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Investigating the use of digital technology in Jewellery Design: A thematic analysis

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Abstract

According to Brynjolfsson and McAfee (2012), digital technologies are one of the most important driving forces in the economy today, thus an understanding of these phenomena and a discussion of their influences has to be developed. Brown (2009), notes that one of the technologies that can be seen as an important innovation in this era is Computer Aided Design (CAD), which has revolutionised the creative capabilities available to designers and engineers worldwide. Nonetheless, there is a distinct lack of questioning in regards to what influence digital technology has on the creativity of designers. As a field, jewellery design is heavily associated with traditional handcraft values such as labour, material and complexity. And such values are being challenged by digital technologies. MacLachlan, Earl and Eckert (2012) suggest that, in the case of designer makers, tools are embodiment of rules working alongside more conceptual rules and conventions, in order to transform a design problem towards a creative design solution.

Purpose: This study is for both educational and industry purposes; with its primary focus being to advance knowledge about the jewellery design practice and the outcomes of this practice while integrating digital technologies. Thus qualitative approaches were used in order to explore a comprehensive analysis on how jewellery designers perceive their creative practice and what tools they use to realise their work. According to Silverman (2011), qualitative research is valued to the wider community with one of its strengths being its ability to access directly what is happening in the real world, by examining what people are actually doing in real life rather than asking them to comment upon it.

Design/methodology/approach: As an insider researcher, I conducted open ended semi-structured interviews of professionals working across fashion, contemporary and fine jewellery. The interviews of 8

professional jewellery designers were voice-recorded, in addition to note taking. According to Kvale (1996), interviews allow participants to introduce and reflect on issues and practices that they perceive as relevant to the research topic. This sample of designers enabled an informed snapshot of jewellery creative practices. All eight interviews were transcribed, then thematic analysis was used as a method to identify, analyse and report patterns/themes within the data (Braun & Clarke, 2006) and how they correspond with the established literature on creativity. An inductive analysis was used, as according to Braun & Clarke (2006), it is a process of coding the collected data without trying to fit it into a pre-existing coding frame, or my own preconceptions, thus using a form of thematic analysis which is data-driven.
The objective of this qualitative research was to explore the concepts and themes that emerge when questioning creativity in the jewellery design practices. A thematic analysis (Braun & Clarke, 2006) identified overarching themes evident across the designer's views, suggesting the key concepts that contribute to the designer's creativity is a collaborative approach of hand making techniques and technology. To the best of our knowledge, this is the first study to examine such issues of creativity and use of tech in the jewellery field.

Findings: The results of the analysis highlight that in jewellery creativity we may have new attributes to add to existing creativity theory. The designers interviewed agreed that some of the crucial elements of creativity were curiosity, playfulness, experimentation of process and materials, freedom, fun, innovation, stepping out of their comfort zone, having no fear, and improvisation. Which is not necessarily reflected in creativity research. The designers stated that they are looking at creative jewellery that evokes a feeling or excites them. In line with creativity research, the majority of the jewellers agreed that originality is an attribute necessary in creativity, though creative products are more than just original (Selcuk et al,2017, Runco, M. A., Illies, J. J., & Eisenman, R. 2017). Findings of this study support the idea that another factor not reflected in the standard definition, is that people's evaluation of creativity may be influenced by the concept of aesthetics and elegance (Selcuk et al 2017).
The designers were in agreement with current research, that CAD/CAM applications are applied to assist in creation, modification and analysis or optimization, in order to facilitate efficiency, increase the designer's productivity, improve the design, develop better communication of design ideas and shorten significantly the production time (Wannarumon & Boheze, 2004., Bernabei et al. 2015., Brown, 2009).

Keywords: jewellery design, new technologies, 3D modelling, 3D printing, CAD, thematic analysis.

