WHAT'S DIGITAL ABOUT FASHION DESIGN?

ENABLING THE DESIGNER FASHION COMMUNITY TO UNDERSTAND AND ADOPT TECHNOLOGIES THAT LEAD TO NEW ECONOMIC MODELS IN THE DIGITAL ECONOMY

**RESEARCH WORKSHOP
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AAM.

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FASHION · INNOVATION · RESEARCH · EVOLUTION

NEMODE
New Economic Models in the Digital Economy

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NEMODE NETWORK+

NEMODE Network+ is an initiative under the Research Councils UK (RCUK)'s Digital Economy (DE) research programme to bring together communities to explore new economic models in the Digital Economy.

www.nemode.ac.uk

AAM ASSOCIATES

AAM is an independent research agency and consultancy focusing on emerging models of digital innovation in the social sector and creative industries.

www.aamassociates.com

LONDON COLLEGE OF FASHION, UNIVERSITY OF THE ARTS LONDON

London College of Fashion is a world leader in fashion design, media and business education. In boundary-pushing research: where fashion intersects with science, engineering, and technology. And in enterprise: where it partners with top brands and helps launch exciting new businesses.

London College of Fashion (LCF) have been nurturing creative talent for over a century, offering courses in all things fashion. LCF encourages its students to examine the past and challenge the present. To have their own ideas and to find their own styles and voices. Then use them to improve the way we live, and transform the future

Research at the LCF thrives within the College's unique specialist and transdisciplinary environment and is supported and resourced by dedicated research facilities such as the cosmetic science and digital laboratories, Fashion Space Gallery (FSG), world-class library and archive.

As one of six UAL colleges, LCF contributed to the Research Excellence Framework (REF 2014), where UAL's research was assessed as being 83% World Leading and international, is ranked a top five research university in its broader peer group in the UK and first in the Power ranking for Art and Design: History, Practice and Theory.

www.arts.ac.uk/fashion

Matthew Drinkwater is Head of Fashion Innovation Agency at London College of Fashion, University of the Arts London

Matthew works at the crossroads of Fashion, Retail and Technology to head up LCF's Fashion Innovation Agency. The agency partners the most exciting designer talent in London with the very latest fashion-tech to create ground-breaking brand collaborations and consultancies across the fashion, retail, lifestyle, cultural and digital industries.

Matthew delivered the world's first digital skirt for Nokia, wireless charging clothing for Microsoft and what Forbes described as 'the first example of truly beautiful wearable tech' for Disney and was named in the 100 most influential in the world of Wearable Technology. He is currently working on global concepts in wearable's, fashion technology and IoT.

Fashion Innovation Agency

The Fashion Innovation Agency (FIA) is based at the London College of Fashion and is part of the Centre for Fashion Enterprise (CFE). FIA works with global luxury, contemporary high-end brands, FMCG brands, OMNI channel retailers and designers across fashion and product design.

http://www.fialondon.com/

Philip Delamore is Co Founder and CIO of Change of Paradigm

Philip is a designer and strategic future thinker in the Digital Fashion space. He is a member of BSI and the ISO working group TC133 for new standards in Digital Fashion. He also consults on technology and design innovation to some of the most respected established and emerging brands in the Luxury Fashion and Media sectors.

Change of Paradigm (COP) is a startup that designs, develops, manufactures and distributes through its own online e-commerce platform luxury Fashion Capsule Collections. Product design and development are made in collaboration with well-recognized fashion designers using 3D CAD software and products are displayed on COP's e-commerce platform only in the form of products rendered (pre-rendered or real time rendered) in 3D simulation allowing full interaction between the customer and product prior to purchase and manufacture. This requires several technology challenges to be solved including: CPU complex cloth physics (multiple layers cloth/body interaction, integration to games engines to allow real-time interaction, GPU rendering (cloud) of high quality textures (e.g. BTF), delivery of video streams real-time (or quasi real-time) to multiple users.

http://changeofparadigm.com/

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1 EXECUTIVE SUMMARY

The digital economy presents the designer fashion community – and the broader creative sector within which it operates – with compelling opportunities to develop alternative business and economic models, as new ways emerge of engaging, creating, interacting and selling, driven by mobile connectivity.

Through a short desk research phase we explored what 'digital' means for this community, and through discussions with researchers and practitioners considered how clusters of emerging digital products and channels within the fashion design cycle are creating opportunities for new models in both, product and business development.

The research workshop invited industry professionals from the fashion sector to interrogate and discuss the statement 'What's Digital about Fashion Design?' The session offered a brief overview of the intersection of technology and fashion design, and how the fashion industry currently operates within the digital economy.

Attendees reflected and responded to the presentation in facilitated group discussions post the presentations, going on to share their experiences and understanding of this agenda in an open forum discussion.

The session's key findings segmented into three themed areas:

The challenge to tradition – which explored how the traditional fashion design cycle, whilst being contested by new digital approaches, platforms and services maintains a stronghold unlike other sectors within the creative industries. Similarly, the prevailing industry key performance metrics focused on consumer social media sharing were considered to be a hindrance to fostering innovation within core digital business activities. Whilst there is a wealth of digital activity focused on sales there is a dearth of activity earlier on in the design process, which could have potential to transform both a designer's practice and business. These concerns were also reflected in the belief that technology companies and new entrants not wedded to the traditional fashion design cycle would drive the development of new revenue models.

Digital and the design process – which challenged the potential of digital interventions to help save time and costs in day-to-day processes for fashion designers. This area also considered how critical access to practical tools and workspaces and digital skills development are for designers to be able to take advantage of the new processes underpinning the rise of the digital economy. More collaboration between fashion, technology and manufacturing is required to provide for needs beyond short-lived gimmicks, based on technology and data being fully integrated.

Developing new models – which questioned to what extent digital engagement could be integrated into the entire product development life within the present business and cash flow models. Fashion designers were considered to be in a unique position, with specialist knowledge and understanding of design to help shape developments in digital technology, especially the burgeoning wearables market and IoT. The lack of use cases of how technology is supporting the transformation of wholesale, financing, back end business operations and supply chain networks was considered to be a hindrance to adoption.

This short project has highlighted that there is a much bigger research opportunity to interrogate how the traditional model of fashion design is being changed and transformed by digital technology, and how willing the SME designer community are to adopt new models of engagement with manufacturers, wholesalers, retailers and consumers.

The event demonstrated the need for better dissemination of how designers are currently navigating new models of practice with digital technologies during this period of significant growth in the digital economy.

While a number of complex barriers were cited in relation to the fashion designer communities' openness to explore and adopt new models within the digital economy, we share attendees' eagerness to continue to question and interrogate how such innovation could better serve both design process and product and business model development.

2 TERMINOLOGY

NEW ECONOMIC MODELS

As described by NEMODE Network+, new economic models are a reflection that the traditional sectoral view (some describe this as the vertical space, in that constellations of companies are in a vertical from creation to distribution) no longer holds. Consider for example the iPhone and later smart phones: this has affected the market for cameras, torches, games, alarm clocks, and transformed the way we access media, eroded incumbents' dominance, etc. Therefore, it has expanded from its original position into other markets and sectors across a horizontal.

