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Crochet Lace as Expression of Digital Culture

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Introduction

Human designed physical patterns, while having been investigated extensively in terms of their historical, geographic and cultural significance and their aesthetic and/or mathematical characteristics, have not been fully investigated in terms of their evolutionary potential. This paper discusses an experimental art research project which focuses on human designed, physical textile patterns to explore pattern as *process* and investigate the potential for these patterns to evolve and become *emergent*.

The experimental art projects focused on lace and in particular, crochet lace pattern forms commonly referred to as doilies.[1] Crochet lace patterns are widely recognized, domestically produced hand-made physical patterns created from a low-technology repetitive manual process and located for the most part within a craft context. The project explored the developmental potential of these physical pattern forms by translating them into digital media and working in the digital environment. The research created crochet lace pattern simulacra in the form of a series of digital animations written in computer programming code that illustrate how digital crochet lace patterns form.

This paper discusses the properties of lace that make it worthy of further investigation, the motivation behind the selection of crochet lace patterns, and explores the digital environment and its impact on the development of the crochet lace pattern forms. It then reports how the digital crochet lace patterns, when created in a digital environment and constructed using digital media and manipulated by computational processes, became a hybrid form – that is, an amalgam of human design decisions and computational processes. As such, the crochet lace simulacra epitomize the intersection of computational processes and human intervention which is common in the digital environment.

Lace

Both the techniques employed in the production of constructed textiles and the materials used have a direct impact on the structure of the fabric created. For example, a woven fabric differs both visually and physically from a knitted fabric. In turn, the structure of the fabric influences the form that a pattern takes, be it within or on the fabric. Therefore, pattern designs for constructed textiles must take into account the technique employed in the construction of the fabric. In addition, a design must also account for the way in which the fabric forms – that is, whether the fabric forms, vertically, horizontally, in the round, etc – as this will ultimately impact on the form of the pattern.

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[1] The name comes from Mr D'Oyley, a nineteenth century shopkeeper in London who sold fabrics. See Mary Konior, Heritage *Crochet: An Analysis* (London: Dryad Press Ltd. 1987).

The relationship between technique, structure and pattern is pronounced in lace. Although lace can be made from any one or a combination of techniques and a broad range of materials can be used, the making technique impacts profoundly on the pattern form. This is because the manipulated thread or threads create, not only the structure of the fabric, but also the pattern. In other words, with lace the structure of the fabric not only *influences* the pattern, it *is* the pattern; the structure and pattern cannot be divorced.[2] Virginia Churchill-Bath summarizes the relationship stating: "Lace may be defined as an openwork fabric in which the pattern is achieved with threads that are basic to the structure of the fabric."[3]

In addition, lace is constituted by a double structure conjoining the material (the thread) and the immaterial (the space between the thread). The threads define spaces that form an integral part of pattern. Pat Earnshaw suggests that lace is "a lot of holes surrounded by thread."[4] The spaces, or 'holes' as he calls them, are defined areas purposely constructed as part of the pattern.[5]

The integrated nature of the relationship between materials, technique and pattern has contributed to a sustained interest in lace and lace making. Unlike many forms of constructed textiles, lace does not have any significant utilitarian function; it is used primarily to adorn and decorate. This should enable sustained attention to be focused on exploring, investigating and innovating the pattern, whether formally or aesthetically. However, as Churchill-Bath observes, lace-makers have primarily recycled pre-existing lace patterns:

> Lace-making potentially offers artists as much freedom of personal expression as do painting and drawing, but traditional lace patterns were almost always copied from another lace or from someone else's pattern.[6]

Furthermore, Rosemary Shepherd, curator of the Powerhouse Museum 2nd International Lace for Fashion Award 2001, suggested that lace had not changed to any great extent in more than 500 years.[7]

Therefore, the research project sought to investigate whether the lace pattern making process can undergo change to such an extent that substantially new lace patterns can emerge. The research focused in particular on one form of lace pattern, crochet lace.