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Introduction

The starting point of the process of designing a piece of jewellery is, alike most design subjects, the formation of an idea or initial concept; this may be originated by the customer or designer. Then an initial sketch is followed by a continuous research, modification and maximizing control over the final shape. Thus, during the design process, the shape is constantly evolving. This initial idea can be communicated in visual terms and then becomes concrete when taking form, through the employment of various systems of model making (in wax or metal depending on design complexity) and fabrication. The designer then makes decisions on details and manufacturability. The jewellery making process which follows depends on the modelling material; if pieces were made in metal, silicone moulds are created, while wax models- typically made for one off jewellery pieces- follow a lost wax casting process. When the desired metal is cast in the moulds, the craftsmen then files off any excess metal and polishes the surface, adding any texturing techniques or setting stones. Besten in the book 'Contemporary jewellery in Context' describes the separate worlds of *''the goldsmith, the obedient and old-fashioned craftsperson, and the new jeweller who strives for a more liberated view on jewellery: less about the intrinsic material value and more about the form-giving aspect and meaning of jewellery''* (p.26).

In the jewellery design field aspects such as creativity, analysis and development have to be balanced with beauty and function (Wannarumon, Unnanon, Boheze, 2004). Creativity therefore depends on the knowledge, experience and perceptions of the designer. Baber, Chemero and Hall (2019) argue that creativity which could be constructed as a 'cognitive' activity per excellence, arises from the dynamic systems involved in jewellery making. The authors continue by stating that the manner in which an action is coordinated is influenced by the criteria by which the product is judged. Concluding their article on 'What the Jeweller's Hand Tells the Jeweller's Brain: Tool Use, Creativity and Embodied Cognition', the authors point out that in jewellery making, constrains imposed by the materials used, the tools, the design brief, the aesthetic considerations or historical considerations, are necessary in defining the boarders of the conceptual space in which creativity emerges. Cross (1982), states that knowledge of design resides in people (i.e. The designers), in the process and in the products themselves. Similarly, Schon (1991) stresses the role of the practitioner, whose understanding and knowledge of a particular field corresponds to a perspective situated within the process of the praxis. In jewellery the maker's knowledge increases not only by one's hands-on experience in the field but also by observation: "The ability to recognize and understand concepts and process makes possible a profound 'conversation' between the jeweller and any finished work'' (Untracht, 1985).

The consensus is that CAD/CAM systems are in applied to assist in creation, modification and analysis or optimization, in order to facilitate efficiency, increase the designers productivity, improve the design, develop better communication of design ideas and shorten significantly the production time

(Wannarumon & Bohez, 2014., Bernabei et al. 2015., Brown, 2009,). Scarpitti (2019), states that digital processes also allow the construction of complex models with internal undercuts and voids that we are not able to achieve with traditional methods. Whereas Marx (2000) notes that digital design not only allows elements of the product to be easily manipulated in comparison to traditional methods, it also has an appeal to clients as it provides them with a clear understanding through the use of realistic renderings. These renderings can be presented at an early stage of the design process to the client, thus allowing changes to be made without having to build and rebuild physical models. Brown (2009), notes that CAD is most praised for its ability to create complex representations of a concept, with the most advance aspect of CAD being the function of analysis which uses stress and heat to test the viability of the object being created.

While the range and impact of digital tools available to jewellery designers is increasing, an examination of the current design and production methods and tools employed in the creative process is required. This research has identified a lack of questioning on the influence of the use of digital tools and aims to communicate a changing vision of the world within the confines of traditional jewellery design practice. Specifically, it examines the effect of Computer Aided Design and manufacture (CAD, CAM) as well as Rapid Prototyping (RP) and Augmented Reality (AR) technologies have on the creative process of jewellery practitioners. To facilitate an understanding of the creative process within jewellery design, this paper uses qualitative data to review the current use of digital technology and the effect this has in the field of jewellery design. Focusing on creativity and the maker, it takes a closer look at the creative process while making use of new technologies and concluding with creativity assessment methods.

Methodology

A qualitative approach was used in order to explore a comprehensive analysis on how digital technologies (CAD, CAM, RP, AR) influence creativity within the jewellery design field. According to Silverman (2011), qualitative research is valued to the wider community as one of its strengths is its ability to directly access what is happening in the real world; by examining what people are actually doing in real life rather than asking them to comment upon it. Specifically, ethnography methods were used for this study, where we studied the shared patterns and behaviours of Jewellers and explored the designers practice from the view point of the designers in order to find information regarding the role of digital design and manufacturing in their practice.

