Tampere University of Applied Sciences

Recreation of stippling and Pointillism in vector illustration

Gerda Skruzmane

Bachelor's thesis
May 2021
Media and Arts
Interactive Media

ABSTRACT

Tampereen ammattikorkeakoulu
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Bachelor's thesis 64 pages
May 2021

The goal of this thesis was to determine how two traditional art styles – stippling and Pointillism – have been adapted to the digital illustration landscape, as well as compare various methods on how their characteristic dot work could be reproduced in vector graphics. The purpose of this research was to provide information on how to best choose a vector dot work method for various situations or contexts, taking into account their visual authenticity to their traditional counterparts as well as their flexibility as a digital art technique, among other criteria.

The theoretical research for this thesis was done through literary and content analysis on stippling and Pointillism as they developed historically, followed by reviewing their current day presence in digital art. The modern significance of the two dot work techniques was determined to have arisen alongside the emergence of the flat design style. Practical testing was then done on three different vector dot work methods by preparing a base vector illustration and applying all three methods to it both in the style of stippling and Pointillism. This was done to test the benefits and drawbacks of each technique in a fair manner.

The results showed that each method differed from one another not just in visual output but also in how simple they were to set up, what were their limitations and strengths, as well as how much they had kept the characteristics of traditional stippling and Pointillism contrasted by how much they had evolved away from their source inspirations. These findings were compiled as a table of scores ranging between 1-5 for each criterion, providing a straightforward reference for choosing between the methods.

Key words: vector art, stippling, pointillism

CONTENTS

ABBREVIATIONS AND TERMS

clipping mask	in Adobe Illustrator - a vector object that acts as a frame, making any graphics that are grouped with it only appear within its bounds
blend mode	an opacity setting in Adobe software that changes how the colours of an image will affect the colours of the image below it
DPI	dots per inch – measurement of resolution
filter	in the context of design and art software, an effect that can be applied to objects, layers, or the entire image to alter its looks, generate new graphics or distort shapes
px	pixel
raster	in the context of digital art, an image comprised of a rectangular grid of pixels, where each pixel can display a different colour
resolution	in the context of digital art, density of pixels in an image, usually measured in dots per inch
skeuomorphism	design style that aims to mimic real-world objects when creating user interface elements, using them as shorthand for virtual concepts
UI	user interface
vector	in the context of digital art, a graphical element that is constructed from points and lines placed in coordinates, allowing the use of mathematical scaling and distorting of the graphics with no loss of detail or quality

1 INTRODUCTION

While digital art exists wholly separate from traditional art in technique and medium, digital artists have always strived to replicate the best aspects of traditional works on virtual canvases. This becomes apparent as soon as you explore any digital marketplace or material library for digital art tools – you're presented with an abundance of watercolour textures, brush patterns resembling real pencil or chalk marks, and tutorials on applying a fake paper grain to your work.

Two traditional art methods in particular have risen in popularity as targets for digital reinvention and have intermingled to the point where the terms have become nearly interchangeable in the context of digital art – pointillism and stippling. The purpose of this thesis is to explore the roots of both art styles in traditional mediums, deduce why they have become so prominent in digital art, as well as analyse a few methods of reproducing the styles digitally to compare their success. To reach the criteria required to judge the results of each method, both stippling and pointillism will be analysed from a historical standpoint, setting benchmarks for authentic digital recreation. This theory base will be accompanied by a study of stippling and pointillism as they appear in current digital art, providing context for the niche these styles are presently filling. While the original intention of reproducing a traditional art style digitally might be to represent it as accurately to the original as possible, it is equally important to consider its role and execution in the digital medium separately from its traditional roots, considering how it may have evolved since.

In the rapidly changing fields of digital illustration and design, it is vital for an artist to adapt to trends and expand their list of competencies. Being able to not only reproduce a popular style accurately, but to also do it efficiently and expertly will allow the professional artist access to more and better opportunities. This research aims to provide the digital art community with the knowledge and tools necessary to make educated choices when working in the pointillism and stippling styles.

2 CENTRAL CONCEPTS

2.1 Stippling

Stippling is described as a form of engraving – usually onto a copper plate - that utilizes a dotting method for laying in outlines as well as the darker parts of an image. The deeper shades are to be achieved by etching larger dots that are laid closer together, effectively creating contrast by varying the density of the dotting (Fielding 1841, 63-65).

The stippling method is very commonly understood to be a close relative of the crayon manner, otherwise known as chalk engraving – an engraving style with similar execution and visual outcome to that of stippling. As Fielding states in his book (1841), the styles are so similar in their process that “stippling” and “chalk engraving” can be used almost interchangeably.

The goal of the crayon manner initially was as a means of imitating actual chalk or pencil drawings on paper, replicating the rough paper grain and the texture of the medium. This was done by utilizing tools that allowed the engraver to push dots into copper plates (Michel 2003). Stippling differs only slightly, as the dot work is purely used to achieve different values and shading in the artwork, not as a direct imitation of paper or chalk texture. However, the effect remains wholly similar in outcome.

2.1.1 History

The emergence of the crayon manner is commonly attributed to the French artists Jean-Charles François (1717-1769) and Gilles Demarteau (1722-1776) (Fielding 1841). François had originally been a pupil of a painter, but eventually took upon copperworking and worked as an engraver of coats of arms. In 1740, François began work under the publisher Robert-Menge Pariset, and in the same year released his publication - Principes de Dessein Faciles – which introduced the new engraving techniques he had been experimenting with. He moved to Paris

around 1757, becoming employed in the court of Louis XV and receiving the title “Engraver of the Designs of the King’s Cabinet” in 1758 (HiSoUR 2017). A crayon manner portrait commission of the king by François is shown in Figure 1.

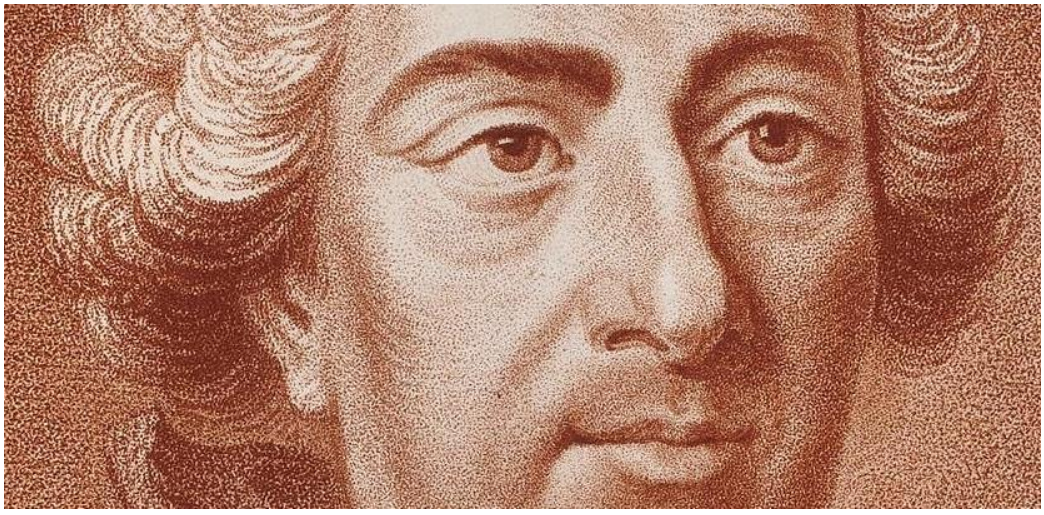


FIGURE 1. Detail of Louis Quinze, Roy de France - Louis XV (François 1767)

Gilles Demarteau, who partnered with François and later became the successor of his title (HiSoUR 2017), helped refine the crayon manner technique further, and was praised by the French Academy for “perpetuating the drawings of the masters and multiplying examples of the most beautiful ways of drawing” (Béguin 1981). As visible in Figure 2, Demarteau’s work exhibited unprecedented high quality in its technique – the dot work is dense and subtle, delicately suggesting the varied lights and shadows of the marble statue, originally reproduced in drawing by Grangé.

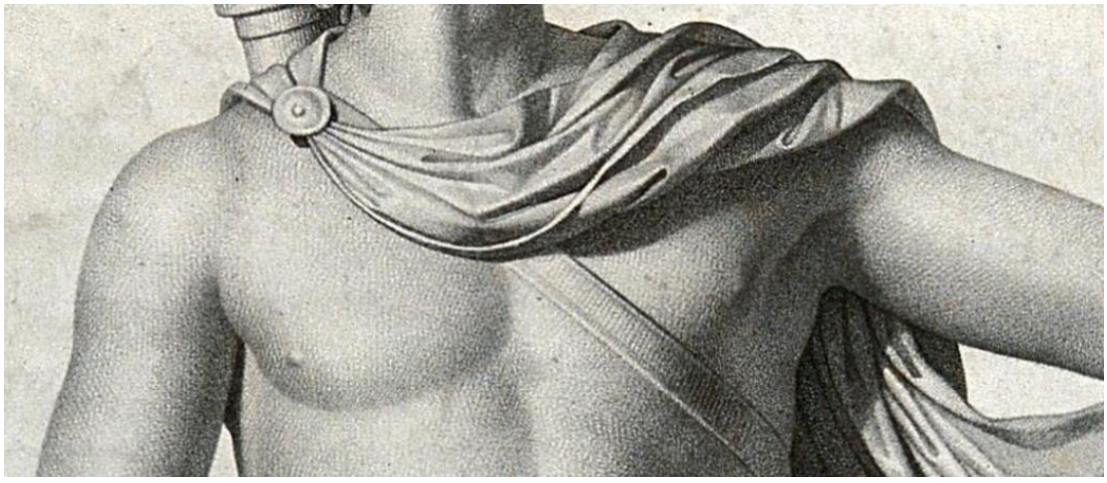


FIGURE 2. Detail of Demarteau’s stipple engraving of Apollo Belvedere after Grangé, printed by Denon (Demarteau & Denon 1805)

2.1.2 Breakdown of methodology

Stipple engraving is a form of intaglio printmaking, which is distinguished from other printmaking methods by the fact that the print is created from ink that is below the surface of the plate. The recesses in the plate can be made in a variety of ways – cutting, scratching, or etching (Encyclopedia Britannica n.d.).

The plate most commonly is made of copper or zinc, and it is first polished to remove any imperfections from its surface to avoid printing unintentional marks (Met Museum n.d.). A waxy, acid-resistant coating known as etching-ground is laid over the plate, and the engraving process begins by the artist needling in outlines and the dark parts of the image. Varying the density and size of the dots lets the artist control the intensity of the shading (Fielding 1841, 63-64).

It is also important that the dot work is not so dense that the individual markings merge, as the ink might bleed between the recesses and lessen the detail of the dot work, creating imperfections (Met Museum n.d.). Stipple engravers developed several specialized tools to help maintain even, accurate application of dot work and speed up the engraving process. The bulk of the shading was done using roulettes – tools with a textured metal rolling head that could apply a specific shape and density of dotting to the plate depending on the size and spacing of their teeth, as shown in Figure 3 (Béguin 1981).

FIGURE 3. A stippling roulette head with dot texture (Intaglio printmaker n.d.)

The plate is then “bitten in” – treated with acid to deepen areas of the plate that are unprotected by the etching-ground, notably the parts worked over by engraving tools. This allows the plate to hold more ink due to the increase in volume of the engraved recesses, as well as increasing the porousness of the surface itself (Béguin 1981).

When the biting process is finished, any remaining touch-ups can be done by dry-point needle or stipple graver (seen in Figure 4 - tools 1 and 12 respectively, in order from top to bottom) after removing the etching-ground. Manually working over the plate with a dry-point needle allows the artist to place lighter dot work in more delicately lit areas of the piece, as well as strengthen the middle and darker shades to their liking. Unlike roulettes, these engraving tools may raise burrs or unwanted notches from the material of the plate, which must be carefully scraped off to maintain a level surface (Fielding 1841, 64).

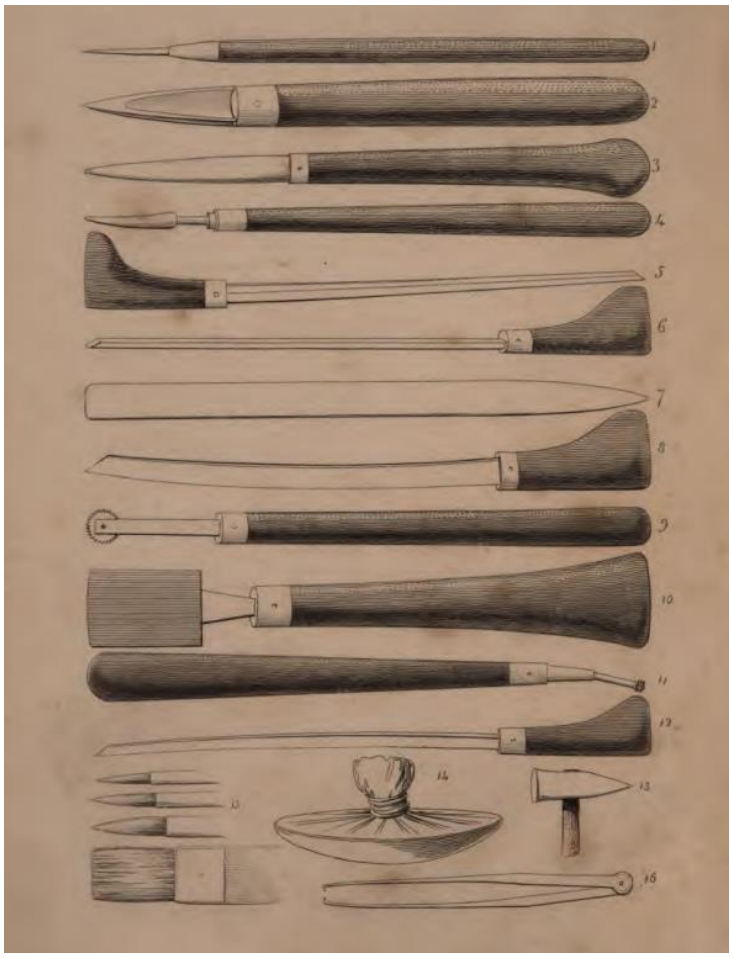


FIGURE 4. Engraving and printmaking tools (Fielding 1841)

To prepare for printing, the plate must be evenly covered in a thin layer of ink across its entire surface. A cloth ball or a rectangular tab of cardboard or wood can then be used to remove all excess ink from the plate, as the surface must be devoid of unwanted colour that has not sunk into the recesses of the engraving. Lastly, the plate receives a final polish by delicate paper or cloth before being placed onto the bed of the rolling press, usually cushioned by a felt printing blanket to lessen the pressure on the plate itself (Met Museum n.d.).

The paper that will be receiving the print is dampened to increase its receptiveness of ink and is placed on top of the plate face down. Another printing blanket is folded on top as added protection from the roller. The plate and paper are then rolled through the press together, the pressure forcing the ink from the engravings in the plate to transfer onto the surface of the paper (Met Museum n.d.).

Figure 5 presents an exemplary crayon manner print made by William Hebert in 1770 – the height of popularity for the method. The piece showcases the strength and versatility of the tools available for engraving printmakers at the time – at a glance it is almost indistinguishable from an actual crayon or pencil original, yet the reproduction process becomes clear when analysing the quality and mannerisms of the linework. Each stroke representing a mark of a crayon is clearly made up of a delicate array of irregularly spaced dots created by rolling a thin roulette.

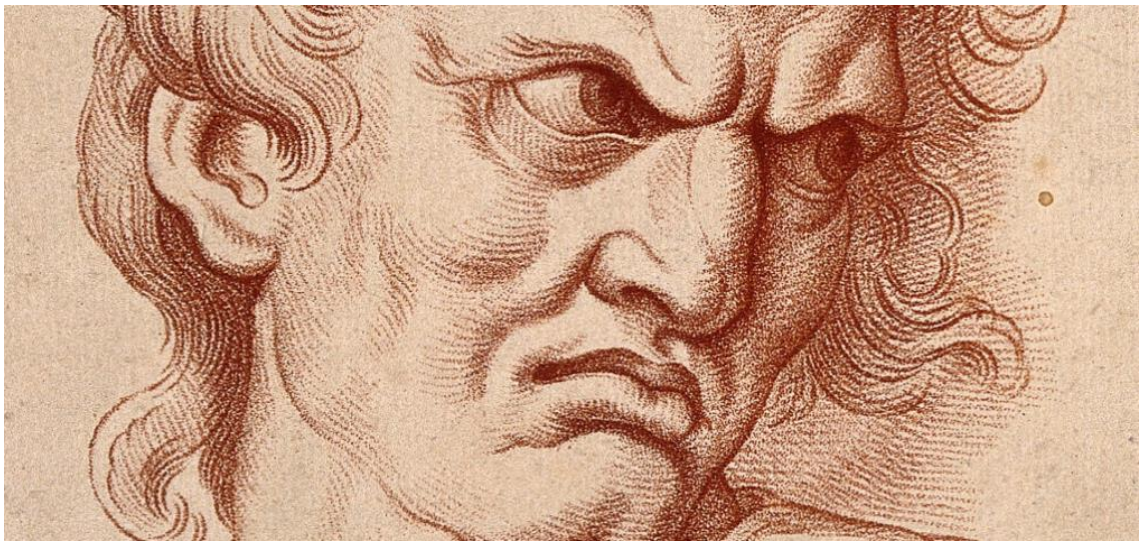


FIGURE 5. Detail of a crayon manner print based on a drawing by C. Le Brun (Hebert W. 1770)

2.2 Pointillism

As the Impressionism period swept over the art world in the 19th century, a new movement arose as a response - occasionally referred to as Divisionism or Neo-Impressionism, Pointillism differs from contemporary styles through its peculiar painting technique. The Pointillism method involves no mixing of pigments on the palette, instead the artist applies small strokes of raw, unmixed colour to the canvas directly, relying on the eyes and mind of the viewer to merge the tones when looking at the work from a certain distance (Martet 2019).

