

# **CONSUMER ENGAGEMENT AND VALUE ENHANCEMENT THROUGH PRODUCT INDIVIDUALISATION**

BY

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## ABSTRACT

Product customisation has always been a regular practice as a form of self or group identification. Previous studies have demonstrated that when investing time and effort to customise a product, an emotional attachment to that product develops. Since the 1980s, new technologies in design, manufacturing and communications have facilitated customisation practices for mass manufacturers as well as for individual consumers. For example, computer algorithms can now automate customisation (i.e. individualise), meaning that the investment of time and effort can be significantly lower than in other customisation processes. Such novel automated practices have, however, not considered the effects on emotional attachment to products, which occurs when the consumer personally engages in the process.

This research investigates individualisation as a form of customisation by looking at the relationship between an individualised product and the consumers' attribution of value and emotional attachment to the end result. This was achieved through a mixed methods approach: following a literature review, in-depth interviews, observation and experiments were carried out. Four pilot studies were conducted, involving 42 respondents (designers, company directors, and consumers). The main study engaged a further 44 respondents, profiled as one of two types of consumers depending on their critical engagement with customisation processes, namely Active Consumers (AC) that Passive Consumers (PC). Data was collected through five Action Research cycles and incorporated key features of Design-Based Research. It was then processed, coded and analysed using thematic analysis.

This study makes contributions to knowledge in the area of product customisation and individualisation, as well as in the research methods developed, applied and refined over the four pilot iterations and in the main study. Results suggest that despite limiting freedom of choice, individualisation is a valuable approach to product customisation, particularly for PCs willing to relinquish part of the decision making to an automated process, in order to obtain a customised and unique design. ACs, on the other hand, value their freedom to customise their own products and see individualisation as a limitation to the customisation experience and as a hindrance to developing emotional attachment to the product.

These findings have the potential to inform entrepreneurs' and designers' decisions to better understand and exploit the benefits associated to individualisation processes. Offering specific consumer groups opportunities to engage with the individualisation process can trigger a strong emotional product attachment and potentially generate new business opportunities.

## DEDICATION

This work is dedicated to my wife Vicky for her love, help, companionship, understanding and endurance in spite of everything.

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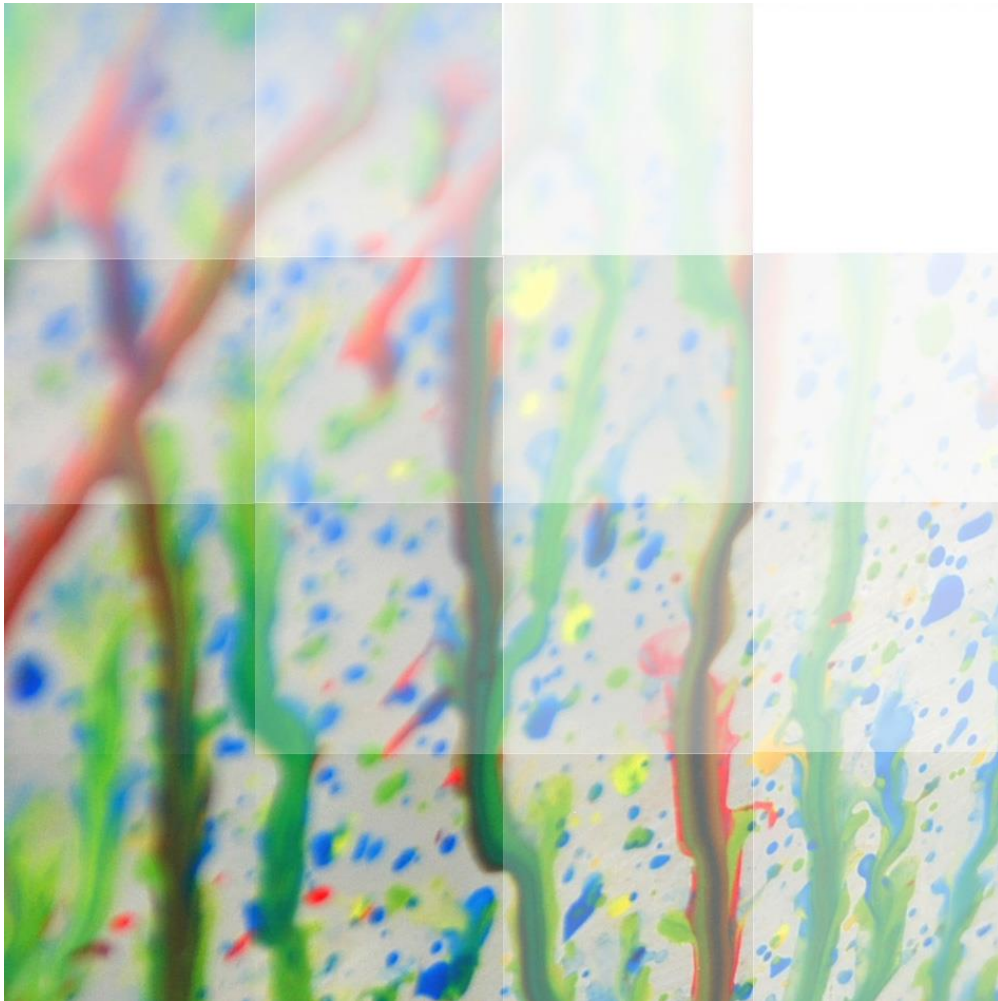
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## ABBREVIATIONS

AC	Active Consumer
ACA	Active Consumer doing exercise A
ACB	Active Consumer doing exercise B
PC	Passive Consumer
PCA	Passive Consumer doing exercise A
PCB	Passive Consumer doing exercise B
P##	Pilot (number) Participant (number)
S##	Study stage (number) Participant (number)
AR	Action Research
DBR	Design-Based Research
AM	Additive manufacturing
VR	Virtual reality



# 1. INTRODUCTION TO THE RESEARCH

## INTRODUCTION

From ancient items to the most recent mass manufactured products, objects have always been vehicles to express ourselves with shapes, colours and textures, making customisation a common practice through history of products as a form of personal or group identification. Egyptian pharaohs, as an early example, had their coffins custom decorated with messages and symbols preparing them for the afterlife. Those same sarcophagi would later be reused and re-customised when other members of the family died, as explained in Cooney (2007). The arrival of industrialised methods of production took manufacturing from the everyday domestic environment and into factories. Later, mass manufacturing pushed such trend further, making customisation a thing of rarity reserved for the skilled person. Typical examples of this are engraved family heirlooms such as locketts and mourning jewellery. More recently, the advancement of technology has allowed us to customise our mass-produced goods, such as phone cases, bags, trainers and cars.

In 1980 Toffler coined the term “prosumer” referring to the emerging producer-consumer. This prosumer was the critically engaged consumer who led a new wave of customisation trend. Empowered by communication and manufacturing technologies, consumers were enabled to become producer-consumers and/or be individually considered by manufacturers. However, we cannot say that customisation is again an everyday thing for everyone, but rather reserved for those who know how to customise and are aware of what they like and want. Many authors, such as Knott (2013) and Hermans (2014) talk about different types of consumers: those who lack the skills and vision to customise products to please them and generate emotional bonds, and those who actively engage in customising what they purchase (or even *make* what they consume).

Nowadays, technologies in communication, design and manufacturing have evolved to a point where it is possible to achieve unique products automatically (for example using computer algorithms), namely product *individualisation*. Product individualisation is one form of customisation, aimed at delivering unique solutions, based on the possibility of "automated production of one-off pieces" (Atkinson & Dean, 2003:2): the creation of a family of objects with aesthetical differences between them that make each 'family member' a unique exemplar. Product uniqueness has been identified as a consumer need by previous studies on customisation (Tepper et al. 2001; Etgar, 2008) and a factor in achieving satisfaction for which consumers would be willing to pay a premium (Franke & Schreier, 2008).

As opposed to products customised by consumers themselves (i.e. consumers actively participating in the customisation process), individualisation is a form of customisation in which products are automatically customised *for* the consumers rather than *by* the consumers (e.g. through computer algorithms). It is, however, still uncertain if individualisation is a form of customisation relevant to our time, one which consumers would value. And, if it is valued, how that value would be characterised. Further, it would be necessary to determine both if consumers could generate an emotional bond with individualised products as they do with non-automated (i.e. more traditional) forms of customisation and the level of consumer engagement in such automated process. Therefore, understanding how different types of consumers (see e.g. Knott, 2013 and Hermans, 2014) engage and benefit from individualisation is highly relevant for this research. Using a mixed methods approach, this study will assess the value of individualisation as an approach to product customisation, evaluating its effects on the consumers' relationship with the individualised manufactured results. The study will also assess the effect of individualisation as a factor to determine product attachment and whether the type of consumer plays a role in that relationship.

## **1.1. RESEARCH AIM**

The aim of this study is to explore and evaluate how consumer engagement in product individualisation influences the emotional attachment and perceived value of products.

## 1.2. RESEARCH QUESTIONS

Research into product personalisation and customisation suggests that consumer participation in the design stages can enhance the perceived value and emotional attachment towards the product for the consumer (de Beer et al. 2009; Mugge et al. 2009; Ariadi et al. 2012), compared to that with an off-the-shelf product, as it reflects the user's relationship with the product (Mugge et al. 2009). This study will evaluate the potential benefits of individualisation, such as beneficial emotional attachment between consumers and the individualised product.

Two research questions are proposed:

- 1- To what extent do consumers value and emotionally attach themselves to consumer products as a result of individualisation?**
  
- 2- Are value and emotional attachment dependent on the level of engagement in the individualisation process? If so, how?**

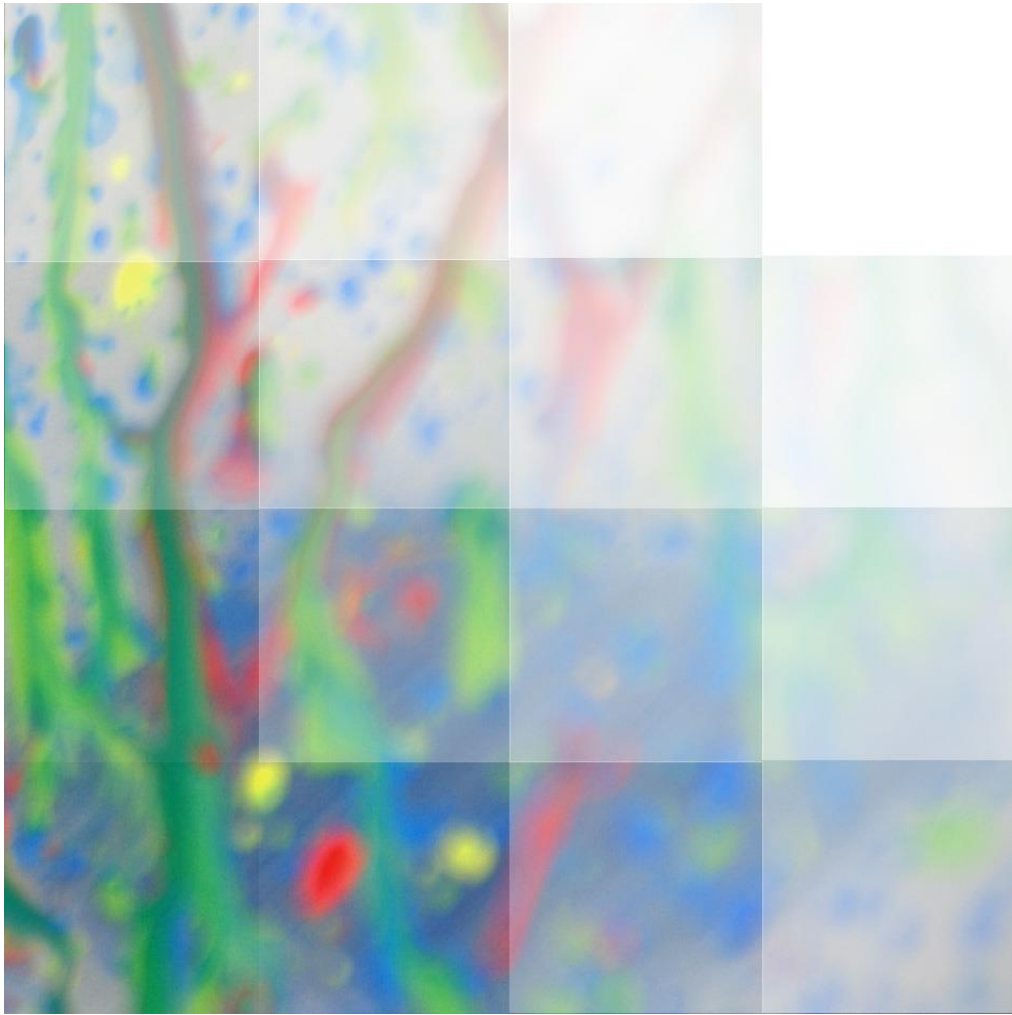
The gap in knowledge addressed by this research is an appreciation of the relationship between consumer engagement in the design of an individualised product, and the attribution of value and emotional attachment to the manufactured result through that engagement.

## 1.3. RESEARCH OBJECTIVES

The objectives of this research are:

- To identify the validity of an individualisation approach to product customisation, better understanding its effects on product design as a driver for a consumers' emotional attachment to a product
- To identify consumer types that might benefit from individualisation
- To characterise the notion of 'added value' in the context of product design
- To explore the relevance of individualisation as a novel, digitally enabled approach on product design.
- To undertake four exploratory case studies (pilots), which will inform a final in depth (main) study on individualisation exercises, combining established research methods.





## 2. LITERATURE REVIEW

## INTRODUCTION

This research centres on evaluating the implications of a consumer's engagement with a particular approach to product customisation and his or her attachment to the resulting product. To this end, a literature review has been conducted, covering:

- why consumers customise things
- perceptions of risk in the customisation process
- economic implications of customisation for companies and consumers
- use of toolkits to allow consumers to participate in customisation processes
- consumer attribution of value to customised goods, and
- understanding the context in which customisation occurs.

The next chapter places this study in the context of relevant previous research and defines the key terminology.

## 2.1. TERMINOLOGY

Key terms such as customisation, mass-customisation, personalisation and individualisation are often used interchangeably. The use of different definitions to describe similar terminology is also common. This sub-chapter defines key terminology used in this work in order to align it with previous work in product customisation and individualisation.

Mapping every art and design practitioner under only one type of approach to product customisation is almost impossible due to the nature of the creative practice. Further, practitioners tend to define their own practice and often work and experiment across different methods (hence the difficulty to maintain clear use of the terminology). Effort has been made by different academics in the past trying to build a taxonomy for the benefit of anyone working alongside product customisation. However, those efforts have also failed to achieve an agreement among academics, practitioners and entrepreneurs. Some illustrative examples of this are presented next.

Jiménez et al. (2013), offer a range of definitions from a marketing background, which differ from those coming from researchers with an art and design background. For example, Jiménez et al. (2013: 1849) explain that “mass customisation” is a process which would only “allow a customer to finish rather than create a tangible product by choosing certain features [...] from a limited set of scaled product platform”. Meanwhile, Bardakci & Whitelock (2003) as well as Tseng & Jiao (2001), argue that what defines “mass customisation” is the implementation of modern technology in communication channels and manufacturing, key factors to increase “customer choice while avoiding the high cost of product tailoring” (Bardakci & Whitelock, 2003: 464). There are also differences on how different customisation tools are portrayed. For example, Jiménez et al. (2013), indicate that the Nike ID online toolkit to personalise trainers offers the consumer the opportunity to “co-design” the product, resulting on a “product never previously offered by the company” (Jiménez et al. 2013: 1849). However, Knott argues that “even advocates of this new model of productive consumption would be aware of the continuing limitations to consumer expression. The Nike ID design suite, for example, seems to be overplaying genuine individual choice. It limits the consumer to marking their trainers...” (Knott, 2013: 47). It becomes clear that what for some is an opportunity to create a “product never previously offered”, for others it is a tool that restricts the customisation of trainers.

Such 'unaligned' terminology leads to possible confusions in research on product customisation. In the context of an un-even landscape of definitions and in order to maintain coherence between this research and previous work on product individualisation, it became sensible to adopt and adapt definitions aligned with those already in use in the literature.

Therefore, the following sections provide definitions for:

- a. Customisation and Mass customisation
- b. Full customisation
- c. Personalisation
- d. Individualisation
- e. Co-design
- f. Prosumer
- g. Consumer engagement
- h. Product attachment
- i. Value
- j. Mass confusion
- k. Toolkit
- l. Customisation complexity

#### **a. Customisation and Mass customisation**

Customisation refers, in this study, to the tailoring of goods to the requirements of its owner as it was practiced before the industrial revolution (Piller, 2010). With the help of modern technology, customisation becomes accessible to the masses “avoiding the high cost of product tailoring” (Bardakci & Whitelock, 2003: 464). Mass Customisation then, could be defined as the aforementioned Customisation aided by the “technologies and systems to deliver goods and services that meet individual customers’ needs with near mass production efficiency” (Tseng & Jiao, 2001: 658). Customisation will hereafter be used as a general term, which includes the following three sub-categories: individualisation, full customisation and personalisation. Points **b**, **c** and **d**, below, define the three different forms of product customisation considered in this research.

#### **b. Full Customisation**

Full Customisation refers to when a consumer is in full control of the product’s final outcome, by providing direct instructions for all aspects of the product to meet his/her “needs and wishes” (Campbell et al. 2003). This research will use Campbell et al. (2013) description of

“customisation”, to illustrate the concept of “Full Customisation” used on this work: a “process of taking a general product design concept and tailoring it to the needs of a specific consumer” (Campbell et al. 2013:4). For example the message on your phone’s answering machine, a food recipe or designing a wedding dress.

### **c. Personalisation**

Personalisation is the selection of pre-established or pre-designed modules or features to configure a product or service aligned with a customer’s requirements. This method is often associated with the use of toolkits that guide the consumer through selection and configuration. For example the Dell Computers toolkit (which helps to personalise the machine by choosing from a range of hard drives, screen sizes, memory and more), the Nike ID toolkit and some insurance companies (which let you choose features such as level of cover and excess).

### **d. Individualisation**

Individualisation is the approach to customisation this research focuses on. It is an automated form of product customisation which is less dependent on consumer decisions (compared to the cases explained above) and is aimed at delivering unique solutions every time. The use of automated systems to generate form and find novel solutions for design problems has been successfully applied for some time in fields like design engineering, medical sector, aerospace, and architecture (using generative design as a strategy to improve engineering products’ performance).

Individualisation starts from a ‘meta’ design with defined product parameters (for example approximate size, weight, colour, material thickness and manufacturability constraints), created by a designer. The individualisation process is then “governed” (Foucault, 1982) by randomly generated data (e.g. through computer algorithms or by rolling a dice) and only constrained by the defined parameters. Dean et al. (2005) explain that the adoption of computer algorithms responds to the necessity to generate automatically an infinite number of alternatives while being able to remain within the defined parameters, guaranteeing appropriate results (i.e. manufacturability and safety).

Figure 2.1 shows an adaptation of Campbell et al.’s (2013) interpretation to visualise the different kinds of customisation approaches:

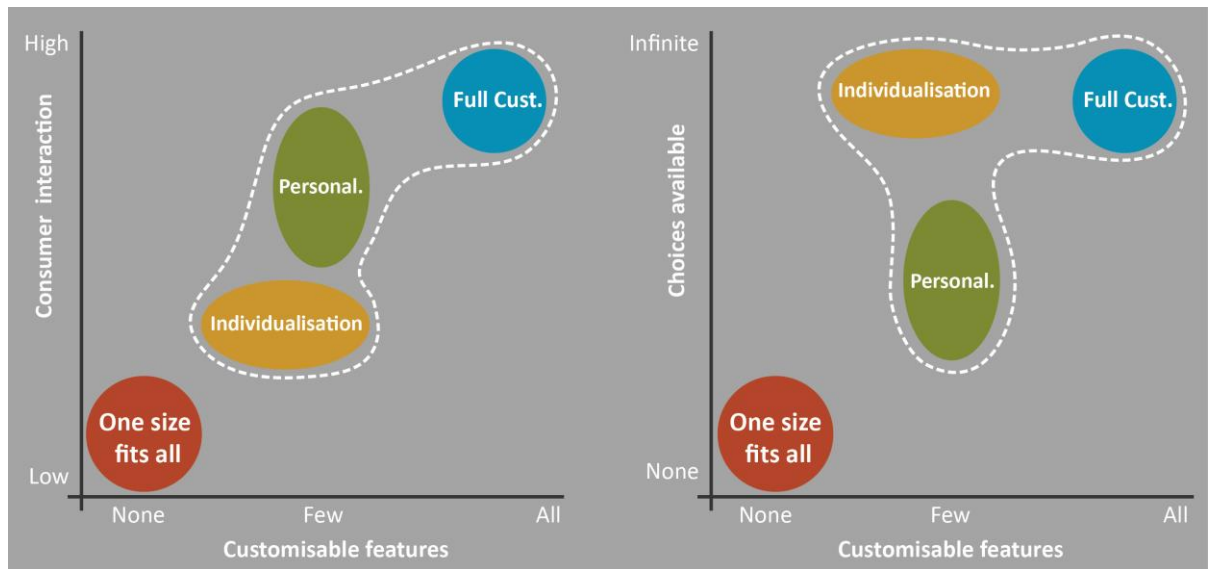


Figure 2.1. Adaptation of “Different types of customisation” diagram, from Campbell, Jee and Kim (2013).

Figure 2.1 provides a visualisation of how standard products and the three approaches to customisation compare in relation to what they offer to consumers. In both diagrams, the ‘one size fits all’ choice sits at the bottom-left as the consumer is restricted to what is available off the shelf. Personalisation and individualisation key difference is in the trade-off between consumer interaction and choices available. Individualisation offers higher variety of choice at the expense of lower consumer interaction because it is facilitated by an automated toolkit. Such automation is what makes an infinite range of choices possible, as defined by Dean et al. (2005). On the other hand, personalisation systems allow more consumer interaction whilst retaining control on variety of choice (for example to guarantee manufacturability). Finally, full customisation remains at the top-right as it offers all the freedom to tailor the product, only restricted by consumers’ wishes.