Noaks and Wincup (2004), sketched out the characteristics of three different interview formats; a) structured interviews: where the required skills include no prompting, no improvisation, and training to ensure consistency, b) semi-structured interviews: where some probing is required, rapport is built with

the interviewee to understand the aims of the project, c) open-ended interview: requires flexibility in addition to active listening and rapport with interviewee.

In comparison to other data collection methods, in-depth interviews can offer more detailed information about the views of the participants investigated (Boyce & Neale, 2006). Guest, Bunce and Johnson's (2006) study has statistically demonstrated that 12 interview participants are enough to generate a saturation data set. As an insider researcher, I conducted open ended semi-structured interviews. The interviews of 8 professional jewellery designers were voice-recorded, with field notes taken additionally as a primary means of data collection.

To limit bias, as an insider researcher, I conducted semi-structured interviews asking indirect questions to the participants. I replaced questions that imply there is a right answer with those that focus on the designer's true point of view. According to Kvale (1996), interviews allow participants to introduce and reflect on issues and practices that they perceive as relevant to the research topic.

When collecting qualitative data, in order to achieve 'rich data', the researcher has to be an active listener which allows the interviewee the freedom to express their views (Noaks and Wincup, 2004). According to Fontana and Frey (2000), in order to understand the language and culture of the participants of open ended interviews, we must first decide how to present ourselves as a researcher or learner in order to gain and maintain their trust, and establish understanding of the interviewees' viewpoint. Silverman (2011), referred to open ended questions as *'questions likely to get a more considered response than close ended questions and therefore provide better access to interviewees views, interpretation of events understanding experiences and opinions'* (p.167).

The study was granted ethical approval by UCLAN's Ethics committee prior to any data collection. The designers recruited were professionals, having been met at various meetings and discussions such as design events, jewellery design related exhibitions, fairs, conferences and through personal networks. This sample of designers enabled an informed snapshot of jewellery creative practices. I identified designers with a minimum of 10 years' experience in the field, practicing full time in the fields of fine, contemporary and fashion jewellery. At these events I approached designers, verbally giving them information about my research project and collected the contact details of the designers who showed interest. The aim was to develop a trust with the participants, by sharing my background and involvement in the field. They were then sent an email with the project information and were given 3-5 days to decide if they would like to take part in this study.

The open ended semi-structured interviews took up to 30 minutes at a location agreed with the designers (their studios or cafes) and included the following questions:

1. Invite participant to describe their design practice

2. Can you give us a definition of creativity in your studio practice?

3. What criteria do you look for in your own work and in the work of others?

4. What processes do you use to create your designs?

5. What would happen if one of the processes you use is taken away?

6. Do you have anything to add on the subject of creativity in jewellery design?

Prior to any data collection, consent forms were given to all participants, informing then on the subject of this study, and the way their data will be stored. They were also informed of their right to withdraw from the study up until the point of data analysis which was two months from the interview/observation date where I explained their right to withdraw without prejudice (for example to their job, studies or well-being) and without providing a reason and without it affecting any benefits that they are entitled to. The participants were informed that the findings of the research will be written up as feedback to them and for other organizations interested in this work. They were also informed that the findings will be presented as part of a PhD thesis project and may be published and used for future teaching purposes.

Analysis

The aim of the study was to deepen our understanding of how the use of digital technologies influences jewellery designers and to learn more about the creative process of these designers. To do this ethnography was used, in order to understand how jewellery designers perceive their creative practice and what tools they use to realise their work. In relation to the research question, this analysis is interested in designers' own accounts of their experiences and points of view when it comes to the use of digital tools. Discussions focused on what tools designers use and at which part of their creative process they implement them. Here we draw on Braun and Clarke's (2006) six phase framework and apply it in a systematic manner to describe and explain the process of analysis within the context of learning and teaching research.

All eight interviews were transcribed as a first step, followed by familiarizing myself with the entire body of data. The analysis then helped in identifying similarities of the creative processes of those jewellers working with digital technologies (or not) and how they correspond with the established literature on creativity. With the data collected, thematic analysis was used as a method to identify, analyse and report patterns/themes within the data (Braun & Clarke, 2006). I used my judgment as a researcher to identify themes which capture something important about the data in relation to my research question. I will be using an inductive analysis, as according to Braun & Clarke (2006), it is a process of coding the collected

data without trying to fit it into a pre-existing coding frame, or my own preconceptions, thus using a form of thematic analysis which is data-driven.

