)

Fig. 19. Picasso/Villiers, *Le magicien aux taureaux*, I 1962

---

Another artist, German-born Floris Neusüss, also featured in the *Shadow Catchers* exhibition alongside Cordier, has drawn upon elements of this technique. Neusüss is most known for his contribution towards the photogram but whilst his life size photograms were the main pieces of his work in the exhibition, there were also two other pieces in this part of the exhibition that had a description of: gelatin-silver print with painted developer and fixer.

![Fig. 20. Neusüss, *Untitled (Körperbild, Kassel)*, 1966](image-url)
Martin Barnes, the curator of the *Shadow Catchers* exhibition, describes Neusüss’s technique as:

> Departing from the conventional photogram. Neusüss experimented by wiping a brush, sponge or rag dipped in developer of fixer across the surface of the paper to produce controlled, painterly gestures… where after the exposure, Neusüss painted around the outline of the model using photo-chemicals, thus selectively developing and fixing areas of the image. Certain areas of the paper were deliberately not fixed, allowing the work to change colours over the years.  \(^{37}\)

He goes on to suggest: ‘*This embrace of what might be described as ‘chemical automatism’ recalls the surrealist technique of allowing chance to dictate the final creative outcome of an artwork.*' \(^{38}\) Nowhere in Barnes’ essay on Neusüss is there any reference to the chemigram, he clearly avoids making the link between Cordier’s Chemigram and Neusüss’s painted developer and fixer. One can only assume this is deliberate given that the two know of each other and their individual practices, after all they are also both represented in America by the same gallery.

**Conclusion**

From this survey, I draw the following three observations. One, that Pierre Cordier the key figure in the chemigram world breaks from photography, this rests considerably on the illumination of controlled light. I, on the other hand, feel that light is a significant factor in all making of the chemigram. There are also several artist who follow Cordier’s maxim, Eva Nikolova and Edward Mapplethorpe for example are using photographic tools but as artists are closer to painting than photography. Two, other artists do not break from photography, but incorporate the chemigram into a more widely conceived framework of photographic practice these include Bill

---


\(^{38}\) Ibid, p.22.
Henson and Mark D Roberts. Three, that a good way to think of this diversity is like a spectrum, with a range of positions between the two poles.

It is not always clear cut, practitioners move about within this spectrum, which is why I argue for a broader, more flexible definition. Personally, I feel my practice recognises more continuity within photography. I will now go onto discuss my exploration of the chemigram and the technical processes I have experimented with, which utilise some of the extraordinary potential of the chemigram (straight and with resist) technique. This exposition will provide the all-important background for how I subsequently evaluate my body of work, (See chapter three).
Chapter Two
Exploring the Chemigram

Introduction
In this section I am going to discuss the technical aspects of my practice revealing my methodology of researching, making, thinking, reflecting, focusing on the materials and processes. I start by discussing the core ‘ingredients’ in a chemigram; light, chemistry, and photographic paper. I go on, and examine chemigrams with resist, the form that I have focused on the most, and survey the properties and effects of the various resists that I use. Finally, I look at straight chemigrams and the processes that I experimented with during my practice-led research.

The Fundamentals

Light
I first approached my practice by using the “lights on” process that Cordier describes in his definition of the chemigram. I did this because it is advantageous to clearly see the entire goings on of chemical reactions on silver halide grains. Prolonged exposure, however, affects the silver halide grains, dependent on the amount of time exposed to light and the different makeup of the various photographic papers that are used. Prolonged exposure will make the undeveloped then fixed areas on the emulsion become a different tone than the white that normally occurs in darkroom conditions. Generally the older the photographic paper is the more silver rich it is which in turn gives a stronger tone when fixed.

I experimented with sunlight, fluorescent and incandescent light but it wasn’t long before I found sunlight and fluorescent light were too strong and prompted too many variables dependent on photographic paper type, the strength of the light, the temperature and concentrations of photographic black and white chemistry. I gradually decreased the amount of light to a little safelight bulb with the red cover taken off. Then I began to pre-flash the photographic paper and continue to work in darkroom conditions, which enabled me to maintain a white in undeveloped areas and control the amount of light the emulsion absorbed. Light fogging would produce soft greys in the developer. I would often use this as a starting point, later on I could
darken the greys with a torch or fluorescent light in-between the revealing of the resist. This allowed a base of white and tonal ranges all the way to black.

Fig. 21. (Detail) *Untitled 134-5*, 2014

*Chemistry*

A key variable ingredient in chemigrams is the photographic chemistry. Once again, there are many possible variations when it comes to chemistry, temperature range and concentrations. I generally chose to stick to the manufacturer’s recommendations. For example; Ilford multigrade developer mixed with water at 1:9 at 20 degrees. I took stop bath out of the equation and used a tray circulating running water and Ilford rapid fixer mixed with water 1:4 at 20 degrees. A chemigram can travel between developer, wash and fixer numerous times; this can influence the ratios and lead to contaminated chemistry as small amounts of chemistry build up in their opposing trays. This can eventually lead to the silver halide grain being partially developed where solid blacks are not produced or partial fixation that, when developed, produces coloured tones. This is also a common occurrence in large communal darkrooms full of novices. Contamination can be best avoided by thorough draining of the photographic paper when removed from the tray, hanging it over the chemistry until drops become slow, and adequate time in the wash. Water needs a little more time than the usual in stop bath.

*Emulsions:*

*Resin Coated (RC) Black and White Photographic Paper*

All photographic paper has a considerable degree of variation when using the chemigram technique. New photographic paper, for example, is very reactive to light
and photographic chemistry, whilst older photographic paper is slower in its reaction time. Both have their uses. The way in which a resist reacts with the outer emulsion of photographic paper also varies; some stick and reveal better than others. I tended to favour RC, as the clear plastic topcoat of the emulsion gave the resists that I used the best chance to be removed. The downside of RC is that once bent, plastic has a memory that is irreversible. Overall the main reason for my use of RC was its strength. I have sometimes immersed it in liquids for up to forty-eight hours. I have, however, seen that in some cases the emulsion peels away from the edges and a few times completely pulls away from the base layer. Also, when it is scored with a razor, the overall structure becomes weakened and individual segments can dislodge or peel from the base layer. I have been able to sample a large amount of brands courtesy of the Internet and the overall decline in darkroom practices resulting in a surplus of no longer wanted paper supplies. These have had varying results. I have found Ilford to be the most consistently strong photographic paper brand, regardless of age.

Fibre Based (FB) Black and White Photographic Paper

Like RC there are similar factors in FB, but there are also some very different ones. Once again, Ilford is the most reliable brand, but does not contain a great degree of difference from its RC paper. The obvious major factor is that FB is made up of fibres that weaken when wet. When the FB is emerged in liquids for a prolonged time, more than an hour for example, developer and fixer can penetrate the base layer and reach the underside of the emulsion, causing unwelcome developed or fixed areas. One way to avoid this is to waterproof the underside, with contact or glues, mimicking RC waterproofness. I experimented with sticking FB onto Perspex but found it difficult to find a cheap, totally waterproofing glue. When I used contact adhesive I struggled to eliminate air bubbles. The best result I had was with sign writers’ adhesive, this adhesive has the ability, when applied with hand pressure, to remove the trapped air pockets and achieve a total contact.

