Organic Complexity and AI in Generative Art

Enchanting Algorithms: How the reception of generative artworks is shaped by the audience's understanding of the experience

Paper

Topic: Art

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Abstract
Since the definition provided by the first Generative Art Conference in 1998 [1], there have been a number of other important attempts to define Generative Art such as those by Galanter (2003) and Boden and Edmonds (2009), or to categorise its different forms and components such as Dorin et al (2012). However, there are perhaps fewer attempts to account for the factors that influence the experience of the audience. This paper considers the particular characteristics of Generative Artworks that may shape their reception, as well as both the artist's and audience's understanding of the experience they offer.

In doing so it will argue that Alfred Gell's [2] conception of 'art as a technology' capable of 'enchanting' its audience, is particularly relevant to the understanding of Generative Artworks. The audience's perception of qualities such as 'technical virtuosity' and 'visual complexity' can be seen as having a particular impact on the reception. The nature of Generative Artworks as processes negotiated between human and machine in the production of unpredictable outcomes lends itself to Gell's description of a seemingly 'magical' technology. Furthermore, this conception may be reinforced by wider contexts outside the artwork.

In considering the audience's experience, it is necessary to examine the contexts brought to the work by the audience. This includes current debates surrounding the invisibility of computational processes [3] and the opacity of code, including neural networks and machine learning algorithms [4].

This paper considers how these elements, both within and outside the artwork itself, influence the reception. It discusses examples that take differing approaches to the audience, including artworks created by the author since 2016 as part of an ongoing practice-based enquiry.

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Key words: Generative Art, Enchantment, Audience, Experience

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In considering the audience's experience, it is necessary to examine the contexts brought to the work by the audience. This includes current debates surrounding the invisibility of computational processes and the opacity of code and algorithms. This paper considers how these elements, both within and outside the artwork itself, influence the reception. It discusses these issues in relation to artworks created by the author since 2016 as part of an ongoing practice-based enquiry.

Introduction

Since the definition provided by the first Generative Art Conference in 1998 [1], there have been a number of other important attempts to define Generative Art such as those by Galanter [2] or Boden and Edmonds [3]; or to categorise its different forms and components such as that by Dorin et al [4]. However, there are perhaps fewer attempts to account for how the features and characteristics of Generative Artworks (GAs) may affect their reception. This paper considers the particular characteristics of GAs that may shape their reception, as well as both the artist's and audience's understanding of the experience they offer.

The definition of GAs is often broad and can be extended to include a range of practice both computational and non-computer based, from mosaic patterns to AI systems [2]. However, most definitions note two key defining features: the presence of a system, and a level of autonomy or control passing from the artist to the system. It might be defined as simply "any art process where the artist uses a system … which is set into motion with some degree of autonomy" [2]. Boden and Edmonds also note the autonomy inherent to GAs, arguing the system "takes over at least some of the decision-making". Although crucially they add that the "artist determines the rules" [3]. This begs the question of how autonomous the system or machine is allowed to be and to what extent therefore it is shaped by the artist.

These defining features give rise to other qualities which, while not defining, can be seen as common characteristics or aspirations. Key among these characteristics considered here are complexity and an opacity. Celestino Soddu has noted how GAs produce "events that are unique and complex" [5] adding that these are closely related. For Philip Galanter complexity is not

inherent to the GA since they can also be simple and predictable [2]. However, Galanter argues that the work that aspires to an 'effective complexity', by balancing order and chaos, may have the greatest potential [2, 6]. The opacity, I would argue, takes different forms but is related to both complexity and the autonomy of the system. It can be seen in the opacity of the system to the audience who may have a limited understanding of how it has been made or from whom the workings are hidden. It can also be seen as a result of handing a level of control to the system. While the artist may have knowledge of the rules of the system, the results cannot be known in advance and are effectively hidden. It is these characteristics of complexity and also opacity and the hidden or unknown that will be explored here. This paper will focus on computational processes since these present particular issues for opacity and complexity.

To understand the reception of GAs it is necessary to examine the contexts brought to the work by the audience. This includes current debates surrounding the invisibility of computational processes [7, 8] and the opacity of code, including perceptions of algorithms, neural networks and machine learning [9]. All artworks are received in relation to the wider contexts in which they exist, however, this paper examines some of those specific to GAs and which may result from their characteristics.

