Human acceptance of 3D printing in fashion paradox: Is mass customization a bridge too far?

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

Abstract

In this position paper, the current and potential contributions of three-dimensional printing to the fashion retail industry in a mass customization context is questioned. This is considered from a user-centered design perspective, focusing on the ability and problems in utilizing user-generated design while curating brand loyalty, acceptance, and value. A series of research questions are positioned as pivotal to resolving the customization benefit/disbenefit paradox presented in this paper.

Keywords: 3D printing, user-centered design, fashion, mass customization, retail.

1 Introduction

Mass customization 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 leaves the final design or arrangement of a product until the very latest possible stage, at which point customers are 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 customization is a greater affinity and preference toward 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 customization at the apparel and the market level, there is potentially an unmet quadrant of highly customized garments and apparel within a market level similar to the fast fashion business (Fig. 1).

![Quadrants of customization in fashion.](image)

While this may not carry the refinement and associated elegance of *haute couture*, its creation through the concept of mass customization could potentially open up a novel and rewarding new business model. Additionally, there is potential for a similar leveraging of customization between the *made to wear* and *haute couture* sectors, offering high-end luxury with a personalized/emotional enhancement. While bespoke three-dimensional (3D) printed jewelry design services exist (e.g. zazzy.me), such potential has not yet been implemented within prominent/international fashion brands such as Dior, Paul Smith, and Gucci. Additionally, technological limitations are not fully explored, and human design elements are as yet unknown.

In this paper, technical capabilities of the technology, and how they relate to the emotion of a user, are explored. In particular, this research positions the question, can 3D printing and mass customization enhance the emotion of the customer and society?

## 2 Technical and human context

### 2.1 Mass customization

Pine II [7] described four categories of mass customization:

1. **Collaborative customization** – Products are modified/tailored to suit specific needs and desires of a customer (e.g., a tailored suit)
2. **Adaptive customization** – Standard products are produced and designed to be customized by end users in their home (e.g., home screens of an Android smartphone)
3. *Transparent customization* – Products are specifically and expressly designed for a single customer (e.g., haute couture)

4. *Cosmetic customization* – A standard product is produced, but marketed in unique ways (e.g., Coca-Cola)

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

### 2.2 3D Printing and fashion

Owing to the high level of manufacturing and material development, the current ability to manufacture is evolving on a week-by-week basis. Potential for manufacture includes the production of interlocking parts [10], fabrication utilizing precious metals [11], flexible rubberlike materials [12], and, within an industrial context, even glass [13]. Therefore, since these (and more) manufacturing techniques represent the fundamentals of nontextile 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 (Fig. 2) and Niccolò Casas (Fig. 3). While these designers demonstrate the potential of 3D printing in fashion (and, thus, customization), the prominent/luxury brands have yet to embrace the technology in the same way that industrial design has (Fig. 4).

### 2.3 Human experience of brands

Every item within our lives has been purposefully designed by a human for a variety of functions from ornate through to functional, and we as consumers have decided to purchase, utilize, and appreciate these items. Through this interaction with the product, we feel dynamic and multi-layers experiences [17]. As Pine II [18] commented, authenticity as an experience 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 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 customized by the user (and not an official designer) may mean that
the branding that the consumer has been subjected to no longer applies to the item,
and its value can be diminished or removed. In effect, a Chanel bag may have had
the design oversight of the 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 de
Chernatony’s and McDonald’s [20] comments that a brand is a relationship with the
customer. Therefore, to treat customized items as commodities would be to remove
the essence of the interaction and experience, causing a lack of desire to engage
and a lack of ability to charge a premium price for a “luxury” item [21]. While
this may be of limited concern for fast fashion retailers who could benefit from
the new business model highlighted in Fig. 1, luxury brands, such as Paul Smith,
Vivian Westwood, and Alexander McQueen, may be weary of entering a new busi-
ness dimension between the haute couture and existing made to wear sectors as
suggested in this paper. Consequently, the need to understand this human element from a user-centered design/experience design perspective is paramount.

3 Potential future directions

To answer the issues positioned in 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 customized by the customer, and still be considered a genuine product of that brand?
- Does the market level of the brand influence the degree to which a consumer would accept/reject a user-customized branded design?

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

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

From a design perspective, research in these areas should focus on the human-centered perspective, and not on purely economical or business angle. This is because while these perspectives could inevitably produce financial gains, “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 jewelry 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 sports, with Nike creating bags and apparel utilizing the technology, although within 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 is currently 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 users’ knowledge that a human played an intimate role in the product’s creation rather than an unfeeling machine [23, 26] – and since 3D printed items are necessarily nonhuman, they may have lower perceived luxury status.

Regarding customization, such a practice highlighted in Fig. 1 does not fit into current business models of luxury fashion brands, which 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 in Fig. 5. However, retail is a fluid practice, and such possibilities may become realities in the coming decades; however, this would probably begin with diffusion ranges, but only once the human element discussed above is understood.

5 Conclusion

Arthur C. Clarke [28] famously positioned that “any sufficiently advanced technology is indistinguishable from magic.” However, like all magic shows, subtly, 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 demonstrated by this research is, however, how do we decide on those moments. 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 customization (Fig. 1) and potential decoupling of manufacture to the home (Fig. 5) if the resultant products enhance our universal, democratic, and human pursuit of pleasure [29].

References


