Exploring Evolutionary Possibilities for Digital Doilies

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Abstract

Textiles, as an industry, a field of research, and a creative discipline is at the forefront of exploring the potentiality of new technologies and digital media. However, at the grassroots level of textiles, domestic hobbyists primarily use new media technologies to set up websites, blogs and community groups for the discussion of designs, exchange of patterns, for distribution of images of craft objects produced.

While some handicraft techniques were industrialised during the industrial revolution, for example, knitting, embroidery and some forms of lace making were mechanised, other techniques remained relatively unchanged and the industrial revolution had minimal impact on many forms of domestic handicrafts. So, like the industrial revolution will the information age also have little impact on many domestic handicraft hobbyists?

New media technologies present opportunities for hobbyists to engage with their handicrafts at the source of their interest, which for many engaged in activities such as lace making, is the process and the pattern. This paper shows how domestic hobbyist handicraft activities have inherent properties that enable them to be used to explore complex issues such as evolutionary development of pattern forms and emergent possibilities, by using new media and digital technologies. The project discussed translated crochet lace pattern forms – doilies - into the digital environment. The crochet lace pattern forms were digitally reconstructed (two dimensionally in the first instance) in the digital environment by writing computer software scripts to create onscreen images, emulating the process of construction of a crochet lace patterns. Once the rules for the construction of a pattern form had been translated into computer code, the data is available for manipulation. The data relating to the crochet lace pattern forms were purposefully manipulated the introduction of 'noise' into the system was encouraged, in an attempt to evolve the crochet lace pattern forms or promote emergence.

Introduction

Crochet lace is a familiar pattern form in many societies. However, in their 200-year history, crochet lace patterns have not changed significantly. [1] An experimental research project, conducted through a generative art practice, explored pattern as process focussing on crochet lace patterns and investigating the potential for these patterns to evolve and become emergent. The research explored the developmental potential of these human-designed physical patterns by translating them into and working in the digital environment.

Systems and processes used in the construction of generative artworks may be simplistic or highly complex and may use one, or a combination of systems. This experimental art project used multiple systems. It employed, in the first instance, systems that were established and used extensively before the advent of digital media - the set of rules applied to create craft-based, physical, crochet lace patterns, and the written instructions for crochet lace pattern-making. The crochet lace system was

translated into the digital environment by utilising a set of programming scripts. The research project then combined the crochet lace pattern systems with those inherent in digital media and the digital environment. As a result the simulacra produced at the culmination of the project were a hybrid of crochet lace pattern forms (the systems of crochet lace), digital media (pixels and vectors), and the digital environment (computer languages and operating systems). The computer programming language and the operating systems of the digital environment intervene and interact with the systems of the crochet lace patterns. It is at the convergence of these systems that the artwork, the crochet lace simulacra is located.

Understanding of the pattern-making history, techniques and materials used in crochet lace shows that these pattern forms are an excellent source material with which to explore the development of pattern and its evolutionary potential. This paper explains the properties of lace that make it worthy of investigation. It shows that the patterns' development has undergone a stasis. However, the research project identifies that properties are present within crochet lace patterns that make it available for change.

In addition, this paper suggests that the instructional language used to pass information relating to the construction of lace patterns between lace-makers is a code which, while pre-existing the programming scripts that operate in contemporary software, has similarities to it. All of these elements make this pattern form open to development and the digital environment is a ripe arena for experimentation.

Lace

There is a long and varied history of pattern-making in constructed textiles. Patterns that use craft techniques to manipulate threads can be found in many cultures and throughout recorded history. [2] The range of techniques employed is broad and includes weaving, knitting, crochet and macramé. In addition, a wide variety of materials can be used including silk, wool, metal and plant fibres. [3] In spite of the mechanisation of knitted and woven textiles following the industrial revolution, many textile patterns are still created by hand using low technology tools. [4] The fabrics created are used for a variety of purposes including for clothing or other utilitarian and functional purposes; as decoration; as a means of displaying wealth; to communicate beliefs and traditions; or specifically to explore how a technique influences a pattern form. [5]

The techniques employed in 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. The structure of the fabric, in turn, influences how a pattern forms.

Lace is one form of constructed textiles where the relationship between the technique, the structure and the pattern is pronounced. The making technique impacts profoundly upon the pattern form. The thread is manipulated to form not only the structure of the fabric, but also the pattern. (See Figure1)