In understanding the role of complexity and opacity in GAs, Alfred Gell's [10] conception of 'art as a technology' capable of 'enchanting' its audience, is particularly relevant. Gell suggests that the audience's perception of qualities such as 'technical virtuosity' and 'visual complexity' can be seen as having an effect on reception. The nature of GAs as processes negotiated between human and machine in the production of unpredictable outcomes lends itself to Gell's description of a seemingly 'magical' technology capable of enchantment.

Taking Gell as a starting point, this paper examines the characteristics of GAs and the contexts in which they are created and presented. It does not consider all the contexts exhaustively. Instead it reflects on a number of contexts observed while making and presenting an artwork, *Manual_assembly*. This practice based approach, which draws on 'deformance', has the advantage of considering aspects of both production and reception.

Gell and agency

Anthropologist Alfred Gell's in his work 'The Technology of Enchantment and the Enchantment of Technology' [10], and the posthumously published 'Art and Agency' [11], proposed a theory of art which considered the artwork as an 'agent' which can affect its audience. Gell considers the artwork not in aesthetic terms but in its capacity to affect the viewer. For Gell, art is a form of technology which can enchant us, having almost magical properties that lead us to respond to them as though they were living things. He gives the example of the way in which the visual complexity of patterns on the decorative boards of Trobriand canoes were said to be " 'magically' efficacious in demoralizing the opposition" [11]. As well as visual complexity, Gell argues that the perceived 'virtuosity' of the artist can captivate the audience as they struggle to comprehend how the artwork was made. The materials and tools may be understood but the "complexity of the artistic decision making process" defeats the audience [11]. The hidden process, Gell suggests, exerts its own form of agency. In relation to GAs this virtuosity may be attributed in part to the system itself rather that the artist. We may understand the tools and the material, computers and code, but at least part of the 'decision making' is hidden from us.

Gell suggests that all art objects act as agents but this may be particularly true of GAs due to a common intention for them. Rather than a single proposition, they offer a spectrum of possibilities which in turn have an impact, generating new knowledge, understandings or experiences. This is not to imply that there is no single concept or idea underlying the work or that many interpretations

of any given work are possible. It merely notes their dynamic nature, where intentions are balanced against the unexpected results with the potential to generate an effect. It has been noted that GAs often traverse disciplines, and can present new possibilities and ways to think about the world [1]. This is not to suggest that it is the sole preserve or purpose of GAs but just to note that a common characteristic is that they have an impact on practices, disciplines and understandings of the world.

Gell's ideas have previously been applied to computational artefacts including Daniel Miller's account of websites as traps, noting the way that they model the creator and the audience [12]. Meanwhile, Adrian Mackenzie has noted the relationship between Gell's description of agency and the 'animating' effects of algorithms whereby complexity invites the attribution of agency [13]. Mackenzie argues that algorithms, like the intricate geometric patterns of Celtic knots or Oriental carpets, posses a "cognitive stickiness" [13]. The complex patterns of knots lock the eye into a constant state of animation and present a "perceptual problem" that cannot be satisfactorily resolved [13]. Mackenzie argues that "[a]lgorithms have similar animating effects on their recipients: they put into question who is moving what" [13].

Here we can see how considering agency leads to a questioning of who is being affected by what and why. As Nicholas Thomas notes, it is not claimed that the art object has an effect "independently of a field of expectations and understandings" [14]. Gell has been criticised for seeing as irrelevant many contexts including its 'aesthetics' and the aura of the artwork by treating it as a form of technology [15]. Rejecting the contexts in which the artwork is made and exists has been widely seen as a considerable flaw in this theory. It has also been pointed out that his theory is itself enchanting in the apparent complexity of its detail [16]. However, as Howard Morphy notes, what is useful is that he shows that the artwork can act as an agent and leads us to consider what the effects might be. Gell deflects attention away from human agency by instead attributing it to the objects themselves [15]. This can be useful in allowing us to attribute at least part of the agency to the artwork itself, distinct from any intentions by the artist. However, this must be balanced by the other "historical and contextual factors" in which they are enmeshed [15].

