

An autoethnographic practice-based study:
Exploring the use of Generative Adversarial Networks
within the working processes of printmaking.

by

Amy Jane van den Bergh

26202809

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Supervisor: Natalie Fossey

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ABSTRACT

This research explores the creative effects of including Generative Adversarial Networks (GANs) in the printmaking working process. A GAN is an artificially intelligent computer model trained to mimic the abstract properties of a given dataset. The GAN generated images are used to create new prints, which are then used as data on which the GANs can re-train. The resultant body of prints yields a unique perspective that can be used as part of a feedback loop within the creative generative process.

Printmaking in Western and South African art has been contested and regarded as a 'non-art'. Mixed-media and hybrid printmaking are mitigation strategies which address this. Incorporating GANs falls within the remit of hybrid printmaking. Until now their influence on the creativity that drives the printmaking process remained largely unexplored.

This research provides a basic understanding of GANs, with a focus on their limitations. GANism (art made using the medium of GANs) is studied in order to further understand the application of GANs within the art making process. A review of works by contemporary GANist artists Mario Klingemann (b.1970); Jake Elwes (b.1993); the French collective, Obvious; Tom White (b. unknown) and Anna Ridler (b.1985) has been conducted.

An autoethnographic practice-based research methodology focused on the generative and explorative phases of the printmaking processes is conducted. The study includes reflective methods and documents a process-driven approach to using GANs as an artistic tool within the working process of printmaking. This research contributes to the existing hybrid printmaking and GANism scholarship by presenting an application of GANs as a digital tool within printmaking.

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DECLARATION

Full Name: **Amy Jane van den Bergh**

Student Number: **26202809**


Topic of Work:

An autoethnographic practice-based study: Exploring the use of Generative Adversarial Networks within the working processes of printmaking.

I hereby declare that this research is my own original work. All sources are acknowledged in the text and referenced according to the university requirements.

Declaration

1. I understand what plagiarism entails and am aware of the University's policy in this regard.
2. I declare that this dissertation is my own, original work. Where someone else's work was used (whether from a printed source, the internet or any other source), due acknowledgment was given and reference was made according to departmental requirements.
3. I did not make use of another student's previous work or submit it as my own.
4. I did not allow and will not allow anyone to copy my work with the intention of presenting it as his/her own.

Signature: 

Date: 31 August 2022

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GLOSSARY OF TERMS

AI art	Artificial Intelligence art is made with the assistance of AI or intelligent technology (Elliot 2019; Klingemann 2019).
Computer art	The term used to describe a print that has been created by using a computer. A computer print can be only part computer-led, or entirely computer-led: conceptualised and printed via the computer and electric printer (Noble 2002).
GANism	The term used to describe art created with the use of GANs (Grba 2022).
GANs	The abbreviation for Generative Adversarial Networks. GANs are machine learning neural networks. This research paper is concerned with the capability of GANs to generate images (Goodfellow et al. 2014).
Generative art	This term refers to artworks that have been made using computers (Bailey 2020).
Glitch	The term used to describe an unexpected visual 'error' within a generated image. This phenomenon is used by some GAN artists, such as Mario Klingemann, as a stylistic technique within their work (Schmitt 2018).
Hybrid printmaking	The term used by Paul Coldwell to refer to printmaking that combines traditional printmaking technologies and digital technologies in creating a print, or a print edition (Coldwell 2015).
Latent space	The term used to describe the digital process between one GAN generated image resembling the next generated image (Browniee 2019).
Machine learning	The study of computer algorithms that can perform tasks by inputting data (images) and training the algorithms to output new data (images) (Goodfellow 2016).
Machine learning art	The term used to describe art created with the use of machine learning programmes, such as GANs (Schmitt 2018).
Matrix	The surface used to create the image that will be printed. Various matrices are used within printmaking, including linoleum, wood blocks, copper sheets, screenprinting mesh (Saff & Sacilotto 1978).
Mixed-media printmaking	The term used to describe printmaking that incorporates non-printmaking mediums into the final art object, e.g., painting or sculpture (Mohammed 2021).
Mode collapse	The term used to describe the phenomenon when the GANs' Generator begins to generate only a single image multiple times. This happens after many iterations have been performed by the GANs' Generator and Discriminator (Zhang et al. 2018).
Neural network	The term referring to mathematical algorithms used in computer coding. These neural networks are designed (coded) in order to recognise patterns (Goodfellow 2016).

New media art	The term used to describe art that has been made using digital tools (Rush 1999).
Noise	At the onset of GANs generating new images, their initial output images will result in thousands of random pixels, resembling random dots of colour (Goodfellow 2016).
Printmaking	The medium of art where an image is created by transferring ink or paint from a matrix onto the substrate, often with the use of a printing press. Techniques of printmaking include monotype, relief printing, etching, lithography and serigraphy (Saff & Sacilotto 1978).
Screenprinting	A printmaking technique where an image is created by ink or paint being squeegeed through a mesh screen onto a substrate (usually paper or fabric) (Saff & Sacilotto 1978).
Substrate	The surface onto which the final print is printed. Various substrates are used within printmaking, including paper and fabric (Saff & Sacilotto 1978).
Traditional printmaking	The term used to describe printmaking that does not use any digital technologies, or non-printmaking mediums within the creation of the print (Saff & Sacilotto 1978).

CHAPTER 1: INTRODUCTION

1.1. Overview

This research aims to explore the creative effects that emerge in the working process of printmaking when Generative Adversarial Networks/Nets (GANs) are used. To this end, the printmaker-researcher produced an exhibition of a body of prints made using GANs as a tool within the printmaking process. This body of prints is accompanied by this mini-dissertation: *An autoethnographic practice-based study: Exploring the use of Generative Adversarial Networks within the working processes of printmaking*. By recording the results of using GANs as a tool (conceptual and otherwise), the research explores and describes how the printmaking¹ process is affected by the use of this computer image-making technology.

Having practised printmaking for over a decade, the artist-researcher has worked with traditional techniques such as woodblock and linoleum printing, intaglio etching, monoprinting, and lithographic printing, as well as computer-assisted techniques such as CMYK screenprinting.² Incorporating digital printmaking techniques into her working process led her to question how GANs could be used. The artist-researcher is particularly interested in the application of the technology in the generative phase of printmaking and what results this may have.

The literature review to follow provides a description of the capabilities of GANs in order to explore and describe how GANs are used as digital tools. To further understand the application of GANs within the art-making process, the literature review draws on examples of GANist artworks by contemporary artists. The work of Mario Klingemann (b.1970), Jake Elwes (b.1993) and the French collective, Obvious have been studied.

A brief overview of the role of printmaking and its criticisms as an art medium in Western and South African contemporary art follows. This section considers the contributions of digital image-making technologies to the medium of printmaking between 1970 and 2020. This research is interested in ‘hybrid printmaking’³, as used by the author Paul Coldwell in the article “Hybrid Practices within Printmaking” (2015a). The term

¹ The term ‘printmaking’ will refer to contemporary fine art printmaking, unless explicitly stated otherwise.

² CMYK screenprinting is done by separating and printing an image in four colours: cyan (C), magenta (M), yellow (Y) and black (K). The four colour layers are digitally separated using computer programmes such as Adobe Photoshop.

³ Hybrid printmaking can be understood in two ways. Firstly, according to Paul Coldwell (2015) the term represents printmaking that makes use of both digital and traditional forms of printmaking. This is the understanding of the term used in this research paper. Another interpretation of the term, according to Wael Mohammed (2021), refers to the use of any medium outside of printmaking as well as printmaking to create a print (for example, to combine painting or sculpture and printmaking).

combines both digital⁴ and traditional forms of printmaking and is thus well suited to discussing the variety of digital processes incorporated into the practice of printmaking since the 1970s.

Hybrid printmaking falls under the broader concept of new media art (Rush 1999). Art that uses digital tools has been termed digital art (Haworth et al. 2005) or new media art (Rush 1999). Hybrid printmaking differs from digital printmaking in that the works are not entirely created using a digital tool but rather combine both digital and traditional image-making techniques (Kerlow 2010).

An autoethnographic (AE), practice-based research (PBR) model exploring the use of GANs in the creative process of printmaking accompanies the contextual theoretical research. The Geneplore model developed by Lyle Skains (2018) is applied to focus on the generative phase of the printmaking working process. A body of prints has been created based on the researcher's use of GANs as an artistic tool within her working process. Data was collected by keeping records of the process in a written journal, sketchbooks, photographic and video documentation. A print consultation questionnaire added to the data that was collected. Finally, based on the findings of both the mini dissertation and creative practice, a conclusion has been drawn about GAN-inspired hybrid printmaking, including suggestions for possible areas of further research.

During the AE PBR, a number of significant comparisons between printmaking and GANism arose. This suggests the existence of a synchronicity between GANs and printmaking processes. This synchronicity strengthens the claim that using GANs as a tool within the process of printmaking can expand the field of hybrid printmaking.

First, both GANism and printmaking are entangled in machinery and technology (Zylinska 2020; Benjamin 2007). Reliance on technology and the machine (the printing press) to produce the art object is inherent in printmaking. GANism is reliant on the computer as machine, and the capabilities of machine learning to produce art objects. The machine's role within the process of both printmaking and GANism brings into question the role of the artist's creativity and authorship within the art medium. As such, it is the researcher's opinion that both printmaking and GANism are contested as 'elite' art forms or considered to be 'non-art'.

Second, both mediums have a certain amount of control within the process, yet simultaneously there is space for chance happenings to arise in the process. This is connected to both mediums' reliance on machinery and technology. The uncontrollable nature of the process exists because of the random disruptions the machinery and technology provide. Within printmaking, it is the researcher's opinion that a lack of control is evident in

⁴ The digital technologies include but are not limited to digital scanners, photocopiers, computer drawing software such as Adobe Photoshop, digital printers, laser cutters and 3D printers (Coldwell, 2015).

features such as the mis-registration of overlapping layers of the print itself. Within GANism, features such as the neural glitch within the GANs process are evidence of the lack of human control.

Third, a matrix is used to create the art object in both printmaking and GANism. For printmaking, a range of matrices exist from woodblocks to silkscreens, while for GANism, the computer algorithm is the matrix of the art object. For both mediums, the art object exists only because it has been transferred from or through the initial matrix (the silkscreen; the computer algorithm) to the final art object.

A fourth similarity is that both mediums rely on a substrate for the art object to exist on. The substrate can be any surface onto which the art object is transferred from the matrix. Both mediums use a variety of possible physical and digital substrates ranging from paper to the digital screen. The artist's choice to use a specific substrate often adds an element of meaning to the artwork.

Fifth, both mediums generate the art object through iterative processes. Within printmaking the iterative process is marked by working and reworking the matrix and pulling a number of state proofs⁵ until the printmaker is happy with the image and ready to pull the final print edition (the art object). State proofs can be compared to the GANs' latent space within the hundreds and thousands of iterations it undergoes while generating images.

Sixth, collage as a technique can be inherent in both processes. Collage, as an art making process, falls under printmaking as it is historically related to cutting and pasting together pages of texts or images from books to create a new image (Maxwell 1977; Dawson 1988). Within GANism, the artist-programmer goes through a process of cutting and pasting the algorithm in order to generate GANs output images. Furthermore, in the output images themselves there is a dada-esque/surrealist 'collaged' feel within the elements of the image — visual indeterminacy — a common feature of GANism.

Seventh, the end of both mediums' processes is marked by multiplicity. For printmaking that multiplicity is the print edition: the re-production of the same exact image multiple times. For GANism, the GANs process ends in mode collapse: the re-production by the GANs generator of the same exact image over and over.

One last correlation between printmaking and GANism exists specifically within the technique of screenprinting. Within printmaking, the silkscreen is used to physically push ink through a mesh, transferring a stencilled image onto the substrate. In GANism, the computer screen is used to digitally transfer the GAN's

⁵ State proofs are printed once the printmaker has worked on or reworked the matrix. The printmaker pulls (prints) a print to see what the matrix transfers onto the substrate. State proofs show the various stages of the print as it evolves on the matrix. This process is repeated until the printmaker is satisfied and ready to print the final edition of prints.

algorithm into a generated output image. This similarity is of particular interest to the artist-researcher as her medium of choice is screenprinting.

1.2 Background to the study

Hybrid printmaking emerged owing to technological advances from the 1970s onwards which made various digital image-making technologies more accessible to printmakers (Coldwell 2001; Lovejoy 1991). Based on this pattern of assimilating developments in digital technology into the domain of printmaking, this research positions GANs as a new technology that may be able to expand the field of hybrid printmaking.

During the 1970s, personal computers became more affordable, offering printmakers a new technology that could be used as a tool within their working process (Coldwell 2001; Rush 1999; Lovejoy 1991). The medium of printmaking was historically primarily concerned with the dissemination of ideas through the reproduction of text and images (Coldwell 2015; Law 2017). With the advent of the computer and the internet, which can “transmit sound, image and information over long distances” (Lovejoy 1992:66), print now no longer bore sole responsibility for communicating ideas and sharing knowledge.

The author Jim Noble (2002:72) notes how the role of prints has changed and believes printmaking must adapt and respond to the computer’s capabilities. Noble (2002) emphasises that at this junction, the printmaker’s role is to explore and understand computer technologies – a motivating force behind this research. The idea of printmaking being irrevocably changed by the computer is supported by both Coldwell (2015a; 2015b) and Noble (2002). The effect of this change is cautioned by Noble and welcomed by Coldwell. For this reason, the following research explores and describes the role of GANs in printmaking from both Coldwell’s and Noble’s perspectives.

GANs were pioneered in 2014, forming part of the fast-growing field of machine learning,⁶ and are continuously improving in their capabilities (Goodfellow et al. 2014). Amongst their various features, GANs are capable of generating images. GANs are programmed to find patterns among pixels within thousands of images of a specific subject (for example, portraits). Once these patterns are learnt, the GANs are further programmed to generate a unique imitation of the learnt subject (in other words, they will generate a made-up portrait). Most smartphone owners have encountered GAN technology without realising it. Apps on smartphones such as FaceTune or Snapchat apply GANs to create age, beauty, gender and background filters over portraits (Gu et al. 2019). These are rudimentary applications of the complex technology but illustrate how accessible this technology has become.

⁶ Machine learning is a field of computer science that is concerned with the capability of computers to solve problems through the use of mathematical algorithms (Mitchell 2006).

Artists working with GANs are either programmers themselves, or seek out collaborations with programmers in order to use this technology (Lovejoy 1992:73). Mario Klingemann (b.1970), Jake Elwes (b.1993) and the French artist collaboration Obvious use GAN technology to create art. They are artists as well as skilled programmers and interact with the GANs at the base level of coding and programming the technology.

Mario Klingemann is considered a pioneer of the AI art movement.⁷ He uses GANs as a tool to illustrate the inner workings of GANs themselves (Klingemann 2019; Schmitt 2018; Daniele and Song 2019). This is evident in his video installation, *Memories of Passersby I* (2019) (Figure 7). In this work, two screens display portraits that continuously morph into one another. Each of these portraits is a make-believe, GAN-generated portrait. This video essentially shows the GAN's algorithm working within its iterative training stages⁸ in order to generate portraits.

Jake Elwes' work is also led by the inner workings of the GAN. In his installation video piece, *Closed Loop* (Elwes 2017) (Figure 8), for example, two screens are installed across from each other. On the one screen, a word is displayed. The second screen is programmed to respond to this word by generating an image that illustrates the word. The first screen then responds to this image by generating a new word that more accurately describes the image that has just been generated by the second screen. This is a continuous cyclic video installation (Elwes 2017). For both Klingemann and Elwes, GANs are complex tools they have learnt to use and manipulate, inspired by the functionalities of this neural network itself.

The artist collective Obvious similarly use GANs in their working process but differ from Klingemann and Elwes in terms of how they represent the images generated by the GAN. In *Sacred Heights* (2020) (Figure 9), for example, the collective programmed a GAN to generate a unique image in the style of a Ukiyo-e woodblock print.⁹ They then collaborated with a traditional Ukiyo-e woodblock printer in Japan, Beno Uki Ga (b. unknown), who carved, inked up and printed the GAN-generated Ukiyo-e image (Obvious 2020). Although Obvious incorporated a traditional medium (in this case, woodblock printing) to transform the digital image into a physical artwork, the image generated by the GAN remained readable in the final artwork.

It is important to remember that the iterations of the GANs mechanisms can result in upwards of hundreds of GAN-generated images. This means that while the GAN generates the final artefact, it is the role of the individual artist to select which one(s) to exhibit from the many images generated. In the case of

⁷ The AI art movement (or AI art) encompasses art made with the assistance of artificial intelligence (AI) or intelligent technology (Elliot, 2019; Klingemann 2019).

⁸ The process that takes place during the GAN's activity to produce unique but believable representations requires the AI to move through a series of processes during which it learns what a believable likeness is. One such stage is the iterative training stage, where two independent components, called models, interact. One model generates images while the other assesses them. See section 6.3 for further details.

⁹ Ukiyo-e is a form of traditional Japanese woodblock printmaking (Kozbelt & Durmysheva 2007; Saff & Sacilotto 1978:53)

Klingemann's and Elwes' cyclical video installations, their role is to program the specific algorithmic equations in order to allow the GAN to continuously generate images. The control the artists have lies in the choices they make in the coding or in the selection of the/a final GAN-generated image.

For screenprinter Tom White, his process can be described as a collaboration with his GANs. His end goal is to create a screenprint of an abstract representation of an everyday object, such as *Banana* (2019) (Figure 6). In order to achieve this, the artist disrupts the GANs' basic algorithm by making the GANs generate stylistically abstract images. In other words, he is training his GANs firstly to generate real life objects, such as bananas. Once his GANs is generating bananas he codes the GANs to alter the style of the output images to represent Pop Art-like abstract, simplistic images of bananas. These are then used to make his final screenprints.

Incorporating mediums outside of GANs into GANism is beautifully illustrated in the datasets of Anna Ridler. Ridler asserts that the GANs output images are always a reflection of the input dataset, which has been chosen by a human artist. Her datasets are hand drawn or painted and are thus a reflection of herself. The GANs, trained on her self-made datasets, are therefore a reflection of her as well. Ridler either chooses to use her datasets as her final art objects, such as *Myriad (Tulips)* (2018) (Figure 3) or she includes them alongside the GANs output images such as her work *Fall of the house of Usher* (2017) (Figure 4).

Thus far, the research has provided an overview of hybrid printmaking, as well as an introductory explanation of GANs in order to attain a working definition of these topics. These will be explored in the literature review along with a brief overview of the role of printmaking in Western¹⁰ and South African contemporary art. Using examples of works by Mario Klingemann, Jake Elwes, Obvious, Tom White and Anna Ridler, the research will analyse some ways of using GANs as tools within the printmaking process. Furthermore, an AE PBR methodology will be conducted to examine how printmaker-artists can use GANs as tools in their working process and what effects may result.

1.3 Statement of problem and research questions

This research explores the working processes of the artist-printmaker when using GAN technology. The research question is: How can a contemporary fine art printmaker use GANs within her working process? The answer to this question may offer innovation in printmaking and expand the field of hybrid printmaking.

¹⁰ While 'Western Art' has become a contested descriptor within contemporary art history, this research retains the meaning as follows. The terms refer to art practices focused on the cultural traditions and history of European and North American art.

A problem that the research addresses is that GANs are not well known to printmakers for two reasons. One, they are difficult to comprehend and use; and two, there is an inadequate understanding of GAN technologies amongst artist-printmakers. The artist-researcher acknowledges her lack of computer science knowledge and skills and that her interest in and engagement with GANs is limited to a very basic application of the technology. Therefore, another question the research addresses is whether the artist-printmaker can use GANs adequately without an understanding of computer science or the ability to code (design and engineer) the underlying models that constitute the GANs. In other words, can GANs be used by a non-computer-scientist artist?

Leading on from this initial exploration, the research attempts to make clearer the ways in which artist-printmakers not educated in computer science can use GANs as conceptual tools within their creative practice. This research attempts to better the printmaker-researcher's understanding of GANs by exploring the technology to determine how it can be used in the working process of printmaking.

1.4 Aims and objectives

The aim of the research is to explore and describe the effects of using GANs as a tool within the working process of printmaking. Using GANs in the generative phase of the working process, as described by Kaufman & Sternberg (2007:56), a body of GAN-inspired prints has been produced and exhibited. In so doing, the research comes to grips with this relatively new image-making technology (GANs) to explore and describe what this technology may mean for the future of printmaking and how it may potentially reinvigorate the practice.

The following objectives are positioned to achieve this:

1. Produce a literature review that discusses the following concepts:
 - GANs image-making functionalities
 - GANism
 - The role of printmaking in Western and South African art
 - Hybrid printmaking
2. Explore and describe the effects of integrating GANs into the working process of printmaking:
 - Produce a body of prints inspired by the use of GANs. This is facilitated by the use and exploration of an open-source GAN, outsourcing the coding thereof to a GAN engineer (Karras et al. 2020) and the study of the subsequent GAN output images generated.
 - Organise a print consultation with a selection of printmaking peers to receive feedback about the GAN-inspired body of work being created. The data gathered from this print consultation in the form of questionnaires firstly focuses on how the participants (as the audience) viewed

and reacted to the new GAN-inspired prints. It further examines how implementing GANs into the printmaking working process has affected the aesthetic of the new body of work in comparison to the artist-printmaker's previous works. Thirdly, the questionnaire addresses whether or not an emotional response has been evoked through the new prints. Lastly, based on how the artist-printmaker has experimented with and implemented GANs into their working process, the printmaking peers are asked if they see merit in possibly exploring the medium themselves.

- Record and describe the use of GANs and the effects the tool has on the working process of the printmaker-researcher within their practice-based research. Data was collected by documenting the process in a written journal and sketchbook as well as through photographs and video footage.
3. Develop a critical discussion that explores and describes the effect that integrating GANs into the working process of printmaking had on the artist-printmaker.
- Provide a post-practice analysis of creating the GAN-inspired prints by applying the theories discussed in the literature review of this research.
 - Consolidate the findings of the explorations of GANs using the data collected from both the print consultation as well as the journals, sketchbooks, photos and video footage kept by the artist-researcher.
4. Draw conclusions that address the research question and aims.

CHAPTER 2: METHODOLOGY

This chapter outlines the qualitative, autoethnographic practise-based research methodology and reflective methods applied in this study (Candy 2011). The research design and its methods have been planned in order to answer the research question: *How can a contemporary fine art printmaker use GANs within her working process?*

The first method used in this study is a robust literature review which includes the analysis of a number of GANist artworks. The second method used is a qualitative, autoethnographic (AE) practice-based research (PBR) model based on Lyle Skains' 'Practitioner Model of Creative Cognition' (Skains 2018; Lapadat 2017). A significant feature of this specific method is the application of the feedback loop that characterises the Geneplore method of creativity: the back-and-forth nature of the generative and explorative phases within the working processes of printmaking (Finke *et al* 1996). The third method used is a print consultation questionnaire. Through these methods, the qualitative results of how GANs are used as well as how they influence the working printmaking process and the final prints will be documented.

2.1 Research design

This study makes use of three research methods to gather data. While the first, and primary method within this study is the exploration and description of the artist-printmaker's own practice while using GANs, the other two methods are used in order to further understand the effects that arise within the working process of the artist-printmaker while using GANs. The other methods used within this study are a robust literature review containing an analysis of GANist artworks and a printmaking consultative questionnaire.

In the first method, EA PBR aims to expand on the understanding of the primary data collected by the artist-printmaker while working with GANs in their printmaking processes. Data is collected throughout the research. The final exhibition showcases the body of prints created during the research and offers significant insights about the new knowledge generated from the research process.

Supporting the first method, the literature review endeavours to add understanding and knowledge about GANs as a form of art making. This is supplemented by the analysis of GANist works by contemporary international artists. The analysis is intended to provide a contemporary example of how GANs have been applied to art making. The review provides a sample of works that apply GANs in various ways within art making processes by studying works created by Mario Klingemann, Jake Elwes, Obvious, Anna Ridler and Tom White. Next, the artist-researcher focuses on the role of printmaking within Western and South African contemporary art and how it relates to the rise of hybrid printmaking as an interdisciplinary contemporary art medium.