Another necessary adjustment is that FB is a lot slower in its reaction time to light, developer and fixer. Also, the fibres on the surface, with its thin embedded emulsion

on top, can be an excellent receptor for resists which can attach themselves permanently. This can be frustrating, resulting in a range from large surface areas to a very small lonely island of resists hanging on tight to virtually the entire piece of paper.

Film

I used both camera film and lith film and found that they were best suited to straight chemigrams or soft resist (see below for more information). As I mainly focused on hard resist I used film sparingly. Film is very susceptible to scratching, and emulsion that is submerged for a long time in chemistry will become very fragile, making it difficult to handle.

Black and White Glass Plates

Given that I was collecting vast amounts of relatively inexpensive old photography paper from across the world (often the postage cost more than the paper), some exciting bundles, unearthed from deep forgotten places, provided a further opportunity for experimentation. Once I got a bundle of about twenty pieces, mostly dating from before 1960, which included a few boxes of 2.54 x 2.54cm glass plates. I initially dropped some developer on one to see the results. Once I got the speed of the emulsion I tried out a few resists but quickly found that the emulsion was very fragile and would separate from the glass from the weight of the resist, so I soon gave up on them. Then, sometime later on, a 35.56 x 35.56cm half empty box of Ilford 1.3mm plates turned up, from some abandoned photography corner somewhere in the university. These plates were designed to capture starlight and had a very thick emulsion for prolonged exposures. This emulsion when wet could take well over twenty-four hours to dry at room temperature, but it was durable enough to use dry resist (see below).

Ilfochrome and Cibachrome Paper

Ilfochrome positive colour paper ceased production in 2011 and the relevant chemistry shortly after. I had acquired a significant amount of paper, both the older
Cibachrome and Ilfochrome, from various vendors but the chemistry was difficult to find. I was able though to acquire some of the last P-3 kits available in Australia, in 2012. I mostly had Ilfochrome classic white polyester stock and also some Ilfochrome classic paper. I found that with the classic paper the emulsion layer was susceptible to peeling away, when scored and processed but this was not the case for the polyester. The only downside was that it could be cut completely through.

Now the tricky bit in processing: I quickly gave up working in the dark, as is required with normal production of Ilfochrome, and used soft lighting from a small single bulb as I was only too aware that the bleach bath contained harmful sulphuric acid which I thought would be useful to see (I was wearing a industrial gasmask). Maintaining the chemistry at the required temperature of thirty degrees was also problematic. I was, however, able to produce colours in a chemigram with resist on Ilfochrome positive paper by limiting the amount of time in the chemistry. I was able to achieve different colours according to what layer of emulsion (nine in total) the chemistry reached and the subsequent repeated bathing and revealing of emulsion allowed different times and different results.

![Image](image.png)

Fig. 22. (Detail) *Untitled 289-3, 2013*

**Chemigram with Resists**

Just as in a straight chemigram (a chemigram without resists) “the physics of painting”\(^{40}\) lies in the interaction between the emulsion and the photographic chemistry that determines the final result of the chemigram with resist. Equally, the way in which a resist is applied to the surface of the emulsion will have a crucial

---

\(^{40}\) Cordier, *The Chimigramme/The Chemigram* p. 234.
affect on the final outcome before it has even reached the chemistry. Careful consideration is needed as to what resists are best to use, the best way to apply them and the timing of processing. If total coverage is needed, an even coat is desirable in order to achieve a consistent release of resist, across the photographic paper. This is best achieved from a paint roller, which can be difficult when trying to apply a generous amount. The same applies for a spray can, but both of these are much better than a brush, which tends to leave thick and thin lines when dried. When only partial coverage is desired any manner of things can be used to apply the resist; brushes, knives, sticks, anything that a painter might use.

Soft, dry and wet resists:

- Soft resist - is usually an organic compound, most often water-soluble.
- Dry resists - is any compound that is applied wet and allowed to dry.
- Wet resist - is when using a dry resist in its wet state.

I will now go on to discuss the resist that I had the most success with in a chronological order of experimentation.

Wood Varnish

Like many of those new to chemigrams, I began by exploring straight chemigrams but was soon attracted to the complexities of the chemigram with resist. Having researched Cordier’s use of the process, I learnt that it was very similar to Indonesian batik process in textiles. In batik hot wax is finely drawn onto fabric and when dried it is dyed.\(^41\) Wherever the wax has set, the dye is unable to stain. When the wax is removed its outline is left behind. Already familiar with this technique from my own youthful travels in Indonesia I thought of applying the technique to photography.

Cordier, in discussing the processes behind his most detailed chemigrams, mysteriously referred to a magic varnish that protects metal. Skilful application of this had resulted in the numerous concentric lines in works such as *Chimigramme 12/1/82 Zigzagagramme*. With the tantalising promise of a *magic varnish* in mind, I went out to find varnishes.

Initially, I started off with an old tin of oil-based wood varnish, which I had laying around. I gave the tin a good stir and then with the stirring rod dribbled a generous amount onto a few pieces of RC and allowed it to dry overnight. The next day I realised I had coated the wrong side and also that the varnish had become rock hard. Not giving up on the wood varnish I got the tin back out and dribbled some fresh varnish over more RC, this time right side up and crudely thinned it out with a chopstick. I waited about an hour and then dropped it into the fixer and agitated. I soon saw little bubbles appearing where the varnish was. After about two minutes in the fix, I pulled it out and put it into water noting that small amounts of varnish had left the RC and remained floating both in the fixer and the wash. This got ugly quickly, the varnish stuck to everything. I pushed on and put it into the developer, agitating it a little. It wasn’t before long I saw the bubbles that occurred in the fixer get developed with a small black line circling them. I pulled the paper out and put it into the wash. A little more was dislodged before it went back into the fixer, agitating it again I noticed a small whitish area had formed apart from the black line. When it had grown to about a millimetre I retrieved it out and put it into the wash.

Of course, by now there was more varnish in the trays than there was on the RC. Still undeterred, I put it back into the developer, agitated, and when the second ring appeared I was delighted to see how a chemigram with resist could work. I did several more that day and once went ten times through the process developer, wash and fix.

---

At the end of the day I spent over an hour cleaning up the residues (luckily the trays and sink were stainless steel!). Over the next few weeks I played around with this technique, moving on from my start of 25.4 x 20.32cm and reaching 40.64 x 50.8cm by the end. Despite my pleasure at the results, I did want to find a resist that didn’t require such a massive clean-up at the end of the day, having learnt, only too well, the joys of oil mixing with water.