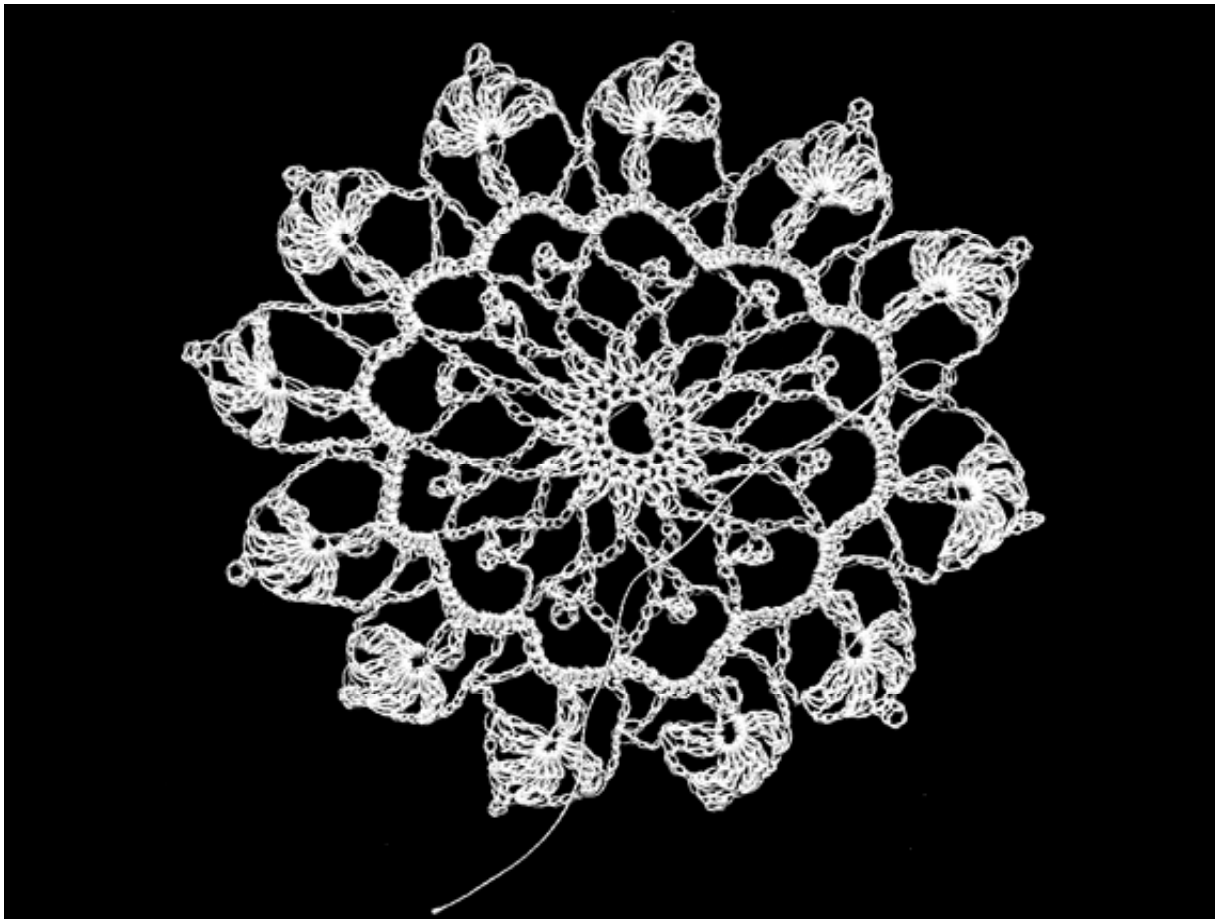

Figure 1 - *Physical Lace pattern*

Lace is constituted by a double structure conjoining the material (the thread) and the immaterial (the space between the thread). Spaces form around and between the threads and are an integral part of the pattern. Without these spaces, the fabric is not lace. Pat Earnshaw suggests that lace is "a lot of holes surrounded by thread." [6] But the spaces, or 'holes' as he calls them, are neither an absence nor a result of removing elements of the fabric. They are defined areas purposely constructed as part of the pattern. [7] So, with lace, the structure of the fabric not only *influences* the pattern, it *is* the pattern. The structure and pattern cannot be divorced. [8]

Unlike many forms of constructed textiles, lace does not have a significant utilitarian function. It is primarily used to adorn and decorate. This freedom from utilitarian purpose should enable attention to be focussed on the exploration of the pattern form, whether in its formal qualities or aesthetic value. However, rather than exploring new and/or innovative lace designs, lace-makers have primarily recycled lace patterns and, as a result, lace has not changed to any great extent in more than 500 years. [9] Churchill-Bath observes:

> 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. [10]

This immediately raises a question as to why a stasis has occurred in the development of lace patterns. Is it because there is a finite number of patterns available? Or is there some characteristic of the pattern-making process that has limited its scope and, if so, can that characteristic be changed so that new patterns can emerge?

Crochet Lace Pattern Making

Crochet is a thread-work technique that can be used to make fabric suitable for functional items and garments and is also one of the many techniques that can be employed to create lace. The technique involves the manipulation of a single continuous thread with a single metal, wooden or bone hooked tool. [11] While the history of the technique is disputed, it is believed to have evolved from techniques such as needle-point and tambouring and Crochet as we recognise it today is believed to be no more than 200 years old. [12]

Using this technique, not only could new patterns be created, but patterns that had been made using time-consuming techniques such as bobbin lace, Venetian point and needle-point could be reproduced significantly more quickly. [13] However, some criticism has been levelled suggesting that crochet lace is not 'real' lace. [14] This is due to the technique being employed primarily to copy other techniques rather then forging new pattern forms and also because, when new crochet lace patterns are made, they often lack the openness and transparency of other techniques as they incorporate less space in their design. [15]

A major use of lace was to adorn garments, and so demand for lace waxed and waned under the influence of fashion. [16] However, the crochet technique developed into a popular hobbyist activity and became commonly used to create individual lace-pattern motifs referred to as doilies. [17] Doilies were used in homes in a variety of ways such as protecting furniture from staining by cups and plates, a partly functional use, although their primary purpose remained decorative.

