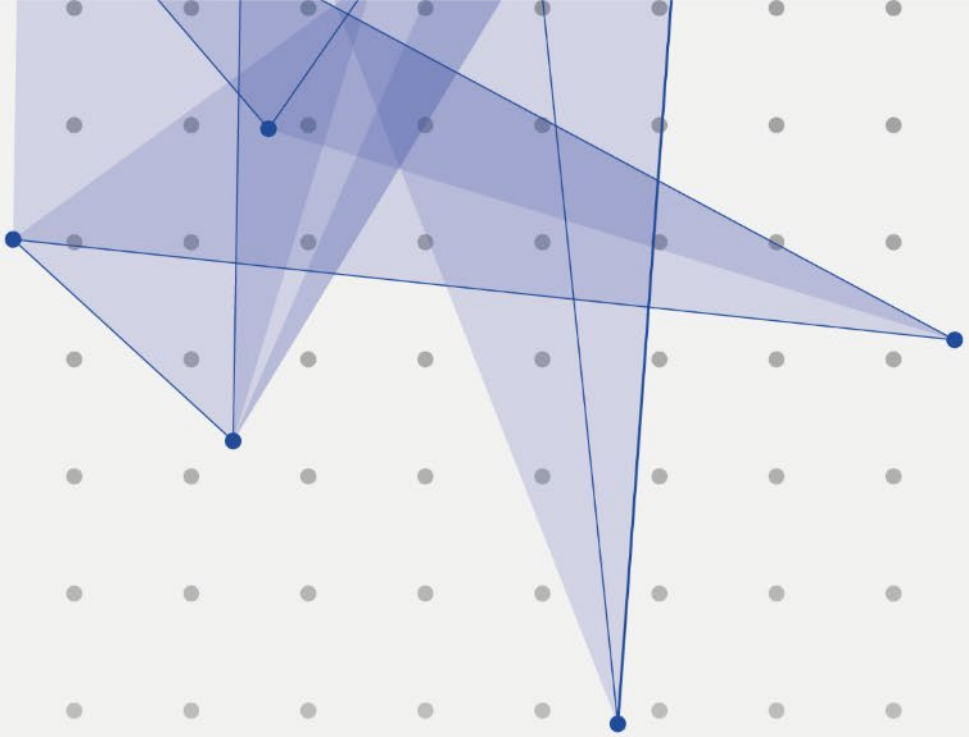

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"**From Abstractness to Concreteness** – experiential knowledge and the role of prototypes in design research"

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Graft-games: Experiential prototyping for the exploration of crossovers between craft and gaming

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Abstract

This paper presents an experimental prototyping approach, termed 'grafting', for investigating theoretical crossovers between craft practice and the play of video games. It presents a case study of prototype 'graft-game' *Hazuki Knit,* developed as a probe for exploring an emerging theoretical field of study that acknowledges embodied skill within the play of videogames aligning it with craft labour. In particular, it proposes a method of prototyping in which an existing game is directly grafted onto a craft activity in order to enable the direct observation of its impacts upon embodied and inarticulable actions of participants during grafted gameplay at a series of themed public events. Through discussion, it presents grafting as a method for interrogating the potentialities brought about through joining these two related yet distinct activities. Utilising key findings from a case study of prototype 'graft-game' *Hazuki Knit* conducted by the author between May 2018 and June 2019 this paper reveals that directly joining craft with a digital game can lead to high-risk gameplay that can negatively impact the quality of the craft output.

Craft; Gaming; Graft-game; Crossovers; Prototyping

There is much existing research that investigates the collaborative nature of craft (Felcey et al., 2017; Adamson, 2007), its ability to connect people (Gauntlett, 2018) and transcend traditional boundaries, especially in relation to digital technologies (Rosner, 2010; Golsteijn et al., 2014). In recent years there has been a growth in theoretical research within games studies that acknowledges the skilled aspects of videogame play from authors such as such as Brock & Johnson (2021), Brock & Fraser (2018), Nørgård (2012) and Reeves et al (2009). There is, however, little empirical research that directly explores links between craft and gaming, especially from the perspective of creative practice. Alongside this, an increase in accessibility to digital fabrication and physical computing in recent years has created "opportunities to merge crafting activity with electronic games" (Sullivan and Smtih, 2017: 38) leading to exploration of alternative games and custom controllers. In their 2017 paper *Designing Craft* Games, Sullivan and Smith presented reflections on three 'Craft games' that use craft as either a method of creating input devices or components for games (digital or non-digital), or craft as a physical output for a game. None of these examples, however, interrogate the impact that merging these two activities has upon the craft or gaming aspects. This paper presents a case study from the completed doctoral research of the author to discuss an experimental prototyping approach in which craft and gaming are explored in direct relation to one another, through a process referred to as 'grafting'. This

approach did not seek to join craft with gaming to merely create a new input or output for a game. Instead, ‘grafting’ aimed to bring craft and gaming together as an active method of enquiry for exploring the potential impacts of combining these two forms of activity. The term ‘grafting’ is borrowed from horticulture where it is used to describe “joining parts of two or more plants so that they appear to grow as a single plant” (Bilderback et al., 2014: online). In using grafting as both a metaphor for the approach and a description of the method employed in connecting a game and a craft activity through a direct and physical join, this study aimed to explore and capture the potential impacts that arise through grafted gameplay.

Thematic Crossovers

Within horticulture, grafting is commonly carried out with trees and shrubs and, although the parts “do not have to be from the same species” (Iannotti, 2020: online), they do need to be compatible. The characteristics of each part are thus carefully considered before grafting. This research took a similar approach by considering the commonalities between craft and gaming practices through the identification of theoretical crossovers. An analysis of key craft and gaming literature established three key areas of crossover which are considered fundamental to both.