Definitions **e** and **f**, next, explain how the consumer relates to product customisation processes.

### **e. Co-design**

Co-design is the experience of configuring a product (i.e. customisation), between a customer and the designer (or manufacturer or a toolkit) of that product. ‘Co-design’ differs from ‘prosumer’ (defined next) in that the producer and the consumer are two different things. Merle et al. (2008) explain that the co-design experience generates added value: product value, experience value, hedonic value and consumer’s pride. And “the value associated with

the co-design experience can have an influence on the perception of the value associated with the product” Merle et al. (2008: 33).

#### **f. Prosumer**

Prosumer is a term coined by Alvin Toffler in 1980 on “The Third Wave” and applies to the consumer becoming producer: a consumer who is more informed about the products of his/her choice, who looks for greater customisability and who often produces what him/herself will consume. Konczal (2008) specifies that the term prosumer refers to a 22-to-42 year old consumer activist. Knott (2013) adds that the concept of the producer-consumer existed long before 1980, but became more prominent after the advent of industrial revolution and mass production. And also explains three characterisations of the prosumer, depending on the tools and advice available to the consumer: "a) the one who follows the rules (i.e. tools and advice) b) the one who rejects such provision and pursue self-sufficiency, c) the one who adapts tools and materials in the process ad hoc bricolage" (Knott, 2013:45).

Ariadi et al. (2012: 4) explain that after a round of exercises for data collection, participants were “asked to evaluate the software's user friendliness and their acceptance of the sample products”. Similarly, Franke & Schreier (2010: 1025) look into the “preference fit” of customised products and “perceived process enjoyment” and effort put into customising them. This work aligns to that body of research by referring to the “preference fit” as the attachment to individualised products and the “process enjoyment” and ‘effort’ as the engagement with individualisation process. Under that alignment, Franke & Schreier’s (2010) suggestion that preference fit is "impossible to calculate objectively" means this work also needs to consider attachment and engagement as "composite subjective impressions" and therefore propose measuring items as described under definitions **g- Consumer engagement** and **h- Product attachment** (page 24).

#### **g. Consumer engagement**

In this study consumer engagement will refer to the engagement with the process of customisation proposed (in this case, individualisation). A ‘fully customised’ product (explained in point **b**, above) would naturally require a high degree of consumer involvement. However, the automated nature of individualisation means that understanding the level of consumer involvement is crucial to determine his or her engagement in the individualisation process. This engagement will be assessed through participants’ responses and reactions to individualisation experience during studies (including some of the participants’ actions after

the session). Such experience (which may vary depending on each participant) could generate a special meaning to the participant and in turn contribute towards an emotional attachment to the product. Factors to consider when assessing consumer engagement would be:

- verbal expressions
- body language during the experiment (this could evidence excitement, boredom, indifference)
- time spent using the toolkit (the more time using the toolkit, it would be interpreted as more engagement and keen interest on achieving a successful outcome)
- other reactions such as taking photos during the process; this would be interpreted as a positive sign of engagement: a moment worthy of being captured (getting distracted by telephone texts would be understood as the opposite effect)
- interest in inviting others to do the experiment (snowballing)
- distractions

Finally, Peck & Shu (2009) point out that touching an object, or imagery of the object, increases the perception of ownership thus strengthening an emotional bond, defined next.

#### **h. Product attachment**

Product attachment: "an emotional-laden bond that develops if the product has a special meaning to the owner" (Wallendorf & Arnould, 1988 in Mugge et al. 2010: 279). Mugge (2007) explains that an emotional attachment to a product often develops when the consumer actively customises the product. However, a process in which the product is customised *for* the consumer rather than *by* the consumer (as is the case with individualisation), could influence the generation of an emotional attachment, which must be studied to better understand the effects of product individualisation.

Mugge et al. (2010: 279) explain that "an average performing product can result in the experience of satisfaction, because it is adequate and performs according to expectations. However, a person will not become attached to an average performing product, because it has nothing special, and thus it does not elicit pleasure or stimulate emotional bonding". Such emotional attachment to a product could grow over time, with life experiences of using or wearing that product. However, registering such effect in this study from a selected sample, would be impracticable within the timeframe of this research. If signs of consumer engagement are identified in participants' reactions and responses during the individualisation process and interviews, this might suggest an emotional product attachment could develop over the period of ownership. Indications of product attachment might be identified in



responses during and after the experiment sessions. Factors to consider when assessing attachment would be:

- verbal expression when referring to the finished product
- whether participants choose to wait for the product they have made to be ready or take a 'standard' one off the shelf at the end of the session
- responding to the previous question depending on how the 'standard' product looks
- contacting the researcher after the session to find out how and when will they get their finished product
- responses from participants after 45~60 days of volunteering to find out if:
  - they still have the product
  - if they keep the product with others of the same type or elsewhere
  - if they have made use of the product at some point. These product attachment cues will be further explained under section 1.3 Product Attachment and Meaning section of this chapter (see page 44).

Franke and Schreier (2008) suggest that added value can be found from the perceived uniqueness of a self-designed product. The consumer engagement in a customisation process and a subsequent emotional attachment to the resulting product, could lead that consumer to perceive added value from that product. It is therefore relevant to define what this research will consider as added value, as follows.

### **i. Value**

According to Merle et al. (2010: 6), value “results from a trade-off between perceived costs and perceived benefits to the consumer”. The idea of ‘added value’, builds from that and can be linked with the notion of product attachment (see page 24): a consumer can *feel satisfied with the value of an “average performing product”* (Mugge et al. 2010: 279), however, there would only be added value if extra benefits are perceived for the same cost. Value could also become apparent after a period of ownership, for example through the generation of memories associated with the product, which is a factor linked to product attachment.

Therefore, value could be defined in many different terms, for example: uniqueness value, performance, practicality, functionality, familiarity and many others. For the purposes of this research, the definition of value is a composite formed by two key components: *product value*, which is a consumer projection for a product that has been customised, and *experience value*,

generated by the consumer during the customisation experience. These two concepts will be studied in detail in section 2.2.1.

Finally, it is important to understand the following three concepts as they play an important role in understanding consumer behaviour when customising products using special tools.

#### **j. Mass confusion and choice paralysis**

Mass confusion refers to the effect of information overload on consumers (and difficulty to discriminate between information types and their value) during customisation. “Customers can be easily overwhelmed with choice and information” (Matzler et al. 2007: 7) and that feeling could “annoy and confuse” consumers, leading to postponement of the purchase, delegation of decisions and low brand loyalty (Matzler et al. 2011: 232). Shankar et al. (2006: 1021) refer to “choice paralysis” as occurring “when the cost of processing all this information outweighs the benefit”.

#### **k. Toolkit**

Tools and kits are necessary to customise diverse products, (e.g. a bike, furniture, a car). Toolkits in this research refer to software used to enable the consumer to customise a product. Hippel (2001) refers to toolkits as software technology for consumers to customise products and services. He explains that toolkits allow consumers to obtain “true design freedom” through a process of “learning by doing” which allows a manufacturer to capture the otherwise “costly-to-transfer” information about what a consumer thinks he or she wants (Hippel, 2001: 248). Internet-based toolkits afford the customer convenience, however that same technology can also be used offline, at home or in commercial settings, where the relationship company-customer is face-to-face. Customisation software is meant to guide consumers through the process, feeding information and product choices in an organised manner to avoid confusion.

#### **l. Customisation complexity**

Customisation complexity relates to workflow issues such as order taking, production lines, inventories, marketing and workshop organisation: post production stages and quality control as explained in Blecker et al. (2004) and Mellor et al. (2014). According to Blecker et al. (2004: 890), mass customisation can induce “a high complexity level because of various customer requirements and a steadily changing environment”.

## 2.2. WHY CUSTOMISE

Throughout the history of products, customisation has been a common practice as a form of personal or group identification. Product uniqueness in particular has been identified as a consumer need by previous studies on product customisation (Tepper et al. 2001; Etgar, 2008), and a factor in achieving satisfaction for which consumers would be willing to pay a premium (Franke & Schreier, 2008).

According to Etgar (2008), the choice to customise relates to a variety of factors, such as economic, social, cultural, technological and psychological. He argues that in developing economies, markets of consumers "*strive to improve their standard of living by purchasing low cost, mass produced items*" (Etgar, 2008: 99). On the other hand, he explains that in more developed economies, self-identification, group/peer identification and self-differentiation become more important; for example the desire for unique products becomes a motivator for customisation (key for product individualisation). However, even in appropriate scenarios for product customisation, such choice is not necessarily desired by consumers (Campbell, 2013). For example, Ariadi et al. (2012) and Sinclair & Campbell (2009), report some customers would choose not to customise products (the reports were based on the customisation of ball-point pens and USB-‘flash’ drives), mainly due to unwillingness to invest time on the process and due to respondents struggling with the technical abilities required. Campbell (2013) adds that almost all products require engineers and design professionals to make durable products, and that the ultimate design idea is to generate ‘good’ and safe design. The use of automated systems to generate form and find novel solutions for design problems emerges as an alternative and has been successfully applied for some time in fields like design engineering, medical sector, aerospace and architecture (i.e. generative design as a strategy to improve engineering products’ performance) (Yang & Bouchlaghem, 2010). Also, Belmonte et al. (2014) explore an automated and randomised system for architecture design from the perspective of architecture students (again, not in consumer-products), who report an enjoyable experience which stimulates creativity. Inferring from Merle et al. (2010), an automatic process of product customisation (i.e. with less consumer involvement and time investment required) could work as a motivator to persuade consumers into the new creative possibilities for consumer-products. Indeed, according to Sinclair & Campbell (2009) and Campbell (2013) it could also be argued that consumers could benefit from a customisation approach which enables them to

achieve a result quickly, even in the absence of special technical skills, and assuring a 'good', manufacturable and safe design.

The following factors, found across a number of reports, have been identified as key in product customisation (and therefore influential in terms of individualisation):

- 2.2.1 Added value
- 2.2.2 Economic implications
- 2.2.3 Appropriateness of Additive Manufacturing for product customisation
- 2.2.4 Product type
- 2.2.5 Consumer type
- 2.2.6 Toolkits

### 2.2.1. Added value

Added value for the consumer has been identified as the most persuasive factor into product customisation. The literature describes this factor from two perspectives, the company's (mostly in marketing journals) and the customer's, which relate to consumer behavioural factors. Here there is only a summary of both.

Reports identify two key aspects of added value when customising, namely product value and value of the experience:

**a. Product value:** refers to the value projected for a product that has been tailored to best fit a consumer (Campbell et al. 2013; Merle et al. 2010; Merle et al. 2008) enhancing product satisfaction, and eliciting an emotional bond with the product based on improved design (de Beer et al. 2009). When the product can be aesthetically customised (as in the case of individualisation), the resulting design could generate positive responses due to its appearance (Bloch, 1995; Merle et al. 2010), as it may better fit the consumer's "needs and wants" (Bardakci & Whitelock, 2003: 466).

Etgar (2008), Franke & Schreier (2008), Tepper et al. (2001) and Merle et al. (2010) highlight the consumer's need for uniqueness as a driver for product customisation. Tepper et al. (2001) explain that this is particularly relevant when the unique product can be exhibited and perceived by others. Further, they explain that consumers with a strong desire for differentiating from others would pay more for unique products and perception of exclusivity. Merle et al. (2008) report consumers finding not only added value from design uniqueness, but

also from added functionality on the customised product. This is not often considered a factor to cherish or feel attachment for a product: “People only have a few of these possessions and these products are generally not owned for their functionality” (Mugge, 2007:23), but because of the meaning to the owner.

Finally, the customer’s “active voice” during a product’s design stages has been reported to generate savings to some companies, which in turn means benefits to the customer (Mustak et al. 2013).

**b. Experience value:** relates to the value generated in experiencing the process of customisation with different degrees of participation. Press and Cooper (2003:93), explain that design is “moving inexorably beyond the product or service ad towards the experience”, where people “gain and express” meaning through designed experiences. Further, Mugge et al. (2009:467) suggest that such experiences can trigger new emotions (and memories) and “enrich a person’s life”. It could be said that when consumers experience customisation activities, products “gain” added value.

Press and Cooper (2003: 73) further suggest that design experiences can also bring about new opportunities for communicating with other people: a “holistic cycle of experience”, by, for example, providing forms of social identity such as club memberships. The ‘social’ aspect that is associated with those valuable experiences will be mentioned later in chapter 4, as it was observed particularly during Pilot #2 (page 110).

Press and Cooper (2003: 127) also highlight the importance of “participatory design” for consumers and designers. They explain that it is not just an experience from which consumers can obtain a better fitting product (which adds perceived value), but also that participatory design “can make users feel more valued and empowered and give them a sense of ‘ownership’ in the new design”. Similarly, Design practitioner Assa Ashuach explains that the customisation design experience adds another layer of value on the consumer experience (The Culture Show, BBC 2012).

However, Norman (2004) suggests that apart from Full Customisation experiences (when the consumer is in full control of all the variables of a design, see page 20), mass customisation products, which he describes similarly to what this research defines as personalisation (page 21), are not “emotionally compelling” as there is no “sense of ownership, of pride” (Norman,

2004: 220). This means that a consumer's experience participating in the configuration of a particular product is not sufficient as a memorable experience to elicit emotional value. Norman explains that those customised products have "little or no personal relevance, little or no emotional value" because in such forms of customisation "all you can do is select from a fixed set of options" (Norman, 2004: 219).

Contrary to Norman's (2004) perspective, Press and Cooper (2003) and numerous other reports indicate signs of added value during consumer participation in co-design, as it often proposes a fun and attractive activity which brings joy, entertainment and emotional attachment to the resulting product (Etgar, 2008; Merle, Chandon and Roux, 2008; Mugge, Schoormans and Schifferstein, 2009; Merle *et al.*, 2010) and stimulates creativity (Belmonte *et al.*, 2014). It also helps the consumer's self-expressive value (Mugge *et al.* 2009; Merle *et al.* 2010); increases sense of belonging to a wider group (Mugge *et al.* 2009; Mustak *et al.* 2013) and often makes the consumer learn new skills, (e.g. computer software, painting, using tools, writing, cooking) (Mustak *et al.* 2013) and fulfils a sense of pride with the achievements, as reported by Knott (2013) quoting the case of Betty Crocker with the "just add an egg" product recipes. More importantly, it has been reported that the act of customisation does generate an emotional bond between the consumer and the product being customised (de Beer *et al.*, 2009; Mugge, Schoormans and Schifferstein, 2009; Ariadi *et al.*, 2012) and that "emotions enrich a person's life" (Mugge *et al.* 2009: 467). Finally, Mugge *et al.* (2009), explain that as a result of the emotional bond, those products are kept for longer and disposed of later in life, despite their state of repair.

Whilst individualisation requires minor interaction with consumers, it still is more than that required from an off-the-shelf product. In product individualisation, each offspring is technically a unique alternative in shape to an original design intent. Uniqueness, explain Tepper *et al.* (2001) increases owners' differentiation and self-esteem and responds the consumer's natural desire and need for uniqueness (Etgar 2008; Merle *et al.* 2010; Tepper *et al.* 2001).

Merle *et al.* (2010) indicate that this twofold value (product value and experience value) is hierarchical, where product value ranks above experience value, (although the second can influence the overall perceived value and also lasts longer than the product value).

Syam et al. (2008) add another important factor in cases when the consumer is uncertain about customisation preferences (uncertain about his/her "wants" and afraid of not "liking" the product later) and therefore customising becomes a challenge, leading to possible feelings of regret. Similarly, Schwartz (2015:126) addresses such aspect of consumer behaviour pointing out that "the more options you have, the more likely it is that you will experience regret". Aiming to avoid regret, customers tend to customise reflecting attributes of a standard product. Syam et al. (2008: 380) claim that "There always exist a segment of consumers who prefer a standard product to the custom product", in spite of the benefits the custom product might offer. Furthermore, they argue: "additional standard products can work to the benefit of custom products". Such a view could be seen as 'counterintuitive', as a higher availability of 'safe' responses (i.e. functional standard product options) would gain space over the spectrum of customised possibilities. Essentially, this means that the higher presence of new 'correct' or 'safe' answers encourages customers to propose their own solutions with less uncertainty, as the perception would be that putting forward a 'wrong' answer is unlikely.

Figure 2.2 (page 31), below, shows two continuums between a standard product and a customised one. The first continuum presents a scenario where the consumer has to 'leap' between a standard product and a customised one. The second continuum represents a company that could offer a standard choice, plus a number of alternatives to it. Each of those alternatives generates a 'safety island' or 'zone' along the continuum. Customer-proposed solutions would then probably remain close enough to one of the 'safe' responses within the continuum. Future studies could investigate how many 'safe' or standard products to provide and how much to invest in diversifying the stock in order to promote effectively the willingness to customise.

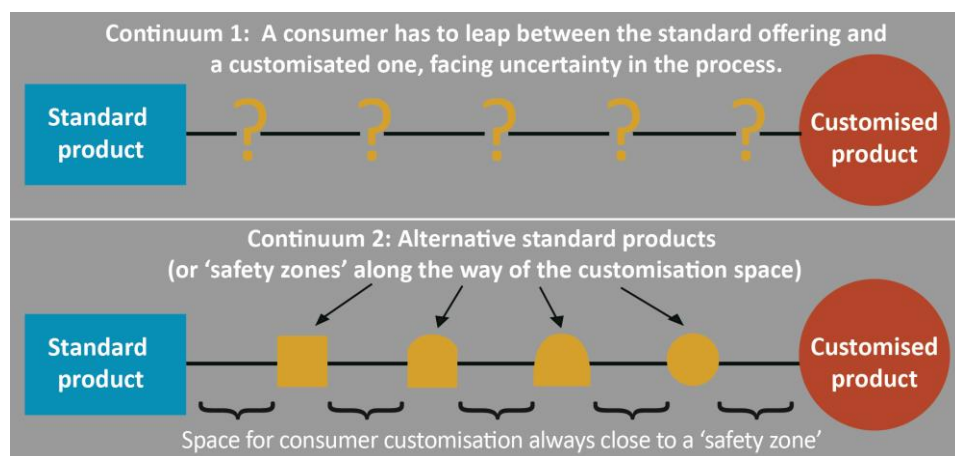


Figure 2.2. Linear continuums between a standard and a customised product.

Product individualisation, not depending 100% on consumer's choice, would only produce 'safe' alternatives where those are the result of directives from the designer's original intent. Product individualisation would benefit consumers if, as claimed by Merle et al. (2010), added value could be perceived through offering less choice (e.g. automatically or semi-automatically) whilst still delivering customised products, in cases where otherwise mass confusion would be prone to happen, or for those consumers who are not willing to spend time customising. Shankar et al. (2006) agree: "More choice often makes choice harder not easier for consumers". Indeed, Franke et al. (2010) explain that they "do not know the extent to which the feeling of having made a contribution is desirable". Further, they "propose that this relationship [between consumer participation and product value] might be modelled as an inverted U-shaped function with a maximum; beyond that point, higher contributions are increasingly perceived as effort, not as additional value", as illustrated in the Figure 2.3, below. Indeed, Ariadi et al. (2012) reported some study participants expressing a preference for not customising products by themselves, but buying and downloading from internet sites a 3D-printable design of their choice instead.

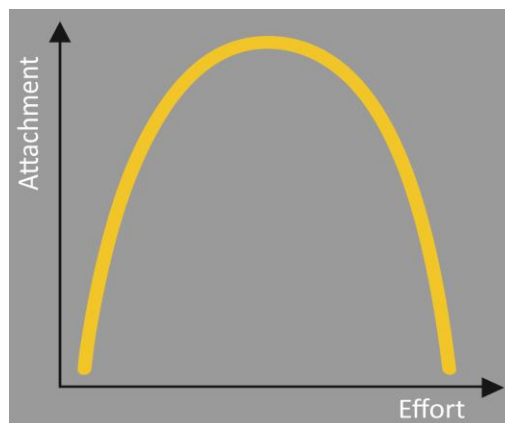


Figure 2.3. Inverted U-shaped function as explained by Franke et al. (2010)

### 2.2.2. Economic implications

Various researchers explain how new responsibilities placed on consumers willing to customise could generate savings to a company. For example, the participation of the consumer can reduce the design stages: product time to market and design iterations (Atkinson, 2011; de Beer et al. 2009), which are marketed as benefits for the consumer (Mustak et al. 2013). Arguably, offering customisation possibilities could also generate complexity and added costs on the company's side when it comes to multiplication of product variants, for example: complexity in order taking, in production lines, inventories, marketing, (Blecker et al. 2004; Mellor et al. 2014), as well as in workshop organisation, post-production stages and quality



control (Mellor et al. 2014). Blecker et al. (2004) for example, explain that doubling product variants can increase the production costs by 20~35%, (depending on the kind of technology the company requires). Amongst different existing manufacturing techniques, additive manufacturing (AM) appears as the one that can best manage the production of one-off designs (key for individualised products, as defined on page 21) in a cost-effective manner whilst permitting the involvement of consumers to elicit an emotional attachment with the product. The appropriateness of AM for individualisation will be discussed in the next section.

