Growing Artefacts out of Making

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Abstract

In this paper I am presenting a speculative exploration into materialisations of digitally captured craft gestures as evocative artefacts. I am discussing initial findings and early experiments of a design-led case study capturing and materialising data of transient movements of skilled crochet practitioners into physical traces of the making process. I explore how such traces of the embodied processes of making translated into tangible artefacts can evoke conversation and reflections on craft techniques and practices with the potential to enrich the craft artifact itself. I argue, that by making such 'invisible' traces of embodied craft processes not only visible but physical, a richer connection between artefacts and the practitioner's process of making can be encouraged. Through digitally fabricated, discursive resources, I am exploring facets of the relationship between the experience of making, the meaning of material artefacts and digital fabrication as tool for reflection and discussion. I discuss findings of a practice-led design case study with crochet practitioners by drawing out five threads that emerged from initial experiments and will highlight potential for future research.

Keywords: *Embodied craft, making materialisation, reflective fabrication.*

Introduction

I understand craft as the skilled process of making, an active and embodied engagement with materials. Ingold (2013) stresses the importance of a person's involvement in the organic making process of an object to create a more meaningful connection. When pointing out the importance of such active involvement he goes further to state that, 'I want to think of making […] as a process of growth' (ibid, p.21). I am drawing on this perspective to creatively explore the complexity and difficulty in understanding embodied interactions between craft practitioners and their materials with novel use of technology and data materialisation techniques.

When documenting the making of a craft artifact, video recordings or image representations are often the preferred medium to communicate some of the more embodied processes of craft practice that may be difficult to articulate. With fast developing innovations in movement capture and digital fabrication technologies, it is becoming more viable to record additional facets of the making process, such as gestures and movements, that can potentially add a layer of depth to the documentation.

An expanding area of research in Human Computer Interaction (HCI) is not only looking at the technical requirements of movement capture and digital fabrication, but is also increasingly exploring the DIY maker community. For example, Tanenbaum et al. (2013) are drawing from the increasing democratisation in the maker movement to develop design implications for future HCI research, including areas such as personalisation and reappropriation.

Additionally, Ratto (2011) introduced Critical Making, which utilises the shared practice of making to engage people with critical reflection on social issues. This shows that academic research is increasingly drawing from maker culture as well as craft practice. The use of digital technology to augment and annotate craft practices and its artefacts is progressively the subject of HCI research, such as Rosner (2010) exploring meaning making and memory of craft practices.

Others, such as Willis et al. (2011), have applied the embodied immediacy of the craft process to digital making by creating embodied, interactive fabrication tools whilst other research is focusing on using digital technologies to explore and better understand the tacit dimension of craft practice, for example Wood et al. (2009). Not only has academic research focused on this combination of craft practice and digital

Image 1

technologies, but it has also become increasingly intertwined in practice to develop new ways of creating unique craft objects through embodied interactions. Examples show interactive turning of digital forms to be 3D printed with clay (Unfold, 2010), motion captured spatial sketching of furniture pieces (Front Design, 2006) or digitally capturing hand movements to be incorporated into the craft object itself (Jorgensen, 2007). Another direction is that of 'hybrid material territory' (Zoran, 2013, p. 330) that directly combines digital fabrication and craft practice.

Zoran joins digitally fabricated artefacts with the skilled, manual craft of weaving to create hybrid craft objects. Although the hybrid nature of this work is unique and relevant here, the potential and value of engaging the craft practitioners in a more mutual process of making rather than solely completing pre-fabricated artefacts stays underexplored.

A more conceptual stance is assumed by Auch (2013), questioning what the role of dexterity will be in the future of increasing digitalisation and pervasiveness of technology. In her explorations of making with weaving, knitting and embroidery she combines hand movements, brain activity and digital tools with the view to put hand and brain on an equal level of appreciation.

To build on this area of practice and research spanning digital capturing technologies and craft practice, I am exploring how additional means of recording other facets or threads of the embodied making process, in this case of crochet practitioners, can give a supplementary account of the overall experience. However, I am not claiming that this method of gesture capture is in any way superior to traditional means nor can they replace them, but with these initial experiments I investigate how, by tangibly materializing the making process, a different type of engagement or enrichment is taking place that connects the artefact and the process of its making more directly.