**Apple Stroop**

Another of Cordier’s named resists is apple stroop, which he describes as his favoured soft resist. The apple stroop can be found on the shelves of a continental deli. It is a sweet spread, much like jam, having a consistency somewhere in-between jam and honey; a puree of apples and sugar concentrate. It is water-soluble and sticks to the emulsion firmly, gradually dissolving in the chemistry trays. A short time in chemistry leaves small outlines of development or fixing, a longer time leaves larger lines. At any time the resist can be washed away easily.

This is where the “physics of painting” really determines the outcome. Lines can be made, words can be written, or you can draw figures, shapes or abstract gestures as you wish. I found something as simple as a rough grid of thick lines could make an interesting chemigram. After applying the stroop to some RC, I would fix to begin whiting out the negative space, then give it a short wash in water and then briefly develop, just enough to see a thin line around the fixed areas. These lines became

---

44 Ibid, p. 238.
slightly curved at the corners as the stroop began to dissolve and the agitation in the liquid would hit them the hardest. Next was to wash and fix for twice the time in the developer (fixer is around twice as fast as developer in reaction time) as the fixed areas clearly separate from the black outline. I would wash off the remains of the resist and the developer would create the outlines of little islands, not quite square in a grid. This process can equally be reversed; you can start with the developer first.

Fig. 24. Applying apple stroop 2012.

From small beginnings I scaled up to 40.64 x 50.8 cm, sometimes using up nearly an entire pot (500gms) when I attempted to get as many multiple direction lines as possible on a single piece of RC. The stroop was consistent and reliable, unlike my hand that could smudge a part of the soft resist when it was lay down in position needing it to be all scraped off and the RC washed and dried before I could start again. Soft resist generally works on all types of emulsion; they especially worked on sheet film.45

Epoxy Enamel

I had no desire to repeat Cordier’s chemigrams, but I did want to understand the principles behind his work. This led me to look into his infamous “magic varnish”. I tried numerous resists; oil-based products, acrylic products and organic products, all of which had varying results. Whilst researching a varnish “that protects metal” I

---

45 See, for example, my Untitled 2012 chemigram on “What’s Matt Higgins up to?” [http://nonfigurativephoto.blogspot](http://nonfigurativephoto.blogspot) which was made using 10.16 x 12.7cm black and white film. Accessed 1st November 2014.
found that there was no specific product that did this, but I did come across epoxy enamel paint. Later, this became my resist of choice and the one I experimented with most. Epoxy enamel is a final rustproof topcoat used in protecting metal. Whilst it is touch dry in about twelve hours, it doesn’t properly cure for over a week. When it is applied to RC or FB it behaves much the same as if it was on metal. I found that I could completely cover the emulsion end to end; this was best achieved using a small 3” paint roller. I would start the process the night before, initially with the lights on but later flashing the emulsion before applying a fresh layer of paint over it and allowing it to dry overnight. In the morning, I would lay it down on a wooden baseboard supporting an enlarger. Wood was a deliberate choice, as the next step was to use a scalpel or razor blade to score the surface of the paint and emulsion. This is a delicate step: not enough pressure and the paint, let alone the emulsion, is not cut, too much pressure and the corners of the emulsions can uplift, even peel away, or worse still cut a hole through the paper. A hard surface would prompt harsher cutting whereas wood gives the right amount of upward pressure for scoring. These scored lines become the starting point for the chemistry to react to the emulsion.

![Marked out areas 2013](image)

Fig. 25. Marked out areas 2013

The ease with which the paint is removed depends on the consistency of the paint, the thickness of the cover and the amount of time in liquids. It does not react to developer or fixer but gradually softens up so the warmer the liquids the better. When the paint is new, it is very runny but over time, as it reacts with oxygen in the can, it thickens up. A new coat of fresh paint sticks very well due to the thinness of it, too well sometimes and it becomes impossible to remove. When the paint has softened up,
with the aid of warm running water, small areas of emulsion can be exposed to the chemistry. After a sizeable amount of paint is revealed, it can be either developed or fixed. Then it can be washed and rested in the alternative bath for few minutes. A small developed or fixed line now borders the point where the paint is in contact with the emulsion. This can be repeated numerous times as the paint is physically removed and processed. Sometimes during this process, as the paint is being separated, it reattaches itself, aided by agitation in the tray. This could lead to chemistry being caught inside or partial processing sometimes resulting in silvering out.

I would typically work on two chemigrams at a time, alternating between baths and this would last anywhere from five to ten hours. As the paint thickened in the can it allowed me to apply a thicker coat, which in turn gave me more control in removing it because, when immersed in liquids, the paint softened up very quickly. I found it possible to remove entire scored sections of the paint, this allowed me to start and stop wherever I wanted.

*Aerosol can spray paint*

This can be used like epoxy enamel and a lot of the cans available are just that. They also can be used like wet wood varnish but instead of a wood varnish flat 2D result, 3D like effects can occur. This again, is a messy process; first I would place a small piece of tape on the back of some RC, making sure a good chunk of the tape is sticking out, then I sprayed on a thick even coat over the RC. I found if I waited for around 30 seconds then picked it up (the tape made this easy) and immersed it into the fixer, after a very short time, small bubbles/holes would appear penetrating the paint. Once the fixer had entered the holes and I saw the white of the emulsion, I would hastily pull it out and quickly put it into the wash just briefly, enough to get most of the fix off. Then into the developer. Once there, development would occur where the fixer hadn’t reached and would fade light to dark away from the initial hole. These bubbles formed across the RC, anywhere from 1mm to several centimetres in diameter. After a while, the paint holds on and no further developing occurs. I would then wash off the remaining paint and finish of the remaining unprocessed emulsion in developer. Where there are large areas of fixed white/beige appear is due to the
initial plunge into the fixer where the paint dislodges itself from the RC as it enters and breaks the surface tension of the fixer.

*Nail polish*

The toxic pungent smell of nail polish is enough to deter anyone from using it as a resist! My first discovery was that I needed a gas mask. I also quickly found that I needed to buy it in industrial size quantities (1-5L) as the little 15mls were expensive and didn’t go far. Initially I painted with it. I tried RC and FB and found RC to work the best. After I dried it overnight, I found that if I developed it first, then soaked it in water for 10 minutes, I could get a perfect outline of where the nail polish was when fixed. The longer time in, the greater the line. I could then soak it overnight in water and in the morning, using warm water, remove the nail polish and develop the emulsion that was hidden.

In January 2013, I spent the entire month using the nail polish to create a 3 x 10m mural. I spent a few days creating a darkroom in the School of Art, lecture theatre and once the windows were covered up, I wrestled with emergency lighting, and covered the ground and 2 metres up the wall with plastic drop sheets. I then brought in all the portable safelights I could find and spaced them around. The next day, I laid down 100 50.8 x 60.9 RC and in a manner reminiscent of Jackson Pollock, dripped 4 litres of nail polish over the RC, closed the door and left hastily. It stunk!