The extent to which pattern instructions have been documented and shared has contributed to the popularity of crochet lace, including present day interest. The importance of documenting patterns grew with the establishment of lace as a cottage industry. [18] Lace dealers relied on maintaining a series of pattern models that could guarantee sales, and so it became important to not only document successful crochet lace patterns, but also to pass on the instructions for their manufacture. The instructions often took the form of images, as many lace-makers were not literate, but increasingly the patterns were documented as text. The earliest forms of written instructions for crochet-lace patterns were verbose and difficult to follow for all but the most experienced crochet lace-makers. They gave detailed information relating to the thickness of threads to be used, the stitch formation, the stitch series for individual motifs, and how the motifs were to be joined.

Crochet 'code'

In the last quarter of the nineteenth century women's magazines became a vehicle for the widespread distribution of crochet lace patterns. Published pattern instructions in magazines proved to be successful and soon thread companies began to produce and distribute instructional pattern booklets to help expand their sales. These booklets contained simplified pattern forms to appeal to beginners and the verbose patterns instructions developed into a 'shorthand' or form of code. As they became less verbose they became more systematic, akin to the syntax used within pattern books today. For example "make two single crochet stitches into the space created by the five chain stitches in the previous row" became "2 Sc in 5Ch Sp". Terms such as "repeat until end [of round]", "Repeat 3 times then …", "Repeat from * to *" began to appear. These instructions were compact, taking up less space on a printed page, and concise and were easily interpreted by lace enthusiasts. [19]

While the instructions preceded the programming scripts of contemporary software applications, a similarity can clearly be observed with syntax currently used in software programming. This suggests that we might take seriously the proposition that the digital environment is an ideal environment in which to explore the development of crochet lace patterns. Furthermore, the relationship between textiles and 'code' is not new, as textiles have been instrumental in the development of machinery that can interpret operating instructions or code. [20] Throughout the industrial revolution, textile processes were at the forefront of mechanisation. Development of the Jacquard loom advanced machine-production. It was based on a draw loom but in addition used a punch card system which allowed the warp to be manipulated without human intervention. This was a significant achievement and was a working example of how instructions (i.e. the weaver's design) could be translated into a

form of code (the punch cards) that could be interpreted by machinery (the loom).

Situated within a craft context, innovation and originality were neither valued nor a requirement of lace-making, being secondary to the quality of craftsmanship. [21] As a result, there existed a general apathy and active discouragement in the creation of new innovative patterns. Moreover, many hobbyist lace-makers were solely interested in engaging with the meditative process as relaxation with little desire to be innovative. [22] Thus, throughout its history, crochet lace pattern making referenced, resembled, or recreated existing patterns and the development of this form of pattern-making stagnated.

However, there have been lace-makers who argue that lace and lace-making are more than a craft or hobbyist activity and advocate that they are artists introducing innovation and originality into lace and lace-making. [23] But, experimentation with lace and lace-making has primarily focussed on the use of novel materials, techniques and/or the scale of the work. Traditional silk, wool and fibre threads were replaced with metal, plastic or plexi-glass, and work was made on a monumental scale claiming to intensify the integration of space and thread. [24] Although worthwhile developments, these efforts did not, to any significant extent, explore how pattern encompasses the relationship between structure and space. And there was little attempt to examine the developmental potential for lace through pattern. [25]

Placing lace within the broader context of developments in art during this period further illuminates the under-development of this activity. Lace makers had continued to focus on the production of physical objects, paying little attention to the *process*, at a period in time when a shift of focus from object to process was occurring in the art world. Furthermore, in an age increasingly cognisant of the interrelatedness between pattern, process and information, pattern in lace had become secondary to material concerns.

So, to summarise, because of their complexities and cultural context, crochet lace patterns were impacted only minimally by the industrial revolution. The patterns produced in crochet lace today differ very little from the pattern motifs produced over the past few centuries. [26]. However, while the industrial era impacted little on the development of crochet-lace patterns, the relationship between pattern instructions and computer programming code suggests that digital media could affect this pattern form significantly.

The formal pattern properties of crochet lace are key to the development of the pattern form and thus it is the exploration of these properties that may yield signs of evolutionary development and emergent possibilities, Furthermore, it is by translating lace patterns into a digital environment that these possibilities can be more fully explored.

Crochet lace pattern properties

Crochet lace-making has always been a process. The individual patterns form and develop as a result of the physical manipulation – the inter-looping of threads. [27] Crochet lace can exist as physical instantiations and as three-dimensional forms, these patterns exist both in space and incorporate space into them. Furthermore, crochet lace patterns continue to exist as spatial patterns and arrangements even when translated into the digital environment where they occur as both arrangements of pixels on the screen and computer code simultaneously.