The print consultation questionnaire, the third method, aims to gather data from five of the artist-researcher's printmaking peers, in response to the artist-printmaker's new GANs-inspired body of work. The printmaking peers are familiar with the artist-researcher's body of work and may offer insight into the new GAN-inspired prints. The questionnaire poses seven questions and is intended to explore two ideas. The first is whether using GANs as a tool within the working processes of printmaking has been successful – in other words, does GANs effectively add to the artist-researcher's body of work in either an aesthetic or conceptual way? Secondly, the questionnaire aims to explore whether the application of GANs in this research may be used by other printmakers – in other words, does it inspire other printmakers to explore GANs themselves?

2.2 Practice-based research and the research instruments

This study is structured on iterative processes and the reflection thereof, using the research instruments of written journals, sketchbooks, photographs and video footage. Supplementary data is attained by using a print consultation questionnaire. A body of prints was created as part of this process and presented in the form of an exhibition. The literature review grounds the study from its broadest application (printmaking) narrowing it down to its application within hybrid printmaking. A further narrowing of the study focuses on GANism as a medium to use within hybrid printmaking. At the narrowest application of this study are the final artefacts made by the artist-printmaker during their iterative practice using GANs within their printmaking working processes. By researching the working processes of printmaking itself, the research is able to explore the practice and how the application of GANs affects this process. Linda Candy states,

Practice-based research ... embraces practice as its central focus. Not only is the practice itself embedded in the research process but the research questions arise from practice and the outcomes are directed towards enlightening and enhancing practice in whatever form it takes. (2011:36)

The research question focuses on the artist-printmaker's working process, and how GANs can be applied. The new knowledge that arises may enhance the artist-printmaker's practice through iterative cycles of applying GANs, exploring the effects, describing these effects, and reflecting on them.

As this study uses the researcher's own practice and process as the focus, the best suited research design is a practice-based research (PBR) methodology. The research involves the artist-researcher immersing herself within her printmaking practice, applying GANs to her working processes, and describing the effects this has on her processes. The research is focused on her process rather than the final art objects. In this PBR study, the art objects generated while applying GANs to the printmaking process are "the basis of the contribution to knowledge" (Skains 2018:86). The GANs-inspired prints are accompanied by a critical discourse (the literature review) that contextualises the explorative and descriptive findings these prints generate. The GAN-inspired prints are exhibited and provide significant insight about the working process of printmaking

when GANs are applied. The exhibited prints represent the new knowledge acquired through using GANs in the printmaking working process.

The iterative method within this study has been designed by incorporating the Geneplore model of creativity. This method was designed by Lyle Skains (2018) in his own practice-based methodology (Finke, Ward & Smith 1992 in Finke 1996; Korba 1993). The Geneplore model of creativity, developed by Ronald A. Finke, Thomas B. Ward and Steven M. Smith, and described in the book *Creative Cognition* (1996), states that creativity happens in two phases. The first phase is the generative phase. This is the brainstorming ideation phase. The second phase is the explorative phase. The two phases can repeat several times until the final artefact is complete (Kauffman & Sternberg 2007:55). The iterative action/ flow between the research question and research process forms a continual feedback loop within this study.

The artist-researcher generates multiple series of small print studies inspired by the use of GANs and reflects on these in view of the research question. After reflection, the artist-printmaker creates again in response to this reflection and new applications of GANs within their process. The continual new insights this feedback provides is the means by which the artist-researcher conducts this study.

The creative process runs alongside contextual theoretical research in the form of a literature review (Candy 2011). The contextual research, grounded in CR, provides the knowledge required to interpret and analyse the creative iterative process in order to draw conclusions. The literature review creates the parameters or boundaries that the printmaker-researcher can explore and within which they can discuss their qualitative findings. The theoretical concerns addressed in the literature review, which give rise to the research problem itself, include the role of printmaking within the broader context of contemporary art practice, the rise of hybrid printmaking as a contemporary interdisciplinary art medium and lastly, the rise of GANism.

While the researcher is experimenting, they describe their process and findings. This is to record the implicit knowledge that needs to be made explicit, as well as recording new knowledge that is discovered through the process. The descriptive process of record keeping is performed while the artist-researcher is experimenting, but the reflective process is performed only after the researcher has explored multiple iterations of applying GANs within her processes. Skains says that,

The basic method is to engage in the creative practice in order to explore a research question: how does applying something unfamiliar/new/different to the familiar act/practice affect the practitioner's process and the creative artefacts? (Skains 2018:92)

Considered in relation to this model, this research is focused on how GANs (the unfamiliar tool) is used within the printmaking working process (familiar practice) and may affect the printmaker-artist's process and final artefact.

Data is collected by means of the following research instruments: written journals and sketchbooks are used to keep a record of insights, observations, processes, problem-solving and challenges found in the creative process, and photographic and video footage is used to document both the GANs and the working process of printmaking. The artist-printmaker gathers data throughout their interaction with GANs through notes and considerations within a written journal. They also make use of sketchbooks throughout their process. Their sketchbooks form part of the iterative process of back-and-forth working with the creative studies. Notes and comments are jotted down in the sketchbook throughout the process as well. Photographs and videos are used to record the processes and artworks created within this research. The GANs generated output images are also recorded as JPEGs and used throughout the working process.

After the final body of prints has been created, a discussion of the research is conducted as part of the post-practice reflexive analysis. The content of the research instruments is analysed in order to describe any non-obvious meanings or findings within the working process. The discussion provides insight into how printmaker-artists may use GANs in their working process. The artist-researcher acknowledges that the art practice and research undertaken reflect her own perspective and will by no means be the only interpretation of the findings. The artist-researcher's perspective, understanding, meaning-making and engagement with the research is based on her lived experience of continual reflective iterations between her working process (exploration) and writing (description).

To add to the artist-researcher's understanding, the print consultation questionnaire is used. This can be found in Appendix B. The purpose of the print consultation is to receive feedback from a select number of printmaking peers who are familiar with the artist-printmaker's previous body of work. These peers are asked questions to establish their perception of the new body of prints, and they subsequently assess the artist-printmaker's use of GANs in creating the body of prints. As this research is concerned with whether the application of GANs may expand the field of hybrid printmaking, this data enables the researcher to determine whether other printmakers find merit in using this technology.

2.3 Ethical considerations

The University of Pretoria's Faculty of Humanities requires researchers to ensure social responsibility, justice, benevolence, respect for the individual, and professionalism in collecting data from human subjects. The subjects involved in the study are the printmaker-researcher as well as the printmaking peers who were asked to complete a questionnaire in a print consultation.

2.3.1 General ethics

The research is qualitative and autoethnographic in that the printmaker-researcher is both the researcher and the subject of the research. This ethical consideration is addressed by the post-practice reflexive process

of analysing the data only after the final body of prints has been produced, creating a distance between the printmaker-researcher and the data.

Another ethical consideration is that, since the scope of the research is restricted to only one application of GANs into the working process of printmaking (with the printmaker-researcher as the sole subject), the research findings may be limited (Lapadat 2017). The printmaker-researcher further acknowledges that although GANs will provide a considerable amount of inspiration for their work, other factors may contribute towards the conceptualisation and creation of the final body of prints.

2.3.2 Questionnaire ethics

In line with the university's ethics policy, before conducting the print consultation questionnaire the printmaker-researcher first asked the group of five respondents for their informed consent to participate in the questionnaire. The printmaker-researcher ensured their identities were kept confidential within the research, allowed the participants to withdraw their responses if they wanted to, and only used their responses in as much as it adds to the post-practice analysis of this research.

The letter of consent (Appendix A) that was given to the print consultants outlined that their responses will remain confidential, and their data will only be used within this research. Their data is added only as anonymous appendices to the dissertation and will be stored for ten years in the university's Research Data Repository, according to the University of Pretoria's Policy for the Preservation and Retention of Research Data. The findings of the questionnaires will not be shown outside of this research. Before the print consultation, the participants were given consent forms and a written explanation of the purpose of the questionnaire.

As the group is made up of only four print consultants, the artist-researcher created a Google Form for the participants to fill out (Appendix B). This form ensures a measure of anonymity. The print consultation was carried out via Google Meet. The participants filled out and submitted their research questionnaire via a Google Form at the same time, again ensuring a measure of anonymity in their responses. The researcher gave the participants twenty four hours to complete the forms. Only once they had all submitted their responses could the printmaker-researcher access and download the responses. This ensures that the printmaker-researcher is not able to identify which responses belong to which printmaking peer.

As the participants are printmaking peers, the printmaker-researcher has considered the possibility that they may feel pressure to respond positively, or favourably to the researcher's questions. To ensure this was prevented, the researcher explained in both the consent form and their presentation to the

participants that participants' responses need to be honest as this affects the integrity of the research.
There are no 'correct' or favourable answers.

CHAPTER 3: LITERATURE REVIEW

The literature review to follow is separated into four parts. First, it introduces and describes the GANs image-making functionalities necessary to understand the technology, in order to use it within the printmaking process (Goodfellow et al. 2014). Secondly, it focuses on the art created using GANs, featuring examples of GANist artworks. The third section focuses on the role of printmaking in Western and South African contemporary art. The last section focuses on using GANs within hybrid printmaking and new media art (Rush 1999) by examining the relationship between printmaking and digital technology and how printmaking has adapted and grown through its potential to incorporate the use of new image-making technologies into its processes (Coldwell 2015).

3.1 *Understanding GANs: a computer technology becomes an art medium*

This research views GAN technology as a digital image-making technology with the potential to affect both printmaking processes and the creativity of artist-printmakers. In this section, it is therefore necessary to explore and describe the elements and functioning capabilities of GANs. The motivation behind this section is to understand the basic architecture of GANs and how they function. It is thus a condensed study of the intricacies and complexities of a dynamic area of machine learning within computer science. Understanding the functionalities of GANs also aims to establish an understanding of the new art medium that has risen out of this technology: GANism.

GANs are situated within the machine learning branch of computer science and are concerned with mathematics of statistics and probability in the form of computer software mathematical algorithms. Situated within the domain of AI, machine learning is fundamentally about a computer program learning how to perform a given task (Mitchell 2006). These tasks include but are not limited to data mining, classifying data, and generating data (Alvarez-Melis & Almores 2017; Finn et al. 2016; Heath & Ventura 2016; Mitchell 2006). The capability of GANs to generate data (images) is the functionality that this research aims to explore and describe.

GANs were first used in 2014, and the technology owes its development to the advances within machine learning and neural networks leading up to 2014 (Goodfellow et al. 2014). Machine learning works within an organised structure of computer coding in order to perform the tasks it is required to do. The basic structure of machine learning is called the neural network (Burke & Ignizio 1997, Czuchry 1990). These neural networks are further structured and coded according to a specific architecture or model.

In 2014, Ian Goodfellow developed the algorithm for a neural network that combines two models, which run simultaneously (Denton et al. 2015; Bengio et al. 2014; Finn et al. 2016; Ioffe & Szegedy 2015; Radford et al. 2016; Mao et al. 2017; Odena et al. 2017; Gulrajani et al. 2017; Isola et al. 2017; Jay et al. 2017; Mescheder

et al. 2018; Miyato et al. 2018; Liu et al. 2015; Karras et al. 2018). Goodfellow uses a game in order to illustrate how GANs work (Goodfellow et al. 2014). He explains that GANs work like a two-player game where the two computer-coded models running simultaneously are the two players. The element of competition between the two players is what keeps the game going. The two players in this specific game are the Generator (G) and the Discriminator (D). Both players are fully functioning neural network models. While the game is in play, the models work simultaneously, each trying to win the game.

At the onset of the game, the D is given a dataset of specific images by the computer programmer, or GAN engineer. These are known as the real data. The real data is made up of thousands of images of a specific subject (for example, cats). Fundamentally, the game is about data generation. The G is a neural network model trained to generate images (Creswell et al. 2018). Without seeing the real data, the G generates random data: pixelated images. When the G has generated images (generated data), the D classifies this data as fake. It does this by comparing the G's data to the real data it was given at the onset of the game. The D is a neural network model trained to identify patterns. These patterns are identified through the layout of pixels embedded in the image. If the G's data does not possess patterns that are convincingly similar to the real data, it is classified as fake¹¹

As the game progresses, the G learns what fake data looks like from the feedback it gets in each round of interacting with the D. At the same time, the G is also learning what the real data might look like. Theoretically, with each round of the game, the G should be getting better at fooling the D. Each round is called an iteration (Creswell 2018). The game continues until the G starts to generate images that the D cannot discriminate from the real data. That is to say that the game continues until, for example, the G generates images of cats that are so similar to the original dataset of cat images that the D starts to label those generated cats as real data.

The aim of the game is to win. For the G, that means that it needs to generate images that are convincing enough for the D to classify them as real. For the D to win, it would need to be able to identify, with accuracy, which images have been generated by the G and which images are real. The G's aim is to deceive the D, and the D aims to avoid this.

GANs have a number of real-life applications. In the medical industry they are useful because they are able to generate large amounts of image data. Having more data of images that represent, for example, a diseased organ vs a healthy organ, allows doctors to give better diagnoses with the help of AI. In the business sector,

¹¹ The terms *real* and *fake* used throughout this research are taken directly from the literature written about GANs (Goodfellow et al. 2014; Creswell 2018).

GANs are used to predict risk and worst-case scenarios. In the creative industries, GANs are used in many ways. Video game designers use the capabilities of GANs to generate photo-realistic portraits of their game characters. GANs also assist photographers or videographers in sharpening their images or footage, or to alter the images in different ways. Converting the background, or applying filters over the image is all possible because of GAN technology. Perhaps the most commonly known use of GANs is in smart phone applications where images can be manipulated in a number of ways: photographs can be converted to cartoon images or emoticons, photographs can be aged, genders can be changed photographically, clothing can be changed, removed or added, facial expressions can be changed, and 2D objects can be made 3D. Lastly, GANism is the creative application of this technology that uses the capabilities as a means to express an artistic vision and voice.

GAN technology is at a relatively early stage in its development, and computer scientists are constantly researching and advancing its functionalities and capabilities. Their aim is to tweak and adjust the algorithms within the GANs software. Although interesting, this is not the concern of this research. While printmaker-artists may require a basic understanding of the technology, an in-depth understanding of the mathematical algorithms is beyond the scope of this research. There are many options for open-source GANs. Just as there are a variety of printmaking tools – relief inks, etching needles, silkscreen meshes – GANs are a medium with a variety of tools. It is the printmaker-artist's curious exploration of this medium that will lead her to decide how she will use these tools within her working process.

In summary, this research positions GANs as a digital image-making tool that may offer printmakers opportunities for new ways of working. Although this tool is presently limited in its use due to its reliance on complex computer programming, this research aims to demonstrate that hybrid printmaking would benefit from exploring the possible use of this tool and its capabilities.

3.2 GANism

There are a number of terms used to describe the art made using GANs: Machine Learning Art (MLA), Artificial Intelligence-Driven Art (AI-Driven Art), Generative Art and GANism. GANism strictly uses the capabilities of GANs to produce art objects. Artists working in GANism are concerned with how the GANs models are coded, and their artistic intervention lies in how they choose to use this code to produce their GANs generated output images (Grba 2022). By altering the coding, the GANist artists are disrupting the GANs architecture, causing the GANs to produce an output image that is somewhat conceptually controlled by the artists. GANist artists can create these disruptions in a number of ways, discussed in this section.

3.2.1 *Disruption 1: The glitch*

When observing a GANs generated image, at first it appears to mimic a human-generated image. On closer inspection the image is made up of elements that do not seem to make sense. This feature, typical to GANism, is termed ‘visual indeterminacy’ and is reminiscent of the surrealists (Hertzmann 2020). Aaron Hertzmann (2020) notes how there is “a common GAN aesthetic: images that seem realistic but yet somehow unrecognizable” (2020:1).

This GANs feature can be seen in the works of Mario Klingemann. His GANs generated images look surreal, because of the presence of glitches in the GANs. The term ‘glitches’ refers to malfunctions or inadequacies within the programming of GANs that cause the output image to have elements that are visually incorrect or inaccurate (Burke & Ignizio 1997). For artists such as Klingemann, these glitches provide the creative or artistic style that inspires them (Schmitt 2018). He uses both the algorithm and its glitches as his ‘paint brushes’ (Spratt 2018). His selection process is intrinsically linked to how he sets up and programs his GANs algorithms – ultimately trying to get the GANs to create glitches in the portraits. The artist calls this technique “Neural Glitch” (Klingemann 2019; Schmitt 2018).

Figure 1 is an example of Klingemann’s work where the neural glitch is evident. *My Artificial Muse* (2017) represents the artist’s muse and inspiration: the inner workings of GANs. At first glance, the neural glitches in this image do resemble a painter’s expressive mark-making. The setting, or lack thereof, makes the figure appear to be floating, untethered to reality. The artist has created a convincingly surrealist, expressive painting of a reclining nude through his use of glitches in the code.



Figure 1: Mario Klingemann, *My Artificial Muse*, 2017, digital image (Klingemann 2017)

3.2.2 *Disruption 2: The dataset*

At the onset of the GANs process is the dataset – the images the artist chooses to feed into their GANs. This provides an opportunity for the artist to disrupt the GANs’ architecture. An example of this is Jake Elwes’ video installation *Zizi: Queering the Dataset* (2019) (Figure 2). Elwes uses a face-generating GANs and disrupts

the process by feeding a dataset of drag performers' faces into the GANs' original dataset of human portraits (Elwes, 2019). His intention in this video is to celebrate diversity and ambiguity in a society that he argues is driven by data. Elwes creates a dataset that is more inclusive and reflective of society by adding images of drag performers (Elwes 2019).



Figure 2: Jake Elwes, *Zizi: Queering the Dataset*, 2019, video installation (Elwes 2019)

For another GANist artist, Anna Ridler, the dataset becomes the final artwork. Ridler's point of departure from other GANist artists is her conceptual decision to create her own datasets. She is inspired by the way in which GANs can use her datasets and generate new interpretations of her own artworks (drawing, photography, and painting). The control she has is in the choices she makes in creating these datasets. In her work *Myriad (Tulips)* (Figure 3) Ridler took 10 000 polaroid photographs of Dutch tulips, singularly labelled and categorised the images and uploaded them into her GAN. In doing this task of creating and labelling her own dataset, the artist controls the GANs input process. Instead of displaying the GANs generated images, Ridler chooses to display her dataset as the art object itself.

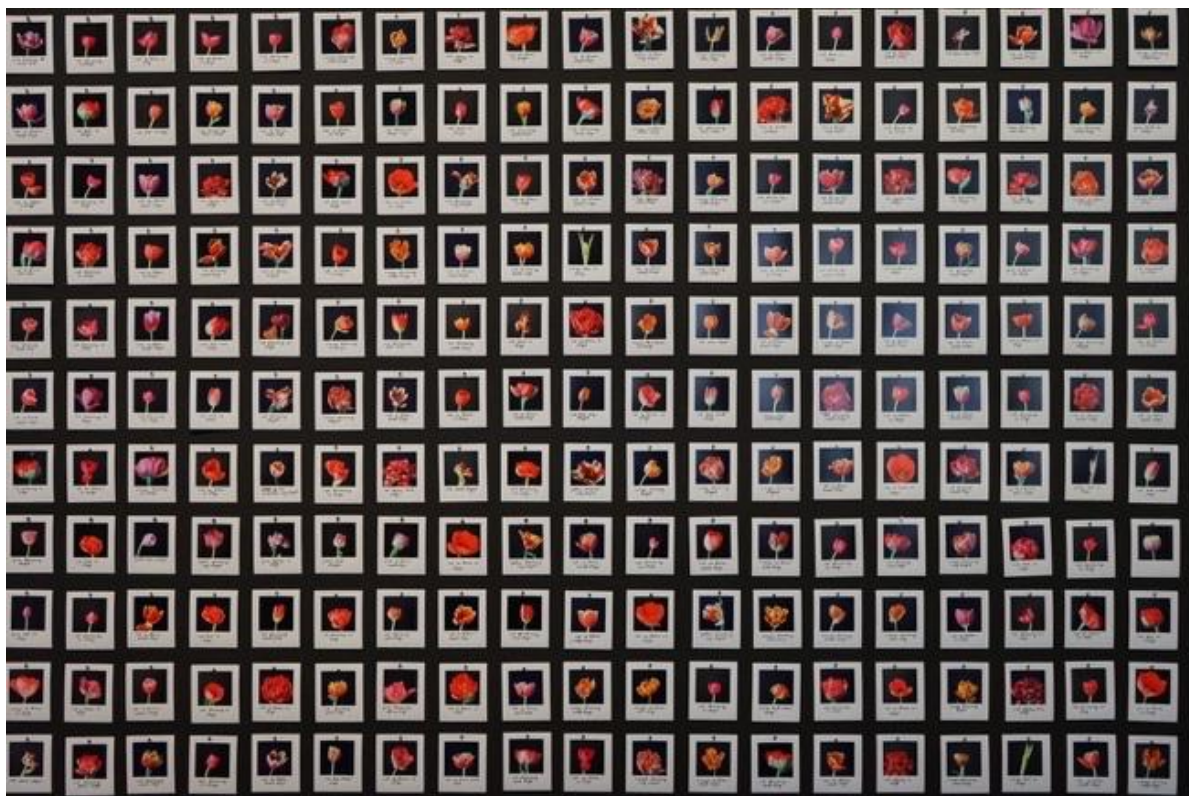


Figure 3: Anna Ridler, *Myriad (Tulips)*, 2018, labelled polaroid photographs (Ridler 2018)

Ridler's conceptual influence for this decision is concerned with data bias. She asserts that the GANs output images are always influenced by the human decisions that go into creating the dataset. Therefore, the GANs output images are always a reflection of the artist themselves. Ridler gives us her own data bias, latent in her dataset, to be viewed as the art object. The labels — handwritten and scratched out, corrected and re-written — are a view into the biased choices the artist makes. Ridler's work also references the amount of human effort that goes into the dataset, or into running a GANs.

In her video piece, *Fall of The House of Usher* (Figure 4), Ridler is once again creating the dataset, but this time she is physically painting each of the two hundred greyscale images used for this work. The art object, a twelve-minute silent film, is inspired by the 1929 Watson and Webber silent film based on Edgar Allan Poe's short story about decay and destruction from 1839. Ridler uses stills from the silent movie as inspiration for her two hundred greyscale ink paintings. These are her dataset on which she trains her GANs. The GANs' output images are then placed in alternating series with Ridler's ink paintings to create a haunting feedback loop between Ridler and her GAN.



Figure 4: Anna Ridler, Stills from the film 'Fall of the house of Usher', 2017, video installation (Ridler 2017)

3.2.3 Disruption 3: The code

How the artist(s) chooses to alter their GANs code directly effects the GANs output images. GANist artists may also choose not to alter or disrupt the code at all. This is evident in Paris-based group Obvious' *Edmond de Bellamy* (Figure 5). This work can be viewed as a GANs-led digital print, entirely conceptualised and created using the computer as a tool and medium. The choice of Obvious not to intervene or alter the GANs algorithm results in a simplistic example of GANs' capability. The only presence of human hand is in the writing of the algorithm's 'signature', the un-altered GANs algorithm on the bottom right-hand corner of the print.



Figure 5: Obvious, *Edmond de Bellamy*, 2018, digital painting (Christies 2018)

In contrast, GANist artist Tom White significantly alters and adds to the basic GANs' architecture to generate his artworks. His work can be seen as a collaboration between him and the neural network he is coding. White's intent is to use GANs as a tool within his working processes to create abstract representations of objects in the real world. In order to achieve this, he disrupts the GANs' basic algorithm by coding the GANs to generate abstracted output images. White then uses these GANs generated images to create screenprints, such as *Banana* (Figure 6).



Figure 6: Tom White, *Banana*, 2019, screenprint (dribnet 2019)

3.2.4 *Disruption 4: The latent space*

Once the GAN is coded and operating, the artist may choose to focus on the latent space of the GANs architecture. The latent space is controlled by the GANs algorithm, and is the process by which one iteration of the GANs generated image morphs into the next, continually aiming to morph into an image that the discriminator classes as real. This is a continuous feedback loop within the GANs architecture. The creativity of the artists lies within the choices they make in the coding of their GANs' architecture.

A work that illustrates this latent space is Mario Klingemann's *Memories of Passersby* (2018) (Figure 7). The artwork is made of two screens next to each other, one is constantly generating male portraits, and the other, female. The GANs portraits are constantly in a state of morph between portraits, and create a feeling of unease. This discomfort is a characteristic in Klingemann's work and often results in images that are both beautiful and disturbing, haunting, ghostly and bizarre (Miller 2020). The choice to exhibit the video footage of the GANs latent space (the figures morphing into each other) gives the viewer a look into the way the GANs algorithms function.

