Assessing the Applicability of a Sizing Framework into Online Fashion Retail

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Abstract— **This paper describes the e-Size project, its objectives, its contribution to specific innovation areas, the methodological approach adopted, as well as presenting the preliminary results of an exploratory survey administered to a convenience sample of customers in the attempt to assess the potential validity of the use of the sizing applications amongst fashion retailers. Our findings illustrate that all of the participants found that the sizing application was helpful because of the size recommendation for online shopping. Most of the participants agreed that the recommended sizes were accurate. They also found the experience to be easy and straightforward. Nonetheless, there is room for improvement.**

Index terms -Size, Online Fashion, Retail, Shopping.

I. INTRODUCTION

Drawing on our existing research, e-Size aims to capitalise on the use of widespread devices such as mobile phone and home webcam technology to assess the implementation and the deployment of a novel yet existing software application aimed at capturing accurate body measurements to increase fashion garments' online sales. The key objectives of the research being: to further develop an existing software application aimed at producing accurate body measurements in close collaboration with a fashion retail partner; to enhance the retailers customers' satisfaction by improving the quality of their online shopping experience; to focus on user experience testing to contribute to the development of the user experience; to critically evaluate the opportunities and the challenges that are associated with the deployment and implementation of such novel software application for the retailer and for the broader fashion industry; to contribute to the reduction of the economic and environmental impact associated with garments' returns due to their poor fit. The application is novel since it uses 2D images to infer 3D bodyshape and has more potential to offer "true virtual fitting" as opposed to the applications which only use 2D measurement data. By virtue of this novel software application customers are more likely to better match their shape and measurements to garment data, therefore increasing their satisfaction with the online shopping experience and by thus reducing returns. More specifically, this project will focus on user experience testing, specifically by integrating feedback from customers into sizing information or guidance

to improve their online shopping experience and feedback into the garment information as well. The keys to this are the quality and accuracy of the measurements, overall user satisfaction with the online experience and effectively matching body and garment measurements so the consumer can find the best fitting clothing size. This paper consists of four sections. The first section outlines the literature review, the second section describes the methodology adopted. While the third section highlights the preliminary findings of the research, the final section illustrates the conclusion, their limitations and directions for further research.

II. ONLINE FASHION RETAIL: BENEFITS AND CHALLENGES

Today, within the fashion industry, E-retail conceived as a web presence alone [1] is not sufficient for any high street retailer to operate or promote themselves. Doherty, Ellis-Chadwick and Hart [2] suggested that the Internet adoption might not be a viable strategy for all retailers, as the likelihood of an organisation succeeding in their investment decision would be dependent upon the retailer's specific internal and environmental inhibitors and facilitators. More specifically, it was argued that only those retailers with an appropriate blend of technological and organisational capabilities and an appropriate product offering, which were operating in Internet-friendly market-place, should contemplate Internet retailing, at least until the market and technology were more mature. Moreover, it was suggested that certain products categories were likely to have the greatest growth potential and opportunity to create competitive advantage: books, music, computers, and airline tickets were viewed as potential winners, whilst clothing and fashion goods were tipped as losers [3].

Traditionally, the term 'channel' described the flow of a product from source to end-user. This definition implies a passive unidirectional system whereby the manufacturer / producer marketed through a wholesaler or retailer to the consumer [4]. The concept of the retailer as simply the final distributor has been supported by the emphasis on "buying decisions, operational concerns" and overall "product orientation" [5]. However, recent developments in information technology are changing this orientation by enabling retailers

to focus their marketing efforts on managing the customers more effectively [5]. It is now widely recognised that the Internet's power, scope and interactivity provide retailers with the potential to transform their customers' shopping experience [6], and in doing so, strengthen their own competitive positions [7]. The Internet's capacity to provide information, facilitate two-way communication with customers, collect market research data, promote goods and services and ultimately to support the online ordering of merchandise, provides retailers with an extremely rich and flexible new channel [8]. In doing so, the Internet gives retailers a mechanism for: broadening target markets, improving customer communications, extending product lines, improving cost efficiency, enhancing customer relationships and delivering customised offers [9]. By and large, consumers have responded enthusiastically to these innovations [10], and on-line retail sales have grown significantly over the past fifteen years, and are predicted to continue rising into the future [11], [12]. This suggests a shift towards a bi-directional retailer / consumer relationship, in which more power accrues to the customer [13]. In evaluating the Internet's potential as a retail channel a number of advantages, opportunities and threats have been identified by the literature. The reported advantages are:

■ Accessibility. Given the current rates of domestic PC uptake and the basic desire to communicate [14] the use of the Internet is forecasted to expand exponentially.