The Pointillism style was heavily inspired by the science of optics in relation to colour perception and the principles of tonal harmony. The relationships between different colours when placed against one another could influence how they were perceived. Colour pairs such as blue and orange therefore could be considered complementary to one another, as they could enhance each other's intensity simply through proximity and juxtaposition (Sotheby's 2018).

2.2.1 History

There are two artists credited for the invention of Pointillism - Georges Seurat (1859-1891) and his student Paul Signac (1863-1935) (Encyclopedia Britannica n.d.). Seurat was originally inspired by a book called Principles of Harmony and Contrast of Colours, published by the chemist Michel Eugène Chevreul in 1839. While working for a Parisian tapestry company that wished to improve the quality of colour for their textiles, Chevreul discovered that the seeming intensity of thread colours had less to do with the chemistry of the pigments used and more with the optics of hue combinations. The Pointillists applied this theory to the technique of their paintings (Sotheby's 2018).

As Artrust (2016) have noted in their article, Pointillism was not the original intended term to describe the Neo-Impressionism style. Seurat himself had intended to call the style “Chromoluminarism” from “chromatic” – relating to colour or colour phenomena – and “luminous” – relating to light, shining, illustrious (Merriam-Webster Dictionary n.d.). Seurat’s naming choice was supposed to allude to the interplay between colour and light that was so important in Impressionist works, and he felt that being reduced to an artist who simply “paints with dots” was belittling when the origin of the style was so rooted in rigorous scientific theory (Artrust 2016).

Like Impressionists of the time, Pointillists most often depicted various landscapes and waterscapes, preferring to paint in open air (Martet 2019). The ever-shifting surface of a river or leaves in the wind lend well to the irregular dot work typical of the technique; the intense, raw colours shimmering together on canvas to depict a vivid lighting and atmosphere of a natural scene, such as the one below in Figure 6.

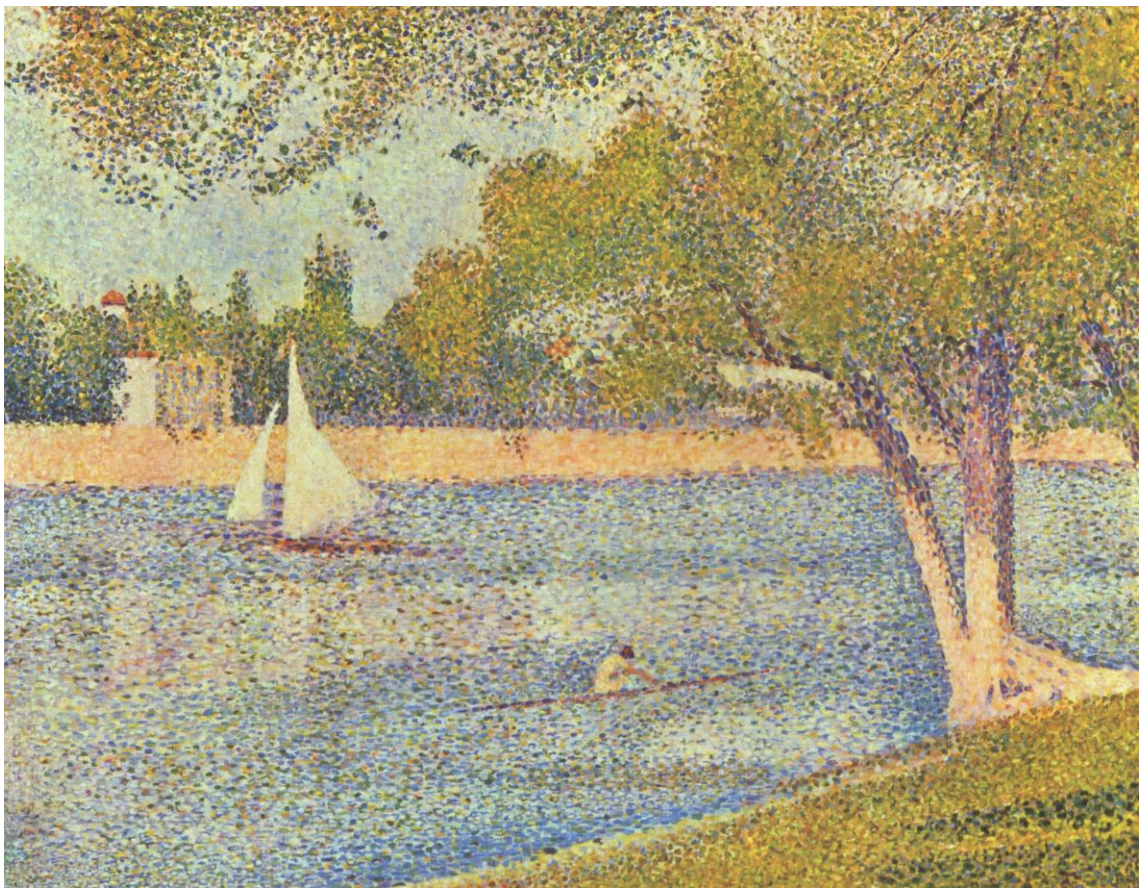


FIGURE 6. The river Seine at La Grande-Jatte, a landscape painting done in Pointillism style (Seurat 1888)

In contrast to his teacher's body of work mostly featuring open air landscapes, Signac often painted detailed portraits and interior scenes as well. His depictions of people especially showcased exceptionally detailed dot work, increasing the fidelity of the work's subjects. As seen in Figure 7, the individual brush marks are incredibly small and densely placed, giving the piece a more precise, controlled look while still maintaining the vibrancy of light so characteristic of other Neo-Impressionist works.

FIGURE 7. The Dining Room, painted in Pointillism style (Signac 1887)

2.2.2 Breakdown of methodology

Ever since the 15th century, linen cloth canvases were the most common supports for painting, mostly woven in a square pattern of coarse single strands. However, the commercialization of cotton production in the 19th century (the time of Impressionism and the emergence of Pointillism) allowed canvases to instead be made from the much smoother and lighter material, favouring diagonal or twill

weave patterns. Regardless of the cloth choice, the canvas had to be prepared for painting by sealing it to avoid the paint from soaking into the cloth, as that would weaken it over time. Sealing was historically done by wholly covering the surface with rabbit skin glue. Other than canvas, wooden panels were commonly used as painting supports, and cardboard supports rose in popularity during the 19th century as well (Valentine Walsh n.d.).

Oil paint was widely adopted as the main paint medium in the 16th century and continued its prominence in Impressionist and Neo-Impressionist works. Several different oil types can be used as binders – most often linseed oil, however walnut and poppy seed oils are common substitutes. As is noted in the Valentine Walsh (n.d.) introduction to painting conservation – oil paints can produce incredibly saturated, rich tonalities in their colours, and so it is not surprising they would be favoured among professional artists, despite the drawback of incredibly long drying times.

This disadvantage was partially rectified in the 19th century, when experimental new gel mixtures were developed, allowing artists to severely cut down on oil paint drying times. The gel compounds most commonly were based on lead acetate and would subtly influence the properties of the paints they were mixed into, acting as catalysts for their drying process and altering their consistency (Dacher & Sanchez & De Viguerie 2017). This innovation paved the way for art styles such as Pointillism, which relied on layered, repetitive applications of exact paint strokes which must not become unintentionally smudged or mixed.

When it comes to the method of applying Pointillist dot work, several variables can influence the visual outcome of the technique. The size and shape of the dots used can greatly vary the fidelity of the work – smaller, rounder shaped dots made with the tip of the brush can be placed more evenly and densely packed without overlapping (e.g., Figure 7), while larger strokes - rectangular or oval - made with the flat side of the brush produce a more irregular, bold effect (e.g., Figure 8).

As is visible in both Figure 8 and Figure 9, another dimension of the Pointillist method is the density of dot placement and its effect on the lighting and perceived hue of the image. In the Sea at Grandcamp (Figure 8), Seurat leaves parts of the

brown support panel exposed, most notably in the areas of the painting showing the sea, adding a complimentary warm tone to contrast the colder greens and blues of the water. Pissarro, on the other hand, uses dot work density as a means of controlling the light value in Eragny Landscape (Figure 9) – the cotton canvas is shown more readily in the brightest areas such as the sky and the grass in the foreground, while the darker shades of the tree trunks and the foliage in the distance maintain relatively dense dot work.

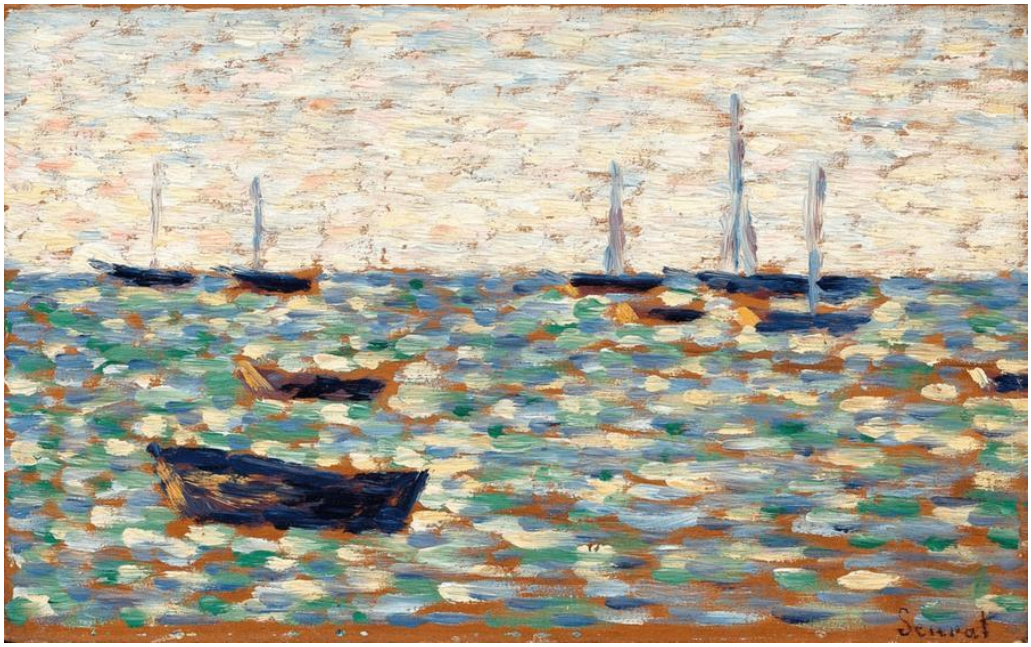


FIGURE 8. The Sea at Grandcamp, one the first Pointillism style paintings (Seurat 1885)

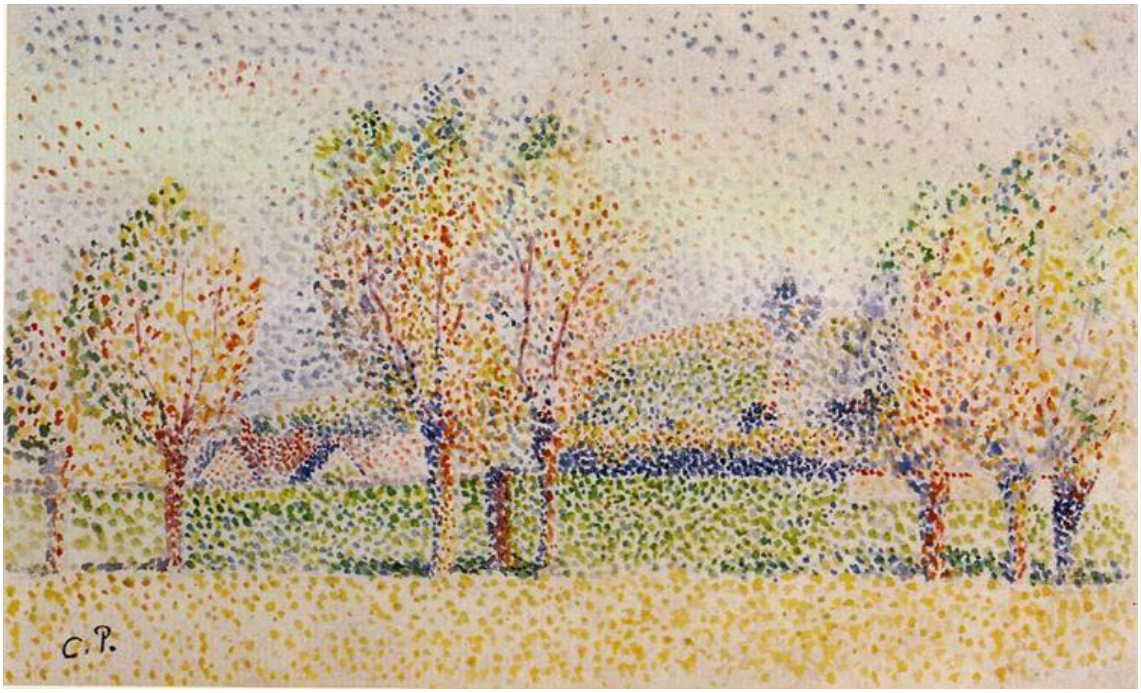


FIGURE 9. Eragny Landscape, early Pointillist painting (Pissarro 1886)

2.3 Vector art

When speaking in the context of digital illustration and design, a vector is a visual element constructed from points and lines placed in mathematically defined coordinates, allowing scaling and distorting of the graphics with no loss of detail or quality (Encyclopedia Britannica n.d.). Vector graphics are often compared to the other most common graphic computation type - raster graphics. Raster images are comprised of a rectangular grid of pixels, where each pixel can display a different colour (Encyclopedia Britannica n.d.). This makes raster formats more suited for purposes requiring a high fidelity of tonal information (such as photographs) while vector formats are preferable when working with dynamic, exact shapes that require lossless scaling for different use cases (such as icons or logos).

A vector graphic will generally consist of a number of points and the lines connecting them, together referred to as a vector path. Each point may have up to two handles, which affect the curvature of the line extending out from the point in the handle's direction. The further away the handle extends from its origin point, the larger its area of influence on the line. As visible in Figure 10, a vector graphic

can also store information for a fill colour (fills the area on the inside of the vector path), as well as stroke weight and colour (width and colour of the outline).