Similar to Ingold (2013), this work is based around a longitudinal morphogenetic model of the form-generation process, which in contrast to the hylomorphic model, places more emphasis on the on-going interaction between the practitioner and their material. Rather than the practitioner imposing a specific form onto a material in a one directional process, I focus on the process of making as a more active, reciprocal process between physical material and cognitive idea, out of which the artefact grows. This direct impact on one another of the two parallel strands of the making process, which Ingold (2013) refers to as flow of consciousness and flow of materials is essential to the making process.

At the intersection of these two threads of the same process, one could see the tool, in this case the crochet hook, as a conduit or negotiator between the two flows. Each flow being influenced not just by one another but also by the tool itself, which plays an important role in most craft practices. With this in mind, I focused in this case study on exploring the movements of the tool as mediator between material and practitioner.

The Study

I set up a practice-led design exploration with a group of crochet practitioners ranging in skill level from beginner and intermediate through to semi-professional and professional. In the initial discussion with the group about their craft I found main points of conversations and importance to their practice were the materiality of the tools, the 'flow' and tension of the wool. Additionally, they described crochet and their reasons for enjoying it due to its addictive, productive, meditative, colourful, creative, sculptural nature and it giving a sense of achievement even as a beginner.

The next steps were to start recording and collecting traces of the crochet practitioners movements and gestures by fixing accelerometers onto the craft tools, i.e. the crochet hook (see Image 1). In this way, I recorded facets of the making process of a simple crochet pattern, a granny square, to establish a comparable baseline for all participants. The collected data was then translated into different forms to engage the participants. Together with colleagues an interactive sonification system was developed which enabled the crochet practitioner to get direct sound feedback from their movements. The details and findings of this sonification work are not part of this paper and will be published separately. After this, simple visualisations of the data in graph forms were generated showing the differences in stitches alongside the 3dimensional threads which showed the varying movements (see Image 2).

With the 3D threads of the data showing the differences in movements while forming an *in itself* contained shape, I chose these forms to fabricate in different materials to start off the conversation and to potentially elicit responses to the materials in order to explore the relation between digital fabrication and craft practice. By translating the data into physical traces as 'provocations to thought' (Turkle, 2007, p.5), I

Image 1.
Left to right: The participants in the initial workshop; the sensor attached to the crochet hook; and one of the participant's finished granny square

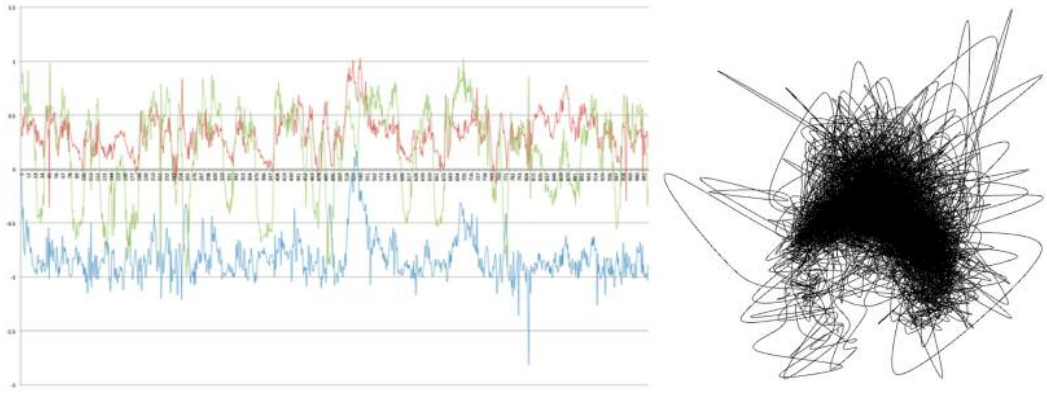

Image 2

Image 3

was attempting to encourage the practitioners to reflect on material qualities, embodied knowledge and shared understanding of their practice. Through these digitally fabricated materialisations, I was aiming to highlight the complexity and difficulty in understanding embodied interactions between craft practitioner and their material, thus drawing a closer connection between the object and its making process as well as the embodied actions of the practitioner.