Manual_assembly

Many of these issues relating to agency, perceived complexity and opacity came to the fore while producing and presenting an artwork called *Manual_assembly*, produced by the author as part of a practice-based investigation. *Manual_assembly* is a relatively simple GA program written using Processing. When running, it changes random values within the Scalable Vector Graphic (SVG) image files of an IKEA instruction manual for a Billy bookcase. This changes the attributes of certain lines, such as their length, curvature, weight, position etc. The SVG is then displayed and in this way a new 'drawing' of an IKEA manual page is displayed every 10 seconds (figure 1), which is approximately how often a Billy bookcase is sold. Subsequent versions altered the work in order to draw out other aspects. This included presenting it as a twitter bot called @Manual_Glitch and a three volume set of books.

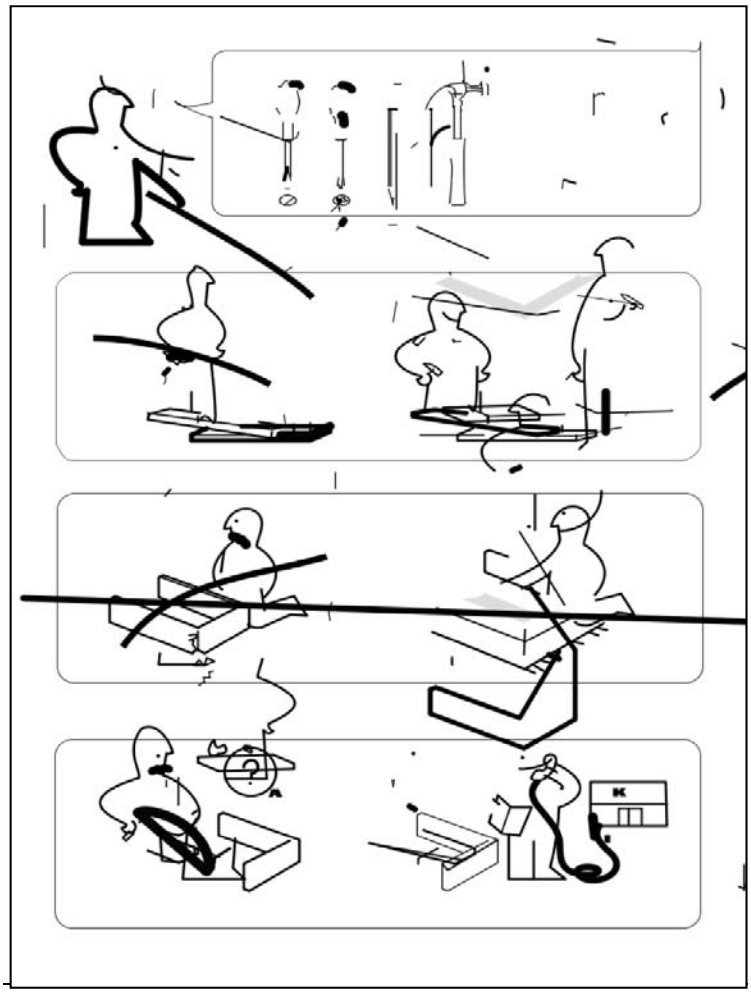

Figure 1. Screen grab of the output of *Manual_assembly*

The approach borrows from 'deformance', put forward by Jerome McGann and Lisa Samuels [17] initially as an approach to the study of written texts, but which has also been applied to other media. Deformance, a portmanteau of deform and performance, involves altering a text, in order to present a new perspective that may reveal new understandings. Each deformance is a 'performance' of the text and aims to draw attention to the "constructedness of a text" and its seams [18], challenging the assumptions about how it was put together. The deformance here works in two ways. The drawings of the IKEA manual are deformed to reveal something of the audience's relationship with the image. However, I also deformed the system, by altering the code itself, in order to try and reveal my relationship and working process.

Complexity and Virtuosity

When considering the complexity of *Manual_assembly* it is important to note that it would score low in terms of effective complexity, consisting of a simple process of randomizing values. Neither can I make any claims to particular technical virtuosity. However, as Galanter and Levy suggest, complexity is "a matter of content, not complicated technique" and involves "large numbers of components interacting in nonlinear ways" [19]. In this way *Manual_assembly* suggests complexity by showing how many components, individual lines and parts of lines, make up the 'whole' image. Ian Bogost notes the dazzling effect that exploded diagrams can have. Rather than being solely informative, we are captivated by the sheer complexity of the system they show and enter the otherwise inaccessible and "murky otherworldliness" [20]. But this complexity requires a careful balancing of order and chaos in relation to the context of the original image.

