In what ways could digital approaches innovate knitting?

What are the opportunities for digital tools in Shetland?

In what ways could digital technologies enhance youth engagement with crafts?

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1. Reading the Portfolio

The point of departure in the thesis is the analysis of the first engagement on Shetland. This portfolio intends to show the design process of the prototypes next to the research insights that they embody. Together they form a digital knitting experience which challenges the traditional design process and provide a playful way of exploring future design approaches for digital tools in Fair Isle knitting. The development is shown chronologically from ideation, to a design and development phase, to the point where they are reintroduced to the context in Shetland. This linear order is chosen for greater clarity when reading the portfolio although some design stages occurred at slightly different times during the research process. If this is the case, I will direct the readers attention to it. Nonetheless, it will be possible to read the portfolio in one go without referring to the thesis. At the end of the portfolio on page 29 is an USB stick, which contains materials such as a copy of the knitting software and a short video demonstration of the prototypes. After this the reader can resume with the thesis.
The lairds, they’d never gi them cash, they’d take their stuff which was knitted and gi them goods from the shop. [...] And for the fisherman they were fishing for the laird but they never got the money either it was always just the goods. So basically they kept them where they wanted them, it was a bit like slaves really. And call them a different name but they were basically slaves to the laird. You had to sell it to them you didn’t have an option.

(Local Knitter Ida)

Although, this portfolio looks at possible roles for digital technologies in Fair Isle knitting and seeks to challenge the traditional design process, it is embedded in a wider narrative of insights that emerged during the first visit to Shetland. It is beyond the scope of this study to consider all of them. However, two relationships deserve brief elaboration.

Firstly, the revival of Shetland knitting has brought opportunities for knitters to explore new roles and approaches in their heritage practice, but also introduced tensions with influences such as craft tourism and differing perceptions around the meaning of tradition, innovation and authenticity.

Secondly, the fear of skill loss has been linked to losing the Shetland way of life. Suggesting, it is more than the technical skills but a common identity that is threatened by a decline of knitters. As someone from outside Shetland I tried to recognise these sensitivities while designing the prototypes and presenting them to Shetland knitters.
I designed the digital knitting needles for my first scoping visit after observing knitters at the Edinburgh Yarn Fest. These aimed to challenge the traditional tools and techniques. So the ideation on this page begins after I had designed the digital knitting needles and taken them to Shetland. I had no concrete use envisioned prior to my visit and wanted to explore them as conversational tools. When prompted with the digital knitting needles the local knitter Belva suggested these could be used in an interactive pattern to indicate the position in a knitting pattern.

Based on Belva’s feedback, I imagined a blue-sky concept where the digital knitting needles could form part of an augmented reality application. Part of the application would be an interface that indicates the precise position in a pattern.

Many of the knitters in my class at Wool Week would use a ruler on a chart to keep track of the row they are in. (Shetland Knitter Belva)

Digital Knitting Needles

Digital Fair Isle

As part of the prototyping approach, I intended to present knitters concrete examples of functionally robust artefacts. I therefore decided to amend the concept of the augmented reality knitting to a “provotypeable” point. By which I mean being able to realise key aspects of the idea with the technology and skills available to me. In this case I made the interface part of standard portable device like a laptop.

Digital Fair Isle

It is an application that indicates position in a knitting pattern. Based on Belva’s feedback, I imagined a blue-sky concept where the digital knitting needles could form part of an augmented reality application. Part of the application would be an interface that indicates the precise position in a pattern.

Pattern Library

Integrated Tutorials

Pattern Library

Integrated Tutorials

Pattern Library

Integrated Tutorials
After the initial phase of ideation, I developed detailed concepts for the digital knitting needles and for the Fair Isle software. As outlined in the literature review, I intended to consider especially the design recommendations of balancing:

- openness and boundedness (Wallace et al., 2013: 3444)
- ambiguity and interpretation (Gaver et al., 2013: 3452)
- inconspicuousness and intrusion (Boer and Donovan, 2012: 369)

The detailed (and as I believe bounded, interpreted, and leaning towards intrusive) mock-ups helped me to balance my final concepts against these recommendations before introducing them back to the context in Shetland. The descriptions on this spread are technical. I will outline on the pages that follow a detailed rationale for what I included in the final prototypes.

Both needle tips are digitally connected by a wire. These are typical in circular knitting needles that are used for tubular knitting.

Conductive tips to sense fine motor movement during knitting and to enable counting the stitches.

I added an algorithmic method for exploring new motifs for Fair Isle patterns. The rationale is provided on page 16.

A library of motifs designed with the software.