The workshop was conducted in two parts starting with the unveiling of the materialisations (see Image 3), which were initially hidden under a cloth upon participants' arrival in order to capture their response as a group rather than individually. Except for the participant's knowledge of the artefacts being generated from data captured during the first workshop, the shapes were initially left anonymous without explanation to obtain participants' unbiased responses and interpretations of the artefacts.

After this discussion I then disclosed which shape belonged to whom and explained the data translation process in more detail to explore how their perception of the artefacts might differ from or compare to their initial thoughts. In the following, I will discuss the initial findings from the practitioner's responses and interactions during the 'materialisation' workshops.

Emerging Threads

Upon examining and analyzing the collected qualitative data from this exploration the following five threads emerged as points of further conversation and potential for future research.

Encourage Discussion and Reflection on Technique

Upon unveiling the fabricated artefacts and an initial excited response from the participants, 'wow, lovely' and 'they are fabulous', the differing shapes and their comparability between them encouraged participants to discuss, reason and compare the shapes amongst themselves and in relation to their craft techniques.

Purposefully not naming or highlighting the materialisations for each participant, the shapes were left open for interpretation and consideration, encouraging discussions about why one shape might be their own or another might be someone else's based on their differences in crochet techniques. For example, one participant suggested that, 'maybe this is yours because you twist more'. While another participant considered a shape as representative of her crochet style, 'I think this one is mine, it's quite dense', with another disagreeing, 'I don't think that's even enough for you'. This discussion led to a wider conversation about their different techniques and crochet styles from being more 'jerky' (jagged) to 'pulling more'. In some cases leading to a comparison of their different personalities, 'that's the personality that she is'.

After I revealed which shape belonged to whom, the conversation about their techniques continued but went into more depth. Upon being asked about her

Image 2.
Left to right: Graph visualisation of one participant's initial data, and the 3D thread of the same data.

Image 3.
Left to right: One participant's shape in different material translations, and presentation of all the artefacts to the participants.

shape, 'So why is yours like a C then?', one participant went into more detail discussing and showing her technique: 'because I put the wool on the wrong side of the hook. I wrap the wool around so I have to twist it to pull it over instead of sliding it behind'. With others comparing this to another shape pointing out distinct differences in the form, e.g. 'you don't twist yours at all so you can see the difference'.

These shared, comparative conversations were mixed with more individual reflections on their practice. Participants were interpreting their shape by drawing on personal interpretations and their own perspective on their technique without directly comparing it to others.

One participant was explaining why her shape was fairly condensed: 'I think that I probably do keep mine very much in one place […] keep it quite close and […] doesn't really move very much', while another was directly relating her movements to her shape, 'the quicker I go the more jagged mine is'. With this, she was clearly referring to her shape rather than the actual crochet piece that she produced in a very neat and tidy fashion. This showed that the movements of the practitioners and the subsequently generated materialisations didn't necessarily respond to the pieces of work in a direct way but highlighted that the movements of craft practice are of a more personal and individual nature.

The comparison and reasoning of the shapes highlighting differences in techniques was a continuous process throughout the workshop and raised awareness of techniques or what could be described as personal quirks, that the practitioners were unaware of before participating in this work. For example, one participant referred to her shape when remarking, 'I didn't know that I made big loopy bits', but then went on to say, 'but now, that I've looked at that I'm doing it a bit gentler now'. This conversation in particular showed that this work had an impact on their thinking about their own and other's crochet techniques and it is also further hinted at the potential of this work for changing behaviour as the participant added, 'I am now like thinking when I'm doing my wool. Like, I'm going around and out, I am now trying to see that picture when I'm doing it'.

Legibility versus Abstraction

During some of the discussions it was also noticeable that the abstract nature of the data translations for the tangible artefacts raised questions around legibility. The level of abstraction of the shapes and their creation was discussed by the participants with some not understanding how the shapes related to their movements asking, 'why doesn't it look more like crochet?', highlighting how they were trying to make sense of how the shapes related visually and tangibly to the process and movements of crocheting. I was attempting to create shapes for the participants, which were not only directly representational of their crochet techniques but rather abstract provocations for conversation and meaning making.