From the perspective of the consumer, there are economic implications too. Firstly, following Blecker et al. (2004), an increase in the production costs is likely to result in a higher final product price. However, different reports suggest that, depending on the product type, customers would still be happy to pay a premium for customised goods (Campbell et al. 2013; Bardakci & Whitelock, 2003; Merle et al. 2008; Merle et al. 2010; Piller, 2010). Tepper et al. (2001) and Franke & Schreier (2008), identify that the willingness to pay for something unique, would depend on perception of product uniqueness, which could support the idea of added product value for the case of individualised objects. Secondly, there is a cost for the consumer in terms of time investment during the customisation process. The amount of time is variable depending upon the degree of the customer's involvement on the process, the available technology for the consumer interaction and the complexity of the product in question. Etgar (2008) points out that time is an important resource for the consumer and "Consumers who enjoy more discretionary time will be more prone to engage in co-production" (Etgar, 2008: 100). Because product individualisation requires a comparatively small amount of time investment from consumers (compared to cases of full customisation, for example), it could argued individualisation benefits from a possible advantage ahead of the mentioned second aspect of cost for the consumer, as could also be inferred from Merle et al. (2010).

As shown above, the concept of time cost is closely related to risks, such as customisation complexity, mass confusion and to the application of appropriately designed toolkits, all of which will be discussed later.

### **2.2.3. Effectiveness of Additive Manufacturing for product individualisation**

This research focuses on evaluating the effects of a specific method of product customisation on the consumer's relationship with the manufactured results. To this end, some

manufacturing techniques would 'lend' themselves to make mass customisation (and by extension individualisation) as well as low-volume manufacturing, economically viable.

Direct manufacturing technologies such as Additive Manufacturing (AM) are arguably the most appropriate methods for customisation processes due to their capability to produce 'one-offs' and intricate geometries in a cost effective manner, as explained by Dean et al. (2005), Campbell et al. (2013) and Campbell et al. (2012), among others. In this subsection, the use of AM for customisation is analysed. The use of direct manufacturing technologies will subsequently be evaluated in relation to the research methods proposed in this research.

Despite AM processes being expensive to run (cost of machine use, materials, energy) "they offer reduction in whole life-cycle costs" (Campbell et al. 2013: 1). Additionally, Dean et al. (2005) explain that AM could make the customisation process more flexible, fast and cost-effective. Most importantly, AM allows for the generation of one-offs, vital for product individualisation. Particularly, Campbell et al. (2013) and Campbell et al. (2012), explain that AM can add value to product design in different areas: **a-** economic, **b-** ecology, **c-** experience and **d-** design:

- a.** Goods produced through AM could have fewer components; resulting in companies with smaller inventories, (virtually) any shape produced at the same cost, simultaneously and in less assembly time. AM can also improve the company's income: it helps in product differentiation allowing product batches as low as one, making AM appropriate and cost-effective for mass customisation and individualisation. Other more 'traditional' manufacturing techniques, such as injection moulding, rotomoulding, extrusion, casting, require expensive tooling for each different design, turning them impracticable and expensive for uniquely customised designs every time.
- b.** AM reduces waste of material and can produce components with complex geometries, reducing the number of parts in a given product. Thus, the product's final weight diminishes, and could in turn save energy when transported. Additionally, Campbell et al. (2013) mentions new possibilities for complex (particularly internal) geometries, such as more efficient fuel pump designs.
- c.** Consumers want less 'stuff' (material things) and more 'experiences', say Campbell et al. (2013). Crucially, AM contributes towards systems that welcome consumer participation

/ interaction, which has been identified as valuable for consumers by other researchers (Mugge et al. 2009; Merle et al. 2010), and could be key for a greater emotional attachment to individualised products.

- d. Design-wise, AM could trigger "a desire to endow the product with specific design features that will increase its value to the customer" (Campbell et al. 2012: 258). On the other hand, Knott (2013: 62) argues: "whether 3-D printers are empowering or just another false illusion of duped prosumption depends on how one uses them".

It is important to highlight that Campbell et al.'s (2013: 1) argument about the "reduction in whole life-cycle costs", would become more evident as time goes by and the technology becomes commonplace. AM is still a 'novel' technology to some degree and it can be expensive to buy and run. As is the case with most novel technology, it is expected to become normalised, i.e. gradually evolve, be adopted by more businesses thus dropping prices and becoming a commonplace technology.

Dean & Pei (2012), Ford & Dean (2013) and Woudhuysen (2013) point out that adopting AM for customisation should not be solely based upon its characteristic manufacturing flexibility, but also upon the nature and design of the products involved, materials and other resources required, and finally the purpose of the customisation. They argue that due to the cost of AM machines, supplies, maintenance and energy, the use of this premium technology has to fit within a balanced multidirectional circle composed by three elements, as shown in Figure 2.4 (see page 35), below.

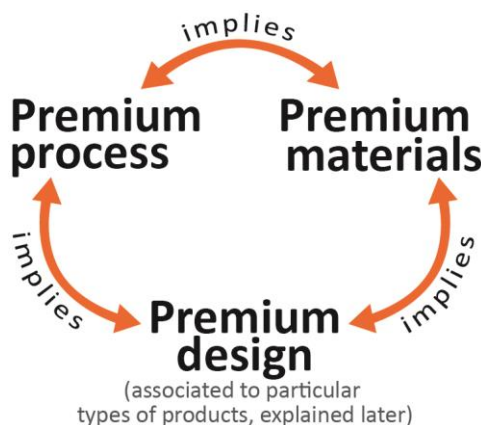


Figure 2.4. The three elements that can determine what product consumers customise. All factors should balance each other.

If the use of a premium material (e.g. gold, platinum, titanium and silver) is not a key requirement, the other two factors would have to justify each other. de Beer et al. (2012), also emphasise this idea, particularly when the premium materials are inflated with the use of precious stones as it could be the case with jewellery.

It could be argued that this equation affected results to the studies reported in Ariadi et al. (2012) and Sinclair & Campbell (2009), as the sample products used for the studies belong to product types which are often perceived as inexpensive, i.e. not worth the customisation time investment, the premium process, nor premium materials. The implications of product type are considered next.

#### **2.2.4. Product type**

As suggested in the previous section (see 2.2.3, page 33), product type could be an important factor in choosing whether or not to customise a product. Two main responses have been collected from the literature as to how product type can have an influence on that decision:

1. The earlier explained balanced three-way-equation, (Dean & Pei, 2012; de Beer et al. 2012; Ford & Dean 2013; Woudhuysen, 2013).
2. Product characteristics reflected on the “demand pattern” (Bardakci & Whitelock, 2003)

1- The multidirectional balance suggested by Woudhuysen (2013), Dean & Pei (2012), de Beer et al. (2012) and Ford & Dean (2013) (Figure 2.4), is relevant for product individualisation in that the requirement of ‘one-off’ production with digital input (computer algorithms) situates direct manufacturing technology (such as AM) as a fixed variable on that equation. Therefore, it would imply the product type should respond to qualities given by the premium design and materials. de Beer et al. (2012) discuss the use of AM in jewellery production and add that "The issue is in balancing the design investment with the material value of the gemstones. [...] There is clearly a need to engage the public with the design process and the creative benefits that new AM materials bring" (de Beer et al. 2012: 5.0). A ‘premium’ manufacturing process invites better materials to be used and a better material invites a better design, enhancing the piece’s perceived value (in the case of de Beer et al. (2012) report, with precious stones). Current practitioner into product individualisation Dr Lionel Dean, calls such type: “high-value consumer products” (Dean and Pei, 2012), (HVCP from

hereafter), and has adopted mostly jewellery, and other ornaments as examples of such group. In line with such choice, Mugge (2007: 23) explains about product attachment “that the most special, treasured, or cherished possessions tend to be largely restricted to highly emotionally laden family heirlooms and jewellery”.

Figure 2.5, below, is a product-process matrix. Products at the bottom of that diagram (“commodities”) are those designed and engineered to be produced in high volumes at low cost, a concept often opposed to added value and uniqueness.

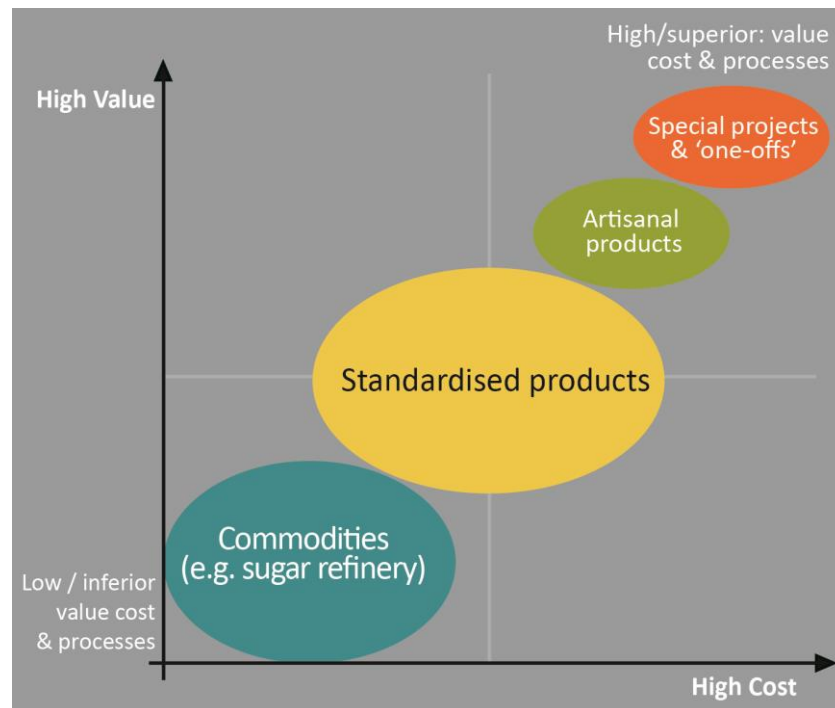


Figure 2.5. The High Value Consumer Product type, occupies the sector of high-value – high cost – premium process. Adaptation from (Hayes and Wheelwright, 1979).

Commodities would not fit well within the concept of product individualisation, i.e. products mostly conceived to be inexpensive, such as table salt, or those in the middle (“standardised”), for example screwdrivers, pens or computer mice. There are, of course, exceptions, where regular inexpensive products are designed for specific contexts, in which premium design and materials are a must: fountain pens could represent such category. At the top-right corner of Figure 2.5, we find the ‘high-cost’ – ‘high-value’ items, which can be illustrated by HVCP, such as jewellery. If we consider a third, perpendicular Z-axis in the figure representing ‘premium processes’, HVPC would be found there according to the multidirectional balance shown earlier: ‘high-cost’ – ‘high-value’ – ‘premium processes’.

2- Bardakci & Whitelock (2003) explain that the choice to customise a product or not, depends on the product's "demand pattern". If that pattern is purely functional (e.g.: table salt, screwdrivers), there is a lower interest to customise. If the "demand pattern" is innovative, customers are more interested to customise, as it "requires that additional reasons to buy innovative, offerings are given" (Fisher, 1997 in Bardakci & Whitelock, 2003: 466). A range of products with different demand patterns were considered for this research's studies and pilot studies, not only jewellery, but ornaments for the home and accessories. In short, items that the consumer could be persuaded to customise, possibly eliciting a special relationship characterised by an emotional attachment to the product (i.e. taking care of it, fixing it when it breaks and feeling proud when using or wearing it).

Finally, within products of an innovative "demand pattern", the intention of a purchase is also relevant. For example, if the intention is to buy a product as a gift or when shopping for ones self, pre-purchase thoughts and expectations start to be taken into account as to whether to customise or not. The meaning of the product to the consumer is further explained under "Product attachment and meaning" (section 1.3, page 44).

Arguably, the present work could have faced a similar challenge as that of Ariadi et al. (2012) and Sinclair & Campbell (2009), were its aims anchored on the use of AM. Researching high-end AM products with premium materials (where jewellery pieces are a good example), was beyond the budget of this research and would have demanded timescales (for production) that did not fit with the designed interview sessions, particularly as the research methods required customising and making a product during every single interview (see Research Design section, page 65). This research investigates product emotional attachment in relation to a method of product customisation, but is not committed to any particular manufacturing technique. Already finished 3D printed pieces were used during pilot studies to propose exercises, along with other technologies whilst paying attention to factors such as available budget, technical possibilities and timeframe. In all cases, the intention was to emulate the product individualisation experience with actual products, which consumers can use or wear (as opposed to models, mock-ups or virtual representations). The technical, logistic and financial impossibility of 3D printing a well-finished product (in terms of visual and tactile qualities) from start to finish during interviews presented a challenge in terms of the research methods and data gathering instruments, as discussed below.

### 2.2.5. Consumer type

Reports suggest that the choice to customise is strongly linked to the type of consumer considered, (Ariadi et al. 2012; Franke et al. 2010; Knott 2013; Hermans 2014, among others), and therefore very important for this research. In particular, those reports suggest that there are consumers who ‘actively’ engage with what they consume and are more likely to customise than other more ‘passive’ consumers because of different circumstances in their work, discipline of study or due to personal interest in customisation processes. Those circumstances can provide ‘active’ consumers with skills and knowledge not only to customise and understand what they like and want, but also to process multiple choices more easily than those with no training. Schwartz (2015: 123) discusses consumer behaviour and choice, and agrees that “for certain individuals, adding more choices to an existing domain simply makes their lives more difficult” and “as the number of choices in a domain increases, so too does the cognitive work required to compare various options”. Such consumers, who do not regularly engage in product creation or design or in customisation processes, might not have those skills or knowledge and adopt a ‘passive’ attitude (as opposed to the former ‘active’ consumer) towards customisation and consumption.

Identifying those ‘active’ and ‘passive’ consumer types is critical to understanding how individualisation, a process that uses automated systems to function (e.g. computer algorithms), can be beneficial. Such differentiation is particularly relevant when addressing Research Question number 2 (see page 16), with a possible dependency of value and emotional attachment to individualised products on the level of consumer engagement in the individualisation process. This section shows how two authors (Hermans 2014 and Knott 2013), who studied consumers facing customisation processes, characterised those two different consumer types. Those authors’ criteria will inform the basis for the rationale behind this work’s identification of two consumer types: ‘active’ and ‘passive’ consumers, which will be fully described as part of the sample design, in Methodology chapter (see page 75).

Some articles take a theoretical approach, characterising each type of consumer (such as Hermans 2014), while others imply that such differences exist, often without offering an explanation of what those differences are or why they have an effect on results. For example, Ariadi et al. (2012: 4) describe the sample for sets of studies as “non-designers from a variety of backgrounds”. Likewise, Franke et al. (2010) recruit business students to analyse and evaluate their behaviour when engaging with mass-customisation toolkits. In these two cases, the criteria behind the sample design are unclear.

Knott (2013) refers to the term prosumer (see Terminology, page 23) and explains that the notion of active producer-consumer existed long before 1980 (when Alvin Toffler coined the word in his book “The Third Wave”), but ever since consumers have been engaged in some form of production for their own provision. In line with Etgar (2008), Knott proposes that background factors can dictate consumer behaviour towards customising, depending on “what tools are handed over to the consumer, what are the political and social contexts of this transferral and how does the newly empowered prosumer wield this productive power” (Knott, 2013: 47). Knott acknowledges the existence of characteristics of an individual as well as background factors, for example that not all consumers can be expected to have the same level of skill or motivation to customise. He explains such differences as “qualitative degrees” of prosumers, and the criteria for the distinction are based on how prosumers would react when faced with a customisation project: one prosumer might be the one “who follows the rules”, “rejects such provision and pursue self-sufficiency”, or “adapts tools and materials in processes of ad hoc bricolage” (Knott, 2013: 45).

Similarly, Hermans (2014) acknowledges that differences between consumer-producers could be influenced by personal characteristics, such as motivation, skills and intention. He proposes a continuum where the “passive consumer” is on one extreme and the “professional designer” on the other. Hermans describes his criteria for such qualitative differences and justifies the sampling criteria for the research. Such a differentiation is deemed necessary because it is in those different types of consumers that prosumer behaviours are explained, strengthening the relevance of the study. When explaining the criteria to differentiate types of consumers, he uses the figure of the “layperson” (the “not trained in a certain profession; not having a lot of knowledge about a certain thing”), and in particular, the “lay-designer” (Merriam-Webster, 2014 in Hermans, 2014: 16). Hermans then borrows the idea of “four levels of creativity” from Sanders & Stappers (2008:12) to describe stages that the lay-designer goes through: adapting, making, doing and creating, as illustrated in Figure 2.6, below.

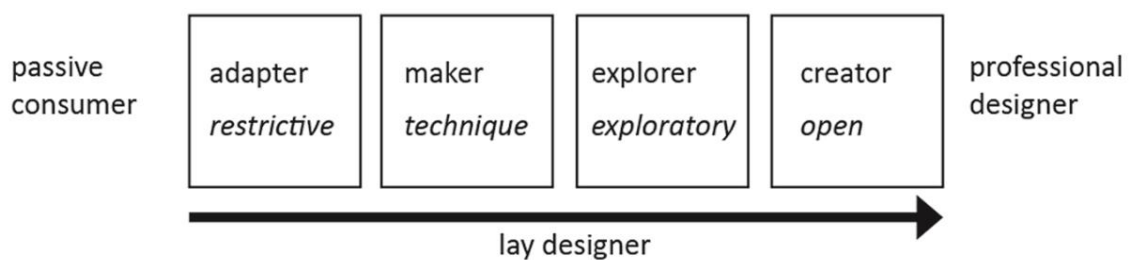


Figure 2.6. Continuum of lay designer with “four levels of creativity”: from adapter, to maker to explorer to creator. From Hermans (2014: 26).



Those “qualitative degrees” (Knott, 2013: 47) would seem to be what some researchers imply when sampling for interviews, such as participants who “self-identify as being interested in design and new technology” (Sinclair & Campbell 2009:15) or are described as “non-designers” (Ariadi et al. 2012: 4) in their studies (which Knott characterises as “passive” individuals “accepting the commodities as already finished”, and the “more proactive and critically engaged” (Knott, 2013: 49)).

Bridging the gap between the passive consumer or adapter (on the left side of the continuum) and the creator or professional designer (on the right of the continuum) has become more relevant with the advent of modern technology, as it offers mass-customisation possibilities. And it is because of those qualitative differences that a study of this kind is important: to identify the value of a customisation approach, to make relevant tools available and to offer new creative possibilities for its identified beneficiaries to engage with. It is therefore key for the objectives of this research (see 1.3 Research Objectives, page 16) that a sample design identifies and differentiates the consumers who ‘actively’ engage in what they consume and customise, and those with a more ‘passive’ attitude towards customisation and freedom of choice. Building on the observations from this section of the literature review, the sub section 3.2.2.1 Active and Passive consumers (see page 75) will focus on these two different types of consumers, proposing both a rationale to characterise them and the criteria to identify each type.

Schwartz (2015) proposes an analogy between the paradox that comes along with freedom of choice and the use of language, which he describes as the “embodiment of human freedom”: what makes that language so liberating is that it “is heavily constrained by rules” Schwartz, 2015: 133). The author implies that our experience of using those rules has reached a level of skill such that the rules play in favour of that freedom. Again, it is important for this research to investigate how the consumer types considered here would behave with product individualisation processes that impose rules of usage and therefore particular levels of engagement. Therefore, whilst availability of choice is good for consumers, it is not necessarily always a good thing, as it can induce choice paralysis, dissatisfaction and even regret associated to second thoughts about the rejected alternatives (for example of a given product) or those that were not explored. Those “missed” alternatives can be interpreted as the “cost” of making a choice, or as the ‘risk’ for consumers when customising.

In the literature, risks of product customisation for the consumer are most often associated with mass-confusion, regret and the poor design, or absence, of toolkits. From a company's perspective, the risks have been identified as different "complexity" factors, explained under 2.2.2 Economic Implications, above. In this section a few additional relevant risk factors will be discussed.

Mass-confusion, also known as choice overload, is a known effect of mass customisation, when the amount and similarity of information and choices overwhelms the customer (Matzler, Waiguny and Füller, 2007; Schwartz, 2015). Excess of information can "confuse and annoy" consumers, which can later lead to negative feelings and deteriorating brand loyalty (Matzler et al. 2011: 232). Furthermore, they explain that such confusion may lead to the postponement of the purchase, cancellation or delegation of customisation decisions to someone else (which would diminish the benefit of self-expression) and paralysis (Schwartz, 2015). In judging the success or failure of a customised product, a person tends to "claim more responsibility than a partner for success and less responsibility for failure" (Benpauldi & Leone 2003 in Etgar 2008: 102), which could represent a risk from a company's perspective. A company offering a range of customisation facilities would run the risk of consumers gaining substantial skills in the long run and becoming competitors by creating products independently or ordering elsewhere (Mustak, Jaakkola and Halinen, 2013).

### **2.2.6. Toolkits**

Toolkits in this research refer to software used to enable the consumer to customise a product. A clear example of toolkit is the one offered on the Nike ID website (Figure 2.7, below), where a customer can personalise a pair of trainers. A toolkit's main function is to guide consumers through the customisation process, feeding information and product choices in an organised manner, sometimes controlling the 'amount' of choice (Matzler et al. 2007), so that confusion is avoided. When toolkits are not fit for purpose, they can also be the cause of frustrating experiences and confusion. Campbell (2013) suggests that in the future products should be finished up to a point where quality and safety standards are met and brand identity is kept, so that consumers have room for input through toolkits and at the same time that input is kept within established limits. Similarly, Atkinson (2011) indicates there would be a change in the relation between consumers and products, as the former would become partly responsible for the latter. Insurance company websites are an example of this: the toolkits allow the consumer to select what will be covered, level of cover, excess and length of cover.