Crochet lace

The crochet technique involves the manipulation of a single continuous thread with a single metal, wooden or bone hooked tool. The thread is manipulated to form stitches that make up the modular pattern forms. There is some dispute as to whether patterns made using the crochet technique can be classified as lace because the patterns often incorporate less space in their

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2 Pat Earnshaw, *The Identification of lace* (Riseborough: Shire Publications Ltd 1980), 45.
3 Virginia Churchill Bath, *Lace* (New York: Penguin Books 1979), 25.
4 Earnshaw, Op Cit., 45.
5 Roberto Casati & Achill Varzi. *Holes and Other Superficialities* (Cambridge, Mass.: MIT Press and London: Bradford Books1994), 20, and Churchill Bath, Op. Cit., 25.
6 Churchill Bath, Op. Cit., 5.
7 Rosemary Shepherd, "The Contemporary Lace Exhibition 2001" http://www.phm.gov.au/media/lace2001.htm.

design and, therefore, lack the openness and transparency of other techniques.[8] However, despite this criticism, crochet lace patterns exhibit many of the properties of pattern which make pattern available for manipulation and change. Therefore they make an excellent source material for the experimental art project.

The motivation for selecting crochet lace patterns for the experimental project was fivefold. Firstly, while crochet is a thread-work technique that can be used to make fabric suitable for functional items, it is also one of the many techniques that can be used to make lace, and so is a technique that allows focus to be directed on to the pattern. Secondly, while the history of the technique is disputed and is believed to have evolved from techniques such as needle-point and tambouring, crochet as we recognize it today is a relatively new technique believed to be no more than 200 years old.[9] Therefore, it offers a condensed period in which to examine any potential development of the pattern form. Thirdly, while machines were built to recreate woven and knitted textiles and various types of lace during the industrial revolution, attempts to imitate crochet-lace were not successful, primarily because of the complexity of the construction of the stitches. So crochet lace patterns were impacted only minimally by the industrial revolution.[10] Fourthly, the development of the pattern form appeared to reach a stasis. This was primarily due to the pattern making process being situated in a craft context where innovation and originality were neither valued nor a requirement.[11] As a result, there existed a general apathy and active discouragement of the creation of new innovative patterns. Throughout its short history, crochet lace pattern making had referenced, resembled or recreated existing patterns. Furthermore, many hobbyist lace-makers were solely interested in engaging with the meditative process as relaxation, with little desire to be innovative.[12] Finally, an important motivation for exploring crochet lace pattern forms was the extent to which the instructions for making crochet lace patterns have been documented. Initially these instructions were verbose and difficult to understand for all but the experienced crochet lace maker. However, at the end of the 19th century and beginning of the 20th century, pattern instructions developed into a 'shorthand' or form of code and became more systematic, akin to the syntax used within pattern books today. While pre-existing computer software, similarities between this 'crochet code' and software programming can be observed.

Innovation

Physical crochet lace patterns, being located in a craft context, developed out of a set of long-standing and accepted aesthetic values that are an amalgam of the application of subjective human design and craft tradition. In order to examine their developmental potential, it became necessary to break the flow of tradition culminating in this pattern form and to disrupt the existing aesthetic. This involved removing the pattern forms from their craft context and

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8 http://www.fairfaxcounty.gov/library/information/arts/crocheting.htm, and Lis Paludan, *Crochet: History and Technique* (Colorado: Interweave Press. USA 1995), and http://www.powerhousemuseum.com/pdf/research/classification.pdf.

9 Konior, Op Cit., 10. A more reliable, less speculative history is offered by Lis Paludan. OP Cit., 76.

10 Judith, L Gwynne, *The Illustrated Dictionary of Lace* (London. B.T. Batsford Ltd 1997), 96-108.

11 Mary Waldrep, *Introduction to Masterpieces of Irish Crochet Lace* and ed.Therese De Dillmont (New York: Dover Publications, Inc.1986).

12 Rosemary Shepherd. "Structures of Necessity" *Exhibition Catalogue* www.lacedaisypress.com.au/philosophy.html last accessed 10/11/2008

employing an art practice approach. In repositioning the patterns as part of an art practice, the values applied to the patterns are changed and innovation becomes paramount.