Although some recognised their shapes early on, it proved more challenging to others. For example, one participant stated that, 'I can't see anything', while others who seem to understand the shapes better were trying to explain the differences. Personally recognising their shapes prior to my explanation was also discussed as noted by one participant that, 'It's funny how you recognised yours', which was explained with it was, 'probably because it's more symmetrical than the others', which apparently was a general personal preference of this particular participant.

Generally, in these conversations the ambiguity of the shapes often encouraged associations in order to describe the shapes, for example a shape being described as a 'moon' or 'crescent' shape or one of the 3D prints as a 'lost island'. The associations were ways for the participants to make sense of the differences and similarities of the shapes. Additionally, the participants did not only show an interest in the shapes themselves, but were also curious and inquisitive about the processes of translating data into generated shapes.

As mentioned above, questions of how the data was translated and why the shapes looked a certain way was initiated by the mysterious, concealed nature of the translation process. This lead to conversations about my research practice and the participants becoming interested in the process of data translation itself, actively offering advice and criticism for future work.

For example, the similarities in size led participants to inquire how the programme was scaling, or more technically mapping, the data to generate the shapes. When explaining how the shapes were somewhat altered by the developed algorithm, they noted that it's 'hard to compare them then isn't it if you're changing the size of them', and suggested, 'it would be really good to see them all in actual size'. In that sense, they were becoming involved in the research process themselves, starting to make suggestions as to what changes to make and what to potentially try in future work. Furthermore, they agreed that a more interactive translation of data would be beneficial for the participants to assume a more active role in the whole process of making with their data. So although the abstract nature and uniqueness of the shapes did encourage comparison and conversation of the tangible artefacts, a more personal, participatory experience rather than abstract translation process should be explored further.

Materials Matter

With crochet being such a tangible and haptic craft experience, I considered the fabrication of the shapes in several different materials as an attempt to gain some insight into the material qualities of digitally fabricated artefacts in relation to craft practice. Although the discussion of the chosen materials in relation to their craft practice was brief, they did discuss the crochet materials I used to collect their

initial movement data and how this may have had an impact on the their movement with it being different materials and tools to their usual practice. One participant noted, 'I think it was harder because it was a bigger hook and bigger wool as well.' This highlights how important the material aspects of craft practice are and that the choice of materials and tools is a very personal one for each practitioner.

By encouraging participants to select one or several artefacts to take with them as a *souvenir*, I hoped to instigate a discussion of the different materials and qualities. It was notable that participants did not choose the card or fabric artefacts but all selected one or several of the wood, acrylic and 3D printed artefacts. When discussing their material choices it became clear that their selection was something intangible and not conducted consciously. It was a more personal response or attraction towards certain materials.

However, all artefact choices fall into the category of more sturdy or rigid materials, in comparison to the card, paper or fabric that were not chosen. Equally another commonality between the chosen materials was a higher contrast and visibility of the data traces. This might be giving the shape more depth in comparison to the visually *weaker* traces on the card and fabric, which is particularly evident in the 3D printed version.

Although the highest contrast of all artefacts was the black and white print of the paths on card rather than then laser cut artefacts, which was not chosen by any of the participants as a souvenir. It became clear, when I prompted them to discuss their choice of material, that the inherent qualities of material were essential for their selection. One participant reasoned that with the translucent acrylic material 'you have the light coming through so you can see more of the forms', while another's motivation for choosing the wood shapes was 'the thickness with those'. Although there were difficulties in articulating their material choices, their selections still highlighted that there is value in (a) the quality of the material, (b) the visual nature of the traces and (c) the digitally fabricated artefacts themselves which lead to further conversation and appropriation of the shapes.

Possibility for Appropriation

While choosing the materials as their souvenirs, all participants were holding shapes up and comparing the different materials, considering what they would like to do with them. A range of potential future uses were discussed, for example one participant declared 'I would wear that as a brooch', holding it onto her clothes to see what it would look like (see Image 5), while another noted that one participant's artefact is 'the best shape to wear'.

Other future uses included coasters and hair clips, whilst another participant was considering how she would like to appropriate the shape: 'I'd like to stick flowers on there and wear it', which directly related to her own craft practice, often working with embroidery and floral felt shapes.