In addition to spatial properties, crochet lace patterns also embrace a modular structure. Threads are manipulated to create stitches which can be grouped together in arrangements to form modules. These groups of stitches, acting as modules, can be repeated to form rows and to eventually create motifs (See Figure 2) which can then be combined to create an overall pattern. This modular structure not only exists in the Euclidean spatial arrangements of a physical crochet lace pattern, but also exists in the written instructions detailing the construction of the pattern form. For example, the details relating to the construction of a singular stitch may be referred to in the construction of a module. The module information may form repetitive elements within the design and these elements combine to

create instructions for self contained motifs which eventually create an overall pattern. However, instructions for each type of stitch, pattern element or motif need only be written once and then can be referred to on many occasions within the construction of the overall pattern.

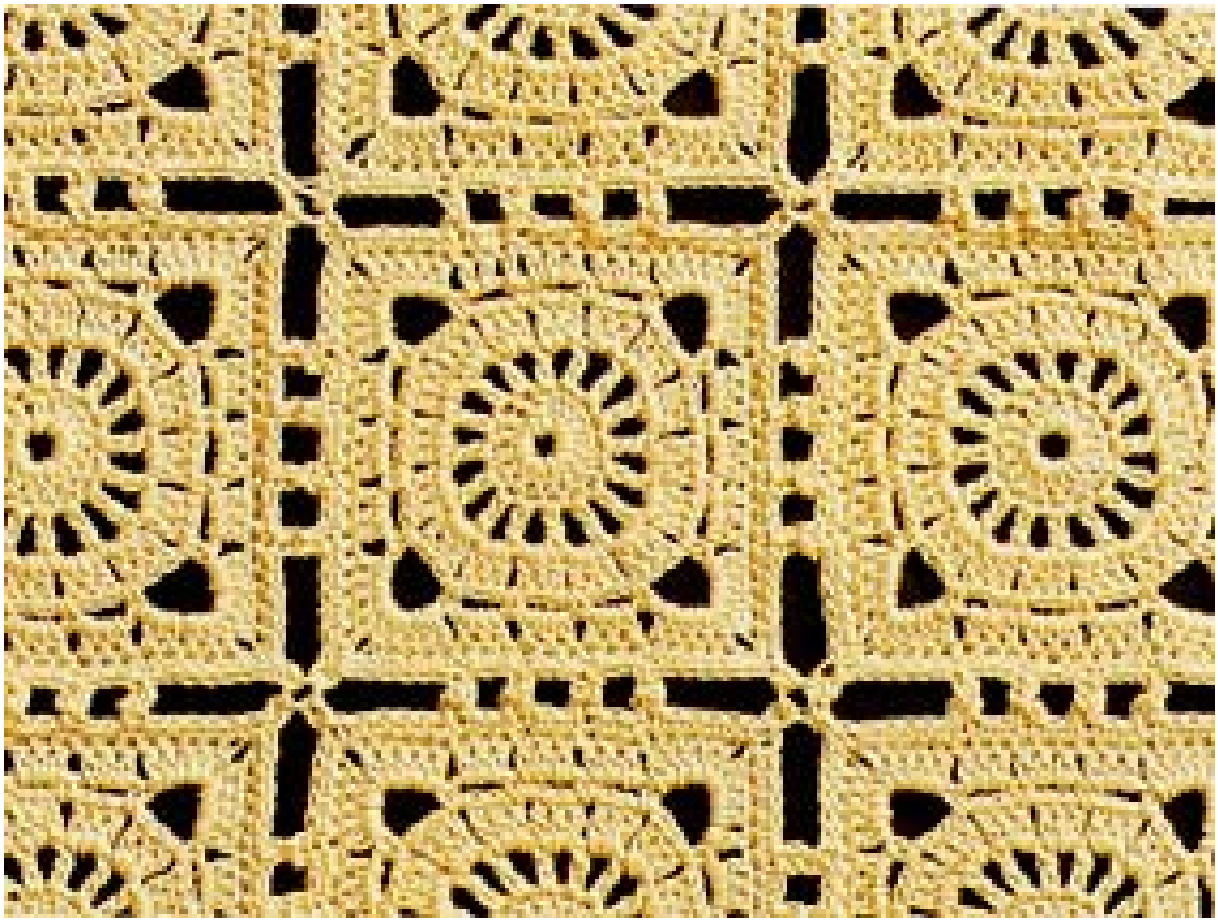

Figure 2 – Modular arrangement of crochet lace patterns

As crochet lace patterns are translated into the digital environment, this modular structure of both the spatial arrangements and the written instructions are retained and, furthermore, the programming code creating the simulated digital pattern is also constructed modularly.

Crochet pattern forms are constructed from a series of actions, rules or instructions which underwrite the creation of the lace patterns. Therefore to translate these patterns into the digital environment involves translating the rules pertaining to the physical process into an algorithm that can simulate the pattern process.