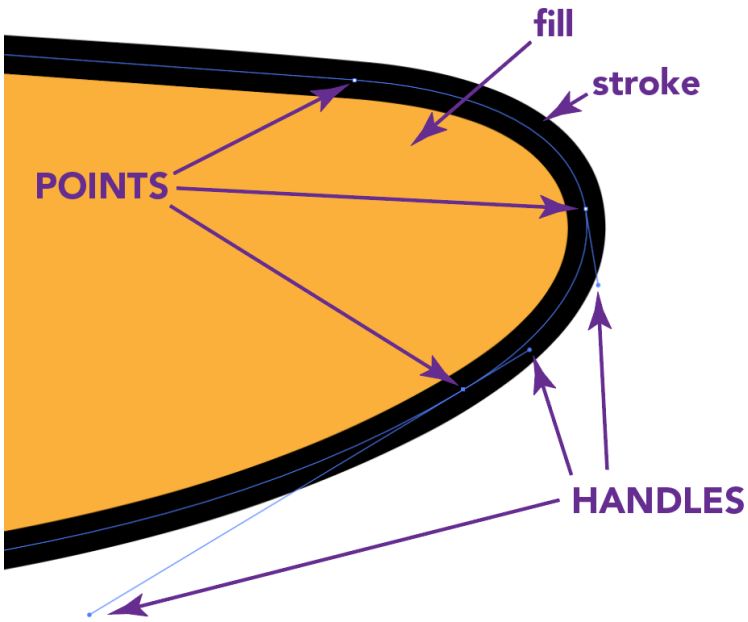
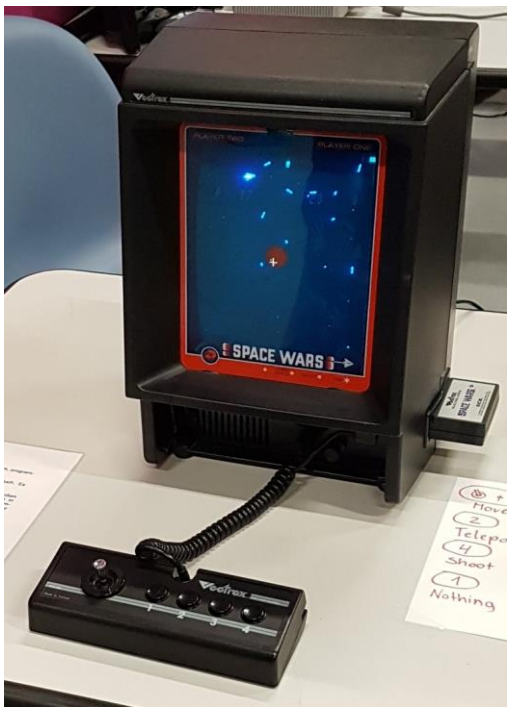


FIGURE 10. An example vector shape showcasing its base components

2.3.1 History

The rise of vector-based graphics began around the 1950s, as early computers did not have the computational power to display raster images and defaulted to vector graphics instead. Among the first machines to utilize vector technology was the mainframe computer Whirlwind, invented in 1951 by Jay Forrester and Robert Everett of Massachusetts Institute of Technology (Simon 2019).

In 1963, Ivan Sutherland released the first vector graphics drawing program Sketchpad for the TX-2 machine. This paved the way for the commercial spread of vector graphics, as they were rapidly adopted for use on the home gaming system Vectrex (Picture 1) as well as arcade machines for well known video game titles such as Asteroids and Space wars (Simon 2019).



PICTURE 1. The Vectrex home gaming system running Space Wars (Syltefar 2019)

The next leap in widespread accessibility of vector graphics came in the mid 1980s with the release of the Apple Macintosh alongside computer graphic design software such as Aldus PageMaker (1985), Adobe Illustrator (1987) and CorelDraw (1989). In 1999, the creation of the first open standard vector format called Scalable Vector Graphics (SVG) enabled vector images to be transferred and edited between different software, further increasing the ease of use of vector graphics. SVG has remained the most common vector file format to this day (Simon 2019).

2.3.2 Breakdown of methodology

The vector graphics software market is incredibly populated with many different product choices. According to the live G2 (n.d.) vector software comparison, the highest-ranking products based on user satisfaction ratings at the time of writing are Adobe Illustrator, Sketch, CorelDRAW and Affinity Designer. However, majority of these software are largely comparable when it comes to basic feature availability – therefore choosing one is mostly up to the personal preferences of the user. Due to existing familiarity with the product as well as the widespread

availability of third-party tools and materials made for this software in particular, all practical work for this thesis will be made using Adobe Illustrator.

The document setup for vector illustration begins with determining an artboard size in the chosen units of measurement – Adobe Illustrator offers standard units both in imperial (inches, feet, yards) and metric (millimetres, centimetres, metres) systems, as well as digital units such as pixels, points, and picas. Pixels (px) is a good default option for most kinds of work intended for display on computer screens. It is also possible to convert between units of measurement during any stage of the work process if necessary.

The document colour mode is a choice dependent on the target use case for the work. There are two options – RGB (red, green, blue) and CMYK (cyan, magenta, yellow, key). The RGB colour mode is aligned with the way computer displays produce different colours through mixing red, green and blue light (Merriam-Webster Dictionary n.d.) and is therefore ideal for work that is to be displayed only digitally. On the other hand, the CMYK colour mode is intended to approximate the range of colours available when printing with cyan, magenta, yellow and black (key) ink (Merriam-Webster Dictionary n.d.) and is used for print works such as posters, flyers, business cards, etc. As is visible in Figure 11, the RGB colour mode (shown in the top row) and the CMYK colour mode (bottom row) differ slightly when displaying the same tones – the CMYK palette tends to become more muted to account for the physical restrictions of standard ink printing.

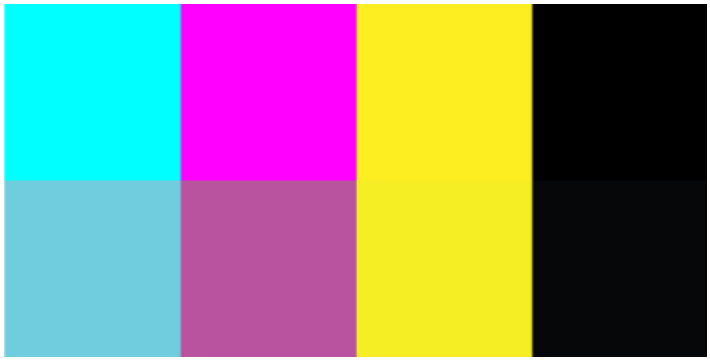


FIGURE 11. Comparison of RGB and CMYK colour modes

Another important document setup choice in Adobe Illustrator is the resolution of raster effects. Resolution, in the context of computer graphics, refers to the density of pixels in an image, and is usually measured in dots per inch – DPI for short (Merriam-Webster Dictionary n.d.). While vector graphics are independent of resolution, some effects available in Adobe Illustrator are still generated through raster methods. The standard resolution options are 72 DPI, 150 DPI and 300 DPI – a larger number means increased fidelity (Figure 12).

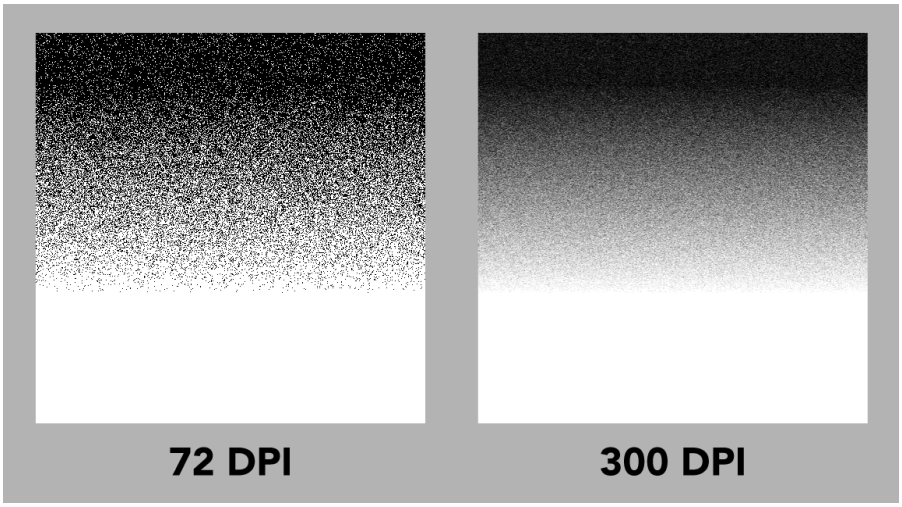


FIGURE 12. Comparison of a grain effect on two different DPI settings

While Adobe Illustrator offers a wide variety of different tools, only a few general tools are necessary for building basic vector graphics. The Paintbrush Tool allows freehand drawing of vector paths and is great for quick sketching or illustration work. A more structured option for creating paths is the Pen Tool that allows the user to place and modify vector points directly, as well as edit handles to adjust the curvature of lines between them. For basic shape creation, the Rectangle, Ellipse, Polygon and Star Tools cover most cases.

To begin the example vector illustration, a rough sketch was drawn using the Paintbrush Tool (Figure 13). This work was to be utilized later for the purposes of testing and comparing the different stippling and Pointillism recreation methods, therefore the chosen subject had to be diverse in its shape language, featuring areas of different sizes and qualities, as well as overlapping shapes – an illustrated bird fit these requirements adequately.

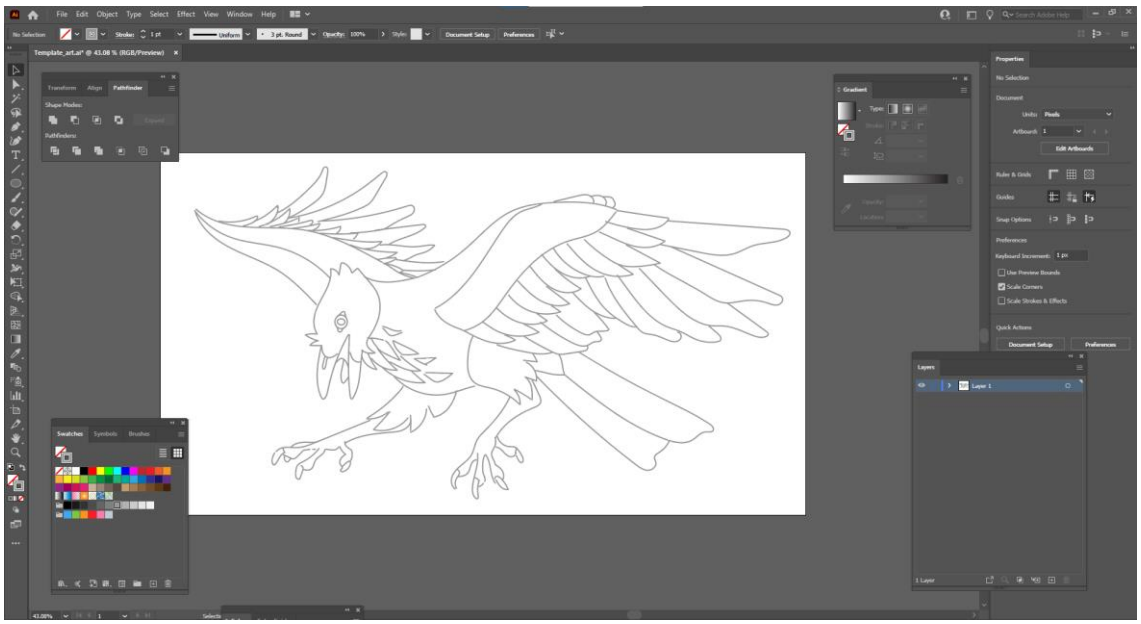


FIGURE 13. Adobe Illustrator user interface showing an artboard with a sketch

The individual vector shapes can then be created with the Pen Tool and filled with the desired colours. This is made easier by utilizing the layer function of Adobe Illustrator – layers act as separate sheets that are stacked on top of one another, and each layer can contain graphics such as vector objects or raster images. Any transparency in a layer can be seen through to the layers below. Moving the sketch to another layer that is positioned on top and making it slightly transparent enables the sketch to be always partially visible while not obstructing view of the shapes drawn below, as shown below in Figure 14.

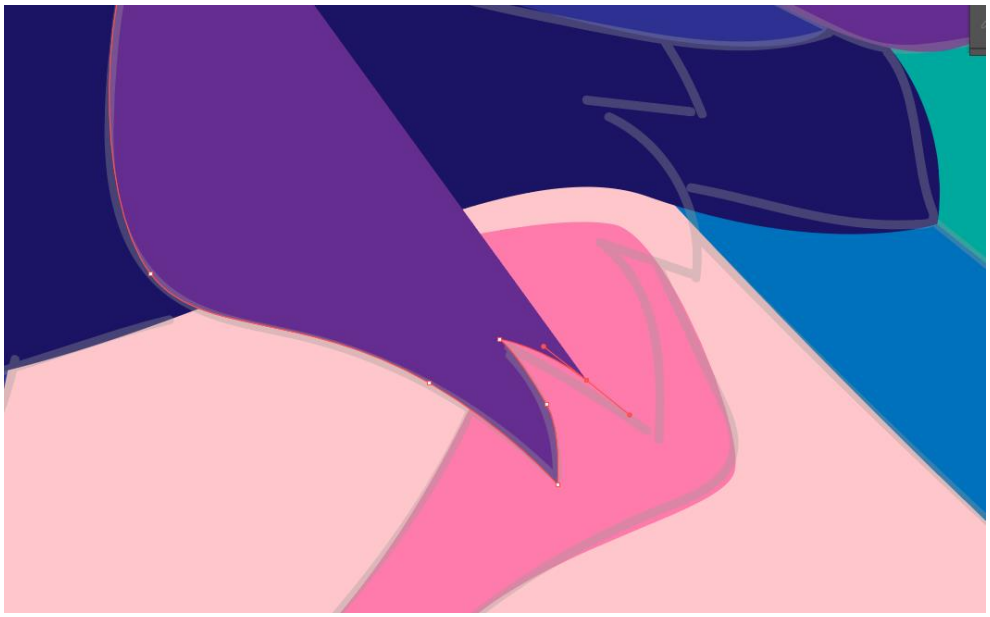


FIGURE 14. Following the sketch to recreate it with filled vector shapes using the Pen Tool

Another benefit of using vector graphics is that each shape remains as a separate object in its layer and can be edited independently of the rest of the image at any point. Like layers, vector objects can be stacked on top of one another in the layer's hierarchy, creating overlapping areas where some parts of the shapes below can be obscured by the ones above. An example of this is visible in Figure 15, where the selected vector path for the bird's head is below the eye and beak shapes, but above the body and the wing in its background.

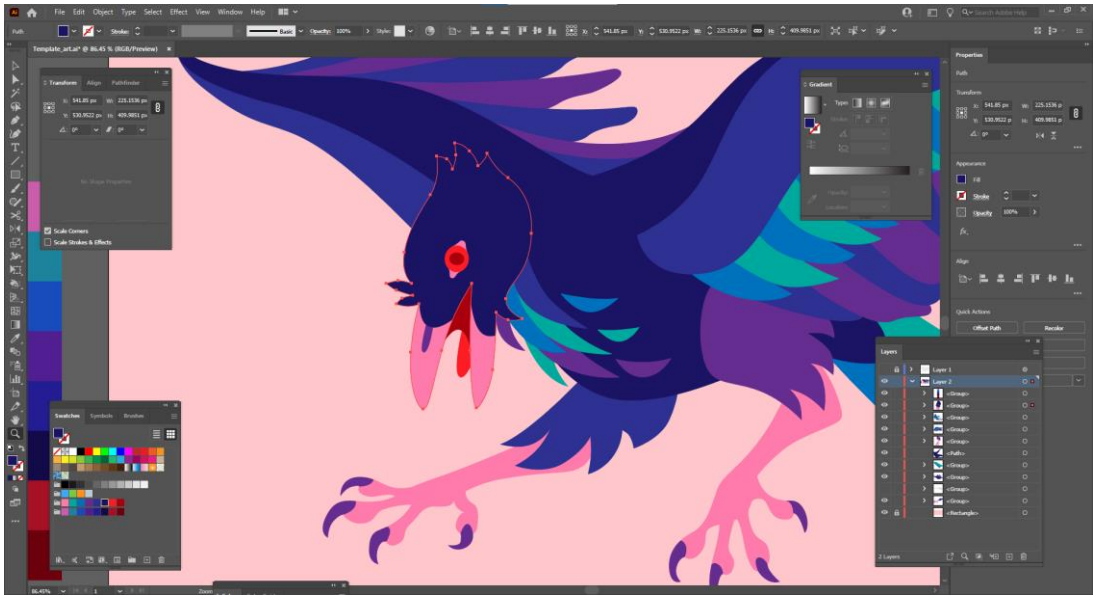


FIGURE 15. Complete illustration of the bird with the vector for its head selected to show its points and lines

3 STIPPLING AND POINTILLISM IN DIGITAL ART

3.1 Current presence

In modern day digital art, stippling and Pointillism are terms that are largely interchangeable. This seems to stem from the generalization of both styles as belonging under the umbrella of “dot art”, essentially reducing their definitions to the commonality between them – the work process involving some manner of dot work. Searching for terms such as “digital art pointillism” (Figure 16) or “vector pointillism” on Google Images reveals digital recreations of what could be considered fitting for either style.