Furthermore, as the experimental research employed a generative art practice approach, focus shifted away from the object – that is, the physical crochet lace pattern – towards the systems and processes inherent in the creation of the pattern form. As a result, the site of innovation shifts from the object to the process of its construction. Thus the aesthetic shifts towards a systems aesthetic.

Digital environment

Physical crochet lace pattern forms are composed from a system of organization – that is, a set of rules relating to the selection of stitches and their order of construction. The form that crochet lace patterns take is also impacted by their materiality – in this case, the threads used in their construction, the size of the hook selected, etc. In addition, the environment in which the patterns exist can also impact the pattern form. For example patterns can change from the effects of gravity, humidity, light, etc. Similarly, when creating crochet lace patterns within the digital environment, it is important to be cognizant of the influence that the digital environment and the use of digital media can have on the development of the pattern form. Therefore, it is useful to examine some of the elements of the digital environment that has the potential to impact on the development of digital crochet lace patterns.

The digital environment operates simultaneously as a series of discrete and integrated spaces. It is at once stratified, hierarchical and a mesh, and in a constant state of flow and change. It is made up of networks, operating systems, programming languages, code, data and information, and is a 'trading place' of bits and bytes. Within this 'ecosystem', a term used in relation to the Tierra project which explores evolutionary development within the digital environment, 'objects' such as modules of code, application objects, document files, images etc, can be created or 'placed'.[13]

Importantly, 'objects' that are located in the digital environment and the digital environment itself are of the same materiality – i.e. data. This commonality within the digital environment offers the potential for data and information to flow across networks, mesh-works and strata, and through operating systems, software applications and document files. The boundaries between an 'object' and its environment are less clearly defined and demarcated than in the physical world.[14] Thus, simulated crochet lace patterns constructed from computer code, existing as digital media within the digital environment, can be interjected with, interrupted by, or interspersed with data and information initiated by the operating systems, software applications, programming languages, or any of the many systems and processes operating in the digital environment.

In the digital environment, patterns are inherent at all levels. They exist as iterative processes and conceptual algorithms functioning within the architecture of the operating systems and software applications, as patterns in the markers of the code (i.e. characters used such as *!*), and as spatial patterns produced through the color or tonal structure of pixels creating graphic images

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[13] http://alife.tuke.sk/projekty/tierra/doc.html last accessed 12/08/08

[14] Lev. Manovich, *The Language of New Media* (Cambridge, Mass.: MIT Press. 2001), 46.

onscreen. In this environment simulated crochet lace patterns become one form of pattern among many. [15]

The modular structure of computer programming incorporates routines, subroutines and feedback loops. For instance, they use phrasing such as 'if/then' and 'repeat/while'.[16] Incorporating feedback into the system enables programming code to be continuously and iteratively updated. Not only can this feedback update variables and adjust execution sequences, it can also add, remove or rewrite elements of code.[17] As a result, the potential arises for a range of events or actions to occur that are unrelated to the initial coded instructions and, in short, developments, neither planned nor envisaged by the programmer, can occur. [18]

Noting these characteristics of the digital environment, the experimental research explored how crochet lace pattern form is impacted when located in this environment. The project was based on a pre-established premise that, as a process, pattern is available for change.[19] In addition, the research project established that crochet lace patterns possess some of the properties of pattern that make it available for change.[20] Therefore this suggests that crochet lace patterns are available for change. This change can occur in a variety of ways. For example, in physical crochet lace, pattern change can affect their spatial arrangements, modular construction and/or written pattern instructions. Likewise, digital crochet lace patterns can also be changed as a result of modifications to spatial arrangements, modular construction, and/or changes to the written pattern instructions.

However, in addition, the digital crochet lace patterns can also be impacted by changes made to the underlying iterative processes and programming code. Furthermore, changes to digital crochet lace patterns can be caused by a number of events. For example, one cause might be a deliberate, direct and decisive authorial action made via a mouse, keyboard or sensor. A second might be the impact of conditional algorithms written in software code. Another cause of changes may be adjustments made to variables or execution sequences as a result of inbuilt feedback loops. Finally, change may be caused by an injection of 'noise' into the system. The injection of 'noise' into the system is an alien element which, within the digital environment, can take the form of a burst of radiation, a power surge, or a coding error that has the potential to disrupt the information flow and cause an extreme mutation.[21] In this instance, the development of a crochet lace pattern moves beyond the control and expectations of the author. It is this combination of human intervention, feedback loops and injection of 'noise' that offers the potential for evolutionary development, and/or emergent possibilities.[22]

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15 William J. T. Mitchell, "Interdisciplinarity and visual culture", *The Art Bulletin* Vol 77 1995, 6.