1) Habitual practice

Learning through habitual practice has been attributed to the acquisition of craft-based skill (Sennett, 2008; Risatti, 2013). As stated by Sennett “skill is a trained practice” (Sennett, 2008:37) and in “learning a skill, we develop a complicated repertoire” (Sennett, 2008:50) of routinized procedures, embedding them through “the conversion of information and practices into tacit knowledge” (Sennett, 2008:50). Habitual practice refers to the process of embedding knowledge over time through the repetition of actions. To gain and develop skill, to embed it into our knowledge system, we must be in action, as “going over an action again and again […] enables self-criticism” (Sennett, 2008:37-38) on which skill development depends. “As a person develops a skill, the contents of what he or she repeats change”(Sennett, 2008:38). This way an “open relation between problem solving and problem finding”(Sennett, 2008:38) occurs through which a rhythm of solving and opening repeats over and over in a progressive manner. This is key to the acquisition of skill over time.

The playing of video games requires a similar acquisition of skill with players displaying “remarkable dexterity developed through many hours”(Reeves et al., 2009:205) of gameplay through which they develop a deep understanding of their ‘material’: the game. Through adopting Sennett’s analysis of craft and applying it to gaming labour, Brock and Fraser present an account of gameplay that “recognises that players have to establish technical skill to negotiate the increasingly demanding, complex puzzles that contemporary computer games offer”(2018:1221). Through their analysis of *Dota 2*, the authors discuss how players acquire “sense data about the game through a series of tutorials”(Brock and Fraser, 2018:1224) in which the player learns and practices the “basic mechanics of right-clicking, scrolling, and re-centering”(Brock and Fraser, 2018:1224) to progress their skills. Through practice “*Dota 2* players constantly adapt their grip to establish control over the game”(Brock and Fraser, 2018:1224). The repetitive actions of pressing buttons in the problem-solving environment of a videogame thus align with habitual practice in the context of craft expertise.

2) The desire to do well

Sennett states that "[c]raftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake" (2008:9). It is this impulse that highlights the craftsman's "aspiration for quality" and "evidence of truly rewarding work" (Brock & Fraser, 2018:1219) and it is Sennett's analysis of craft labour that Brock and Fraser (2018) apply to, and align with, the act of gaming. According to Jesse Schell "doing something 'for its own sake' […] is an important characteristic of play. If we don't like to do it, it probably isn't play" (2020:39). To this end, craft and gaming could be classified as intrinsically motivated activities, without external reward.

According to Juul, a game is:

> A rule-based system with a variable and quantifiable outcome, (…) the player exerts effort in order to influence the outcome, the player feels emotionally attached to the outcome, and the consequences of the activity are negotiable. (Juul, 2011:36)

Variable outcomes, be they scores or items created, are what make a game desirable to play (Juul, 2011) and in this sense, match the goal of craft to produce an object or artefact. According to Sennett, it is the "aspiration for quality" that drives a craftsman "to improve, rather than get by" (2008:24). The outcomes of a video game tend to remain virtual, but both outputs, whether physical or virtual, hold value to the player and the craftsperson alike. Both act as evidence of actions and both player and maker exert effort in the production or achievement of their outcome. In doing so, the player and the maker develop a desire to improve these outcomes through practice.

3) Minimising risk

It is the craftsman's "desire to do a job well for its own sake" (Sennett, 2008:9) that highlights the craftsman's "aspiration for quality" (Brock & Fraser, 2018:1219). According to Pye, in craft "the quality of the result is not pre-determined, but depends on the judgement, dexterity and care which the maker exercises as he works" (Pye, 1995:20). Essentially "the quality of the result is continually at risk" (Pye, 1995:20). Pye refers to this as the "workmanship of risk" (1995:20), implying that at any moment the workman has the potential to ruin the job, be that through "inattention, or inexperience, or accident" (1995:9). Pye goes on to explain that "[a]ll workmen using the workmanship of risk are constantly devising ways to limit risk" (1995:5) such as the use of tools or 'jigs' to assist in the making process. Neal draws attention to the role of skill in controlling risk suggesting that "if you're experienced then" it's "possible to argue that […] near-perfection can be achieved with regularity" (2018:22). This reflects that skill can play a role in minimising instances of risk.

Failure and the need for repetition that video games often demand, is a core component of in-game progression and skill development. As Keogh describes:

> As I fail and repeat a videogame, I learn more about the videogame and how to handle it both literally and figuratively; I become more attuned to its rhythms and capable of progressing farther the next time (2018:145).

Just as it can be argued that level of skill can play a role in reducing risk in craft, Juul tells us that failing through a lack of skill in games allows players to "reconsider [their] strategies" and "expand

[their] skill set" (2013:74). Experiencing failure and the enforced repetition it brings about in order to progress, in both craft and gaming, is thus closely linked to the development of habitual practice and improving skill that further reduces the risk of failure.

Grafting the prototype

The three thematic crossovers were used to assess the impact of directly connecting craft with gaming. This was achieved through the development of a protoype graft-game. As the term 'grafting' suggests, directly connecting an existing game to a craft activity required access to, and the adaptation of an existing game. The expertise of technologist James Medd, who had previously developed his own digital games, was sought for this research. The intention was to graft an existing game onto an existing craft to explore what changes and impacts a direct union between the two may have on the individual elements or, as a combined entity. Within this research, the development of a prototype graft-game was intended to act as a form of probe to enable the direct observation of grafted gameplay and resultant impacts upon the individual game and craft activities. Thus, the binding together of the two experiences was intended as an 'analytical tool' (Durling and Niedderer, 2007) and not about creating a fully-fledged game.

Hazuki Knit prototyped the 'grafting' of an existing developmental game, *Hazuki* (developed previously by Medd), onto a domestic knitting machine through a set of switches attached to the knitting machine row counter. As described by Medd, *Hazuki* is a "QTE-centric game" (Medd, 2020: online) inspired by 'quick time events' experienced in video games where players are required to 'hit' particular buttons at a certain time as they appear on the screen. *Hazuki* focuses solely on this playing style utilising four arrow buttons ('up', 'down', 'left' and 'right') that must be pressed within a certain time limit when a corresponding symbol of each button appears on the screen (see Figure 1). If the player fails to press the correct button within the time, the game is over.