This leads to the final property of crochet lace patterns which suggest their suitability for translation into the digital environment, that is, how these patterns exist not only as physical forms but, simultaneously as code. The once verbose lace-making instructions became abbreviated and a syntax was developed which included feedback loops and modules. This syntax parallels developments in software programmes. For example, ‘if…then’ and ‘Repeat X times’ The pattern instructions operate as a code to be interpreted by the lace-maker. However, it can become a parseable language – that is, a layer of computer code can be added to the pattern instructions enabling them to be read and interpreted by computer software applications. As the syntax of the pattern instructions merge with the programming language, the code of the pattern instructions becomes part of the flow of information.

The digital environment offers this form of pattern-making several opportunities. First, it can remove the focus from the physical object and re-focus attention on the formal pattern process. Second, the pattern’s development can become a hybrid of human and technological influences. The pattern can

be impacted upon not only by the subjective decisions of the lace-maker but, in addition, can be exposed to external technological input (that is, mouse, keyboard, etc), and/or be impacted by the information flow of programming scripts and operating systems within the environment in which the pattern is immersed. The digital environment also enables the pattern process (that is, the way the pattern *forms*) to be viewed as a whole rather than focus being placed on how the pattern is *constructed*. Finally, the digital environment can allow a greater number of algorithmic and iterative processes to be carried out more quickly and effectively.

A potential disadvantage of the digital environment is its perceived lack of physicality. However, the digital environment can be viewed as an arena free from many of the constraints of tradition, history and the predispositions of the maker. It is an environment in which alternative materialities can be explored and where pattern can be examined as a concept (the relationship between the code and the pattern); as series of electronic pulses (pixels); or as code (the pattern structure of the programming script).

One final area for consideration in relation to the development of crochet lace patterns within the digital environment is the extent to which patterns can be recognised when they are translated and transformed. It may not be easy to recognise emergent patterns because of our lack of experience with the evolved pattern form. Thus, such explorations require an open mind when assessing the forms created.

Translating and extending crochet lace patterns

While crochet lace patterns are created from a simple set of rules relating to the selection of stitch types and their arrangement, there are many variables, such as stitch size, angle, position etc., handled intuitively by the lace maker that add complexity to the recreation of the patterns digitally. Therefore, the experimental art project simplified the options as much as possible and constructed algorithms to create a series of animations to emulate the visual formation of the crochet lace patterns.

In the experimental research project writing the programming scripts focussed on trying to create a ‘Whirlpool’ pattern (See Figure 5). In this pattern, the number of stitches per round grows incrementally after completion of each round. Also, the pattern module (that is, the sequence of stitches making up a pattern within each round of the overall pattern) is incremental. Each stitch element of the pattern was positioned on screen by allocating it a set of Cartesian coordinates in relation to a fixed point on screen. The result was a range of ‘samplers’ that explored pattern variations. [28] As the animations became more sophisticated the stitches were positioned using polar coordinates in relation to the centre of the stage.