This ability to combine previously separate user experiences [1] is being made even more interesting by the development of sensor technology and big data. The question becomes what is the boundary around the data? Current research is looking at data at the level of the individual, groups of individuals in families, groups of friends, communities, even towns and cities. These boundaries enable eco-systems to come together to provide all the services the user(s) require. Data is made available and shared within all these units of activity and there are opportunities for both incumbent players and for the emergence of new organisations and ecosystems.

DIGITAL ECONOMY

As described by NEMODE Network+, this horizontal movement has been accentuated by the digital economy. As Normann predicted in 2000, the digital economy is liberating us from the constraints of:

1. Time, when things can be done
2. Place, where things can be done
3. Actor, who can do what
4. Constellation, with whom it can be done

Technology enables organisations to bundle existing activities and assets and link them in new combinations with other organisations' technology and assets free from the constraints of time, place, etc.

NEW ECONOMIC MODELS IN THE DIGITAL ECONOMY

As described by NEMODE Network+, digitisation is changing the way businesses compete – Professor Ng [2] argues that this is the coming together of social media, devices, [3] connectivity and the widget in the 'new oil' and that all of this happens in a context that provides the potential for New Economic Model in the Digital Economy.

DESIGNER FASHION COMMUNITY

UK designer fashion businesses are recognized as a driver of innovation and inspiration for the wider UK and global fashion industry. In common with current UK trends, where 95% of all UK businesses are classed as micro enterprises (Lord Young 2013 Growing your business report), the designer fashion community consists largely of micro businesses with under 10 employees, many start ups in their first few years of trading. Around 80% of the estimated 400 designer fashion businesses in the UK are located in the London area [4]. Due to the fast cycle of seasonal fashion, designers operate in an extremely time-sensitive and high-intensity system leaving little time and resources for strategic development.

FASHION DESIGN CYCLE (LINEAR MODEL)

A. DESIGN INITIATION AND DEVELOPMENT

Design research, inspiration and concept development is an ongoing process that tends to continue until a few weeks before the catwalk show. It involves visual exploration of ideas taken from books/online/exhibitions/film/media/materials/tech etc. Themes can be historical, thematic, conceptual, personal etc., or an external brief. The research informs the concept and mood of a collection, as well as details such as colour palette, silhouette and textiles etc.

[1] Reference: Majchrzak, A., and Markus, M. L. 2013. "Technology Affordances and Constraints Theory (of MIS)," in Encyclopedia of Management Theory, E. H. Kessler (ed.), Thousand Oaks, CA: Sage Publications.

[2] http://www.nemode.ac.uk/?page_id=51#_ftn1

[3] www.valueandmarkets.com

[4] British Fashion Council 2010 The Value of the UK Fashion Industry, Report for BFC by Oxford Economics. http://britishfashioncouncil.com/content.aspx?CategoryID=1745

B. PRODUCT DEVELOPMENT

Product development tends to start just after initial design research, it involves sourcing materials, making and experimenting with prototypes (toiles and textile swatches), silhouettes, colours. Several iterations take place for the development of a final sample collection. Designers will explore, play, sketch, and test prototypes, and constantly switch between working 2D and 3D in order to refine a design. A collection can include garments, accessories, shoes, textiles etc.

C. SALES - TRADE (WHOLESALE) AND BUSINESS TO BUSINESS (B2B)

Designers launch their collection with a fashion show or presentation, and invitations are sent out to press, buyers and journalists for brand promotion and wholesale for retail orders. Live streaming with 'buy now, wear now' apps have recently been integrated into fashion catwalks.

Ready-to-wear fashion shows happen twice a year for both womenswear and menswear, and there are pre-collections shown in between. Orders from a collection are taken at shows and then followed with a significant showroom-selling period.

Wholesale B2B trade can be for retail, online and physical platforms such as e-business/e-commerce/e-tail, social shopping, retail apps, web and mobile, and more recently virtual dressing rooms.

D. BATCH / BULK PRODUCTION AND DELIVERY TO RETAIL (B2B)

Designers prepare their collections for bulk production & delivery to retail. This involves pattern digitizing & grading, material supplies and textile print, knit, weave and embellishments etc. being ordered, liaison and descriptive spec sheets for garments manufacturers/factories and specialist makers. Orders are aggregated and garment production begins (usually externally).

E. SALES – RETAIL, ONLINE, PHYSICAL ENVIRONMENT AND BUSINESS TO CONSUMER (B2C)

Consumer facing brand marketing and promotion is set up in order to push sales. This involves media production of photo-shoots and videos for online channels, in-store promotions and printed media. Some brands put on an invitation-only press open day with a special buying experience in order to generate advertising coverage. New digital sales tools, apps and virtual dressing rooms are starting to be utilised as a service that nudges interest towards online purchasing.

F. SALES – BESPOKE OR PERSONALISED (MASS CUSTOMISATION) AND DIRECT TO CONSUMER (D2C)

Direct to consumer (D2C) orders can be an entirely bespoke and unique made-to-measure design experience, this is a traditional service that normally happens at high cost.

Mass customisation and personalisation is becoming more ubiquitous within online sales, designers are able to offer a selection of modular variations incorporating customer preference input.

All of these services normally require a waiting period for the goods to be designed and produced.