Through grafting, the aim was to capture the action of 'knitting' which, in the case of the knitting machine, was the act of moving a carriage back and forth across the knit bed to create successive rows of fabric. To capture this action two small switches were added onto an inbuilt row counter on the knitting machine (see Figure 2). The movement of the carriage (triggering the switches) was then captured digitally for the game, controlling when the directional symbols would appear on the screen, thus controlling how fast or slow the game aspect would be. As a grafted game, *Hazuki knit,* became a two-player game with one person (Player one) using the control panel to respond to the prompts displayed on a standalone screen, and the other (Player two) controlling the knitting machine (see Figure 3).

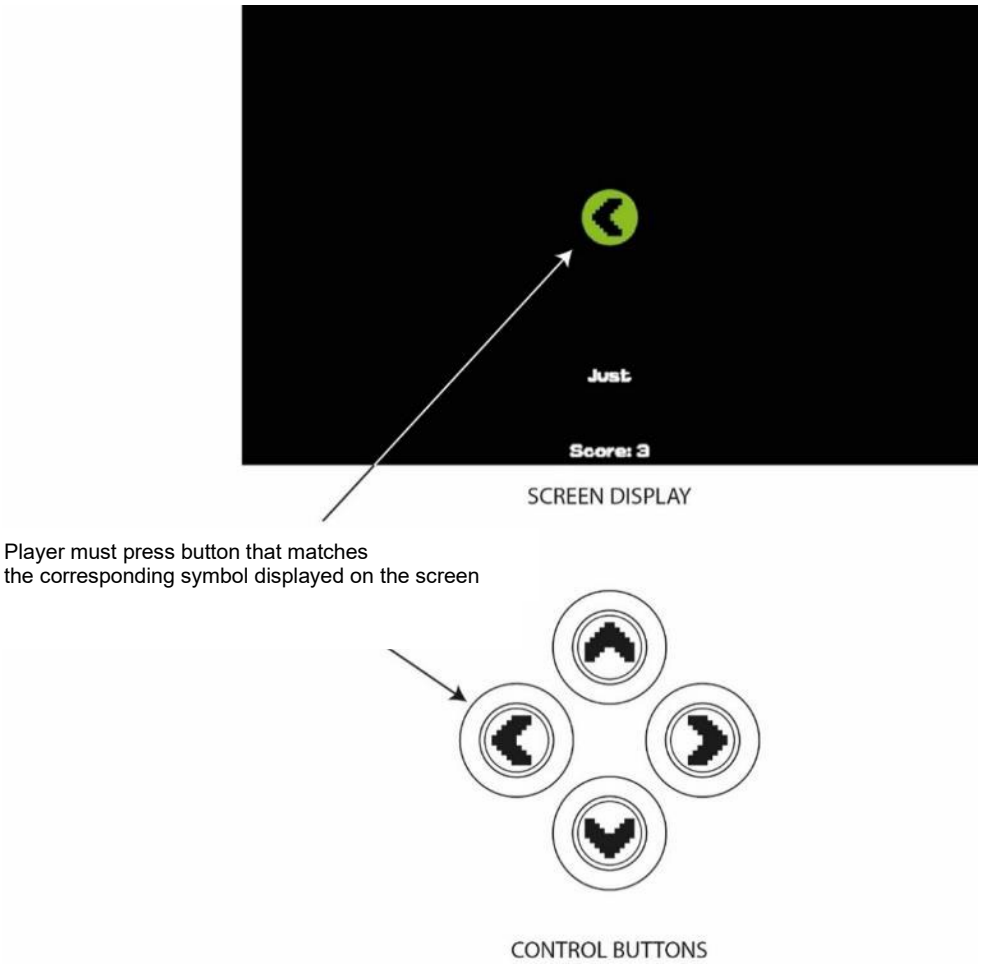

Figure 1: Hazuki screen displaying symbol of button to be pressed

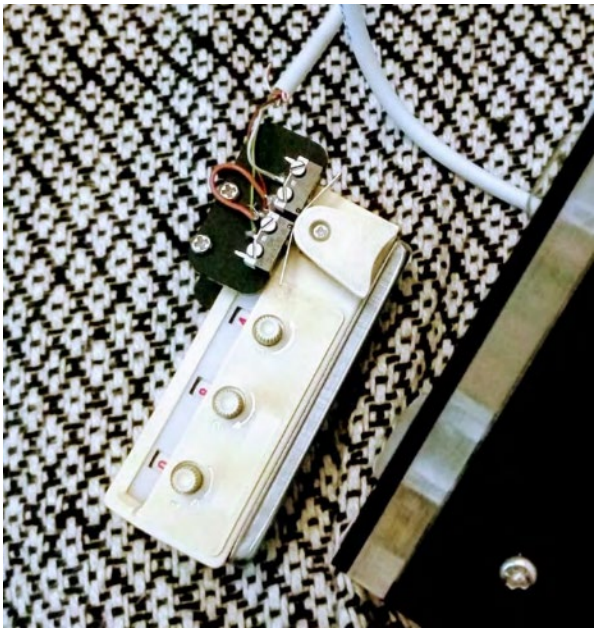

Figure 2: Row counter from knitting machine with added switches above carriage trigger