Image 4

Image 5

With this in mind, revisiting the earlier discussion around abstraction, it can be emphasised here that the abstract nature of the forms were ambiguous enough for participants to inflect their own meaning and uses onto the artefacts to be more personally relevant than a prescribed use would have been. Thus, furthering the craft practitioners' engagement with the artefact to potentially incorporate their artefact in their own work creatively. This is hinting at the potential such artefacts may hold to possibly be folded back into their craft practice, drawing a unique connection between the artefact and the making process which will be explored further in future work.

Materialisation as Memento

So far I have mainly focussed on discussing the conversational aspects of the data artefacts during the workshop itself. However, I would also like to consider the value of the artefacts beyond the duration of the workshop.

After asking what participants have done with the objects after the workshop, one participant mentioned that after showing the 3D print to her family she took the artefact to her studio as she finds the idea of 3D printing 'inspirational'. She explained that she was using her 3D print to engage visitors to her studio in conversation about craft practice, mentioning that she 'got to show people at the studio especially during the Art Tour and people were interested in the idea of transferring movement into a sculpture'.

This highlights, not only that the work had an impact on the participants' thinking about her crochet technique, but the artefacts themselves have value beyond only being reflections on craft practice opening up a much wider range of conversations.

Image 4. Participants interacting with their data materialisations.

Image 5. Trying on their shapes as brooches and hair clips.

Image 6

Another participant sent a picture of her artefact taking pride of place on her mantelpiece at home (see Image 6) and commented that it is 'for me to feel proud of', is showing that not only does the artefact carry personal meaning for her, but also her giving it a thoughtful and special place in her home. She went on to explain that she likes that the artefact 'visualises a tradition and is written in secret crochet code', which for her represents her 'struggling and (more or less) succeeding to learn a skill I'd always admired and associated with my granny and mum'.

This shows how participants interpreted the shape in a very personally meaningful way relating to her practice and heritage. The same participant who earlier 'couldn't see anything' in the data translations still had a very personal and meaningful relationship to her unique artefact. Her description of the artefact embodying her personal 'secret crochet code' that only she knows about, highlights how the data materialisations can become things in their own right. These personal responses to their own artefacts emphasises the materialisations' potential to act as mementos of experiences that go beyond the workshop and reflections on craft practice, holding much stronger personal, even emotional meanings.

Combining and Following the Threads

In this paper I have shown early experiments and findings of how traces of the embodied processes of making can be translated into tangible artefacts to evoke conversation and reflections on craft practice. I have discussed this initial study of data materialisations in the context of craft practice as five emerging threads to indicate the potential and value of data translations into personal artefacts. In summary, let me draw out the main aspects of these findings to consider and highlight prospects for future research:

- By encouraging discussion and reflection through the generated materialisations, the practitioners acquired new knowledge about their own techniques as well as differences and similarities to others'. It highlights the potential impact these shared conversations had on their thinking and their practice and how data materialisations can act as resources to facilitate such exchange.
- The level of abstraction in connection with the legibility of the data was an issue raised in relation to the craft practice itself. Although further work is necessary here, it also highlights that the practitioners entered a more mutual relationship with the researcher through becoming actively involved in the process and suggesting a more interactive, participatory approach for making data materialisations.
- Although it is common knowledge amongst craft practitioners that materials and materiality matter in craft practice, the importance and personal preference of such was raised in several conversations. In relation to the data materialisations several material characteristics were considered favourable, such as material thickness, translucency and intensity of data traces.
- The ambiguous nature of the generated artefacts encouraged imagination of potential future uses and opened up possibilities for personal appropriation, which hints at the potential that data materialisations may hold to be incorporated back into the practitioner's own craft practice.
- Investigating the value and meaning of the data materialisations as mementos beyond the workshop itself showed that the artefacts had potential to become meaningful things in their own right rather than solely being byproducts of their craft practice for the purpose of research. They were not only used in wider conversations about art and craft practice, but also held more personal meaning and emotional connections to family and tradition as described by one participant, both highlighting the value of the ambiguous nature of the artefact as beneficial for personal attachment and facilitating conversations.