16 A simple example of a feedback loop is the thermostat.

17 Manuel De Landa, "Meshworks, Hierarchies, and Interfaces" in *The Virtual Dimension: Architecture, Representation, and Crash Culture*, and ed John Beckmann, (New York. Princeton Architectural Press. 2000), 276-8.

18 N Katherine Hayles. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature and Informatics* (Chicago: The University of Chicago Press, 1999), 225.

19 Gail Kenning "Pattern as Process" (PhD. Thesis unpublished 2008).

20 Ibid

21 Hayles, Op Cit., 33.

22 Hayles, Op Cit., 285.

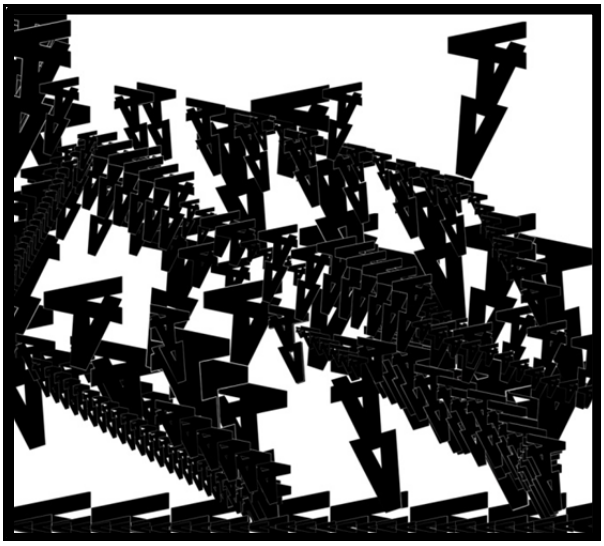

Figure 1.

However, significant change to a pattern's form can create new challenges. If what we can recognize as pattern is the result of existence of a set of rules, a system of organization, or the presence of repetition, regularity or periodicity, then randomness is that which cannot be recognized as pattern. Differentiating highly complex patterns or emergent properties from randomness may not be easy.[23]

Thus far, this paper has discussed how crochet lace patterns, designed by humans, become available for change when translated into digital media and located within the digital environment. In addition, this paper has shown the potential for these patterns to be impacted by digital systems and processes inherent in the digital environment in which they exist. However, it is important to note that even when relocated in the digital environment the patterns are not beyond human influence. The algorithmic processes undertaken in the construction of the pattern forms, the programming language chosen, and the efficiency of the software code, are all designed or chosen by humans and have a indirect impact on the way in which the patterns develop.[24]

Algorithmic processes

To demonstrate how the algorithmic processes impact on the development of the pattern forms the research explored three different approaches to 'place' stitch elements of the digital crochet lace pattern simulacra.

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[23] Hayles, Op Cit., 25.

[24] Originating out of mathematics, the term algorithm is ubiquitous in software programming. While in computer science it is strictly defined, the term is increasingly used across a range of disciplines, particularly in the emerging software, new media and digital media areas. It is within this broad context provided by Coveney and Highfield and Adrian Mackenzie that the term algorithm will be used in this paper. See Peter Coveney and Roger Highfield. Frontiers of Complexity: The Search for Order in a Chaotic World (London: Faber and Faber 1995) 27 and Adrian Mackenzie. Cutting Code: Software and Sociality. (New York: Peter Lang Publishing 2006) 43