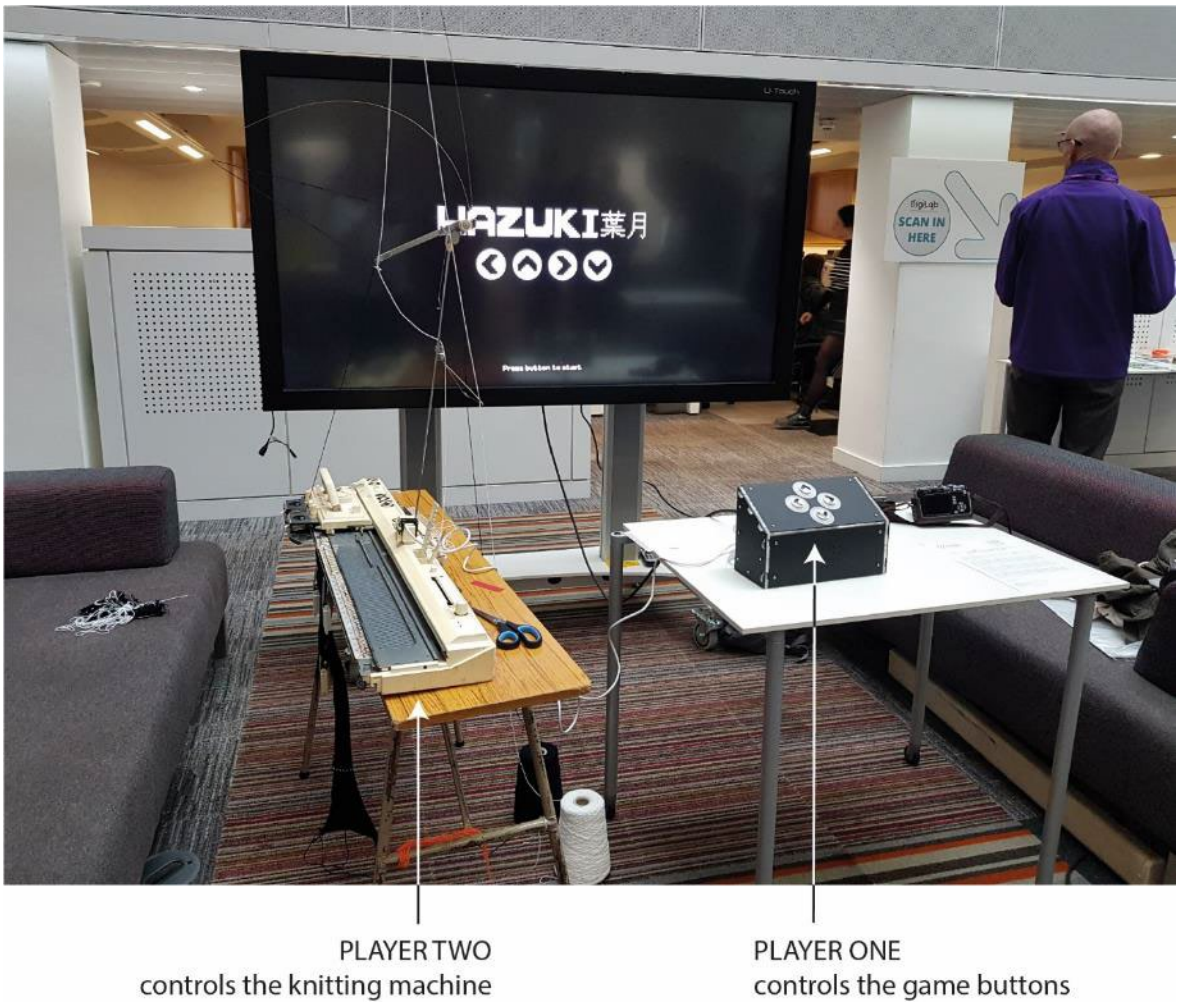

Figure 3: Hazuki Knit set-up with screen, control panel and knitting machine

The grafted prototype was showcased at 3 public events across the North West of England between May 2018 and June 2019. Events were a combination of digital, making and gaming-focused, aimed at engaging members of the public. At each event, observations were made of participants as they played the 'grafted game' using a participatory approach that employed mixed methods including the recording of reflective field notes and video recording to capture both verbalised interactions and inarticulable actions. The prototype was not presented as a 'finished game' but framed as a 'graft-game' prototype within the context of ongoing PhD research. The observations recorded focused on those physically interacting with the prototypes but recognized all forms of participation including peripheral observers, taking into account their reactions to gameplay.

The activity at each event was facilitated by both the author and technologist James Medd. All observation were recorded and documented by the author. Data, comprised of reflective field notes and video recordings, collected during observations was analysed using thematic analysis, selected for its flexibility (Braun & Clarke, 2006). Using Braun and Clarke's (2006) stages of analysis as a model, codes and themes were predominantly developed and refined using the thematic crossovers identified as placeholder themes, with new codes added where necessary.

Observations and evaluation

During observations of grafted gameplay, it was possible to observe the embodied actions of participants with existing experience, particularly in relation to gaming controls. Experienced gamers positioned their hands over the control buttons in a more deliberate way than non-gamers. For example, it was clear that participants who had gaming experience were those who held their fingers poised over the four buttons, positioning the index finger and middle finger or thumb of one hand over the top and left buttons and the index and middle finger or thumb of the other hand over the right and bottom buttons in a diamond format. Less experienced participants tended to use just one hand, using one or several fingers to press each button as required. See comparative images in Figures 4 and 5.

Figure 4: Images showing hand and finger positions of participants who presented as experienced gamers