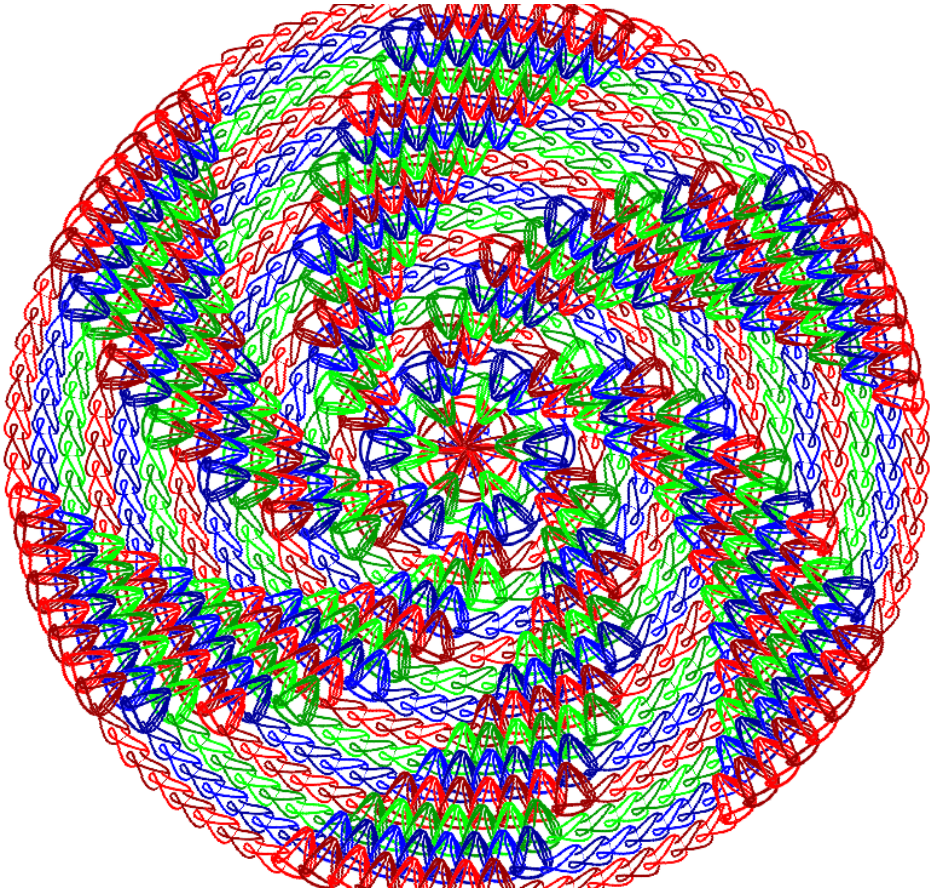

Figure 5 – whirlpool design

The programmed animations enabled patterns to deviate from their planned path as a result of manipulating variables, and/or adapting elements of the code, and/or because of inaccuracies in mathematical logic or formulae, and/or because of data formatting issues. In spite of these variations, the algorithm created to translate the crochet lace system of rules into the digital environment retained a high level of control over the pattern forms.

The next phase of the work attempted to adjust the algorithm to reflect flexibility offered by the physical pattern making process, relinquish some of the control retained by me as programmer, and relinquish the control that the algorithm had had over the pattern form. So rather than creating patterns in relation to a registration point onscreen, the pattern was recreated by programming the scripts to 'find' stitches positioned in close proximity and position new stitches in relation to them. This resulted in greater inaccuracies in the pattern and gave it a 'hand-made' appearance. (See Figure 6)

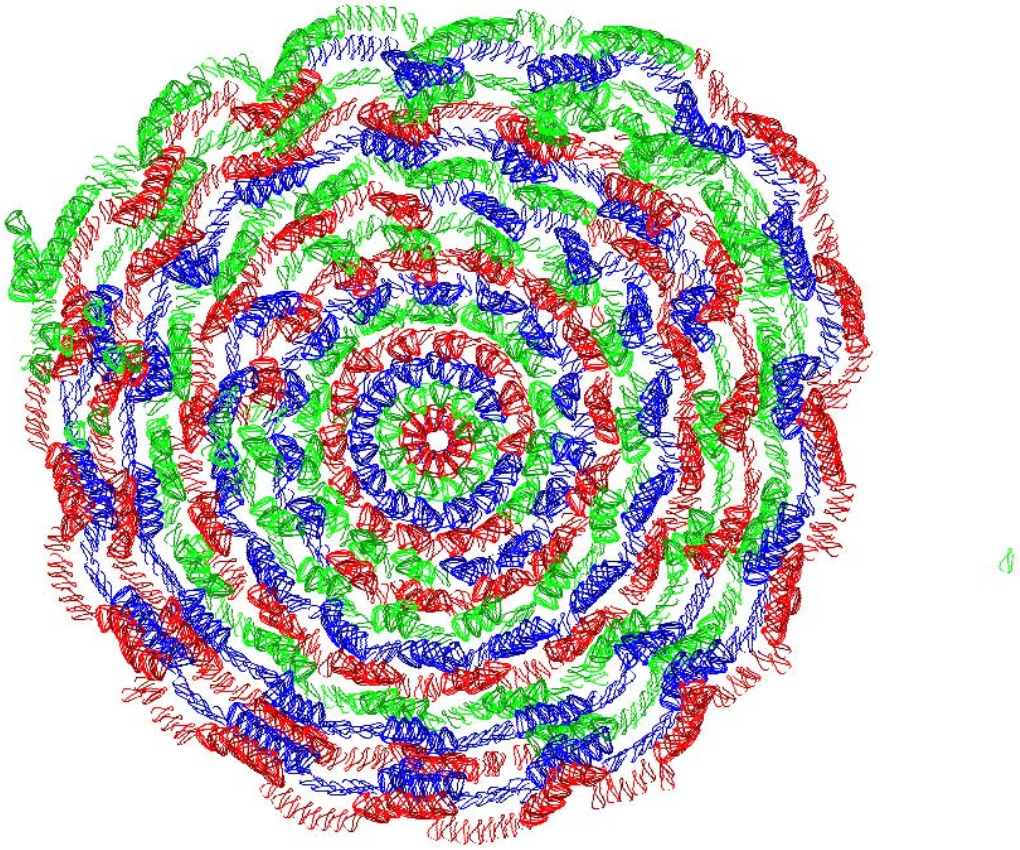

Figure 6 – Whirlpool pattern created by 'finding' stitches in close proximity

Glitch [29]
The programming scripts were checked on a step-by-step basis for accuracy. On occasions a script was uneventful when executed on a step-by-step basis, but when run in its entirety pattern variations would unexpectedly occur. The flow of script could be 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. Such events would cause the programming scripts to halt, jump or collapse into continuous inescapable loops. While the disruption in the flow of the script caused what initially appeared to be random positioning of the stitches, as the programming script continued, elements of repetition could be observed in the sequence and/or placement of the stitches and alternative patterns appeared. Files containing the programming scripts for these 'renegade' patterns could be saved and the script replayed. This enabled the scripts to be re-examined and for the aberration to be investigated. In the normal course of software programming such aberrations would be treated as bugs but, these were welcomed in the experimental project to see the extent to which these glitches impacted on the pattern forms.