■ Direct Communications. As an interactive channel for direct communication and data exchange [15] the Internet enables focused targeting and segmentation opportunities for retailers who can more closely monitor consumer behaviour.

■ Cost savings. The internet could ultimately replace the High Street by satisfying all shopping needs on-line, from home. This could benefit the retailer by substantial transaction cost savings [16].

■ New Markets. It is predicted that retailers can gain additional sales, either to existing customers or through attracting new ones via a whole new global marketplace [17]. Furthermore, the new communication opportunities of the Internet provide the potential and easy access for brand positioning and diversifications into new product areas [18]..

■ The possibility to leapfrog stages of development since e-retail could facilitate retailers to shift from multi-channel distribution to cross-channel distribution [12] by also implanting new business models, undertaking substantial rationalization of the existing operations [19]and enabling the emergence

of new collaborative practices across their supply chains [19], [20].

The anecdotal evidence provided by the experience of China is highly significant. According to McKinsey [12], China has overnight become one of the most wired retail markets. Millions of customers can now log on and purchase a vast number of products that they could only dream of acquiring just a few years ago. McKinsey's [12] analysis seems to suggest that 60 percent of online consumption is simply replacing offline retailers but the remaining 40 percent is incremental consumption that would not have happened without e-retail. This is particularly the case outside China's biggest cities where brick-and-mortar retail remains undeveloped. E-retailing is beginning to fill the gap. In particular, Chinese consumers seem to buy more apparel and houseware than any of their counterparts (70 percent of the total online consumption), where astonishing growth has been achieved with very reasonable investments.

However, although the comparative advantages of using the Internet appear compelling, its potential as a retail channel will only be realised if a number of well-documented limitations are successfully addressed. For example technical problems: the complexity of the user interface bandwidth restrictions and access connection speeds and security concerns [21]. From a retailing perspective the Internet also presents a number of problems. The use of the Internet is an elective activity whereby consumers require effort to access sites and products and consequently planned purchasing may dominate over impulse purchasing [18]. The move from a physical to a virtual marketplace may require more complex product differentiation and positioning [22], [21]. Fundamentally, Shi and Salesky [23] warn that value created by retailing on the Internet is unlikely to be additional but rather a re-distribution of profitability from current retail channels.

According to McKinsey [12], however, e-retail is not just a replacement of purchases that otherwise would have taken place offline. It actually seems to spur incremental consumption especially where there is a demand for products that brick-and-mortar retailers have not yet managed to deliver. It appears that the true benefit of the Internet as a retail channel has to be traded off against these drawbacks. Additionally these challenges are further exacerbated within the context of the fashion industry where the aforementioned challenges are coupled by some distinctive ones due to the intrinsic nature of fashion products. Fashion products are experiential by their nature [24], thus replicating the shopping fashion experience in the online environment poses additional challenges [21]. High street retailers still find it challenging to communicate store atmosphere and excellent service via online communication [25], [1]. However retailers that operate single and multiple channel strategies can provide a range of

valuable benefits for customers while still maintaining heritage, luxury status and service. This can be achieved by innovative use of new technologies and digital tools such as 3d body-scanning, style advice, co-design and interactive screening, which enables an online retailer to equal or surpass that of the physical retail environment [25], [26]. This is becoming a key strategy for the future viability of fashion high street retailers, as additional channels can provide additional income.