THE FASHION CYCLE

INSPIRATION, RESEARCH & DESIGN CONCEPT

PROTOTYPING

PRODUCT DEVELOPMENT

SALES - CATWALK SHOW, WHOLESALE. TRADE, B2B

BULK PRODUCTION & DELIVERY TO RETAIL

SALES - RETAIL/ONLINE, PHYSICAL ENVIRONMENT, B2C & PERSONALISED
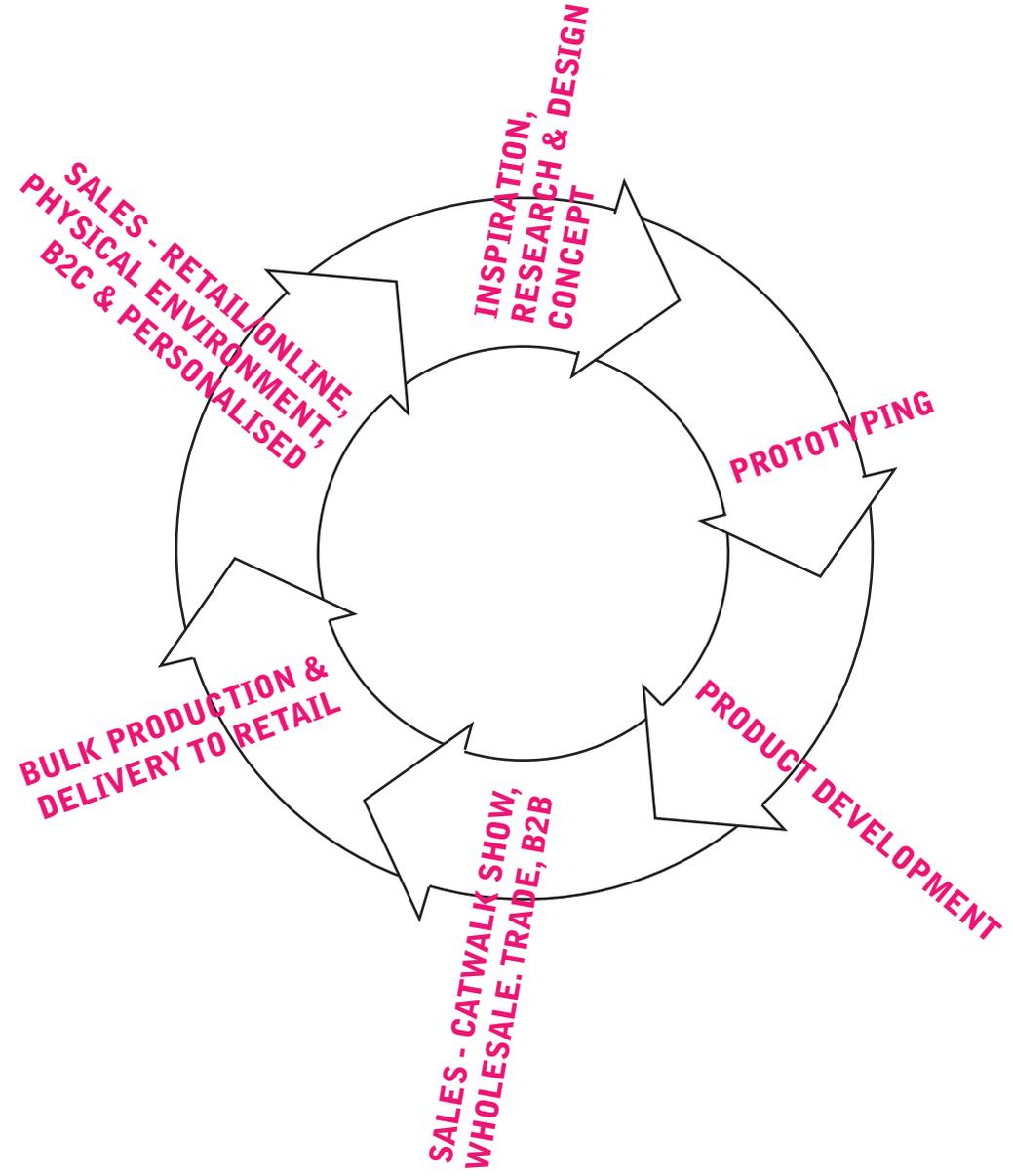
DIGITAL CLUSTER DESCRIPTIONS

View full Selective Survey

1	3D PRINTING	A process for making a physical object from a three-dimensional digital model, typically by laying down many successive thin layers of a material. This is also referenced as "rapid manufacturing", concerning laser sintering and electron beam melting technologies which enable short runs of actual finished parts to be produced. 3D Printing can also be used to describe old die making tools and patterns for castings.
2	BEACON TECHNOLOGY	A class of Bluetooth low energy devices that broadcast to nearby portable electronic devices. The technology enables smartphones, tablets and other devices to perform actions when in close proximity to an Beacon.
3	BODY SCANNING & MEASURING	Body scanning systems use light beams to generate 3D images from point cloud data and provide highly accurate body measurements. This data has been applied to the creation of anthropometric mannequins and virtual avatars, used for design and marketing visualisations and new virtual-try-on solutions.
4	BUSINESS SUPPORT	Other general components which support business operations, i.e. Accounting, Legal and general Web/Mobile development.
5	BROKERAGE PLATFORMS	Online platforms which designers and makers use to find manufacturers, material suppliers and workshop facilities.
6	CROWDFUNDING	The practice of funding a project or venture by raising many small amounts of money from a large number of people, typically via the Internet.
7	CROWDSOURCING	Obtaining information (or input into a particular task or project) by enlisting the services of a number of people, either paid or unpaid, typically via the Internet.
8	DATA DRIVEN FORECASTING	Predicting or estimating (a future event or trend) using data analytics.
9	DESIGN INSPIRATION AND MANAGEMENT TOOLS	Digital tools, which capture and manage design files, including: image searching, cataloguing and online storage.
10	DESIGN PREPARATION SOFTWARE	Programs and other operating information used by a computer, in this case concerning generic and proprietary design software used at product development stage.
11	DIGITAL DOCUMENTATION AND PUBLICATIONS	Electronic publications of a written, printed or photographic documents / content.
12	DIGITAL EMBROIDERY AND DIGITAL PRINTING	Digital processes using proprietary programmable software to automatically control sewing machines and printing machines to apply patterns on textiles.

13	**FREELANCE RECRUITMENT SITES**	Online recruitment platforms for creative freelancers.
14	**GARMENT MEASURING**	Tools, which produce spec sheets and tech packs for sampling and garment measuring prior to grading and production release. A 'digital tape measure' has also been developed but not widely taken up.
15	**INVENTORY SOFTWARE**	Platforms, which list items (goods) in stock, or the contents of physical building.
16	**LASER TECHNOLOGY**	Focused light beams applied to flat materials for textile surfacing, cutting, pattern making, engraving and seam welding. Stereo lithography is a technique or process for creating three-dimensional objects, in which a computer-controlled moving laser beam is used to build up the required structure, layer by layer, from a liquid polymer that hardens on contact with laser light.
17	**LIVE STREAMING**	The transmission or receiving of live video and audio coverage of (an event) over the Internet.
18	**MANUFACTURING PLATFORMS**	The process of converting raw materials, components, or parts into finished goods. Manufacturing commonly employs a man-machine setup with division of labour in a large-scale production - this category relates to manufacturers who have developed streamlined online platforms.
19	**MAGIC MIRRORS**	Augmented reality virtual try-on systems in stores.
20	**MATERIAL TESTING AND EXPERIMENTATION**	The testing of materials and processes in relation to for example, strength, durability, safety, efficacy, etc. Experimenting with materials for new applications and uses
21	**MOBILE MARKETPLACES AND E-COMMERCE PLATFORMS**	Commercial transactions conducted electronically via the internet on mobile technology or desktop.
22	**OPEN SOURCE SOFTWARE**	Denoting software for which the original source code is made freely available and may be redistributed and modified.
23	**ORDER MANAGEMENT AND FULFILMENT**	Platforms, which support the completion of process from point of sales inquiry to delivery of a product to the customer.
24	**PATTERN DIGITISING**	Pattern digitising, which provides digital scanned lines that are readable by most CAD apparel programs and a cost-effective way to convert old and manually made patterns into digital files.