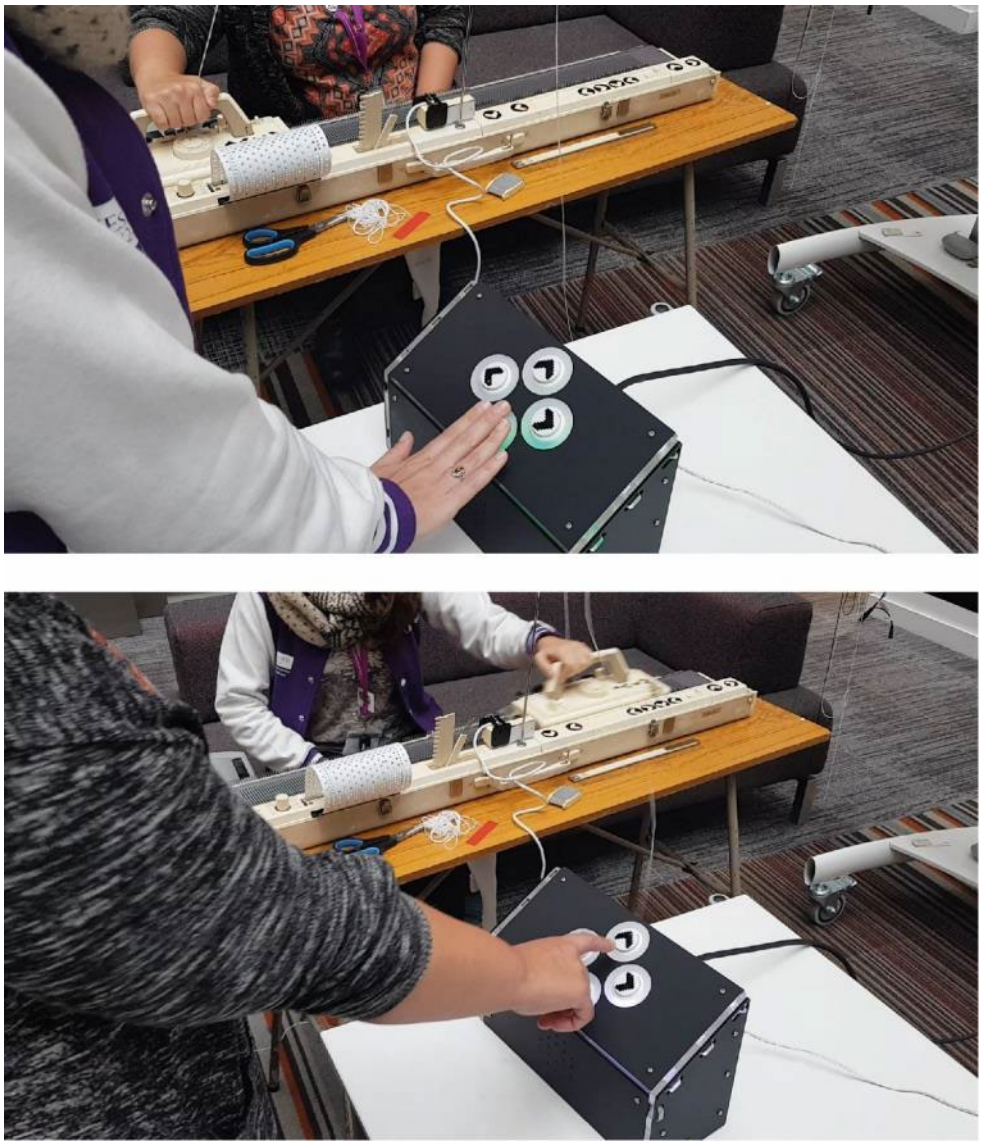

Figure 5: Images showing hand and finger positioning of participants less experienced with video games

Players who admitted to being less experienced with playing digital games tended to position their hands more haphazardly, often retracting their hand away from the buttons and hovering in mid-air in between presses.

Very few participants who engaged with activity at the various events were familiar with knitting machines, with only a handful recollecting family members having had one, and none claimed to have used one themselves before. This did not appear to have a large impact on the ability to control the knitting machine for the graft-game. The handle of the knit carriage appeared to be very approachable for participants with players instinctively placing their dominant hand around the handle. The knitting machine did have various protruding items such as tension rods and yarn stranded across the knitting area and participants were given safety guidance on these aspects. As a result, some participants were cautious when first using the knitting machine, for example moving the carriage slowly and then swapping hands at the end of each row so their arms would avoid yarn threaded across tension rods. In general, though, it did not take long for participants

using the knitting machine to get ‘into a rhythm’ and settle into a standard position of holding the carriage handle with the dominant hand and resting their other hand out of the way on their lap or using it to hold the edge of the table to steady it and themselves.

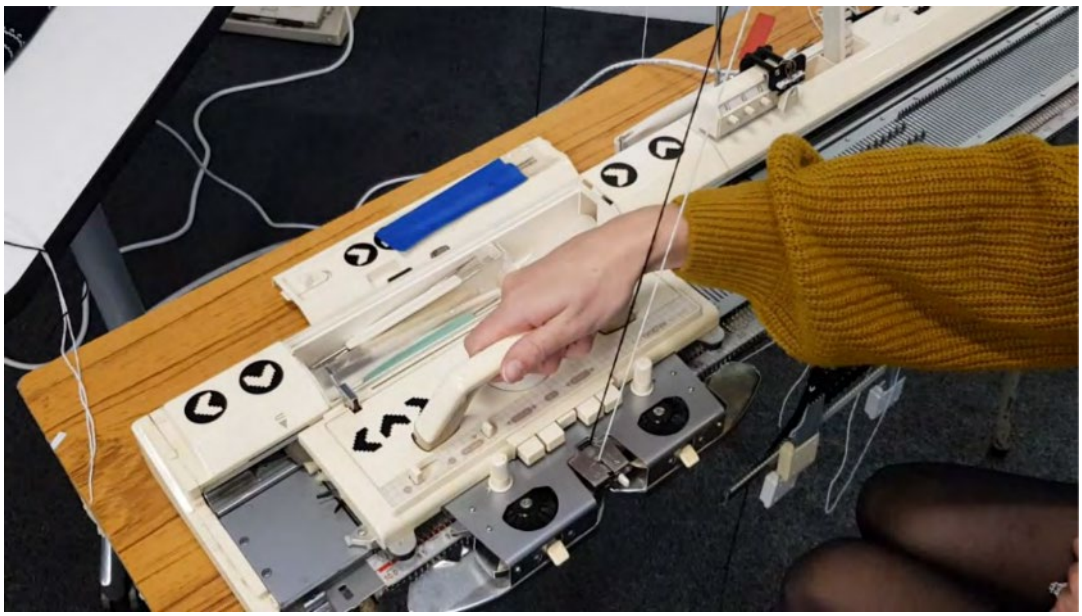

Figure 6: Participant holding the handle of the knit carriage to control the knitting machine

Optimising gameplay for a high score

Outside of existing experience, observations revealed that participants optimised their bodily movements through repetitive gameplay. For example, some participants would adjust their hand positions, especially when using the button controls as Player one, when playing a second game. For example, the image on the left of Figure 7 shows a participant playing their first game as Player one. In this game their hands are positioned above the controller hovering some distance from the buttons, reactively moving a hand towards a button as a prompt appears on the screen. On the right of Figure 7, the same participant is playing their second game as Player one on the controls. This time, their hands and fingers are positioned more deliberately with fingers on their left hand resting on the ‘left’ arrow button and fingers on their right hand resting on the ‘right’ and ‘down’ buttons. This positioning enabled them to respond to on-screen prompts with more considered, less frantic movements. In both games there is still some fumbling of movements to reach the ‘up’ arrow button with their left hand, but the participant’s hand positioning in the second game resulted in a slightly higher score. This adaption of the body that optimised gameplay was witnessed across many participants. In reducing ‘clumsiness’ and increasing the efficiency of movements, the quality of performance was improved in more accurate responses to the on-screen prompts.