From the perspective of experiential web-atmospherics in the fashion industry there is a body of knowledge which includes Kurniawan [27], Schenkman, and Jonsson, [28] and Mahlke [29]. However, recently Manganari, Slomkos and Vrechopoulos [30] reviewed the subject in 'Store atmosphere in web retailing'. A conceptual model of consumer responses to the online store environment was tested and was compared with the physical store environment in terms of sensory perception, accuracy of product information and social presence. From the findings it emerges that all of these dimensions are equally important in the online store environment. This is in line with the findings from a recent study conducted by Ross on Saville Row's tailors where e-tailoring with the aid of dedicated body scanner is a widespread practice [31], [26]. In particular for clothes which need to provide an exceptionally good fit, the anthropometric data generated by sizing systems such as body-scanners can actually bridge the gap between "custom-made" and "mass-produced" [32] and ultimately lead to a substantial growth of online sales [1]. Anthropometrics, the study of measuring the human body, has been considered by tailors and scientists for decades, but instead of using traditional methods of measurement, a good fit can now be achieved digitally. The big question for high street retailers is how accurately? This brief summary of the literature highlights the high level of interest in the commercial potential of the Internet as a distribution channel for the fashion industry and some likely implications for store based retailers. A criticism of the literature is that much is based on speculation and informed comment as opposed to primary evidence. As such, there is the opportunity to conduct some valuable research by focusing upon fashion retailing on the Internet.

III. THE PROPOSED SIZING FRAMEWORK

From a preliminary survey of the applications commercially available, there are various size and style recommendation/mapping services using a low-cost webcam, including *Upcload*, *Metail*, *Fits.me* and *Poikos*. Some of these services require a minimum of two photographs – a front view and in profile. They also require detailed preparation regarding the calibration and segmentation of the captured image, thus making them difficult to use [33]. According to the Technology Acceptance Model (TAM), there are two types of technology acceptance – perceived usefulness and perceived ease of use [34]. Most of the size and style recommendation services fit into one category only, rather than combining both. In terms of ease of use, *Metail*, for example, uses a Virtual Try-On (VTO), where the users have control of their body shape, hairstyle and skin tone. Amongst all of these services, the research team found that *Upcload* provides the most accurate measurement, with their entire measurement process taking an average of 20-30 minutes [35]. An initial focus group amongst 14 users was conducted to assess the viability of a novel application that would overcome the limitations provided by the existing sizing applications. From the findings it emerged that accuracy and ease of use are of paramount importance to the customers. Thus a sizing application, which can extract body measurements from a single front-facing photograph to deliver garment size recommendations, has been developed to be tested for this project. This has taken the form of an online service – *ShapeMate* – which can be plugged in to fashion e-commerce platforms, to enhance the user-experience and recommend the best garment size when shopping online. One of the main goals was to make the technology appeal to a wider audience, by responding to the general demand for low cost and ease of use, as expressed by our initial focus group. *ShapeMate* also needed to be made scalable and apt to run on various devices and platforms. Hence, the core system was implemented as a web service, for the benefit of cross-platform support as clearly depicted in Figure. 1.
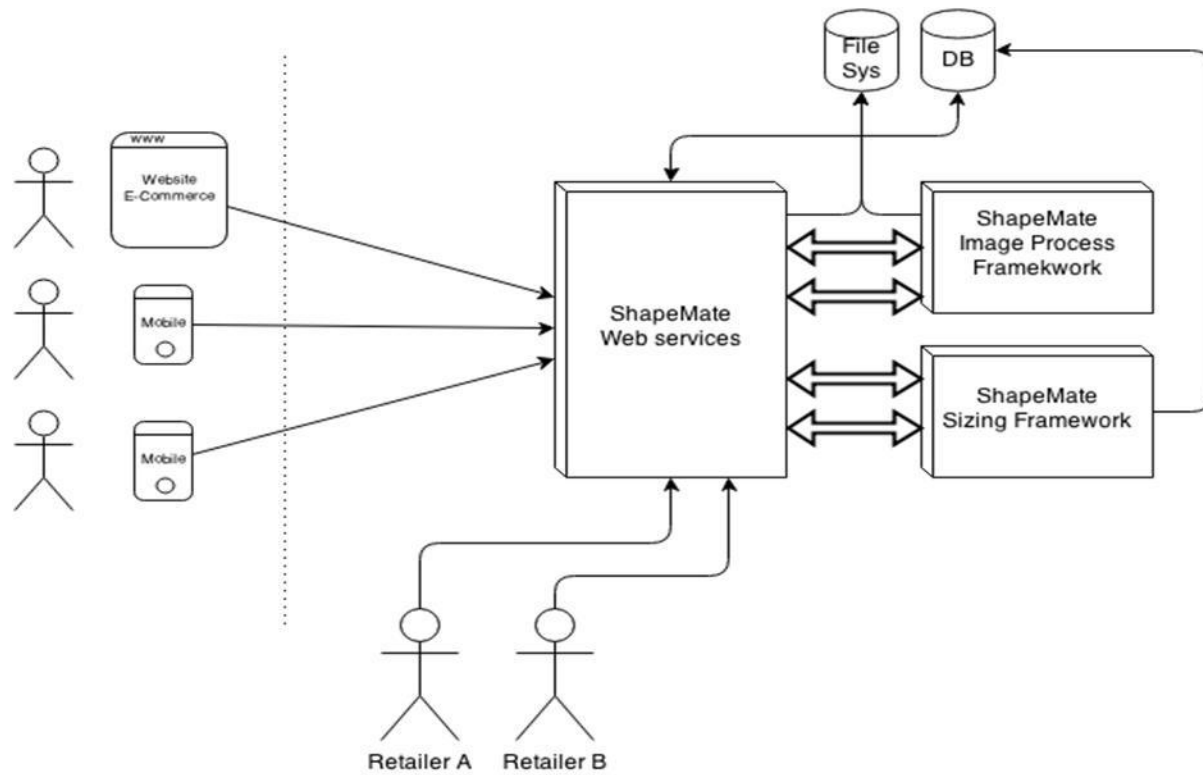
Figure 1. ShapeMate workflow diagram of the system architecturet