25	PATTERN GRADING	Pattern grading is defined as re sizing of base patterns and the creation of pattern grade rules, excel formulas and grading charts to derive a range of consumer sizes.
26	PRINT ON DEMAND SOFTWARE	A system or process whereby individual copies or small numbers of a product are printed to order.
27	PROTOTYPING	Tools or processes which produce an example of a style that uses specified hardware and is a benchmark for final fabrication trial giving room for trial and error, experiments and refinements concerning for example, silhouette, materials, details, etc.
28	RETAIL APPS AND PLATFORMS	A self-contained program or piece of software designed to fulfil a particular purpose; an application, especially as downloaded by a user to a mobile device (specific in this instance to larger retailers).
29	ROBOTICS	A branch of technology that deals with the design, construction, operation, and application of robots.
30	SOCIAL SHOPPING AND COMMERCE-ENABLED SOCIAL NETWORKS	Social shopping is a method of e-commerce where shoppers' friends become involved in the shopping experience. Social shopping attempts to use technology to mimic the social interactions found in physical retail shops. This also includes websites and applications that enable users to create and share content or to participate in social networking.
31	TRANSPARENCY AND SUSTAINABILITY APPS AND PLATFORMS	Technology used to empower designers, retailers and consumers to understand their supply chains in order to employ systems, which can be supported indefinitely in terms of environmentalism and social responsibility.
32	VIRTUAL DRESSING ROOMS	The online equivalent of the near-ubiquitous in-store changing room, enabling shoppers to try on clothes to check one or more of size, fit or style, but virtually rather than physically.
33	VIRTUAL REALITY	Computer-generated simulation of a three-dimensional image or environment that can be interacted with in a seemingly real or physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors.
34	WEARABLES AND E-TEXTILES	Wearable technology is a category of technology devices that can be worn by a consumer and often include data tracking and information collection. Electronic textiles (e-textiles) are innovative textile materials, (fabrics, yarns and threads), that incorporate conductive fibres or electronic elements directly into the textile itself (also referred to as Biometric fabrics).
35	WHOLESALE PLATFORMS	Platforms, which facilitate the business of selling of goods in large quantities, typically to be sold on by retailers.

3 INTRODUCTION

The digital economy presents the designer fashion community – and the broader creative sector within which it operates – with compelling opportunities to develop new business and economic models, as new ways emerge of engaging, creating, interacting and selling, driven by mobile connectivity.

Through a short desk research phase we explored what 'digital' means for this community, and through discussions with researchers and practitioners considered how clusters of emerging digital products and channels within the designer fashion community are creating opportunities for new models in both product and business development.

The research workshop event took place in October 2015 and was entitled, 'What's Digital about Fashion Design? Fashion, Technology and the Digital Economy.' The event invited academics and industry professionals from the fashion sector to discuss the designer fashion communities' understanding of the digital economy, and how adoption of digital technologies could lead to new business and economic models.

The session also aimed to interrogate the current uses of technology within the designer fashion community and possible gaps for digital innovation in the fashion design cycle.

The workshop was structured in two parts:

1. Presentations on the intersection of technology and fashion design, and how the fashion industry currently operates within the digital economy.

2. Facilitated open forum session, focusing on key themes identified in the desk research phase.

This session arose from our interest in broader new economic models that have arisen as a result of the digital economy, and a concern that the potential of such models within the fashion community is being overlooked, warranting much greater attention.
Acknowledging, whilst the largest global fashion companies are able to invest heavily in digital infrastructure, there is also a pressing need for smaller operators within the designer fashion community – the vast majority of the sector – to innovate and embed digital thinking in their operations, rather than developing products and then working out how to 'go online'.

The methodology for our desk research phase predominantly focused on horizon scanning and cataloguing a selective survey of digital products, platforms and services, which relate to the fashion design process. We assorted individual listings into specified digital clusters, subsequently aligning them to a stage in the traditional fashion design cycle.

The workshop event was participatory in order for industry experts to be able to share their responses to the presentations, and understanding and experience of the digital agenda.

In the following pages we have outlined a series of key themes and findings that arose from the desk research phase and the workshop session. In response we have offered some initial recommendations as to how we might further this exchange.

We welcome responses from anybody interested in this topic, and are always open to collaborations and sharing learning, so please do get in touch.

WORKSHOP PRESENTATIONS

A short overview of the session, including participants' comments, can be underline viewed online.

The presentations given on the day are also available to watch online:

Professor Sandy Black, Professor of Fashion and Textile Design and Technology, London College of Fashion, University of the Arts London

Mary Jane Edwards, Co-Founder and Director, AAM Associates

The case studies presented during the workshop pointed to how digital technology is currently utilised by the designer fashion community, also referencing examples in the commercial and retail sectors. Links to the example case studies and references highlighted in the presentations can be found in the Appendix.

SELECTIVE SURVEY DESK RESEARCH

The selective survey document, which is referenced throughout this short findings report identifies some of the key clusters of digital technology tools being developed for and utilised by fashion designers, aligned to the traditional fashion design cycle.

A copy of the selective survey is available online, to which we also welcome suggested additions of digital products, apps, platforms or services and new categories of digital clusters relevant to fashion design and the fashion design cycle. Contact details can be found on the inside front cover.

4 KEY THEMES AND INSIGHTS

4.1 THE CHALLENGE TO TRADITION

THE LINEAR FASHION DESIGN CYCLE

"THE FASHION INDUSTRY LIKES HOW IT WORKS, IT HAS AN ENTRENCHED WAY OF OPERATING – THE SEASONALITY IS VERY DIFFICULT TO CHANGE."

It is now widely acknowledged that fashion retailers and brands, especially the luxury market were slow to adopt digital technologies and new business models emerging as a result of the growth of the digital economy. Whilst this inevitably had an adverse 'trickle down' effect on smaller fashion design businesses within the SME community during the early to mid noughties, in recent years a swathe of digital products services and platforms have begun to emerge in the market. These digital tools have created new opportunities for engagement with consumers and disrupt traditional creative and production processes in the designer fashion community. But is this change welcome?

During the research workshop several participants concurred that whilst e-commerce and communications in terms of social media had transformed sales and some distribution models, it was still underpinned by a traditional cycle of designing and showcasing a range, consolidating orders with wholesalers, to manufacturing, and retailers and fashion publishers marketing the range.

The presentations and discussions took account for the fact that the fashion sector is inherently still very craft based and ultimately trades in physical goods unlike many other commercial industries within the creative sector. However,

it was suggested that the narrative and literature around the digital economy and digital technology within fashion wasn't always accessible and relatable to the day-to-day product design and development activities undertaken by designers.

Several participants questioned how robust the designer fashion community's understanding of the opportunities presented by digital technology was. It was felt that there is a perception of a lack of leadership of the agenda from governing bodies or intermediary organisations outside educational intuitions. Journalistic commentary and papers were perceived to focus primarily on the importance of investing in the digital economy or the 'digital experience' in customer related sales, but few advise on practical pathways to do so, or embrace broader change industry-wide.

THE NEED FOR NEW KEY PERFORMANCE INDICATORS

"TECHNOLOGY AND FASHION IS BEING DONE A DISSERVICE BECAUSE OF IT IS SO 'FADDY.' UNTIL WE MOVE ON FROM KPI'S THAT ARE PR DRIVEN IT WON'T BE ABOUT THE PRODUCT LIFE CYCLE AND WHAT ACTUALLY AFFECTS A BUSINESS."

Whilst attendees recognised how, for example, mobile technology, data analytics, cloud computing and software

are transforming the way most companies and businesses do business it was felt that the industry was wedded to metrics that often bore no relevance to the potential revenue generating activities of such technological innovation. Instead it predominantly focuses on social media shares and publishing metrics.

'Digital' in the vast majority of cases is still an 'afterthought' to business activity or companies are handing over parts of their supply chain to middlemen or online platforms, losing potentially vital information and data. Similarly, it was referenced that digital technologists have only recently assumed senior management roles at board level within some large brands and luxury retailers. [5]

The discussion on the challenge of the current key performance indicator (KPI) metrics emphasised the importance of strategy and understanding the aims and objectives for design or business activity, which digital may or may not be best placed to deliver against. The presentations also focused on asking designers to think about what problems they had, which could be solved by digital technology or successes that could be scaled by digital tools.