The concept included the previously described interface that shows the current position in a knitting pattern.

Iterating a motif based on the generative settings.
4.1 Digital Knitting Needles Evolution

I prototyped the concept of a device that would tap a pattern on the hand while knitting. However, I disregarded it due to complexity and because it would foreground a product development approach.

The first prototype of the digital knitting needles used a wire and conductive copper tape wrapped around the tips.

A sample swatch that I knitted to better understand the technique of stranded knitting.

As aforementioned, the needles were made prior to the first visit to Shetland and led to the emergent provotyping approach that frames with this inquiry. I designed the needles during a phase of experimentation in which I engaged as I was readjusting the research focus. In this phase I played with the traditional techniques, tools and materials. Some of these Fair Isle experiments are shown in this page and give insight into this process.

It is the knitting in the round and the long double pointed needles, the Fair Isle is two colours in the row and not any more than that. [...] in Fair Isle the traditional way is you hold one colour in each hand. (Shetland Knitter Claire)

Bamboo Rod
Thin Steel Wire
Laced Metal Tips

I prototyped the concept of a device that would tap a pattern on the hand while knitting. However, I disregarded it due to complexity and because it would have foregrounded a product development approach.
I intended to challenge the family and placed based origin of knitting motifs. This provocation aimed at an aesthetic level but also at the parameter of time and the feeling of designs being ‘around forever’. I therefore decided to explore the use of algorithmic design approaches to generate new aesthetics, but also to challenge the component of time by rapidly producing alternatives of a motif. The algorithm was meant to symbolise a “placeless” origin of designs and encourage negotiation of new meaning by being contradictory to the Shetland based approaches.

Central to the design considerations was following a playful approach that would encourage experimentation and limit the perception of being intrusive in a negative sense.

First, I explored an algorithm called “Conway’s Game of Life”, a piece of open source software, which creates random populations of cells and then calculates based on the amount of neighbours which population of cells multiplies or dies. As done with mechanical artefacts in my PDE practice, I reverse engineered the algorithm by separating it in its subcomponents. I then reassembled them in a way to make the concept of generative design meaningful for Fair Isle knitters.

I limited the columns and rows of the matrix to a number that would be suitable for a single repeat motif of a Fair Isle pattern. In the Fair Isle knitting practice, repeat patterns would not always be square and of different sizes but I limited myself to this approach to communicate the principle rather than propose plenty of functionality.

In this iteration, I added a visual interface including a slider with which the mathematical rule of the algorithm could be changed. This was done to illustrate to knitters that the algorithm can be modified and is open for adaptation.

Aside of improvements to the visual interface, I added a library of traditional Fair Isle motifs. These could be loaded into the matrix. The intention was to show that the generative algorithm could not only be used to create motifs from scratch but also to modify existing ones.

The final iteration of the software includes an interface that counts the stitches and rows by being connected to the digital knitting needles. The Fair Isle pattern library was removed in favour of a tangible interface consisting of the interactive Fair Isle swatches. The swatches will be elaborated on in the pages 19-23. I also simplified the library interface to make it more open for interpretation. A manual of the software is provided on the next page.
4.2.1 Kniterator Manual

This page provides a user manual for the Kniterator alongside a detailed description of the individual functions. Please refer back to this page when using the software which is provided on a USB stick in page 29.

ITERATIVE VALUE SLIDER

The higher the iterative value the longer the program will keep on changing the motif. A low iterative value will result in a quickly resolved motif.

GENERATIVE VALUE SLIDER

A high generative value will add more cells to the matrix in proportion to existing ones. A low generative value will remove cells from the matrix.

ITERATE BUTTON

Pressing the iterate button is used to start or stop the iteration process. In order to draw with the mouse in the matrix, the process has to be paused. Alternatively, one can press ‘spacebar’ to iterate and pause.

LOADING A TRADITIONAL PATTERN

A traditional motif can be loaded into the matrix by touching the interactive Fair Isle switches, as elaborated later on, or by pressing the key ‘a’ for an example motif.

MODIFYING MOTIF

Cells can be added or removed from the matrix as long as the program is not iterating. This is can be manually done by clicking on the individual cells or by using the algorithmic iterate function.

STITCH AND ROW COUNT

The red bars will move along the columns and rows when knitting to help navigating a pattern. This can be also be simulated by pressing the UP ARROW.

LOADING A TRADITIONAL PATTERN

A traditional motif can be loaded into the matrix by touching the interactive Fair Isle switches, as elaborated later on, or by pressing the key ‘a’ for an example motif.