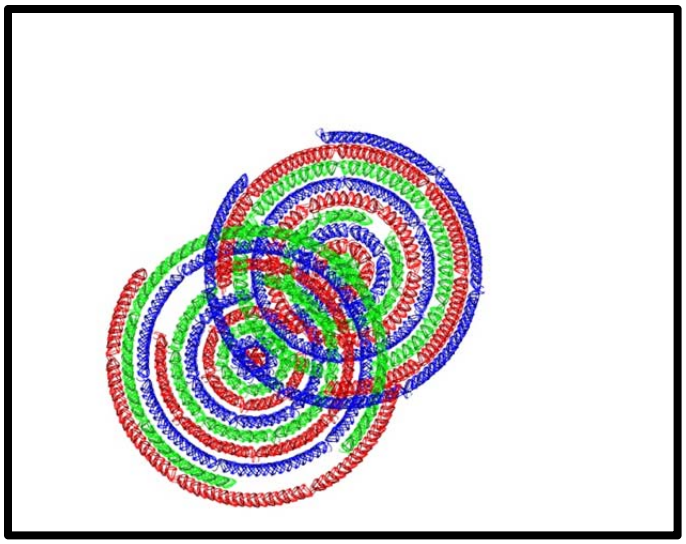

Figure 2.

The first set of patterns programmed to emulate the crochet lace pattern process were based on a standard row-by-row construction. Each stitch element was positioned using Cartesian coordinates in relation to a fixed point onscreen – the top left hand corner. The programming script calculated the Cartesian coordinates for each stitch automatically at the outset of the animation. Then each stitch image was placed systematically in the appropriate place onscreen. As the position of each stitch was determined at the outset, this approach offered little potential for spontaneous pattern variation to occur. The result was a range of 'samplers' that, on the whole, explored minor pattern variations.[25] Although this approach lacked flexibility, more significant pattern variations did unexpectedly occur when the flow of script was interrupted by unplanned events such as system halts or inadequate memory resources, or as a result of formulaic or syntax errors and/or illogical programming statements (Fig. 1).

The next phase focused on a more sophisticated round-by-round pattern where the number of stitches in each round grows incrementally. The pattern was created by positioning the stitches using a mixture of polar and Cartesian coordinates. Using this approach, the stitch positions were established based on their proposed distance and angle from the pattern's centre point. Importantly, all stitch values and positions, were dynamically calculated as the pattern progressed. While this approach still maintained a high degree of control over how patterns formed, variations to the pattern did occur. This was as a result of changes made 'on the fly' to variables relating to a stitches position or size or the number of stitches in a round, or as a result of rounding-up values in calculations or the number formatting (i.e. 2 or 10 decimal places) used in calculations (Fig. 2).

[25] Samplers pre-empt the construction of many textile forms across a range of techniques (i.e. knitting, crochet, embroidery etc). They serve as a means to practice the technique, explore the material and to test the accuracy of the tension applied, and to test pattern arrangements.

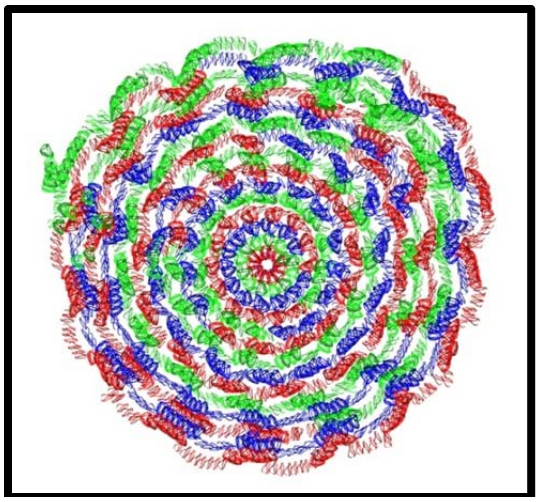

Figure 3.