OPERATING IN A PREVAILING CULTURE

"DESIGNERS KEEP GOOD MANUFACTURERS DETAILS VERY CLOSE TO THEIR CHESTS! THERE ISN'T A STRONG CULTURE FOR SHARING CRITICAL BUSINESS INFORMATION OR CONTACTS INFORMALLY."

Several attendees cited that in some cases there was still an innate distrust of 'digital'. Especially since bulk production processes operate within manufacturers who have limited digital systems in place, or even websites in some cases. The absence of a trust-based culture in the industry was considered to be a barrier to developing new models of business and sharing new product development tools.

Change or early adoption of new processes, especially concerning digital technology trends is often reliant on an organisation's culture and management style. It was thought a greater understanding of the conditions in which digital could be incorporated into a product development lifecycle in stages would support cross- disciplinary and cross-sector learning.

4.2. DIGITAL AND THE DESIGN PROCESS

GAP IN DIGITAL SKILLS

"DIGITAL TECHNOLOGY OBVIOUSLY ISN'T GOING TO BE A REPLACEMENT FOR CRAFT BASED DESIGN PRACTICES, IT SHOULD BE MORE ABOUT HOW IT CAN ENHANCE WHAT I WANT TO ACHIEVE."

The innovation challenges for fashion designers were considered to be diverse, from programmable textiles, search engines utilising metadata based upon images rather than text, to virtual reality experience design, and 3D printing software.

Participants questioned to what extent digital engagement could be integrated into the entire product development life cycle when there is evidently a skills gap within the industry. It was considered important to think of new ways of up-skilling established fashion designers, and professionals in the industry (outside educational institutions) with a basic overview of new digital software and tools available. Conversely some attendees stated that they wouldn't change their traditional education in favour of acquiring the skills to utilise digital applications. A few designers suggested this re-focus would circumvent the critical foundations within design inspiration and product development, such as play.

NIKE MAKING APP

NIKE MAKING IS A DIGITAL TOOL DESIGNED TO INSPIRE FASHION AND TEXTILE DESIGNERS AND CREATORS TO MAKE BETTER CHOICES IN THE MATERIALS THEY USE. NIKE SPENT 8 YEARS DEVELOPING A SUSTAINABLE MATERIALS INDEX TO INFORM THEIR OWN DESIGN TEAMS ABOUT HOW MATERIAL CHOICES IMPACT THE ENVIRONMENT. THE IDEA OF THE MAKING APP WAS TO OPEN THIS DATABASE UP TO ANY FOOTWEAR AND APPAREL DESIGNER.

THE CENTRE FOR SUSTAINABLE FASHION AT LONDON COLLEGE OF FASHION COLLABORATED WITH NIKE, WORKING WITH PROFESSIONAL DESIGNERS AND LCF MA STUDENTS TO DEVELOP A TECHNOLOGY INFORMED DESIGN APP FOR SUSTAINABILITY, LAUNCHED IN 2013. THE RESOURCE IS FREE TO DOWNLOAD AND ENABLES DESIGNERS AND MAKERS TO COMPARE THE ENVIRONMENTAL IMPACT OF SPECIFIC MATERIALS CHOICES FROM DIFFERENT PERSPECTIVES INCLUDING ENERGY, CHEMICAL COMPOSITION, WASTE, AND WATER USE.

HTTP://SUSTAINABLE-FASHION.COM/PROJECTS/NIKE/
HTTP://NIKEMAKERS.COM/#/

3D PRINTING

"THE POTENTIAL IS NO DOUBT GREAT, BUT MOST PEOPLE DON'T REALISE YOU CAN'T YET ACTUALLY PRODUCE A FINISHED PRODUCT YET!"

There was much optimism at the event around the potential of 3D printing in terms of aiding transparency and sustainability issues. The ability to create clothing and customise products without having to hold significant inventory and stock was considered to be a big driver of growth for new business models within the digital economy.

However, it was acknowledged that the promise of low cost small batch production made possible by 3D printing software and hardware wasn't yet fully realised in the fashion market for SME's. 3D technology has in some cases reduced the use of physical prototypes for retailers and begun to respond to consumer demand for personalisation, but again, is yet to gain real traction for the fashion designer community en masse.

It was noted by attendees that designers are utilising CAD software such as Rhino, and 3D visualisation packages such as Marvelous Designer and Gerber but that these innovative explorations are often impeded by access to 3D printing systems, automation solutions, hardware and equipment to improve manufacturing and design. This is exacerbated by the lack of development of sustainable raw materials for 3D printing.

The innovation and experimentation in 3D printing for fashion has been most successful at the conceptual level of high-end catwalk fashion utlising couture processes with technical collaboration. Dutch fashion designer Iris van Herpen pioneered collaborations with different architects (who are familiar with using 3D design software) to develop one-off fashion creations made from several 3D printed segments. This work has inspired many others to experiment with the technology, for example Noa Raviv from Israel.

NEW PROCESSES FOR PATTERN CREATION

The process of clothing development creates a 3D object from 2D sketches, 2D patterns and 2D fabrics; designers visualise and craft the design both mentally and physically, moving between 2D and 3D spaces. Much software system development has so far not been fully integrated with design conceptualisation. Kiwy Huang, a PhD researcher at London College of Fashion is developing his Draw2Wear concept in order to develop 3D visualisations of designs directly from 2D sketch concepts, and automatic creation of 2D patterns, working with a virtual avatar with which the designer can interact.

WEARABLE TECHNOLOGY

"TECHNOLOGY IS IN FASHION, BUT IS IT FASHIONABLE?"

The rise in intelligent devices and 'wearables', especially within the health and fitness industry has seen a number of startups and collaborations emerge intent on making such items practical and aesthetically pleasing in design terms. High performance and responsive fabrics are not new to the fashion sector, but the integration of sophisticated data collection and analytics are a relatively recent phenomenon. The 'quantified self' concept as illustrated in the presentations is driving much of the smart clothing that

is reaching consumers.

Participants suggested that fashion doesn't always need technology and that the wearable trend, much like the KPI's in fashion, were doing the industry a disservice. Several attendees raised concerns that the consequences of innovation in smart clothing, programmable and E-textiles not being driven by fashion designers was potentially damaging to the industry as a whole. Attendees agreed that more research would be useful to interrogate the role of such technologies in the design process and models relating to the consumer journey.

GOOGLE, PROJECT JACQUARD

IN THE SUMMER OF 2015 GOOGLE ANNOUNCED PROJECT JACQUARD, WHICH WEAVES TOUCH AND GESTURE INTERACTIVITY INTO TEXTILES USING CONDUCTIVE THREADS. THE PROJECT HAS COLLABORATED WITH LEVI'S TO PRODUCE JEANS MADE FROM TOUCH-SENSITIVE MATERIALS EMBEDDED WITH ELECTRONICS AND BLUETOOTH CONNECTIVITY.

COLLABORATIONS WITH BRANDS, RETAILERS AND TECHNOLOGY COMPANIES

"WE NEED TO COLLABORATE, OPEN RESEARCH THAT IS THE ONLY WAY THINGS WILL CHANGE AND DESIGNERS WILL START TO DEFINE THEIR PLACE IN THE DIGITAL ECONOMY."