Step1: Become familiar with the data

Following the six phases of analysis set out by Braun & Clarke (2006), I first started by familiarising myself with the data by immersing myself in it. According to Lapadat and Lindsay (1999), the interpretative skills researchers need to analyse data may be achieved by closely reading and transcribing the data in detail. Thus, in order to develop a thorough understanding of my data, I transcribed all the recorded interviews into written form. The audio recordings of all interview were listened to a number of times for their accurate transcription.

Step 2: Generating initial codes

Some initial notes for coding were taken, which appeared interesting in relation to my research question. Coding was done manually, by writing notes and using highlighters to indicate potential patterns. I tried to code as many themes/patterns possible, then collected and copied all the codes and notes into a separate digital file.

Step 3: Search for themes

I then started developing potential themes from the list of codes. Constant comparative method was used to explore each data source in relation to those previously analysed. Using visual representation on illustrator, I tried analysing the codes to look into how some may be combined to form an overarching theme. At this stage I started having a sense of which themes were of significance and which seemed to reflect the data best before analysing more scripts and comparing them again.

Step 4: Reviewing themes

After reviewing and refining, I have identified the following five key themes in relation to investigating the use of digital technology in Jewellery design (fig.1):

1. Multifaceted design practice where story telling is of importance.
2. Creative jewellery is: innovative, original (material/process), playful, responds to a brief, aesthetically pleasing and well executed.
3. Responsive to the past, current and future needs and technological advancements.
4. CAD tools: production efficiency, time and low cost, forms/ hand tools: irreplaceable starting point of process.