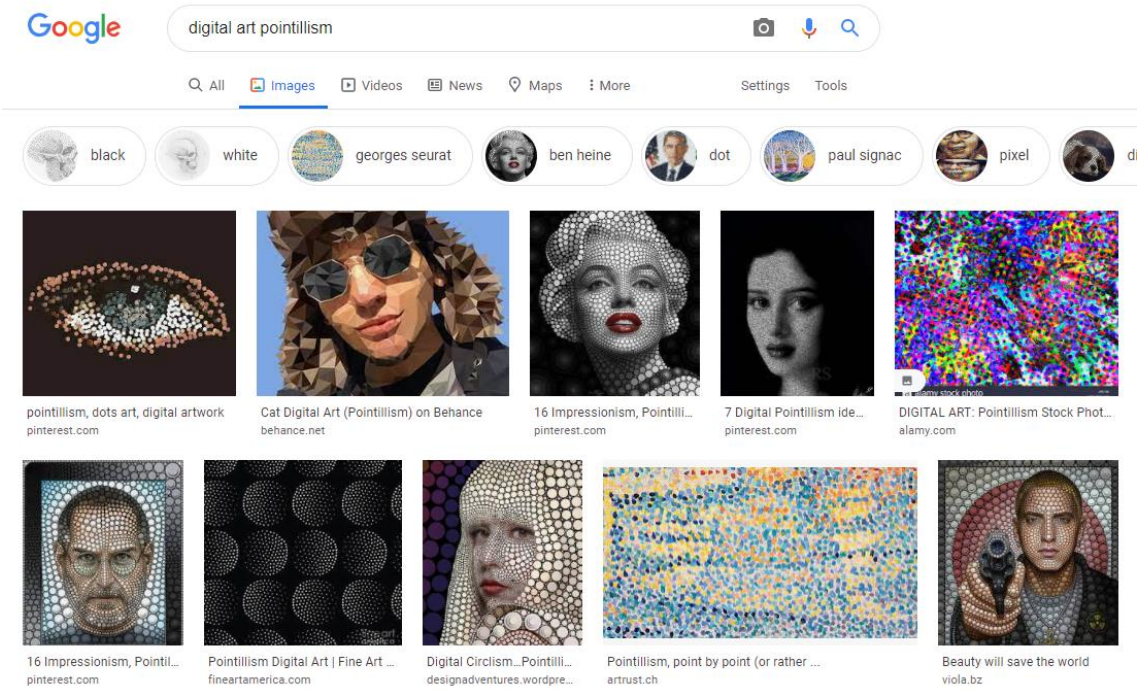


FIGURE 16. Web search for “digital art pointillism” (Google Images n.d.)

Furthermore, it is relatively difficult to distinguish which pieces have been made using vector graphics versus raster graphics due to a common lack of documentation regarding tools and software on published digital works. Both stippling and Pointillism feature a relatively straightforward, pragmatic approach to their workflow that suits the geometry-based vector medium well but can be replicated to equal effect in raster graphics. Due to this, in the absence of an artist’s comment on their choice of software or digital medium for a piece, both

potentially raster-made and vector-made pieces will be treated as equally valid examples of digital recreations of stippling and Pointillism for this thesis, despite the overall focus on vector graphics.

3.1.1 Rise of the flat design style

The widespread popularity of stippling and Pointillism in the digital art scene can at least partially be attributed to fields such as user interface (UI) design, branding and editorial illustration adopting a preference for flat design styles. The characteristics of the flat style include the use of simple geometric shape language, bold colour palettes and the absence of complex semirealistic textures and shading found in the opposing skeuomorphic design style that had been the preceding industry standard (Yalanska 2016).

Skeuomorphism is defined by the mimicry of real-world objects when creating user interface elements – a common example being a recycling bin icon to indicate deleting files – aiming to rely on users' familiarity with existing concepts as shorthand for digital features (Interaction Design Foundation n.d.). An example comparison between the two can be seen in Figure 17 below. The bold shape and colour language permeating the flat style is much more welcoming to the expressive elements of stippling and Pointillism.

FIGURE 17. Instagram logo from its skeuomorphic era on the left and the flat design style on the right (Popicon n.d.)

As Yalanska (2016) mentions in her article “Flat Design - History, Benefits and Practice”, the cultural shift towards flat design began in the early 2000s, cementing itself as the industry standard after being adopted as the branding style of Windows phone UI, quickly followed by the competing Apple mobile operating system iOS 7 in 2013. The style has several benefits – it is readable and easily adjustable for different screen sizes and resolutions, as the lack of raster-dependent textures characteristic of skeuomorphism allow most designs to be developed as vectors.

Being relatively simple to understand and copy, the style is also less demanding on artists and developers. As Quito (2019) emphasizes in the article “Why editorial illustrations look so similar these days”, efficiency is an increasing necessity for illustrators and designers alike – the ability to adjust to client demands as cheaply and quickly as possible is crucial at a time when artists are in direct competition with cheap stock art sites and increased customer mentality of “paying with exposure”.

3.1.2 Examples

One of the most well-known artists that has adapted their own version of Pointillism to digital art is Ben Heine, who coined the term “Digital Circlism” for his series of pop culture portraits. Figure 18 below shows his work depicting Lady Gaga as an example of the technique – Heine utilizes single colour dots of varying sizes to denote the shapes and tonal qualities of his portraits. The dots decrease in size in areas of darker shade or increased level of detail, such as the eyes or mouth. While lacking in many defining aspects of traditional Pointillism, the influence is clear in how Heine has chosen to adapt the style to more modern digital art sensibilities.

FIGURE 18. Lady Gaga in the Digital Circlism style (Heine 2014)

Browsing popular design and illustration portfolio sites such as Behance or Dribbble reveals more examples of stippling and Pointillism reappearing in the modern digital art scene. Artists like Murat Kalkavan (Figure 19) utilize various dot work in commercial and personal works alike, blurring the line between the two art styles as well as flat design. His work is characterized by sparse, bold dot work, generally used as a colourful stipple to denote shading, but occasionally taking on a more even spacing and a mix of complementary tones like the chromatic play found in Pointillism art.

FIGURE 19. Hidden (Kalkavan n.d.)

The TIME magazine cover from March of 2019 (Figure 20) features subtle stipple-like grain, existing somewhere between shading and texture – this stippling method permeates the field of digital illustration. Jordan Kay's (2021) portrait series utilizes a bolder version of this – her depiction of Ringo Starr (Figure 21) features a similar grain stipple, though it is used not only as a means of denoting shade, but also to create unique tonal combinations through the mix of complimentary colours.

FIGURE 20. Detail of TIME magazine cover for the March 25, 2019 release (TIME, 2019)

FIGURE 21. Detail from a poster dedicated to Ringo Starr (Kay 2021)

3.2 Variety of methods

There is no one way of reproducing a traditional art style digitally, though some methods are more direct than others. The overall effect needed to achieve a look resembling stippling or Pointillism is relatively straightforward – the work needs to show some form of dot work and must be utilized either as a form of shading (following stippling), or as a manner of creating unique tonal structures (following Pointillism).

Due to the generality of these styles, several different approaches can be chosen from. Some methods will achieve a more faithful recreation of the traditional art styles they're based on, while some can take on a more modern look representative of the digital medium.

3.2.1 Filtering and blend modes

One of the more common and easily copied techniques of replicating dot work digitally is by using a combination of grain filters and blend modes. A filter in the context of design and art software such as Adobe Illustrator is an effect that can be applied to objects, layers, or the entire image to alter its looks, generate new graphics or distort shapes (Adobe n.d.) – some basic examples shown below in Figure 22.

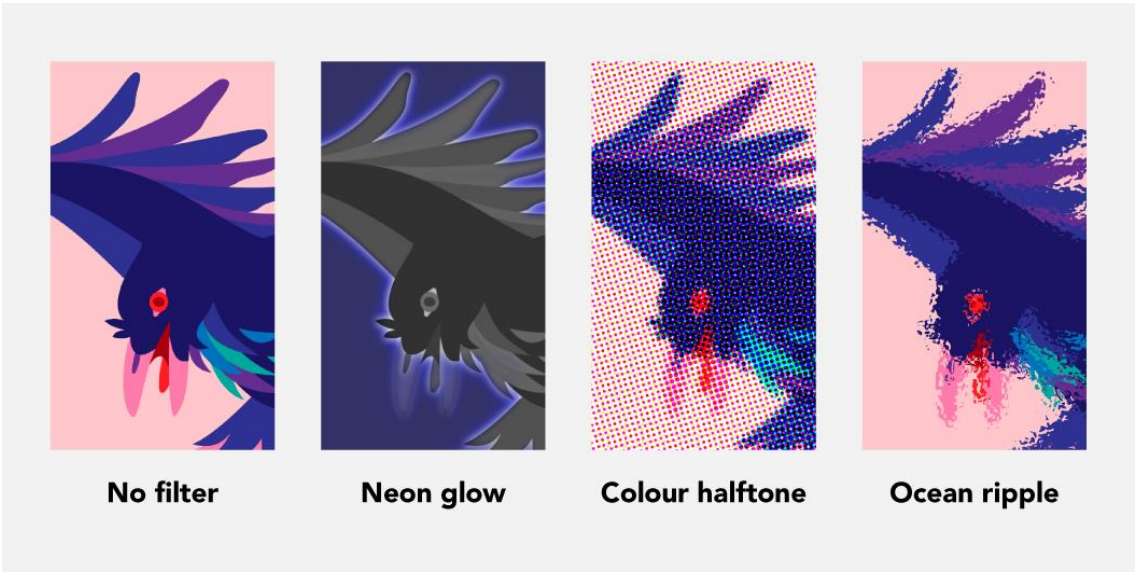


FIGURE 22. Filter effects in Adobe Illustrator

A blend mode in Adobe software is an opacity setting that changes how the colours of an object or a layer will affect those below it. As shown in Figure 23, the various modes apply the black-white gradient to the images according to different rules. Multiply takes the colour information from the image below it and multiplies it by the blend object colours (in this example the gradient), resulting in a darkening effect. At the same time this reduces the opacity in lighter areas of the blended object. Screen works similarly but multiplies the inverse of the colour information, creating the opposite effect – a lighter result that leaves the darkest parts of the blend object more transparent. The various other filters perform similar mathematical calculations between colour information, all resulting in slightly different effects (Adobe n.d.).

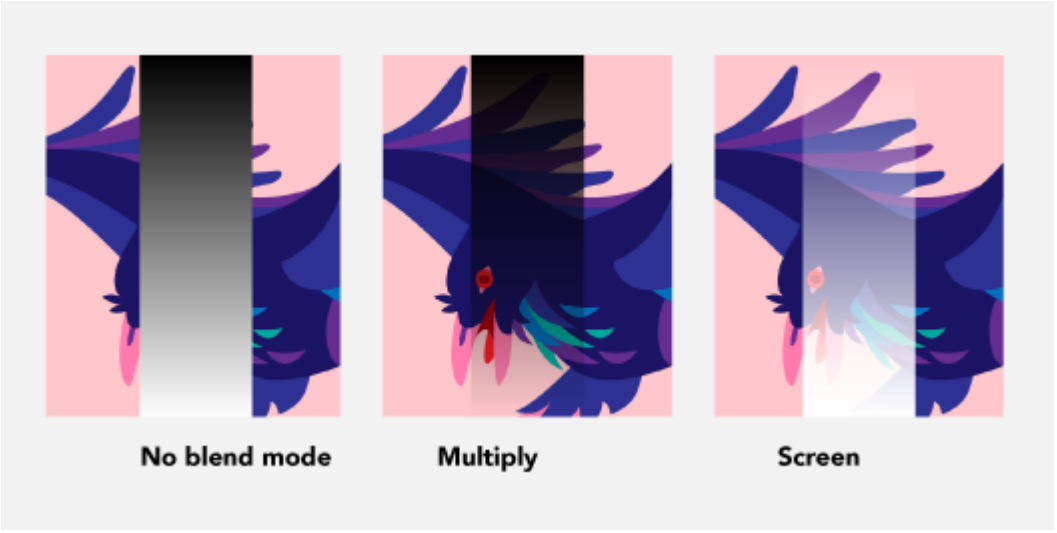


FIGURE 23. Blend modes in Adobe Illustrator

By utilizing a combination of the grain filter and the Multiply blend mode it is possible to achieve a dot work like effect as shown in Figure 24. This effect can be customized by applying it to specific parts of the image only, changing the angle and the disparity between white and black in the gradient, as well as the opacity of the gradient. Different blend modes such as Screen or Overlay can be used as well for different results. The main drawbacks of this method are the reliance on pre-built effects and math existing within the software – the artist will have little control over the process of achieving the effect- as well as the fact that the grain filter is technically a raster effect despite its use in vector software.

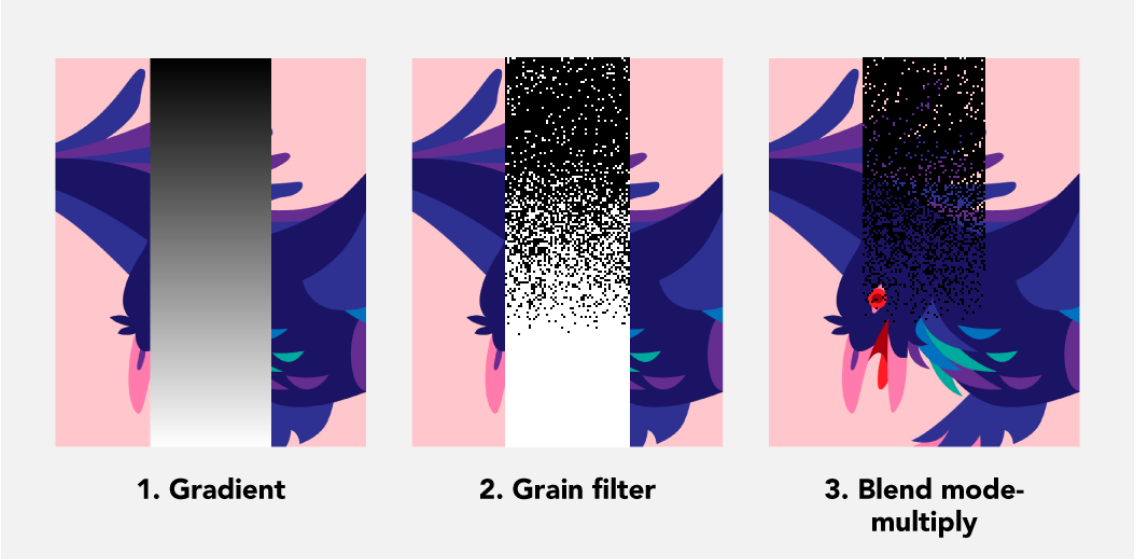


FIGURE 24. Process of creating a dot work effect using filters and blend modes

3.2.2 Brushes

While reproducing dot work in a digital art program is entirely possible simply by selecting a default round brush and drawing individual dots, the benefit of using established software is the accessibility of custom brush shapes through brush editors and community-created libraries. Figure 25 shows four different example brushes from the default Illustrator brush library – the first from the top is a simple round brush for comparison, while the rest are intended to imitate a particular traditional medium or tool. In Illustrator, any vector path with a stroke weight and colour can have these brush styles applied.

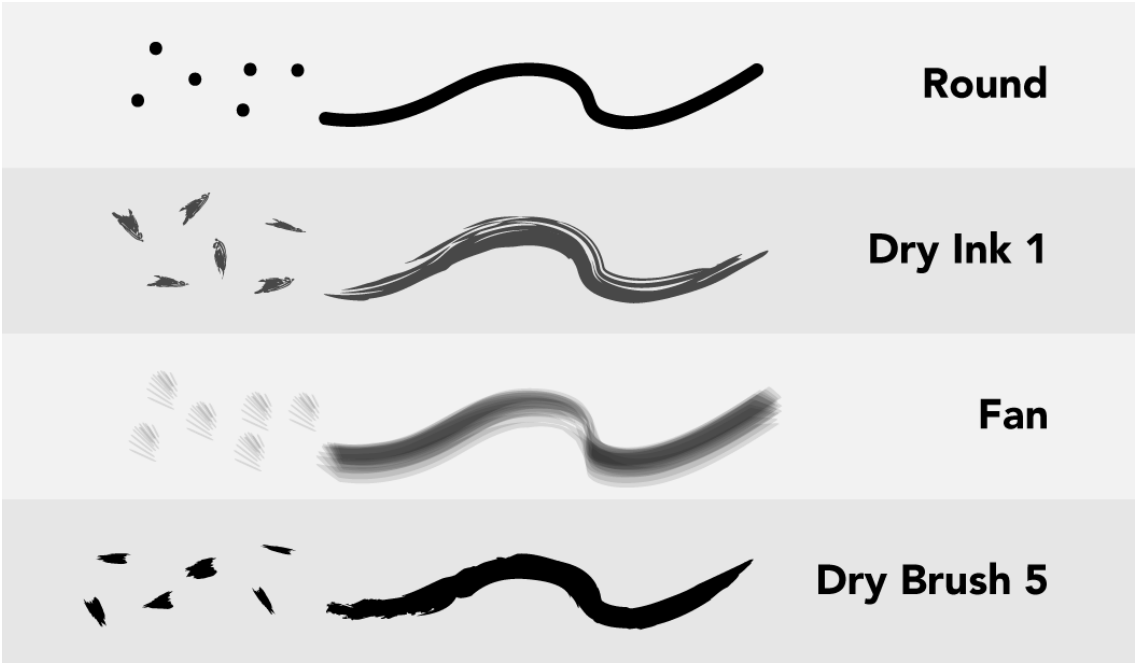


FIGURE 25. Adobe Illustrator brush examples

Online libraries for community-created brushes are an incredibly valuable resource when attempting to replicate a specific visual style or art form. Dot work is no exception, as there are many brush packs available for free download or purchase that can be utilized to speed up the work process. As an example, Chris Spooner's free brush set from 2015 (Figure 26) is one of the most popular stippling sets available and features 8 brushes with varied stipple weight and density. The slight imperfections in the dots themselves as well as the uneven spacing between them create a hand-drawn feeling to the art even though none of the dot work is being applied manually.