On occasions, a pattern would stall because the programming script would be unable to move to the next programmed function and would simply halt. Similarly, sometimes the programming script would become trapped within an inescapable feedback loop and the same pattern would simply be repeated over and over again.

In some instances when the programming script fell into inescapable feedback loops, slight variations would occur in the calculation of the stitch positions and what at first appeared to be a repeat of the existing pattern was not. Stitches seemed to form on top of each other and the patterns appeared to grow three-dimensionally creating tunnel patterns. Other interesting patterns arose because of errors in formulae and miscalculations. This caused patterns to implode – that is, the stitches were

repeatedly positioned over the top of existing stitches. The pattern growth path was drawn back towards the centre of the pattern and the patterns appeared to build in layers upon themselves.

Other elements that suggest there is scope for these pattern forms to be developed further, and to possibly become emergent, were the disconnected nature of some patterns and the manner in which multiple motifs were generated. As patterns were generated, some stitches did not connect to other stitches. In these instances, pattern modules or individual stitches operated as discrete elements. [30] The 'stray' elements could remain isolated and still be part of the overall pattern, or could become connected later (i.e. reconnected) via other stray pattern elements or stitches. These patterns generated on screen lacked the regularity, repetition and order, of the physical crochet lace pattern forms. They lacked a perceived order as they radiated dramatically from the centre point. [31] (See Figure 7)