SAVE & RELOAD BUTTON

By pressing save the current pattern will be stored and can be reloaded at any given point by pressing reload. Pressing save again will result in the previous pattern being overwritten.

MODIFYING MOTIF

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RESET BUTTON

Pressing the reset button will empty the matrix. Alternatively, you can press the key ‘c’.

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USER ENGAGEMENT IN GLASGOW

In order to evaluate intermediate steps of development, I had a local knitter in Glasgow testing the software while knitting samples as shown below. In her feedback, she describes how she found designing new motifs with the software as relaxing but that she struggled with choosing colours as she was not an experienced Fair Isle knitter.

FEEDBACK FROM SHETLAND KNITTER

Further, I made a video demonstration of the software which allowed me to share it with knitters in Shetland remotely. The link is below. The feedback shows with the video is provided next to the screenshot on the right. The screenshot below shows the email correspondence with one of the Shetland based knitters. She also mentions knitters difficulty with colourways.

EXPLORING FAIR ISLE COLOURWAYS

Following the feedback from the Shetland based knitter and the knitter in Glasgow, who both mentioned the difficulties of choosing colour, I aimed to explore ways of designing a tool which could enable quick experimentation of motif and colour.

EMBROIDERED FAIR ISLE SWATCHES

This resulted in a laser cut template that could be embroidered with wool. The number of rows corresponded with the size of the matrix in the Kniterator. I chose to explore the embroidering as a faster alternative for beginners to encourage experimentation with Fair Isle colourways.

USING FAIR ISLE SWATCHES AS INTERACTIONS

Personal experimentation with the embroidery template showed, that the method was quick but not as effective as imagined. However, as I was interested in bringing materiality to the interaction with the Kniterator, I imagined the embroidered swatches as possible interaction points to explore the motifs digitally. In the following page, I will describe how this stepping stone resulted in the interactive Fair Isle swatches.
The final aesthetic and functionality of the interactive Fair Isle swatches were directly drawn from the Fair Isle swatches found in the folder in the Tangwick Ha museum in Shetland. As part of the digital knitting experience, they served as a "tangible Fair Isle motif library". By touching one of the swatches, the black and white motif appeared in the matrix of the Kniterator where it could be modified. It was important to me to embody this insight about templates in knit, as it metaphorically translated the traditional design process into a digital one and the interaction concretely showed the difference between colourway and motif in Fair Isle. Something knitters apparently had difficulties with.

4.4 Interactive Swatches Evolution

[][..] If somebody had a new pattern, you would knit it and then had it to look back at it. They were like templates in knit. You would also get so much more information from it because you could see the texture, the colour blending and the gauge. Some people would cut the repeat pattern out of an old jumper and just keep that as a reference.

(Local knitter Ida)
5. The Digital Knitting Experience

THE DIGITAL KNITTING EXPERIENCE

The schematic shows an initial concept of how I planned to disseminate the prototypes at the conference in Shetland. My concern was that the prototypes would be interpreted as propositions for deployable products, whereas I was interested in foregrounding the methodological aspect of experiencing them as stepping stones towards future design approaches.

INTERACTIVE FAIR ISLE SWATCHES

By touching one of the three swatches the black and white motif appears in the matrix of the Kniterator.

THE KNITERATOR

In the Kniterator knitters can explore to modify the traditional motif either by using algorithmic design methods or manually. It also allows to design entirely new ones from scratch.

DIGITAL KNITTING NEEDLES

The digital knitting were linked to stitch and row counting interface in the Kniterator. They allowed to demonstrate the principle of the interactive pattern and how digital tools could complement traditional making techniques.
5.1 Shoormal Conference Display

For the setup at the Shoormal Conference on Shetland, I designed a display to present the prototypes alongside research insights and guiding questions for conversations. In the presentation of the additional information, I attempted to show a relevant narrative but did not make the insights as explicit as here in the portfolio in order not to impose my own interpretations. I hoped the balance between written insights and tangible interactions would encourage engagement, contextualise the tools and allow delegates at the conference to gain immediate access to the exploratory nature of this study. Further, the wooden materiality of the set-up was supposed to imitate a workshop character to counteract impressions of “finishedness” of the prototypes.
6. Digital Provotype Portfolio

The digital knitting experience is seeking to provide a playful way of exploring future design approaches for digital tools in Fair Isle knitting. It questions how these approaches would look like if they were conceived in Shetland. On the USB stick is a copy of the Kniterator program provided. Please refer to the manual on page 18 for instructions. Additionally, if it is not desired to install the software, a short video demonstration is provided that shows core elements of the digital knitting experience. After exploring the fundamentals of the provotypes, please continue reading the thesis in the fieldwork chapter.