Manual_assembly uses a random approach to the placement of the lines but this is balanced against the order of the underlying image. The system has been carefully set not to alter the original to a point where it can no longer be recognized and rendered as an SVG image. It has also been set to produce images which are noticeably different to the original and which seem to generate pleasing or fortuitous combinations quite frequently. A great deal of the complexity would seem to be a matter of perception and judgment. Without my knowledge of what the original should look like – clean lines, well placed and spaced so as to give an unambiguous presentation of the drawing as information – it would not be possible to balance the order and chaos. It also requires a very important context brought to the experience by the audience which is an appreciation of the original images, of IKEA and the experience of constructing flat pack furniture. The drawings produced may seem closer to our experiences of flat pack than the original ordered images (figure 2).

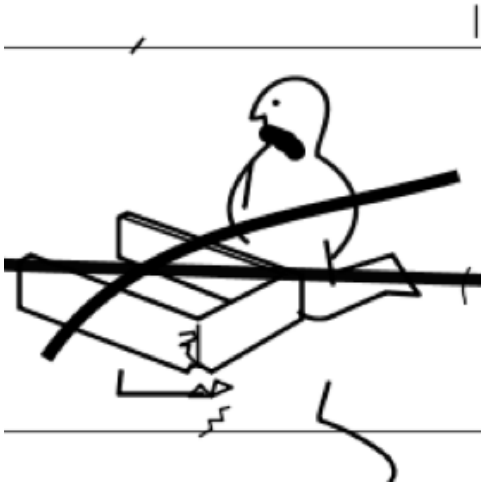

Figure 2. Detail from output of *Manual_assembly*

Anna Munster argues in relation to networks, that complexity is something that can be made perceptible [21]. Recognising a pattern is then a matter of perceiving and recognizing something already seen. This raises questions as to what the role of the human is in, if not determining the outcomes of a GA system, influencing or validating them by perceiving complexity. Similarly, Vilem Flusser in his description of the technical image, highlights the role of the human in selecting and drawing significance from an automatically generated image. It involves "stopping at a situation that human beings have determined to be informative" [22]. This shows an inherent contradiction as the improbable, through its encoding in the system, becomes probable. So "that which was programmed into the apparatus as negative entropy is transformed into entropy" [22]. Here it is the limits of the human that determine the outcome - both artist and audience. Bogost similarly notes the human centric approach, arguing that typically "the idea of computation is inextricably linked to human understanding, experience, and knowledge." [20]. The human limits are (inevitably) encoded into the work/system as Scott Dexter notes [23]. If not acknowledged this would seem to limit the potential for GAs. What if we can't see the patterns in the chaos and so engineer them out? This is not to propose a solution but it is important to acknowledge the potential problem.

Aside from the potential for complexity encoded in the system, it became clear that the code exerted an agency simply by being code. When selected for an exhibition of contemporary drawing practice the selectors opted to exhibit *Manual_assembly* as a screen recording rather than a running version of the program (figure 3). This screen recording begins by showing a computer desktop and the code visible in the Processing window as the program is started. It ends when the program is stopped before the video loop starts again. This initially came as surprise but on reflection seeing 'behind the curtain' to be made aware of the code has an important role in shaping and framing the audience's understanding of the images. If seen simply as a series of

images made by some unspecified means, it would be far less engaging. When the work was mentioned at a subsequent discussion panel one of the selectors noted it specifically for its use of code as a tool. The agency of the code is such that just seeing it fleetingly can shape the experience. This is in contrast to another version of the work in which the code is completely hidden.