As a result of the advantage of using web services, *ShapeMate* can potentially run on any platform or device, be it a website, mobile app, etc. As shown in the system workflow diagram illustrated in Figure 1, once the user interacts with the service, the core system receives all the data and photos generated, then processes and passes them on to the Image Process Framework, where the measurements are extracted. The body measurements are subsequently compared with relevant garment sizes, to produce accurate size recommendations. The Image Process Framework takes the single front-facing photograph and by separating the body from the background, creates a silhouette, which is then compared with a database of existing 3D scans of various models. Our proposed Sizing Framework uses guidelines set by the retailers themselves, on how they intend their clothes should be worn. The retailer specifies and rates which garment elements are important for fit and style. This is then cross-referenced with the body measurements to generate a rating for each element.

IV. METHODOLOGY

Primary data has been generated by means of focus group interviews aimed at testing the validity of the proposed sizing framework. A focus group, consisting of nine

participants (male, age between 20 and 49 years), was used for the study. Participants were selected based on convenience sampling on the criteria that all were related to the fashion industry, owned a mobile phone and regularly used online shopping. This allowed for deep immersion into fashion applications' users, with regard to the development and design of body scanning apps for the fashion industry.

Drawing on our existing research, the current project aims to capitalise on the use of widespread devices such as mobile phone and home webcam technology to assess the implementation and the deployment of a novel yet existing software application aimed at capturing accurate body measurements to increase garments' online sales. The key objectives of the research being: To further develop an existing software application aimed at producing accurate body measurements in close collaboration with a fashion retail partner; To enhance the retailers customers' satisfaction by improving the quality of their online shopping experience; To focus on user experience testing to contribute to the development of the user experience; To critically evaluate the opportunities and the challenges that are associated with the deployment and implementation of such novel software application for the retailer and for the broader fashion

industry; To contribute to the reduction of the economic and environmental impact associated with garments' returns due to their poor fit.