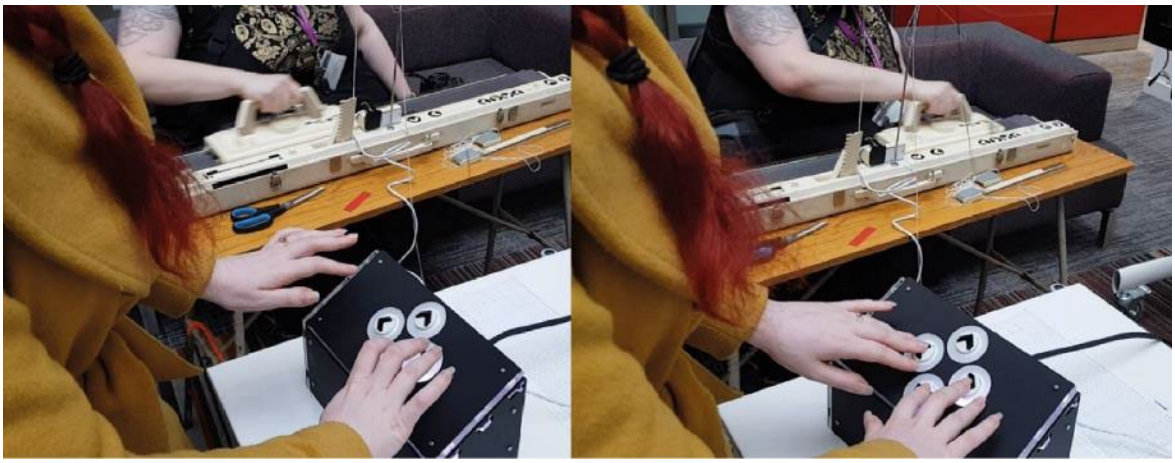

Figure 7: stills from video recordings shows change in hand positions of one participant, their first game on the left and second game, with more deliberate finger positioning, on the right

Optimising gameplay to achieve a high score in *Hazuki Knit* was not only dependent upon the skilled actions of Player one to press the correct button on the controller, it was also reliant upon the actions of Player two. The pace at which Player two moved the knit carriage along the machine bed determined how fast 'prompts' appeared on the screen, thus dictating how hard the game would be for Player one. This resulted in some participants playing as Player two, adapting their actions to work cooperatively with Player one in order to achieve a high score.

Cooperative gameplay could be defined as mutual support through which both players work together to achieve a high score. According to Sennett, this form of cooperation is "built into the genes of all social animals; they cooperate to accomplish what they can't do alone" (2012:5). In the case of *Hazuki Knit*, Player one is unable to progress in the game without the actions of Player two moving the knit carriage on the knitting machine. Cooperative play that was observed was primarily led by players on the knitting machine, with many players in the position of Player two deliberately pausing the knit carriage at the end of each row to enable adequate time for Player one to press the correct button. The act of deliberately pausing movement on the knitting machine removed the risk of Player one experiencing 'Game Over' due to being too slow, leaving only the risk of pressing the wrong button. This demonstrates a common desire to achieve a high score with participants working cooperatively to achieve it.

There were no observed interactions that suggested a desire by any participants to improve the quality or production rate of the knit fabric being produced on the knitting machine. This suggests that the goal of achieving a high score was prioritised over any perceived goal attached to the act of knitting. The engagement with the knitted output may have been different if the activity had been set up with a more defined output such as producing a pre-determined length of knitting or creating a collective finished object through gameplay. Any knitting that was produced during gameplay was as a by-product of successive and ongoing gameplay, with the production of the knit not being as motivating as achieving a high score.

Optimising the knit output

During gameplay of *Hazuki Knit* it was observed that the outputs and concurrent goals of the adjoined activities provided differing levels of motivation to participants. In effect, the end goal of both the digital game and knitting aspect were the same, to achieve as much as possible: either through knitting or getting a high score. The game score, was made explicit throughout gameplay, displayed on the screen (see Figure 8) for both participants to see, counting upwards each time Player one successfully pressed the correct button in time. This was accompanied by a satisfying 'BEEP' sound that increased in pitch slightly each time the score increased by one, communicating progress towards the goal of achieving a high score. The knitting aspect of *Hazuki Knit* provided a tangible means of tracking progress in the grafted game through the length of the knitted fabric being produced, which increased by one row each time the carriage moved across the knit bed (see Figure 9). This growing fabric reflected the steadily increasing score.