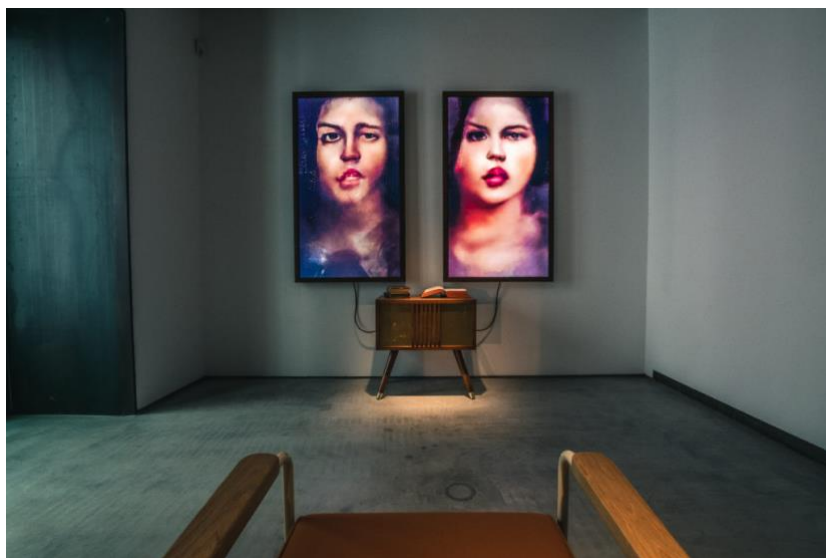


Figure 7: Mario Klingemann, *Memories of Passersby*, 2018, video installation (Notaro 2020)

Another work that illustrates the latent space of GANs, and more specifically, the feedback loop between the Discriminator and the Generator within the GAN is Jake Elwes' installation, *Closed Loop* (2017) (Figure 8). Elwes installs two screens set up across a room from each other. The first screen displays text. The second screen responds to the text by displaying an image to represent it. The text on the first screen is then adapted to better describe the image that has just been generated. This process continues in the form of a video, creating a loop between the two screens (Elwes 2017). This artwork visually demonstrates the dialogue between the Generator and Discriminator. The video enables the viewer to watch, in real time, the iterative process of the GANs' latent space, re-representing the text as image and to observe the conversation between two creators: a painter and a writer. Each interpretation by either the writer or the painter becomes a mesmerising process in a continuous loop.



Figure 8: Jake Elwes, *Closed Loop* (extract), 2017, video installation (00:01-00:21)

3.2.5 *Disruption 5: The final representation*

At the end of the GANs process, the artist makes a curatorial choice about which of the thousands of GANs images becomes the final artwork, and how it will be displayed. Some artists choose to use video installation as this best illustrates the iterative nature of GANs, such as Klingemann's *Memories of Passersby* (Figure 7) and Elwes' *Closed Loop* (Figure 8). The choice to make the final artwork a physical, digital print highlights the surreal painterly-like nature of the GANs images, such as Klingemann's *My Artificial Muse* (Figure 1) and Obvious' *Edmond de Bellamy* (Figure 5). Artists may also use non-digital mediums as their final representations, such as Tom White's *Banana* (Figure 6). The final representation of White's work is

screenprints inspired by the GANs output images. Aesthetically, his work reminds one more of the genre of Pop Art than of GANism because of his choice to incorporate another medium as his final representation, allowing a visual departure from the typical GANist aesthetic.

Another example of incorporating a non-digital medium as the final representation is Obvious' *Sacred Heights* (2020) (Figure 9). The work was created in collaboration with printmaker Beno Uki Ga (b. unknown). In their collaboration, Beno Uki Ga was commissioned to replicate Obvious' GAN-generated art through a traditional printmaking process: Ukiyo-e woodblock printing. The image was generated by using a dataset of Japanese woodcuts in the genre of Ukiyo-e. The final image, curated by Obvious, was then turned into a traditional Japanese woodblock.



Figure 9: Obvious and Beno Uki Ga, *Sacred Heights*, 2020, woodcut (Obvious 2020)

This work can be seen as part GAN-led and part printmaking-led. The printmaker's role was technical, and the artwork's inspiration was credited to the GANs' capabilities. The woodblock print resembles the stylistic features of Ukiyo-e woodblock printing at first glance. However, upon closer inspection, the landscape is made up of elements that are unclear. The trees in the background, for example, are loosely shaped random squiggles of colour that merely resemble the shapes and patterns of trees. The printmaker replicated this visual indeterminacy implicit in the GANs generated and the print embodies the meaning associated with the tradition of Ukiyo-e printing.

Ukiyo-e printing has specific features and is steeped in meaning about the ephemeral aspects of life. The conceptual strength of these prints relies on key features within the aesthetics of the image: stark simplicity, depth, a sense of aging and the passing of time, and the feeling of calm mystery. In *Sacred Heights* the ephemeral nature of the GANs latent space has been translated through the use of Ukiyo-e woodblock printing. The GANs process is continuously cyclical, but here, one moment within that cycle is made timeless, caught in a moment forever transfixed in this image. While it has a sense of tranquillity, there is also an unsettled feeling created by the surreal, irregular shapes and composition, the floating trees, the red looming

figure in the foreground and the dark shadows. The blurry feel of the image further enhances the sense of mystery within this image. At first glance one sees a landscape, but on closer inspection the disjointed, surrealist image is not necessarily a simple landscape at all.

3.2.6 *Disruption 6: Mode collapse*

At the end of the GANs process, a phenomenon termed ‘mode collapse’ occurs when the Generator starts to repeatedly generate the same image. The exact reason for this happening is still not yet understood by GANs engineers. However, one theory is that the GANs’ Generator has learnt that it can ‘trick’ the Discriminator into labelling an image as real data, and so it repeatedly generates the same image, constantly fooling the Discriminator. The GANs’ process begins to break down until every single image made by the Generator is the exact same image.

This computer process can be metaphorically seen and understood in the act of printing the *Sacred Heights* (Figure 9) edition. The physical act of creating a Ukiyo-e woodblock print mimics ‘mode collapse’. As the final object is an edition of prints (an edition of the exact same image), or a re-production of the print matrix multiple times, the printmaking process is mimicking the GANs’ iterative process coming to its end. Here, both the GANs and printmaking processes end in the same way: with a series or edition of exactly the same image.

3.2.7 *Summary*

Common traits within GANism provide a challenge for artists to create work that does not appear generic in its aesthetic. Dejan Grba notes, “(t)his expressive issue reaffirms the importance of the artist’s decision-making and overall poetic articulation” (2022:10). How the artists choose to disrupt their GANs is a means of controlling what GANs traits they do or do not include within their art objects. While GANist artists are inspired by the GANs process, they choose different aspects of this process to highlight in their work. For Klingemann, the neural glitch is central to his work; Elwes focuses on the feedback loop within the GANs process; Obvious celebrates the algorithm and gives authorship to the GAN itself.

A criticism of GANism is that the art is conceptually weak (Grba 2022). The artists rely on and celebrate the processing abilities of GANs and their algorithms that produce the art object they exhibit (Zylinska 2020). The final object is aesthetically unexpected and interesting only in as much as it was produced by a computer, or as Zylinska states, “(i)t is art as spectacle” (2020:76). Few GANist artists push the final art object further than the GANs generated image, which perpetuates the generic aesthetic and somewhat gimmicky nature of GANism. Art evokes an emotional response from the viewer (Emery 2011), however, the responses that the current GAN-led artworks elicit in viewers are primarily concerned with the capability of GANs to make convincingly realistic and unique images. This is due to the way in which most GANist artists are deeply

inspired by the GAN's process itself. It is thus arguably the novelty of the GAN's capabilities rather than the artist's creativity that is celebrated. When GANs are more widely used and understood, their potential to provoke emotional responses like this may be diminished if the artists are relying solely on the GANs generated image as their art object.

Gan-inspired artists that push the final art object further than the generated GANs output image expand the application of GANs in art making. Obvious, White and Ridler are examples of artists who are inspired by the GANs process but not entirely led by the GANs. They disrupt the GANs' process by incorporating art mediums and tools outside of the computer into their processes. They do this by limiting their use of GANs to the generative stage of art making. They are using the GAN-generated images to inspire new art objects in various mediums. This application of GANs acts as an example of how the technology can be incorporated into the artist-researcher's own printmaking practice and relates to the concerns and aim of this research.

3.3 *The role of printmaking in Western and South African art*

This section provides an overview of the role of printmaking within Western and South African contemporary art. It briefly explains why printmaking has been contested as an art medium and what attempts printmakers have made to raise the perception of printmaking, and in particular, the multiple print. The aim of this section is to show how hybrid printmaking has developed partly from the need to overcome a history of questioning the authenticity of printmaking.

Printmaking can be traced back to the ancient prehistoric cultures that are known for cave or rock art (Eichenberg 1976). In the East (Japan), Ukiyo-e woodblock printing began around 220 AD (Eichenberg 1976). In Western printmaking history, the woodblock print was introduced in the fifteenth century. Owing to its potential to create multiples, printmaking became a utilitarian medium used to spread religion, propaganda, and knowledge (Eichenberg 1976). With the innovation of the Gutenberg Press (circa 1440), print editions increased significantly in size. This made printing an efficient means of disseminating knowledge in the West. Western printmaking advanced to encompass relief, intaglio and lithographic techniques. By the twentieth century, the innovation of the camera and the technologies that accompanied it enabled printmaking to advance even further with serigraphy (Saff & Sacilotto 1978). Before the electronic era, printmaking was a medium that was primarily concerned with the production of images and texts in order to spread knowledge (Lovejoy 1992; Saff & Sacilotto 1978). The electronic innovations of the 1970s onwards ushered in the digital print and expanded printmaking to include digital techniques, creating the hybrid print (Coldwell 2015a).

South Africa was introduced to printmaking through missionaries from the West (Davis, Dick & le Roux 2018). In more recent South African history (1960s – 1994), printmakers used their art as a means to resist the apartheid government (Williamson 1989). Printmaking in South Africa has grown as a community-based art

form where access to presses, materials and print masters afforded artists a means to express themselves creatively and collaboratively (Berman 2011; Hobbs and Rankin 1997). Educational collaborative printing studios such as The Caversham Press (Kwa-Zulu Natal), Artist Proof Studio (Johannesburg), and Bag Factory (Johannesburg) continue to offer South African printmakers the space to create.

For most of its history, printmaking has been used as a tool to spread ideas (Lovejoy 1992). The ability to create multiple prints was the driving force behind many of printmaking's technical advances. However, artists have also used and manipulated the technology as a medium of expression (Abidin et al. 2013). It was used in this way by Western artists such as Dürer (b. 1471), Rembrandt (b. 1606), Goya (b. 1746), Picasso (b. 1881), and Warhol (b. 1928), and South African artists such as David Koloane (b. 1938), William Kentridge (b. 1955), Diane Victor (b. 1964), and Norman Catherine (b. 1949).

Historically, because of printmaking's role in disseminating knowledge, printmakers were perceived as craftsmen rather than fine artists, and the role of printmaking was associated with the commercial 'not-art' peripheries of the art world (Piercy 2001). The criticisms of printmaking have been the driving force behind the expansion of the field. The continued endeavour of printmakers to establish their practice within the 'elite' art world has perpetually been contested on the grounds of authenticity (Benjamin 2007; Mattick 1993; Pelzer-Montada 2001). The authenticity and originality of printmaking was questioned because of the medium's reliance on machinery or technology and its ability to create multiples. This has led to a number of interventions by printmakers to overcome this perception: the limited edition, monotypes, mixed-media printmaking and hybrid printmaking.

The establishment of the 'limited edition' print took place in the twentieth century (Mohammed 2021). While a limited edition of prints still consists of multiple prints of the same image, these are restricted in number. The smaller the edition number, the higher the perceived value of the print (Abidin et al. 2013). The printmaker is also obligated to destroy the original matrix of the print once the full edition has been printed, preventing further copies being made.

Once-off prints (such as monotypes) avoid the controversy surrounding the authenticity of multiples yet remain reliant on some form of matrix or printing press for their creation. Other attempts to create once-off prints by incorporating non-printmaking mediums have led to mixed-media prints and expanded the field of printmaking (Mohammed 2021). By combining techniques outside of the domain of printmaking within a print, such as painting on top of an etching, or turning the etching into a sculptural object, the printmaker creates a single mixed-media print, rather than an edition of prints (Mohammed 2021).

The ability to make multiple prints was only possible through the invention of mechanical, electronic and digital machinery and tools used within printmaking. Printmaking is intrinsically connected to the development of image-making technologies because printmaking is essentially a form of image-making technology itself. As author Jenn Law (2017:286) explains,

Print-based technologies have been in the process of almost constant development since before the 3rd century ... Some of this evolution has been by goal-driven design, but much of it developed simultaneously or in response to innovations in other fields — and occasionally, even, by accident

A clear pattern throughout the history of printmaking is that it adapts and integrates new image-making technologies to make printing easier, more environmentally friendly, and more economical (Eichenberg 1976). The development of the technology of printmaking is accompanied by the development of the artist-printmakers' skills and their curious exploration of these new technologies. Prior to the nineteenth century, the innovations adopted by the medium were mechanical and industrial. With the invention of electricity and the computer, the innovations of the late twentieth century ushered in electronic and digital advances in image-making technologies (Coldwell 2013).

The invention of the computer has been influential to printmaking and artist-printmakers (Noble 2002). Noble says that "Looking at the 'computer print', there are various ways in which the computer can be said to be involved" (2002:69). The computer became a tool for artist-printmakers, providing them with an 'electronic palette' which included the ability to duplicate, paste, erase, and move images with greater ease on a new substrate: the computer screen (Rush 1999:177). As newer software for image-making develops, new possibilities for computer prints emerge. Equally, the experimental innovations of printmakers working with digital technologies have led to advancements in the computer (Rush 1999). At present, printed works of art can be entirely conceptualised and rendered using a computer and digital printer, with a pencil used to sign the printed outcome. Alternatively, only parts of the process can be computer-led. For example, colour separations for CMYK screenprinting are done digitally, but the process of exposing the screens with the CMYK positives and printing each layer is carried out by the printmaker-artist (Saff & Sacilotto 1978). Future integrations of computer software and printmaking are logically connected to the advancing capabilities of computers.

The criticism of printmaking here, however, is that the hand of the printmaker wields the technology that creates the art object rather than creating the art object directly. With the invention and advances of computers and the internet, contemporary printmaking is no longer the predominantly utilitarian tool it once was: it is now mainly used as an artistic medium of expression. However, it still relies heavily on the printing press, regardless of whether the printmaking is printing multiples or a once-off print. Despite its criticisms, printmaking has continuously adapted alongside new technologies making creating multiples easier and more accessible. The future development of printmaking relies on the ability of printmakers to adapt their

processes and welcome innovations within the field (Coldwell 2015a). The next section will discuss how the field of printmaking is expanding through the use of digital tools and computer technologies, giving rise to hybrid printmaking.

3.4 Hybrid printmaking using GANs

Printmakers, because of their creative curiosity, are intrigued by new image-making technologies and have incorporated them into the print process. In *Art, Science, and the History of Ideas*, Arthur Miller (1996) says that “the notion of experimentation was intentionally used because artists were being influenced, or at least inspired, by startling new scientific and technological development” (1996:411). This positions GANs to similarly inspire printmaker-artists to experiment and further develop the medium of printmaking by exploring and creatively applying this new medium into their processes. Jenn Law (2017:265) suggests that “often, it is the ways in which existing knowledge systems and technologies are combined that is innovative.” As such, innovation could be said to occur when the artist-printmaker combines a new technology (GANs) into their already existing knowledge system (printmaking).

This innovative combination of new and old image-making technologies (GANs and printmaking) is a form of hybrid printmaking, a term Coldwell (2015a) uses to describe any process of printmaking that combines digital and traditional processes. Jim Noble’s (2002) term, ‘computer print’ is also descriptive of this combination of processes¹². Jan Pettersson (2017) states that the combination of new media in traditional printmaking, hybrid printmaking, will keep printmaking relevant in contemporary art. Of this combination, Pettersson (2017:24) states that

The result is a cross-pollination that points to the total reflection of today’s contemporary art. New technologies and innovative approaches to the media, by artists from all fields and from many cultures, have given printmaking a relevant and radical meaning.

Pettersen views the integration or “cross-pollination” of computer image-making technologies with traditional printmaking techniques as increasing the “parameters” of printmaking. This, according to the author, is achieved by “constant development of traditional processes, with the introduction of new approaches” (Pettersson 2017:25).

Combining GANs into the printmaking process expands the field of hybrid printmaking. GANs introduces a loosening of control to the artist-printmaker as the computer is the generator of images. The fact that the artist no longer needs to control the creation of the artefact creates the potential for more creativity (Lovejoy 1991). This places the artist in the position to observe and select the generated images or to use these images as inspiration for further work. In *Philosophy of Art*, Theodore Gracyk (2012) provides a chronological

¹² The reason that this research chooses to use the term ‘hybrid printmaking’ rather than ‘computer print’ is that the main area of research is focused on printmaking and to a lesser degree, the role of computer technology.

understanding of the philosophy of creativity and claims that, “artists are inspired by forces outside of themselves, forces that they cannot control” (2012:43). This further supports the argument proposed by this research that if the artist-printmaker incorporates the uncontrollable and unpredictable image-making capabilities of GANs into their process, they potentially may encounter inspiration.

In author Oliver Grau’s view (2003:305), this lack of control changes the role of the artist. He states that “image evolution takes control away from the artist and assigns him or her the role of passive onlooker of non-sensory processes”. He also supposes that it is this use of computer processes in the creation of works of art that has enabled art to be made that was not entirely controlled or even envisioned by the artist themselves (Grau 2003). The impact of computers as efficient image-makers, according to Grau (2003), is that the role of the artist-printmaker is no longer one of being the work’s creator, but rather its viewer.

Lovejoy and Grau’s discourses concern the notion of Noble’s computer print (2002) and to what extent the print is computer-led or printmaking-led. Noble (2002) is concerned with the potential of computer image-making technologies to make traditional printmaking image-making technologies redundant. In his view, the time-consuming, laborious, and oftentimes expensive nature of printmaking techniques are rendered “unproductive, uneconomic [and] non-existent” by the efficiency and relative affordability of digital technologies (Noble 2002:68).

In spite of this view and the multitude of image-making technologies available to artists, Abidin et al. (2013:406) explain that “artists still employ handmade techniques because these often allow a greater range of personal expression” and printmaker-artists still use commercially redundant printmaking techniques to express their creativity. Woodblock printing, for example, is one of the earliest printmaking techniques yet remains a prominent printmaking medium for contemporary printmaker-artists (Eichenberg 1976; Law 2017; Saff & Sacilotto 1978).

It is the view of this research that, instead of the computer influencing the function of printmaking, printmaking uses the functions of computers for the advancement of printmaking’s image-making technologies. In this sense, printmaking controls how the capabilities of computers influence the medium, and the artist-printmaker is not simply a passive onlooker, as Grau (2003) asserts, but is rather an active user of an image-making technology. This active use requires that the artist-printmaker learn about the technology, problem-solve, plan, and select the images that will be used. It also involves deciding how best to express their creativity – to decide to what extent they use the tool, and therefore, to what extent the print is computer- or printmaking-led.

This literature review has explained the capabilities of GANs necessary to understand its application in this research. The use of GANs in art making processes was explored in the discussion of GANism. By focusing on the role of printmaking and its progression towards hybrid printmaking, this research has narrowed down the application of GANs into a specific field: hybrid printmaking.

Printmaking is a medium of artistic expression that is constantly challenged and enhanced by newer technologies. In the electronic era, digital technologies rapidly advance in their capabilities — and specifically in their image-making and print capabilities. As such, hybrid printmaking is a rapidly expanding field. As the capabilities of digital image-making technologies constantly usher in new opportunities for printmakers, such as GANs, the role of the printmaker is to engage curiously with these technologies. Coming to grips with these new tools and implementing them into the working process of printmaking is true to the nature of printmaking throughout history. GANs are one such tool and offer both challenges and opportunities for hybrid printmaking.

CHAPTER 4: REFLECTION ON PROCESS

My research was grounded in my personal curiosity about what would happen if I used GANs to inspire new works. Particularly, I wondered how my creativity would be affected¹³. In fact, would it be different at all, or just a continuation of my body of work? Either way, how would applying GANs to my working process affect my flow of creativity¹⁴? Arthur Miller sums up my starting point in the words “Art and Science at their most fundamental are adventures in the unknown” (1996:432). I had assumptions about how the GAN would work and how my work would be affected. These were soon proven wrong.

Throughout the research I aimed to be led by the process of responding to the GAN images. This was challenging at times because the GAN-inspired prints I was creating felt separate from my previous body of work. Towards the end of the research, this unnerving feeling was resolved as the work started to come together in a cohesive way that felt connected to my previous body of work. Through critique sessions, a print consultation and my post reflective investigation (my sketchbooks and journal) I was able to see how applying the GAN to my working process enabled me to make highly creative prints, that were distinctively in my style and simultaneously pushing my work in a direction I had struggled to achieve previously.

Through on-going application of GANs in my working process, I was able to create prints that were initially GAN-led; however, I moved towards creating GAN-inspired prints¹⁵. The image-generating mechanism of the GAN itself was the inspiring force behind much of the works. My research can be separated into five experimental bodies of work that have been named *Iterations*. Each of these five iterations differs slightly in how I used the GANs within my working process. Apart from the last iteration, I limited the use of GANs to the generative phase of my practice. I then responded through screenprinting and collage in the explorative phase of my practice. As a result, the artworks created were focused on the medium of printmaking, and not AI or GANism. This research considers printmaking as the medium of expression and GANs as a tool that can be used within hybrid printmaking.

This chapter will explore my initial assumptions and my subsequent experiences while interacting with GANs. The majority of the chapter focuses on my experience of using GANs, broken up into the five iterations. I attempt to highlight interesting observations uncovered during my research that I documented in my

¹³ The mode of writing in the reflection has shifted to first person. The reason for this change is that this chapter refers to the practice of the researcher, and is written from a self-reflective perspective.

¹⁴ While creativity as a research topic is not the focus of this study, it is a significant aspect that arose during the post-reflective analysis. This research views creativity as described by Kauffman and Sternberg: “Most definitions of creative ideas most often asked comprise three components. First, those ideas must represent something different, new or innovative. Second, they need to be of high quality. Third, creative ideas must also be appropriate to the task at hand. Thus, a creative response to a problem is new, good and relevant” (2007: 55).

¹⁵ The terms GAN-led and GAN-inspired are my own terms. Jim Noble refers to the computer-print being part computer-led and part print-led. In my research I wanted to evaluate the extent to which I was led by the GAN or the printmaking process. If I was more led by the GAN itself, the work was GAN-led. If the work was only partly led by the GAN and more by the printmaking process, I called this GAN-inspired.

personal journals. These have been included as photographs within the text. While I was working with the GAN, a number of concerns arose and these are detailed in this chapter. I also share some key insights from the print consultation I conducted. In this reflective post-practice analysis of my research, I conclude that using GANs in my working process afforded me challenges and opportunities. It moved my practice in a new direction and allowed me to develop a deeper understanding and new perception of my art making.

4.1 Initial assumptions and challenges

When I initiated this research, I had a number of assumptions regarding working with GANs. The first assumption was that the GAN output images would closely resemble my body of art. Consequently, I assumed that I would study the GANs output images and create a print in response. Similar to how a Rorschach test prompts imaginative responses from the viewer. A further assumption was that the back-and-forth process between myself and the GANs would be a simple three-step process in which GAN generates an image, I study the image, and I respond directly to the image. I envisioned this to be easy and straightforward, potentially simplifying the generative phase of my working process. My interaction with GANs did not go as I had assumed it would. At all times I needed to remain true to how I was emotionally and creatively responding to the use of GANs, rather than enforce my assumptions onto the research itself.