Fig. 26. Lecture theatre / darkroom 2013
The next few weeks I went about processing the paper. (Not before turning the lecture theatre into an enormous camera obscura.) I had done smaller murals and settled on each sheet of RC getting 3 minutes in developer, 10 minutes in wash and 5 minutes in fix before being washed and soaked overnight. I found I could do up to 10 a day. It was not before long I realised the nail polish was acting differently than the previous batch I had tested. The white outline of the nail polish’s journey was too thin and not what I was trying to achieve. Ultimately, this was a disappointment. I had wanted to present long, strong gestural lines. I needed bold markings, suitable to the dramatic scale of a mural. I attempted to translate this into my application of the polish. Achieving this, however, became difficult once the polish had hit the outer plastic. It stuck to my feet and dislodged the grid. I was able to make markings that spanned several metres in length but these fine lines were not easily visible from a distance on the finished, processed piece.

Fig. 27. Thin markings 2013

To maintain an even consistency I kept to the original process. Once finished I hung the mural and whilst its size was impressive, from a distance it mostly looked black.
It wasn’t till you went closer that you could recognise the detail. This was the most expensive project that I undertook and I was happy to have done it but I regretted not testing the new batch of nail polish, I thought I would be all right coming from the same manufacturer.

Sometimes I would coat up RC and lay too much nail polish down. This would need to dry a bit longer and when I got around to using it, often the next week, I found it would not come off no matter how hard I tried. I first heard of nail polish through my research into Cordier, he had described how he would get nail polish to crack.\textsuperscript{46} I too was interested in this, but had no luck, it was far too flexible. I put it down to modern nail polishes not being like the nail polish of the 1950’s and 60’s, the time during which Cordier was experimenting. Nearly two years after I had first played around with nail polish, I had all but given up when I happened to look through my plan drawer at home and picking up a 10.16 x 15.24cm chemigram that had a large block of nail polish left on it, I rolled it over the edge of the drawer and, to my surprise, it cracked into large plates. This shows the benefit of not throwing everything out!

\textsuperscript{46} See The Chimigramme/The Chemigram, p. 235.
So when I next had a chance I coated up some 25.4 x 20.32cm, both FB and RC; and buried them away, about a month later I was able to crack away. I will later discuss other resists that crack but the big difference with nail polish is that there is far more control when cracking. If the coated photographic paper is folded in half, a single line, sometimes straight and sometimes fractured will occur. Subsequent folding will do the same. Large or small plates can be made and generally they slowly lift when emerged in liquids without the use of physical intervention. The main benefits of cracking are firstly, that the surface of the paper remains intact (unlike using epoxy enamel and a blade) and secondly, the varnish lifts off without the need for manual intervention.

**Oil paint varnish**

In my research the closest resist I found to the elusive “magic varnish” was in an art supply shop in the aisle that contains oil paints and relevant paraphernalia. Oil paint varnish exists in both oil-based and acrylic form. Now, the acrylic form would simply fall off completely from the emulsion, but the oil-based form had the ability to gradually separate from the scored lines without any physical hand pressure being required, taking place in the trays alone. I first heard about this on nonfigrativephoto blog where author and chemigrammer Doug Collins spoken about using it in several examples of his research into chemigrams. However unlike the “magic varnish’s” ability to go on slowly receding till the end, Golden MSA varnish would start off strong and after a few lines was made to

dramatically pull away. Late into my research I came across a small tin of Derivan Matisse matt oil-based varnish and found that on glossy or semi glossy FB it managed to hold on slowly, receding for about 1 hour in the trays. After that it seemed to harden up and became troublesome to remove. I experimented with thinners, different ratios even mixing it with Golden MSA varnish but found that the best result was when it was used straight out of the tin. I was able to create a few works where the scored lines were close enough to complete the chemigram within the hour.

Fig. 30. (Detail) *Untitled 623-2, 2014*

Another feature of the varnish is its ability to be cracked. As Cordier described with nail polish, when the varnish coated RC/FB is soaked in cold water for around 10 mins, it can then be cracked. This is as simple as bending it over a sharp edge just the same as nail polish, but unlike nail polish cracking oil paint varnish produces relatively small plaiting and more often than not fractures across the RC/FB. Whilst researching cameraless photography I came across László Moholy-Nagy’s *Diagram of Forces*, 1939 (Fig.31) in a exhibition catalogue and learnt that he had written on the back of the photogram: A light sensitive paper was made wet, squashed and exposed to light. The result is a ‘diagram of forces’ projected on the flat sheet.48

48 Rice L & Steadman D, “Photographs of Moholy-Nagy from the collection of William Larson” (Galleries of the Claremont College, USA 1975) p.35.
I experimented with the idea of ‘squashing’ the paper. When done with a coating of varnish, it cracks wherever the creases are made. This can then be crudely flattened and put into the developer. If this is all done with a strong pre-flash and under safe lights, developer can enter the cracks recording the creases. Afterwards, when it is fixed and washed properly, it can be heat-pressed flat again.
When I first started to imagine all the different ways a resist could be applied, I thought of ways in which the hand could be “illuminated” or amplified. I came up with the idea of an inkjet printer to administrate the resist. Following further research, I learnt of the difficulties in achieving this as the needle and pumps designed to administrate inkjet could not facilitate a resist that was designed to dry or have the viscosity of organic material. Later, I thought of a 3D printer (after seeing one online) and noted that it used hot liquid plastic that dried quickly to make an object. I called up some commercial labs that advertised 3D printing but wasn’t able convince any of them to put a piece of photographic paper in their machine. I left the idea on the backburner until 2014 when ANU’s Photography and Media Arts Workshop, acquired one. I left the dust to settle and eventually rocked up to the room where it was housed with a 25.4 x 20.32cm of RC and FB and a pair of scissors and tried to convince the powers-that-be to give it a try. After a small discussion it was given the green light.

As we discussed the logistics I explained that initially I only wanted to see if it would actually work and was happy to get any amount of plastic down. I noticed as I watched the printer finishing up a piece that the filament ejected was very thin. I also saw that on other finished pieces, decorously arranged on the window sill, the underside of the object had a thick generic continuous “S” shaped foundation layer. This thick foundation was present in all the objects. I suggested that we tried to get some of this foundation layer down. We struggled with attaching the RC and FB to the base plate but eventually got there. First up came the now scaled-down RC and when enough had been laid down we stopped the print and removed the RC only to find the hot plastic had melted through the emulsion, not burning it but definitely engraving it. Then it was time for FB and a similar amount of plastic was applied. This time when it was removed the plastic had stuck and it had not damaged the

---

49 Elke Van Derkelen has found a use for an inkjet printer with chemigrams. The photographic paper is feed into the machine, printed on and then processed in the darkroom (the ink is the resist). See http://www.elkevanderkelen.com/chemigrams.html for examples of this. Accessed 1st November 2014.
surface. Excited I raced to the darkroom and put it into the fixer, not for very long, as I wanted to see if it would work. I washed it and placed it into the developer. Soon I saw that the plastic was resisting the chemistry from the emulsion, and a small black line had appeared underneath the white plastic. From digital to the darkroom. I pulled off two sections and fixed. Then pulled the rest off and developed it.