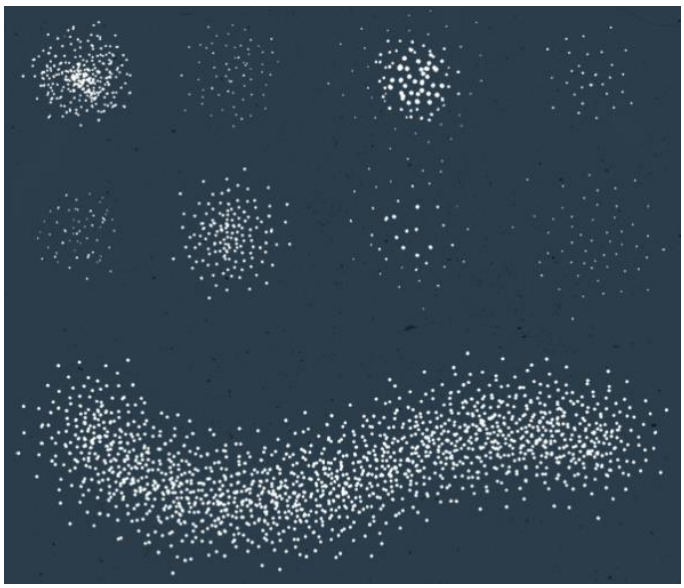


FIGURE 26. Stippling brush preview (Spooner, 2015)

The best way to control the application of these brush styles is by utilizing clipping masks. A clipping mask in Illustrator is a vector object acting as a frame for artwork, making any graphics that are grouped with it only appear within its bounds. A clipping mask can be any vector shape – Figure 27 below shows a simple rectangle clipping mask making any stipple dots outside of its frame invisible. This is, however, also one of the main drawbacks of this method, as it requires the artwork to consist of an increased bulk of objects to account for each individual brush vector as well as the clipping mask objects, increasing the computer performance requirement to work in this method.

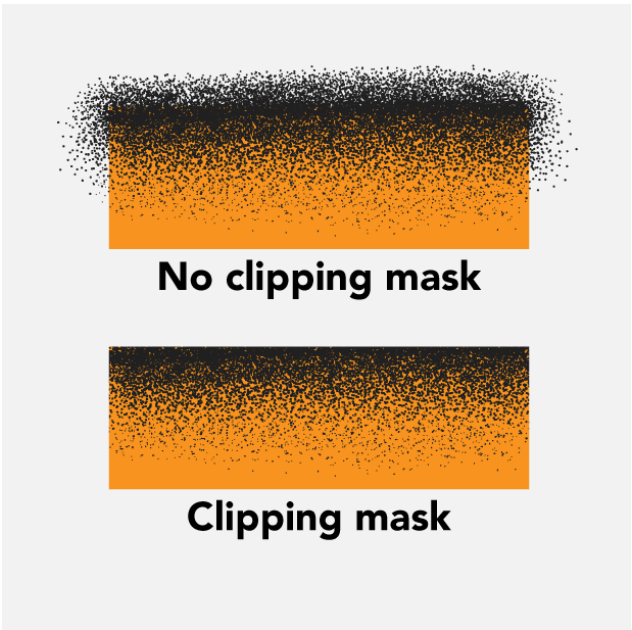


FIGURE 27. Comparison between a shape not using and using a clipping mask

3.2.3 Dynamic generation with software plugins

Another specialized approach to replicating dot work is through automatic generation, utilizing mathematical algorithms to determine the distribution of dots. This topic has been popular in the field of computer graphics and especially image processing – a common research exercise is recreating photos or drawings in Pointillism or stippling styles by writing code that generates dots according to the colour information of the original source graphic.

As Simon Barthelmé (2015) writes in the documentation of his image and video processing code package Imager – it is not enough to simply generate dots on the principle of straightforward increase of dot density for darker areas and lower density for lighter areas. The algorithm will produce too much dot overlap, resulting in unwanted clumping. The goal of writing a dot generation tool should be maintaining the image contrast through variety in dot density while also distributing the dots in a way that reduces overlap. Figure 28 below shows an image compilation of his process of improving the dot work algorithm.

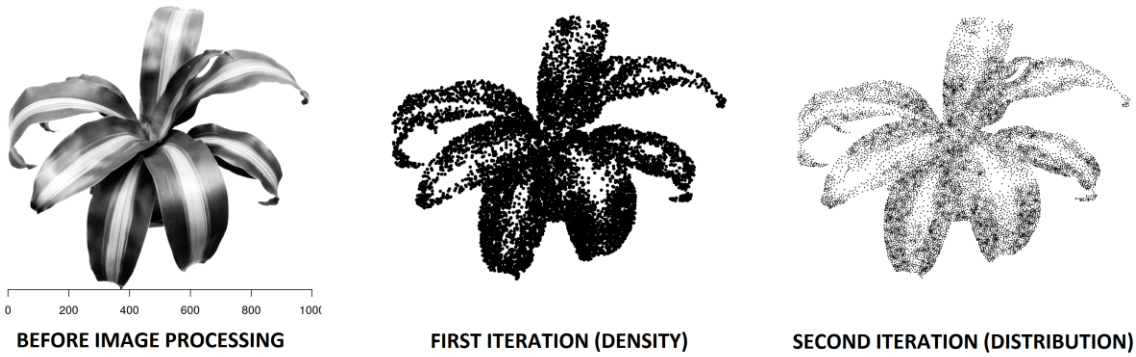


FIGURE 28. Evolution of a dot work generation algorithm (Barthelmé 2015)

An article by Silvia Hao (n.d.) emphasizes the relation of stippling and Pointillism and provides code examples for mimicking both styles through image processing. Hao's research mirrors the conclusions from Barthelmé (2015) on the importance of good dot distribution to faithfully simulate the look of traditional stippling, and further extends the topic into how a Pointillism-like effect can be generated as

well (shown in Figure 29) by introducing some randomized deviation to each dot colour (Hao n.d.).

FIGURE 29. Pointillism simulation based on a portrait photography (Hao n.d.)

This knowledge base of image processing research has paved the way for development of similar tools outside the field, one such example being the Stipplism plugin for Adobe Illustrator. Created by Astute Graphics, Stipplism enables the generation of both stipple and Pointillism-like effects directly in Illustrator that can be applied to any vector object (e.g., Figure 30), featuring a wide variety of customization options for colour, dot shapes, density, etc. (Astute Graphics n.d.)

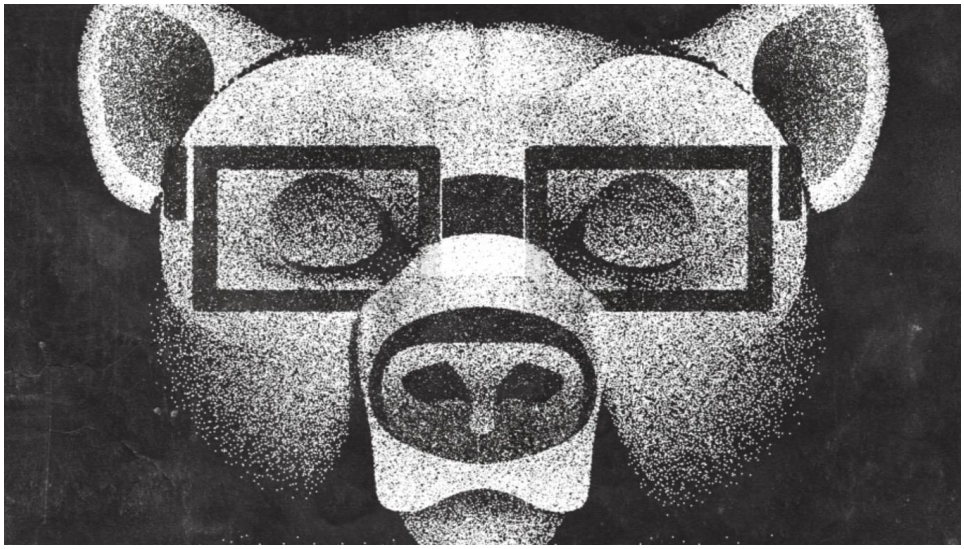


FIGURE 30. Example artwork produced with Stipplism (Astute Graphics n.d.)

The plugin is intended as a way of recreating the traditional art techniques as faithfully as possible, putting focus on authentic dot distribution and shape to replicate a hand-made feeling to the artwork. However, the broad variety of settings allows for a complete departure from traditional stippling and Pointillism, disregarding the physical restrictions of engraving or painting mediums and embracing the possibilities provided by working digitally. As the dot shape can be any vector path provided to the plugin, its algorithms can be made to generate any number of effects – Figure 31 below shows option selection for creating a flower petal effect.

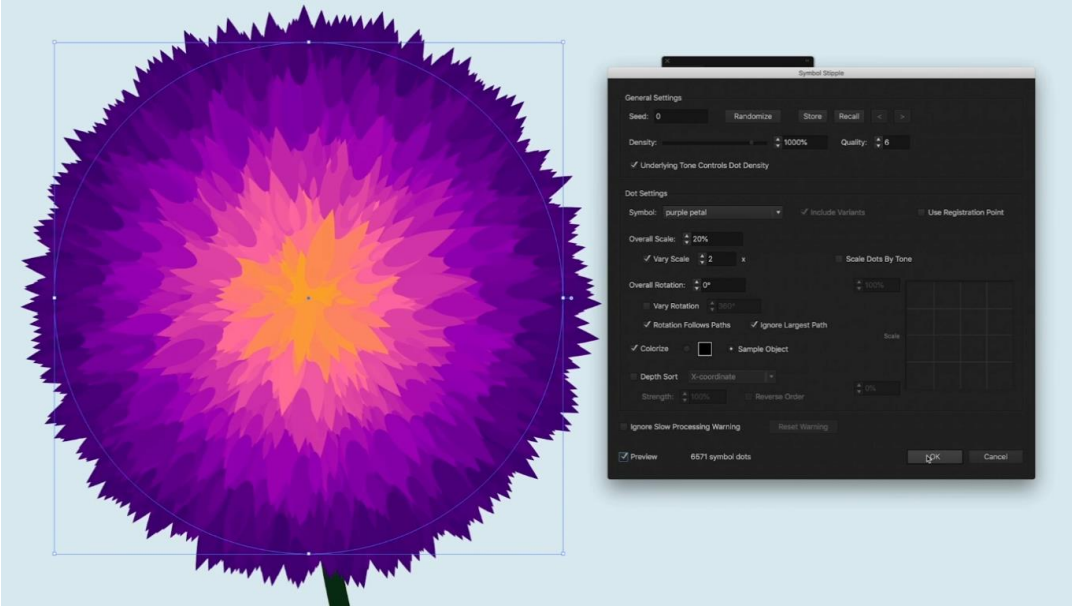


FIGURE 31. Flower petal generation with Stipplism (Astute Graphics n.d.)

However, the creative freedom and powerful algorithms this plugin provides come at the cost of a yearly subscription fee to Astute Graphics – at the time of writing, the pricing for their plugin bundle (each plugin can not be leased separately) on the Astute Graphics website is 119$/year. The second drawback to this method is similar to a problem encountered with utilizing filters and blend modes – a reliance on algorithm math that the user is not in control of and might not fully understand the inner workings of.

4 METHOD TESTING

4.1 Filtering and blend modes

The one prerequisite for working in the method of filters and blend modes when replicating dot work is to keep the raster effect resolution low (72 DPI) to preserve a distinguishable dot size generated by the grain filter (previously shown in Figure 12, page 20). An increased DPI will result in higher fidelity artwork, making the grain too smooth to be recognized as individual dotting.

To begin, each vector object that will receive stipple shading must be duplicated. The original object that's lower on the layer hierarchy will remain in the intended base colour of the graphic, while the duplicate on top will be turned into a black-white gradient as in Figure 32 below. The gradient itself can be linear (colour change happens in a straight line), radial (colour flows from the middle outwards in the shape of a circle) or freeform (the colour changes between points on the surface of the object). The angle controls the direction in which the gradient will frow from one colour to another, and radial gradients have a unique setting for aspect ratio to stretch and squash it into more oval shapes. All gradient settings are relative to the size, shape, and rotation of the vector they are applied to.

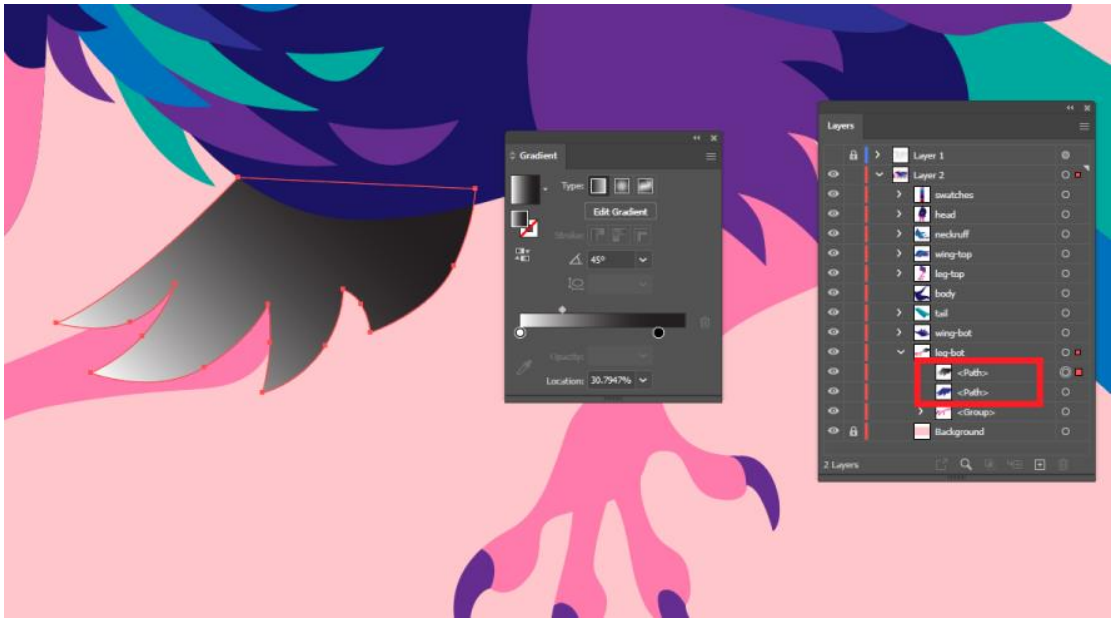


FIGURE 32. Layer hierarchy of the original object and its black-white gradient duplicate highlighted with a red box

The grain filter can now be applied and customized on the duplicate object. For a standard dot work effect, the Grain Type should remain on “Stippled”, but the other two options (shown in Figure 33 below) can be freely adjusted. Intensity controls the overall density of dots across the effect. Contrast changes the distribution of the grain – a lower contrast value results in more evenly distributed, sparser dots in the gradient range, while a higher contrast will overlap the dots in darker areas much more and leave lighter areas almost devoid of any.