5. Collaboration of new tech & traditional toolbox is essential.

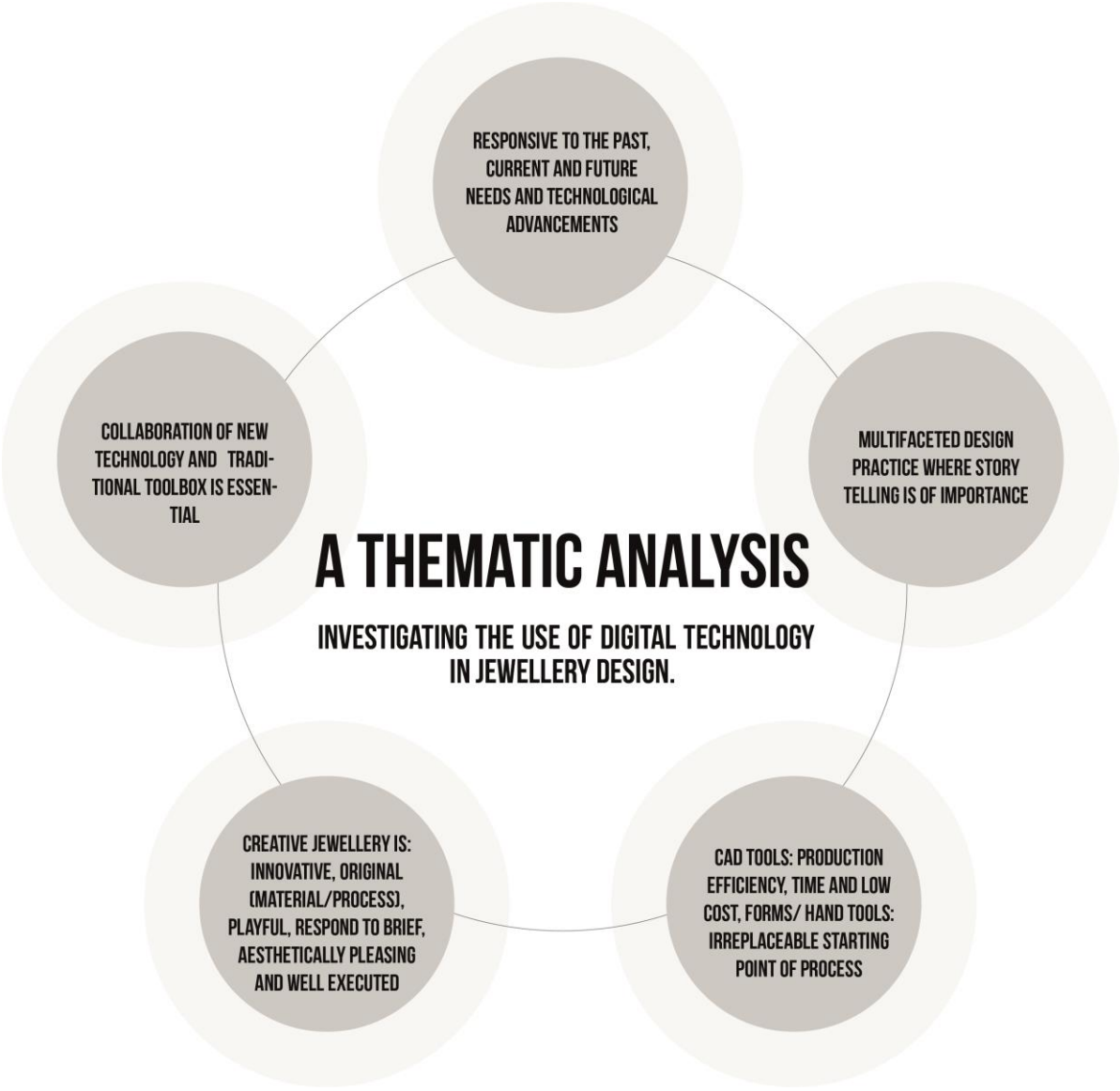

Figure 1

Step 5**:** Define themes

The majority of participants have multiple facets to their practices. For example, most designers mentioned they have both a commercial line as well as a more bespoke/client facing aspect of their practice:

D2: ‘’.. *I have collections I do once a year once every few months whenever I have enough money, and that's kind of like the most creative or the most selfishly creative I suppose of my output in that its totally am not doing it for anyone else other than for me, which is probably not so wise because we should be more commercial, but it's the kind of face that everybody knows and then we sell from that and then the*

other things. I mean I also do bespoke that's a bit of a slightly different process and that I also work as a consultant for other companies I think the collections part that I do is the essence of the creativity…''

When asked to describe creativity in their practice, a couple of designers (similarly to the students) found it difficult to give a definition. While others made statements like:

D1: ''*You know what, I've been creative for so long I can't even imagine not being a creative and virtually the only things I think about are my creative practice. I'm really sad and I don't do anything.*''

The majority of the jewellers agreed that originality is an attribute of creativity, though creative products are more than just original (Selcuk et al,2017, Runco, M. A., Illies, J. J., & Eisenman, R. 2005).

D5: ''…*about my own work here it's the details and that it makes sense and that it creates enjoyment pleasure and excitement. That is for me, the key that is the very minimum thing yeah, but it's like it's not easy to create excitement. People want to touch that, want to have it, want to wear it, yeah, and pushing the idea of beauty and conventional thinking and we thinking of beauties…*''

This is in line with research which supports the idea that another factor not reflected in the standard definition, is that people's evaluation of creativity may be influenced by the concept of aesthetics and elegance (Selcuk et al., 2017).

Baber, Chemero and Hall (2019) point out that in jewellery making, constrains imposed by the materials used, the tools, the design brief, the aesthetic considerations or historical considerations, are necessary in defining the boarders of the conceptual space in which creativity emerges. The design brief boundaries are what this designer sees as an opportunity to unleash creativity:

D1: ''…*But having those really rigid boundaries you have to be more creative when you're thinking. Even though that process I described to me is like that kind of obvious creativity, it is like coming up with stories and being all wonderful and floaty and having a lovely time listening to music. You know that's kind of almost easier creativity then being stuck in this like small clocks and trying to find a way to make a product that's a bit better than something else that it was before*…''

The designers interviewed, agreed that some of the crucial elements of creativity were curiosity, playfulness, experimentation of process and materials, freedom, fun, innovation, stepping out of comfort zone, having no fear, and improvisation. These elements are not currently reflected in creativity research. The designers stated that they are looking at creative jewellery that evokes a feeling or excites them.

Jewellery is a domain in which aspects such as creativity, analysis and development need to be balanced with aesthetics and function (Wannarumon, Unnanon, Boheze, 2004).

D8: ''…*that's the whole point in creating I guess, partially the whole point is to show your work to get other people's perspectives*.