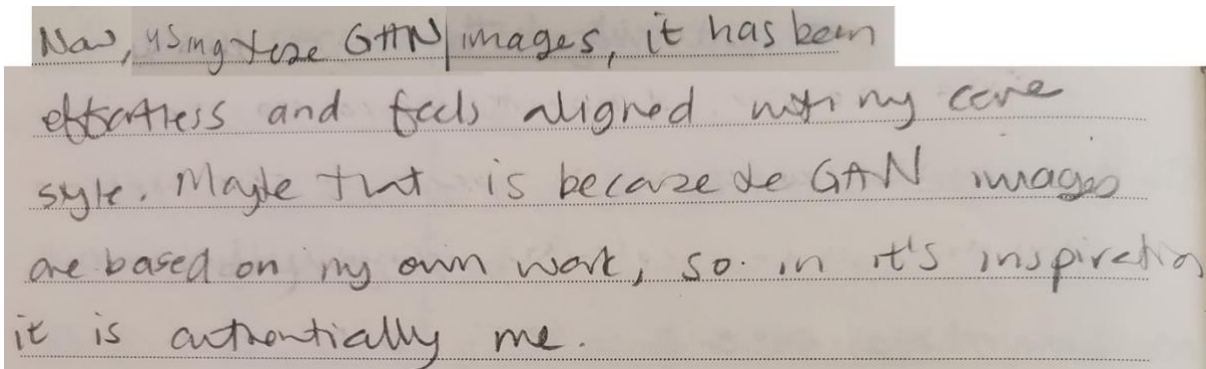
One initial assumption I held was that prints I generated after applying the GANs would be visually a continuation of my initial dataset. The GAN generated images were, however, starkly different from my dataset and created a disruption in my work. I found myself in a position where I was creating prints that I did not immediately feel reflected my previous body of work. This was due to the new prints not being merely a continuation of my previous body of work, with embedded GANist traits, such as visual determinacy or surrealist glitches. The new work was, to a large extent, a radical departure from my previous work. As I would come to discover, the GANs acted as a disruptive tool within my working process, which in turn sparked immense creativity. During my post-practice reflection and feedback from both the print consultation and exhibition, I discovered that these new works encompassed an authentic essence of my art practice and style.

When I received the first batch of GANs generated output images¹⁶ early in my research, I was surprised by how abstract and nondescript they were, certainly not resembling a clear representational image. This created some disappointment at first and posed a new challenge. My initial dataset was made up of mostly illustrations of birds, botanicals, portraits and a small body of landscapes. My assumption was that I would at least receive images that resembled birds, as this was by far the most represented subject matter within the dataset. When I began to study the GANs images I was struck by how they resembled simplified and abstracted landscapes.

¹⁶ I will refer to GANs generated output images as GANs images from here on out, in order to simplify the term for ease of reading.

I found these landscape-like images fascinating. I had attempted to create abstract works, particularly landscapes, many times before. These previous attempts seemed to turn out controlled and contrived, and not within my personal style. In a sense my attempts always felt like I was trying to copy another artist's landscapes. I had considered these to be failures and discarded them¹⁷.

The GANs images provided a means to create landscapes that felt as if they entirely belonged to my body of work, yet were fresh and new at the same time. Even when 'copying' the GAN's images, I felt as if I was copying my own work, discovering my own images and simply re-creating them. Figure 10, an excerpt from my journal, explains this sense of the new prints connecting to my overall work. This affirms Anna Ridler's insistence that the GAN images are always a reflection of the artist themselves. The GAN images were random and unpredictable, yet contained an essence unique to my work.



Now, using these GAN images, it has been effortless and feels aligned with my core style. Maybe that is because the GAN images are based on my own work, so in it's inspiration it is authentically me.

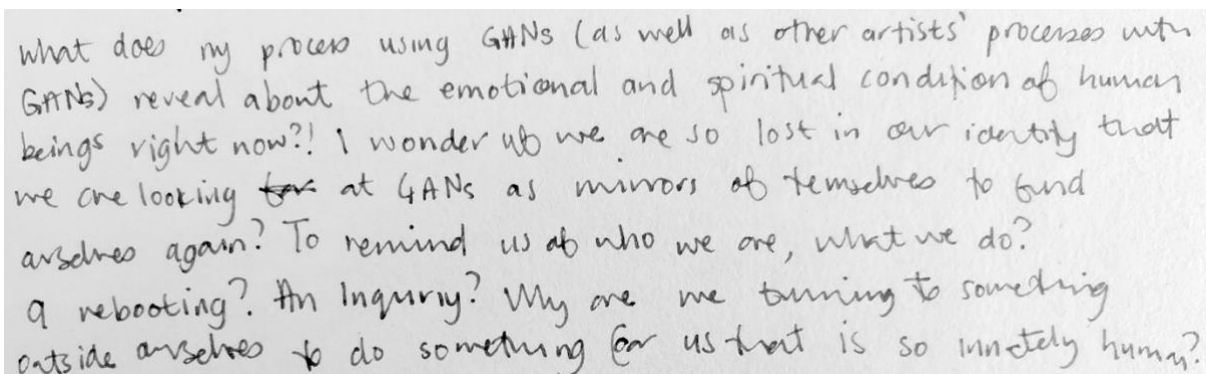
Figure 10: Excerpt from research journal describing the authentic feel of the abstract GANS landscapes.

My assumption about the GANs generating images resembling my art had to shift. The GANs images contained an essence of my work, but certainly were not defined images. The GANs had managed to interpret my work in a form that was distinct (a landscape), and had elements within it that felt true to my style. These elements were the colours, textures and compositions that emerged in the GANs images. Shades of pinks, greens and golds were repeated, as were charcoal-like textures and marks. The GANs images also repeatedly generated circular compositions as well as horizon lines.

I expected the GANs to hold a mirror up to my work; rather, it presented me with a playhouse's warped mirror. This intrigued me and I started to think about the way a GAN sees images. It interprets thousands of pixels in order to find or create patterns. By applying the GAN to my body of work, I was using it to disrupt the way I see my work. When I studied what the GAN had highlighted within my dataset, I was able to see things about my work that I had not noticed before. I was able to explore and experiment in ways I had not done before.

¹⁷ These failed attempts at landscapes were not included within the dataset I gave the GANs.

The notion of the GAN holding up a mirror to my creative practice arose early in my exploration of GANs. In Figure 11 my thought processes in this regard are shown. I wondered whether using GANs would help me to find an essence of myself and my creativity that I could not find without the use of this technology. Without using a GAN as a mirror to my work, I had struggled for years to pin down my artistic style and voice. By using GANs, I was finding that I could have a less biased view of my work, which helped me identify key features of my style. This also references the letting go of control and the creativity that this affords (Lovejoy 1991), specifically in having to creatively confront a source of inspiration that is unexpected and different from one's usual sources of inspiration.



What does my process using GANs (as well as other artists' processes with GANs) reveal about the emotional and spiritual condition of human beings right now?! I wonder if we are so lost in our identity that we are looking ~~for~~ at GANs as mirrors of ourselves to find ourselves again? To remind us of who we are, what we do? A rebooting? An Inquiry? Why are we turning to something outside ourselves to do something for us that is so innately human?

Figure 11: Notes from my sketchbook during the early phases of exploring GANs

The way in which the GANs inspired new prints throughout this research was far less predictable than I initially envisioned. There was no Rorschach test, or step-by-step simple feedback loop. Rather, the research became about the disruption that the GAN brought to my practice and how I creatively responded to this disruption. I became inspired by the way in which the GAN generated images. This discovery led me to be loosely inspired by the GANs' images and more inspired by the GANs' image-making process.

In summary, implementing GANs into my generative phase of printmaking helped me produce works that included GANist traits, like visual indeterminacy or glitches. GANs provided a positive disruption in my practice that resulted in creative interventions and new prints. I was able to view my previous body of work through the lens of GANs and this enabled me to understand my own artistic style and voice in a new way. It exposed elements of my visual language, such as colour choices and texture. My research allowed me to experiment and explore with the mediums of GANism and screenprinting. As a traditional printmaker, this interfacing with GANs technology provided me with a challenge and opportunity to work in a less predictable manner and offered a systematic point of view for my research.

4.2 Interaction with the GANs

Going into my research, I had a basic understanding of what GANs were and how they functioned. Since I had limited access to GANs and do not have the computer coding skills necessary to code a GAN myself, this part

of my process was outsourced. In my research into hybrid printmaking, I studied the works of artists in the 1960s who were working with computers, electric scanners and printers. This new media art was created by artists having to work in collaboration with computer programmers (examples include Kallin and Johannessen's *Exploring Picture Space*, and Beck & Jung's *Morning Bell*) (Lovejoy 1991). I found myself in the same position as they had been and chose to work in collaboration with a GANs engineer, instead of working with the technology myself.

This choice limited my sphere of control to generating the datasets that would be given to the engineer to run. Throughout the process I could consult with the computer engineer and discuss the GANs process in order to understand its functions and limitations better. I also needed to understand how to write about GANs correctly in my research. This began with thinking about the technology correctly. I found it challenging not to anthropomorphise GANs at the start, yet as the research grew, I departed from this notion and understood the technology more as a tool I was wielding, rather than a creator with whom I was collaborating. This distinction was important for me as it freed me to work more lightly with the technology, enabling my work to be GAN-inspired and not GAN-led.

Feeling inspired by the GAN and not forced to be led by the GAN addressed some of the theoretical concerns I had within the research. Jim Noble's (2002) interpretation of the computer-print was concerned with the tension between the advancement of the computer and the role of the traditional artist. However, the more I worked with the GANs as a tool, the less tension I experienced. I rather began to experience what Paul Coldwell (2015a) described when discussing hybrid printmaking: the merging of a digital tool and a traditional medium provided new opportunities within the medium; it did not restrict the medium. Within my research I was able to produce highly creative abstract landscapes by applying the GANs as a tool in my working process. The GANs did not restrict my process, instead, by integrating it, I was able to explore a hybridity in my process that resulted in an increased capacity for creativity.

In my journal entries (Figure 12), I noted that once I stopped focusing on the GAN as the creator of images, and re-focused on myself, the printmaker-researcher, I began to have more control in the process. As the research project continued, I found myself becoming more inspired by the GANs' ways of generating new images, rather than the images themselves. This came about by studying the images and curiously trying to understand the technology and how the GANs generates images.

3. ~~The~~ Removing the pressure to rely too heavily on the GAN for art creation, rather that the role of art creation is ^{contrastly focused} ~~focused~~ on the inherent creativity of the P-R. The focus remains on the printing process instead of the role/affect of GANs. The P-R is entirely in control of the creative process, does not rely on GANs for creativity but only uses it as further inspiration.

Figure 12: Excerpt from my journal discussing the GAN as the inspiration, rather than the creator.

During the research it felt as if the GAN was interpreting my work and I, in turn, was interpreting the GAN. This feedback loop continued throughout the research and seemed like the childhood game of broken telephone¹⁸, with each interpretation becoming more disconnected or scrambled from the original image. The GANs images had a sense of my initial dataset, just as my response to them had a sense of the GANs images themselves. Each reproduction of imagery was inspired by the previous one, and uniquely different from the previous reproduction at the same time. Figure 13 shows a small selection of images within the initial dataset given to the GAN alongside the GANs images that were generated based on this dataset. On the left is an example of the types of images I fed into the GAN from my body of work. These were used to train the GAN, resulting in the images on the right.

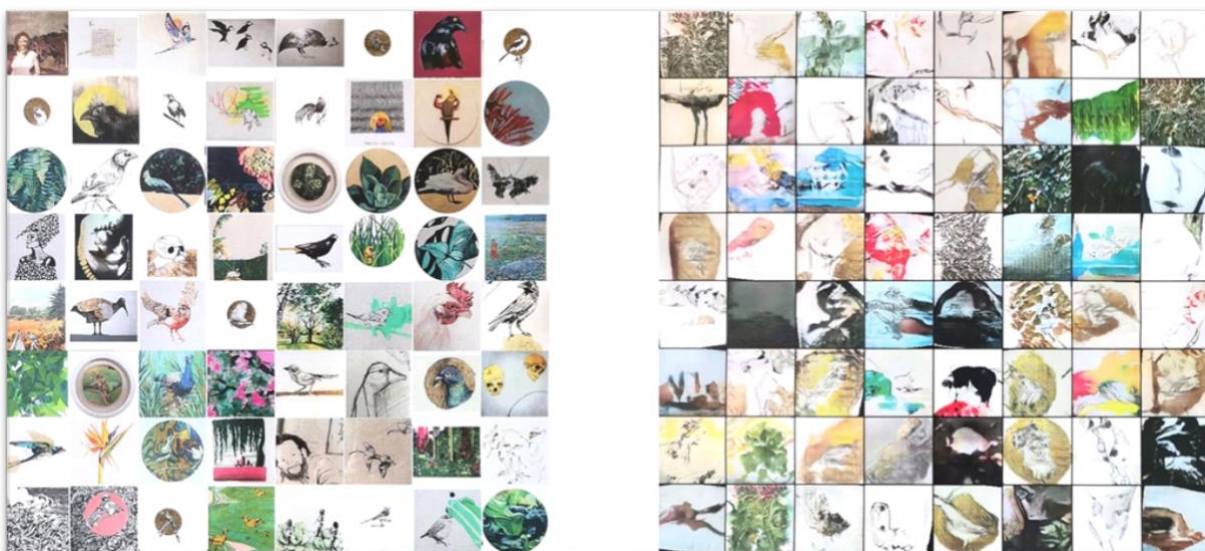


Figure 13: An example of my images (left) alongside the resulting GAN images (right).

¹⁸ In this game, one child whispers a sentence into another child's ear. That child then whispers what they heard into the next child's ear, and so on. At the end, the last child says out loud what they heard. Inevitably, this is different from the original sentence.

After studying the GANs images I began to understand how the GAN was generating them. The new images created by the GAN were reassemblages of images from the original dataset. This can be seen in Figure 14, which shows the generated images (right) as a reassemblage of a few of the original artworks (left) fed into the GAN. The GAN images also displayed the glitches in the GAN's process, evident in the GAN's abstract interpretation of the dataset. In this case, the glitches most likely came about because of the small dataset. Most GANs work effectively with datasets of over ten thousand images. My dataset consisted of just over one thousand images. The second possible reason for these glitches is that the dataset included too much variety. In order to create the largest dataset possible, I had to incorporate all my work, which spanned a number of subject matters, genres, mediums and styles. This prevented the GAN from accurately training on one specific type of image, for example, bird illustrations, and forced the GAN to train on a wide spectrum of images that were not grouped cohesively. The resulting GAN images reflected this varied but limited data in its abstracted, pixelated and simplified representations of the dataset.

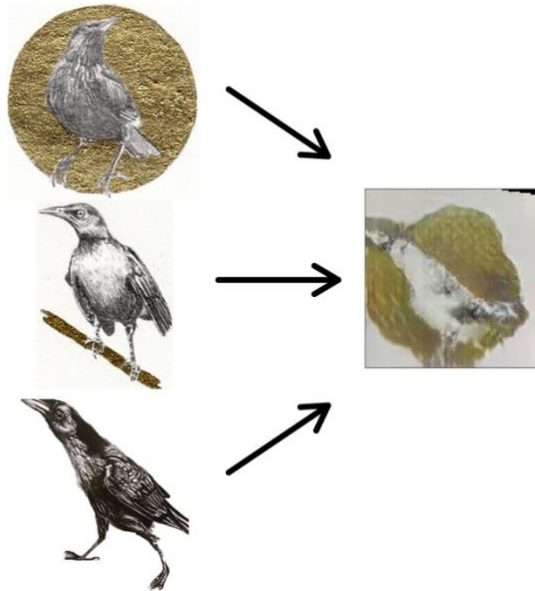


Figure 14: The GAN's generated image (right) as a reassemblage of some of the original artworks (left).

Understanding this process influenced how I was inspired by the GAN. As I progressed in my research, my use of the GANs' image and the GANs itself changed. Initially my prints were tightly connected to the GANs images themselves, but as I became more curious about the GANs' iterative processes and less concerned about the GANs image, my work reflected this. I continued to use these GAN images in the generative phase of my creation, but the application thereof differed. I would go on to use these images as inspiration during the initial brainstorming and generative phase of my process. They would not be used as final artworks themselves. A summary of my use of GANs and the results thereof can be seen in Appendix D.

4.3 First iteration: Imaginary Landscapes

My first body of prints made in response to the GAN's outputs is titled, *Imaginary Landscapes*. After feeding the GAN a dataset consisting of one thousand artworks of birds, florals and portraits, I assumed the GAN images would reflect this dataset. Rather, the GAN generated images that were abstract, nondescript and seemed to resemble abstract landscapes. As stated previously, this was significant to me as I had always wanted to create loose, abstract landscapes, but my personal style is very detailed and controlled, so I had struggled to feel satisfied with my attempts. The GANs images offered a way to overcome this struggle. Figure 15 is an excerpt from my journal. I note how GANs can act as creative catalysts because of the unexpected images they generate, in my case, offering a means to create abstract landscapes.

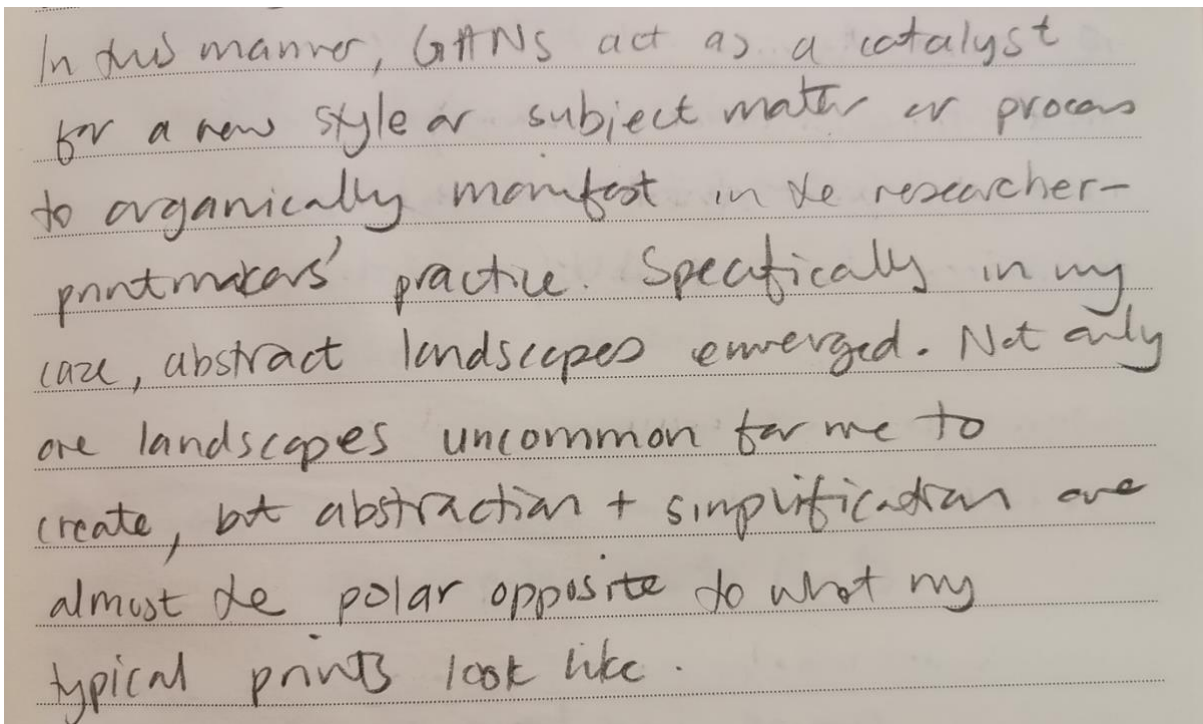


Figure 15: Excerpt from my journal describing my response to the GAN landscapes

I chose a selection of the GAN-generated images that, in my assessment, resembled the elements of a landscape, and I used these as direct inspiration for a body of work. In Figure 16, you can see three images demonstrating my process to produce these prints. In the first image (left), the GAN-generated output image is shown. While the image is made up of non-descript objects, I felt it resembled a field of trees, with grass in the foreground. In the middle image, I used Adobe Photoshop to create a half-tone stencil of the GAN's image. This stencil was then burnt onto a silkscreen using a photo-sensitive emulsion. I exposed the stencil onto the screen with a UV lightbulb for 4 minutes. This process created a stencil of the GAN's image on the screen, which could be printed on paper (the image on the right).



Figure 16: The process of my series, *Imaginary Landscapes*

I chose to use handmade paper that I made by tearing down old drawings and prints to make a new paper pulp. The resulting paper has tiny specks of colour and texture from the torn up artworks. This was conceptually significant to me as it mimicked the GAN's ability to fragment and re-piece together the dataset in order to generate new images. Just like the GAN broke down my digital dataset into pixels and reassembled these pixels into patterns, my handmade paper broke down my physical artworks to create a new art object: the paper.

The stencil of the GAN's image was then screenprinted onto the handmade paper with a neon pink ink. I chose this colour as it was a dominant feature in the GAN's generated images. This layer functioned like a 'map' of the GAN's landscape. Figure 17 unpacks a further application of the halftone positive. The GAN generates an image by clustering pixels together into patterns. The halftone stencil is a crude representation of these pixel patterns, which ended up forming a recognisable image. In the childhood drawing game 'connect the dots', the image is hidden until a line is drawn between each sequential dot, revealing the image. My use of the GAN was sequential in this first iteration. It followed a step-by-step flow of processes in order to create and reveal the final image.

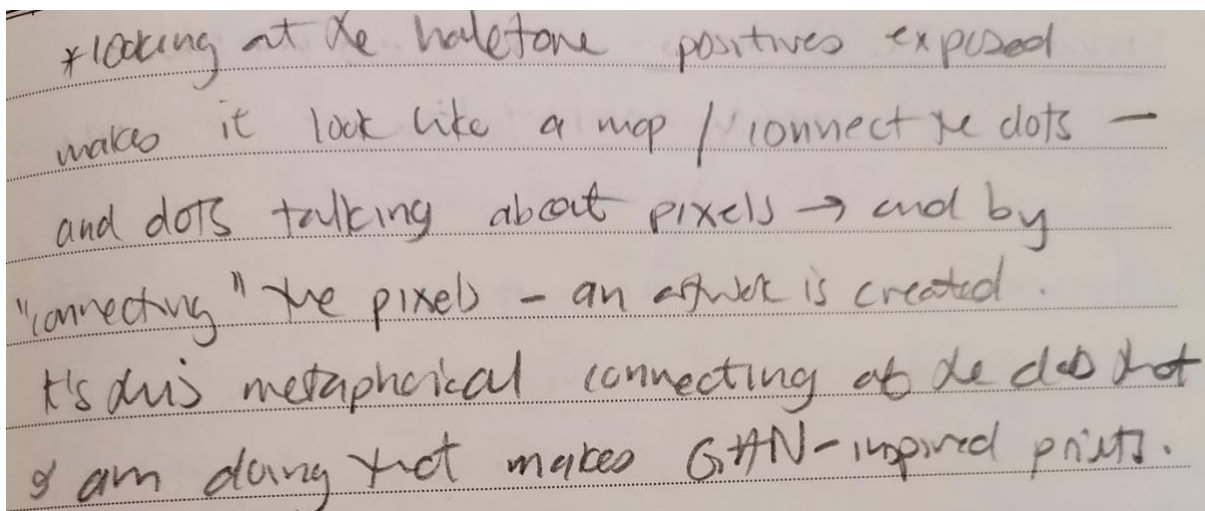


Figure 17: An excerpt from my journal about the halftone positives I exposed

The final connecting of the dot was the final layer of the print. It was created by using this 'map' as a guide for painting the colours of the landscape onto an open silkscreen. This method was uncontrollable, to a large extent. I attempted to paint the colours onto the screen to resemble the GAN's image as closely as was possible, but the misregistration of the two layers – the neon pink halftone 'map' and the silkscreen monotype – was inevitable. Figure 18 shows the final artwork with the misregistration between layers.