Whilst we've seen a number of collaborations between established fashion designers and brands and retailers emerge exploring digital technologies, some of which are highlighted in the workshop presentations - there is yet to be a significant rise in technology companies partnering with designers outside a fashion education context.

Practical and inclusive collaborations between sectors was considered essential in order to further develop this agenda, to create both more case studies and refocus investment in digital technology within the fashion industry. It was felt that the focus of product development, especially within growing markets such as wearable technology could be better served with greater input from fashion designers and fashion education.

It was believed that fashion designers are in a unique position, with specialist knowledge and understanding of design to help shape developments in digital technology, especially the wearables market and IoT. Their inclusion in technological innovation within larger technology companies, brands and retailers could also support the development of new value propositions with the digital economy, which better serve the sector and consumers.

4.3   DEVELOPING NEW MODELS

NEW VALUE PROPOSITIONS

"THE DIGITAL ECONOMY IN FASHION SEEMS TO BE DRIVEN BY CONSUMER EXPERIENCE, SALES AND SPEED OF DELIVERY. IS IT EVEN POSSIBLE TO TAKE A STEP BACK AND THINK ABOUT HOW DIGITAL COULD ADD DIFFERENT VALUES TO A BUSINESS?...I THINK WE'RE QUITE FAR AWAY FROM DEVELOPING NEW MODELS."

The desk research phase confirmed that is a wealth of digital activity focused on stage five of the fashion design cycle, Sales – online retail, the physical environment and direct from business to consumers, and a dearth of activity earlier on in the design process.

There was much discussion at the event questioning how new economic models could emerge when the current value of 'digital' is tightly defined in a retail and consumer framework – did there have to be a division between making vs. selling? How could the opportunities brought about by investing in digital be framed to encourage adoption?

Participants again cited that there aren't many forums where the designer fashion community can experiment or collaborate across sectors making it difficult to define or design alternative value propositions.

DIGITAL AND BUSINESS PROCESSES

"THERE ARE GOVERNING BODIES OR INTERMEDIARIES IN OTHER SECTORS THAT TAKE SMALL BUSINESSES THROUGH THE WHOLE PROCESS OF TECHNOLOGY – THIS SEEMS QUITE ABSENT IN FASHION."

The principles of the digital economy offer a multitude of critical intersection points for any business. Constant change in technology and new forms of global communication has meant that most creative industries in order to be competitive are having to push the boundaries of nearly all business models from conception – production – medium – media etc.

Conversations during the workshop indicated that even for the focus of the digital economy from an e-commerce perspective there are less feted examples of how digital technology is being utilised in a broader business context.

This was also reflected in desk research which identified a multitude of apps, platforms and services dedicated to getting fashion designers to sell online but far fewer tools to support designers in production, shipping and managing inventory for example.

THE WHOLESALE RELATIONSHIP

"WHOLESALERS WANT TO KEEP THE ENTIRE RELATIONSHIP TO THEMSELVES – IT'S WHERE THE PROFIT IS. FASHION IS EITHER FOCUSING ON HAVING THAT RELATIONSHIP WITH THE WHOLESALER OR CIRCUMVENTING IT TOTALLY, RATHER THAN ON WHAT WORKS FOR AN INDUSTRY AS A WHOLE AND HOW DO YOU GUIDE INDIVIDUAL BUSINESS THROUGH THE PROCESS."

Following on from the above point, one of the most prominent areas for potential new models to materialise is the B-to-B marketplace and wholesaler relationships.

Platforms like JOOR, Le New Black, NuORDER and Modalyst have grown in prominence over the past decade. These sites focus on helping designers and retailers manage the back end of their business from ordering and sales venues by charging a fee per transaction. These platforms are on the rise and mark a move away from the traditional model of showrooms and tradeshows.

Participants were again keen for more use cases and case studies on how technology is supporting the transformation of back end business operations (such as, order tracking, order fulfillment and collection schedules), and supply chain networks.

INVESTMENT DECISIONS

"WHAT DOES IT MEAN TO EMBED DIGITAL INTO OPERATIONS FOR THE DESIGNER FASHION COMMUNITY? ESPECIALLY WHEN YOU NO LONGER NEED A PHYSICAL STORE?"

Conversations explored how designers could potentially invest more time and money into creative research and development processes if physical overhead costs were cut and replaced with digital services. Removing the high cost of company stores would enable designers to embark on new journeys and perhaps bring in new team members such as consultants and developers. Replacing the physical with digital would greatly affect budgets and free up spending for embedding digital into day-to-day operations.

CROWDFUNDING, CROWDSOURCING AND THE SHARING ECONOMY

"IN OTHER INDUSTRIES WHEN YOU REMOVE THE

MIDDLE MAN, THAT'S WHEN YOU SEE BIG CHANGE HAPPEN. THIS HASN'T BEEN THE CASE IN FASHION, YET..."

Crowdfunding platforms like Crowdemand, Out of X, Before the Label, and I Am La Mode offer new models to effectively manage and connect the supply chain, from product development and production to retail and the end consumer.

These online sites also offer unprecedented user participation in the selection of designs and in some cases co-creation of limited edition or bespoke garments, which in turn informs the development of a designer's or brand's identity.

Crowdfunding and crowdsourcing was considered to have the potential to offer radical new models, which dramatically affect the product development life cycle. Examples being: opening up the idea generation process and earlier engagement with consumers, which in turn foster product promotion, lowering pre-production barriers often involved in bulk production and manufacturing and mitigating cash flow issues normally associated with production.

Similarly, crowdfunding and crowdsourcing have encouraged transparency in the product development process, alongside consumers accessing and interacting during the design initiation phase, which is a recent change to traditional fashion business formats. This trend plays into broader principles in the digital economy that match customer need and value earlier on in a product development cycle.

Traditional fashion business models are also now being affected by the sharing economy with young platforms such as Rent the Runway becoming increasingly popular

[6]. There has been some reluctance within the fashion designer community to embrace rental service models, but there is increasing research into how and why consumers are transitioning away from the ownership of goods to a more collaborative and sharing framework. [7] These new economic models could change the role of both designers and retailers to consumers and alter how fashion is distributed on a global scale.

SALES DIRECT TO CONSUMER

"YOU'LL FIND SOME DESIGNERS HAVE A GREAT SOCIAL MEDIA STRATEGY BUT NOT A MOBILE OPTIMISED ECOMMERCE SITE."

The trend towards customers expecting increased personalisation and specialisation has seen brands and retailers invest in new services, which support digital interactions across the entire customer journey. These services have also transformed traditional parts of the fashion cycle, for example runway shows, which are now often interactive and live streamed. Once considered a novelty, these digital applications and new broadcasting mobile apps such as Stre.am are becoming commonplace. The live streaming and broadcasting mobile apps are also starting to capture valuable basic data sets for brands and designers, in terms of audience age, gender and location - even those that rely on third party platforms such as Twitter.

For the first time this year mobile browsing surpassed computer searches in ten countries including the United States and Japan. [8] Never before has a consumer of

fashion had so many options for purchasing in literally the palm of their hand. Several participants in the workshop felt that micro fashion businesses were simply not able to compete with retailers on choice, range price, location and specialisation. However, attendees went on to acknowledge that digital platforms and services had, in comparison to traditional distribution models and retail, lower barriers to entry in terms of overall cost.

