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# The Human Acceptance of 3D Printing in Fashion Paradox: is mass customisation a bridge too far?

Christopher J. Parker  
*Department of Design & Fashion Business,  
The University of Manchester, UK*

## Abstract

This position paper questions the current and potential contribution that 3D printing has to the fashion retail industry in a mass customisation context. This is considered from a User Centred Design perspective, focusing on the ability and problems with utilising User Generated Design while curating brand loyalty, acceptance, and value. A series of research questions are positioned as pivotal to resolving the customisation benefit/ dis-benefit paradox presented in this paper.

*Keywords: 3D Printing, User Centred Design, Fashion, Mass Customisation, Retail*

## 1 Introduction

Mass customisation has been described as “*postponing the task of differentiating a product for a specific customer until the latest possible point in the supply network*” [1, p. 419]. However, a more apt definition is that of Tseng and Jiao [2]: “*producing goods and services to meet individual customer's needs with near mass production efficiency*”. In effect, this is leaving the final design or arrangement of a product until the very latest possible stage, at which point the customer is able to select features and design elements personal to them, a relationship that can be seen as both a service and a collaboration [3], [4]. While this is necessarily limited in what can be created, the promise of mass customisation is a greater affinity and preference towards the product from the

view of the customer, greater in emotional interaction than possible with an off-the-shelf product [5], [6].

Considering the level of customisation in apparel and the market level, there is potentially an unmet quadrant of highly customised garments and apparel within a similar market level to the fast fashion business; see Figure 1.



Figure 1. The Quadrants of Customisation in Fashion

While this may not carry the refinement and associated elegance of *Haute Couture*, its creation through the concept of mass customisation could potentially open up a novel and rewarding new business model. Additionally, there is potential for a similar leveraging of customisation between the *Made to Wear* and *Haute Couture* sectors, offering high-end luxury with a personalised/emotional enhancement. While bespoke 3D printed jewellery design services do exist (e.g. [zazzy.me](http://zazzy.me)), such potential has not yet been implemented within prominent/ international fashion brands such as Dior, Paul Smith, Gucci, etc. Additionally, the technological limitations are not fully explored, and the human design elements are as yet unknown.

This paper will explore the technical capabilities of the technology, and how they relate to the emotion of the user. In particular, this paper positions the question; can 3D printing and mass customisation enhance the emotion of the customer and society?

## 2 The Technical and Human Context

### 2.1 Mass Customisation

Pine II [7] described four categories of Mass Customisation:

1. *Collaborative Customisation* – Products are modified/ tailored for the specific needs and desires of the customer (e.g. a tailored suit)
2. *Adaptive Customisation* – Standard products are produced, and designed to be customised by the end-user in their home (e.g. the home screens of an Android smartphone)
3. *Transparent Customisation* – Products are specifically and expressly designed for a single customer (e.g. haute couture)
4. *Cosmetic Customisation* – A standard product is produced but marketed in unique ways (e.g. Coca-Cola)

In this paper, it is the first form of mass customisation that we are interested in, since it is the sphere where the customer has the greatest potential for personalised enhancement. While 3D printing and mass customisation can be considered separate spheres of manufacture, Berman [8] highlighted how 3D printing can play an important part in this dynamic and evolving future as part of a new and successful business model. Considering the consumers involvement in customisation, while being a new and challenging field (due to the necessary skills in design, aesthetics, and computer design skills), has been shown to be not only possibly, but highly fruitful [9]. However, further investigation into new and novel approaches to human interaction are required to make this promise a reality.

## 2.2 3D Printing and Fashion

Due to the high level of manufacturing and material development, the current ability to manufacture is evolving on a week-by-week status. Potential for manufacture includes the production of interlocking parts [10], fabrication utilising precious metals [11], flexible rubber-like materials [12], and within an industrial context even glass [13]. Therefore, since these (and more) manufacturing techniques represent the fundamentals of non-textile fashion apparel, the question relating to 3D printing is not one of potential capabilities, but only the degree to which they are currently accessible by home and industrial producers within a realistic economic model [14].

Examples of contemporary use of 3D printing in fashion can be seen in the work of Iris van Herpen and Julia Koerner (see Figure 2) and Niccolò Casas (see Figure 3). While these designers demonstrate the potential for 3D printing in fashion (and thus customisation), the prominent/ luxury brands have yet to embrace the technology in the same way that industrial design has; see Figure 4.



Figure 2. Extravaganza  
by Dario Scapitta [12]



Figure 3. Niccolò Casas  
Swing Bracelet [15]



Figure 4. Roland Kreiter:  
Mysqueeze [16]

### 2.3 The Human Experience of Brands

With products we create and interact with in our lives, these experiences (and the services which surround them) are dynamic and multi-layered [17]. As Pine II [18] commented, authenticity can be considered the “*new consumer sensibility*”, which leads to a paradox in the fashion domain. As Auty and Elliot [19] demonstrated a large degree of the perception of a fashion items quality and utilitarian function is derived from the associated brand value of the item, rather than an objective assessment of the item; particularly true with those interested in high fashion. Therefore, while minimal alterations to a fashion item may not produce a difference in consumer experience or perception, an item greatly modified or customised by the user (and not an official designer) may mean that the branding they have been subjected to no longer apply to the item, and its value can be diminished or removed. In effect, a Chanel bag may have had the design oversight of head designer and creative director Karl Lagerfeld, the more the customer is in charge of alterations, the less his influence is relevant or represented, and the less the bag may be considered ‘Chanel’.