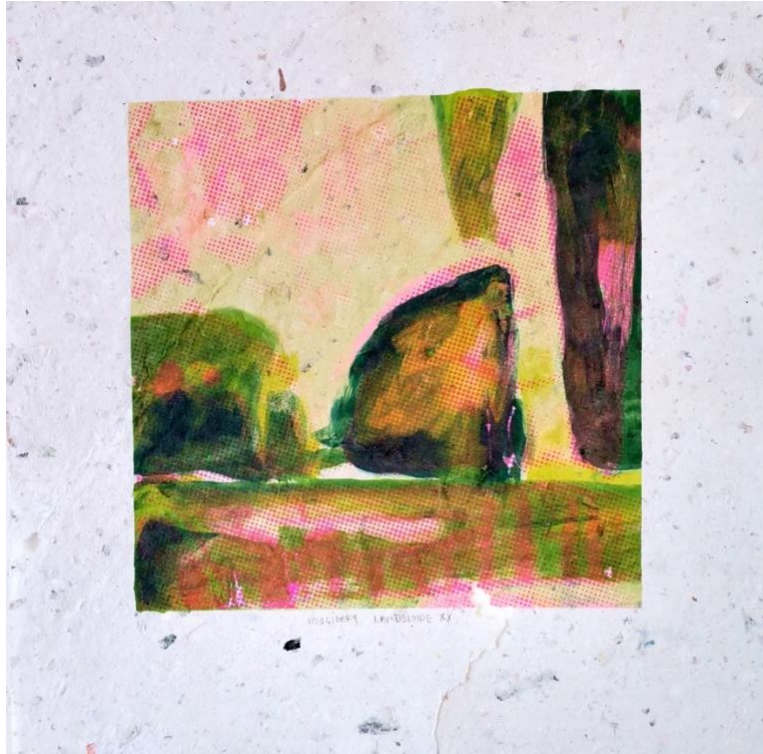


Figure 18: Imaginary Landscape xx

As an initial experiment, I enjoyed this series of works. The concept and final images were linked to the capabilities of the GANs. It reflected my research at the time, which was trying to unpack and understand how GANs functioned. I was intrigued and curious about the technology and fascinated by the output images I had received from the GAN. This first iteration was GAN-led in as much as the final images were closely linked to the GAN images themselves. Although they were not exact copies, when placed side-by-side it is easy to see their visual lineage (Figure 16).

The potential to have generated these new prints is linked to my previous prints. This is because the GAN was trained on images of the previous prints. It is not that the GAN is generating entirely new works, but that it is rearranging and shifting the way I see my old works in order to inspire me to create new works. The GAN acted as a creative catalyst as it provided fresh ways for me to view my older works. The inspiration for the work is still, on a philosophical level, myself and my work. The GAN is able to present me and my work to me in a way that sparks creativity.

4.4 *The second iteration: A Sense of Somewhere*

The next iteration I created was inspired by the first, *Imaginary Landscapes*, particularly my second monotype layer. This next series, however, was indirectly inspired by the GAN's images. This time, I did not try to copy them directly. The first iteration had enabled me to generate landscapes that were loose and abstract. I wanted to see if I could continue this without using the GAN images as a 'map'. In this next series, I studied the GAN's images and chose a number of them with which to work. I observed the image carefully and attempted to recreate the colour palette or composition of the image in some sense while painting directly onto my silkscreen. Figure 19 shows three examples.



Figure 19: A selection of works in the series, *A Sense of Somewhere*

When I began working on this series, I would clean my screen after every print. After some time, I decided to reapply new paint over the printed screen and keep pulling prints before cleaning. With each print, I would apply new paint to the same areas as before. As a result, the screen became densely saturated with ink and colour. In my journal (see Figure 20) I was engaging conceptually with the idea of printing multilayers on a print. Practically, it resulted in my reworking the screen, leaving traces of previous print layers. These layers all merged in the screen and created images that were densely saturated.

This week I've been doing some quick loose screen-
 prints monotypes of the abstract landscape
 theme in the GAN output. I definitely
 want to do more but I'd like to start doing
 more than one layer. I can achieve
 this through printing more than one
 layer, or by drawing/painting over the
 screenprinted layer. I think this will
 "conceptually" add to the depth of these
 images + their parallel with the GAN
 process.
 As the GAN is learning there are multiple
 layers and so by creating art prints
 that are multi-layered, where the
 surfaces are reworked etc, I think it is
 exciting.

Figure 20: An excerpt from my journal while working on *A Sense of Somewhere*

The resulting prints became multiple smaller series within the larger series. These works morph into each other, illustrating the GAN's own iterations. Figure 21 shows how the progression of these prints moved from loosely abstract landscapes into saturated planes of colour. I enjoyed how this process mimicked the way that the GAN, after running hundreds and thousands of iterations, began producing images that were oversaturated with colour and texture.

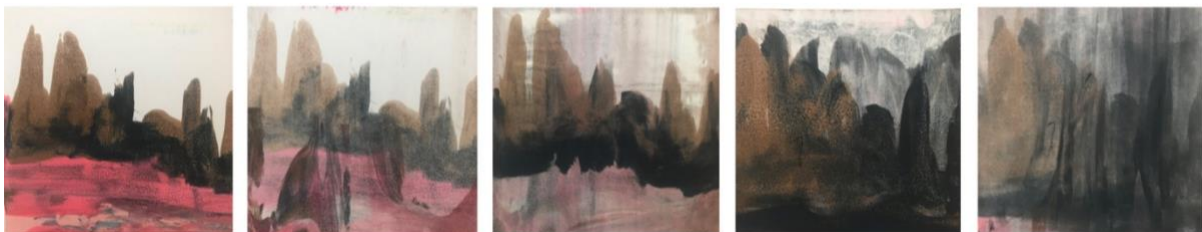


Figure 21: A series of five screenprint monotypes, using a screen increasingly densely saturated in ink.

I continued printing these small 9,5 x 9,5 cm screenprint monotypes over a number of months, until I had two hundred images. At each print session I would randomly choose a selection of colours from my inks. I did not want to overthink this part of the process, because I felt that the GAN images were made of colours randomly put together, sometimes creating a jarring effect. The colours the GAN used were drawn from my

own artworks, but how the GAN combined the colours seemed random. A GAN is unable to distinguish what colours look ‘good’ together, or what colours clash when placed together. However, the GAN was using colours that are typical in my own work. My work is colourful and I often place bright, unrealistic colours next to each other. As I began to operate like the GAN, selecting random colours from the inks I had used in previous works, the effect on my creativity and confidence seemed to grow.

Each print was exciting to pull¹⁹. When I looked at all of them together, I was proud of their whimsy and playfulness. I had finally managed to create a body of abstract landscapes that felt authentic. Figure 22 shows all two hundred of the images that made up the series, *A Sense of Somewhere*. When thinking of a title for this series, I returned to the inspiration the GAN had afforded me. I had attempted to make an image that contained a sense of the GAN image, but was not a copy of it – almost like a memory of the image itself. The GAN’s images were landscapes of made-up places, places that only existed somewhere in my creativity. Furthermore, they were only made possible by using a GAN to hold up a mirror to my creativity.

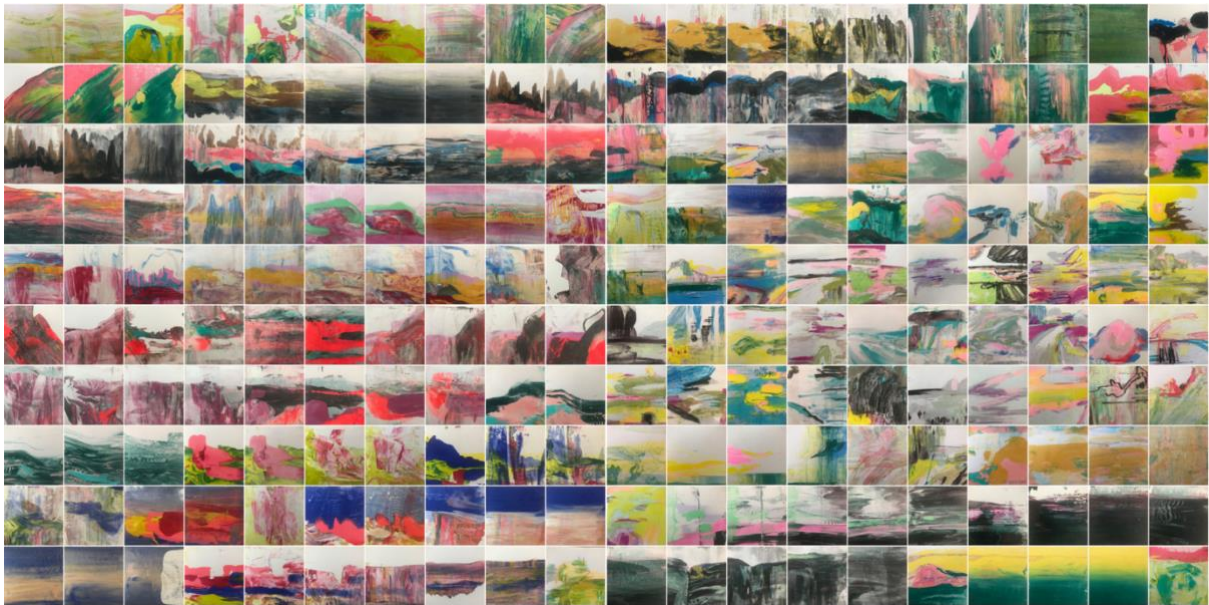


Figure 22: All two hundred images in *Sense of Somewhere*

After completing the two hundred miniature landscapes, I wanted to attempt a larger scale format and see if the larger works would have the same whimsical sense to them. I kept the process of creating these larger landscapes exactly the same as the smaller ones – studying the GANs image, responding to the image by painting directly on an open screen and printing the monotype screenprint. I created a total of fourteen 50 x 50cm large abstract landscapes. One of the large landscapes is shown in Figure 23.

¹⁹ This is a printmaking term that refers to the act of pulling, or making, a print.



Figure 23: One of the larger abstract monotypes within the series, *A Sense of Somewhere*

These larger works posed a significant challenge in their production. I work with water-based inks in my studio and they tend to dry out and cause the screens to become blocked easily. This meant that I had to work swiftly while painting and pulling the print. I am also short and the screenprinting equipment becomes cumbersome and physically difficult for me to operate at such a large scale. Screenprinting is a strenuous act, especially when working with large screens. This process involved my stretching, standing on my tip toes, spilling ink, making a very messy work station, and straining my body in order to produce one print. The entire process was made more complicated and time consuming, and forced me to become even more abstract and expressive through these images than in the smaller counterparts.

Attempting to control the placement of ink and consequently the composition was near impossible at this large scale. I had to work so quickly and messily that many 'glitches' occurred on the surface. For example, in Figure 24, in the middle of the image the neon pink ink has texture made up of vertical lines. This texture is evident in almost all the larger monotypes and is created by the squeegee slipping and bouncing on the surface of the screen. This happened because I needed to apply a lot of force to push the ink through the large screen and I could not maintain a steady force while pulling down the squeegee – I was simply not strong

enough. These ‘glitches’, however, add a sense of movement and texture to the prints, and seem intentionally applied. Figure 24 includes a larger scale landscape in the series *A Sense of Somewhere*, (top image) with evidence of glitches on the surface of the print resulting from printing at a larger scale. The bottom image is a close-up of these glitches.



Figure 24: A larger scale landscape in the series *A Sense of Somewhere*, (top) and a close-up (bottom) of the glitches resulting from printing at a larger scale.

Despite the challenges these larger scale monotypes created, the end result was successful. The prints are convincing landscapes and at their large scale they have a monumental atmosphere to them. The smaller landscapes feel more playful and whimsical, while the larger ones feel weightier and have a sense of atmospheric presence. Personally, I am pleased with the results. The landscapes strike a balance between being organically abstract and at the same time representationally landscape, while also containing a true sense of my own style, particularly because of the colours I used. As the second iteration within my

experimenting with GANs, this body of work encouraged me and stirred up excitement for further exploration.

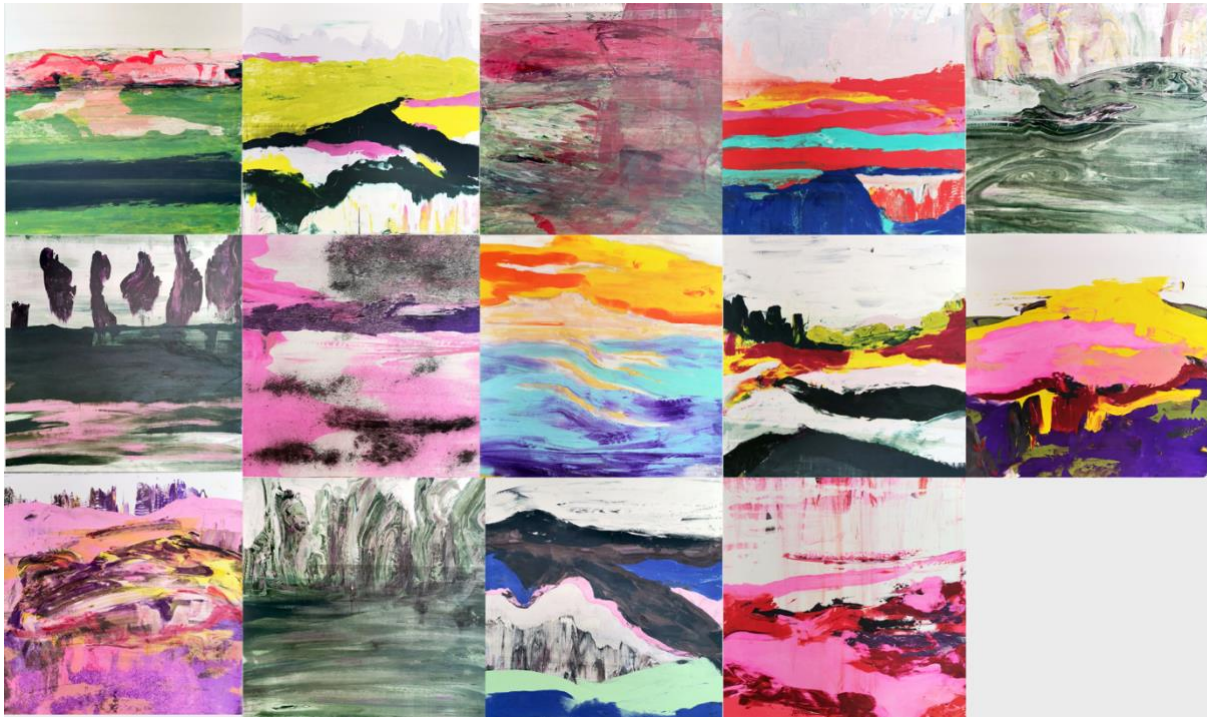


Figure 25: All fourteen of the larger landscapes in the series *A Sense of Somewhere*

Working through this iteration, the GAN was a means to propel my creativity. I was inspired by the GAN images but was able to incorporate screenprinting and the uncontrollable nature of printmaking into my work. The GAN opened a creative path for me, and I experimented and explored this avenue through printmaking. The painterly quality of a silkscreen monotype is similar to the GANs images. The uncontrollable nature of the medium provided a number of 'glitches' in the print, similar to the glitches that characterise artworks made in the style of GANism. Furthermore, the ability to quickly print multiple artworks in this medium mimicked the high-speed mechanical capabilities of GANs.

4.5 Third iteration: Daisies

At this point, I wanted to create a new dataset for the GANs. In the first GAN, the input dataset contained too much variety to create an output image that resembled anything other than an abstract representation. This time, I wanted to try to control the GAN-generated images more. I had been studying the works of Anna Ridler and was inspired to attempt creating my own dataset, similar to in the way Ridler did in *Fall of the House of Usher* (2017). Ridler hand painted two hundred black and white images from stills of the 1929 Watson and Webber silent film, *Fall of the House of Usher*. She used this dataset to train her GAN. The feedback loop she created involved her watching the movie and choosing stills. Based on these stills she would paint a 'copy' of the image in her style. These paintings were then fed to a GAN, which in turn generated its own copies of her images. She used both the GAN's images and her own to create a silent stop

frame animation. Ridler also exhibited her dataset of two hundred paintings. Her concept for this piece was ‘repetition, remembrance and recreation’ (Ridler 2017).

During my research project I fell pregnant and became a mom for the first time. For the first six weeks the days were marked with repetition. Each day was broken into two-hourly cycles of my baby crying to alert me to feed him, my breastfeeding him for twenty minutes and rocking him to sleep, followed by thirty minutes of hand pumping breast milk to store for his night-time feeds. Soon he would stir and cry again. Days were spent anchored to my couch, staring out at my garden. Night times felt endlessly exhausting following the same repetitive pattern, while trying to fit in windows of much needed sleep. My life had never been marked with as much repetition as this. As a result, when conceptualising my new iteration with the GAN, I knew I needed to draw inspiration from this season.

In the winter weeks, those first six weeks, the only flowers thriving in the cold were daisies. I would pick handfuls and place them in vases while my baby was strapped to my chest. Months later, while researching metaphors of motherhood, I discovered a coincidental symbol: the daisy. Daisies are the harbinger of new motherhood. Traditionally, they would be given in celebration of the birth of the first child. This tradition is mostly lost today. Immediately I knew that this would be the inspiration for my new dataset.

I went on to create a dataset of two hundred pencil line drawings of daisies in six days. The repetition of drawing daisies was wearying and exhausting, representing the tiring first six weeks of motherhood. This dataset was fed into the GAN and resulted in output images that resembled daisies. The blurriness and visual indeterminacy of these images alluded to the blurry head space I experienced because of sleep deprivation with a new-born. The two datasets can be seen in Figure 26.

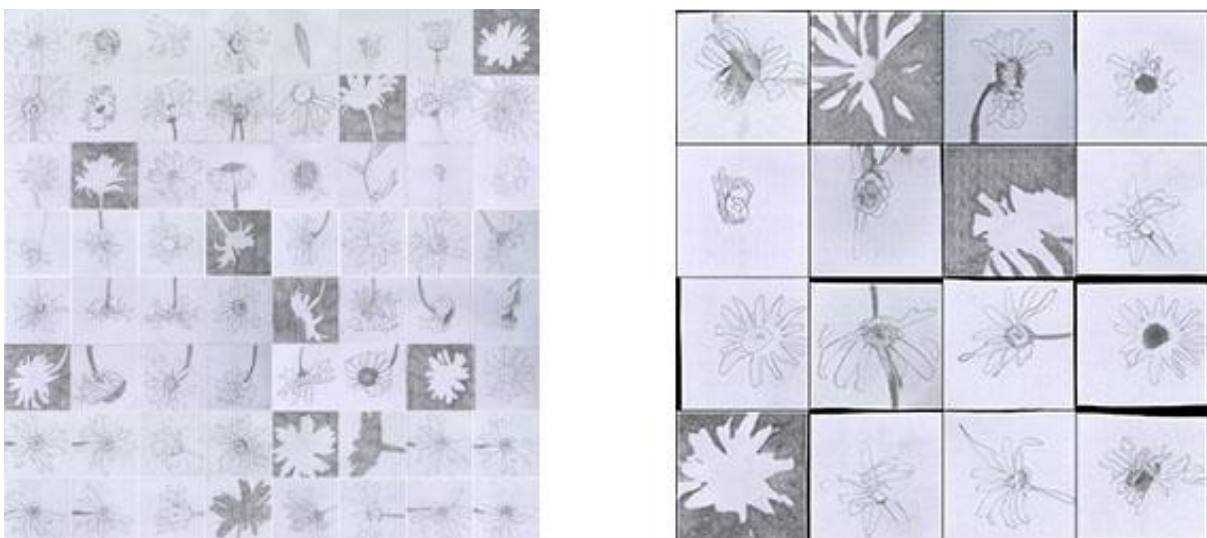


Figure 26: A selection of my own hand-drawn daisies (left) and the resulting GAN output images (right).

Using the GAN images, I chose one of the daisies and drew it onto my screen, as can be seen in Figure 27. This daisy was then printed. I did not wash my screen immediately, so the drawing of the daisy was still visible on the screen, a kind of visual memory of the drawn daisy. I used this as a guide and re-drew the same daisy. I repeated this process to create a series of two hundred screenprint monotype daisies. In re-drawing that daisy, I performed a ‘remembrance’ and ‘recreation’ of my motherhood. The daisies all bear a resemblance to each other while differing slightly. It is impossible to hand draw the daisy precisely the same way each time, just as it is impossible to remember an experience precisely the same way as it occurred.



Figure 27: A photograph (left) of the silkscreen table setup with the first daisy and (right) a photograph of ten of the printed daisies.

Just as the pencil line drawings had been exhaustingly repetitive, even more so, the printing of the daisies stretched my physical limits once again. The fatigue I experienced while printing the same daisy over and over mentally and physically exhausted me. The mundanity of this repetition harked back to the monotony of early motherhood. Figure 28 is a journal excerpt explaining how the process made me feel like a machine. The repetition of mundanity blurs each day, and each print, removing the sense of individuality and replacing it with a sense of strange sameness. The days were the same and the prints embodied that experience.

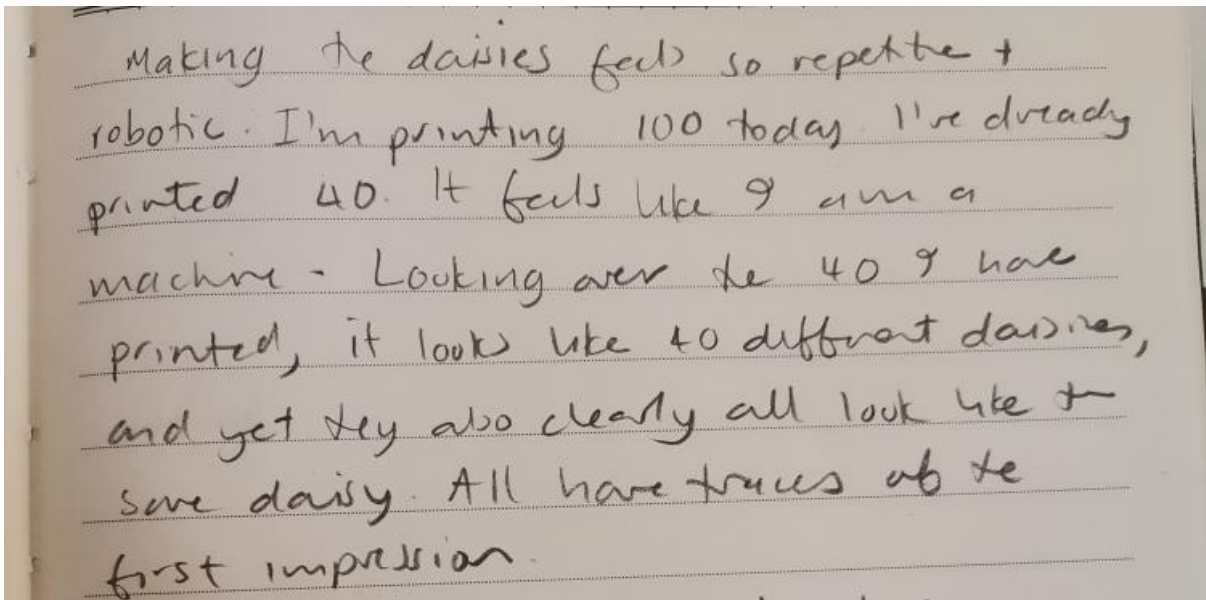


Figure 28: A journal excerpt describing the mechanical process of printing the two hundred daisies.

After all two hundred daisies were finally printed, I uniquely titled and editioned each print. This part of the process was inspired by Anna Ridler’s work, *Myriad (Tulips)* in which she hand wrote individual descriptions for 10 000 polaroid photographs of tulips. Coming up with two hundred unique titles that describe essentially the same one image was an arduous feat. The titles were variants of what the image essentially was: A black line drawing screenprint monotype of a daisy. The titles I came up with were descriptive of the print: either the image itself (e.g. daisy, flower, botanical), the process (e.g. serigraphy, monotype, screenprint), or the quality of the image (e.g. faded, blurry, messy). Figure 29 shows a few examples of titles, as well as the completed pile of prints.



Figure 29: The process of editioning the two hundred daisies.

This iteration was completed and had been a lot more tiring than the first two iterations. The drawing and printing were so repetitive. I chose to exhibit all the daisies in a grid form to show this overwhelming sense of repetition, as well as alluding to the sprouting daisy garden outside my window. It had been a success for me in that it captured a sense of the obscure reality that new motherhood presented to me: each day made

up of the same moments one following after the next, inconceivably differing from one another, until all those repeated, exhausting, machine-like processes overwhelm one and leave one feeling engulfed by one's new identity and its responsibilities: motherhood.



Figure 30: A photograph of *Daisies* installed in my final exhibition

The GAN previously inspired detachment from any representational artistic themes that I was used to. However, through understanding the mechanisms of how GANs generated images I was able to control more of the image outcomes and return to a more representational style. I knew if I wanted the GAN to make an

image that looked like a daisy, I needed to have a dataset of only daisies. When watching the GAN shift between its iterative attempts to replicate a daisy image, I noticed the subtle changes it would make to the image. Petals would be added, left out, shortened, crumpled up, lengthened and so forth. Even though I based all my prints on one daisy, I mimicked the GANs process in each re-print – focusing on a different aspect of the daisy each time, rendering it slightly different. This was a creative challenge that pushed me to think of a daisy not as a physical object, but as a collection of lines and points on a 2D plane that had any number of combinational possibilities.