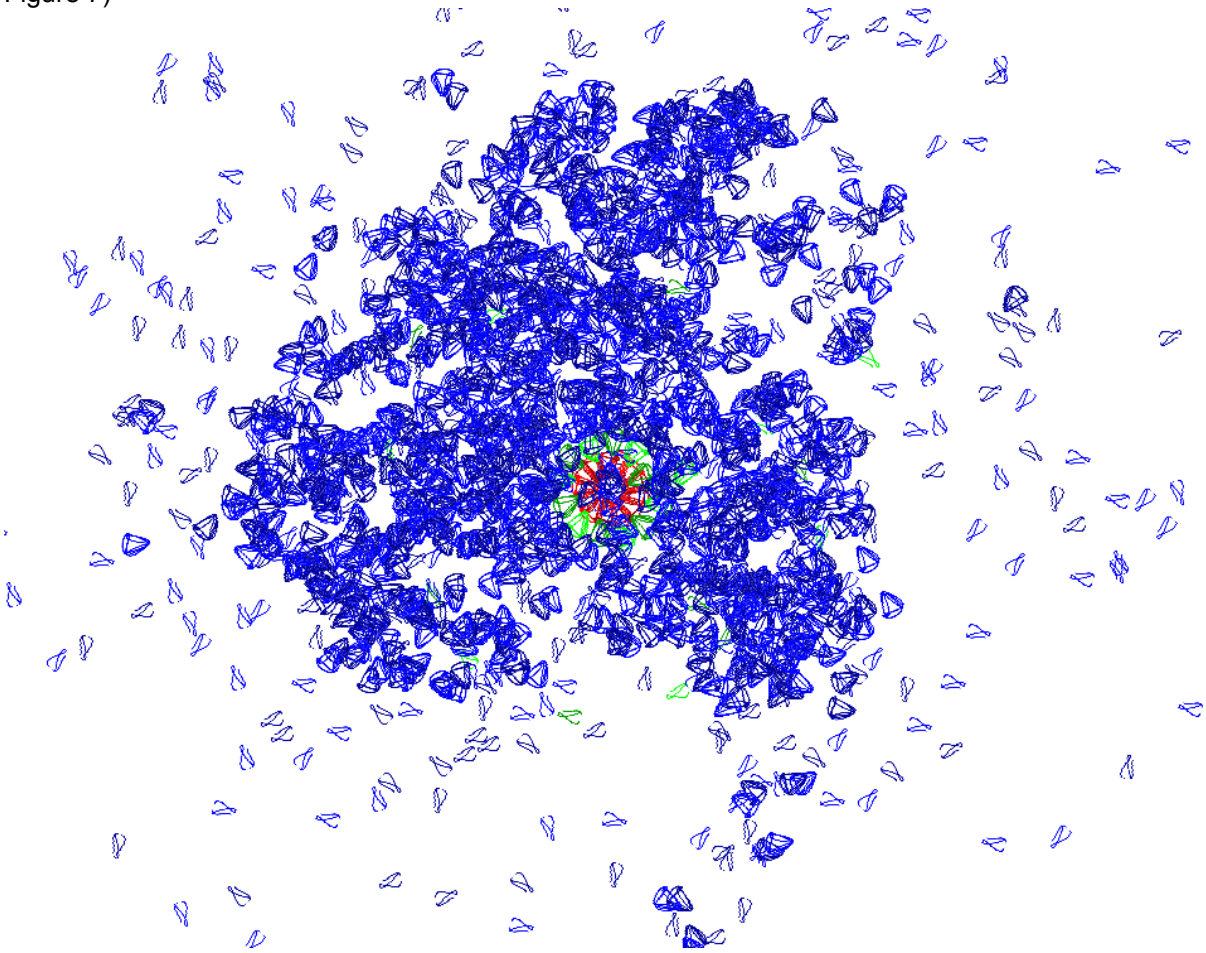

Figure 7 – Patterns elements could be disconnected

Not all of the patterns generated adhered to these classifications. Furthermore, it was not possible to assess whether all patterns generated could be reconstructed physically. However, the physical construction of the generated patterns will occur in the next phase of the project. There are precedents in physical crochet lace pattern making that suggest that many digital patterns *can* be created physically. These precedents include firstly, layering and pronounced three-dimensionality in some forms of Irish crochet lace, secondly, instances where multiple crochet lace makers make individual pattern motifs that are joined late in the process, and thirdly, sets of doilies that are positioned next to each but are not physically joined. Each of these suggest that the 'layered' patterns, multiple motifs and patterns with disconnected elements are prime to be reconstituted in the physical environment.

References

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[2] Donald W. Crowe and Dorothy K. Washburn, *Symmetry Comes of Age: The Role of Pattern in Culture* (Seattle:. University of Washington Press, 2004) xi

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[7] Roberto Casati & Achill Varzi,. *Holes and Other Superficialities* (Cambridge, Mass.: MIT Press and London: Bradford Books1994), 20

[8] Earnshaw, *The Identification of lace,* 45

[9] Shepherd 'The Contemporary Lace Exhibition 2001'

[10] Virginia Churchill Bath, *Lace. (*New York: Penguin Books 1979), 5

[11] It should be noted that while patterns use a single continuous thread patterns may consist of multiple motifs that are created separately and are joined together to complete the piece, or on occasions are not joined but form sets of doilies that are positioned in the same vicinity on a piece of furniture.

[12] Although Mary Konior suggests that there were written reference to crochet hooks between AD50 and 137 and that the activity continued in the Middle East this is speculation as there has been no fragmentary evidence found. See Mary Konior, *Heritage Crochet: An Analysis* (London: Dryad Press Ltd. 1987), 10 A more reliable, less speculative history is offered by Lis Paludan. See Lis Paludan, *Crochet: History and Technique* (Colorado: Interweave Press. USA 1995), 76

[13] Mary Waldrep, introduction to *Masterpieces of Irish Crochet Lace* edited by Therese De Dillmont (New York: Dover Publications, Inc.1986), 5 and Konior, Op. Cit., 14-17

[14] http://www.fairfaxcounty.gov/library/information/arts/crocheting.htm accessed and Paludan, Op.Cit.

[15] It is interesting that this criticism is directed at crochet lace for copying patterns as it has been a widespread activity in lace-making generally.

[16] Paludan, Op. Cit., 65 and Patricia Wardle, 'Victorian Lace' in *Irish Crochet Lace: 150 years of a Tradition* Exhibition Catalogue http://lacismuseum.org/exhibit/Irish%20Crochet%20Lace.pdf accessed 12/08/2007

[17] The name comes from a nineteenth century shopkeeper in London who sold fabrics; Mr D'Oyley. See Konior, Op. Cit.

[18] Judith, L Gwynne, *The Illustrated Dictionary of Lace* (London. B.T. Batsford Ltd 1997), 10

[19] Churchill Bath, Op., Cit.

[20] Lev Manovich, *The Language of New Media* (Cambridge, Mass.: MIT Press 2001), 22

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[22] Rosemary Shepherd. 'Structures of Necessity' Artists Statement in Exhibition Catalogue www.lacedaisypress.com.au/philosophy.html last accessed 10/11/2006

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[24] Earnshaw. *Threads of Lace: from Source to Sink,* 97

[25] Delwich,. in the introduction to the third lace Biennial 1985 and Earnshaw, *Threads of Lace: from Source to Sink,* 97 and Delwich, *Tenth Lace Biennial* and Rosemary Shepherd, 'The Contemporary Lace Exhibition 2001'

[26] Konior, Op. Cit., 14

[27] Shepherd, 'Structures of Necessity'

[28] 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.

[29] I am deliberately adopting the term Glitch often associated with a 1990's music genre, in particularly the work of Kim Cascone and using the term to suggest how the patterns are created from bugs, crashes, system errors etc which impact upon the pattern process visually

[30] It is noteworthy that the physical crochet lace patterns usually require all elements of a pattern to be joined for them to be part of the overall pattern. However, a precedent has been set for this way of working with physical crochet lace pattern making where motifs can be constructed as discrete elements of the overall pattern and then joined by another motif or series of linking patterns or simply placed alongside each other.

[31] While this radiating pattern is familiar in physical crochet lace pattern making, the intensity with which these patterns grew, and the relationship between the size of the individual stitches and the size of the overall pattern, have not been explored in physical pattern forms.