The importance of this paradox in a consumer context is illustrated by the comments of De Chernatony and McDonald [20], that a brand is a relationship with the customer. Therefore to treat customised items as commodities would be to remove the essence of the interaction and experience, causing a lack of desire to engaging and a lack of ability to charge a premium price for a ‘luxury’ item [21]. While this may be of limited concern for the fast fashion retailers who could benefit from the new business model highlighted in Figure 1, luxury brands such as Paul Smith, Vivian Westwood, and Alexander McQueen may be weary of entering a new business dimension between *Haute Couture* and

existing *Made to Wear* sectors as suggested by this paper. Consequently, the need to understand this human element from a User Centred Design/ Experience Design perspective is paramount.

### 3 Potential Future Directions

In order to answer the issues positioned by this paper, future research must focus on answering the following questions:

- Can branded items be 3D Printed at home and be accepted as a genuine/ valued product of that brand?
- To what extent can branded items be customised by the customer, and still be seen a genuine products of that brand?
- Does the market level of the brand influence the degree to which a consumer would accept/ reject a user customised branded design?

This gives rise to two dimensions of manufacturing (simple machines at home, complex machines in a factory), and the design input level/ skill of the consumer (low for simple alterations, high for advanced custom design). This is graphically represented in Figure 5.

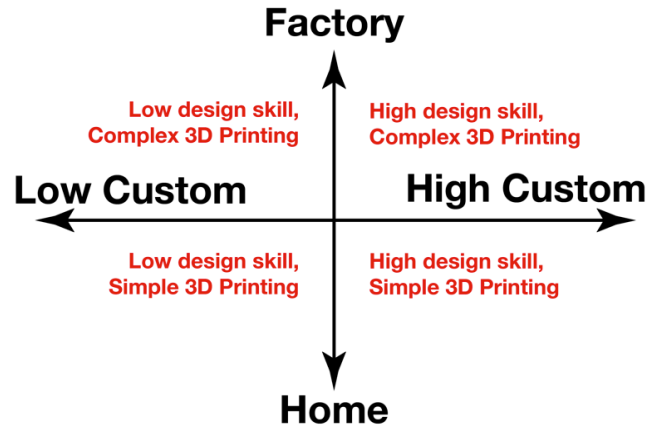


Figure 5. Four research scenarios relating to customisation and home/ factory production

From a design perspective, research in these areas should focus on human-centered perspective, and not from a purely economical or business angle. This is because while these perspectives could inevitably produce financial gain, *"the more materiality there is, the less humanity there is"* [22], and without humanity and emotion, there is no need for expressive arts or luxuries such as fashion [23].

#### 4 Discussion

While 3D Printed apparel has been featured in prominent fashion showcases such as New York Fashion Week [24], 3D printed jewellery is currently only available via specialist ‘low end’ designers, bespoke crafters, or hobbyists. Currently, the most prominent area of 3D printing related to fashion is in the sports context, with Nike creating bags and apparel utilising the technology, although be it at a highly limited product range, with even greater limitation on consumer purchase [25].

The question therefore stands as to why 3D printing is not available in higher, more luxury focused markets. Current research is yet to trial such products in this area, and there currently is no research to say that customers of such higher markets would accept or reject such creations. However, from a design perspective, a hypothesis could be that luxury consumers desire craftsmanship - products empowered by the users knowledge that a human had an intimate part in the products creation rather than an unfeeling machine [23], [26] -, and since 3D printed items are necessarily non-human, they may have lower perceived luxury status.

Regarding customisation, such a practice highlighted by Figure 1 does not fit into current business models of luxury fashion brands, who have a tendency to increasingly control apparel design in-house, with an engineered product range and image [27]. Similarly, the luxury business model described by Moore & Birtwistle necessitates controlled manufacture, which under the industries current philosophies negates the possibility of home manufacture proposed within Figure 5. However, retail is a fluid practice, and such possibilities may become realities in coming decades, although this would probably begin with diffusion ranges, but only once the human element discussed above is understood.

#### 5 Conclusion

The author Arthur C. Clarke [28] famously positioned that “*any sufficiently advanced technology is indistinguishable from magic*”. However, like all magic shows, subtly, and knowing when to use distraction and suggestion also includes when not to use such skills. In the field of industrial design, a parallel can be seen, it is not that we must embrace all technologies all the time, but we must know when to embrace them, and when to leave them as alternatives. The question space demonstrated by this paper is however, how do we decided when those moments are. While further research is needed in this area from a design perspective, it is important to note that whatever the answer is, we should as a

society only look to engage in the customisation (Figure 1) and potential decoupling of manufacture to the home (Figure 5) if the resultant products enhances our universal, democratic, and human pursuit of pleasure [29].

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