4.6 Fourth iteration: Cut and Paste and Print

My fourth GAN-inspired body of work was a series of collages. After interacting with the GAN for the previous series of works, I was aware of how the GAN's output images were a reassemblage of elements from within my initial datasets. This reassemblage reminded me of collage. As a concept, I wanted to explore how I could act in the same manner as the GAN: my process mimicking the GAN's process. Essentially, could I generate a hand-made strategy inspired by the GAN's computer process?

For my collages, I cut up old prints and drawings and reassembled elements from each into new collage artworks. Figure 31 illustrates this process. Collage, as a technique, falls under printmaking, as it is historically related to the cutting and pasting together of pages of texts or images from books to create a new image (Maxwell 1977; Dawson 1988). Within GANism, the artist-programmer goes through a process of cutting and pasting the algorithm in order to generate output images. Aesthetically, the elements of the output images themselves also have a surrealistic, Dada-esque, collaged feel.



Figure 31: The image on the left shows the eight artworks used to create the collage on the right.

The collages I created were all different sizes and different images, some collages made up of the same elements. I had used editions of prints to make these collages, so I was able to use the same elements repeatedly in multiple collages (as seen in Figure 32). In attempting to mimic the GANs process, I decided to

work on all twenty collages at the same time. The GANs I was working with throughout my research generated a grid of 8 x 8 images simultaneously. Working with multiple collages at the same time was a new way of working for me. Each collage was a work-in-progress at different stages of completion. Some remain incomplete, while others feel overworked. Overall, the collages have a cohesive feel that is achieved through the same bright and clashing colours used throughout, repeated elements from print editions used throughout, and the bizarre scenes generated by the collage process itself. This is evident in Figure 32. The top two images both contain a cupid figure. The middle collages both contain a yellow cloud. These repeated elements are possible because I used editions of old prints to create the collages. The bottom excerpt from my journal explains how the repetition of these elements within the collages creates a coherent sense of narrative in the works.



Looking at my 20 collages I've made, because
I collaged them using all the same ~~part~~
set of prints, there are similarities +
repetition between them that make them
feel like they all belong to the same
narrative.

Figure 32: Repeated elements evident in the collages: the cupid figure (top) and yellow cloud (middle), along with a journal extract explaining the coherent sense of narrative (bottom).



Figure 33: Three more examples of the collages that were created in this series.

In a journal excerpt (see Figure 34) I noted how the collage process I was exploring was providing insight into my personal artistic style. The deconstruction of old works to reconstruct new works helped me to better understand my artistic voice, to uncover the 'Amy-ness' of my work. When viewing the collages together, certain aspects stick out. These, I believe, are indicative of my style and body of work. They are bright clashing colours, humour and playfulness within the narrative of the composition, kitsch subject matter and a strong sense of story-telling.

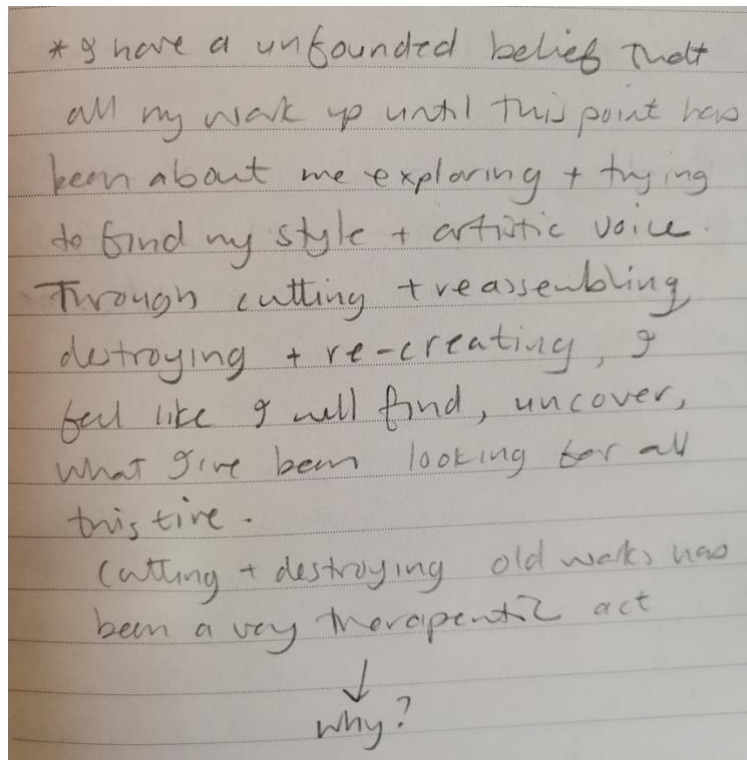


Figure 34: A journal excerpt reflecting on how my collage process helped me uncover elements of my artistic style

The choice to return to my representational work came about because I had been reflecting on my first three iterations and felt that they were so different from my previous body of work. One of my initial assumptions was that the GAN would generate images that looked like my work. These collages represent this assumption. I imagined the GAN would make narrative illustrative images that were made up of elements found in my artwork. As I began working with collage I was acting as the GAN, in the way I had expected the GAN to create.

Most of the collages are reassembled still life scenes. In my research I was encountering a number of arguments about the authenticity of printmaking and its position in the art world. Compared to its counterparts, painting and sculpture, printmaking was not afforded the same grandeur. Similarly, in the medium of painting, still life is considered the less serious counterpart to the genres of landscape, portraiture, religious and historical paintings. By representing still life through printmaking I was emotionally working through the tedious amount of research criticising print.

Towards the end of my research I began to look at the first three iterations I had worked on and realise they did in fact resemble my previous work and my stylistic essence. Perhaps at the time I printed them I was too close to the work to acknowledge this. Through post-practice reflection I was able to see how the colours and compositions were very Amy-like. The GAN had enabled me to embrace and portray my essence in a way that I had not fully grasped until much later.

The prints could well act as abstract settings for my collages, further elements to piece together and create new images. Each iteration seems to feed into the next and speak to the previous, as well as to the dataset. There is a cyclic re-discovery that takes place while working through GAN experiments. I found myself inspired by the GAN, inspired by myself and inspired by the creative response the GAN drew out of me. Where my work had been limited or defined by restrictions in the past, the GAN broke through these and forced me to do the same.

Once the collages were complete, I began translating a few of them into screenprints. In Figure 35, a three-layer multicoloured screenprint on the right was created in response to the collage on the left. The title of the print is *Unrequited Love*. This artwork refers to how I have found GANism and the medium of printmaking to be treated by the contemporary art world. Owing to printmaking's ability to generate multiples, and GANism's reliance on an uncontrollable computer process, both mediums are often perceived to be inferior to the 'elite' art of painting and sculpture. The authenticity of works created using these mediums is also commonly questioned.



Figure 35: The final iteration: Using the collage as inspiration for a multi-layer screenprint, *Unrequited Love*.

This collage-based series was significant in my process as I felt that the work I was generating was even less GAN-led than the previous iterations, and more in line with my previous body of work. It was still a new direction but the collages felt somewhat familiar to my work. By mimicking the GAN's generative mechanisms I was able to create work that was distinctly my own. I also believe that my future work will benefit from exploring compositions through collage.

4.7 Fifth iteration: Dancing Daisies

In my research into GANism I had studied a number of artists, the majority of whom were using digital forms of image-making as their medium of expression. My personal practice within this research had been focused on the traditional printmaking techniques. I had made this choice for a number of reasons. As discussed in

my research, it is my opinion that GANism offers a potentially gimmicky art medium that relies on the audience marveling at the capabilities of the computer. I do not believe it will have continuing visual impact on an audience when GAN technology is widely distributed, better known, more stable and creating more realistic results. Part of the creativity of GANism is the artists' ability to work with the glitches that are found in GAN images and processes. In contrast, although it endures a number of criticisms, printmaking has stood the test of time and continues to evolve, particularly in the field of hybrid printmaking.

With it acting as a control sample in a sense, I wanted to see how generating a GAN-led image digitally would compare to my previous iterations. I wanted to document the results of forcing myself to work entirely with the images the GAN had generated, creating an artwork that celebrated the capabilities of the technology, rather than printmaking. Figure 36 shows my initial thoughts going into this iteration's process. It would also act as a visually explanatory piece for my audience to understand how the GAN operates in its latent space.

Jim Noble (2002) writes about the computer-print that could exist whereby the artist conceptualises and creates a print entirely on the computer. My previous iterations limited my application of the computer (the GAN) to the generative phase of my working process. In other words, I had used it in the brainstorming phase. The explorative phase of my working process had involved my screenprinting or collaging artworks. Now, I wanted to use the computer in the explorative phase as well.

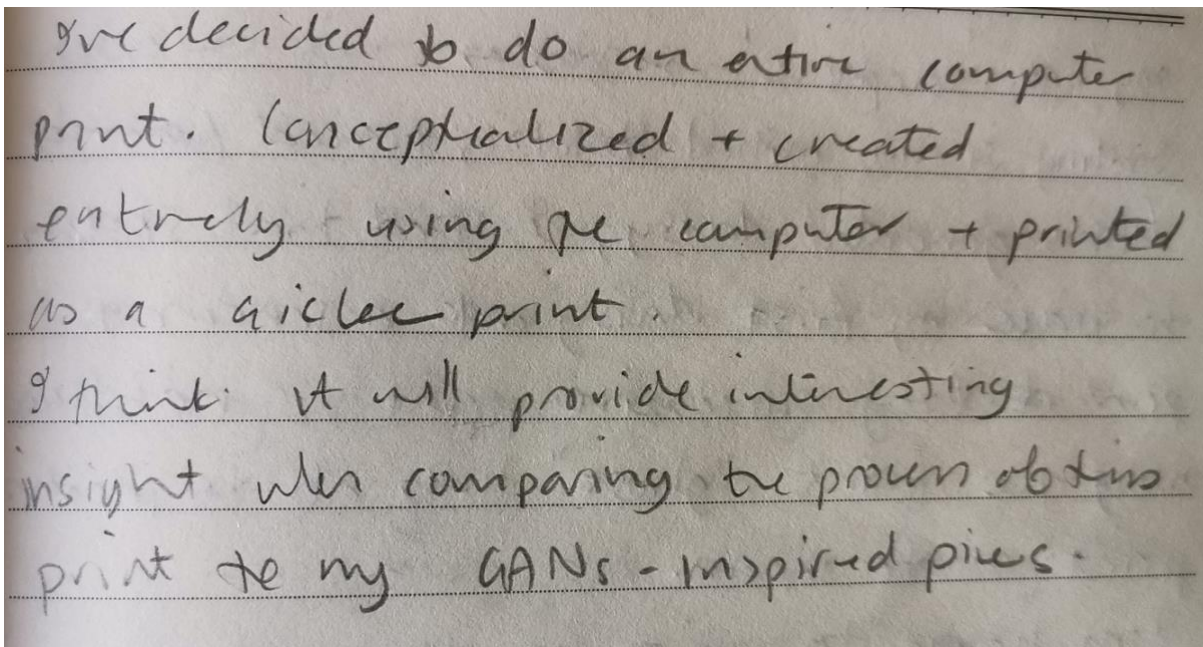


Figure 36: A journal excerpt about my decision to explore digital printmaking

For this iteration I returned to the daisies that the GAN had generated in my third iteration: *Daisies*. Within the latent space of the GAN, the daisy images morph and alter slightly as the Generator attempts to generate a daisy that the Discriminator classifies as real data, indiscriminate from my original line drawings. In order

to translate this visually I wanted to animate the constant shift in and through the GAN's daisy images. I wanted to animate the latent space of the GAN's daisies.



Figure 37: One of the thirteen samples of the GAN daisies, consisting of thirty individual GAN daisies.

I took thirteen samples of the GAN daisies, each made up of thirty square blocks, and separated each GAN daisy in Adobe Photoshop. Each sample is a visual representation of a moment in the GAN's latent space while it is being trained on my line drawn daisies (as can be seen in Figure 37). After each daisy had been separated and its background removed on Adobe Photoshop, I began to create a composition made up entirely of these GAN daisies. I wanted to make a short animation of a still life composition of a bouquet of daisies, each daisy shifting in its own GAN latent space. I created the wallpaper, table cloth and vase's decoration using the GAN daisies. The bouquet in the vase is also all GAN daisies. Figure 38 shows a stage of the composition in progress.



Figure 38: The starting frame for my animation *Dancing Daisies*, (access through Artivive App).

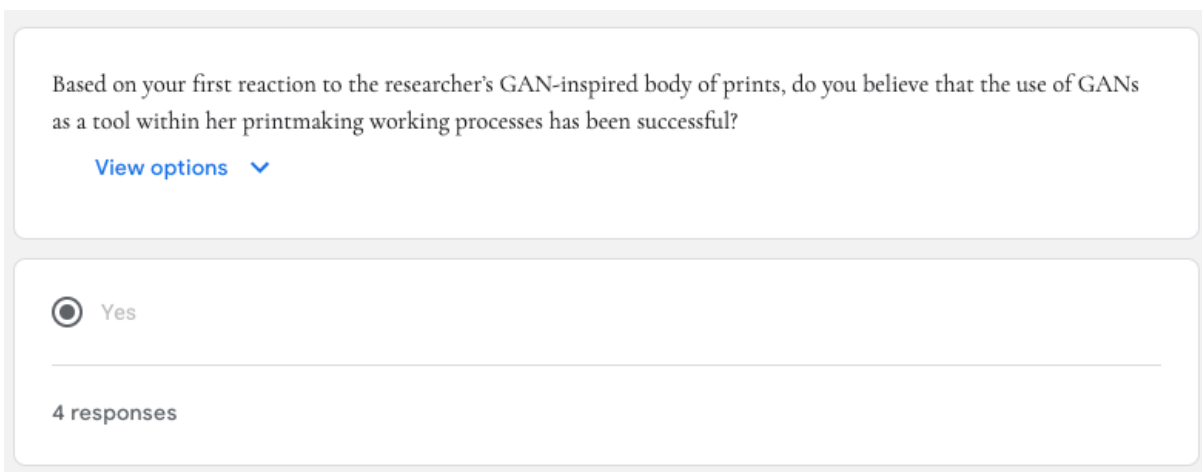
I chose to keep the composition shades of grey, directly influenced by the GAN daisies themselves. The square format, used throughout my five iterations, was chosen based on the format in which all of the GAN images had been given to me. The final artwork created for *Dancing Daisies* is a short animation. The audio is myself singing the lullaby ‘Daisy Daisy, Won’t you marry me?’ to my son and patting him to sleep. In the video loop created, the daisies in the vase all shift and move through their various GAN iterations. The video can be accessed through the Artivive App by aiming the viewer’s smart phone camera at the starting frame of the video. This frame was printed digitally and presented at my exhibition.

In comparison to my previous iterations, this one was entirely GAN-led. Conceptually this piece encapsulates the quintessence of some of the most pertinent research points I addressed. As an image it is a simplistic still life digital print accompanied by an animation. GANism, printmaking and the still-life genre are ostracised by the elite art world to a degree. The digital print, or computer print, is even less recognised as a serious art medium because of the absence of the artist’s spontaneous hand-made presence and the reliance on computer technology. Nevertheless, for the audience at the exhibition this print prompted exciting interaction with the work. Whether the audience understood the concept behind the work or not, their emotional response to the animated video was gleeful and energetic, with them calling their friends or people alongside them to watch together.

4.8 *Print consultation*

My application of GANs into my working process resulted in prints that felt highly creative and exciting to me. I had addressed my research question, “How can a contemporary fine art printmaker use GANs within her working process?” However, I remained curious as to whether this application of GANs had the potential to expand the field of hybrid printmaking by other printmakers using the technology. I set up a print consultation with five of my printmaking peers²⁰ in order to receive feedback from them regarding both my specific research project and the way in which I applied the GANs, and also to determine whether they saw merit in using GANs as a tool themselves.

The first question asked the participants whether they saw the application of GANs into my working process as successful. All four of the participants responded “Yes”. Even though I personally felt it was a success, I had not expected such a positive response to my work. I felt my new GAN-inspired prints were so different from my previous work that the participants might find this a problem. Their responses proved my assumption wrong (Figure 39).



Based on your first reaction to the researcher’s GAN-inspired body of prints, do you believe that the use of GANs as a tool within her printmaking working processes has been successful?

[View options](#) ▾

Yes

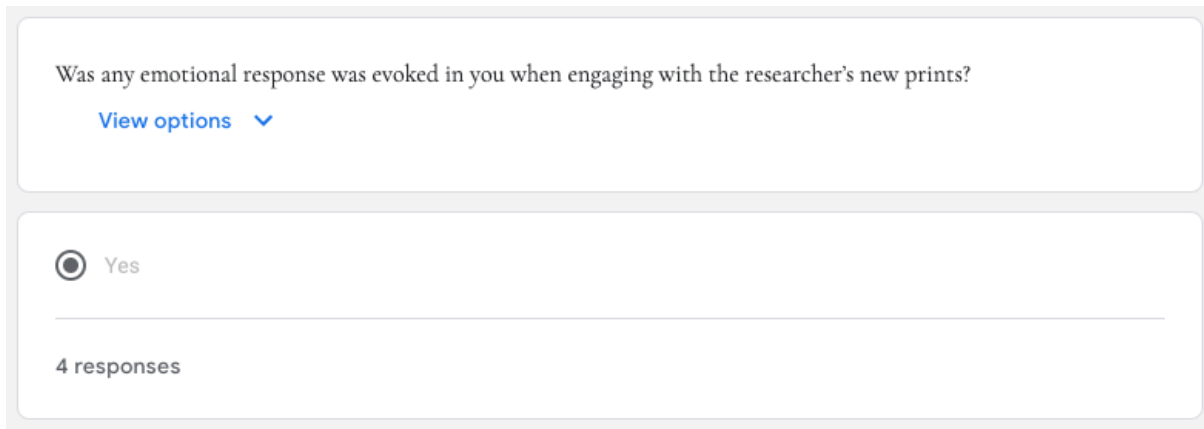
4 responses

Figure 39: Google Form response to Question 1 of the print consultation

The second question related to the first and asked whether or not an emotional response was evoked when looking at the GANs-inspired print. Again, all four participants said “Yes” (Figure 40). Question three led on from this question and asked participants to select one, or more, of three aspects they believed they were responding to: the capabilities of GANs, the aesthetics of the art object and the concept behind the art object. Three of the participants selected “the capabilities of GANs”. Two participants selected “the concept behind the art object” and one participant selected “the aesthetics of the art object” (Figure 41). The majority

²⁰ The five participants I chose to present my work to have worked alongside me since 2006. They are familiar with my body of work and personal artistic style. I wanted to present my new work to them in comparison to my previous work and ascertain how they would respond to this new work. After presenting my work and detailing how I used the GANs and was inspired by the GANs process, I asked the participants to fill out an anonymous Google Form consisting of seven questions. Unfortunately, on the day of the presentation one of the participants had to cancel due to a family emergency. I consequently presented to four of the invited participants and received four anonymous responses.

response, that is, “the capabilities of GANs”, aligns with my research into GANism and how the audience responds to the artworks as artefacts showing computer capabilities. I noted in my research that this presented a potential concern in that the work of GANism may be gimmicky, and once GANs are more widely used and understood, the impact of these works may be less compelling.



Was any emotional response was evoked in you when engaging with the researcher's new prints?

[View options](#) ▾

Yes

4 responses

Figure 40: Google Form response to Question 2 of the print consultation

If you answered YES to question 2, what do you believe you are responding to when you experienced these emotions? (tick all relevant boxes)

[View options](#) ▾

The capabilities of GANs

The aesthetic of the art object

1 response

The capabilities of GANs

The concept behind the art object

1 response

The capabilities of GANs

1 response

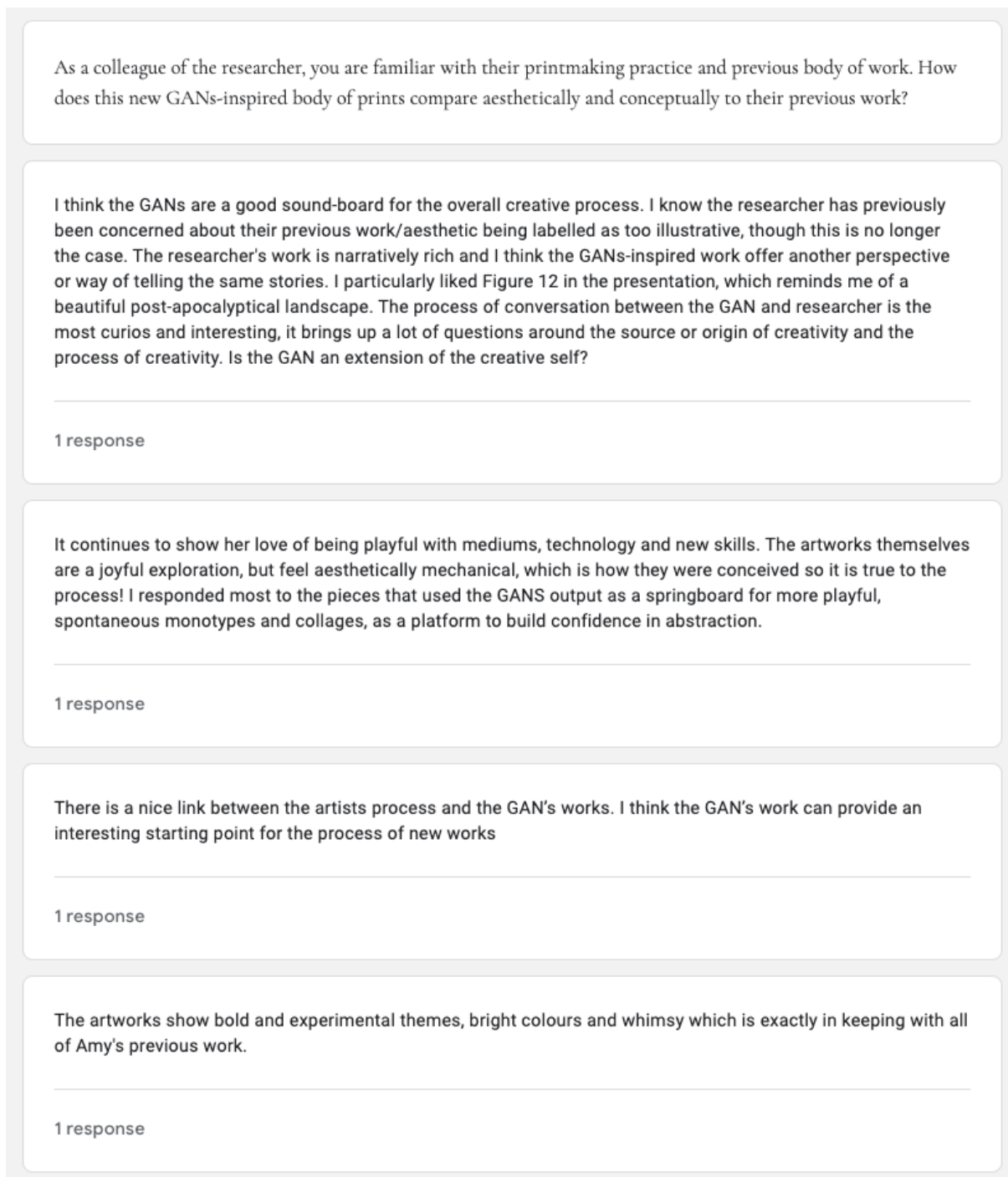
The concept behind the art object

1 response

Figure 41: Google Form response to Question 3 of the print consultation

This presents a challenge to me, specifically in terms of how my work is presented or exhibited. In discussing my work, I have had to explain and unpack the functionality and role of GANs within my process. Therefore, the viewers are immediately impressed by the GAN's capabilities, as it is a newer technology they are witnessing. In my future work, now that I have established how I will be applying GANs in my working process, I do not think it is necessary to continue presenting the GANs as a precursor to my prints. Rather, going forward, I will let the prints I create stand alone and speak for themselves in their presentation. This limits the GANs appropriately to a utilitarian tool used within my process, and not a co-creator of the prints.

Question four of the consultation asked the participants to compare my GANs-inspired prints to my previous body of work. An exciting observation I discovered in their responses is that the new prints felt consistent with my body of work, yet were able to push my work into a direction I previously struggled to achieve. The work that was less GAN-led, and more loosely GAN-inspired felt more successfully representative of my body of work. The responses were aligned with my own opinion about how the GANs was best applied when kept as a tool within the beginning stages of my working process, and not too tightly used in the forming of the final prints (Figure 42).