Mala: *So does that mean if I'm on my own in the middle of nowhere and I'm being creative and don't show it to anyone I'm not creative*?

D8: *I guess you're creative but it's not art is it? Because art is only art when it's got a spectator. I am sure I've read that somewhere for my PGcert reading. I guess you can only get a scale of if you are creative or not if you compare it to other people, you need other people otherwise you can't compare your creativity…*''

The quote above highlights that in order to get a scale of your creative outcome you need others to compare it with. In other words, designers need a spectator in order to make judgements about how a jewellery piece is creative. This resonates with Amabile's statement in 1983*: "…creativity can be regarded as the quality of products or responses judged to be creative by appropriate observers, and it can also be regarded as the process by which something so judged is produced*" (Amabile, T. M., 1983, p.31).

The majority of designers mentioned the issue of only having an analogue/traditional style of jewellery design training. This is in line with Brown's (2009) findings that suggest a technological divide of new designers from their mentors who trained prior to the advancement of CAD, CAM. The designers later on clarified that they use some form of digital tool during their creative process. Some designers, while recognising their lack of knowledge of digital tools, explained that to resolve this they employ others to assist them in doing so.

D7: ''*…I think my brain kind of work[s] with fairly simple shapes but it's much more about the decorative kind of application[s], but then I'll sketch quite a lot and then because I don't know how to use any of this fancy computer programs I have a design assistant who comes to do all that for me so that in a way and then there's another kind of creative iteration in that process as well I think.''*

Where another designer saw it as an opportunity to use the tech to test and question what can be achieved:

D5: ''*...[I] had also the opportunity to see 3D printing, you know haptic devices, and that was for me amazing because it was very similar to the hands on process, yeah. I got feedback from the computer and this was so the key point where I started, and get excited, because I also found it fascinating to create volume without weight, to cast things my pieces are very opulent and exuberant and I was very interested in the decorative applied art, so the function that you can vary is important so, and I find thinking about ways how I can realise this and then like 3D printing was a good way because I could also hollow pieces, yeah volume without weight*.''

D6: ''*…when I was introduced to CAD and 3D printing it opened a world that was very interesting to me and that I sort of could see a point of difference for myself in there. Not that that was necessarily a*

strategic decision to go down 3D printing coz you know not many other people have but I could see that I could create the forms and experiment in the way that I wanted to''.

In line with CAD/CAM applications research (Wannarumon & Bohez, 2014.; Bernabei et al., 2015; Brown, 2009), the consensus is that CAD/CAM systems are applied to assist in creation, modification and analysis or optimization; in order to facilitate efficiency, increase the designers productivity, improve the design, develop better communication of design ideas and shorten significantly the production time:

D1: ''*…for instance the collection botany is a process which is a piece of modern technology that enables that collection to exist. It wouldn't be able to do without because of its accuracy and because of its immediacy as well you know I couldn't produce the pieces at a price that people would pay for if I had to cut it all by hand, but then equally [as] I said earlier I'm really interested in old processes, so And I love making things by hand, so I indulge, I mean it's a real indulgence, I can make things using old processes but then again they that informs their aesthetic*..''

D8: ''*…if [I] took Rhino away I wouldn't be able to make but it would take me an age to make some of the things I've made and it probably wouldn't even be able to make it because some of the things are so fine that yeah, I wouldn't be able to make it all. It would take too long it wouldn't be profitable And if you took illustrator away, I would just hand draw it, I would just use Rhino hahaha. I could be flexible with the other packages.*''

D8: ''*…so the first one would be to hand draw sketches, lots of different sketches and then I'd go back to the client and get their opinion on it and then I'd maybe draw it again, another like final drawing, show it again and make any more changes and then I go to Rhino, produce it in Rhino; um actually no before that and then do it in Photoshop with the drawing on the finger so they can get it to scale and see how it might look on their finger coz some people just have no idea.*''

This is in line with research which suggests that knowledge about digital design not only allows elements of the product to be easily manipulated in comparison to traditional methods, but also has an appeal to clients as it provides them with a clear understanding through the use of realistic renderings (Marx, 2000).