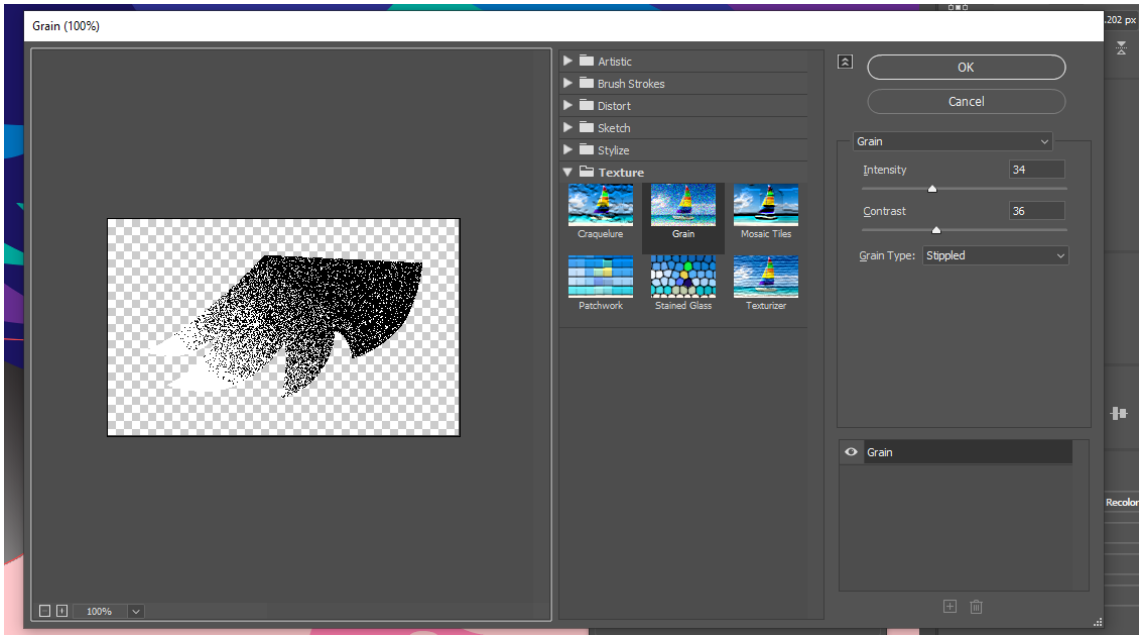


FIGURE 33. Grain effect application window

After the grain effect is applied, the final step is to set a preferred blend mode, in this case Multiply. As is visible in Figure 34, the stipple effect is quite intense when left at 100% opacity (left side) – reducing it to a lower opacity (35% on the right side) can make the effect softer if that is preferable.

FIGURE 34. Comparison of 100% opacity at 35% opacity stippling

Applying this method across the whole image is a relatively quick and simple process. The more objects need to be stippled, the more duplication will need to be done; however, keeping with good practices when it comes to layer management and grouping helps the work document remain tidy and its object hierarchy readable. The result (Figure 35) is an efficient stipple effect, although it is noticeably not handmade and brings a distinct digital feeling to the work.

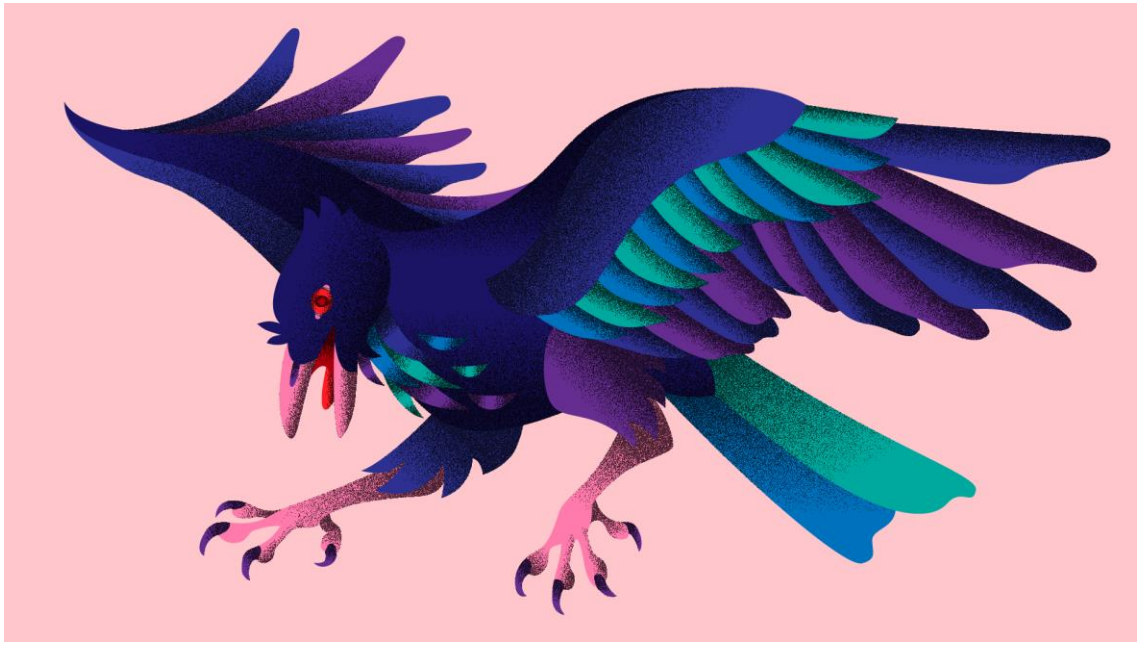


FIGURE 35. Finalized filter and blend mode stipple effect, opacity for dot work set to 70%

FIGURE 36. Detail of the finished work from Figure 35

When it comes to recreating a Pointillism inspired effect, this method becomes more convoluted. Firstly, the gradient must be changed to the desired colour of the dot work both on the side that should have higher dot density (black in the previous example) as well as the side that should have lower dot density (white in the previous example) as shown in Figure 37. The side with lower dot density must have its opacity decreased to 0% in the gradient.

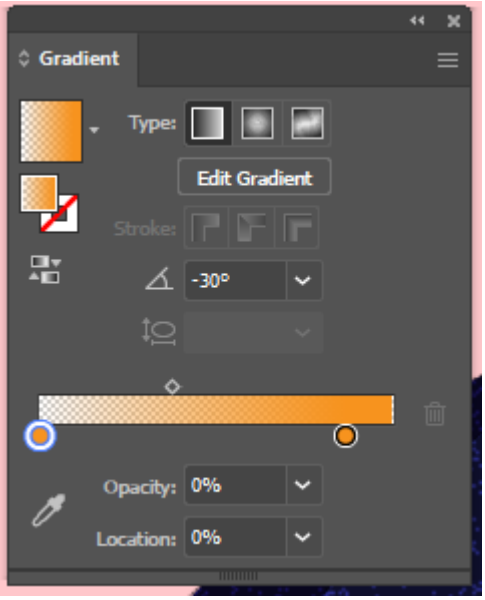


FIGURE 37. Gradient settings for colourful dot work

Secondly, the grain effect must have its settings adjusted – “Stippled” Grain Type will always be forced to be in grayscale, so the Grain Type must be set to “Sprinkles” – a similar effect that allows colours. Lastly, opacity should be brought to 100% and the blend mode must be adjusted to one that will most accurately display the preferred grain colour, as Multiply will generally only attempt to darken the tones. Blend modes such as Colour, Overlay, Hard Light and even Normal will be preferable, although the effect will not be perfect – the colour of the object below it will always be slightly skewed, or the grain colour might be inaccurate. This aspect of the method is the least user friendly and requires a lot of experimentation. For the finished example in Figure 38, the blending mode was set to Hard Light, and the stipples adjusted to be in complimentary tones to the colours of the vector objects below.

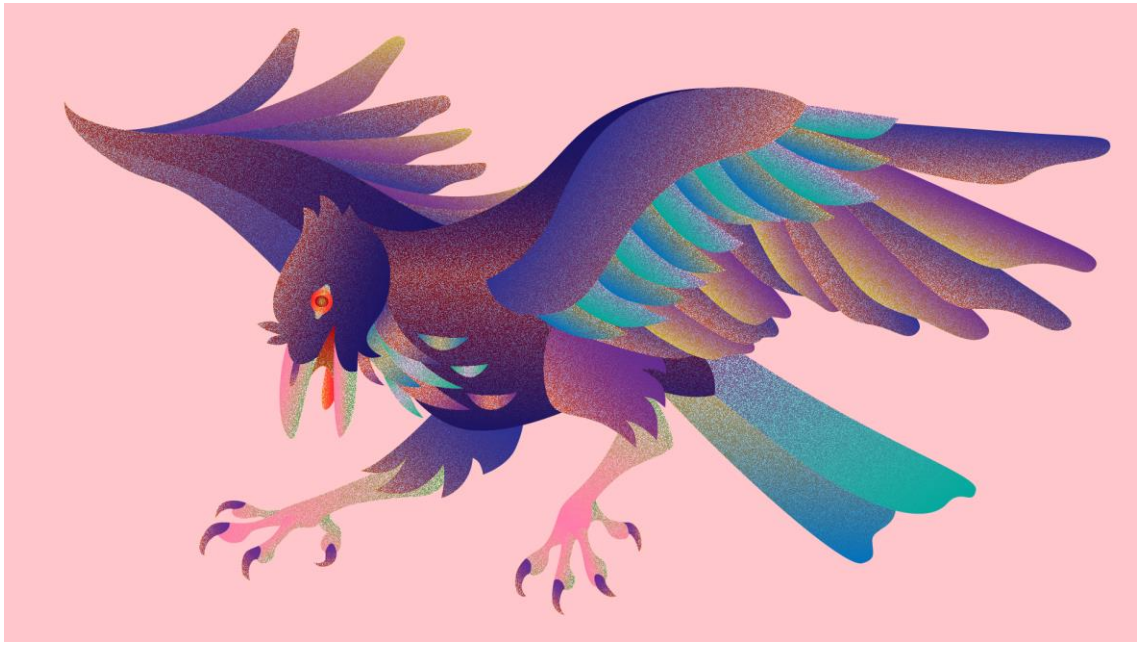


FIGURE 38. Finalized filter and blend more example of an attempt to mimic Pointillism tonal structures

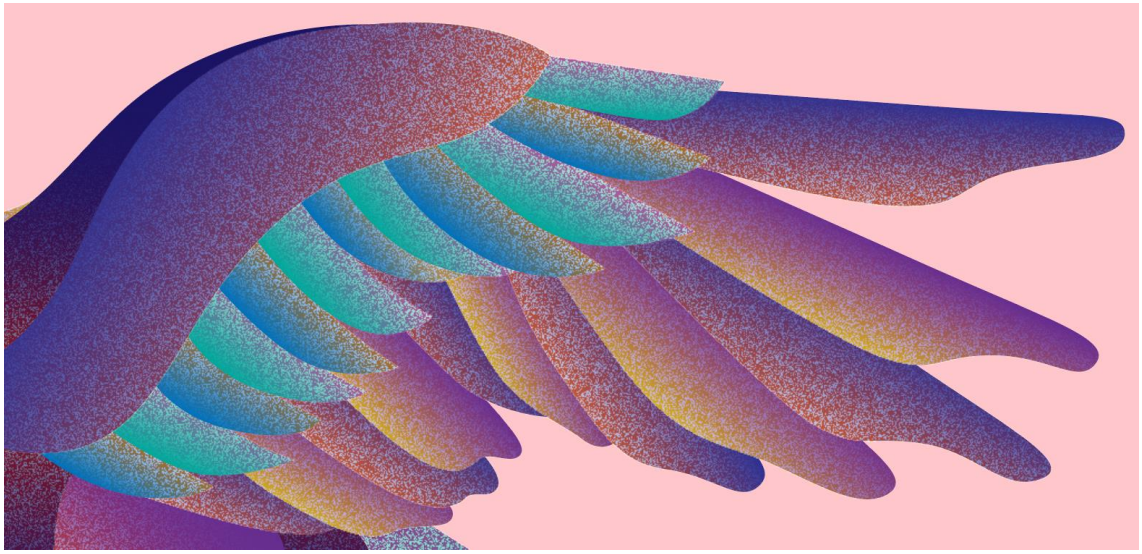


FIGURE 39. Detail of the finished work from Figure 39

4.1.1 Benefits

The accessibility and simplicity of technique for using the filter and blend mode method can be considered its biggest strength. It works “out of the box” in Adobe Illustrator, and presumably can be utilized in any other art software that features some form of grain effect. This method does not require the user to acquire any additional resources, is performance friendly and does not introduce too much

object clutter to the work file. Mastering the method is incredibly fast as there is very little depth to the technique besides experimenting with the grain filter options and blend modes – this means even beginners can reach very good results even when trying the method for the very first time.

This method is especially effective when trying to efficiently replicate standard stippling work. It provides a quick way of setting up interesting shading that gives the image a unique texture. While it doesn't perfectly resemble its traditional counterpart, this method has become a staple of modern digital illustration and is widely used in artwork and design.

4.1.2 Drawbacks

The main issue with the filter and blend mode method is its lack of flexibility. While basic black dot work can be produced very easily, straying from this default reveals the rigidness of the method being reliant on two pre-built software effects – some results simply cannot be achieved due to the nature of the math in how the effects were programmed, and therefore there is a limited number of possible looks that can be achieved.

This is especially noticeable when attempting to replicate the Pointillism style, which is known for its wide expression of brilliant, raw colours and bold brush strokes. Controlling the exact colour of the dot work is nearly impossible, and there is no way to customize the dot size or shape, leading to all artwork produced with the method looking generic.

It is also noteworthy that the effect can not purely be considered a vector graphic – while the grain filter is being applied to vector shapes and its dynamic output allows it to adjust when the base vector shape is changed, it is still dependent on the raster resolution of the work document. This dependency is centralized – one setting affects all grain filters in the document – therefore there is no way to have varied dot sizes in a single work file, as they will all update at the same time when the document raster resolution is changed.

4.2 Brushes

To acquire new brushes for Adobe Illustrator, they must either be downloaded from an online library, or made using the brush editor manually. As the brush editor is quite an in-depth tool and a complex subject matter, this thesis will not feature a guide on how to create brushes yourself. Instead, the practical testing of the brush method will be done with Spooner's (2015) free stippling brush pack - therefore, any unique visual outcomes or particular brush settings might be unique to this specific tool set.

Once a new brush or set of brushes has been downloaded, it can be imported into Illustrator by opening the Brushes menu (Window > Brushes), expanding the extra options by clicking the three small lines on the top right side, then selecting Open Brush Library > Other Library (Figure 40). This will open a file select window that allows the user to search their hard drive for a compatible brush file and import it.

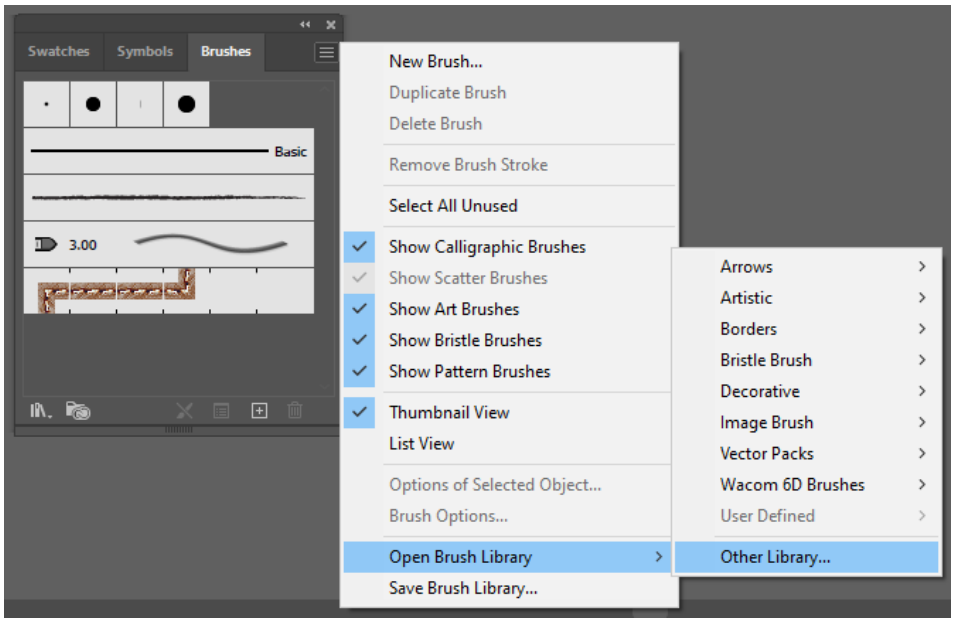


FIGURE 40. Brush importing

Once the brushes are imported, they will appear in their own separate Brush Library window (right side of Figure 41) and can also be accessed in the top toolbar under Brush Definition. They can now be applied to any existing vector object or used to draw new paths with the Paintbrush Tool, as pictured below in

Figure 41. The simplest customization option is changing the stroke width to increase or decrease the overall size of the dot work.