As a colleague of the researcher, you are familiar with their printmaking practice and previous body of work. How does this new GANs-inspired body of prints compare aesthetically and conceptually to their previous work?

I think the GANs are a good sound-board for the overall creative process. I know the researcher has previously been concerned about their previous work/aesthetic being labelled as too illustrative, though this is no longer the case. The researcher's work is narratively rich and I think the GANs-inspired work offer another perspective or way of telling the same stories. I particularly liked Figure 12 in the presentation, which reminds me of a beautiful post-apocalyptic landscape. The process of conversation between the GAN and researcher is the most curious and interesting, it brings up a lot of questions around the source or origin of creativity and the process of creativity. Is the GAN an extension of the creative self?

1 response

It continues to show her love of being playful with mediums, technology and new skills. The artworks themselves are a joyful exploration, but feel aesthetically mechanical, which is how they were conceived so it is true to the process! I responded most to the pieces that used the GANS output as a springboard for more playful, spontaneous monotypes and collages, as a platform to build confidence in abstraction.

1 response

There is a nice link between the artists process and the GAN's works. I think the GAN's work can provide an interesting starting point for the process of new works

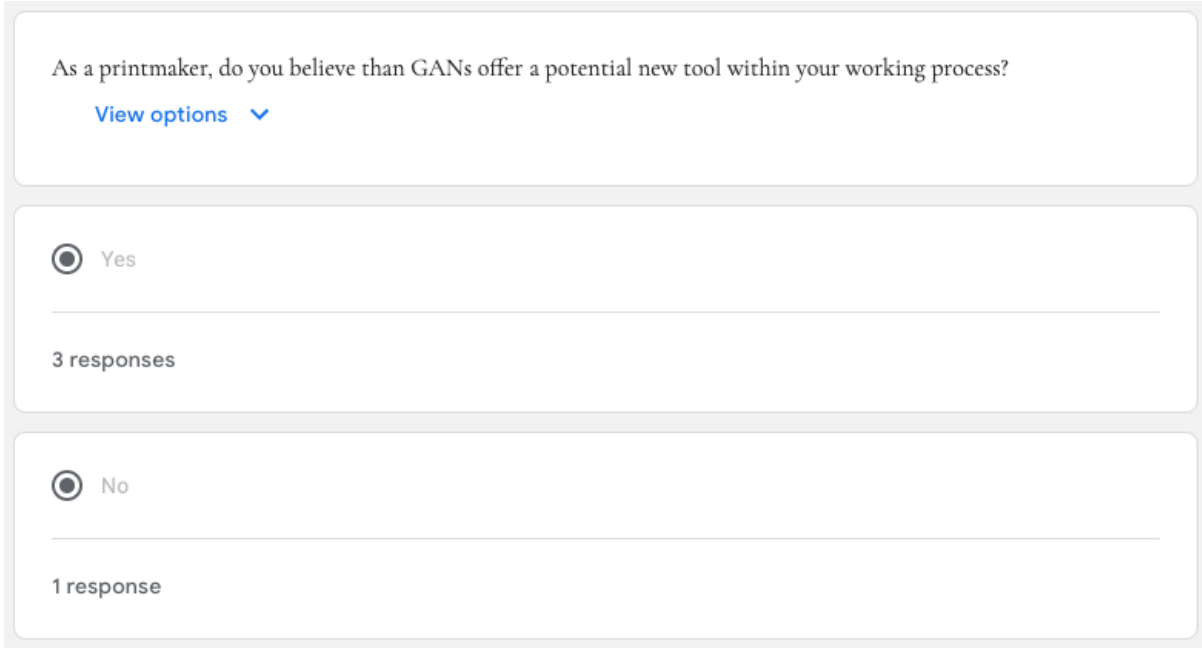
1 response

The artworks show bold and experimental themes, bright colours and whimsy which is exactly in keeping with all of Amy's previous work.

1 response

Figure 42: Google Form response to Question 4 of the print consultation

Question five asked the participants whether or not they would consider using GANs in their own processes. Three of the participants would, while one responded “No” (Figure 43). This is a good indication that more printmakers might explore GANs to expand the field of hybrid printmaking. Question six explored this further by asking the participants to use a sliding scale to show how likely they would be to use GANs in their own work (Figure 44).



As a printmaker, do you believe that GANs offer a potential new tool within your working process?

[View options](#) ▾

Yes

3 responses

No

1 response

Figure 43: Google Form response to Question 5 of the print consultation

The researcher has described to you how they have implemented and experimented with GANs in their working process. Based on this, where on the scale would you consider exploring GANs in your own working processes?

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Very much
<hr/>						
1 response						

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Very much
<hr/>						
1 response						

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much
<hr/>						
1 response						

	1	2	3	4	5	
Not at all	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much
<hr/>						
1 response						

Figure 44: Google Form response to Question 6 of the print consultation

The last question allowed the participants to leave any further comments on the presentation that were not addressed in the previous questions (Figure 45). The first response touched on how printmaking is such a ‘mechanised’ process and is constantly at odds in the artworld because of its ability to create multiples. This aligns with my research into printmaking in chapter 3. I found it interesting that this participant believed that the GANs images themselves were ‘almost too “Amy”’. When I was working with the GANs images I found

them so different from my work, in that they were loose abstract compositions. Perhaps I was too close to the work and held on tightly to my first assumption going into this project – that the GANs images would closely resemble my own illustrative, representational body of work. It was a pleasing discovery to read this participant’s view of the GANs images. I had been concerned throughout this research that the work I was creating was in opposition or contrast to my body of work and would be made in a research ‘vacuum’ of sorts. This comment alleviated my concerns and has allowed me to feel confident that my new prints do belong to my overall body of work. It also boosts my confidence in continuing to apply GANs in my working process after this research is complete.

The participants also seemed to prefer my later iterations with the GAN, where I loosely used the GAN as inspiration. Three of the participants make comments about future applications of the technology in my work, or in general. I believe this is proof of the curious exploration that Paul Coldwell (2015) states printmakers exhibit. When offered new technology, printmakers keep asking questions about experimenting with how this technology could work for them, their process, and printmaking in general. These participants show their curiosity in their responses. There is also a sense among the responses that the research and my engagement with GANs was a collaboration between me and the technology. I believe this is a natural perception because, as printmakers themselves, they are constantly working in collaboration with some form of technology.

Do you have anything you would like to add or elaborate on?

I think this masters work shows an incredible amount of hard work and engagement with new technology and new ways of thinking about the art making process. It made me think about how printmaking already has such a mechanised process underpinning it and how as artists one can be tempted to produce artworks in a GANS-like manner (often encouraged by galleries) simply to secure and maintain collectors of your work. It made me think about how the very first printmakers embraced new technology in presses and silkscreens - how its commercial benefits for repetition have always driven progress towards efficiency. I think this masters is successful in drawing attention to the stereotypes that we still find in the artworld - that something that can repeat and mechanised a process makes the output somehow less original, less personal than an artist drawing/painting/shaping a medium directly with their hands. Printmakers, photographers, collage artists - they fight these stereotypes daily in finding an audience for their work. I don't think Amy's GANS output inspired works were less "Amy", but almost too "Amy", as if they were trapping her in old ways of working. When she used them as sources of inspiration, rather than sources for reproduction, there was an excitement evident in the work about new ways of working. I am fascinated by Amy's use of GANS and to see future applications of such technology. How exciting to be playful with something right when it's just beginning!

1 response

I'd be curious to see how the GANs would react to being fed portions of images as opposed to full images, and to what degree they can interpret the disintegration of images. Would the output be completely different? I also really enjoyed how process driven and collaborative the GAN-inspired work is. Printmaking is for the most part a creative collaboration between technology (and machine in some cases) and human.

1 response

I loved that the body of work came full circle. Amy collaborated with the GAN's, it learnt from her and then she learnt from it. A truly unique and fascinating process and conclusion.

1 response

I think there is a lot of potential in using AI and machine learning in the art making process, especially in a time of NFT's and the evolving Metaverse

1 response

Figure 45: Google Form response to Question 7 of the print consultation

I found great value in the results from the print consultation. During my research process I had kept all my work private and restricted how much I presented on social media. As such, I had no idea about how it would be received and what responses it would generate. I had concerns and doubts about whether the work was

conceptually strong enough, or aesthetically complex enough to elicit positive responses in an audience. After engaging with these participants my confidence in the work has grown and I am excited about further work with GANs. At times I wondered whether or not I would continue using GANs in my working process after I finished my research. As the research draws to a close, in light of these responses as well as my own experience throughout this process, I am certain I will continue to curiously experiment with GANs.

CHAPTER 5: CONCLUSION

By incorporating GANs into my Fine Art printmaking process, I have been inspired by the GAN's process itself and have used this to make new prints. Some of these prints were GAN-inspired, whilst others were more directly made with the GAN's output images. This PBR mostly incorporated the GAN's images into the generative phase of my process, while the explorative phase used screenprint monotype or collage as a medium of expression. The research has proven to be a positive experience overall, and I anticipate continuing to create in this manner.

Marcus Sautoy, in his book *The Creativity Code: Art and Innovation in the Age of AI*, discusses how using AI technology in our creative processes may provide us with the disruption we need to do something new (2019). He likens the repetitive production of the same creative processes to a computer's systematic algorithms. By applying a machine, in my case a GAN, into the creative process, the creator is forced to stop creating like a machine and respond intuitively and creatively to the disruption within their process.

This allegory strikes true in my personal experience of applying GANs into my working process. My process as a printmaker was disrupted by working with GANs, and this resulted in a number of series of prints. The early series (*Imagined Landscapes*) was most closely inspired by the GANs and led me to create works that were significantly different from my previous body of artwork. As the process continued, I was able to use the GAN's process of reassembling and collaging images together to influence later series of artworks.

The research project focused on my process as a printmaker and seeing what effect implementing GANs into my familiar practice would have on my work. During my research, I became fascinated with what GANs would generate. As previously mentioned, at first, their limited capabilities frustrated me when I realised that their output images would be abstract and non-representational. However, this became a strength in the project, as it enabled me to be inspired by the GAN's images rather than seeking to replicate them. In other words, the abstract, visual indeterminacy of GAN-generated images became a means to inspire prints. By generating my own datasets, I was familiar with the original data and enjoyed seeing how the GAN responded to them and how it reassembled the data in the final output images.

At the onset of the project, I had some assumptions that the process between myself and the GAN would be similar to a Rorschach test. I imagined that the GANs would produce images that looked like something, or triggered something in my imagination that I could then recreate in my style and medium. The reality of the project was far less prescriptive. It challenged me to look at the GAN's images that were so dramatically different from my work and to respond by creating something inspired by them, while staying true to my own practice. I believe that this process resulted in highly creative responses that I would never have been able to predict or produce were it not for incorporating GANs into my practice.

The GAN not only acted as a creative catalyst for my art practice during this research, but it felt like a creative extension of myself. By training the GAN on my artwork, the results, although computer generated, were generative extensions and reflections of my art making practice. The disruption was in how the GAN presented this. Through its fragmenting and reassemblage of the datasets a strange, warped reflection of myself was presented to me. Letting go of the need for a representational ideal, I was able to evolve and build confidence in abstraction. The results were prints that broke out of my original style and pushed my creative boundaries towards positive experimentation and play.

A modern-day proverb is that to become an expert at something, one should practise it for ten thousand hours (Gladwell 2008). For a GAN to produce images that resemble literal objects, it requires datasets of upwards of ten thousand images. In my project, I found that making datasets of two hundred similar images resulted in interesting and semi-representational GAN-generated output images. This has informed my practice and has encouraged me to work in series or to create separate bodies of work. Each series contains at least two hundred images that can then be fed into a GAN. The driving force behind this form of working is my curiosity about what the GANs might generate with each iteration – what response will they give me?

Printmakers working in hybrid printmaking (the mix of digital and traditional printmaking techniques) may certainly benefit from using GANs to inform their processes. Their choice of how GAN-led or GAN-inspired their art practice can be will emerge from curiously working with the new image-making technology and incorporating this into their already familiar working processes. This will inevitably generate interesting outcomes. In some way, this is a continuation of a well-worn path, where printmakers have always sought to find new and interesting technologies that can be assimilated into the processes of printmaking, and where problem-solving continues to lie at the heart of the practice. In this sense, it is my argument that the printmaker is naturally a good audience and user of GANs.

Lastly, to my mind, it would benefit GANs technology to welcome its use and experimentation in the field of hybrid printmaking. To overcome the potentially limited novelty wearing off and GANism suffering the fate of a short-lived art fad, GANs would fare well to be used as a conceptual or utilitarian tool within a field as exciting, and constantly expanding, as hybrid printmaking .

In conclusion, I believe that this specific form of hybrid printmaking presents a number of possibilities for future research. Most intriguing to my mind would be to explore case studies of various printmakers engaging with the technology and documenting their reactions and the resulting prints that emerge. Another application of GANs into hybrid printmaking could involve studying the effects of supplementing the researcher's own brainstorming sketches with other artworks in the style or medium from which they want

to make prints. This would possibly help the researcher to visualise their prints, explore unexpected compositional elements, and potentially enhance the creativity of their print. Lastly, this research project made use of GANs in their basic algorithmic architecture. It would be intriguing to see if the GAN could be coded and manipulated to replicate certain glitches or to prioritise certain aspects of a researcher's body of work (such as a specific colour palette or repeated imagery) in the generation of output images..

SOURCES CONSULTED

- Abidin, MZ, Daud, WSAWM and Rathi, MRM. 2013. Printmaking: Understanding the Terminology. *Procedia-Social and Behavioral Sciences* 90:405-410.
- Alvarez-Melis, D and Amores, J. 2017. The emotional GAN: Priming adversarial generation of art with emotion. Paper presented in the 2017 California NIPS Machine Learning for Creativity and Design Workshop, December.
- Bailey, J. 2020. The Tools of Generative Art, from Flash to Neural Networks. [Online]. Available at: <https://www.artnews.com/art-in-america/features/generative-art-tools-flash-processing-neural-networks-1202674657/>. Accessed 9 March 2022.
- Bell, D., 2004. Explaining Ukiyo-e (Doctoral dissertation, University of Otago).
- Bengio, Y, Laufer, E, Alain, G and Yosinski, J. 2014. Deep generative stochastic networks trainable by backprop. Paper presented at 31st International Conference on Machine Learning, January: 226-234.
- Benjamin, W. (2007; first published 1936) 'The Work of Art in the Age of Mechanical Reproduction', in Hannah Arendt (ed.) *Illuminations*, translated by Harry Zohn, New York: Schocken, pp. 217-251.
- Berman, K. (2011). Artist Proof Studio: Twenty years of responding to South African transformation imperatives. *de arte*, 46(84), 52-69.
- Browniee, J. 2019. How to Explore the GAN Latent Space When Generating Faces. [Online]. Available at: <https://machinelearningmastery.com/how-to-interpolate-and-perform-vector-arithmetic-with-faces-using-a-generative-adversarial-network/#:~:text=The%20latent%20space%20itself%20has,a%20standard%20deviation%20of%20one.> Accessed on 9 March 2022.
- Burke, L and Ignizio, JP. 1997. A practical overview of neural networks. *Journal of Intelligent Manufacturing* 8(3): 157-165.
- Candy, L. 2011. Research and creative practice. *Interacting: Art, research and the creative practitioner*: 33-59.
- Is Artificial Intelligence set to become art's next medium? 2018. [O]. Available: <https://www.christies.com/features/A-collaboration-between-two-artists-one-human-one-a-machine-9332-1.aspx>. Accessed 27 August 2020.
- Cetinic, E. and She, J., 2021. Understanding and creating art with AI: Review and outlook. arXiv preprint arXiv:2102.09109.
- Coldwell, P & Laidler, P. 2013. Printmaking – new and old technologies – a conversation. *PORTO ARTE: Revista de Artes Visuais*, 19(32): 113-118.
- Coldwell, P. 2001. Interrogating the Surface. Paper presented in 2nd Impact International Printmaking Conference, Helsinki, Finland.
- Coldwell, P. 2008. Between digital and physical: some thoughts on digital printmaking. *Journal of the New Media Caucus*, 4(02).
- Coldwell, P. 2010a. Computer Art & Output: The Impassive Line. Paper presented in CAT 2010, 3 February 2010, London: pp.125-136.
- Coldwell, P. 2010b. In exciting times. *Printmaking Today* 19(3): 9-11.
- Coldwell, P. 2015a. Hybrid practices within printmaking. *Journal of Visual Art Practice* 14(3): 175-178.
- Coldwell, P. 2015b. Print, making and the work of art alone. Paper presented in SNAP 3, 12-15 November 2015, Rheine Germany.
- Creswell, A, White, T, Dumoulin, V, Arulkumaran, K, Sengupta, B and Bharath, AA. 2018. Generative adversarial networks: An overview. *IEEE Signal Processing Magazine* 35(1): 53-65.
- Czuchry Jr, A. J. (1990). The Development of a Research Environment for Neural Networks: Instantiating Neocognitions. Georgia tech research inst Atlanta artificial intelligence branch.

- Daniele, A and Song, YZ. 2019. January. AI+ Art= Human. Paper presented in AAAI/ACM Conference on AI, Ethics, and Society January, Hawaii, USA.
- Davis, C, Dick, A and le Roux, E. 2018. Introduction: Print Culture in Southern Africa. *Journal of Southern African Studies* 44(3): 377-381.
- Dawson, J. 1988. *Prints & Printmaking*. London: New Burlington Books.
- Denton, EL, Chintala, S & Fergus, R. 2015. Deep Generative Image Models using a Laplacian Pyramid of Adversarial Networks. *Advances in neural information processing systems* 28 pp. 1486-1494.
- dribnet, 2019. The Treachery of ImageNet: Toilet. [Online]. Available at: <https://dribnet.bigcartel.com/product/the-treachery-of-imagenet-toilet>. Accessed 9 March 2022.
- dribnet, 2019. Banana Trial Proofs. [Online]. Available at: <https://dribnet.bigcartel.com/product/banana-trial-proofs>. Accessed 9 March 2022.
- The Next Rembrandt: bringing the Old Master back to life. 2018. [O]. Available: <https://medium.com/@DutchDigital/the-next-rembrandt-bringing-the-old-master-back-to-life-35dfb1653597>. Accessed 27 August 2020.
- Eichenberg, F. 1976. *The art of the print: masterpieces, history, techniques*. London: Thames and Hudson.
- Elwes, J. 2017. Closed Loop. [O]. Available: <https://www.jakeelwes.com/project-closedLoop.html>. Accessed 27 August 2020.
- Elwes, J. 2017. Closed Loop (Extract). [Video recording]. Vimeo. Available at: <https://vimeo.com/206500912>.
- Elwes, J. 2019. Jake Elwes. [O]. Available: <https://www.jakeelwes.com/about.html>. Accessed 27 August 2020.
- Elwes, J. 2019. Zizi: Queering the Dataset. [O]. Available: <https://www.jakeelwes.com/project-zizi-2019.html>. Accessed 27 August 2020.
- Elwes, J. 2019. [O]. Zizi: Queering the Dataset. Available: <https://vimeo.com/388245510>. Accessed 27 August 2020.
- Emery, J. 2011. Art Is Inoculation: The Infectious Imagination of Leo Tolstoy. *The Russian Review* 70(4): 627-645.
- Ezcurra, MP, Simoniti, V, and Fonseca, C. 2018. *Reality machines: an art exhibition on post-truth*. Mexico: Tecoloti Press.
- Finn, C, Christiano, P, Abbeel, P and Levine, S. 2016. A connection between generative adversarial networks, inverse reinforcement learning, and energy-based models. Paper presented in ICLR 2018, Vancouver.
- Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research, and applications*. Cambridge: MIT Press.
- Finke, R. A. (1996). Imagery, creativity, and emergent structure. *Consciousness and cognition*, 5(3), 381-393.
- Ganley, D., 2021. Reading vs. Scanning: Notes on Re: Print. *AI & SOCIETY*, pp.1-14.
- Goodfellow, I, Pouget-Abadie, J, Mirza, M, Xu, B, Warde-Farley, D, Ozair, S, Courville, A and Bengio, Y. 2014. Generative adversarial nets. Paper presented in *Advances in neural information processing systems*, 8-11 December, Montreal, Canada.
- Gracyk, T. 2012. *The philosophy of art: an introduction*. Cambridge: Polity.
- Grau, O. 2003. *Virtual Art: from illusion to immersion*. Cambridge: MIT press.
- Grba, D., 2022. Deep Else: A Critical Framework for AI Art. *Digital*, 2(1), pp.1-32.
- Gu, S, Bao, J, Yang, H, Chen, D, Wen, F & Yuan, L. (2019). Mask-guided portrait editing with conditional gans. Paper presented in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, 15-21 June 2019, Long Beach.

- Gulrajani, I, Ahmed, F, Arjovsky, M, Dumoulin, V and Courville, AC. 2017. Improved training of Wasserstein GANs. In *Advances in neural information processing systems*: 5767-5777.
- Heath, D and Ventura, D. 2016. Before a computer can draw, it must first learn to see. Paper presented in the 7th international conference on computational creativity, Paris.
- Hertzmann, A., 2020. Visual indeterminacy in GAN art. *Leonardo*, 53(4), pp.424-428.
- Hobbs, P & Rankin, E. 1997. *Printmaking in a transforming South Africa*. Cape Town: David Phillips.
- Ioffe, S & Szegedy, C. 2015. Batch normalization: Accelerating deep network training by reducing internal covariate shift. Paper presented in 32nd International Conference on Machine Learning, 6-11 July 2015, France.
- Isola, P, Zhu, JY, Zhou, T and Efros, AA. 2017. Image-to-image translation with conditional adversarial networks. Paper presented in IEEE conference on computer vision and pattern recognition, 7-12 June, Boston.
- Jay, F, Renou, JP, Voinnet, O & Navarro, L. 2017. Unpaired Image-to-Image Translation using Cycle-Consistent Adversarial Networks, Paper presented in IEEE international conference on computer vision, 21-26 July, Hawaii.
- Karras, T, Aila, T, Laine, S. & Lehtinen, J. 2018. Progressive growing of GANs for improved quality, stability, and variation. Paper presented in 6th International Conference on Learning Representations, 30 April – 3 May, Vancouver.
- Karras, T, Aittala, M, Hellsten, J, Laine, S, Lehtinen, J & Aila, T. 2020. Training Generative Adversarial Networks with Limited Data. Paper presented in NIPS Deep Learning conference, 8 December, Zoom.
- Kaufman, JC and Sternberg, RJ. 2007. Resource Review: Creativity. *Change* 39(4): 55-58.
- Klingemann, M. 2019. [O]. Available: <https://aiartists.org/mario-klingsmann> Accessed 10 December 2020.
- Korba, R. (1993). Creativity and Consciousness in Problem Solving: Creative Cognition and the Modular Mind. Paper presented at the Annual Meeting of the Speech Communication Association, 18-21 November 1993, Miami.
- Kozbelt, A and Durmysheva, Y. 2007. Lifespan creativity in a non-Western artistic tradition: A study of Japanese ukiyo-e printmakers. *The International Journal of Aging and Human Development* 65(1): 23-51.
- Laidler, P and Coldwell, P. 2012. Printmaking—new and old technologies—a conversation. *Porte Arte* 19(32).
- Lapadat, JC. 2017. Ethics in autoethnography and collaborative autoethnography. *Qualitative Inquiry* 23(8): 589-603.
- Law, J. 2017. Thinking Through Print: An Evolutionary Approach to Imagining Graphic Futures, in *Printmaking in the Expanded Field*, edited by JS Pettersson. Oslo: Kunsthøgskolen i.
- Leavy, P. 2017. *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. New York: Guilford Publications.
- Liu, Z., Luo, P., Wang, X. and Tang, X., 2015. Deep learning face attributes in the wild. Paper presented in Proceedings of the IEEE international conference on computer vision, 7-13 December 2015, Chile.
- Lovejoy, M. 1991. *Postmodern Currents: Art and Artists in the Age of Electronic Media*. Ann Arbor: UMI Research Press.
- Lovejoy, M. 1992. *Postmodern Currents: Art and Artists in the Age of Electronic Media (Second Edition)*. Ann Arbor: UMI Research Press.
- Mao, X, Li, Q, Xie, H, Lau, RY, Wang, Z and Paul Smolley, S. 2017. Least squares generative adversarial networks. Paper presented in the IEEE international conference on computer vision, 1-4 May 2017, Atlanta.
- Mattick, P. Jr. 1993. Mechanical Reproduction in the Age of Art, *Theory Culture Society*, 10 (127): pp.128-147.
- Maxwell, W.C., 1977. *Printmaking, a Beginning Handbook*. Prentice Hall.