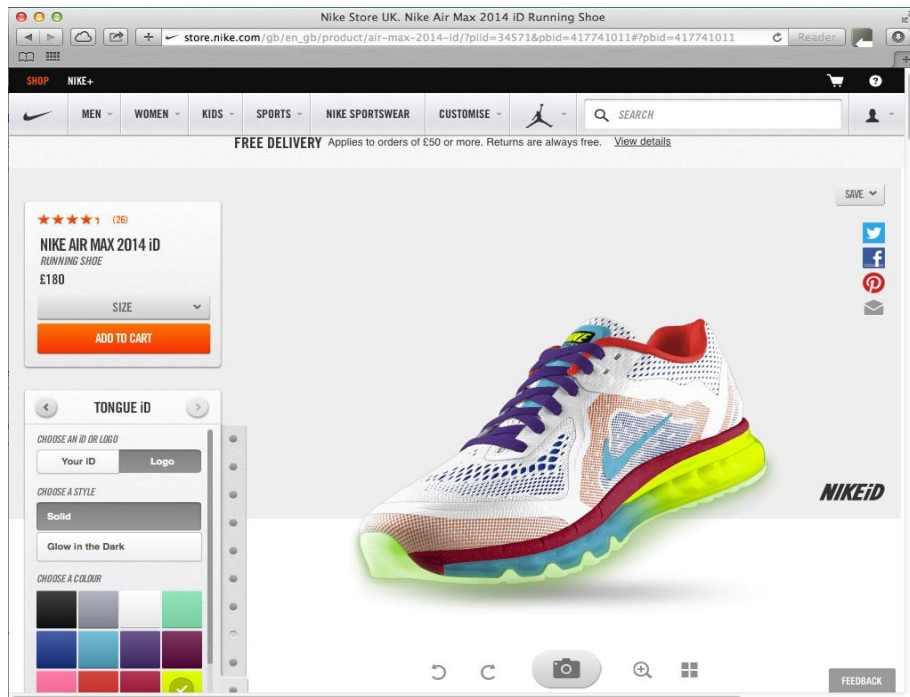


Figure 2.7. Screenshot of Nike ID website, featuring the toolkit to personalise trainers. Source: www.store.nike.com

The amount of freedom of choice within toolkits is debated amongst researchers. For example Mugge et al. (2009), argue that limiting toolkits might militate against the consumer-product emotional bond, whilst Franke et al. (2010) suggest that too much consumer participation could have a negative impact on that bond. Shankar et al. (2006) argue that whilst the freedom to choose is empowering, exercising it can also become a negative experience. Most researchers seem to agree on two key aspects: first, toolkits should “avoid mass-confusion and enhance consumers’ experience, a driver for profit opportunities” (Piller, 2010: 17). Second, neither toolkits nor prosumers can replace a designer (Blecker et al. 2004; Campbell, 2013; Campbell, de Beer, et al. 2012; Sinclair & Campbell, 2009). They explain how the designer remains responsible for the product and product configuration alternatives, even though s/he might not be aware of the final outcome, which could raise issues regarding intellectual property and safety.

The implementation of a toolkit guided by computer algorithms for product individualisation means that a consumer could interact with software containing just enough choices as intended by the designer, to make an informed selection for manufacturing. Indeed, Merle et al. (2010) argue that added value could be delivered by offering less choice. This could be seen as suitable for customers not willing to get too involved in a customisation process (e.g., those discussed in Ariadi et al. (2012), who reported to be happy to download a design from the internet for 3D printing), making the process automated and cheaper to run, compared with hiring a designer for every offspring.

## 2.3. PRODUCT ATTACHMENT AND MEANING

As is the case in other bodies of research (Jiao et al. 2007; Mugge et al. 2009; Knott 2013; Mustak et al. 2013; Etgar, 2008; Merle et al. 2008), product attachment is a key concept in this research. As mentioned earlier, the experience of customisation can generate an emotional bond with the product as well as a sense of ownership. Product emotional bond would be one element of value with which to measure the forecasted benefits of product individualisation and customisation in general. Mugge et al. (2010) argue that in feeling attached to a product, the meaning to the owner (i.e. memories the product generates over time) is more important than the product's utility and appearance.

Concepts collected from de Beer et al. (2009), Mugge et al. (2009) and Ariadi et al. (2012), suggest the idea that in full customisation and personalisation, the emotional bond with the product could result from the combination of customer time and effort invested in the process:

**Time customising + Effort customising = Emotional bond with product.**

Mugge et al. (2009) go on to explain that the aforementioned equation would also be true in cases when the customisation process implies not only intellectual, but also physical effort (e.g. customising a bike or building furniture). Mugge et al. (2009) also indicate the use of toolkits with inbuilt limitations could be counterproductive for the generation of such bond.

Following Mugge et al. (2010:279), "a person will not become attached to an average performing product, because it has nothing special, and thus it does not elicit pleasure or stimulate emotional bonding". Mugge et al. (2010:279) go on to cite Wallendorf & Arnould (1988), who explain that product attachment is "an emotional-laden bond that develops if the product has a special meaning to the owner". Therefore, it could be claimed that a product that has been customised presents a special meaning for the owner and therefore generates pleasure and stimulates the emotional bond, all key ingredients of product attachment. Mugge et al. (2010) suggest that the generation of memories while using / wearing the product would determine a possible lengthy emotional attachment.

We can now enumerate four key elements in the building of product attachment:

- I. Time invested customising → sense of ownership
- II. Effort invested customising → sense of ownership
- III. Meaning to the consumer
- IV. Time spent using/wearing the product

Considering elements I. and II., it could be argued that individualisation presents a weakness, as the investment of time and effort required from the consumer is lower compared to cases of personalisation or full customisation (although still higher than a product taken off the shelf). However, individualisation works inversely, offering added value by reducing the time and effort required (as also inferred from Merle et al. 2010), yet also aiming to achieve product uniqueness value (Etgar, 2008; Franke & Schreier, 2008; Merle et al. 2010; Tepper et al. 2001). Additionally, Peck & Shu (2009) explain that the “mere touch” of an object increases ownership as well as product imagery. Whilst individualisation does not involve timely, effortful bonding experiences of customisation, it could allow the observation of the product being manufactured or even the manipulation to some degree, which could increase perceived ownership and bond.

Point number III. from the list above refers to meaning of the customised product. It is important to highlight two perspectives on this. Firstly, the experience of product meaning even before the time of purchase, including factors such as familiarity with the product (perhaps due to a period of time planning the purchase of the product), desire to own the product (for different reasons, for example fashion, social status, differentiation or group identity) and sense of ownership. Peck & Shu (2009), investigate sense of ownership prior to purchase, elicited by imagery manipulation. Such experiences start to generate meaning for the consumer and influence purchase intentions.

Secondly, Atkinson et al. (2009) address meaning to the consumer, arguing that although processes such as individualisation can produce unique outputs, they lose the personal meaning contained in the hand crafted object, which somehow deteriorates the strength of customisation. “This personal meaning for the owner of a craft object is created through a complex range of psychological associations. There is a question whether the new design and production systems described here have the potential to produce objects which have enough ‘craft’ characteristics to retain the ability to create personal meaning. On the one hand they

produce unique objects, but on the other hand, they are not ‘handmade’” (Campbell, E. 2006 in Atkinson et al. 2009: 16).

Accordingly, pottery artist Jonathan Keep (who used individualisation among other techniques) shares his experience as a producer. Although he does justify the meaning of the individualised art object, he also agrees working in a virtual world made him realise the importance of the human need for the physical contact with the clay and his joy of the handmade: “In the pot Bowl that is suspended at head height I wanted to maintain some of that feeling of the pot floating, like a thought, while emphasising its earthiness in the realisation it is made of stoneware fired clay. The 'stuffness' of the material is lost in virtual space” (Keep, no date). Indeed, it is popularly accepted that when the product in question involves qualities brought by ‘making’ and ‘craft’ ability, what seems most important is the human input: the ‘handmade’, the ability of a trained craftsman. Arguably, this is true in many other areas such as cooking, music and painting. Comments received during a presentation of this research in April 2014, (while disseminating this work), also questioned the ‘meaning of individualising’ products.



Figure 2.8. Clay-3D printed Iceberg collection by Jonathan Keep (<http://www.keep-art.co.uk>).

Keep (n.d.) attempts an explanation to the meaning of this novel process of form generation in his art pieces: “From the elemental forces of earth, fire and water pottery has traditionally drawn on nature for inspiration. In using computer code to create this work I aim to add a further layer to include the elemental, ‘natural mathematical’ patterns and structures that underlie all form. The appreciation of this work illustrates just how much we are connected at a very deep level to the natural world”.

Design practitioner Jan Habraken from Formnation, speaking about the Chairgenetics project (chairs 'with DNA', Figure 2.9, page 47), argues: "let the artificial intelligence take the next step and design objects that go beyond our imagination or comprehension", as the process created shapes "that we would have never been able to dream up ourselves" (Habraken, 2014).



Figure 2.9. In first plane, a chair 'with DNA', by Jan Habraken (source <http://www.designboom.com/>)

The meaning that a consumer puts into a customised design could include some of the aspects mentioned in the "Added value" section, above (see page 28). For example, the meaning of owning a unique product could be key for customers with high "Consumer Need For Uniqueness": the willingness to pay a premium price for uniqueness might even be seen as a driver for "social differentness by excluding ownership of the object by the majority" (Tepper, 1992 in Tepper et al., 2001: 62). However, in line with Atkinson et al. (2009), an audience at a research students' event at De Montfort University, questioned the meaning of individualising objects (compared to other forms of customisation). That questioning brought attention to the issue that individualisation should be able to highlight its value for consumers, without much further explanation. "The narrative of the work must be readable by the public", explained Keep, J. during a lecture at this university on 30<sup>th</sup> May, 2014. Indicative responses as to what is the meaning of an individualised object for a consumer later came to light during analysis of the data collected for this research.

As explained earlier, Franke & Schreier (2010) suggest that preference fit cannot be objectively calculated as is a "composite subjective impression" and suggest its components can be

measured instead. This research intends to measure 'subjective components' of product attachment adapted for product individualisation, the tentative methods are briefly presented as follows and the definitive design is clearly explained in chapter 3 Methodology:

- a. Manipulation of product imagery → Sense of ownership
  - a.1- Instant reaction and responses towards a product after it has been made during an interview
  - a.2- Whether participants choose to wait for the product they made, to be ready (e.g. dry and ready to use or wear) or take a 'standard' alternative version off the shelf at the end of the interview session
  - a.3- Contacting the researcher after the interview to find out how and when will they receive their finished product.
  
- b. Product meaning (e.g. uniqueness)
  - b.1- The rationale behind their choice to question a.2 (above). For example, whether choosing the product they made is because they like it more than the 'standard' one, or is because of a personal bond instead.
  - b.2- Whether they proceed (after the interview) to see an image of the finished product uploaded on the Flickr site (this site offers an image view counter, so visits can be tracked) after being provided with the appropriate link (this instrument was later discarded as it did not offer reliable data).
  
- c. Contacting participants 45 to 60 days after taking part in the experiment to find out about their time spent owning the product by asking:
  - c.1- if they still have the product
  - c.2- if they keep the product with others of the same type or elsewhere
  - c.3- if they have worn the product at some point.



## 2.4. THE GAP IN KNOWLEDGE

In this chapter, various reasons why consumers customise were analysed, including consumer types, product types, product attachment and meaning. Previous research investigated the emotional attachment towards customised products where the consumer has direct input over the result and has also looked at different types of products and manufacturing processes. Further, earlier work has looked into characterising different types of consumers who are presented with toolkits and customisation processes. For example, Franke & Schreier (2010), researched the enjoyment/effort and preference fit with customised products. As mentioned in section 2.2.5, it is critical that this research identifies the two key types of consumers: those who 'actively' engage with what they consume and customise, and those who adopt a 'passive' attitude towards consumption, described in detail in sub section 3.2.2.1 Active and Passive consumers (page 75).

Building on that body of research, the gap in knowledge this work addresses is the relationship between consumer engagement in the design of an individualised product, and his or her attribution of value and emotional attachment to the manufactured end result.



Figure 2.10. The gap in knowledge being addressed by this research.

That relationship is expected to be influenced by the factors already discussed in the literature review, but also factors directly related to the nature of the specific individualisation process chosen for this study, including the degree of decision-making power afforded to the consumer.

During the literature review, four key elements have been identified as constituting the value of customised products for consumers and were adopted in this research:

1. Product uniqueness
2. Emotional attachment
3. Engagement during the customisation experience
4. Opportunities the user is given to assess points 2 and 3

These four key elements of customised product value for consumers will be taken into account for the design of interviews for data collection. Point number four of the list refers to the opportunity to generate memories associated with the product which could make the product not only unique, but also irreplaceable. The generation of memories during the customer's individualisation experience (i.e. interaction with the toolkit and participating in the process of manufacturing a product) will be part of this study. However, the research will only monitor the evolution of those memories and generation of new ones over a period of six weeks of ownership. Therefore it will only be possible to draw conclusions based on customer responses and reactions in the short term.

This research has therefore been designed to make a contribution to knowledge aligned with the Aim, Objectives and Research Questions detailed earlier (see pages 15 to 16) by proposing:

- The validation of a specific approach to customisation (individualisation)
- The types of consumer who would value individualisation the most
- How and why those consumers engage in individualisation process
- Where the value of individualised products lies for those consumers

Following the literature review, it is also expected the design of this research could make a contribution to knowledge by:

- Developing an iterative approach to qualitative research appropriate for product individualisation.

## 2.5. WHY IS THIS RESEARCH IMPORTANT?

In line with Franke et al. (2010), this study examines the relationship between engagement in a customisation process and the attribution of value to the product. However, it focuses on individualisation (as opposed to other approaches to customisation, see pages 20 to 21), where aspects such as the involvement of the consumer (i.e. amount of decision power), type of consumer and type of product in the design are key.

The gap in knowledge that has been identified (section 1.4, page 49) is worth filling because the research community that looks at product design and customisation needs a better understanding of the implications of the consumer product attachment and added value engendered by novel, digitally enabled and creative approaches to product design. Findings from this research will also be relevant for the better exploitation of direct manufacturing techniques (such as additive manufacturing), which have the capability to manufacture unique (e.g. individualised) products every time.

The beneficiaries of this research include, first of all, business and consumers. If individualisation is a valuable method of customisation for consumers, it would then become a method for the generation of valuable products with which consumers would possibly generate an emotional bond. Further, by proposing new channels for creative expression to the wider public, new experiences, emotions and meaningful memories for consumers (including consumer types located to the left of the continuum in Figure 2.6, page 40) would be nurtured. Novel offerings could trigger different emotions and “emotions enrich a person’s life” (Mugge et al. 2009: 467), which in turn could contribute to social wellbeing. Those emotions can ultimately can trigger attachment to the product.

Secondly, as key stakeholders, businesses, designers, art practitioners and manufacturers would also be beneficiaries, as they would be informed about the value of individualisation for consumers, empowering them to exploit the emotional bond between consumers and products, thus generating new investments, offerings and businesses for consumers to explore.

## 2.6. CHAPTER SUMMARY

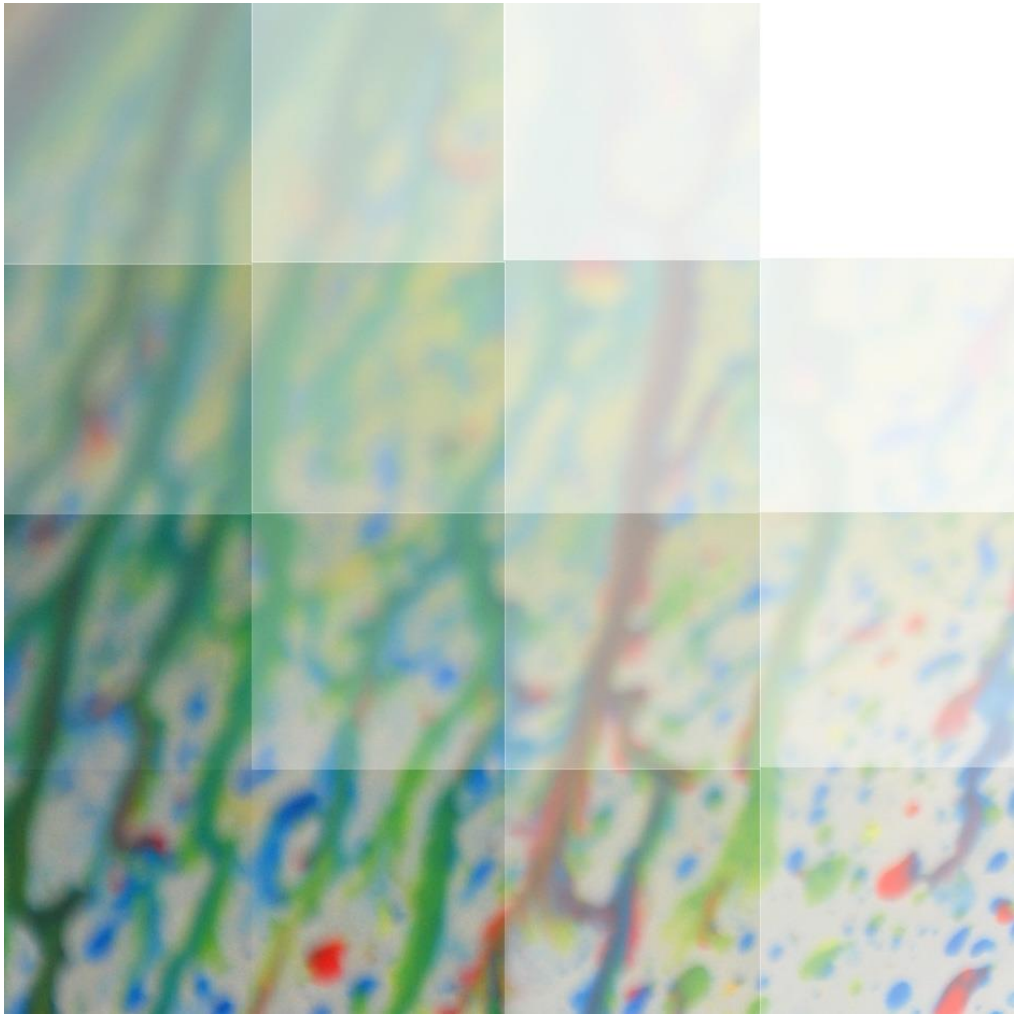
This chapter reviewed literature on product design and customisation. Table 2.1, below, features the major topics identified by the literature review, each illustrated by a selection of key authors.

Key issues	Sample authors
Why customise, meaning of customised products	Etgar 2008; Jiao et al. 2007; Atkinson et al. 2009; Keep (n.d.)
Added value and uniqueness	Tepper et al. 2001; Etgar 2008; Mugge et al. 2009; Franke & Schreier 2008; Merle et al. 2010; Campbell et al. 2013; Bloch 1995; Press and Cooper 2003
Consumer types and behaviour	Knott 2013; Hermans 2014; Toffler 1980; Syam et al. 2008; Ariadi et al. 2012; Sinclair & Campbell 2009; Schwartz 2015
Individualisation and customisation	Campbell et al. 2013; Atkinson & Dean 2003; Dean et al. 2005; Piller 2010; Tseng & Jiao 2001; Ariadi et al. 2012; Sinclair & Campbell 2009
Consumer engagement with the design process and design experiences	Mugge et al. 2009; Franke et al. 2010; Schwartz 2015; Sinclair & Campbell 2009; Ariadi et al. 2012; Press and Cooper 2003; Norman 2004
Emotional attachment to a customised product and emotional design	Mugge 2007; Mugge et al. 2009; Mugge et al. 2010; Tepper et al. 2001; Etgar 2008; Press and Cooper 2003; Norman 2004
Economic implications and 3D printing	Ford & Dean 2013; Dean & Pei 2012; Atkinson 2011; Piller 2010; de Beer et al. 2012; Campbell et al. 2013
Product type	de Beer et al. 2012; Ford & Dean 2013; Woudhuysen 2013; Dean & Pei 2012; Dean et al. 2005; Bardakci & Whitelock 2003
Toolkits	Hippel 2001; Mugge et al. 2009; Franke et al. 2010; Matzler et al. 2007
Mass confusion, choice paralysis and complexity	Matzler et al. 2007; Shankar et al. 2006; Mustak et al. 2013; Schwartz 2015
Methodology, research methods, research design and approach	Bryman 2008; Braun & Clarke 2013; Blaxter et al. 2006; Griffin & Hauser 1993; Franke & Schreier 2010; Ariadi et al. 2012; Rowley 2012; Wang & Hannafin 2005; Vignali & Zundel 2003; Trochim 2006
Sampling	Franke & Schreier 2008; Ariadi et al. 2012; Sinclair & Campbell 2009; Gyi et al. 2009; Rowley 2012; Griffin & Hauser 1993; Konczal 2008; Braun & Clarke 2013
Data analysis	Boyatzis 1998; Neal et al. 2015; Henerson et al. 1988; Braun & Clarke 2013

Table 2.1 Major topics identified by the literature review and sample authors.

The chapter offered definitions of the terms used throughout this thesis, keeping the terminology aligned and consistent with previous research. The chapter identified and analysed key factors that influence product customisation, such as added value, economic implications, technology, and most importantly how different products and consumer types

adapt to new product customisation possibilities. Following previous research, this chapter suggests that certain types of consumers can benefit from individualisation. It explored benefits and drawbacks of such process (for example with the design and use of toolkits) as well as product attachment and meaning of customised products, challenging previous research in light of the affordances of automated processes. It concludes by identifying, justifying and describing the gap in knowledge that this research intends to fill. A rationale is offered for how this research can contribute to a better understanding of consumer product attachment and added value through a novel and creative approach to individualisation in product design.



## 3. METHODOLOGY

## INTRODUCTION

This chapter provides a rationale for the chosen research methodology and the methods employed in its implementation. It starts by proposing a methodology pathway, then the narrative focuses on each stage of the pathway, explaining the reasons for the decisions taken.

In order to make sense of the many different choices and choose an appropriate approach for this research project, it became necessary to visualise possible frameworks and to customise them within established research theory. Several authors agree that in qualitative research there is room for flexibility to accommodate different needs (for example Rowley, 2012 and Braun & Clarke, 2006). Design is, as with Architecture, “a complex, multifaceted field of study, meaning that no single approach can tell you everything you need to know” (Lucas, 2016: 21). “What is important is that the finished product contains an account – not necessarily that detailed – of what was done, and why” (Braun & Clarke, 2006: 86).