![Fig. 33. 3D printer as a resist 2014](image)

Now that I knew it could work I went about trying with the help of Samuel Thow from the department, to get one of my own designs made in Illustrator. This, however, turned out to problematic and ultimately unsuccessful, as the filament was too thin to adhere properly to the FB and I lacked sufficient knowledge of the relevant software.

I can see a lot of potential with a 3D printer but much more research is needed. I bought a relatively inexpensive 3D Air Pen online. It was able to use the same plastic as the printer and was hand-held. When I first tried it I had the same problems of thin filament. I widened the pen tip made of brass (which would get extremely hot) with a small drill bit, almost doubling the output hole. This slowed down the amount that was released but it was thicker. But I could not though manage to get it to stick well to any FB.
Other resists

After I understood the basics of using a resist in my first year of candidature (2011), I went onto explore as many resists as I could find, anything that would stick to photographic paper, I searched hard-ware stores, paint shops, junk yards, kitchens and offices and tried and tested about a hundred items. Some of these include; honey, jam, vegemite, treacle, pear stroop, glucose, different types of flour and water combinations, glycerine b.p, floor polish, rubber cement, acrylic varnish, polymer varnish, damar varnish and oils. Gradually I built up a knowledge of what could produce a chemigram with resist and which ones were useless. A good many of the ones above and, many more, simply fell off the emulsion. I had the idea that henna could be a possible resist after witnessing it being applied to the body, but when I eventually tracked some down, I found that when it was applied onto photographic emulsion it would develop and create a straight chemigram. I thought of the possibility of collaborating with a henna artist and am yet to pursue this.

Straight chemigrams

I was concentrating so heavily on chemigrams with resist that after the initial stages of my research, I left the straight chemigram alone. All this changed when in June 2013 I had a day workshopping with Nolan Preece in Reno, North America. Of the many techniques we exchanged were two straight chemigrams he showed me that I found fascinating. Below is a brief discussion of these two techniques.

Thiourea and sodium hydroxide

Thiourea is a chemical used in Sepia toning; it is used in the bleaching process, and removes the silver halide grains. When the crystals are mixed with water they are very powerful. A rich concentration left to sit too long on the emulsion can corrode a hole all the way through the paper. Sodium hydroxide, more commonly known as drain cleaner or lye is able to develop the silver halide grains. It works best when it is in manufactured in small 1mm balls. There are two ways I explored the use of these chemicals, firstly, the way I was shown, was to put a piece of RC or FB in a tray of shallow water and to generously sprinkle thiourea (a pepper shaker is best) over the
photographic paper, agitating a little and making sure large crystals dissolve. Fairly instantly the thiourea begins to fix in the areas it comes into contact with. Then, add 5 to 20 small lye balls. When they come into contact with the thiourea and are rolled around, they develop the surrounding area and leave trails of their journey. Sometimes silvering-out can occur. This is very fast and difficult to control.

Fig. 34. *Untitled 301-3*, 2013

The other way that I adapted back in Australia was to put a piece of RC or FB onto a flat piece of Perspex and position it on a 45-degree angle in the sink. I could experiment with sprinkling dry thiourea and lye on the top half of the photographic paper, using a spray bottle and adding fine amounts of water to it. The gravitational pull of the water forced the chemistry to run downwards. I did this to try to maximize the silvering-out that sometimes happened in the process discussed above. I found that if the thiourea had begun to engage with the silver, and lye then came over the top of this, at a certain point silvering-out could occur producing a large range of colours. (See in following chapter) Again this was a fast process and somewhat difficult to control.

*Ilfosol 3 film developer*

---

The other technique I was shown used the thick super concentrate film developer Ilfosol 3 (in fact, it was initially the Kodak equivalent). It also needs water to be active and much like the above technique works best in a shallow tray of water or when water is added to it. It’s fast and needs to be carefully administered to the emulsion. This is best done using something like a large syringe. With practice in the tray, 3D like forms can be produced, however, achieving the delicate balance of the right amount of Ilfosol is critically important as too much will turn the whole thing black.

![Image](image.png)

Fig. 35. (Detail) *Untitled 527-2, 2013*

Single drops or continuous lines work best, like all straight chemigrams; the “physics of painting” determines the final result. Another way to use Ilfosol is to add it to running water that is flowing over the photographic paper, the developer follows the movement of the water smoothly marking the emulsion along the way depending on the amount administered.
Conclusion

The key observations that I made during my exhaustive experimentation and research are that firstly, all chemigrams are extremely unique and very difficult to repeat with precision. This is because of the ‘physics of painting’ that I have referred to several times during this discussion. What this means is that the interplay between application, material and process is what produces the final chemigram, and this is always subject to the most minute of variables; light levels, temperature, age of material, mood of artist etc. Secondly, the straight chemigram has the potential to yield striking results very quickly, but the chemigram with resist does permit a considerable amount of control for the artist. I also found the sheer range of creative and technical possibilities provided by the various resist materials a satisfying and compelling artistic challenge. Finally, despite the comprehensive and intensive research that I carried out, I know that there are many more areas left to be explored. Greater familiarity with 3D printing software for example, or at the other end of the technological scale, closer engagement with henna. I have established that the chemigram, with or without resist, is truly an open invitation to experiment and play.
Chapter Three
Evaluating Practice

Introduction

Throughout my practice-led research I have been constantly experimenting with materials and processes, at the same time I have also been aware of the way in which a chemigram appears to the viewer. An empty sheet of photographic paper is full of possibilities, the silver halides embedded in the emulsion can be manipulated or controlled in order to harness their materiality and they’re unique but familiar physical appearance. The marks made and how they correspond to or alienate each other is the difference between a coherent chemigram and a failure. These differences can be subtle or dramatic. I’ve learnt throughout my research that a tiny little reaction in an isolated area can entirely alter the outcome, sometimes enhancing it, other times disrupting the overall image. My experimenting in the darkroom is fed by these differences and the desire to create a chemigram that captures a chemical energy, which becomes visually interesting.

The measure of what is a coherent chemigram is strange to describe; a feeling that something is not quite right is the simple way of putting it. But looking further at this phenomenon there is a large range of factors involved. There’s the balance of positive and negative space (action and inaction in the image), the dramatic variations of marks that can be made, the tones that can be produced and the amount of overall information and detail that is present and presented. These complex factors constantly inform my practice and technical and aesthetic choices are always being made when producing a chemigram.