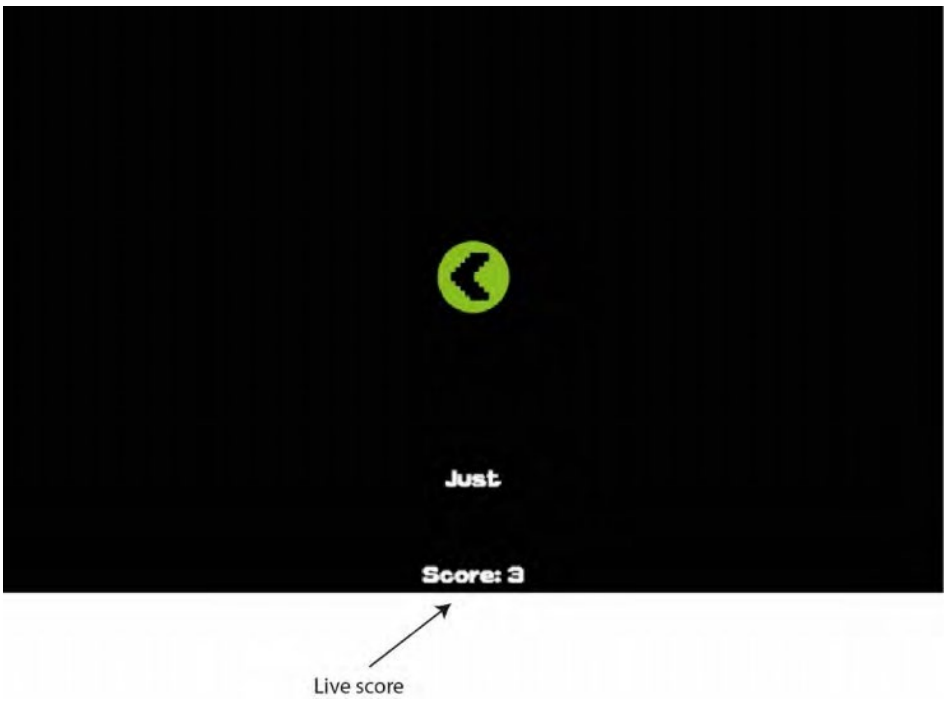

Figure 8: Hazuki Knit screen display including a live score

Unlike the game score, the physical knitted piece continued to grow from one game to the next unless a new piece of knitting was cast on. Removing a knit piece from the machine and casting-on anew is a slow process and due to the nature of the short- term participatory contexts in which *Hazuki Knit* was played, it was decided that the knitting would be left as a continuous piece in order to not delay participation in the game. The piece of knit being produced, therefore acted as a 'collective' object that all participants contributed to, whereas the digital score was personal to individual or pairs of players. This undefined collective object provides a point of difference from amateur knitting where the fabric being knit is most likely to be for the purpose of a finished object or garment that the knitter may have personal investment in. As noted by Twigger Holroyd, for many hand knitters it is the "anticipation of the use of the items they make" that makes the activity

significant to the individual and “legitimates the activity of making it” (2013: 106). The finished output of a wearable or useable item is thus the goal within amateur knitting. Few participants engaging with *Hazuki Knit* watched the knit as being produced or even realised that the knitting machine was knitting at all. It appeared that participants related the knitting machine’s purpose only as a game input.

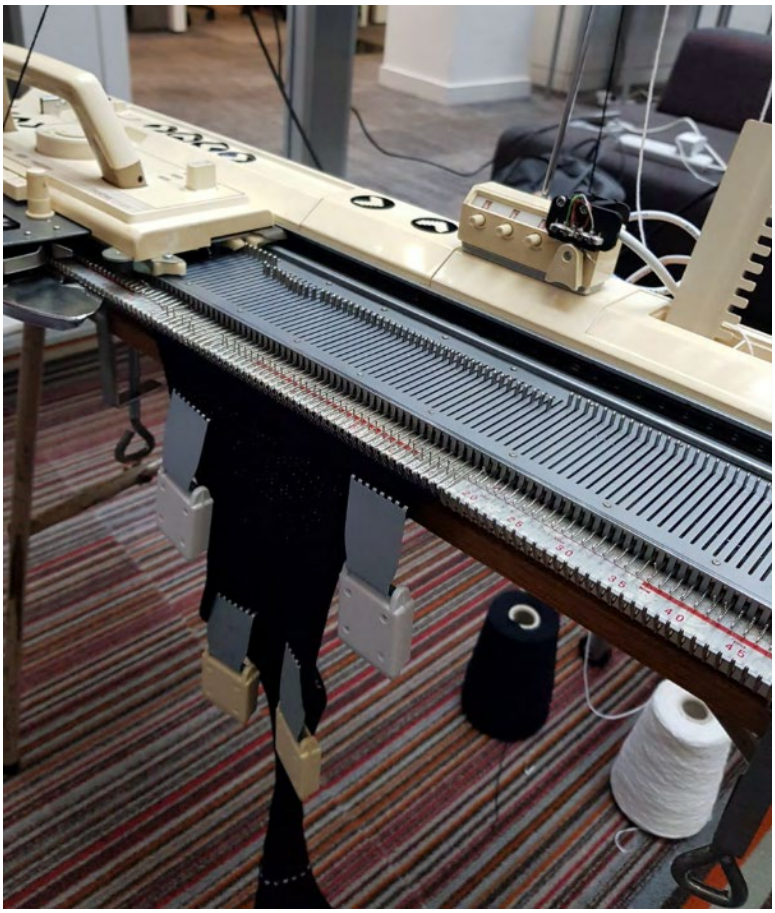

Figure 9: Knit fabric being produced as result of Hazuki Knit gameplay

At the second event (Game Jam, Salford), participants’ connections to the knitted fabric in relation to progress in the game was explored further, initially experimenting with adding a single row of a contrast colour at the end of each game. The rows in between these contrast lines then came to represent game scores with one row equal to one point in the digital game. At a later event (Liverpool MakeFest), the knit fabric output was adapted further to incorporate more colours of yarn, with colours to be selected by participants. Colours were swapped at the beginning of each new ‘game’. As games progressed, coloured stripes emerged in the knit fabric, with narrow stripes representing lower scores and wider stripes being from longer games with a higher score. As a result participants did have more interest in the knitted fabric being produced and were keen to compare their ‘tactile’ score with fellow players. The addition of asking participants to select a colour for the knit also provided the opportunity to draw attention to the knitting before gameplay started. Far more conversations about knitting in general occurred at this event than at the previous two which may

have been due to these increased discussions and awareness's of the knitting being produced during gameplay.