The third approach also used a mixture of Polar and Cartesian coordinates and established a range of variables that could be updated as the programming script ran. But, there was one major difference compared with the previous approaches. The positioning of stitches was calculated in relation to the location of the last stitch created and a stitch from the previous round. Using this approach, the programming script 'looks' for the coordinates of an existing stitch (the 'target' stitch) in close proximity to the last stitch and calculates the position of the new stitch relative to the relationship between the last stitch made and the 'target stitch'. If the distance between them is small, then the new stitch is placed in close proximity to both. But if the distance between the stitches is large, the new stitch is positioned at a corresponding distance from both. The area allocated to 'look' for the 'target stitch' can have a significant impact on how the pattern forms. For example, if the area is small, it limits the number of stitches likely to be 'found'. Alternatively, with an increased area, there are potentially more stitches available to act as 'target stitches', the choice of which will affect the position of the next stitch. The last approach undertaken allowed for a greater freedom in how patterns formed and not only created patterns that had a greater 'hand- made' irregularity (Fig. 3), but also, on occasions, created significantly varied patterns (Fig. 4).

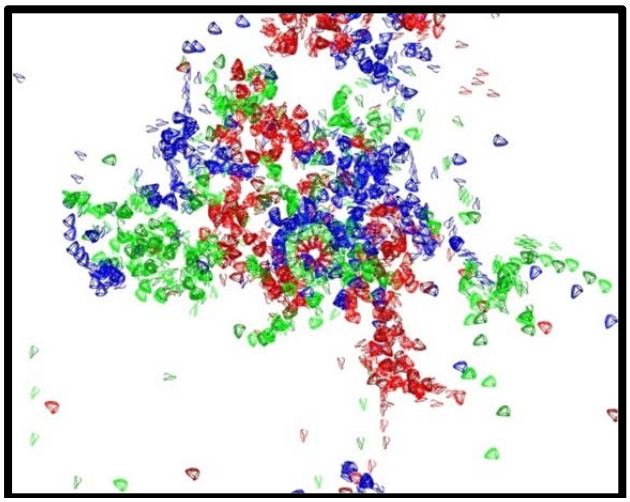

Figure 4.

Each of these three approaches produced dramatically different results (compare Figures 1, 2, 3 and 4 below). It is difficult to make a direct comparison between all three approaches as the first process emulated a row-by-row pattern design. However, processes two and three both emulated the same Whirlpool pattern, but produced significantly different variations on the original form.

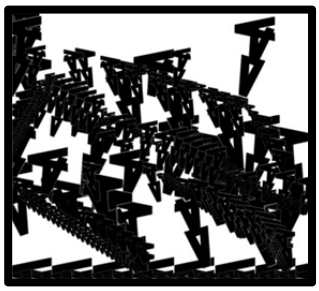

Figure 1

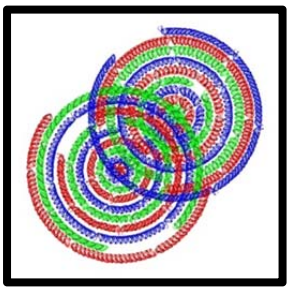

Figure 2

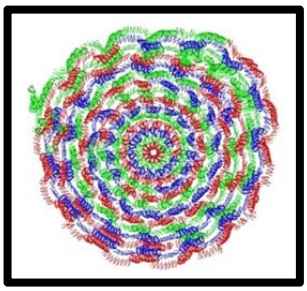

Figure 3

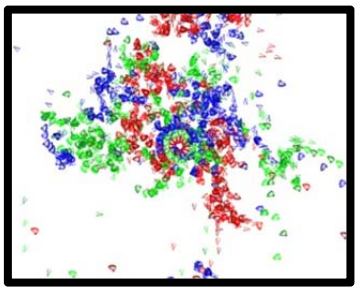

Figure 4

Conclusion

The aim of translating crochet lace patterns into the digital environment was to explore the evolutionary and emergent possibilities for this type of pattern form. This involved introducing a systems approach which meant that patterns developed in the digital environment were available for manipulation by computational processes and digital systems and ensured that the development of the pattern forms were removed from the direct control of human design decisions. Importantly, what this paper and the experimental art research project have shown is that the digital environment, while constructed of data, information and computational processes, is impacted by human input and design. Therefore, the crochet lace simulacra reflect not only the influence of computational processes and digital systems, but also elements of human design – specifically the initial physical crochet lace pattern design used and human intervention such as choices made relating to the algorithmic processes and programming languages used. The crochet lace simulacra are therefore a hybrid of human design decisions and computational processes.[26]

[26] Manovich, Op Cit.