From start to finish a chemigram can be altered. For example, shorter time in the developer, more resist revealed or the amount of light the emulsion is exposed to. To an extent, I can manipulate these aspects to change the final result. It is often the case that what I expect at the start is different from the reality at the end. This comes from the huge interplay that light, photographic paper, photographic chemistry, resists and myself, as the artist, can offer. I have often found that at end of the day in the darkroom I look up to see chemigram drying above and dismiss it as ‘not being right’.
I think this because I tend to concentrate on areas in which I have struggled with a particular process or because I feel the resulting chemical reactions do not have an adequate negative space and the overall chemigram seems flat. Weeks later, I fish it out of the plan drawer and view it in a different context, seeing more than when I first evaluated it. I find this to be a strange reality and figure it comes down to my fatigue at the end of the day in the darkroom, having created the piece step by step and then, by contrast, viewing it in daylight and in a more settled mood.

Making Judgements, Contrasting Chemigrams

Fig. 37. Untitled 281-4, 2014

A way in which I’d like to illustrate this process of determining the merits of a finished chemigram from a perspective, is to contrast two works: *Untitled 281-4* and *Untitled 254-5*. *Untitled 281-4* was made using glossy RC and epoxy enamel as a
resist, at a time when I had a better understanding of the dynamics of epoxy enamel and its ability to thicken up. This enabled me to have greater control when physically removing it away from the photographic paper. It was also when I felt I wanted to experiment with incorporating more negative space, more white, in my work. Previously I had concentrated on filling the photographic paper with as much detail as I could. Untitled 281-4 was also made at a time when I was experimenting with a scored grid and abstract gesture across the surface of the paint.

In the darkroom, working within safelight conditions, I pre-flashed the RC before coating it with paint. Wanting to work with black and white only, I turned the overhead fluorescent lights on for ten seconds to allow the emulsion to be totally exposed. I then rolled paint onto it and allowed it dry overnight. In the morning, trying to leave approximately evenly spaced lines apart, I scored six wavy lines downwards and six across. Then with a waterproof pen I drew over the top, marking the points within the rectangular blocks I wanted to start from. I pulled back 5mm of paint in these selected areas, developed, washed and fixed for four minutes and then repeated this process five more times. I individually removed the remaining paint, (the entire square could lift off as one) and fixed.

Initially, I was very pleased with this process mostly because of the lightness of the chemigram and the abundance of white being divided with strong black bars. I did, however, find that in attempting to achieve random grouped black bars with white lines certain problems arose. I feel that some areas of Untitled 281-4 work better than other areas, for example where there are solid blocks of white of up to three panels I see a certain sense of harmony –a balance amongst the respective components resulting in the overall coherence of the picture plane - between the black and the white areas. But, when there is more than three, I feel that this becomes unbalanced, creating a division between the areas of black and white in the chemigram. Also present in Untitled 281-4, up in the top right hand corner, a group of black bars that are completely surrounded with white areas. This could easily be altered with another try and through a better placement of ‘start areas’, but the reality of trying to be random with start points is fraught with disappointments. I have noticed though that keeping it to three segments of white-only feels right. Another difficulty is trying to be so solid with the black mark making, a few time they have turned white! This
happens because of the dynamics of the paint, as it is pulled away in one piece it leaves an ever enlarging flap of paint, this then can be stuck back down to the emulsion when developed, so that when in the wash or fix it can be opened up again and processed.

Fig. 38. *Untitled 254-5*, 2014

If we compare this with *Untitled 254-5*, a chemigram I made about six months after *Untitled 281-4*, you can see that I have moved away from small black bars and incorporated a tonal range within the bars. I have also reduced the amount of white at the end and merged it more boldly into the bars. I did this as I felt that arranging the tones and the random release of the resist offered more complexity to the piece. For the viewer, this complexity holds their attention longer as they work harder to take in the overall image. This is one of my aims – to keep the audience puzzling and
focused, to slow down the experience of viewing and open up a dialogue with their own imaginations.

I started by a quick five second pre-flash on an old piece of Glossy RC that was slow to develop. I was able to get the tonal range of light grey to dark grey/black by adjusting the amount of time in the developer. The pre-flash could be developed to very dark grey if it was in the developer for about five minutes, shorter times produced lighter greys. Where there is black, at the beginning in middle and at the end, fluorescent lights were turned on for a few seconds. Releasing the resist and fixing only achieved the white. There are some areas in Untitled 254-5 where, in agitating the fixer, I forced the paint away from the emulsion, enlarging the plain thin white lines. As stated above, I feel that overall this chemigram is more complex than the first example as a result of the reduction of white and the freeing up of the bars. By allowing the component elements more freedom to determine ambiguity, a more energetic chemigram is achieved. Yet some control is retained, I don’t get lost when I view Untitled 254-5, I find I look around it, stopping and starting again and again.
Another way to further reinforce the idea that the tiniest of alterations can produce significant aesthetic differences is to compare two chemigrams that were made on the same day, simultaneously. Like the above, Untitled 178-4 and Untitled 179-4 (see below) were made using epoxy enamel as a resist, and like Untitled 254-5 were pre-flashed for five seconds. The main difference is that they were both made when the paint was reasonably fresh. So a thinner coat of resist was applied, making its removal more difficult. I spent a full day producing these and whilst they share the same scoring of the grid, they are two very different chemigrams.
The dark grey/black tones, which dominate in *Untitled 178-4*, are offset by healthy surrounds of white inside each tile in random arrangements. These tiles coexist and compete within the grid, reducing its dominance. When this is compared to *Untitled 179-4* the more dominant amount of white that is present in each tile heightens and emphasises the use of the scored grid, separating the tiles out from one another and giving a more disjointed quality overall. As well as the irregularity of how the paint was released before it was processed, there is evidence of both rips and bars in this chemigram. Furthermore I surrounded individual developed markings with white either side. I feel that this causes *Untitled 179-4* to become unbalanced overall, with
an incoherent amount of grey/black to white. The lack of uniformity is the result of
the way the resist was applied and the difficulties I had removing it throughout the
process; because the paint was thin I discovered that I had not given an equal
application of paint to the entire photographic paper. This resulted in varying
concentrations of paint that when dried required different methods of removal. These
two chemigram are not only a good way to describe my aesthetic framework, they are
also an excellent examples of uniqueness even though they were processed at the
same time.

**Evaluating different types of Chemigram**

Having provided some sense of my aesthetic decision making processes by
contrasting a number of works, I am now going to discuss single images. These
include two ‘straight’ Chemigrams (no resists) (*Untitled 321-5* and *Untitled 198-3*),
Chemigrams with resists including Matisse Varnish (*Untitled 1-2*), aerosol paint
(*Untitled 98-4*) and a Chemigram using a nail varnish resist and employing a cracking
technique (*Untitled 256-3*).
As I described in Chapter two, applying thiourea and lye directly onto the photographic paper at a 45-degree angle and then adding water was one way I found to slow down the reaction between the chemistry/water and the emulsion. I was also able to reintroduce chemistry/water at any time throughout the process. *Untitled 321-5* was made using this technique. I produced the entire work with the lights on. This is clearly evident at the top of the chemigram where at the beginning, when I sprinkled the thiourea on and added water, it fixed to a white. A considerable amount of time later, when I had finished applying chemistry/water and put it into a tray of fixer, photolysis (when the paper gets colour in it through exposure to light) occurred, producing a pink/beige instead of white. The other tones that are present in the
chemigram show the reaction between different concentrations of thiourea, lye and water on the emulsion. The black is the lye rolling downwards and mixing with water. The brown to honey blonde (and even small amounts of blue) is the lye reacting with the thiourea in various concentrations.