Rather than focusing on expensive ad hoc technology such as dedicated body-scanners [31], [26] the e-Size project capitalises on the widespread use of standard devices such as mobile phone and home webcam technology to take a picture of an individual in their home, upload it and use it to produce accurate body measurements that will ultimately enhance customers' satisfaction by improving their online shopping experience on the retailer's website and by therefore reducing returns due to poor fit. The choice of the most suitable application is driven by previous research [36]. The application is novel since it use 2D images to infer 3D bodyshape and has more potential to offer "true virtual fitting" as opposed to the applications which only use 2D measurement data. By virtue of this novel software application customers are more likely to better match their shape and measurements to garment data, therefore increasing their satisfaction with the online shopping experience and by thus reducing returns. More specifically, this project focuses on user experience testing, specifically by integrating feedback from customers into sizing information or guidance to improve their online shopping experience and feedback into the garment information as well. The keys to this are the quality and accuracy of the measurements, overall user satisfaction with the online experience and effectively matching body and garment measurements so the consumer can find the best fitting clothing size. Drawing on our existing research [36], [35], [37], [38], [39], we specifically seek to assess the implementation and the deployment of a novel software application into e-retailer systems, so that if a customer uses widely available technology such as a mobile phone or webcam as a body scanning device to shop, and then later decides to return an item, it will be flagged up and the customer can be asked for feedback about the reasons for returning the item. In particular, if the return is due to fit (e.g. in case the item was measured incorrectly or the fabric stretched and so on) the system is able to capitalise on this information and undertake a corrective action.

The project will be jointly undertaken with a new start-up firm that is approaching the launch of an online fashion retail platform. The successful implementation and the deployment of the software application are particularly crucial for the online fashion retailer since it could enable them to build a distinctive business value proposition by also timely seizing substantial first mover advantages within the industry. In particular, both the small size of the company and its early stage of its business development lend themselves to greater flexibility in the scope for the implementation and the deployment of an existing albeit novel, software application.

Such flexibility is crucial for the successful completion of the project and the company's distinctive features make the chosen online fashion retailer the ideal industrial setting to engage with the user community. As such there is the opportunity to conduct valuable research in relation to the implementation and the deployment of a novel application in the context of fashion online retail. This project is specifically framed around the user experience with the twofold aim to promote the elimination of waste through reduction of returns (highly significant for both its economic and environmental impact), and to increase customer satisfaction by addressing the balance between online and high street shopping experience within the digital era.

After testing the validity of the novel application by means of focus groups, from an operational point of view, starting from September 2014 the project will encompass the following research activities:

- An initial integration phase where the existing application will be integrated into the exiting e-retailer's operations in close collaboration with the e-retailer.

- A pilot phase during which the existing application will be tested. During this phase the researchers will conduct extensive fieldwork by virtue of user trials and triangulation (data about sales and returns, interviews with the retailer as well as in-depth interviews with selected users).

- Drawing on the findings from the pilot phase some User Case Scenarios (UCSs) will be developed in order to match the users' requirements.

- Validation of the UCSs with the users. During this phase the researchers will conduct extensive fieldwork by relying on focus groups with selected users.

- Recommendations in relation to the application's implementation and deployment and its broader commercialization to the fashion industry at large and dissemination of the scientific results.

In line with the methodological tradition in the field implementation and deployment of technology within fashion marketing retail, the framework and methods of analysis adopted will follow a very linear iterative process by which the findings from each methodological step inform will inform the next one – the integration will inform the pilot; the findings from the pilot will inform the development of the

UCSs; these will be then validated with the users and their validation will be instrumental to produce some robust and reliable data that will in turn inform the final recommendations. The integration, testing, validation and further development of the user experience requires both the input and research collaboration of the diverse group of disciplines such Operations Management, Fashion Management, Interactive Media Design, as well as the incorporation of perspectives on specific issues that are reflective of the diversity of conditions that exist in fashion online retail. The research collaboration with the online fashion retailer provides an ideal means of ensuring and incorporating this multidisciplinary and inter-sectoral input. The complementarities and synergies that could be leveraged by the collaboration with the online fashion retailer are instrumental for the successful completion of the project.