In view of the complexities associated with this research project, the benefits and challenges identified in similar research initiatives, as reported in the literature review, this chapter presents the chosen methodology and the rationale behind it. Academic rigour, coherence with the field of study and flexibility to enable the researcher to conduct the work were key criteria in the selection of the methodological approach.

### 3.1. METHODOLOGY ROUTE MAP

During the literature review, it was not possible to identify an appropriate visual representation that could help understand the many possible methodology routes. To address this, the possible methodology choices to be considered were mapped out (Figure 3.1 below), in order to then design this research’s methodology route from top to bottom on the map. The map presents a number of benefits:

- it succinctly presents viable, justifiable options for research design
- it provides a clear hierarchy for those options, with the most important elements at the top
- it proposes the order in which decisions are made (each ‘layer’ of the diagram is named, and the explanatory text follows that order).
- the hierarchy helped to justify decisions taken (i.e. which elements had an influence over others).

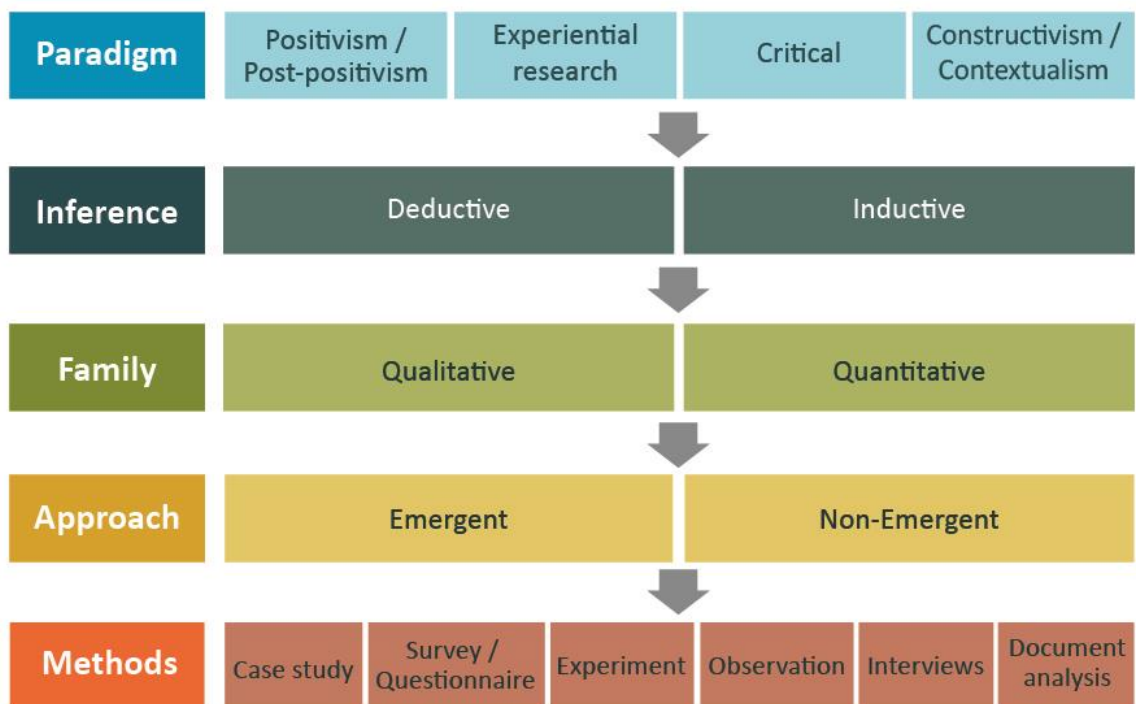


Figure 3.1. Visual representation of possible methodology options to be considered for the research design of this study.

Next, the possible paradigms, inference styles, family types, approaches and methods mapped above are analysed in order to understand their suitability for this research. Finally, section 3.2 Research Design (page 65) will present this map again highlighting the final route of the selected methodology.



### 3.1.1. Paradigm

Paradigms are theoretical ways to explain how the world works, so that those who adhere to a given paradigm understand how to approach reality, beliefs, knowledge and worldviews (Blaxter et al. 2006). A research paradigm represents a major underpinning of an investigation.

Researchers adopt and adapt paradigms for diverse reasons, for example: the nature of the research they are conducting and new knowledge they seek, as well as their personal stance on the nature of reality, how knowledge should be created and therefore how the research project is intended to develop that knowledge. A number of authors have been reviewed and four main paradigms identified as relevant to this study. They are summarised in Table 3.1.

Paradigm name	Description
<b>Positivism and Post-positivism</b>	Separates researcher from the object of research so that any context is neutralised. It does not align with the qualitative data this research requires to answer the Research Questions. It aims at achieving predictability by using approved scientific methods associated to quantitative studies. Whilst post-positivism acknowledges context, it still strives for a definitive truth (Blaxter et al. 2006 and Braun & Clarke, 2013).
<b>Experientialism / Realism</b>	Theorises the world directly from peoples' experiences: "...sometimes referred to as <i>naïve realism</i> [it assumes a] perfect correspondence between reality and the term used to describe it" (Bryman, 2008: 14). Adhering to this paradigm allows this research to work with participants' experiences during interviews (explained later under Research Design, section 3.2) because "...participants' interpretations are prioritised, accepted and focused on..." (Braun & Clarke, 2013: 21).
<b>Critical</b>	Contrary to the Realist paradigm, the Critical paradigm does not take people's opinion at face value. Instead, it depicts a reality by the way a person talks about something, therefore "...language creates rather than reflects reality" (Braun & Clarke, 2013: 25), which could offer some advantages to analyse the type of data this research requires. However, it is characterised as a paradigm that "challenges [and] takes up a view of conflict and oppression" (Crotty, 1998 in Blaxter et al. 2006: 61), rendering it inappropriate for this work. Examples include anti-racist research and feminism.
<b>Constructivism/ Contextualism</b>	Often associated with the study of the social world. Reality is understood in its social context and therefore various truths are acknowledged in a constant state of change. This paradigm would then accommodate important aspects of this research, particularly, the characterisations of consumer types. Knowledge is a social construction, for example between the interviewer and the respondent. (Bryman, 2008; Braun & Clarke, 2013 and Braun & Clarke, 2006).

Table 3.1. Summary of paradigms and their descriptions.

This research focuses on how consumers with different backgrounds respond to a specific application of product design. The study acknowledges diverse factors that had effects on its design and choice of research methods. Assuming the existence of only one possible reality by isolating the subject was inappropriate because the context of each participant was a key factor in understanding their responses – one that should not be neutralised, meaning that

Positivism/Post-Positivism was inadequate for this research. Further, this research does not address a situation of conflict or oppression and does not challenge the semantic level of interviewees' responses as is the case with the Critical paradigm.

This study is then a hybrid between Experientialism and Constructivism. This research listens to participants' thoughts and views on their **experiences** and uses that input to **construct** a version of reality by interacting with the interviewer through language during an interview.

### 3.1.2. Inference style

When a research project is informed by existing theory (i.e. literature and previous research findings) to make generalised hypotheses, it is called Deductive research. It is informally referred to as a 'top-down' approach, where the theory generates a hypothesis which then informs the research design and methods (e.g. interview questions). On the other hand, an Inductive study is one that generates theory from practice (i.e. field observations) and is informally referred to as 'bottom-up'. As is often the case, research can also be informed by a mix of both, in a continuous cycle from theory to observation and back to theory (Trochim, 2006). Figure 3.2 shows how the two inference styles work.

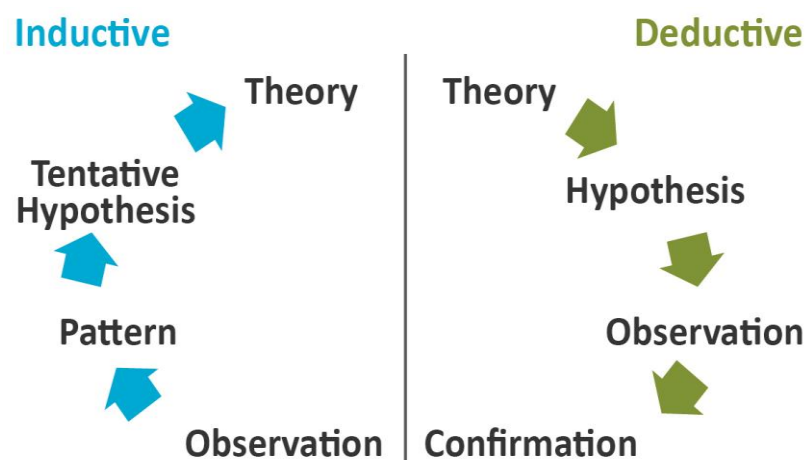


Figure 3.2. Inference style diagram adapted from Knowledge Base (Trochim, 2006).

This research benefits from a mix of Inductive and Deductive inference styles, as the methods designed are informed by: theory from previous research findings identified in the literature and by new data gathered through studies with an Action Research approach (explained further below). A clear example of how this Inductive and Deductive mix works is the design of the interviews (section 3.2.1), described under 3.2 Research Design.

### 3.1.3. Family

The methodology of a research design belongs to a “family” (Blaxter et al. 2006: 61), which can be either qualitative or quantitative. Table 3.2, below, states some key differences between those two families.

Qualitative research:	Quantitative research:
<ul style="list-style-type: none"><li>-is about meanings and behaviours of people</li><li>-provides different answers</li><li>-answers depend on the context</li><li>-acknowledges subjectivity</li><li>-gathers rich and deep data (fewer cases with high quantity of data on each): ungeneralisable</li><li>-process orientated</li></ul>	<ul style="list-style-type: none"><li>-is about numbers and facts of phenomena</li><li>-strives for a definitive, generalisable response</li><li>-deals the object of study as in a vacuum</li><li>-strives for objectivity</li><li>-gathers large quantities of shallow data (many cases studies): generalisable</li><li>-outcome orientated</li></ul>

Table 3.2. Research “family” can be either qualitative or quantitative. Adapted from Blaxter et al. (2006: 65).

From the start of this project, deep and rich data was identified as most appropriate to inform consumer behaviour in relation to individualisation. The research would collect opinions from a group of participants as they complete a number of exercises. For this reason, and given the characteristics shown in the table above, this research adopted a **Qualitative** family, which aligns with the mix of paradigms selected earlier. A small amount of quantitative data was collected to quantify aspects of the evaluation and highlight what could be considered most relevant within the qualitative data.

### 3.1.4. Approach

The selection of the right approach is of particular importance for this research’s development and evolution of its methods and instruments.

Under a Qualitative research family, the research design can have an Emergent or Non-emergent approach. An Emergent research design is “evolving over time”, following discoveries during the early stages of the research, which then guide possible new approaches to inquiry: “Important leads are identified in the early phases of data analysis and pursued by asking new questions...” (Maykut & Morehouse, 1994: 44). A Non-emergent design, on the other hand, whilst still using qualitative methods, is “less open and responsive”, where “data is collected, *then* analysed”, (Maykut & Morehouse, 1994: 44). Figure 3.3 shows how Emergent research works and Figure 3.4 illustrates a unidirectional, Non-emergent design.

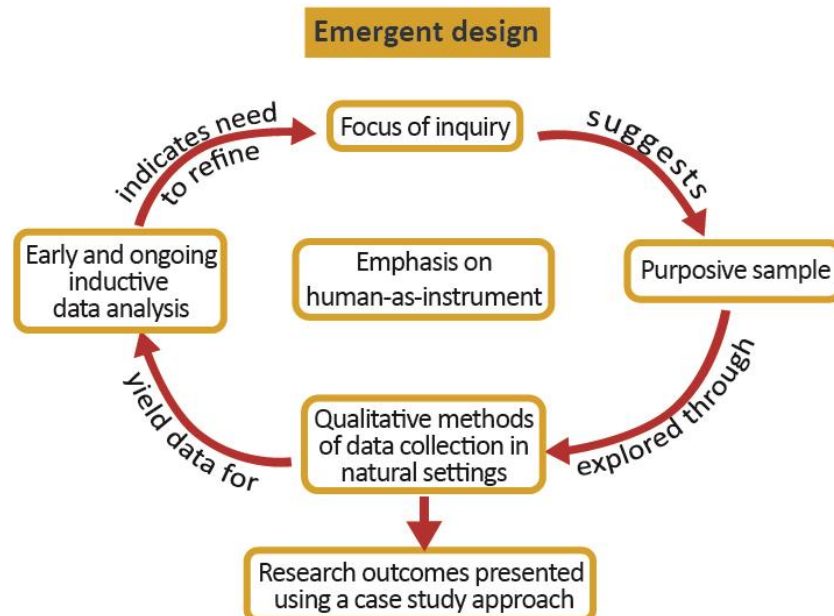


Figure 3.3. Emergent design approach, adapted from Maykut & Morehouse (1994: 48)

Schnurr & Scholl-Grisse mann (2015), for example, appear to apply what could be called an Emergent approach (as per Figure 3.3) to their work about how different mass customisation toolkits affect customers’ process enjoyment. They conduct two experiments for data collection. The early and inductive data analysis from their first experiment indicated a need to re-focus the inquiry. A second experiment took into account important variables that initially were not considered, improving their methods and reliability of data.

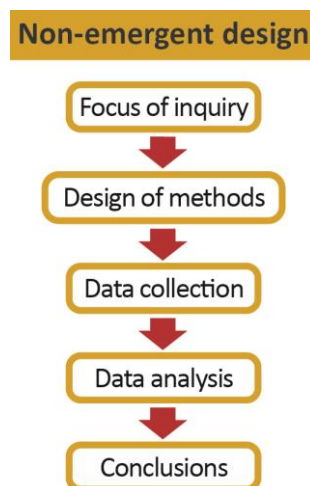


Figure 3.4. Non-emergent design approach with linear design where the data is collected, and then analysed.

An Emergent approach can be well exemplified (although not exclusively) by non-linear designs, such as Action Research (AR) and Design-Based-Research (DBR). AR is characterised by cyclical processes of fact-finding, analysis, evaluation, reflection and new action (as illustrated in Figure 3.5, below), “carried simultaneously to generate knowledge and find practical

(workable) solutions” (Dickens and Watkins on Vignali & Zundel, 2003: 209) involving “collaboration between researchers and participants” (Wang & Hannafin, 2005: 6) which aligns with the characteristics of a Constructivist paradigm.

Wang and Hannafin (2005: 6 to 9) explain that DBR also involves “iterative cycles of design, enactment, analysis and redesign” and it also works “in collaboration with participants”. Further, they suggest that DBR is by nature linked and developed from multiple design and research methodologies, where researchers end up adopting a dual function: that of designer and researcher with hybrid methodologies (and in doing so, the research’s “design processes themselves are studied”). Provided that consistency is maintained with the underlying methodological approach, DBR allows en-route alterations to the methods to anticipate problems and articulate changes when necessary (Wang and Hannafin, 2005). Figure 3.5 illustrates how cyclical processes, such as AR, work.

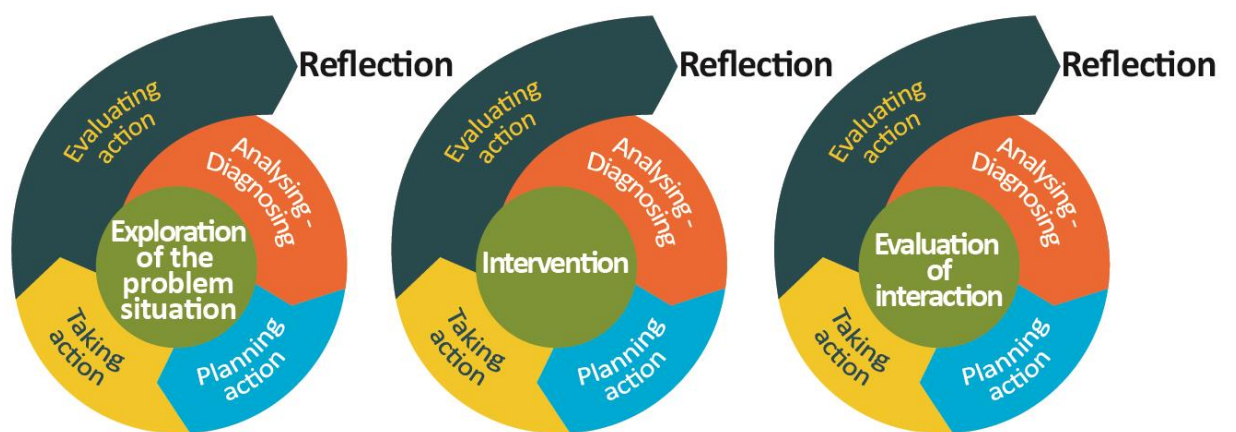


Figure 3.5. Action Research (AR). Adaptation from Vignali & Zundel (2003: 210).

An Emergent approach is therefore more appropriate for this project than the Non-emergent, as it is more flexible and offers the possibility to reflect on early discoveries along the process of the project and take action accordingly. Within that Emergent approach, this research proposes a combination of key components of both AR and DBR, as characteristics identified in both designs contributed to the project. The approach was therefore emergent, cyclical and iterative: identifying a problem, proposing a plan to investigate it, taking actions in accordance with the plan and evaluating the results and effectiveness of the actions. From that evaluation the process then continued by identifying problems in the actions taken and proposing a new plan and so forth. Table 3.3 summarises characteristics of AR and DBR found in Vignali and

Zundel (2003) and Wang and Hannafin (2005), and presents the combination this research based on those two approaches.

Action Research (AR) Vignali & Zundel (2003) >	Research approach used in this study	< Design-Based Research (DBR) Wang & Hannafin (2005)
Cyclical process: “iterative cycles of identifying a problem, planning, acting and evaluating” (Vignali & Zundel, 2003: 208).	Iterative cycles of: diagnosis, design, action, analysis, evaluation, and redesign, as key feature of the methodology to learn, design, test and refine the methods through pilot studies.	Cyclical process: “Iterative cycles of design, enactment, analysis, and redesign” (Wang & Hannafin, 2005: 7). The focus evolves with the topic.
Collaborative approach between researcher and client.	Researcher engages in conversation with participants during semi-structured interviews to understand their experience when individualising a product in the context of their consumer type.	Researcher works in collaboration with participants and practitioners, challenging assumptions of bias due to the interaction of the researcher with participants.
Problem-solving orientated, generating changes on people.	Informed by practice and theory, combined during the iterative process of pilot stages and main study. The understanding of consumer types and their experiences to generate theory is critical. Findings trigger ideas to generate changes in consumer behaviour.	More theory-orientated. “The value of theory is appraised by the extent to which principles inform and improve practice” (Wang & Hannafin, 2005: 8).
Intends to contribute to basic knowledge in social science and social action in everyday life with in-depth knowledge of client’s problem.		Approach to research with the intention of generating theory and knowledge.
Often characterised by an anti-positivistic approach, where results can be generalised.	Qualitative study. Concentrates on participants’ experiences during interviews. Flexible approach allows running studies in different (real-world) settings to verify results.	Not lab-like as in scientific research, but rather grounded in real world settings. Due to its flexibility and adaptable style, results are connected to design processes and settings.

Table 3.3. AR and DBR key characteristics, as per Vignali & Zundel (2003), and Wang & Hannafin (2005) and the combination created for this research from those two approaches.

This cyclical and iterative process is of critical importance for the development and evolution of the research design and instruments, and is reflected on the iterations of four pilots and subsequent Study for data collection. Both the researcher and participants played key roles in that cyclical process, which ties in with the proposed paradigm: theorising on the world from participants’ experiences, constructing a view of reality between both sets of stakeholders and the improving practice.

### 3.1.5. Methods

This section explains and evaluates a range of key techniques considered for this research. Diverse primary and secondary research methods have been identified from the literature. The most salient ones are described and analysed against the requirements of this research in Table 3.4 (page 63).

Methods	Description
Case study	Often used for social studies, the data may allow generalisations and shows complexity of social life. Gathers a large amount of data by studying in depth a small number of subjects, often between 1 and 5 (Blaxter et al. 2006), which is too small compared to the sample size recommended by Griffin & Hauser (1993) for a research in the field of product design (see section 3.2.2 Sample) such as this one.
Experiment	Serves both scientific methods, and (increasingly) social sciences with robustness and validity. It is adequate for this research because it allows to manipulate an independent variable to evidence changes between two groups (under controlled conditions), for example designing exercises where groups of participants customise products using toolkits (similar to Franke & Schreier, 2010). Can yield causal relationships. Offers flexibility and statistical manipulation. Often difficult to isolate variables and keep environments controlled due to unnatural (e.g.: lab-based) social settings between researcher and participant. Blaxter et al. (2006). Combined with an iterative research approach, would also allow the design, test and refinement of experiments.
Survey / Questionnaire	Whilst questionnaires are easy to administer, they are not appropriate for this research as they aim at breadth of data instead of depth, studying people and things in large samples with generalisable and quantifiable results. Also, data reflects time-specific situations rather than the wider and underlying theories and changes (Blaxter et al. 2006) that this research is after.
Observation	Participant observation registers behaviour of people or things in terms of incidents or categories. In unstructured observation there are no pre-set categories. This method can add to this research as it allows the researcher to be immersed in the social setting where the participant is observed. In non-participant observation the observer does not interact in the social setting, but with the use of interviews (as explained right below), it means the researcher and the participant do interact. Bryman (2008).
Interview	Interviews align well to this research because are often associated with qualitative studies, aim at depth of data with open-ended questions and prompt the participant to talk about their opinions and experiences about a given topic. Semi-structured interviews best suit this work: a question is asked and the participant may choose to address topics not anticipated by the researcher, accommodating new, unplanned questions. Structured interviews however, would not work well with this research as they have fixed questions and responses that are categorised by the researcher (sometimes used in quantitative research). In unstructured interviews, themes are proposed to discuss with the participant, who leads the conversation, not the researcher. Interviews are time consuming for the researcher and participant. Braun and Clarke (2013) and Bryman (2008).
Document analysis	This refers to literature review (which has been put in practice since the start of this research) and document analysis (such as in history disciplines).