The direct to consumer model can increase sales margins by eliminating the need for middlemen and traditional distribution models, but critically these models have helped business gain understanding of their customers from data interactions, which is one of the foundations of the digital economy. That said several attendees illustrated that there are still substantial costs associated for D2C business, within marketing, logistics and operations.

DATA-DRIVEN DECISION-MAKING

"MORE COLLABORATION BETWEEN THE MANUFACTURING INDUSTRY AND FASHION DESIGNERS WOULD HELP THE INDUSTRY GET TO GRIPS WITH DATA."

We have seen data-driven marketing transform much of the fashion industry. Data-driven trend forecasting, structured data capture from image, natural language processing and geo located beacon technology in physical retail outlets and RFID tags are often utilised examples of such innovation. However, the potential for designers and makers to more closely align with the manufacturing industry is increasingly feted as the next 'big data' frontier,

and could inform every step of the product development lifecycle.

This hyper-connectivity enabling real-time computing and data analytics could aid every aspect of product development for designers and increase productivity even within small batch production, reducing marginal costs.

CASH FLOW AND THE FASHION DESIGN CYCLE

"THERE'S A LOT OF 'WE KNOW DIGITAL IS IMPORTANT, BUT …' - NOT MANY DESIGNERS ARE ABLE TO INVEST TIME, ENERGY AND MONEY IN UNDERSTANDING WHAT DIGITAL SERVICES WOULD WORK FOR THEM. THEY'RE TOO BUSY GETTING READY FOR THE NEXT SEASON!"

One of the most prevalent themes of the workshop was that micro fashion businesses struggle to engage digitally, understand its economic value and embed it into their processes due to the existing cash flow model. The prevailing seasonality renders many business cash-starved and time poor. A few attendees did however highlight a growing trend of designers moving out of seasonality. It was suggested that until the sector is able to clearly demonstrate what new revenue streams can be created or accessed uptake would remain reduced within the SME community.

Aligned to earlier comments concerning technology companies driving fashion designers adoption of digital - there were also concerns that new entrants to the fashion industry not wedded to the traditional fashion design cycle would drive the development of new revenues models.

UNMADE

UNMADE IS DRIVING A TEXTILE REVOLUTION BY REINVENTING THE KNITWEAR INDUSTRY THROUGH A ONE-OF-A-KIND CONCEPT THAT ENABLES UNIQUE PRODUCTION ON AN INDUSTRIAL SCALE. BY CREATING CUTTING EDGE TECHNOLOGY (KNYTTAN) THAT CAPTURES EXPERT KNIT KNOWLEDGE IN THEIR ADVANCED SOFTWARE, BESPOKE GARMENTS ARE EFFORTLESSLY DESIGNED ONLINE AND PRODUCED TO ORDER FROM THE COMPANY'S SOMERSET HOUSE HQ IN LONDON. UNMADE TAKES ITS MONIKER FROM THE IDEA THAT NO GARMENT IS COMPLETE; IT IS NOT MADE, UNTIL YOU ARE INVOLVED. WHILE THE SOFTWARE IS COMPLEX, THE PROCESS IS CLEAR: SIMPLY MANIPULATE A DESIGN ONLINE BEFORE SENDING IT DIRECTLY TO A KNITTING MACHINE, WHICH TRANSFORMS THE MODEL INTO AN EXCLUSIVE MADE-TO-ORDER GARMENT.

WWW.UNMADE.COM

5 CONCLUDING REMARKS

OPPORTUNITIES

The workshop covered a broad range of topics concerning the issues that discourage, and opportunities, which could support, the fashion designer community to embrace new digital technologies. We have listed some suggestions to further this agenda below. These are by no means exhaustive, but cover some of the key points, which arose on the day:

1. Investment from governing bodies or intermediary institutions and educational institutions to foster and leverage cross sector working between designers, brands, retailers and technology companies.

2. Further education and dissemination of new economic models in other sectors, which could offer alternative models for the fashion sector.

3. The development of forums whereby industry professionals, designers and academics can identify and discuss the issues identified within the current fashion cycle, and existing business, cashflow and revenue models.

4. Stronger leadership from sector governing, or intermediary bodies, in order to offer more strategic analysis of the infrastructure required to better prepare the sector for rapid technological innovation which is forecast to disrupt the industry (i.e. 3D printing, Internet of Things, etc.)

5. Accessible analysis of current market trends in digital technology and the digital economy more broadly, which focus on how they relate to SME's in the fashion sector.

6. Accessible literature and case studies highlighting best practise in digital for both emerging and established fashion designers.

7. Access to specialist knowledge and digital skills training in order to become more productive producers of technology.

8. A regularly updated public platform, which aggregates relevant digital applications and tools for fashion designers with, use-cases to inform investment decisions.

This short research project has highlighted that there is a much bigger research opportunity to interrogate how the traditional model of fashion design is being changed and transformed by digital technology, and how willing the SME designer community are to adopt new models of engagement with manufactures, wholesalers, retailers and consumers.

The event demonstrated the need for more platforms and better dissemination of how designers are currently navigating new models of practice with digital technologies during this period of significant growth in the digital economy.

While a number of complex barriers were cited in relation to the fashion designer communities' openness to explore and adopt new models within the digital economy, we share attendees' eagerness to continue to question and interrogate how such innovation could better serve both design process and product and business model development.

RESEARCH SUPPORTING DESIGNER FASHION AT LONDON COLLEGE OF FASHION

The FIRE: 'Fashion, Innovation, Research, Evolution' series of projects at London College of Fashion, University of the Arts London, led by Prof Sandy Black, addresses the need for support to enable the designer fashion community to connect to academics and to each other, and provide the much needed forum mentioned above. FIRE opens up a new space for designer fashion businesses to think about research more strategically over the longer term, through access to expertise within universities and developing new research collaborations and consortia. Fashion businesses can participate both online (via the FIRE digital platform www.fire-fashion.uk) and offline in workshop and symposium activities.

The FIREup initiative in 2013 funded four catalyst research projects that enabled fashion and textile designers to explore new ideas and business models. These have been developed as case studies accessible for the community on the FIRE platform, and FIRE is seeking further funding to expand its activities across the UK, and address many issues identified above.

London College of Fashion is a unique centre for fashion research and education, grounded in the practices and processes of design, manufacturing processes, management and communication of fashion. LCF hosts two key centres: the Centre for Sustainable Fashion, a pioneering UAL research centre established 6 years ago, and the Centre for Fashion Enterprise, a designer fashion business incubator serving London, established for over 10 years.

6 BIOGRAPHIES

PROFESSOR SANDY BLACK

Sandy is Professor of Fashion & Textile Design & Technology at LCF, UAL and has extensive experience in both the fashion industry and academia. As designer and director of the Sandy Black fashion knitwear label, she sold to prestigious fashion stores internationally, and then developed the successful Sandy Black original knitting yarns and kits, selling across the UK, Europe, US and Australia. Following this design-led enterprise, Sandy went into education and became Director of undergraduate and postgraduate fashion and textiles programmes, first at University of Brighton then at London College of Fashion, where she developed the first multi-disciplinary MA programme in Fashion Studies. She was the programme's first director until 2005, after which she focused on research, including the pioneering Interrogating Fashion inter-disciplinary research cluster, and the project Considerate Design for Personalized Fashion Products (www.consideratedesign.org.uk), both part of the AHRC/EPSRC Designing for the 21st Century initiative.