With the explorative nature of this work, I acknowledge that further work is necessary to fully understand the value, potential and issues of translating craft movements into tangible artefacts for reflection and meaning-making and I will expand on

Image 6.
Participants holding their shapes and one of the artefacts as memento in a participant's home.

this by considering a number of key areas. For one, the relevance of the captured data and potentially different facets of data should be explored in connection to how it might influence the meaning and meaningfulness of these artefacts and the personal relationships participants develop. This work touches on novel ways to engage practitioners with uniquely personal data through tangible, material means with potential to build meaningful relationships, which I believe deserves further consideration in more general terms. There is potential to apply this method to making with data in other contexts, beyond the craft practice described here, as a way of engaging audiences in conversations, reflection and meaning making.

One of the main areas for further exploration is, however, a more interactive, experiential, real-time materialisation approach that could engage craft practitioners more actively in the overall process of making with their own data. Suggested by the participants themselves, it also mirrors Ingold's (2013) perspective I've taken here, following Heidegger's distinction between objects and things, that one has a more affectionate relationship to an artefact if one is more involved in the whole 'lifecycle' of an artefact through active participation in its making rather than having a passive relationship to mass-produced objects. Or as Ingold puts it, 'To witness a thing is not to be locked out but to be invited in to the gathering' (Ingold, p.85). In this case, it does not only encourage a more participatory approach to digital fabrication but also to the data capture, translation and making processes. With this in mind, this work has only scratched the surface of how these shared, participatory aspects of the making experience can be incorporated into artefacts as things.

I have shown here how giving transient making processes physicality can bring tacit aspects of craft practice into focus and initiate conversation. For that matter, it is important to note that the value and meaning of the artefacts or materialisations did arise out of the active process of engagement, comparison and discussion of the shared collection of artefacts amongst the participants in the group rather than being predetermined through isolated artefacts.

This meaning-making process is showing parallels to the shared and social nature of traditional craft practices, such as crochet, with an emphasis on the haptic qualities and materialities of the tangible artefacts. It highlights that digitally fabricated data materialisations can act as a resource for discussion and reflection, underlining the complexity and difficulty in understanding embodied interactions between craft practitioner and their materials. To that extent it is valuable to further investigate the social aspects of crochet practice and how these could inform data materialisations that can potentially be incorporated back into the craft practitioners' work to enrich their craft practice as well as the craft object in itself.

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References

Auch, M. 2013. 'The Meaning of Dexterity' in Shillito, A. M., *Digital Crafts: Industrial technologies for applied artists and designer makers*, London: Bloomsbury, p.25.

Front Design, 2006. Sketch Furniture, available at: *www.frontdesign.se* [accessed October 2014]

Ingold, T., 2013. *Making: Anthropolgy, archaeology, art and architecture*, New York: Routledge.

Ratto, M., 2011. 'Critical Making: Conceptual and material studies in technology and social life', in *The Information Society*, 27, pp. 252–260.

Rosner, D., 2010. 'Mediated Crafts: Digital practices around creative handwork', in Proc. *CHI'10, ACM*, pp. 2955-2958.

Tanenbaum, J., et al., 2013. 'Democratizing Technology: Pleasure, utility and expressiveness in DIY and maker practice', in Proc. *CHI'13, ACM*, pp. 2603-2612

Jorgensen, T., 2007. 'Conducting Form', in Proc. *'Design Enquiries' Nordic Design Research Conference*, Stockholm.

Turkle, S., 2007. *Evocative Objects: Things We Think With*, Cambridge, Mass.: MIT Press.

Unfold, 2010. L'Artisan Electronique, availablr at: *www.unfold.be/pages/l-artisan-electronique* [accessed October 2014]

Willis, K.D.D., et al., 2011. 'Interactive Fabrication: New interfaces for digital fabrication', in Proc. *TEI '11, ACM*, pp. 69–72.

Wood, N., Rust, C. and Horne, G., 2009. 'A Tacit Understanding: The designer's role in capturing and passing on the skilled knowledge of master craftsmen', *International Journal of Design*, 3(3), pp. 65-78.

Zoran, A., 2013. 'Hybrid Basketry: Interweaving digital practice within contemporary craft', *Leonardo*, vol. 46, No.4, pp. 324-331.

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