Table 3.4. Methods in research as inferred from Blaxter et al. (2006), Braun & Clarke (2013) and Bryman (2008).

Blaxter et al. (2006: 67) explain that “various families, approaches and techniques [...] do not map simply on to each other”. For example, surveys are often associated with quantitative research designs, whereas interviews in AR often map into qualitative designs. However, the authors explain that “you might focus on your specific approaches [...] or you might mix or vary your usage”, which characterises a mixed-method approach. Sub chapter 3.2 Research Design (page 65), highlights the methods selected for this study within the ones outlined above. It also presents the final methodology ‘route map’ for this project.



## 3.2. RESEARCH DESIGN

This research strives for rich and deep qualitative data to evaluate individualisation as an approach to customisation and its value for consumers. Data was collected through mixed-methods: experiments, interviews and observation. This sub chapter will explain the rationale behind the research design. According to Steiner et al. (2011), market research and customer surveys are often “inefficient” in capturing consumers' needs as "customers are either unable to correctly express those needs or they are not aware of them" (Steiner et al. 2011: 3). They refer to such hard-to-obtain data as "sticky information". A solution is to allow volunteers to interact with the customisation process (for example using toolkits: software to enable the consumer to customise a product) through exercises, so that they do not have to express verbally, but directly intervene in the product design.

The literature describes methods in which participants respond to interviews or questionnaires and interact with toolkits to customise products. However, the real customised product is not physically available at the time of the interview for the participants to relate to. Another section of the literature covers data collection methods, where participants interact with a toolkit in the first instance, and later they are recalled again to respond to an interview or questionnaire once the product has been manufactured. At that point, the richest and potentially most valuable signs of the participants' interaction with the toolkit have dissipated. To collect the best data, it is necessary to conduct an interview where both things happen in real time: using the toolkit and having the final product available, combining the research methods as described above. Such a mix, in the case of this study, consists of semi-structured interviews, experiments of participants using the toolkits and observation.

The design of the study is informed by responses to face-to-face **interviews** from a sample of volunteers. The volunteers responded to an interview whilst taking individualisation exercises: they individualised a ‘product’ from start to finish, on site, at the time of the interview, meaning that the finished product was physically available to them on completion (the interviews design and rationale are described in section 3.2.1 Interview design, page 69). The researcher also **observed** the interaction between the participants and the individualisation toolkits, and their reactions to the product itself (capturing audio), addressing “sticky information” (Steiner et al. 2011: 3) problems. The devised **experiment** consisted of comparing

the effects of two different ‘degrees’ of toolkit automation (or exercises, which in turn allow different ‘degrees’ of consumer engagement), on two different types of consumers (as described on page 76). The evolution of the design of the exercises is described through the pilots #3 and #4 design, and most importantly, in the design of the study (pages 81, 87 and 91 respectively). The experiment was designed to address research question number 2 (see page 16). It was important to capture how consumers discriminated between standard off-the-shelf and individualised products, whether they identified benefits and drawbacks of individualisation and whether or not they would value the effort that they put towards generating an individualised design over an immediately available standardised option. The methods also incorporate further questioning between six and eight weeks after the first meeting with the volunteer.

Figure 3.6 presents a summary of the chosen methodology route over the map shown earlier in Figure 3.1 (page 56). This study prioritised participants’ experiences interacting with the interviewer through the use of language to construct new knowledge. Once critically analysed, that data developed into evidence-based claims, which can be seen as a contribution to knowledge. The data was primarily qualitative (some quantitative data was also collected) and initial pilot iterations were evaluated during collection to detect emerging patterns, which informed changes through the cyclical process of “design, enactment, analysis, and redesign” (Wang & Hannafin, 2005: 7). The following sections address the design of each data-collection instrument.

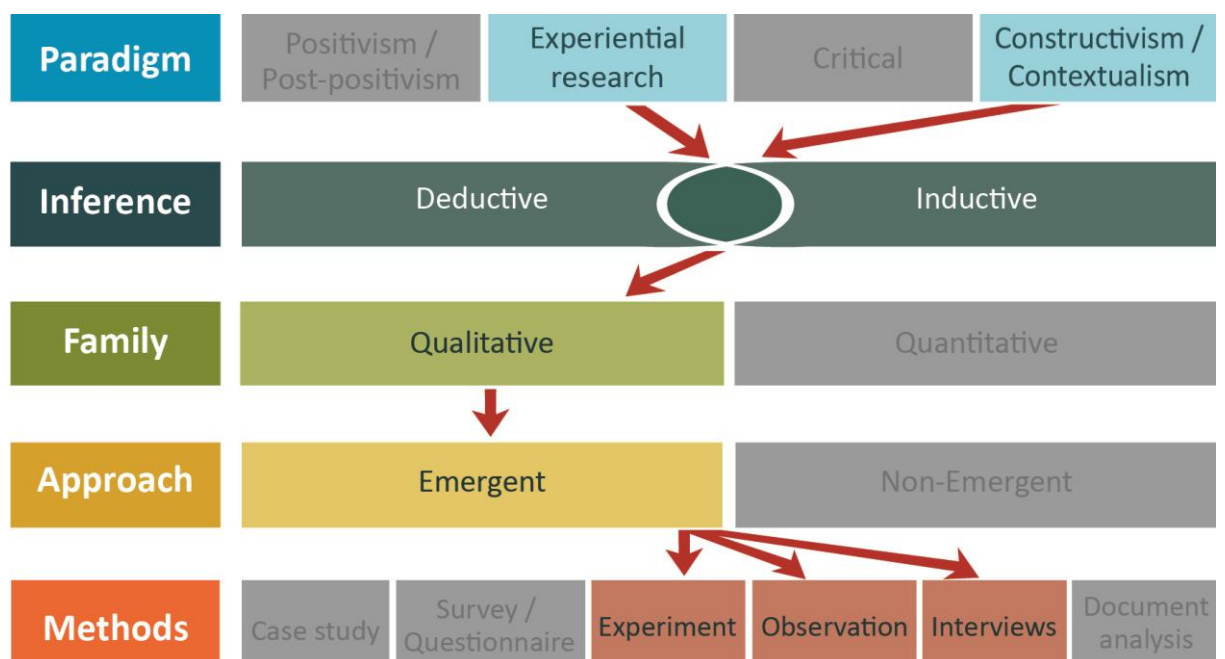


Figure 3.6. Methodology map with the chosen route for this research.

Table 3.5 is a descriptive timeline of every stage of events during the research project, featuring four pilots and a subsequent ‘main’ study (the study was conducted in two stages), all of which will be described in the next sub-sections.

Research phases	Dates	Purpose	Subjects	Number of participants	Structure of the interviews	Rationale
<b>Pilot #1</b>	Sept-Nov 2014	To gather the views of those involved in the application of customisation processes for consumers.	Company directors, designers, shop buyers and Consultants	5	Semi-structured interviews	The research required a full understanding of the implications of individualisation processes in real settings (e.g. economic implications, technical and logistical issues).
<b>Pilot #2</b>	Sept-Oct 2014	To obtain focused insights from consumers who consistently pursue customised products.	Customers from Company #1 and Company #5. <sup>1</sup>	9	Semi-structured interviews	The research also needed clarity on the views of consumers of customisation services and products and their opinions about individualisation offerings: expected benefits and drawbacks. This pilot also informed which stakeholders this research should focus on and provided a basis on which the questions for the next iteration could be designed.
<b>Pilot #3</b>	Nov 2014-Feb 2015	To “beta-test” all instruments, exercises and structure prior to the study.		9	Three hands-on design exercises and semi-structured interviews.	To apply the lessons learned from the previous pilots via a quasi-final version of the interview questions.
<b>Pilot #4</b>	Feb-April 2015			19	Three hands-on design exercises and semi-structured interviews.	With the benefit of the 3 previous iterations, pilot #4 collected data and identified initial patterns. The pilot provided a valuable opportunity to refine instruments (proposed exercises and interview design), the criteria for sampling participants and focus on two types of consumers: Active Consumers (AC) and Passive Consumers (PC)
<b>Study stage #1</b>	July 2015-Dec 2015	To address the research questions in a rigorous and structured manner.	University staff and students	35	One hands-on design exercise (a refined version of the 3 <sup>rd</sup> exercise from pilot #4) and semi-structured interviews.	Benefitting from the 4 previous stages, the study (stage #1) collected the 1 <sup>st</sup> tranche of data through well trialled and tested instruments. Initial data patterns from the earlier phases suggested concentrating on 1 of the 3 exercises to best address the research questions: comparing and contrasting 2 ‘degrees of individualisation’ against 2 types of consumers (AC and PC), resulting in 4 groups or ‘cohorts’.
<b>Study stage #2</b>	March 2016	To evaluate the results obtained from study stage #1.		11	Similar to study stage #1. Set up in a ‘live’ setting with shorter interviews.	Having collected the main data set during study stage #1, this iteration was designed to evaluate those results by re-running the experiments on a different (‘live’) setting. Replication of results would give strength to the research findings. Participants were passers-by spontaneously recruited (as opposed to actively look for participants and prepare them by email).

<sup>1</sup>Company#1 and company #5 (C#1 and C#5) are a retailers of collectable and customisable action figurines.

Table 3.5. Timeline featuring the order in which pilots and studies happened between Sept. 2014 and March 2016.

The research was conducted over a period of just under four years. The Gantt chart in Figure 3.7 illustrates when the different stages took place. Details on how each stage evolved are outlined in Table 3.5.

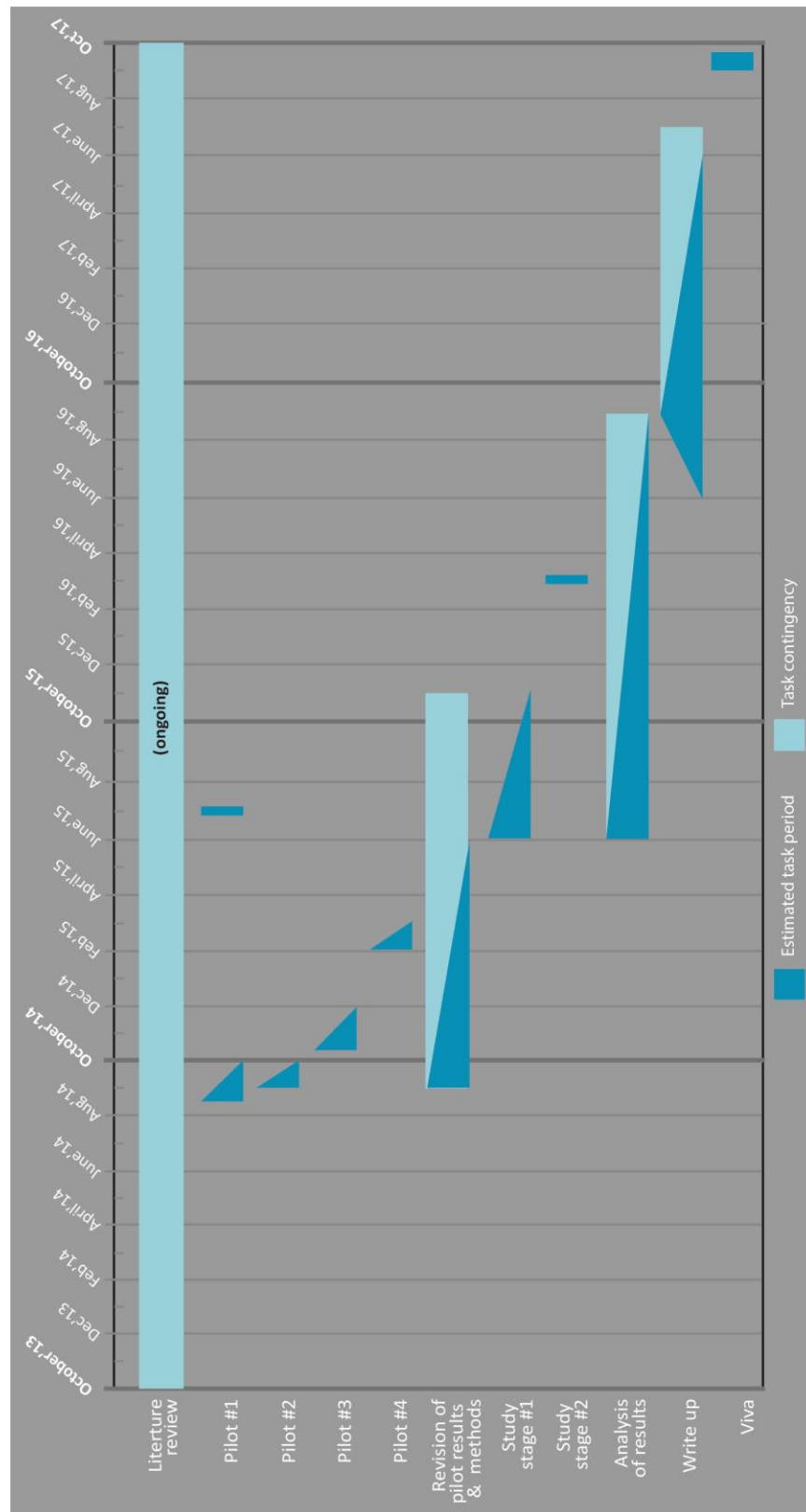


Figure 3.7. Gantt chart, featuring the research activities and their progress over time.

### 3.2.1. Interview design

Rowley (2012: 263) explains that “it is important to take into account both the length of time that interviewees are willing to make available for the interview and the number of willing participants that can be identified”. In a research plan, Rowley points out that the researcher should be careful in the use of time resources, not only for collection but also analysis of data.

The methods used in this research were designed through an AR approach both for pilots and the study. This was the case when designing interviews, which used a mixture of inductive and deductive inferences. Deductive inferences can be exemplified through the use of Ariadi, et al. (2012) and, particularly, Franke & Schreier (2010) as the basis for the design of the questions. Table 3.6 illustrates how the questioning from those two sources were adopted and adapted:

	Ariadi et al. (2012) >	This research	< Franke & Schreier (2010)
Research	Investigates how consumers evaluate a toolkit’s user friendliness and their acceptance of the resulting product.	This research works on the relationship between the engagement in a process of customisation and the possible attachment to the manufactured result.	Looks into the “preference fit” of customised products and “perceived process enjoyment” and effort put into customising them.
Questioning	The proposed questions can be separated into three areas: introductory questions, toolkit engagement questions and questions about acceptance of the product.	The questions were designed in two groups: to address a) engagement with the process and b) attachment to the product. There is an introductory questionnaire for which purposive sampling was used.	The interview questions are explicitly separated into three components of a composite of subjective impressions: “Preference fit”, “Process effort” and “Process enjoyment” (2010: 1025).
Likert scales	Five-point Likert scales are used to collect some quantifiable data to identify important areas or themes, without embarking on full statistical analysis.	This research uses five-point Likert scales accommodating intermediate opinions, gathering some quantifiable data to ‘anchor’ salient areas or themes (further explained in section 3.5 The Analysis of Qualitative Data).	Five and ten-point Likert scales are used.

Table 3.6. Ariadi et al. (2012) and Franke & Schreier (2010) were used as the basis for the design of the interview

This research also used an inductive style (see page 58) for the development of interview questions. The appropriate length of each interview posed a challenge to the design of this study because, as described in pilot #3 (see pilot #3 design on page 81, and 4.2.3.8 Limitations sub-section, page 122), there were a number of time-consuming exercises presented to each participant. This challenge was addressed through AR, as the pilot iterations allowed to make

adjustments. Every iteration of the AR process provided an opportunity to analyse, evaluate and re-design the interviews, learning from previous experiences. In doing so the interviews evolved, becoming shorter and more focused on the richest data. For example (note that all exercises, and the rationale behind them, are described in detail from page 78 to 94):

- Pilot #3 (described on page 81) consisted of three exercises lasting circa 60 minutes in total.
- Pilot #4 (page 87) discarded Exercise #2 after 12 interviews as it was collecting duplicated data, reducing the time to complete a full session down to approximately 45 minutes.
- Study stage #1 (page 91) discarded Exercise #1, concentrating only on Exercise #3, where the richest data was identified (i.e. participants engaged more with Exercise 3 than 1 and provided deeper responses). The decision was taken following early data patterns from pilot #4. The time to complete a session was aimed at 35 minutes. Study stage #1 also restructured the interview so that the questions were divided into two parts: first engagement and then attachment.
- Study stage #2 (page 94) kept Exercise #1 and used a shortened version of the interview (no quantitative data was collected) in order to work with volunteer passers-by who could not spend more than 10 minutes participating.

Copies of the development stages of the interview design are available online and can be accessed through Appendix (page 225).

#### ***3.2.1.1. Selecting a product type for the studies***

The selection of a product to conduct the studies was important and required careful consideration. Industrially customisable consumer products were considered as candidates to illustrate the individualisation process, particularly high value consumer products such as jewellery. Using jewellery for the studies would have suggested premium processes such as additive manufacturing (AM) and materials (as explained on page 33 from the Literature review chapter). Whilst AM has advantages for the industrial production of customised goods, the production timescale for AM products and costs involved (for example materials and use of a printer) rendered that idea impractical for this research in terms of its designed methodology, research methods and budget, particularly as the research methods required customising and making a product during every single interview (Research Design section, page 65). Therefore, it was necessary to find an alternative product that would allow the researcher to address the research questions whilst keeping within the research project within budget.

The aim of this research implies studying the effect of consumer engagement on an individualisation process and the emotional attachment to the product. It does not suggest, however, a specific product type or a manufacturing process. Considering the aim, the research budget, research design and methods, t-shirts were proposed as a vehicle to run individualisation exercises for the interviews.

Section 2.2.4 (page 36) discusses how product types could be an important factor in choosing whether or not to customise a product and considers two main perspectives covered in the literature: (i) the product's "demand pattern" (Bardakci and Whitelock, 2003) and (ii) the balance between three factors: customisation processes, materials and design, as suggested by de Beer et al. (2012), Dean & Pei (2012) Ford & Dean (2013) and Woudhuysen (2013).

(i) Whilst t-shirts could be considered functional products depending on their use and context (and therefore not appealing for customisation), t-shirts have also been proven to be highly customisable products in pop culture. This is evidenced by numerous companies on the high street and online offering diverse customisation techniques and services, generating new experiences and using different materials. T-shirts are items that a consumer could be persuaded to customise, sometimes linked to places, events, people, sports, pop culture and more, possibly eliciting a special relationship characterised by an emotional attachment to the product. It could therefore be said that t-shirts are a type of product that can be considered to offer an innovative "demand pattern" (Bardakci & Whitelock, 2003). In short, t-shirts were deemed appropriate vehicles to run the exercises with research participants.

(ii) The multidirectional circle featured in Figure 2.4 (page 35), suggests that a successfully customisable product type must balance a given customisation processes, materials used and the design. Ariadi et al. (2012) and Sinclair & Campbell (2009), for example, investigated the use of additive manufacturing processes in customisation and used product samples that belong to product types which are often perceived as inexpensive (as opposed to jewellery), i.e. not worth the customisation time investment, the premium process, or premium materials. For that reason, section 2.2.3 suggested that results from those studies should be considered within the limitations of an unbalanced relationship between the manufacturing processes, design and materials used.

Although the t-shirts, randomised coloured design patterns and paint marks applied by hand (the research instruments are explained from 3.3.3.3 Pilot #3 design – Exercise Three) might

not be considered “premium” factors as in the multidirectional circle of Figure 2.4, a balance can still be maintained at a ‘lower’ (i.e. non-premium) level. Therefore, by proposing to use t-shirts as the product sample, this research achieved the aforementioned balance as suggested by de Beer et al. (2012), Dean & Pei (2012) Ford & Dean (2013) and Woudhuysen (2013).

T-shirts were appropriate as they fit the designed research instruments by allowing participants to experience the individualisation process and reflect from it. Additionally, printing t-shirts was financially viable within the budget of the research, which required at least one t-shirt per participant. Very importantly, the t-shirts were also used as an attractive material ‘motivator’ to persuade volunteers to participate. Contrary to other motivators considered, it allowed for customisation in situ from start to finish, as well as conducting the interview whilst the interviewee, in real time, was able to reflect on the product he or she was creating.

### **3.2.2. Sample**

The study population of this research is characterised by consumers who grew up with mass manufactured products and demand something new, more personal products with which they can make an affective connection. That group has already made online customisation retailers popular, by using toolkits to customise diverse products, from computers, mobile phone deals, clothing, accessories to insurance policies, and more. Males and females who are independent to decide their own purchases compose that targeted population. Further, the audience is familiarised with computers, software, online shopping, the idea of customising their purchases and particularly they are increasingly familiarised with software capable of customising what they want. They are also characterised by having an open mind towards modern communication channels, interaction with retailers and customised design. Such a consumer group also includes the prosumer (see Terminology, page 23), a “22 to 42 year old consumer activist” who is “powered by connectivity and interactivity” (Konczal, 2008).

In order to define a sample size for the study, many authors refer to data saturation points and the need to stop collecting data when such a point has been reached. However, identifying that moment requires experience. Rowley (2012: 236) proposes that “a good rule-of-thumb for new researchers is to aim for around 12 interviews of approximately 30 minutes in length, or the equivalent, such as six to eight interviews of around one hour”. Griffin & Hauser (1993)



suggest that 20 or 30 in-depth interviews would be necessary to identify between 90 and 95% of consumer needs in product design research.

Following guidelines collected from Konczal (2008), Rowley (2012) and Griffin & Hauser (1993), this study aimed at conducting 30 in-depth interviews evenly distributed between males and females and between 20 to 50 years old.

Diverse sampling techniques were used, such as:

- 1- Calls through the project's Facebook and Twitter accounts (used to disseminate the project)
- 2- Email lists: help was received from the Graduate Student Office reaching students via email
- 3- Inviting volunteers while participating in a university-held research events
- 4- Publicising across campus with flyers and posters in all Faculty buildings
- 5- Word of mouth and snowballing through every participant

New posters and flyers were produced and posted across campus with each pilot and study iteration. Images of the flyers and posters can be accessed through a link in Appendix (page 225).