- McIntyre, P. 2008. The systems model of creativity: Analyzing the distribution of power in the studio. *Journal on the art of record production* 3: 2008.
- Mealing, S. 2007. *Computers and Art: Computers and Art*. Bristol: Intellect Books.
- Medium 2018. The Next Rembrandt: Bringing the Old Master back to Life. Viewed on 10 December 2020. Available at <https://medium.com/@DutchDigital/the-next-rembrandt-bringing-the-old-master-back-to-life-35dfb1653597>
- Mescheder, L, Geiger, A. & Nowozin, S. 2018. Which training methods for GANs do actually converge? Paper presented in 35th International Conference on Machine Learning, ICML, 10 Jule-15 July, Stockholm.
- Miller, A. I. (1996). *Art, Science, and the History of Ideas*. In *Insights of Genius* (pp. 379-439). Springer, New York, NY.
- Mitchell, TM. 2006. The discipline of machine learning. *Machine Learning* (9): 1-7.
- Miyato, T, Kataoka, T, Koyama, M & Yoshida, Y. 2018. Spectral normalization for generative adversarial networks. Paper presented in 6th International Conference on Learning Representations, ICLR, 30 April – 3 May 2018, Vancouver.
- Mohamed, W.A.S.A.K. 2021. Contemporary Printmaking Art between Marginalisation and Regeneration. *International Journal of Innovation, Creativity and Change* 15(4): 94-305.
- Moro J.M.. 2018. Printmaking in Expansion: Space and Time, Paper presented at Impact 10 conference.
- Noble, J. 2002. Fatal attraction: print meets computer in *Computers and Art* edited by Mealing, S. Oregon: Intellect Books: 59-72.
- Notaro, A. 2020, July. State-of-the-art: Ai through the (artificial) artist's eye. Paper presented in EVA London 2020: Electronic Visualisation and the Arts (pp. 322-328).
- Offert, F. 2018. Embrace the Latent Space. Notes on the Curatorial Challenges of an Emerging Media Art Form.
- Obvious, 2020. About Obvious. [O]. Available: <https://obvious-art.com/page-about-obvious/>. Accessed 27 August 2020.
- Odena, A, Olah, C and Shlens, J. 2017. Conditional image synthesis with auxiliary classifier gans. Paper presented in International conference on machine learning, 6-11 August, Sydney.
- Pelzer-Montada, R. 2001. Authenticity in Printmaking – A Red Herring?. Paper presented in the 2nd IMPACT International Printmaking Conference, 29th August - 2nd September 2001, Finland: University of Art and Design.
- Pettersson, JS. 2017. *Printmaking in the Expanded Field: a pocketbook for the future: collected texts and thoughts*. Oslo: Kunsthøgskolen.
- Piercy, S. 2001. Centre/Periphery – the Predicament of Fine Art Printmaking. Paper presented at 12nd Impact Conference.
- Kligemann, M. 2017. My Artificial Muse. [O]. Available: <http://underdestruction.com/2017/06/13/my-artificial-muse/>. Viewed on 27 August 2020,
- Radford, A, Metz, L & Chintala, S. 2016. Unsupervised representation learning with deep convolutional generative adversarial networks. Paper presented in 4th International Conference on Learning Representations, 2-4 May 2016, San Juan.
- Radulescu, C and Vessey, I. 2009. Methodology in critical realist research: The mediating role of domain specific theory. Paper presented in AMCIS 2009 proceedings, San Francisco.
- Ridler, A. 2017. [O]. Available: <http://annaridler.com/fall-of-the-house-of-usher> . Accessed 16 March 2022.
- Ridler, A. 2018. [O]. Available: <http://annaridler.com/myriad-tulips> Accessed 16 March 2022.
- Roell, J. 2017. How Do Computers See? Let's Find Out - Machine Learnings, Machine Learning. [O]. Available: <https://machinelearnings.co/this-is-part-3-in-a-series-of-posts-on-artificial-intelligence-and-deep-learning-neural-networks-702bbb335605#:~:text=The%20Input%3A%20A%20Matrix%20of%20Pixels&text=Technically%2C%20a%20computer%20doesn't,each%20of%20those%203%2C000%20pixels>. Viewed on 27 August 2020.
- Rolling Jr, JH, 2010. A paradigm analysis of arts-based research and implications for education. *Studies in art education* 51(2): 102-114.

- Rush, M. 1999. *New media in late 20th-century art*. London: Thames & Hudson.
- Saff, D and Sacilotto, D. 1978. *Printmaking: history and process*. New York: Holt, Rinehart and Winston.
- Schmitt, P. 2018. Augmented Imagination: Machine Learning Art as Automatism. *Plot(s), the Design Studies Journal* 5(2): 25-32.
- Skains, RL. 2018. Creative practice as research: discourse on methodology. *Media Practice and Education* 19(1): 82-97.
- Spratt, EL. 2018. Creation, curation, and classification: Mario Klingemann and Emily L. Spratt in conversation.. *XRDS: Crossroads, The ACM Magazine for Students* 24(3): 34-43.
- Sternberg, RJ. 2006. The nature of creativity. *Creativity research journal* 18(1): 87.
- White, T. 2018. Perception Engines. [ONLINE] Available at: <https://medium.com/artists-and-machine-intelligence/perception-engines-8a46bc598d57>. Accessed 9 March 2022.
- Williamson, S. 1989. *Resistance art in South Africa*. Cape Town: David Phillip.
- Zhang, Zhaoyu & Li, Mengyan & Yu, Jun. 2018. On the Convergence and Mode Collapse of GAN. Paper presented in SIGGRAPH Asia 2018 Technical Briefs, SA.
- Zylinska, J., 2020. *AI art: machine visions and warped dreams* (p. 181). Open Humanities Press.

APPENDICES

APPENDIX A: Letter of consent



Faculty of Humanities
Department of Visual Arts

An Autoethnographic practice-based study
Exploring the use of Generative Adversarial Networks within the working processes of
Printmaking.

Consent Form to take part in the Research Questionnaire

To whom it may concern,

You are invited to participate in a research questionnaire conducted by Amy Jane van den Bergh, from the School of Arts at the University of Pretoria.

PURPOSE OF THE RESEARCH QUESTIONNAIRE

The aim of the research is to explore and describe the effects of using Generative Adversarial Networks (GANs) as a tool within the working process of printmaking. The researcher uses GANs in the generative phase of their working process and aims to create a body of GAN-inspired prints to be exhibited. In so doing, the research aims to come to grips with this relatively new image-making technology (GANs) to explore and describe what this technology may mean for the future of printmaking and how it may potentially reinvigorate the practice.

GANs were pioneered in 2014, forming part of the fast-growing field of machine learning,¹ and are continuously improving in their capabilities (Goodfellow et al. 2014)². Amongst their various features, GANs are capable of generating images. GANs are programmed to find patterns among pixels within thousands of images of a specific subject (for example, portraits). Once these patterns are learnt, the GANs are further programmed to generate a unique imitation of the learnt subject (in other words, they will generate a made-up portrait).

¹ Machine Learning is a field of computer science that is concerned with the capability of computers to solve problems through the use of mathematical algorithms (Mitchell 2006).

² Goodfellow, I, Pouget-Abadie, J, Mirza, M, Xu, B, Warde-Farley, D, Ozair, S, Courville, A and Bengio, Y. 2014. Generative adversarial nets. Paper presented in Advances in neural information processing systems, 8-11 December, Montreal, Canada.

Most smartphone owners have encountered GAN technology without realising it. Apps on smartphones such as FaceTune or Snapchat apply GANs to create age, beauty, gender and background filters over portraits (Gu et al. 2019)³. These are rudimentary applications of the complex technology but illustrate how accessible this technology has become.

The researcher has used GANs within their working processes to generate visual studies. The researcher has organised a print consultation with a selection of printmaking peers who are familiar with the researcher's printmaking practice, to receive feedback about the GAN-inspired body of work being created.

Using the research questionnaire, the data gathered from this print consultation will focus firstly on how the participants (as the audience) view and react to the new GAN-inspired prints. It would further examine how implementing GANs into the printmaking working process affects the aesthetic of the new body of work in comparison to the researcher's previous works. Thirdly, the questionnaire will address whether or not an emotional response is evoked through the new prints. Lastly, based on how the researcher has experimented with and implemented GANs into their working process, the printmaking peers will be asked if they see merit in possibly exploring the medium themselves.

If you choose to participate in the research questionnaire:

- Your identity will remain confidential
- You will be given a link to the research questionnaire, a Google form, to fill out anonymously
- Your responses will be used as part of Amy Jane van den Bergh's Discussion Chapter in her dissertation
- Your responses must be honest and unbiased as they will impact the integrity of the research. There are no 'correct' or favourable responses.

³ Gu, S, Bao, J, Yang, H, Chen, D, Wen, F & Yuan, L. (2019). Mask-guided portrait editing with conditional gans. Paper presented in Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition , 15-21 June 2019, Long Beach.

- Your data will be stored confidentially on Amy Jane van den Bergh's Masters research Google Drive until downloaded by Amy Jane van den Bergh. They will then be deleted from the Google Drive
- Your data will be printed and submitted as appendices alongside Amy Jane van den Bergh's Masters Dissertation
- According to the University of Pretoria's *Policy For The Preservation And Retention Of Research Data*, your data will be stored for 10 years in the University's Research Data Repository

In consideration of participation in the research questionnaire, I, _____, (Research Questionnaire Participant), hereby give Amy Jane van den Bergh (Researcher) and those persons acting with her permission and authority, the right to read and discuss my responses to the research questionnaire.

- I voluntarily agree to participate in this research questionnaire. I will not be paid for my involvement. I am free to withdraw from the project at any time, without reason.
- I have read and understood that all data provided will be treated in strict confidence, and that my name will be anonymised.
- I understand that my data will be used within Amy Jane van den Bergh's Masters Dissertation and will be stored for 10 years in the University's Research Data Repository
- I understand that I will not benefit directly from participating in this research.
- I understand that this research has been approved by University of Pretoria Ethics Committee.
- I have read and understood the explanation of the research project provided to me. I have had the opportunity to ask any questions and they have been answered to my satisfaction. By proceeding to take this questionnaire, I agree to take part in this research project and to the above statements. Any statements I have concern with I will discuss with the principle researcher prior to commencing.

Any questions you have about this study can be directed to Amy at 082 264 3810 or hello@amyjanevdb.com, or the supervisor of my mini-dissertation, Natalie Fossey at natalie.fossey@up.ac.za. If you have any questions concerning your rights as a research subject, you may contact the University of Pretoria's Research Ethics office at 012 354 1330 or fhsethics@up.ac.za.



UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Humanities
Department of Visual Arts

Signature of participant

Date

I believe the participant is giving informed
consent to participate in this study

Signature of researcher

Date

APPENDIX B: Questionnaire

An Autoethnographic practice-based study exploring the use of Generative Adversarial Networks within the working processes of Printmaking.

Print Consultation
Research Questionnaire

Based on your first reaction to the researcher's GAN-inspired body of prints, do you believe that the use of GANs as a tool within her printmaking working processes has been successful? *

- Yes
 No

Was any emotional response was evoked in you when engaging with the researcher's new prints? *

- Yes
 No

If you answered YES to question 2, what do you believe you are responding to when you experienced these emotions? (tick all relevant boxes) *

- The capabilities of GANs
 The aesthetic of the art object
 The concept behind the art object

As a colleague of the researcher, you are familiar with their printmaking practice and previous body of work. *
How does this new GANs-inspired body of prints compare aesthetically and conceptually to their previous work?

Long answer text

As a printmaker, do you believe that GANs offer a potential new tool within your working process? *

Yes

No

The researcher has described to you how they have implemented and experimented with GANs in their working process. Based on this, where on the scale would you consider exploring GANs in your own working processes? *

Not at all 1 2 3 4 5 Very much

Do you have anything you would like to add or elaborate on? *

Long answer text

APPENDIX C: Print consultation responses

Question 1

Based on your first reaction to the researcher's GAN-inspired body of prints, do you believe that the use of GANs as a tool within her printmaking working processes has been successful?

[View options](#) ▾

Yes

4 responses

Question 2

Was any emotional response was evoked in you when engaging with the researcher's new prints?

[View options](#) ▾

Yes

4 responses

Question 3

If you answered YES to question 2, what do you believe you are responding to when you experienced these emotions? (tick all relevant boxes)

[View options](#) ▾

- The capabilities of GANs
- The aesthetic of the art object

1 response

- The capabilities of GANs
- The concept behind the art object

1 response

- The capabilities of GANs

1 response

- The concept behind the art object

1 response

Question 4

As a colleague of the researcher, you are familiar with their printmaking practice and previous body of work. How does this new GANs-inspired body of prints compare aesthetically and conceptually to their previous work?

I think the GANs are a good sound-board for the overall creative process. I know the researcher has previously been concerned about their previous work/aesthetic being labelled as too illustrative, though this is no longer the case. The researcher's work is narratively rich and I think the GANs-inspired work offer another perspective or way of telling the same stories. I particularly liked Figure 12 in the presentation, which reminds me of a beautiful post-apocalyptic landscape. The process of conversation between the GAN and researcher is the most curious and interesting, it brings up a lot of questions around the source or origin of creativity and the process of creativity. Is the GAN an extension of the creative self?

1 response

It continues to show her love of being playful with mediums, technology and new skills. The artworks themselves are a joyful exploration, but feel aesthetically mechanical, which is how they were conceived so it is true to the process! I responded most to the pieces that used the GANS output as a springboard for more playful, spontaneous monotypes and collages, as a platform to build confidence in abstraction.

1 response

There is a nice link between the artists process and the GAN's works. I think the GAN's work can provide an interesting starting point for the process of new works

1 response

The artworks show bold and experimental themes, bright colours and whimsy which is exactly in keeping with all of Amy's previous work.

1 response

Question 5

As a printmaker, do you believe than GANs offer a potential new tool within your working process?

[View options](#) 

Yes

3 responses

No

1 response

Question 6

The researcher has described to you how they have implemented and experimented with GANs in their working process. Based on this, where on the scale would you consider exploring GANs in your own working processes?

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Very much

1 response

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Very much

1 response

	1	2	3	4	5	
Not at all	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

1 response

	1	2	3	4	5	
Not at all	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very much

1 response

Question 7

Do you have anything you would like to add or elaborate on?

I think this masters work shows an incredible amount of hard work and engagement with new technology and new ways of thinking about the art making process. It made me think about how printmaking already has such a mechanised process underpinning it and how as artists one can be tempted to produce artworks in a GANS-like manner (often encouraged by galleries) simply to secure and maintain collectors of your work. It made me think about how the very first printmakers embraced new technology in presses and silkscreens - how its commercial benefits for repetition have always driven progress towards efficiency. I think this masters is successful in drawing attention to the stereotypes that we still find in the artworld - that something that can repeat and mechanised a process makes the output somehow less original, less personal than an artist drawing/painting/shaping a medium directly with their hands. Printmakers, photographers, collage artists - they fight these stereotypes daily in finding an audience for their work. I don't think Amy's GANS output inspired works were less "Amy", but almost too "Amy", as if they were trapping her in old ways of working. When she used them as sources of inspiration, rather than sources for reproduction, there was an excitement evident in the work about new ways of working. I am fascinated by Amy's use of GANS and to see future applications of such technology. How exciting to be playful with something right when it's just beginning!

1 response

I'd be curious to see how the GANs would react to being fed portions of images as opposed to full images, and to what degree they can interpret the disintegration of images. Would the output be completely different? I also really enjoyed how process driven and collaborative the GAN-inspired work is. Printmaking is for the most part a creative collaboration between technology (and machine in some cases) and human.

1 response




I loved that the body of work came full circle. Amy collaborated with the GAN's, it learnt from her and then she learnt from it. A truly unique and fascinating process and conclusion.





1 response

I think there is a lot of potential in using AI and machine learning in the art making process, especially in a time of NFT's and the evolving Metaverse

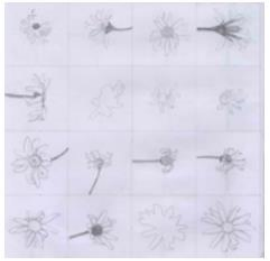



1 response

APPENDIX D: Table documenting the use of GANs within the research

GAN application	Description of dataset	Example image of dataset	Description of resulting GAN images	Sample image of GAN generated images	Researcher's emotional response to the GAN images	Creative response to this iteration	Resulting body of work/creative iteration	Example image of body of work	Gan-led vs GAN-inspired
1	One thousand images of the researcher's work over the last 10 years. This dataset included drawings, sketches, paintings and prints. The subject matter included a range of birds, nature, florals, portraits, cats and a few landscapes. The styles ranged from realistic to cartoon and illustrative. Overall, the dataset represented a wide variety of images.		The sample set received was abstract and visually vague. Images were pixelated and nondescript. There were a few noticeable repeated elements in the images. These include the use of green, pink, turquoise and gold. The use of a circular composition was also repeated. Lastly, texture and mark-making elements from charcoal sketches were evident.		Initial disappointment. The researcher had hoped to receive more representational images, or images that looked more like her initial dataset. The GAN images were a stark contrast to the dataset. After studying the images a number of times, however, the researcher found that the abstract images did seem to resemble landscape-like images.	The researcher selected twenty of the most landscape-like images from the sample set. She uploaded these into Adobe Photoshop and turned them into halftone positives for screenprinting. These GAN images were then screenprinted in neon pink onto handmade paper. Using the GAN image, the researcher attempted to replicate the colour through screenprint monotype, overlayed on top of the halftone pink layer.	<i>Imaginary Landscapes.</i> Twenty 2-layered screenprints. First layer: neon pink halftone exposed positive; second layer: screenprint monotype. 30x30cm on handmade paper.		This iteration was GAN-led, as the final artwork was directly based on the GAN image itself.
2	The same initial dataset was used.	As above	The same sample set as before was used.	As above	The researcher was now reacting positively towards the GAN images as she realised the inspiration they were providing was allowing her to create new work that she felt had creative potential.	The researcher had always wanted to make abstract landscapes but every attempt felt contrived. She also relied heavily on other artists' work for inspiration. Now, however, she was using her own work as inspiration, through the lens of the GAN. She would study the sample set and then make small 9x9cm screenprint monotypes landscapes.	<i>Studies of A Sense of Somewhere.</i> Two hundred screenprint monotype studies. 9x9cm of watercolour paper.		While relying somewhat on the GAN images, these studies are more GAN-inspired and less GAN-led. However, their reference image for this work still remains the GAN image itself.

4	As above	As above	As above	As above	The researcher is becoming more interested in the process of the GAN itself, and less in the GAN-output images. Towards the end of the GAN training, the images it generates are becoming densely saturated with texture or muddied colour. This starts to inspire a smaller body of work within the large two hundred monotype studies.	Instead of cleaning the screen between each print, the researcher is reapplying paint over the same areas on the screen and repulling the print several times. The result is a saturated image that mimics the process of the GAN training.	<i>Towards Saturated Ends.</i> Smaller series, each consisting of five prints, within the larger two hundred studies of <i>A Sense of Somewhere</i> . Screenprint monotype prints. 9x9cm on watercolour paper.		This body of work is GAN-inspired as the researcher's inspiration is shifting away from the GAN images and more into the process the GAN undergoes within its training. There is less reliance on the GAN images and the researcher's process is becoming more organic in its response to the process of both the GAN and screenprinting.
5	The two hundred studies created in the second application are used to make the next dataset.		A new dataset is generated using the two hundred screenprint studies from the previous iteration.		The new GAN sample represents a more coherent set of images that resemble the given dataset much more closely than the previous iterations.	At this point, excitement begins to stir up for the researcher. It is now clear that in order to generate a GAN sample that represents something specific, the researcher needs to create a dataset that is visually coherent and does not contain too much diversity of images. The GAN sample seems to refine some of the compositional elements and colour choices of the <i>Sense of Somewhere</i> studies. As such, the researcher uses these images to inspire new prints, drawing directly from the colour choices made by the GAN and the compositions as well.	<i>A Sense of Somewhere.</i> Fourteen screenprint monotype prints. 50x50cm on bamboo paper.		While relying somewhat on the GAN images once again, these prints are more GAN-inspired. Their reference image for this work still remains the GAN image itself, but the process is controlled by limiting the dataset to the studies created in the previous iteration.

6	Return to the original dataset of one thousand images.	Same as first	Return to the first GAN samples created.	Same as first	The researcher has been studying the GAN samples for over a year at this point and has noticed that the GAN images are often a reassemblage of the images from the dataset. Rather than generating entirely new images, the GAN is taking aspects of a few images in the dataset and using them to make a new image.	This new insight inspires the researcher to act as the GAN does and reassemble her artworks into new collages. She cuts up hundreds of old prints and drawings to make new collages.	<i>Cut & Paste</i> . Twenty collage artworks all ranging in size.		This body of work is GAN-inspired in regard to how GAN images are reassemblages of the initial dataset. As the researcher continues, she is less inspired by the GAN images themselves, and more interested in how the GAN generates these images.
7	The researcher makes use of the collages made for <i>Cut & Paste</i> as a visual dataset of sorts in her process.		The dataset is not fed into a GAN.	Not Applicable.	Not Applicable.	The researcher selects a number of collages to inspire new screenprints. The collages resemble the GAN output images in the sense that they have a repeated colour palette, patterns and textures. They also resemble how the GAN generates its images through reassembling the dataset in a more representational manner. By choosing to turn them into screenprints the artist is refining their composition. The colour choices are inspired by the GAN itself and the researcher specifically intends not to choose colours that harmoniously work together, but to rather create surrealist disharmonious colour choices.	<i>Cut & Paste & Print</i> . A total of four reduction screenprints are made. <i>Deliver us from Kitsch</i> is a reduction screenprint, 50x50cm on bamboo paper.		<i>Cut & Paste & Print</i> is GAN-inspired, once again focusing on the process of how the GAN generates images.

8	A new dataset is created by the researcher drawing two hundred line drawings of daisies.		A new sample set is made representing GAN generated daisies. The daisies resemble the dataset quite well, but contain numerous visual glitches.		By refining and limiting the dataset the researcher is getting GAN samples that are more representational of the dataset. This process adds to the researcher's understanding of how the technology works and what type of dataset is needed. The GAN daisies themselves are visually interesting because of the glitches in the images. Specifically, watching the GAN daisies shift between iterations as the GAN is being trained on the dataset, gives inspiration to the researcher.	Inspired both by the GANs daisies and Anna Ridler's <i>Myriad (Tulips)</i> (2018), the researcher decides to create a body of work that represents the amount of work that goes into running GANs. She also wants to represent the insights she has gained from watching the GANs shift between iterations while training on her hand-drawn daisies. She selects one of the GAN daisies and draws it on a silkscreen. This daisy is redrawn and screenprinted two hundred times, each time altering the drawing slightly - just as the GAN alters the pixels of each of its iterations slightly as it attempts to generate a real daisy.	<i>Daisies</i> . Two hundred screenprint monotype prints. 10x10cm on 20x25cm watercolour paper.		The researcher is inspired by the process of the GAN, that is to say, how the GAN is trained on the dataset and generates images that subtly shift between iterations as it attempts to made a real image. This work uses one of the GAN daisies as a starting point but is not trying to represent what the GAN generated, but rather the process within the GAN. Therefore, the work is GAN-inspired and not GAN-led.
9	The same dataset used for <i>Daisies</i>	As above	The same sample set as <i>Daisies</i> .	As above	In the research, author Jim Noble (2002) expressed that the computer-led print can be made using an aspect of computer technology within the artmaking process, or it can be that a print is entirely conceptualised and made using a computer. As the researcher's practice has been focused on screenprinting throughout the research, she wants to create a hybrid print that is entirely computer-led to see how this will affect her	The researcher wants to create a GAN-led artwork in the form of a digital print and animation. The researcher creates an entirely computer-led print made up entirely of GAN generated daisies. This is inspired by the GAN daisies, Jim Noble's text, as well as the majority of GANist artworks she has studied. Most GANist works exhibit insight into the iterative process of GANs through moving images.	<i>Dancing Daisies</i> . A giclee print accompanied by a short animation accessed via the Artivive App.		This body of work is GAN-led. By comparison to her previous iterations, this work feels most disconnected from the researcher's practice as a printmaker. However, it illustrates the glitchy iterative process of the GAN that was the most inspiring aspect of using GANs in her research.

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