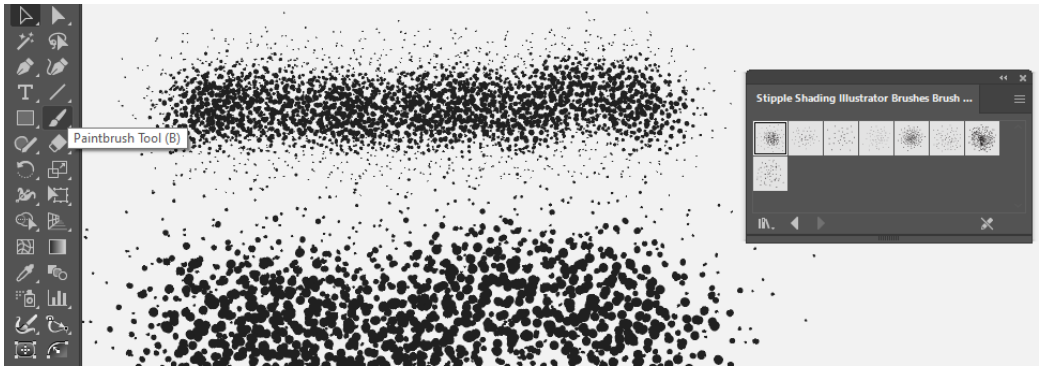


FIGURE 41. Drawing stipple effects using the Paintbrush Tool

For more in-depth customization, it's possible to adjust each brush by double clicking on its icon in the Brushes menu and opening the Brush Options (Figure 42). The most notable setting for this use case may be the Colorization Method, set to Tints by default. While this option works well when using the brush over a light background due to its lowered intensity creating a more authentic traditional stippling feel to the dot work, it does not properly show up on darker backgrounds. It is instead preferable to experiment with other settings – when working on the bird illustration example for this thesis, Tints and Shades was found to produce good results for a standard stippling look.

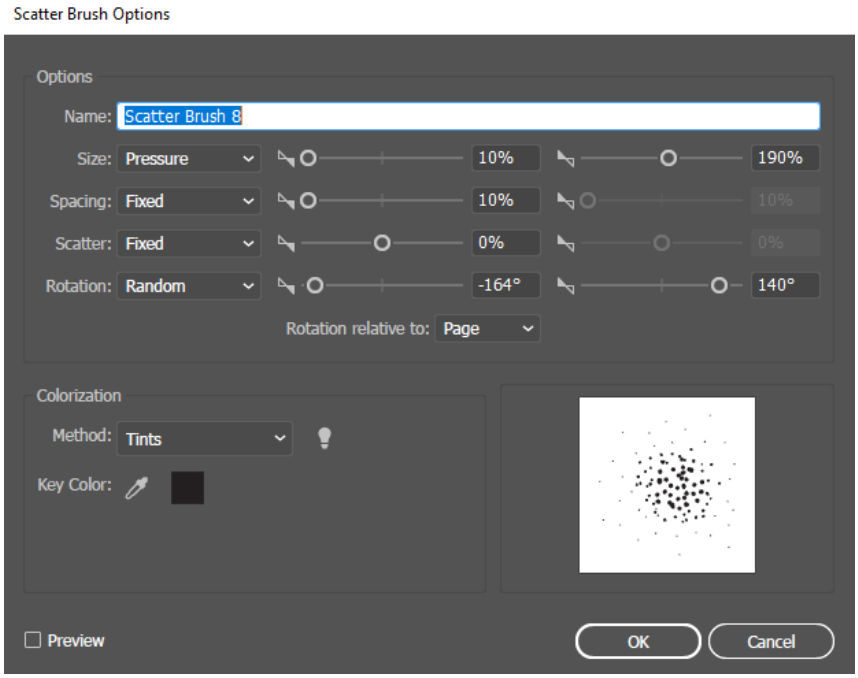


FIGURE 42. Brush Options window

The work process after installing and customizing the brushes is straightforward - any tool that allows the user to create vector paths in one way or another can be utilized to lay in the stipple effect. It is highly recommended to control the dot work placement by using clipping masks, hiding any extra stippling that would otherwise go out of the intended bounds. The result (Figure 43) is a bold example of detailed dot work, closely resembling a hand-drawn aesthetic while being much faster and easier to produce.

FIGURE 43. Finalized custom brush stipple effect

FIGURE 44. Detail of the finished work from Figure 43

Creating a Pointillism style effect with brushes is similarly straightforward, as the artist can have access to all variables of the brush itself, such as the colour and size of the brush work – the only requirement for utilizing colourful dots is changing the Colorization Method in Brush Options to Hue Shift. As visible in Figure 45 below, the effect is a fair digital reimagination of Pointillism when utilizing complimentary tone dot work side by side. However, the denser dot coverage than that of the previous stipple shading example increases the amount of vector brush strokes, quickly multiplying the number of objects in the work file, affecting software performance and overall being more time consuming to produce.

FIGURE 45. Finalized custom brush Pointillism effect

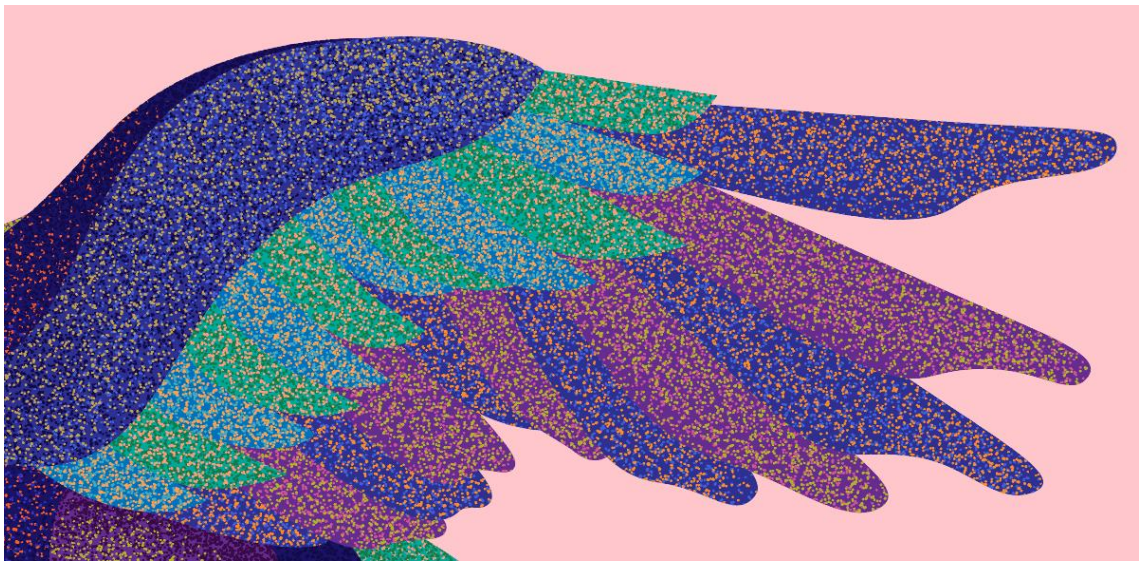


FIGURE 46. Detail of the finished work from Figure 45

4.2.1 Benefits

The biggest advantage of using custom brush effects is the flexibility of the method - at all points during the work process, the artist will have almost complete control over the visual outcome. This technique works just as well in grayscale as it does in colour, making it possible to capture the most striking aspects of stippling and Pointillism alike – the artist can be sure that whichever tone or colour they select for the brush, it will be represented accurately on the canvas.

The wide variety of custom brush packs available online and Adobe Illustrator's built-in brush editor offer and an incredible number of possibilities for the quality of dot work accessible to artists. Fitting tools can be found both for faithful recreation of traditional art methods, as well as more modern takes on what stippling and Pointillism could evolve to in the current art landscape.

This method also brings an unmistakeable hand-crafted feeling to the work, as all brush effects are laid down manually and therefore carry some amount of human imperfection in the outcome. Since the level of detail achieved with this method is directly controlled by the artist's time input, it can produce some of the highest fidelity results with enough work.

4.2.2 Drawbacks

The perpetual increase of software performance costs with each added brush stroke is this method's biggest weakness. All practical testing for this thesis was performed with a recently purchased computer intended for gaming with competitive specs for any graphics-heavy task at the time of writing. The first time that any slowing down of Adobe Illustrator was noticed on this system was at the late stages of creating the Pointillism example from Figure 45, as the brush stroke amount had accumulated to a large degree. Saving changes in the work

document, which is generally almost instant for other files, could take up to 20 seconds, noticeably impacting the speed at which work progress could be made.

The vector object clutter in the layer hierarchy also grew harder to manage the more detail was added. Even while employing proper discipline when trying to draw the minimum amount of brush strokes and combining several vector paths into one where possible, it is still necessary to have each base vector shape duplicated for the purpose of creating clipping masks. An illustration such as the bird example with all its separate colour areas will have its layer hierarchy become bloated very easily.

The final downside is the necessity to either rely on community-created tools to properly utilize the method, or to learn the complexities of the Illustrator brush editor yourself. While there are plenty of high-quality illustration resources available online, some of them come with certain use restrictions (such as mandatory credit to the asset creator or prohibition of using the asset for commercial purposes), and others are only accessible behind a paywall. These factors can severely limit the possible choices an artist might have when acquiring specialized brush packs from online libraries. The other option is to tackle the complexities of the Illustrator brush editor and create unique brushes on your own, however this process can be time consuming and difficult without outside guidance.

4.3 Dynamic generation with software plugins

Installing the Stipplism plugin for Illustrator that will be used to test this method first requires the user to download and set up the Astute Manager from the Astute Graphics website. Once the Manager is installed, the user must log into the service with an Astute Graphics account that is either eligible for the 7-day free trial period or has active time available on their subscription. To perform the practical testing of this method, the trial period was redeemed, after which all available Astute Graphics plugins became available for download.

Once Stipplism has been set up from the Manager, its options window becomes available directly in the Adobe Illustrator UI under Effect > Stipplism, with a choice to apply a regular Stipple or a Symbol Stipple. The default Stipple uses generic round dots, while Symbol Stipple allows the user to use any vector shape that they've prepared themselves. The focus of this test will be on utilizing the regular Stipple options, which can be seen below in Figure 47 as applied to an orange-blue gradient. The General Settings section controls the spread of dot work – Density % for how tightly the dots are arranged, Quality for the precision of the algorithm when calculating dot placement (higher Quality settings impact performance). Underlying Tone Controls Dot Density makes dots sparser in lighter areas and denser in darker areas – this option can either be on or off.

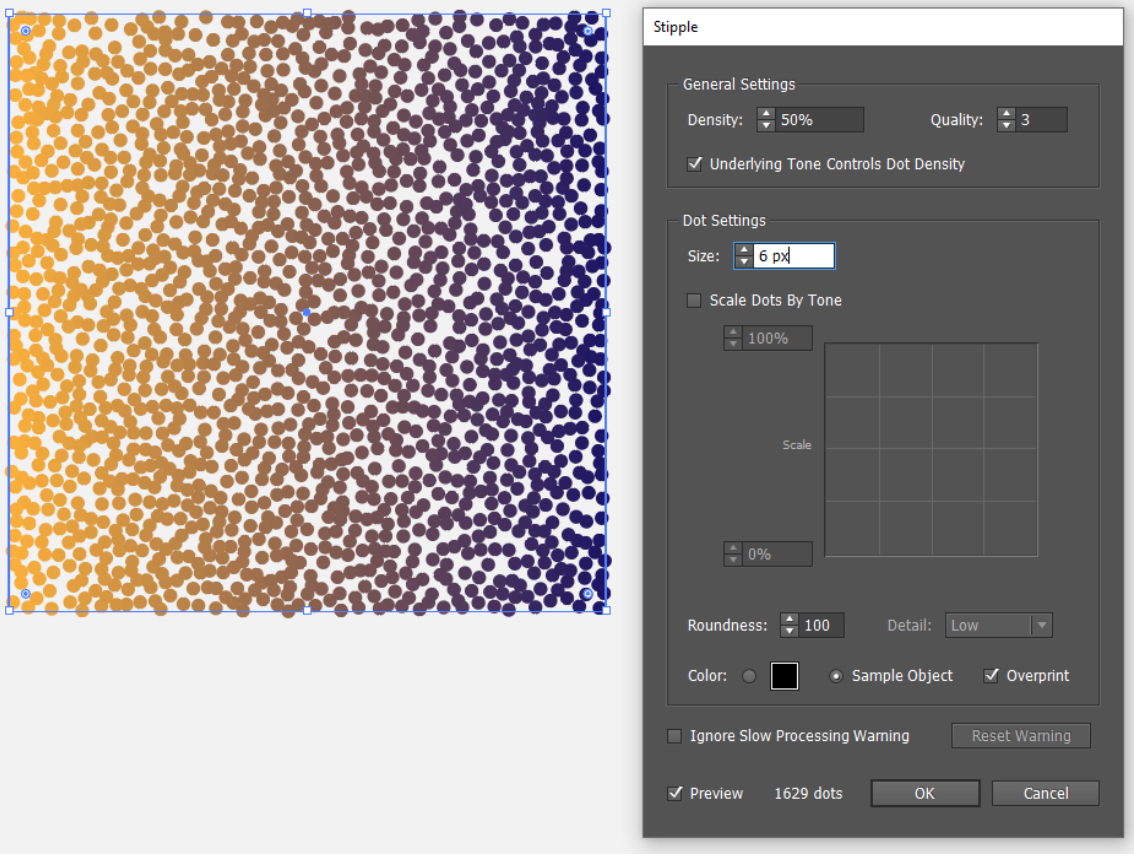


FIGURE 47. Stipplism plugin menu

The Dot Settings section is concerned with the appearance of the dots themselves. Dot size can either be constant as set by Size, or controlled by Scale Dots By Tone, which makes lighter areas have smaller dots than darker areas. If this option is selected, the graph below can be used to adjust the relation between tone and size more precisely. Roundness set to 100% will create perfectly circular

dots, while lowering this value makes their edges more irregular and jagged to simulate the imperfections of dot work in traditional mediums – Detail affects the quality of this setting. Colour can either be a single specific tone or reflect the colours of the base vector shape if Sample Object is selected.

To test a standard stippling effect with this method, all vector objects in the bird illustration were duplicated, the original shape keeping the intended base colour while the duplicate on top was turned into a black-white gradient (similarly to the filter and blend mode method). The Stipplism effect was then applied to all the duplicate objects with Quality set to 5 and Underlying Tone Controls Dot Density checked in, as well as Scale Dots By Tone. Dot Colour was set to pure black, and roundness to 100%. The maximum Density was varied between 30-100% depending on preference on each individual object.

The resulting illustration in Figure 48 below is a very clean example of digital stippling, made in a time-efficient manner. The dot distribution isn't machine-made "perfect" and resembles handmade work convincingly, but still obviously follows some noticeable algorithmic patterns.

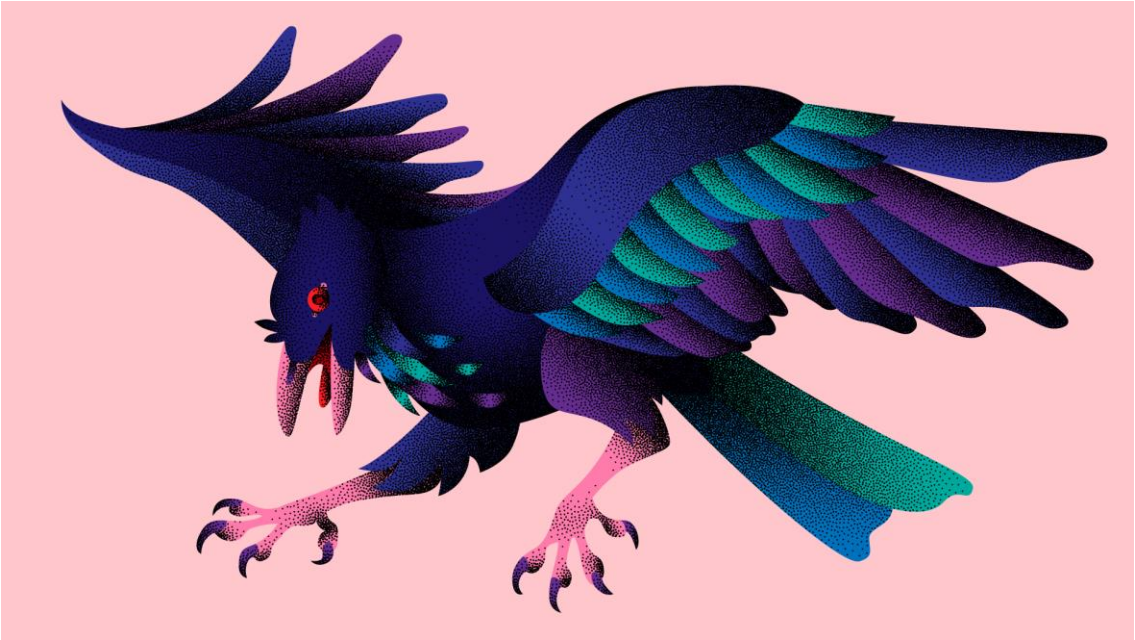


FIGURE 48. Finalized Stipplism plugin stipple effect

FIGURE 49. Detail of the finished work from Figure 48

To produce more Pointillism-like visuals, the Stipplism effect only needs to be adjusted slightly. Beforehand, all the duplicate vector objects must have their gradient colours set to the preferred dot colour at 100% opacity for areas where the dot density should be high and the 0% opacity where the dots should fade out. Then in the Stipplism options window, the only mandatory change is setting dot colour to Sample Object so the effect would take on the colours of the gradient. The rest of the options such as Density can be adjusted to preference. The only setback for this method was that it cannot be used with freeform gradients as they do not support opacity changes, so some gradients had to be adjusted.