As I was making *Untitled 321-5* I was fascinated by the physics of the chemical reactions as they combined and ran down and reacted with the emulsion. I found that they reminded me of Chinese mountain paintings, with strong outlines and lighter detail inside.

The image in *Untitled 321-5* doesn’t look like mountains, nor had I intended to depict mountains, but I feel that there is a comparable quality in the interplay of strong and delicate, bold and subtle elements. I have often found that when the viewer first sees my chemigrams after the first question of “how” they then describe a range of meanings that they provoke in them. These diverse, highly personal interpretations will sometimes surprise me as they make connections that I don’t see. Lyle Rexer when writing about Aaron Siskind says:
For Siskind and others, the undisclosed image was the way for a photograph to forge a true and not mealy circumstantial connection between the artist and audience, by encouraging the viewer to participate in the creation of meaning.\(^5\)

I agree with this and openly accept interpretations of my work.

Fig. 44. *Untitled 198-3, 2013*

The speed at which Ilfosole 3 develops when mixed with water onto an exposed piece of photographic emulsion is incredible. *Untitled 198-3* is a rare example of adjusting to the speed. I say rare because I have tried to emulate this but have never come close. What is captured here is a sense of movement almost like photography’s ability to capture a moment. The overwhelming movement comes from a sizeable flow of water passing from the top downwards. As water travels it starts off wide and soon decreases its width, just like a delta accumulating into one river. This is helped, reinforced, by the stationary, simply outlined drips and blobs that connect with the flow that are around the middle to bottom edges.

The whole piece is a recording of the flow of water and its reaction with the concentrate on the surface of the emulsion. The stationary highlights were briefly in contact with water, just enough time to activate them. The movement that is seen is the result of the Ilfosol 3 leaving the initial point and developing downward with the flow of the water. At the initial point of contact with the emulsion the Ilfosol 3 has also developed, this allows the outline of the concentrate to be highlighted with a tonal range that that gives them depth. These groupings holding a position on the RC helping them to work upwards but at the same time the trails from underneath push them downwards creating a falling sensation.

To begin with, the materiality, solidity, of a glass plate is significantly more substantial than photographic paper. Documenting a glass plate is difficult, the action is on the emulsion side and the presences of clear fixed areas alter the way in which a glass plate is best viewed, especially when photolysis is present. It is best viewed some distance away from a white background with plenty of light from behind the emulsion.
*Untitled 1-2.5* was made by using Matisse matt varnish. The surface of the emulsion was a matt and from previous experience I knew that it worked best with Glossy FB but I used the varnish anyway. Not long after I started processing I realised that the varnish wasn’t going to continue to lift off consistently. After I had recorded five developments the varnish hardened up. I then washed it and went about scoring a myriad on lines, making sure to cross through the individual squares. This allowed the chemistry to enter new areas and because there was ample area that had been processed, the new markings appeared to sit underneath them and were not able to penetrate very far under the now stiffened varnish. I feel that this is successful because it prompts a sense of depth. The thin lines of the second scoring are a fraction of the size of the original, which helps give complexity to the overall chemigram, This is further strengthened by the clear translucent base that allows light to penetrate both ways.
The allure to create the impossible drove *Untitled 98-4*. Without the use of a camera and using material as simple as photographic chemistry, photographic paper and a tin of aerosol paint, I have been able to produce an image that gives the appearance of having been photographed. Although I did not aim for it or anticipate it, I often find that many of my works in the wet process and also with straight chemigrams take on a very organic-like appearance. They hint towards nature - to rivers, water, bubbles even landscapes. *Untitled 98-4* bubbles suggest growth and abundance; a scientist has even told me that it’s like looking down a microscope. They are made using the wet resist, are elusive to (re)create and enjoyable to view.

Creating the bubbles was similar to the fast-paced action of creating a straight Chemigram, it required delicate timing and the interplay of the component factors was, as before, essential. When I first started experimenting with this process on
smaller 8.9 x 13.9cm RC, I found that the bubbles were first appearing in isolated areas and the rest was flat 2D markings, I focused hard on how and why the bubbles were occurring and, after a lot of attempts, found that it was the result of a heavy concentration of paint and a specific amount of time in both the drying of the paint and immersion in the fixer.

Looking closer at Untitled 98-4, I can identify a few problems and elements that I thought could be improved. I do not think that the mixture of pink and white in the undeveloped areas enhances this Chemigram. I feel it would be better if it were one or the other, purely an aesthetic desire for uniformity of colour. This pink/white can be easily fixed by using the safe lights. I would have also liked for more of the bubbling to occur at the top, however, I don’t feel that this detracts from the overall growth that Untitled #8 projects. These are just minor details that would help to improve the balance of the piece making viewing more complex. The general occurrence of the bubbles is more difficult to address though and after numerous different attempts at emerging it into the fixer, I have still found no perfect way of stopping the paint dislodging early from the RC or FB.

Finally I would like to conclude by looking at the last significant development in my research into resists, cracking nail polish in mid-2014. As I said before, this came from an ad hoc experiment that took place in my plan drawer (see chapter two). The significant difference in this body of work is the move away from end-to-end coating of resist that resulted in an end-to-end Chemigram, to the use of a border around the edge of the paper.
When I first experimented with coating a piece of photographic paper with nail polish and allowing it to dry for a month, I noticed that when I cracked the nail polish into hundreds of individual squares, it also cracked the emulsion around the edges. The next time I went about coating the photographic paper, I found FB the best. I covered the edges with painter’s tape. Knowing I wanted a white border, I did this all under safelight conditions. When it was properly dry, Untitled 256-3 was first fixed, this allowed only the edges to be processed, and was done using safe lights. I then washed it and turned on the lights, before submerging it into some cold water for ten minutes.
I cracked the nail polish diagonally into large plates. When the decision to turn on the light was made I felt that I wanted to push the silver halide grains, getting as much light into them to produce a variety of tones. This was also helped by mistreating them in the chemistry. A quick time in the fixer, anywhere from two to ten seconds, then washed and developed, produced a large range of tones. *Untitled 256-3* has a predominantly mauve tone with areas of grey/green and grey/black in each tile. The initial development lines of the outline of the cracked nail polish are very small but help to define each tile. What also assists in defining each tile is the direction in which the nail polish left off. These multidirectional abstract markings in combination with the stark structural outlines unite the chemigram. What ultimately results is a chemigram that conjures up a sense of delicacy, fragility and spontaneity combined with a more robust suggestion of engineering.