V. FINDINGS AND DISCUSSIONS

From the focus group interviews it emerged that the participants found that *ShapeMate* was helpful because of the size recommendation for online shopping. Most of the participants found that the sizing application is accurate and agreed with the recommended sizes after the image has been taken. They also found that the experience tended to be easy and straightforward. Nonetheless, there is room for improvement. For instance, the process would benefit from having clearer guidance for using the webcam. One participant was under the impression that he had to stand in a precise position, as demonstrated in the guide, which is not the case. To enhance the user experience for future development, clearer guidance is required.

Our results show that selected body dimensions can be estimated and classified, within an average accuracy of < 3cm [40].

From the initial focus group, we established that the participants were not too concerned about privacy issues [35]. Being able to use a service that would solve a problem confronting them was far more important than worrying about privacy matters. Those who had any concerns of the kind would be happy to abandon them, if the service offered was valid and appropriate to them.

Even although privacy was not a concern within the focus group, we had to consider a wider user-base throughout the development stage of *ShapeMate*. It was important to build a service that captures and exchanges photos to be handled in a secure manner. After processing the photos and capturing all the required data, the images would no longer be needed and therefore deleted from the backend server. Furthermore, *ShapeMate* was created to capture the users in their natural environment, rather than restricting them with requirements such as uncluttered background, tight clothing, etc. This reduces some privacy concerns, since the user would be posing fully clothed, resembling the type of picture that they would normally upload to a social network. We also use the cookies in the browser to track all the generated data anonymously, in order to enhance the user experience and simplify the steps taken to use the system. With regard to the measurements, the backend framework is currently producing six measurements (High hips, Hips, Abdomen, Waist, Stomach and Bust/Chest) that were considered important for the project and the garments we had for testing. Despite the fact that we currently only use six measurements, the algorithm can produce more measurements as needed, which could be useful for made-to-measure shopping experiences.

Table 1. Sample measurements from the focus group results – comparison between the manual measurements of the body, automatic measurement by using the participant's height, weight and date of birth and automatic measurement by using the participant's single image.

No.	Manual	Without image	With image
Participant 1	Chest: 99cm Abdomen: 93cm Stomach: 98cm Waist: 100cm High hips: 110cm Hips: 107cm	Chest: 99cm Abdomen: 93cm Stomach: 98cm Waist: 100cm High hips: 110cm Hips: 107cm	Chest: 99cm Abdomen: 93cm Stomach: 98cm Waist: 100cm High hips: 110cm Hips: 107cm

VI. Conclusion, Limitation and Direction for Future Research

Although we acknowledge the limitations in terms of generalisability of the findings that are inevitably associated with the adoption of a convenience sample, our findings provide an interesting "snap-shot" of the fashion customers and their perceptions of the sizing technology and its promising potential.

As for the future development of the sizing application, from our findings it emerges that the sizing application is helpful because of the size recommendation for online shopping. While they also found that the application is accurate, they found the experience to be easy and straightforward. Nonetheless, there is room for improvement. The measurement process would benefit from having clearer guidance for using the webcam. Therefore the findings suggest that to enhance the user experience for future development, clearer guidance is required.

This paper provides only an overview of the preliminary results that ensued from the initial focus group that was conducted to assess the validity of the sizing application. Nonetheless, *ShapeMate* has been a success with the test users and the sizing recommendation results were satisfactory for all the participants. We have managed to offer a high level of tracking of body data for anonymous users and members in the database. We can also track how the body has changed over time, which could offer various different features to brands and retailers in the future. The main goal for *ShapeMate* is to enhance the shopping experience and reduce the confusion of sizing across different fashion brands by thus ultimately reducing product returns due to poor fit. In order to create a wider appeal, it was important to keep the user in the same shopping environment and make the interaction between the e-commerce platform and *ShapeMate* transparent and simple. This should boost the engagement and increase the confidence and satisfaction when shopping online.

Following the preliminary testing of the validity of ShapeMate, further funding for the E-size project has been granted. This provides the research team the valuable opportunity to further develop the sizing application and test it with a wider range of customers for online shopping in close collaboration with a fashion retailer as explained in the methodology section. As such, the findings prove that there is therefore substantial opportunity and scope for the e-Size project in the context of online fashion retail.

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