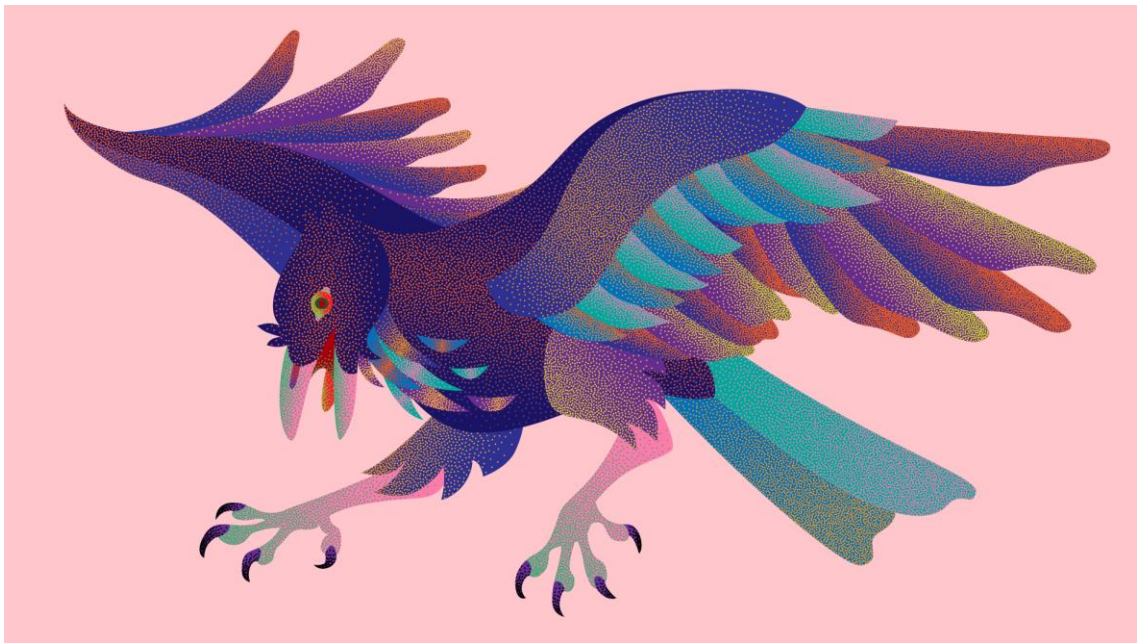


FIGURE 50. Finalized Stipplism plugin Pointillism effect

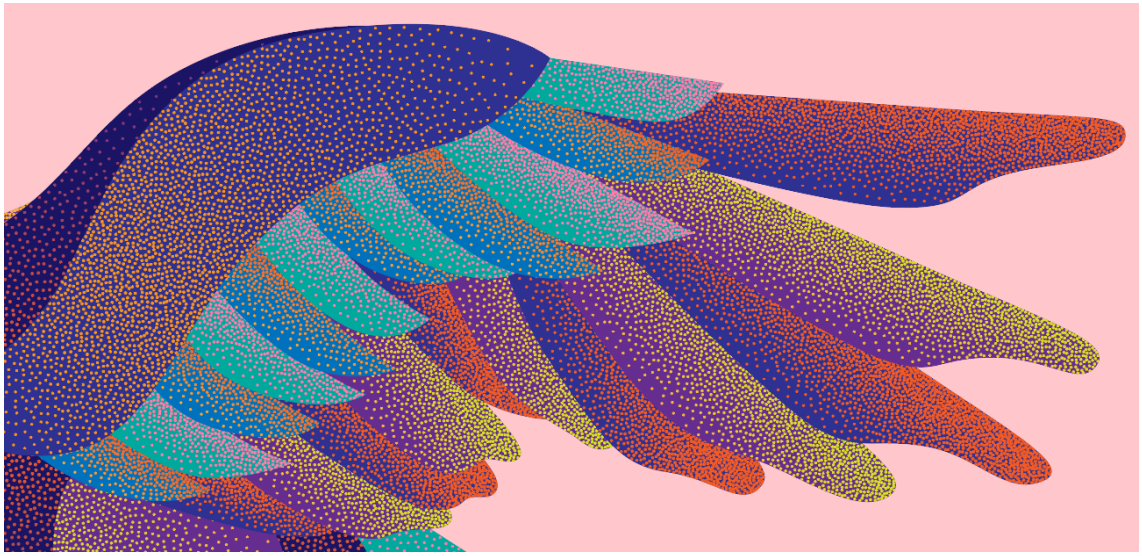


FIGURE 51. Detail of the finished work from Figure 50

4.3.1 Benefits

The incredible variety of options available in the Stipplism menu allow for great accuracy when expressing the artist's preferences in dot work. A lot of control can be had over each aspect of the technique and new changes can be previewed instantly. The effects also dynamically adjust to any edits made to the base vector shapes themselves, making the work process very smooth.

Using Stipplism, both stippling and Pointillism can be recreated effectively without much issue. Neither style is inherently harder to replicate and there are options available that cater to both techniques. Colours remain vivid and there is no need to use blending modes or any other effects to achieve the best possible visual results. Therefore, once the user is familiar with the plugin options, they do not have to learn any additional steps to start working.

The plugin properly utilizes its vector environment as well, making it simple to turn each dot into a separate vector object by using the Expand command, working well in combination with other vector graphics effects and being independent of the document raster resolution. It also supports user-made vector shapes in the Symbol Stipple tool as replacements for standard dot work.

4.3.2 Drawbacks

The most obvious drawback of using Stipplism is its cost. While the first 7-day trial is free, continuing to use the plugin afterwards requires the user to purchase a year's worth of subscription from Astute Graphics, which costs 119$ at the time of writing. There is no way to purchase only one of the plugins for cheaper or select a shorter subscription period – the only way to gain access is to buy the entire service for a whole year.

Relating to the involvement of Astute Graphics is the fact that committing to use this plugin requires the user to become dependent on a third party to keep their software up to date with Illustrator and continuing to provide an uninterrupted service. If the plugin develops a critical issue and can not be used anymore or its developers discontinue it, the artist may not have any means of continuing to produce the exact same visual output in future works. This can be a potential problem for long-term projects or dedicated clients.

Lastly, while software performance did not seem overwhelmingly affected during use of this plugin for most of the work time, it did cause some stuttering when the Stipplism effect was used in conjunction with a freeform gradient, or several vector objects affected by the Stipplism effect were moved across the canvas. In larger projects with more vector objects in the layer hierarchy, the building performance requirements might begin affecting the stability of Illustrator.

5 COMPARISON OF METHODS

5.1 Criteria

When establishing criteria for comparing digital reproductions of traditional art styles, there are two major sides of discussion that need to be considered. Firstly, the results must be appraised as representations of the original style they were inspired by – are they faithful recreations, and are they relatable to their source? It must be possible to view a work of vector stippling or Pointillism and recognize it as such, or at the very least draw notable connections between the traditional art method and its digital successor. This aspect will be referred to as authenticity, and traditional stippling and Pointillism will be used as benchmarks.

Secondly, the criteria need to provide means of justifying the continuity of these methods in the modern digital medium. For one, if a specific method makes the art style more accessible to a wider community of artists, it is providing ease of access – this can manifest as no entry cost, a robust documentation system or simple setup. Flexibility must be considered as well – how well can this technique be adapted to different demands of the work, what are the things that cannot be achieved with this method as opposed to what it excels at?

Lastly, merit is found in innovation and adaptation to the digital medium as well. Some methods might bring a fresh evolution to what we consider stippling and Pointillism, pushing boundaries in their visual expression or the tools with which the work is done. Changes such as this can be vital to keeping an art form alive, and therefore will be recognized as a separate criterion – innovation.

For the purpose of keeping sentence structures clear and readable during comparisons, the three methods from here onwards will be abbreviated to single letters – filtering and blend modes (A), Brushes (B) and dynamic generation with software plugins (C).

5.1.1 Ease of access

Out of all three choices, method A has a clear head start on accessibility as it does not require any additional setup or assets to be installed before it can be utilized. Both filters and blend modes are built-in features of Adobe Illustrator that are quick to access through its menu system. This means that method A will not cause conflicts with any other tools in the software and remain up to date alongside the rest of the Adobe ecosystem, which might not always be the case for methods B or C. Despite not requiring any additional setup, this method is not entirely straightforward to understand, utilizing multiple seemingly unrelated effects and tools that can form unexpected interactions – a lot of experimentation might have to be done to fully master the method.

Method B has relatively low minimum requirements for its setup, but potential for high maximum requirements. At the very least, the user must find and acquire a brush pack in an online asset library that will suit their needs, and then open it in Adobe Illustrator. However, if a suitable tool cannot be found for free, one must either be purchased or made by hand using the brush editor, which can be a complicated process for newcomers. Once brushes are acquired though, they generally can remain compatible with Adobe software for many years despite software updates (Spooner's 2015 stipple brush pack is still useable in Illustrator 2021) and are easy to master even for beginners.

The highest level of entry is undoubtedly for method C, which comes at a 119$ yearly subscription plan as well as installation of third-party companion software. There are no legal means of working in this specific method for free beyond the Astute Graphics 7-day free trial, so there is a lot of pressure on the user to make the best out of this investment. It can be difficult to justify a purchase with this much commitment unless an artist is exclusively working in dot work styles or can fully utilize the rest of the tools made available through the Astute Graphics subscription. Alternatively, a competing plugin could be used if one was developed to the same quality standard - however, since Stipplism is the only available option at time of writing, the method was judged purely on its merits. On the other hand, Stipplism's menu systems are very clear in their terminology and

simple to learn – the plugin can be utilized to its fullest potential with no additional training.

5.1.2 Flexibility

The least flexible method out of the three by far is method A. Both the grain filter and blending modes have associated limitations that multiply with each other when the effects are used in conjunction, turning method A into a game of figuring out what combination of options will produce the least number of issues. While a traditional dark-on-light stipple shading effect can be achieved relatively seamlessly, any introduction of coloured dot work complicates the work process immensely. Since the grain filter is also technically a raster effect, it is dependent on the work document's resolution settings – therefore, varied dot sizes can not be achieved using this method.

Both method B and C offer a much wider range of flexibility, though B excels in it even beyond its close competition. The nature of utilizing brush effects on hand-drawn vector paths brings more customization possibilities, giving the artist full control over each aspect of the work process and accommodating both stippling and Pointillism style exploration. This comes with a drawback, however, as there is a maximum ceiling for detail depending on the hardware quality of the user's computer. Each new vector object with a brush effect increases the object clutter in the work file as well as the weight put on the software performance, eventually impacting the speed of the workflow.

Unlike method B, method C does not suffer from noticeable performance issues in most cases and offers a wide variety of customization possibilities that produce high quality effects. Each aspect of the dot work can be adjusted as necessary both on small scale (individual dot appearance) and as a whole (dot distribution and overall layout), making it simple and straightforward to recreate both stippling and Pointillism art styles, or even freely switch between them with minor setting changes. However, the dependency on the plugin's inherent background algorithms remains – it will always produce noticeable patterns in how it chooses to distribute dots and cannot be manually influenced in detail.

5.1.3 Authenticity

Method A clearly steers the furthest away from the traditional visual look of both stippling and Pointillism, being more in line with the sensibilities of modern digital art styles that tend to feature an extended use of filtering and blend mode colour adjustments. It is still more closely tied to stippling that Pointillism though, being relatively recognizable as a modern extension of the traditional engraving technique. For recreating Pointillism, the separation is a degree too far when it comes to expectations of how the style should look.

Method B, however, is probably the closest spiritual successor of traditional Pointillism in the digital era, allowing artists to showcase brilliant mixtures of raw colour on digital canvases. Imperfections created by manual work are immediately recognizable as characteristics of the artist's hand, which is important for a sense of authenticity. Method B works just as well for reproducing stippling techniques, combining the best of the conveniences of working in digital medium with the legitimacy of handcraft.

Stippling is what method C excels at the most, recreating the intricate patterns and subtle changes in dot work density found in the engraving style. It is clear how much focus was put into making the plugin algorithms simulate natural stipple form, down to the ability to affect dot roundness to deviate from overly perfect digital circle patterns. Reproductions of Pointillism seem slightly less authentic, however, as the style's characteristic bold brushstrokes generally prefer a more irregular application than can be provided by an algorithm. Still, it remains above method A purely due to its potential for customization, which gives the artist access to create more detailed, unique visuals that can resemble Pointillism much closer.

5.1.4 Innovation

As method A stretches the definition of digital dot work the furthest, it could also be considered a rather fresh digital evolution of the traditional stippling style its based on, taking on a whole new look that can only be done in digital media. As mentioned before in chapter 3.1.1, digital artists have had to make certain adaptations to keep up with the rapid freelance illustration market, and method A is one of the outcomes of this cultural change. It is by far the most efficient and cheap of the three methods in its base form, which are qualities that are highly sought after by most design customers. This allows the method to live on as an illustration style in its own right, not needing to perfectly capture that which it was originally a recreation of.

Method B does not particularly bring anything new to stippling or Pointillism in its execution besides the efficiency of being able to produce multiple stipple dots/brush strokes with one vector path. While this does speed up the overall process of producing dot work styles by cutting down on the manual effort, it is still, at its core, more like the traditional techniques than the other methods.

Efficiently automating the dot work process while not sacrificing too much authenticity, however, is a fairly innovative achievement of method C. Furthermore, while the Symbol Stipple was not extensively tested during the process of this thesis, its feature of freely changing the shape of the individual dots to any provided vector object opens a new range of possibilities in how visual patterns characteristic of stippling or Pointillism can be applied to emerging digital art trends.

5.2 Concluding thoughts

To quantify the results of comparing all three methods in a comprehensible manner, the methods were given a score for their performance in each criterion ranging between 1-5, where 1 is low and 5 is high. The results were then arranged in Table 1 below, and every method granted a final average (AVG.) mark, calculated by adding together all its scores and dividing the sum by 4 (the number of criteria).

As is apparent from Table 1, methods A and C received an equal 3-point average. While both methods have their strengths in innovation and method C excels at flexibility as well, they have serious drawbacks that prevent them from being universally applicable. Method A is too rigid in its work process and suffers from a lack of authenticity, steering too far from a traditional sense of what stippling and Pointillism are recognized as. Method C, on the other hand, is incredibly inaccessible due to its massive up-front cost, which necessitates a commitment that most freelance digital illustrators and designers cannot commit to.

TABLE 1. Comparison rankings between the three methods

Method	Ease of access	Flexibility	Authenticity	Innovation	AVG.
A	4	2	1	5	3
B	3	5	5	2	3.75
C	1	4	3	4	3

Method B embodies a positive middle ground, averaging with a score of 3.75 and gaining full marks in both flexibility and authenticity. Where it lacks in innovation it makes up for in its simplicity, friendliness to beginners and the potential it brings to expert use. Out of all options, method B may be the safest choice for most types of digital illustration or design work.

However, the scoring table is only meant to stand as an overview of the results and should not be considered above the detailed textual comparisons between the methods, as they describe specific characteristics of each method that can drastically affect how well it works in certain situations. As an example, while method B has the highest average score, it should be noted that it comes with certain performance restrictions, therefore the method might not be the best choice for large scale projects.

6 DISCUSSION

Digital illustration methods have always been technically removed from their traditional counterparts simply due to the differences in medium. To produce digital recreations of art styles existing in real space, artists have had to make various adaptations and develop innovative methods for achieving a similar sense of texture and tangibility on virtual canvases.

Two art styles in particular have garnered special interest in the digital illustration community – stippling and Pointillism, collectively recognized as dot work. The goal of this thesis was to explore their respective histories, as well as their presence in modern digital art and the methods used to recreate these traditional styles. A fascinating connection was found between the emergence of the flat design style in mid 2000s and the popularity of dot work in illustrations, its prominence largely attributed to the shifting demands in freelance illustration work and the gradual move away from skeuomorphic styles.

Through analysing both their historical presence and the place they have in the digital medium, an overall understanding was formed about stippling and Pointillism which could be used to set criteria for judging how different vector dot work creation methods fare in comparison to their traditional counterparts, as well as against one another in different contexts. The three methods were tested in Adobe Illustrator, utilizing the same vector image in service of fairness, and the results were compiled in a scoring table to provide an accessible guide to the comparison outcome.

With the current freelance illustrator job market growing more competitive and fast paced, artists and designers must be able to make informed decisions about their tools of choice as efficiently as possible, and the results of this thesis aim to provide the necessary information to do so. Not all vector dot work methods will be applicable for all job projects, as each excels in different aspects – that is the main takeaway from this research.

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