As explained in section 2.2.5 Consumer type, it was key for the objectives of this research to identify and differentiate between different types of consumers in the context of their behaviour towards the engagement in what they consume and customise. In order to do this, a purposive 'diagnostic' stage assessing participants' interest in art and design activities was done at the start of every interview for the main study, and is explained in detail in sub section 3.2.2.1 Active and Passive consumers, below.

The criteria behind that 'diagnostic' assessment were designed with inputs from the literature review and through observations from the four pilot studies. The adoption of an iterative approach such as Action Research (AR) and Design-Based Research (DBR) was vital as the pilot studies provided the basis onto which the criteria of the 'diagnostic' were drawn up, and also subsequently design (and refine) the research instruments. Table 3.7 (see page 74) illustrates how other research studies contributed to design the sample for this research.

Literature findings	Research design for this study
<p>Braun &amp; Clarke (2013) indicate a purposive sample is adequate for qualitative research as it implies the selection of participants with a particular interest or knowledge in the research topic and rich data can be gathered. Additionally, Gyi et al. (2009: 306) explain that “participants with experience of a product were able to provide more information [...] than those with no experience”.</p> <p>Sinclair &amp; Campbell (2009: 15) recruited participants who could “self-identify as ‘being interested in design and new technology’”.</p> <p>Belmonte et al. (2014) recruited architecture students who were knowledgeable to provide feedback on a piece of software being evaluated for use in architecture.</p> <p>Ariadi, et al. (2012: 4) recruited “Non-designers from a variety of backgrounds” to evaluate the use of software for consumer use. Contrary to Belmonte et al. (2014), the software was designed for non-designers to use.</p> <p>Franke, et al. (2010) used business students (i.e. not art or design students) to customise t-shirts and assess their experience in customising products themselves.</p>	<p>Gyi, et al. (2009) and Sinclair &amp; Campbell (2009) take the opposite approach to that of Ariadi et al. (2012), Franke &amp; Schreier (2008) and Franke &amp; Schreier (2010) on sampling. Both approaches are clearly justified. For this study both types of participants were relevant (those who are knowledgeable and those who are not), allowing for rich comparisons, as well as diversity in the sample.</p> <p>Interview participants should be able to discuss the relevant topic of the research. For this research into customisation of consumer products, participants needed to be able to comment on their preferences or experiences. Participants also had to “self-identify” as interested in art and design. Therefore they needed to be knowledgeable about specific topics and issues relevant to the research.</p> <p>Interviewing participants who were in the opposite situation, i.e. those who were able to “self-identify” as <b>not</b> knowledgeable or keen on those particular topics, was also important as they react to those topics in unexpected but highly valuable ways.</p> <p>Following the examples from similar studies (such as those listed on the left) it was understood that both approaches were valid. Further, the design for this research benefited by highlighting their differences in relation to individualisation.</p>
<p>Braun &amp; Clarke (2013) explain that quantitative research is characterised for random samples, which facilitates generalisability. Also, specifying a sample for sex or age, means that those demographic variables are meant to be key for analysis.</p>	<p>Sample design indicates 30 interviews with a population as described at the start of this section. The exercises for the research methods produced gender-generic and age-generic products (which in turn makes the design of the exercises easier).</p>
<p>Many reports describe work conducted by researchers at Universities recruiting participants from within their institutions (e.g. staff and students). Some of them required a specific sample that was scarce at university (e.g. elderly people), so they had to reach out.</p> <p>Merle et al. (2008), Matzler et al. (2007), Franke &amp; Schreier (2008), Steiner et al. (2011) among others, use material ‘motivators’ to attract participants and obtain volumes of data. Such motivators go from six euros in cash for 30 minutes of volunteering to Amazon vouchers, new trainers and electronics worth up to £300.</p>	<p>Recruiting people within the university offered advantages, for example: a) an ideal environment to reach 30 people willing to engage in product design research, b) a student or staff participant is someone known by the university. This offered a relatively safe and secure environment to work in for all those involved, including the participant who agrees to take part (key areas for ethical approval).</p> <p>Prizes such as vouchers, cash or goods (i.e. ‘motivators’) help to draw numbers of participants and data. Arguably, the quality of data could suffer from those who take part simply for the chance to receive a prize. Whilst a material incentive can help, it was important that such motivators were within the budget of the research whilst genuinely helping to gather reliable data (i.e. a ‘win-win’ situation).</p>

Table 3.7. Sample design for this study and literature support.

### **3.2.2.1. Active and Passive consumers**

Ariadi et al. (2012), Franke et al. (2010), Knott (2013), Hermans (2014) among others, suggest that the choice to customise a product is strongly linked to the type of consumer considered: those consumers 'actively' engaged in what they consume and customise, and those with a more 'passive' attitude, as explained in sub-section 2.2.5 Consumer type (see Literature review chapter, page 39). Understanding these two types of consumers is of key importance for the objectives of this research and will help us visualise how individualisation could be beneficial for consumers. This sub section will focus on those two different types of consumers, proposing both a rationale that characterises the 'active' and 'passive' consumers and the criteria that identifies each type during the interviews.

The sample for this research met the requirements of the design and the methods, which evolved through the iterative AR approach. Knott (2013) and Hermans (2014) identified different types of prosumers (see Terminology on page 23) and characterised them as per their behaviour and skill in relation to customisation. From the literature findings, it became clear that this research would benefit from interviewing and comparing different types of prosumers, such as those who self-identified as being interested in art and design and those who did not. Therefore, the start of every interview for the main studies stages #1 and #2 consisted of a short purposive 'diagnostic' stage assessing participants' "qualitative degrees" (Knott, 2013: 47) as consumers, and their interest in art and design activities. This took the form of a semi-structured questionnaire where each participant's profile was assessed against these criteria:

- 1- Willingness to engage in DIY (Do It Yourself)
- 2- Aspiration to possess unique products
- 3- Time reference: when was the last time the subject was involved in art or design activities
- 4- Self-identification as interested in art and design

Criterion #1 referred to the consumers' intention to purposively participate in co-design processes with physical and intellectual effort, typical of those who are keen in art or design activities, and possess skills and knowledge to take on such activities.

The aforementioned intention to participate in co-design and customisation was interpreted as a consumer need for differentiation (e.g. unique products), which provides a rationale for

criterion #2. Tepper et al. (2001) describe uniqueness as a consumer need and a source of added product value. Further, they explain there are consumers with different levels of such need. The sampling groups proposed below characterise them.

Criterion #3 assessed consumers' attitude to engage actively in art and design on a regular basis. An active prosumer is one who regularly welcomes opportunities to take part in co-design (such as decorating the home, modifying furniture, a vehicle, an electronic device), as opposed to the consumer who might seldom engage in co-design or who does it unwillingly.

Finally, criterion #4 was used as validation against the previous three criteria. Following sample designs found in literature (see the left column of the Sample design Table 3.7, above), volunteers self-identified as interested in topics and issues relevant to this research. When a volunteer's self-identification aligned with what was assessed through the previous three criteria, that participant's 'diagnosis' was complete and he or she was allocated to the appropriate group. When the self-identification did not align to the findings in relation to the previous criteria, the entire dataset for that individual was revisited and a decision taken by the interviewer.

This research, then, separated the recruited participants into two sample groups for pilot #4 and the two study stages (see Stages in the research process in Table 3.5, page 67) and can be characterised as follows:

**Group Active Consumers (AC)** – Individuals who express an interest in art or design activities, by profession, study, hobby or keen interest and who are interested in getting a customised t-shirt in white fabric.

**Group Passive Consumers (PC)** – Individuals with no particular interest in art or design activities and who are interested in getting a customised t-shirt in white fabric.

### 3.2.3. Ethical approval

All procedures on research ethics set by the University were followed. The University's ethical committee granted this research with ethical approval on 14<sup>th</sup> March, 2014. The following are the steps taken with participants. At the start of each interview, all participants were:

- 1- informed what the research was about
- 2- advised they could withdraw their participation at any time
- 3- advised of their right to remain anonymous
- 4- asked permission to audio record the interview for later analysis
- 5- asked permission to take photos of the resulting products of their participation
- 6- asked permission to use those photos in social media, and relevant academic material
- 7- asked to be contacted again via email, six to eight weeks after the interview for more questions

Finally, participants were requested to fill in and sign a consent form if they agreed to the points above. A copy of the consent form has been made available online and can be accessed via Appendix (page 225).

### 3.3. PILOT STUDIES DESIGN

As already described, this study adopted a hybrid approach between two characteristically iterative designs: action research (AR) and design based research (DBR) (see page 62). The methods selected were therefore refined during different iterations. The research used a mixed-methods technique (page 65), which aligned with the research family (page 59) and approach selected (page 59). The mix consisted of semi-structured interviews, experiments and observation. The literature review was conducted throughout the entire research process, covering both subject matter and research methods. The series of activities undertaken during this research is chronologically illustrated in the Gantt chart on page 68.

In preparation for the main study, four pilot study exercises were conducted, in which the research instruments were put to the test. Pilots #1 and #2 offered a first glance at stakeholders' opinion on individualisation. Pilot #2 in particular was an opportunity to design and test interview questions. Pilots #3 and #4 were particularly useful to establish whether the instruments were good enough to elicit focused participants' responses as well as testing the sample design criteria.

Semi-structured interviews allowed for face-to-face conversations with participants in accordance with the criteria outlined under Research Design (page 65): listening to their opinions while interacting with the toolkit and the product as prompts to trigger the conversation and flexible questioning. A range of hands-on exercises served as instruments to conduct the interviews for pilot #3 (as described under 2.3.3, page 81) to collect qualitative data. The comparison of the effects of different 'degrees' of toolkit automation on different types of consumers, conformed the experiments that evolved from pilot #4 into the main studies. This research also collected quantitative data with the purpose of anchoring key areas that could guide the qualitative data analysis (for example, Likert scales for pilot #4 and study stage #1, pages 122 and 134 respectively). Observation made it possible to capture non-verbal data. The methods included further questioning, typically via email, between six and eight weeks after the meeting with the participant.

Figure 3.8 presents a succinct timeline of the data collection phases (a more detailed description can be found in Table 3.5, page 67).

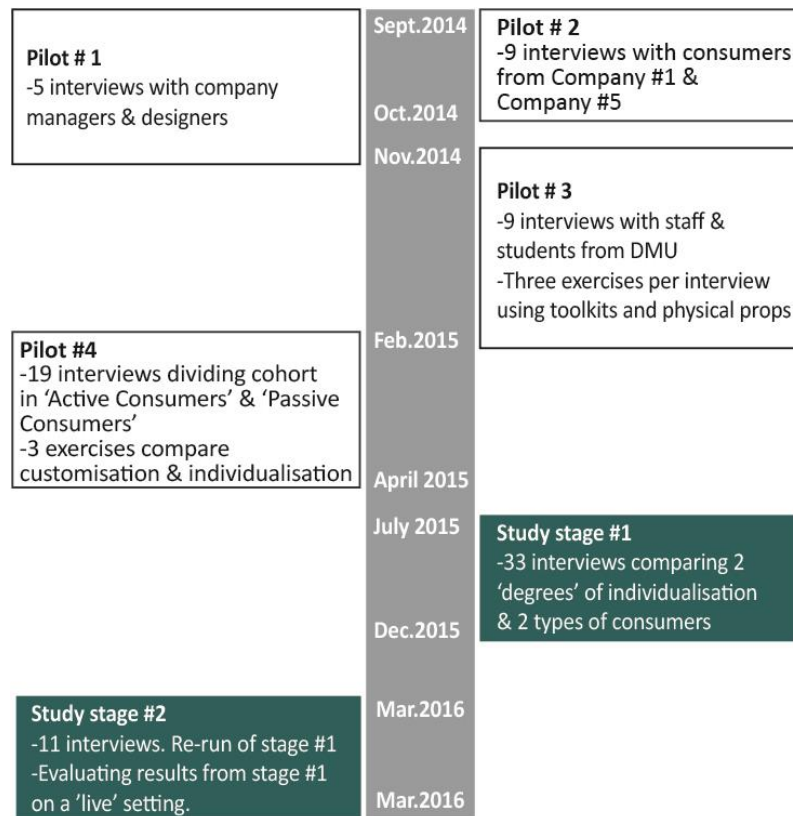


Figure 3.8. Data collection timeline

Pilots #1 and #2 consisted of interviews with managers and customers of different companies, as described in Table 3.8:

Company #	Relevant for Pilot #	Area of activity	Role of person interviewed	Number of interviews
Company #1 (C#1)	Pilot #1	Retailer of collectable and customisable action figurines	Shop managers	2
	Pilot #2		Customers	9
Company #2 (C#2)	Pilot #1	Jewellery	Company director and designer	1
Company #3 (C#3)	Pilot #1	Luxury leather accessories	Company director and designer	1
Company #4 (C#4)	Pilot #1	Additive Manufacturing sector	Consultant	1

Table 3.8. Breakdown of interviews during pilots #1 and #2

A description of the pilots is presented next. Results from these pilots are presented in the Pilot Data Analysis chapter (pages 103 et seq.). The results from the study stages can be found on pages 132 et seq.

### **3.3.1. Pilot #1 design**

This initial pilot study involved conducting interviews with company directors and designers, shop buyers and consultants. The purpose of this pilot was to learn the opinions of those involved in the application of customisation processes for consumers. It was also conducted with a view to testing out an early version of interview questions and to gain familiarity with the potential target audiences of the subsequent studies.

Two store managers from Company #1 (a retailer of collectable and customisable action figurines), two designers (one from a jewellery company and another from a luxury leather accessories company, Company #2 and #3 respectively) and a research consultant from Company #4, were interviewed about how they would see a process like individualisation fit into their businesses. The idea of individualisation was explained and exemplified to the interviewees. Open-ended questions followed. Transcripts of the interviews can be accessed online via Appendix (page 225).

Company #1 (C#1) was identified as a business where consumers buy and customise collectable figurines consistently pursuing uniqueness. Two store managers from C#1 (Leicester and Manchester branches) were contacted by phone, visited and interviewed (semi-structured technique) in their shops.

Circa fifteen designer-entrepreneurs were contacted via email and two responses obtained. Design-entrepreneurs from C#2 and C#3 make their own designs as well as custom-made orders. The idea of individualisation was explained and exemplified to them, followed by a semi-structured interview with open-ended questions.

C#4 provides services to businesses that offer additive manufacturing solutions. A consultant from that company was met at The 3D Print Show, London, in 2014. He was familiar with the concept of product individualisation and his opinion on the application of the process within the public realm was gathered.

### **3.3.2. Pilot #2 design**

The second pilot was also a small-scale study carried out with the purpose of gathering the opinions of individuals who consistently pursue customised products. It also served the purpose of gaining a deeper and broader insight into the field and its key players. This pilot



involved conducting nine short interviews with customers of C#1. Those customers were identified as interested in customising the figurines they buy and collect. This pilot also helped to establish whether individualisation could be applicable to products and customers with different perceptions of the value of individualisation.

A hypothetical offering was described to respondents, where they could buy the figurines from C#1 through an individualisation process. The hypothetical offering was based on the idea that an individualised figurine could be manufactured into sprues (the frames onto which the parts of the disassembled figurines come attached to, as shown in Figure 3.9) for them to put together or further customise as they please. They were asked how a process like individualisation could benefit them and enable them to achieve unique products. Transcripts of the interviews have been made available online and can be accessed through Appendix (page 225).

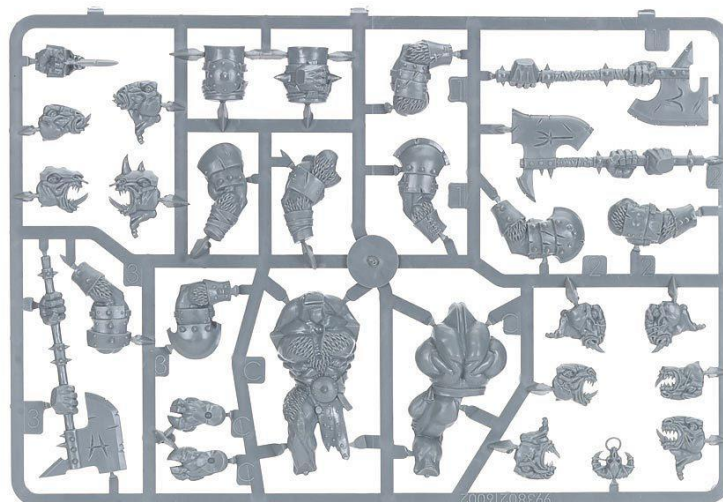


Figure 3.9. Sprues from C#1.

All nine interviews had open-ended questions and were held within the shops while interviewees were customising figurines or playing the actual games.

### 3.3.3. Pilot #3 design

Pilot #3 served as a more comprehensive platform to test and refine the research methods and the data-gathering instruments to be used in the study:

- 1- interview questions
- 2- three exercises proposed to elicit responses (the exercises are explained in full below)

3- sampling techniques (aligning to previous body of research)

4- length of time required to complete one interview session

Nine volunteers were recruited from within De Montfort University (staff and students). Two of the interviews were later discarded due to non-completion, bringing usable results to seven full interviews. As explained in the Methodology chapter (page 72), the sampling criteria were later adjusted for the study. Table 3.9 presents the participants of pilot #3.

Participant number	Occupation	Age/Gender	Completed exercises
1	Research student at Health & Life Sciences	30 / Male	1, 2, 3
2	Learning designer	30 / Female	1, 2, 3
3	Design lecturer	35 / Male	Incomplete
4	Research assistant in architecture	26 / Male	1, 2, 3
5	Research student in Business & Law	28 / Female	1, 2, 3
6	Research student in heritage architecture	33 / Male	1, 2, 3
7	Researcher in engineering	41 / Female	1, 2, 3
8	Research student in engineering	39 / Female	Incomplete
9	Research student in computer sciences	25 / Male	1, 2, 3

Table 3.9. Participants of pilot #3

Three exercises were designed for participants to customise or individualise products (see Terminology in the Literature Review, pages 20 and 21 respectively). Parts of the exercises described below were based on toolkits (referred to as digital ‘platforms’) for the volunteer to interact with on-screen products, using keyboard and mouse. Other parts of the exercises had a different hands-on approach (referred to as the analogue ‘platform’), i.e. not using toolkits but physically manipulating the products instead (see for example Figure 6.8, page 190).

Two types of toolkits were created: one for product individualisation and another for customisation. The former required the volunteer to press the spacebar or click the mouse for the toolkit to be activated, automatically generating an on-screen design for a product. With the latter, the volunteer had to customise a product him or herself on screen, using the mouse.

All toolkits for both the pilots and the study were designed using open source Processing software available from [www.processing.org](http://www.processing.org), which works in the Java programming language. Figure 3.10 is a screenshot of one toolkit being programmed.

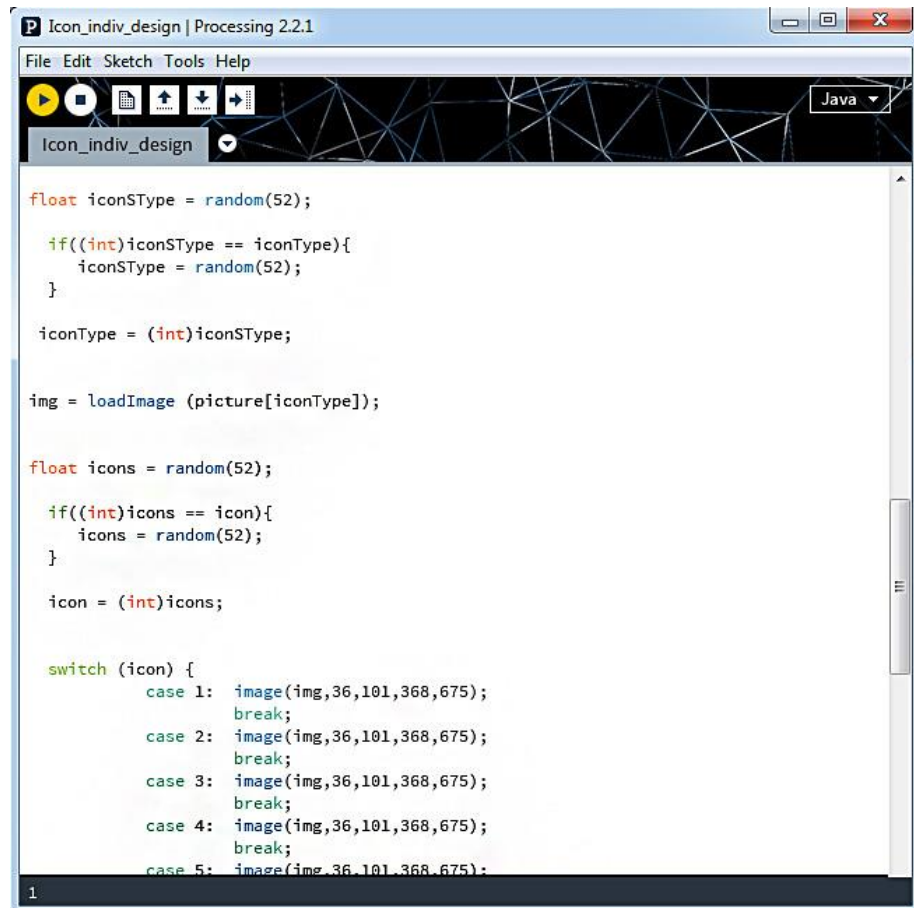


Figure 3.10. Screenshot of the Processing software in which all toolkits (both, for the pilots and the study) were programmed.

*Actuations* refers to the physical act that triggers a toolkit response. The time spent customising the proposed products for the exercises and the number of individualisation toolkit actuations were noted. This was interpreted as participants’ engagement with the process, for example, the more actuations or time spent with a toolkit, the higher their intention to obtain a product that meets their expectations. A description of the exercises in pilot #3 is offered below.