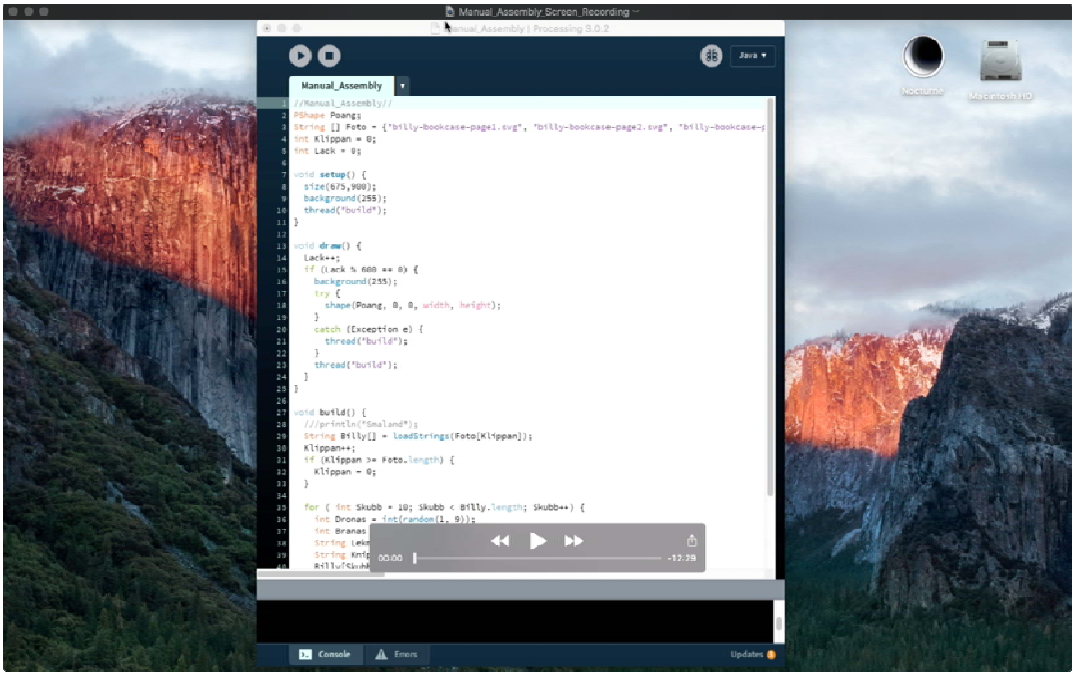

Figure 3. Screen grab of *Manual_assembly* video loop

Manual_assembly was also turned into a twitter bot, @Manual_Glitch (figure 4), which generates new 'drawings' daily. Here the code is not visible at all and nor is it presented in a gallery context. Comments from those who liked or followed the bot did not mention code or workings at all and focused instead on the novelty and currency of the images. For example, commenting that more people should know about and share the images produced. It had lost some of its identity as a generative process and artwork. Instead the images produced became the focus as they were enmeshed in a network. Each image, detached from the process, becomes what Rubinstein and Sluis call a "networked object" [24]. The agency of the code and how it was made are gone but it has gained new agency as the emphasis shifts to the "processes of valorization within computational culture" [24]. The system of the GA has intersected with the system of twitter, a situation with the potential for unexpected results that may overcome the human limits/intentions encoded into the system.

Figure 4. Screen grab of @Manual_Glitch twitter bot

Another example of a GA that exists in a similar 'real world' context is Shiv Integer by Matthew Plummer-Fernandez in collaboration with Julien Deswaef [25]. Shiv Integer is a bot which remixes objects on 3D model sharing website Thingiverse, creating new model files which are re-uploaded to the site with "word-salad names such as 'disc on top of an e-juice golf'" [25]. As the creators have noted, the reaction of fellow Thingiverse users is varied from those who simply do not understand the purpose of the generated models dismissing them as pointless, to those actively annoyed by them. While these reactions might have been anticipated, one user's response was markedly different. The user decided to create back stories for the objects, inventing histories and contexts. This unintended collaboration between the bot and an individual goes beyond the imagined limits of the original bot and has produced a new poetic existence. This seems to hint at the possibilities where GAs are allowed to stray from their original purposes and contexts, breaching the limits of the artist's understanding.

Opacity of code

Many theorists have noted the opacity of code, algorithms and software including Dourish [26], Bridle [8], Burrell [9] and Campinelli [7]. Jenna Burrell argues the opacity of algorithms poses particular problems for accountability and our ability to question how these processes work and that we might begin to redress these issues by auditing code – involving a careful assessment of what the algorithm does [9]. However, as both Burrell and Dourish note, this is not an easy endeavor since issues of commercial secrecy and also literacy come into play, with the ability to read or understand algorithms a "highly specialized skill" [26].

Another layer of obfuscation comes from slippages around terms. Often code, software and algorithm are used interchangeably. It has been noted that, even within groups of programmers, slippages occur [27]. That there is confusion about the precise meaning of these terms even among experts reflects a wider general lack of understanding. Algorithm in particular has entered common usage to describe almost any system involving a computer, and typically to suggest their 'black box' nature. An article recently published in a UK newspaper entitled 'Franken Algorithms' claims

"[f]ew subjects are more constantly or fervently discussed right now than algorithm" [28]. There is a suggestion in pubic discourses that we should fear algorithms because we, typically, do not understand them.