D7: ''…*I think there's something about that collaborative engagement with other people that you bring around you as a team that is also quite important for me. I don't have a kind of designers soul genius approached to my practice I don't think that is ever true unless you are the person who both draws, conceives, makes and sells your work, in which case maybe you can argue that if you're in studio on your own, but I think for most of us who work in kind of larger businesses that's just not true, you draw it somebody else makes it, and in that interchange between you and someone else making it, unless you're basically treating your maker as some kind of robotic producer, you know they always bring things into that piece*…''

While various Jewellery digital modelling specific software were created such as RhinoJewel, JewelCAD, ArtCAM, JewelSmith, and Matrix3D (Bernabei et al., 2015; Wannarumon, 2011), the designers of this study mentioned using Adobe Illustrator and Photoshop and the majority of them mentioned using Rhino. In contrast to research stating that modelling software programs are becoming more efficient and intuitive to use, thus have begun to replace the traditional notepad at the conceptual design phase (Veisz et al., 2012), this team of jewellers stated that everything starts with an initial hand drawing before the use of any digital tools.

D7: ''…*when you see the armies of people who are trained on CAD and think that because they know how to use CAD that is [what] makes the jewellery designer, where it doesn't really, it just means that they know how to use CAD and if you're not a jeweller I think it you know I don't know. In the hands of the guy who does my CAD work who's been one of the last people in Hatton garden trained to make master models by hand, it's a tool and its one tool that he brings to the realization of peoples designs. And I guess the one that helps many people to visualise what it is that the thing will be when it comes out the other end [of] the process but that's not what he's bringing. You know and I'll take things into him and he'll just go no you can't make that because I don't know, and somebody who's not maker but knows how to use CAD would probably happily CAD it up for me, yeah you know, and it will come out as an object that should not have been made.''*

D7's quote resonates with Shillito's (2013) claim that it is vital to have knowledge in the craft world in order to be able to design creatively and effectively with CAD.

Conclusion

The paper begins by providing contextual background on the use of digital tools currently used in the jewellery industry and provides insight on the relation between the tools and the creative practice. While focusing on creativity and the maker, qualitative data was used to review the current use of digital technology and the effect this has in the field of jewellery design, taking a closer look at the creative process of the contemporary jeweller.

The research explored the ways in which designers use technology in their creative practice. All eight interviews were transcribed to find similarities of the creative processes of those jewellers working with digital technologies (or not) and how they correspond with the established literature on creativity. To the best of our knowledge, this is the first study to examine such issues of creativity and use of digital tools in the jewellery design field.

This analysis used a constant comparative method to explore each data source in relation to those previously analysed. By casting aside all preconceived notions and simply allowing the gathered data tell

the story, we can see how the professional jewellers and jewellery students agree that jewellery design creativity is a much more complex theme to discuss. When asked to describe creativity in their practice, some designers found it difficult to give a definition.

This study's first contribution is that, on a practical level, it highlights that in jewellery creativity we may have new attributes to add to existing creativity theory. The designers interviewed, agreed that some of the crucial elements of creativity were curiosity, playfulness, experimentation of process and materials, freedom, fun, innovation, stepping out of comfort zone, having no fear, and improvisation. The designers stated that they are looking at creative jewellery that evokes a feeling or excites them. The elements of creativity discussed by the designers are not reflected in current creativity research. This is in line with research which supports the idea that there might be other factors not reflected in the standard definition, such as people's evaluation of creativity, which may be influenced by the concept of aesthetics and elegance (Selcuk, 2017). In line with creativity research, the majority of the jewellers agreed that originality is an attribute necessary in creativity, thought creative products are more than just original (Selcuk et al., 2017; Runco, M. A., Illies, J. J., & Eisenman, R., 2005).

The designers were in agreement that CAD/CAM applications are applied to assist in creation, modification and analysis or optimization, in order to facilitate efficiency, increase the designer's productivity, improve the design, develop better communication of design ideas, and shorten significantly the production time (Wannarumon & Bohez, 2014; Bernabei et al., 2015; Brown, 2009).

Social norms and consumer meanings must also be steered toward creating the link between the concepts and aesthetics created by the jewellers.

The findings of these interviews concluded that in order to neutralise some of the perceived disadvantages when using CAD/CAM, for example the reduction in hand making skills, the designing with CAD/CAM should be combined with traditional design and making skills.

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