Sandy publishes widely on fashion, textiles and knitwear design and sustainability, and their intersection with science, technology and craft. Her most recent books include The Sustainable Fashion Handbook published in 2012 by Thames and Hudson to international acclaim, and Knitting: Fashion, Industry, Craft also published in 2012 by V&A Publishing, based on extensive archival and contemporary research. She is the founder and co-editor of the journal Fashion Practice: Design, Creative Process and the Fashion Industry (Routledge), now in its 8th year, which gives voice to the practitioner in fashion and those relating research, practice and enterprise.

Sandy's research focus is inter-disciplinary design-led research, within the context of sustainability. She develops projects that integrate old and new technologies and seeks new approaches to the design and creation of fashion-related products through the relationship between craft practices and advanced technology. A key concept underpinning this research is the notion of Considerate Design, developed with the Interrogating Fashion Research Cluster she established in 2005: responsible design that takes into account the wider environmental, ethical, social and personal issues within products and the needs of their individual users, together with life cycle thinking and approaches. New contexts, new business models and new awareness of compelling environmental and social issues are creating new paradigms for fashion and new roles for the designer.

Most recently Sandy leads the FIREup (Fashion, Innovation, Research and Enterprise www.fireup.org.uk) and FIRE.Digital (www.fire-fashion.uk) projects, funded by the Arts and Humanities Research Council, a collaborative knowledge exchange platform researching ways to connect academic research with the designer fashion sector to help build viable and sustainable businesses.

MARY JANE EDWARDS

Mary Jane's early career focused on cultural regeneration, creative producing, social policy and social investment. She was part of the team that redeveloped a disused railway arch under Waterloo station into The Old Vic Tunnels. Whilst working in the creative industries she conceived and coordinated award-winning, large scale volunteering and 'back to work' schemes for young unemployed adults. Mary Jane went on to co-lead action research supported by The Big Lottery Fund into how social investment products could tackle unemployment and support charities and social enterprises to access Government Welfare to Work schemes.

Mary Jane has since consulted in a range of sectors on innovation ecosystems and social financial products. Continuing her exploration of social finance and philanthropy she assisted the research and design phase of a new partnership initiative between the U.S Agency for International Development and The Rockefeller Foundation around the Resilience Agenda with Kurt

Hoffman at New Markets Lab. She also worked for a Canary Wharf Fintech start up creating a new platform for non-monetary trade.

In 2013 she co-founded AAM Associates, an independent research agency and consultancy, which focuses on digital innovation and the application of data in the social sector and creative industries. Mary Jane is currently leading a number of projects relating to the Digital Economy agenda in the creative sector.

Mary Jane also co-runs Shrinking Space a production company which curates and produces arts and science projects. Her studies and training have included periods at: Rose Bruford College of Music and Drama, The Grotowski Institute in Poland, L'institute del Teatre in Barcelona, and The Radnotti Theatre in Budapest. Mary Jane is also a fellow of the RSA.

GABRIELLE MILLER

Gabrielle is a designer and researcher specialising in fashion and textiles. She has significant knowledge of traditional and advanced smart textile techniques, and sustainability practices. Her research interests include new product innovation, digital exploration, historical traditions, practices and cultures within fashion.

Gabrielle graduated from the London College of Fashion in 2007, and since then has worked in textile, print and embroidery design for companies such as Alexander McQueen, Jonathan Saunders, Burberry, and Givenchy. Following seven years of working as a designer in the fashion industry, Gabrielle's work moved into the area of research and digital. In 2013 she was Assistant Producer of Wearable Futures, a large-scale event exploring the future of wearables, from smart materials to new technologies.

Over the past couple of years, Gabrielle has been working as a Research Assistant on numerous projects across UAL.

Her role as researcher and designer focuses on the place where design, materials and sustainability overlap, and how material and social details from the past can inspire future design. She is excited by the potential of new technologies and interdisciplinary approaches that can create new sustainable ways of working in fashion and textiles.

7 APPENDICES

APPENDIX 1

Selective Survey (Online Resource)

APPENDIX 2

Mary Jane Edwards, presentation links:
http://www.slideshare.net/AAM_Associates/whats-digital-about-fashion-design

THE DIGITAL ECONOMY

• http://www.amazon.co.uk/Reframing-Business-When-Changes-Landscape/dp/0471485578

FROM THIS

• https://archive.org/details/catalogueno13spr00mont
• http://www.searsarchives.com/catalogs/history.htm

TO THIS

• http://www.forbes.com/sites/rachelarthur/2015/10/25/hands-on-with-tommy-hilfigers-in-store-virtual-reality-catwalk-experience/

OPENING UP PROCESS OF CREATION

• https://www.periscope.tv/
• https://www.younow.com/
• https://www.ustream.tv/platform/broadcast-anywhere/new
• https://stre.am/
• http://www.fashionschooldaily.com/index.php/2015/10/19/academy-of-art-universitys-fashion-journalism-program-partners-with-sharing-platforms-weebly-and-flipboard/
• https://www.pantone.com/pantone-color-manager-software
• http://www.topshop.com/en/tsuk/category/pinterest-4723765/home?geoip=noredirect

CROWDFUNDING

• https://crowdemand.com/
• https://beforethelabel.com/
• http://stylyt.com/
• http://www.iamlamode.com/en
• http://www.mimoona.com/
• https://www.outofx.com/

THE X OF X

• https://www.renttherunway.com/
• http://www.girlmeetsdress.com/
• http://www.depop.com/en-gb/
• http://en.shpock.com/
• https://www.thredup.com/

WHOLESALE MARKETPLACES

• https://edited.com/
• https://www.lenewblack.com/lenewblack/
• https://modalyst.co/
• http://www.nuorder.com/
• http://www.e-pitti.com/en fieradigitale.htm
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• https://www.threadsuite.com/
• https://www.fulfil.io/
• http://www.stitchlabs.com/
• https://www.try.com/
• http://www.shipstation.com/

INDUSTRY 4.0

• http://www.economistinsights.cdefault/om/sites/files/

Manufacturing_Data_Conundrum_Jul14.pdf
• http://www.forbes.com/sites/benkerschberg/2011/11/01/
manufacturing-moneyball-using-big-data-and-business-
intelligence-to-spur-operational-excellence/

HYPER CONNECTIVITY

• https://www.google.com/atap/project-jacquard/
• http://www.intel.com/content/www/us/en/wearables/
wearable-soc.html
• http://robotic.media.mit.edu/portfolio/sartorial-robots/

SALES DIRECT TO CONSUMER

• http://www.cherwears.com/

3D PRINTING

• https://dam.sap.com/mac/preview/a/67/

3D DESIGN APPS

• https://www.kickstarter.com/projects/eora/eora-3d-high-
precision-3d-scanning-on-your-smartph
• http://www.zdnet.com/article/microsofts-mobilefusion-
app-turns-an-iphone-into-a-portable-3d-scanner/
• http://www.marvelousdesigner.com/
• https://www.rhino3d.com/
• http://www.trupik.com/
• http://www.electroloom.com/

KNYTTAN

• http://unmade.com/