It has also been said that even artists working with code may not fully understand the algorithms and processes they are using [4]. Alan Dorin et al, while recognising the pedagogical value of imitation and the use of tools such as Processing, are concerned that "these systems operate as 'black boxes' whose internal operations are obscure to the artists and designers using them" [4]. Another deformance of *Manual_assembly* threw into question my own relationship with the code. I changed all of the variable and function names to the names of IKEA products such as 'skubb' and 'trofast'. I also tidied the code removing redundant lines that had been there previously, making changes that have no effect on how it functions. As a result, my very visual relationship with the code was revealed. Lines of redundant code that I had used as reference points were gone. Function names no longer described their function. The importance of the form of the code as shapes on a screen rather than its meaning came to the fore. As Hayles has noted, even "code one writes oneself can also become mysterious when enough time has passed" [29]. Code poetry, 'code work' and obfuscated code show the potential for code as an expressive form and the tension between form and function as has been noted by Geoff Cox among others [30].

What this shows is that literacy is clearly not just an issue for the audience and even makers have limits to their understanding. Seeing the code anew reminded me of the effort and learning process it had taken to construct the code and the satisfaction of making it 'work'. Perhaps this is what we find appealing in the first place in wanting to employ generative systems. The agency asserts itself on us as we make the work negotiating solutions and working to find the limits of our understanding. This is not to suggest that everyone takes the same approach to coding. However, I would argue that we need to recognise the limits of our understanding. It should also be acknowledged that the artist can also be affected by the agency of code.

The Importance of the Hidden

Code and the workings of systems are typically hidden but bringing code to the foreground does not necessarily lead to transparency. Another incarnation of *Manual_assembly* does bring the code to the fore and at the same time becomes almost entirely opaque. In doing so it suggests the importance, even necessity, of hiding the working of the system.