**Conclusion**

In reviewing and evaluating some examples of the thousands of works I’ve made I have come to observe some key principles at work in my appreciation and success of the Chemigram. The images that I feel to be the most successful are always the ones that convey complexity. They often seem to accommodate entirely contradictory qualities, light and dark, organics and engineered, delicacy and strength, fineness and boldness. For the viewer, this produces an image that is interesting, mysterious. The eye cannot take in everything at once, the images play, tease and seduce. They wriggle free of easy definition. Reflecting on these principles, I have concluded that it is analogous to the process of making the Chemigram. In earlier chapters, I have emphasised the importance of the interplay of the component materials and processes in producing an image. The Chemigrams that I see as being most successful are the ones which best capture this intriguing and unseen world of chemical bartering, negotiation and compromise.
Conclusion

My practice-led research into the chemigram has been significantly influenced by the work of Pierre Cordier, the man most responsible for articulating and defining the chemigram as a specific and distinctive practice within cameraless photography. Whilst drawing on Cordier’s considerable knowledge and insights, I feel that in my technical and conceptual engagement with the chemigram, I have moved towards a far more expansive definition of the practice than permitted by him. This is turn has led me to re-contextualise it within the wider set of practices within cameraless photography. I acknowledge that the creative instincts motivating the chemigram are continuous with the pioneer spirit of photography’s earliest practitioners, whose chemical experimentation fuelled a fundamental desire to write with light, and at the same are a break from, and within, traditionally conceived photographic practices as defined by Cordier.

As part of my extensive investigations, I have developed a substantial body of work, which, in direct contrast to Cordier, uses full darkroom conditions as an integral part of the work. Further technical innovations I have explored involve use of the wet process - applying wet oil-based compounds straight onto the photographic paper, then processing it; and early forays in the use of a 3D printer as a means of linking the chemigram in the darkroom with the most contemporary computer technology.

In terms of my aesthetic inspirations, my research has drawn upon the physicality of Concrete Photography but has tempered its sometimes austere materiality with some of the exuberance and playful spirit found in Abstract Expressionism.

I am currently continuing with technical experimentation in the darkroom. In particular working on pieces that employ the cracking technique, which appeals because by cracking the resist, I do not have to score the paper, which has occasionally damaged the final product. The more I develop this, the more control I have; increasingly being able to produce more intricate markings. I am also working with Ilfochrome (colour positive paper); a chemigram with resist has not, to my knowledge, been attempted before on this surface and Ilfrochrome’s dynamic colour saturation is an appealing prospect.
My long-term plans are to work in collaboration with the School of Research Chemistry at ANU. I expect that gaining a more precise knowledge of the reactions occurring between photographic emulsion, chemicals and light, will furnish a deeper understanding of what is occurring, and equally what could occur with an applied knowledge. Another long-term project that I intend to pursue is in the creation of resists using the 3D printing technology.

Recently, I have noticed a growing interest in a wide range of cameraless techniques incorporated into bodies of photographic artwork, including creative uses of the chemigram. Following the V & A Shadow Catchers exhibition there has been more interest in the UK. In America Heather Oelklaus is doing exciting new work with the chemigram with resist. The 2014 ANU graduate show in the Photography and Media Arts department also demonstrated an eclectic interest in cameraless and chemigram technique amongst the next generation of photographic artists. I am contributing to this interest by running a two-week course of alternative photographic practices with a strong stress on the chemigram at the Penland School of Craft, North Carolina, USA in June 2015.

For the past four years I have turned the darkroom upside down, inside out and round and round! What keeps me going back, armed with a new pot of sticky substance, is the sense of adventure, the thrill of experiment, the allure of undiscovered chemical potential and the innovation of new outcomes. The body of work I have produced contains pieces I consider to fully embody the beguiling aesthetic of the chemigram at its best. It also contains examples of when the chemistry just did not want to play! And yet for all its expansiveness, this work, for me, still represents only a beginning.

---

52 For example see exhibitions and workshops run by http://www.silverprint.co.uk accessed 1st November 2014.
54 ANU School of Art Graduate show 28th November to 7th December 2014.
The possibilities are endless.
Bibliography


Batchen G, *Burning with Desire: The Conception of Photography* (Massachusetts Institute of Technology, USA 1997.)


Henson B, *Mnemosyne* (Scalo Verlag AG, Zurich 2005)


Nullpunk, *Der Fotografie* (Verlag Niggli AG, Zurick 2006)

Parry E, *Adam Fuss* (Arena Editions Santa Fe, New Mexico 1997)
Pfeiffer I & Hollein M, *László Moholy-Nagy Retrospective* (Prestel Verlag, Germany 2009)


Rexer L *The Edge of Vision: The rise of Abstraction in Photography* (aperture, New York, 2013)


Ryan J, *Across the desert: Aboriginal batik from Central Australia* (National Gallery of Victoria, Melbourne 2008)


Squiers C, *What is a Photograph* (International Centre of Photography and DelMonico Books, New York 2013)

Tillmans W & Kolbitz K (eds), *Wolfgang Tillmans Abstract Pictures* (Hatje Catenz Verlag, Germany 2011)


**Journals and Exhibition Catalogues**

Pierre Cordier “Alchimigramme Chimigrammes” (Le Miroir d’Encre, Brussels 1991)

Baudson P, “20 Years Chemigrams: Interview” (Miller, Brussels- not dated)


Fontcuberta J, “The Artists and the Photograph” (Actar, Barcelona 2000)

Pierre Cordier “Chimigramme” (Antwerpen, Brussels 1974)

Pierre Cordier “Chimigrammes” (L’Autre Musee, Brussels 1982)

Pierre Cordier “Chimigrammes” (Horenbeeck Art Actuel, Brussels 1980)

“Pierre Cordier” (Galerie Municipale Du Chateau D’eau, France 1977)

“Le Chimigramme par Pierre Cordier” (Academie Royale De Belgique, Brussels 1982)


Rice L & Steadman D, “Photographs of Moholy-Nagy from the collection of William Larson” (Galleries of the Claremont College, USA 1975)

Sarachek N, “Marks on Silver: Chemigrams” *(Martin Art Gallery Muhlenberg College USA 2007)*
Web Sites
All websites used throughout research and checked 1st November 2014


http://www.chinaonlinemuseum.com/painting-ma-yuan-1.php


http://www.flickr.com/search/?q=chemigram (Accessed 1/11/14)

http://www.hackelbury.co.uk/artists/cordier (Accessed 1/11/14)

http://www.pierrecordier.com (Accessed 1/11/14)

http://www.nolanpreece.com/ (Accessed 1/11/14)


http://www.nsarachek.com/ (Accessed 1/11/14)

http://www.photograms.org/ (Accessed 1/11/14)


http://www.silverprint.co.uk, (Accessed 1/11/14)