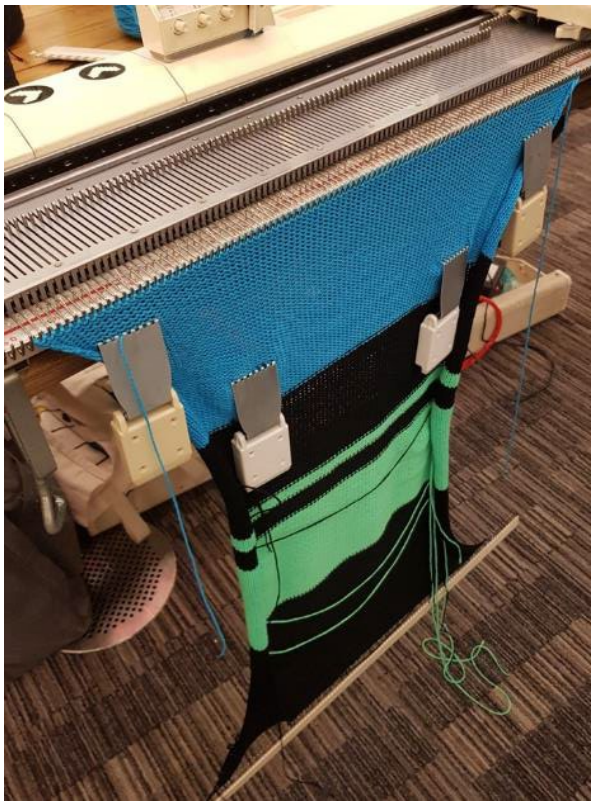

Figure 8 (Left): Knit fabric in progress with contrast white lines marking the start/end point of individual games
Figure 9 (Right): Knit fabric in progress with colour stripes representing complete games

High risk gameplay

Competitive games, as defined by Hunicke et al., "succeed when the various teams or players in the games are *emotionally invested* in defeating each other" (2004:3). The pattern of competitive gameplay that emerged during observations of *Hazuki Knit* did so among participants that played the game with a partner that they were accompanied by, as opposed to single players for whom facilitators acted as the second player for. Instead of cooperating to try and achieve a high score, participants worked competitively with players on the knitting machine deliberately making it harder for Player one on the control buttons. In *The Art of Failure,* Juul (2013) argues that such behaviour is seen as completely acceptable in the context of gameplay, expected even, whereas such behaviour in real life might be seen as rude or confrontational. Within *Hazuki Knit,* deliberate actions to prevent another player from winning were carried out by Player two, moving the carriage faster, increasing the pace at which prompts would appear on the screen for Player one requiring that player to respond more quickly before the carriage began the next row. The resulting sound of the knitting machine going faster also appeared to impose a sense of urgency in Player one. The competitive approach to playing was often accompanied by expressions of joy rather than frustration and could be seen to align with what McGonigal (2011) describes as 'fun failure'.

Participants playing competitively were never observed to be upset or annoyed by this type of gameplay and could be seen to be an act of cooperation in the pursuit of 'fun'.

Cooperative and competitive forms of gameplay sometimes changed between games of the same paired participants. Even if one participant played cooperatively and paced the knitting machine favourably for Player one, the result when participants swapped positions was not always a continuation of cooperative play. Sometimes, when players swapped, the player who had been on the buttons would deliberately knit fast to make the game harder for the other player. This player on the knitting machine, therefore, had more agency over the outcome of the game than the player on the control buttons.

As argued by Sennett (2012), cooperation can also produce destructive results for others, and in *Hazuki Knit* this was observed within the competitive instances during which the quality of the knit output was put at risk. Whilst the participants playing as Player one continued to work towards a high score, participants with competitive desires on the knitting machine were driven by a desire to prevent Player one from succeeding easily. In some instances, the facilitators told players whilst introducing the game, "the faster the knitting, the harder the game is for the other player". This often prompted the player on the knitting machine to go deliberately fast straight away making the game extremely hard for the player on the control buttons. This form of gameplay was often accompanied by laughter as Player one scrambled to press buttons in the short time available and ultimately failed. This would be met with equal joy from Player one, as the paradox of failure (Juul, 2013) was witnessed. McGonigal cites that such positive feelings experienced when failing in games contrasts with failure in real life through which "we are typically disappointed, not energized" (2011:66). The pleasurable experience of failing through competitive gameplay in *Hazuki Knit*, despite being easily recovered from in terms of the game aspect, generally had a negative impact upon the craft output. The excessive pace of the knitting machine put the knit fabric at risk of jamming, in some instances leading to some needles on the knit bed being damaged and requiring replacement at the events. At a lesser extreme faster knitting paces appeared to increase the risk of stitches being dropped, causing holes and ladders in the knitted fabric. The additional excitement and fast playing style also meant that players were more distracted and less likely to notice these errors in action. Cooperative gameplay, on the other hand, put less risk on both aspects of the game but neither forms of play were seen to make the production or quality of the knitted fabric a priority.

Insights and concluding remarks

This paper has presented 'grafting' as an approach to prototyping that enabled the direct observation of the impacts of directly connecting craft and gaming actions. Two key insights emerged through analysis of video recordings and field notes. Firstly, that both players interacting with the grafted game showed a desire to optimise their actions in order to achieve a high game score. In cooperative gameplay, this desire was demonstrated by both players, with Player one optimising their hand positions to improve accuracy of button presses and with Player two, on the knitting machine, adjusting their actions to enable adequate time for Player one to respond to game prompts. Secondly, the "desire to a job well" (Sennett, 2008:9) in terms of the quality of the knit output was diminished during competitive forms of gameplay with the quality being put at increased risk through the frantic actions of Player two. These insights suggest that the grafting of a digital game onto a craft activity, in this case knitting with a knitting machine, has no additional benefits to the craft output

and has the potential to put the quality of the knit output at risk. This could have potential implications in contexts where game elements are being considered for application in productive or manufacturing contexts where craft skills are utilised.

Grafting as a prototyping approach enabled for the observation of existing habitual actions and these should be considered within any future research that might employ similar methods. Within the design of the *Hazuki Knit* prototype, habitual actions of gamers in particular were taken into account through the development of a custom control panel rather than the use of an existing control pad. The generic design of the handle on the knit carriage of the knitting machine also ensured that prior embodied skills were not required in order to interact with and control the knitting machine aspect of the grafted game. If a different form of activity were to be used in the future the use of skill specific tools in relation to the skills of the selected research participants would need to be accounted for.

Through the case study of *Hazuki Knit* discussed in this paper, 'grafting' has been put forward as an approach to prototyping that provides a quick method for exploring an emerging field, without the need for lengthy prototyping or game development. In using existing machines, tools and materials, including an existing digital game, the grafted prototype enabled the investigation of potentialities brought about through directly connecting craft and gaming. This approach has the potential to be applied within other emerging fields that bring together distinct, yet related, practices, especially within fields that are concerned with embodied and experiential forms of knowledge.

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