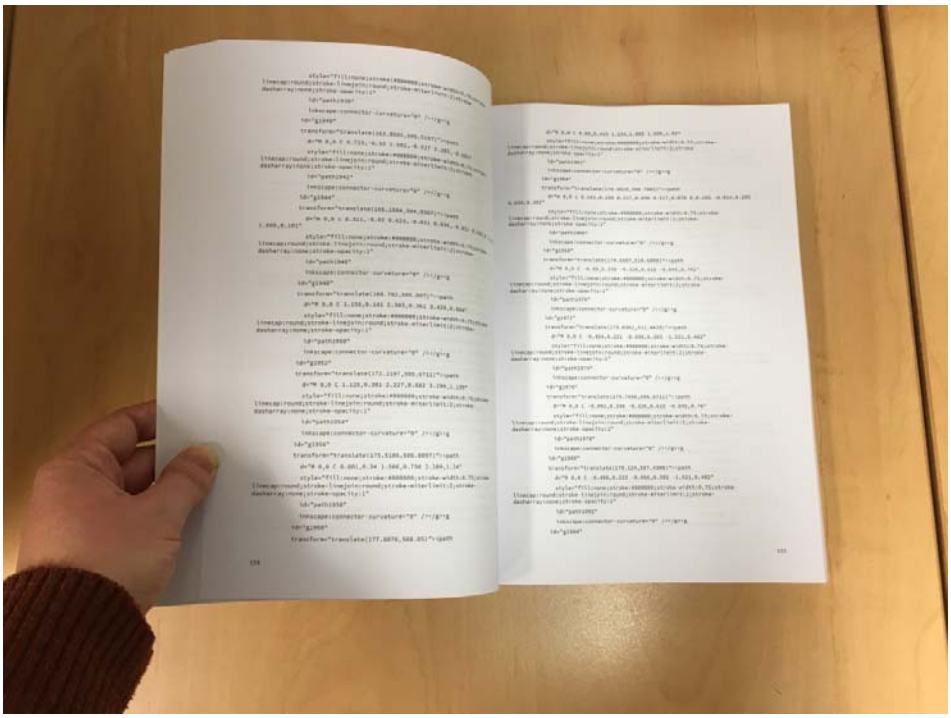

Figure 4. *Manual_assembly* in book form

All of the Processing code and SVG data has been contained in three A4 650 page volumes (figure 4). While the code may be understandable to someone familiar with programming languages, the SVG data, which makes up all but 2 of the pages, is far more impenetrable. Not because the information cannot be read. The markup language of SVGs explains in detail the properties of each line, each angle and point. But the vast quantity of information and the time it would take us to process reveal our human limits. This version shows the opacity of the code precisely by bringing it to the fore. Revealing leads to greater mystification. In addition, without the system – the generative aspect – it is transformed into something else. The vitality has gone and with it the agency seems to have been diminished. That is not to say that it is without agency. The opacity of the code and redundancy of the books as objects, amplifies the differences between human and machine, making them manifest. If I were to execute the code by hand, while the results may look much like the output when the program is run by a computer, it would have a very different character. It will be bound up in the laborious nature of its production and by implication my own will and efforts. This would surely overshadow the images themselves. By revealing all, some of the mystery has gone and the process is all too explainable if not fully accessible. The hidden workings leave a space for imagination.

Boden and Edmonds suggest that for the artist, and the computer scientist, writing algorithmic code gives the " 'feel' of fully controlling the computer", but that this does not necessarily hold true for GAs since they are defined by constraints and rules [3]. And yet as we have seen it is the human that often defines the outcome. There is a contradiction whereby we seemingly want to control our machines and yet also want them to be independent from us. As Steven Connor argues "[o]n the one hand we want to explicate their workings, to work out how they work, thereby demonstrating our priority over them", but on the other hand we want those workings to be "absolute and autonomous of us" [31]. We want to be in control but also expect to be surprised. Dexter argues that have a desire for mystery and for the "yielding of authority" [23]. For Dexter what characterises our relationship with computers is the relationship between the hidden and the revealed. He goes so far as to suggest that we want or need the workings to be hidden from us lest we recognise the limits of the system as our own human limits [23]. Computers are capable of virtually limitless possibilities and yet they are constrained by humans and "[t]he code produced by extremely fallible humans" [23].

GAs offer us the possibility of creating new and unexpected results, but this is only possible if some things are hidden from us. Not only does this prevent us from anticipating the results making the process redundant, but it also leaves room for us to misinterpret the results or even have a misplaced belief in their capabilities. Thomas et al describe algorithms as like a fetish in that they are granted powers to act in the world [27]. Like fetishes, algorithms "enable parties to productively misrecognize what the technology is and does" and this leads to the potential of imagining new possibilities [27].

Our experience of GAs might best be conceptualised as an 'encounter' as described by Gillian Beer [32]. Beer describes how cultural encounters do not always guarantee understanding and can sometimes "emphasise what is incommensurate" [32]. Part of the GA will always be hidden and perhaps as we want and need it to be. Attempting to understand our differences is where we can learn the most. The encounter also considers unforeseen and inappropriate audiences who might therefore bring very unanticipated responses and different knowledge [32]. Importantly they also bring "into active play unexamined assumptions" and may allow us to see "unexpressed incentives" [32]. If we consider our interactions with GAs as encounters, then we might highlight the incommensurate and examine the unexpressed and hidden parts. Importantly, these can be encounters not just for the audience but also for the artist.

Conclusion

This paper has set out to show how the reception of GAs is shaped by perceptions of their complexity and their opacity. The opacity is partly the result of literacy but also wider attitudes to computers, code and algorithms which tend to both mystify and also generalise. Complexity is potentially a matter of perception but is no less captivating for it. Much of this stems from our inability to fathom the decision making process behind the system that creates the artwork. There is a negotiation between the control of the artist and the agency or autonomy of the machine, but there is a similar negotiation between the artwork and the audience. To understand the reception it is necessary to recognise that GAs also exists in a network of other contexts, many of which the audience bring to the artwork. Contexts such as where they are encountered shape what we expect from them. These contexts can also change the agency of the artwork, often in ways unanticipated by the artist.

Ultimately the experience is constrained by the limits of our own understanding. The artist is no less susceptible to these contexts and the limit of their own understanding. However, these limits and the hidden character of the GA may be something that we cannot avoid and may even be needed in our relationship with them. The hidden leaves the space for imagination, faith and belief in what they can do, suggesting new possibilities. They allow us to imagine a 'liveness' and vitality that makes them captivating and enchanting.

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