### 3.3.3.1. Pilot #3 design – Exercise One

This exercise focused on two key aspects: assessing consumer engagement in the individualisation process and comparing possible benefits of choosing an individualised product with those of a ‘standard’ one. The exercise was conducted alongside a semi-structured interview. The exercise required the participant to choose a piece of jewellery (one of the Icon pendants designed by Dr Lionel Dean, see Figure 3.11-a, Figure 3.11b and Figure 3.11-c) from three different possible platforms:

- 1- a ‘standard’ pendant design already manufactured, representing a mass manufactured product, as shown in Figure 3.11-a

2- an individualised pendant design already manufactured, chosen from ten available variants, as shown in Figure 3.11-b. Time spent choosing was noted.

3- an individualised pendant design created by a toolkit on screen. The toolkit showed a different Icon pendant design on a screen every time the spacebar was pressed on a computer (Figure 3.11-c is a screenshot of the software in operation). Only one pendant image was shown at a time and each image was shown only once, as the toolkit did not allow revisiting previous designs. The intention was to generate the perception that the software was generating unique new designs every time. Also, this was to avoid causing “choice paralysis” (i.e. mass confusion) whilst perceiving ‘unlimited’ choice. The number of times the spacebar was pressed was noted.



Figure 3.11-a. (left) A ‘standard’ Icon pendant used for choice 1. Figure 3.11-b. (centre) Features examples used for choice 2. Figure 3.11-c. (right) Screenshot of the toolkit in operation for choice 3.

For platform three, the physically finished individualised product could not be made available, which represented a limitation.

### **3.3.3.2. Pilot #3 design – Exercise Two**

Exercise two worked with the same Icon pendant as before. In this case the exercise compared the engagement experience of customisation against individualisation processes. It also added to results from exercise one, above, in the comparison between individualised offerings and ‘standard’ ones. Participants were asked to select their favourite stone setting for the pendant (selecting stone colour and position) from three possible design methods (all screen based):

1- a ‘standard’ stone setting with a green stone on the centre-left (see Figure 3.12-a)

2- using an individualisation toolkit: six different stones colours in 20 pre-established positions arranged by the toolkit's algorithm every time the spacebar was pressed (Figure 3.12-b shows a screenshot of the toolkit). The number of times the spacebar was pressed was noted.

3- using a customisation toolkit: participants had the opportunity to pick the colour of the stone and place it on the pendant (from six available colours and 20 pre-established positions). Where the stone was taken to a position out of the pre-established boundaries, the toolkit would place it on the nearest acceptable result (Figure 3.12-c). Time spent customising was measured.

The toolkits for choices two and three had similar layouts (Figure 3.12-b and Figure 3.12-c, centre and right, below) and offered twenty positions with six possible stones each, totalling 120 possible results on either toolkit. All stones were described as similar in price (e.g. no diamonds) so that all results had similar perceived prices.

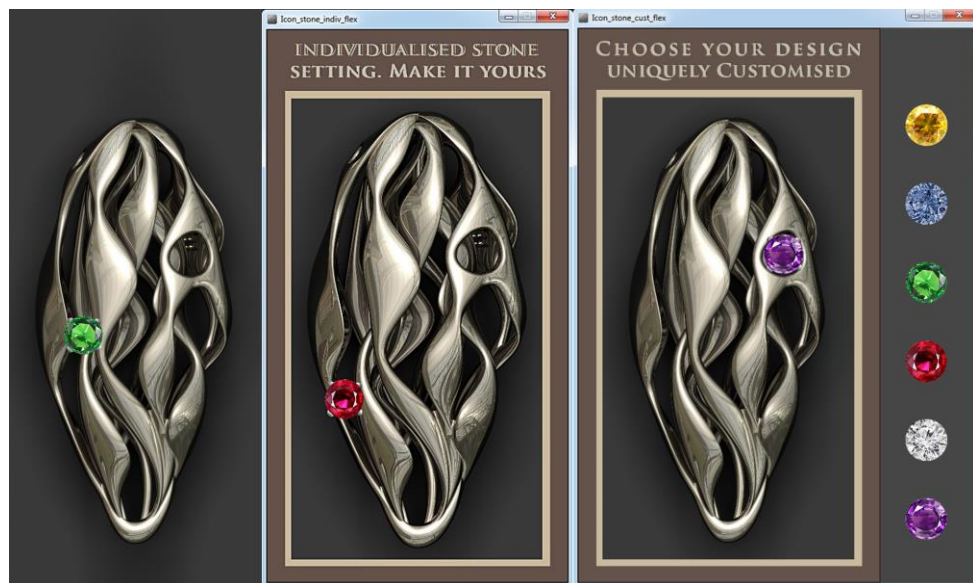


Figure 3.12-a (left) Screenshot of 'standard' stone setting. Figure 3.12-b (centre) Individualisation toolkit. Figure 3.12-c (right) Customisation toolkit.

### 3.3.3.3. Pilot #3 design – Exercise Three

Exercise three was also designed to observe engagement experiences in the process of customisation and individualisation and a possible resulting emotional attachment to a product (a t-shirt with a pattern of coloured paint marks). A possible emotional attachment to the t-shirt was assessed as participants were allowed to keep the t-shirt. This t-shirt was both a vehicle to illustrate the exercise and a motivator to attract participants. Participants were

asked to choose their favourite coloured pattern designs for the t-shirt, from three possible methods:

1- using an individualisation toolkit

2- using a customisation toolkit

3- using a dice as a source of data input to create an individualised pattern (replacing the toolkit's algorithm). This pattern was then painted over a real t-shirt, applying paint with syringes.

Choices one and two worked with toolkits (Figure 3.13) similar to choices two and three from pilot #3, exercise two (above). For this exercise, participants were allowed to use the toolkits any number of times until satisfied with a design. They were asked to close and re-start the toolkit every time, which meant that they were unable to compare the resulting designs. The toolkit featured six colours and 36 possible paintable areas over the t-shirt on a grid of six by six quadrants. The number of times spacebar was pressed was noted and time spent customising was measured. The image below shows a screenshot of the toolkits.



Figure 3.13. Screenshot of the toolkit for pilot #3 – choices 1 and 2.

Choice three of the exercise had a hands-on approach, painting a real t-shirt, as in Figure 4.6, page 119. Rolling a dice generated numerical data input, indicating a) the number of paint shots on the t-shirt, b) X and Y coordinates to locate each paint splodge (on a grid similar to that on the toolkits, see image below), and finally c) the colour for each shot (1=blue, 2=red, 3=yellow, 4=green, 5=violet and 6=orange). Paint was applied using syringes.

For this exercise a dedicated structure was built to hold the syringes, hold a t-shirt horizontally and protect the interviewee from spillages (Figure 3.14-a, Figure 3.14-b and Figure 3.14-c). Participants rolled the dice and pressed the syringes, painting the t-shirt.



Figure 3.14-a. (left) Painting rig test for pilot #3 - choice 3. Figure 3.14-b and Figure 3.14-c (centre and right) Painting rig finished.

As explained earlier in Table 3.5 (page 67), pilot #3 tested methods to be used in the subsequent study. From pilot #3 there were aspects that worked well and areas of improvement. For example, using a t-shirt as a vehicle for the experiments was effective, as the product was an incentive to persuade people to volunteer. Meanwhile, an area to consider for improvement was using jewellery as a vehicle for the exercises, as it meant that a finished product would not be available until a later date, therefore the interview was carried without the product. Completing the exercise at a later date, would mean that the engagement with the process would have passed, so the exercise had to be conducted on-screen only. The methods for the study were adjusted accordingly.

A summary with key findings, limitations and implications for subsequent pilots is presented in Table 4.8, page 129.

### 3.3.4. Pilot #4 design

This fourth pilot proposed similar exercises to pilot #3 (see section 2.3.3, page 81), designed to observe the relationship between engagement in the process of customisation or individualisation and a possible resulting emotional attachment to a product (a printed t-shirt). A copy of the interview questions used for pilot #4 has been made available via Appendix (page 225). Pilot #4 started with the three exercises as in pilot #3 and later discarded exercise

two, which was collecting duplicated data and not offering new insights. Also, eliminating that exercise reduced the amount of time required to complete an interview.

Exercise one remained the same as in pilot #3 (described in section 2.3.3.1, page 83), whilst minor adjustments were made for exercise three (the t-shirt exercise described in section 2.3.3.3, page 85). The adjusted exercise three asked participants to create four design patterns for the t-shirt:

1- using an individualisation toolkit (Figure 3.15-a)

2- using a customisation toolkit (Figure 3.15-b)

3- using a dice as a source of data input (replacing the toolkit's algorithm) for an individualised pattern. This pattern would then be painted on the front of a t-shirt using syringes with paint

4- customising the back of the t-shirt used in point 3, but also painting it with syringes.

Options 1, 2 and 3 of the exercise worked similarly to pilot #3, exercise 3, where the individualisation toolkit controlled the position, colour and size of the paint marks, leaving the number of marks to be decided by rolling the dice. The toolkits could be used to create any number of designs until the participant was satisfied with the result on the screen. The number of t-shirts created on screen and time invested using either toolkit were measured and interpreted as indicators of engagement with the process. Figure 3.15-a and Figure 3.15-b show screenshots of the two toolkits with new layouts.

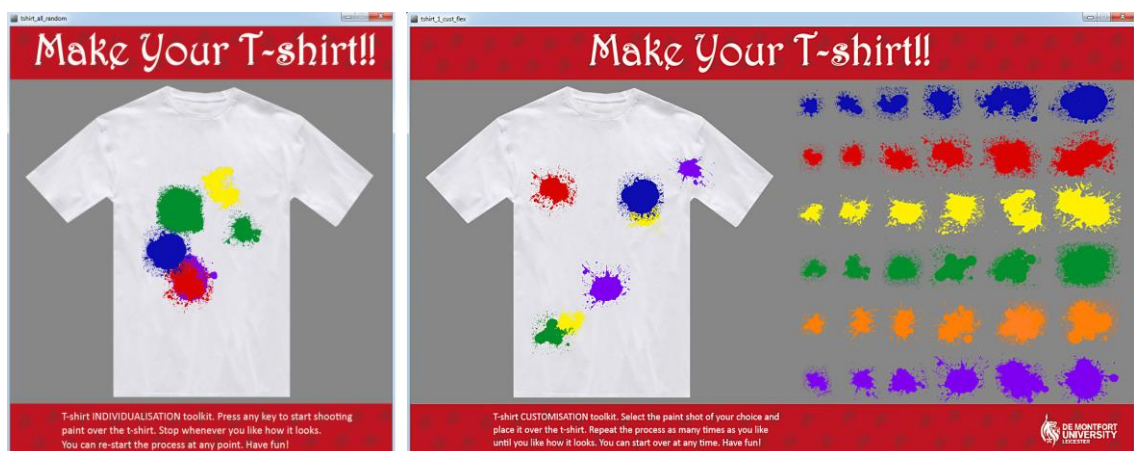


Figure 3.15-a (left) Screenshot of individualisation toolkit for choice 1. Figure 3.15-b (right) Screenshot of customisation toolkit for choice 2.



Options 3 and 4 (described on page 88) had a new t-shirt painting structure designed (Figure 3.16-a and Figure 3.16-b, below) following the notes taken from the previous pilot iteration. The new painting rig allowed painting the t-shirt in both front and back.



Figure 3.16-a and Figure 3.16-b. New t-shirt painting rig allowed painting the t-shirt front and back.

Additionally, at the end of each session participants were offered to either keep the t-shirt that was painted during the interview or take a 'standard' t-shirt previously designed and painted by the interviewer instead. Figure 3.17 shows the standard t-shirt.



Figure 3.17. Design of the 'standard' (pre-designed) t-shirt.

Offering a standard alternative was meant to evidence any possible attachment to the product that participants painted. It was important to note whether they requested to see the standard t-shirt design in order to make the decision about which item to keep. This aspect also triggered the question about how and why seeing the standard t-shirt influenced the decision for either design.

## 3.4. STUDIES DESIGN

After four pilot runs and well trialled and tested instruments, forty-six volunteers were interviewed as part of the 'main' study, which collected the largest tranche of data. The study was conducted in two stages: stage #1 with 35 participants and stage #2 with and 11. Two interviews from stage #1 were discarded due to non-completion, bringing the total to 44 completed interviews. The sample design was as explained in the Methodology chapter (page 72), separating participants into two groups according to their profiles:

**Active Consumers (AC)** group or 'makers' – Individuals who are interested in art or design activities, by profession, study, hobby or keen interest and who are interested in getting a customised t-shirt.

**Passive Consumers (PC)** group – Individuals with no particular interest in art or design activities and are interested in receiving a customised t-shirt.

The rationale behind the sample selection (section 3.2.2, page 72) benefits the study by drawing on the differences between the two types of consumers in relation to individualisation. Pilot #4 focused on interviewing the two groups of participants using one exercise. Study stage #1 aligned both types of consumers with two exercises capable of generating more comparable data than previous iterations to address the research questions.

The stage #1 of the 'main' study (with 35 participants) collected the first and largest tranche of data considered in the analysis and subsequent discussion and conclusions of this research. The stage #2 of the 'main' study (with 11 participants) was intended to validate the results obtained in the first stage, by re-running the exercise in a 'live' setting, spontaneously recruiting passers-by.

### 3.4.1. Study stage #1 design

In the light of emerging data patterns from pilots #3 and #4, the research focused on comparing different 'degrees' of individualisation (as opposed to comparing it to customisation), adjusting the exercises accordingly for the new iterations. This was achieved

whilst keeping the same line of questioning and generating data comparable to the final exercise of pilot #4. For the first round of studies the following two points were considered:

1- the exercise focused on evaluating different 'degrees' of individualisation (i.e.: degrees of toolkit automation and consumer choice) instead of comparing it against customisation, as such information was observed during previous iterations. This resulted in two individualisation toolkits:

a- toolkit A controlled two features: position and colour of the paint marks, placing size and quantity of marks under the participant's control (Figure 3.18-a), and

b- toolkit B controlled all features: position, size and colour of the paint marks (Figure 3.18-b).



Figure 3.18-a (left) Screenshot of toolkit A. Figure 3.18-b (right) Screenshot of toolkit B.

2- the dice was used only to find out the number of paint marks for toolkit B, keeping the 'nature' of the two proposed exercises as similar as possible, with the amount of control offered by the toolkits being the only difference. The whole session became shorter (circa 30 minutes) due to the exercise having fewer stages.

The exercises were then better 'aligned' to each other: both were based on individualisation toolkits, painting t-shirts and the resulting t-shirts had similar quality (see images in Figure 3.19 with a range of t-shirts printed with either toolkit).



Figure 3.19. T-shirts printed with either toolkit achieved of similar quality.

As those factors were 'aligned', evaluations and analysis rendered more reliable results than with previous iterations. This left two variables to work with: the type of consumer (AC or PC as described in the sample design, page 72) and 'degree of individualisation'. Therefore, the research used a matrix of four possible scenarios, as in Figure 3.20.

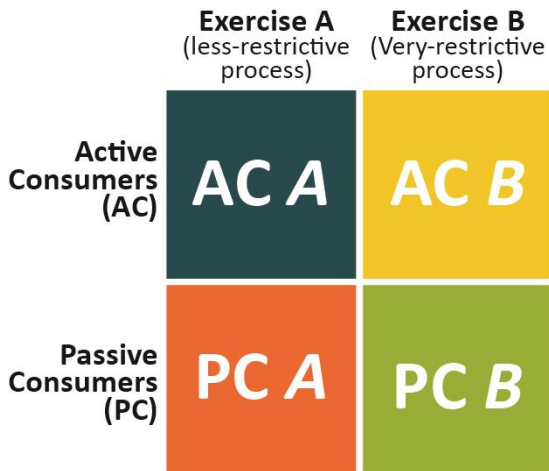


Figure 3.20. Active Consumers (AC) using toolkit A. AC using toolkit B. Passive Consumers (PC) using toolkit A. PC using toolkit B

By focusing on the above four groups, the data sets became more comparable with two variables being controlled in turns: comparing type of consumer while keeping the same toolkit or comparing toolkits within the same type of consumer.

### 3.4.2. Study stage #2 design

Interviews during stage #1 offered a substantial amount of qualitative and quantitative data from participants. Participants were informed about the research and its purpose prior to a one-to-one meeting in a room set up for those sessions. Study stage #2 was designed to evaluate and validate the results from the first stage by re-running exercises in a different setting.

This second study stage had a 'live' setting: a 'pop-up shop' for one day within university campus, interviewing passers-by (a total of 11 people). The interviews were spontaneous, they had no script and had to be shorter than previous studies (the majority of participants were on lunch-breaks at the time). In particular, no quantitative data was collected. The qualitative data gathered at this stage added to the qualitative data collected during stage #1. In order to make the whole process shorter, only exercise A was offered (which did not require using the dice), as described in the previous iteration.

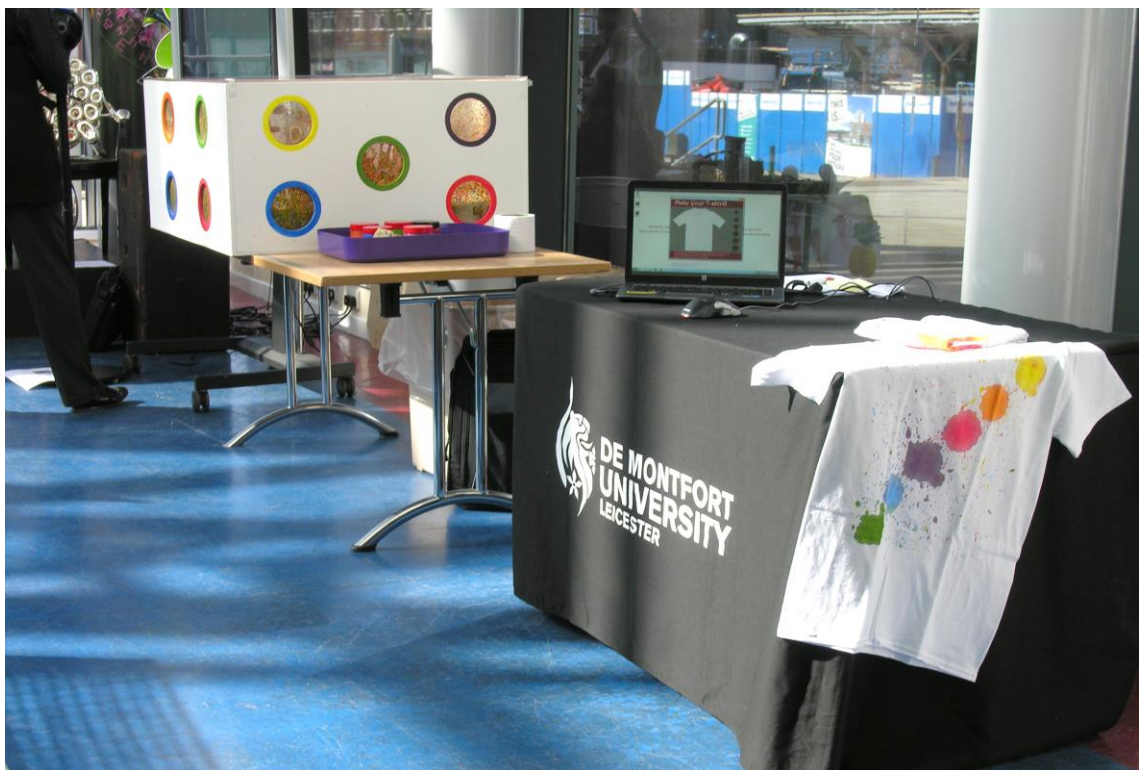


Figure 3.21. Pop-up shop on the university campus used to interview passing students and staff.

Passers-by approached the 'shop' with the research instruments on display and were persuaded to spend less than ten minutes of their time by the idea of receiving a free t-shirt. Often, participants arrived with company who interacted verbally, making the participant further engage in conversation about the experience.



Figure 3.22. Passers-by engaging with the experiments in the 'pop-up' shop.

During the interviews of study stage #2, however short, the participants were profiled as either AC or PC so that the data could be contextualised and aligned to that from the first stage of the study. From 11 participants, eight were identified as ACs and three as PCs. All participants were given instructions (including contact details) to collect the t-shirts at any time.

### 3.5. THE ANALYSIS OF QUALITATIVE DATA: THEMATIC ANALYSIS

This research project collected qualitative data through a mixed methods approach (see 3.2 Research Design, page 65). As part of that approach, quantitative data was also collected with the purpose of highlighting measurable aspects to guide the qualitative data analysis.

Qualitative data, particularly interview and observation data, was analysed using thematic analysis (TA), an established process to code qualitative data (Boyatzis, 1998). TA was identified as an appropriate method as it uses a “wide variety of types of information in a systematic manner that increases their accuracy or sensitivity in understanding and interpreting observations about people, events, situations and organizations”. Further, TA “allows for the translation of qualitative information into quantitative data” (Boyatzis, 1998: 4,5). The four stages of TA are summarised in Table 3.10.

TA stage	Description
<b>Familiarisation with data</b>	This is the first step and requires listening to audio recordings of the interviews and revisiting field notes of the sessions. Interviews are transcribed as part of this initial step. More notes are often taken during this stage. (Braun & Clarke, 2013).
<b>Formulation of codes</b>	“Codes identify a feature of the data (...) that appears interesting to the analyst” (Braun & Clarke, 2006: 88). “Coding is the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon” (Boyatzis, 1998: 63). Codes can be data-driven (coding around collected data) or theory-driven (coding around pre-established questions following theory).
<b>Generation of themes</b>	Careful thought must be given to combining the formulated codes to generate broader themes, which encapsulate groups of codes. Diverse practical techniques can be used, such as tables and mind maps. Some codes can transform into themes and others can be combined or discarded. Contradictions and tensions between codes and themes are often present at this stage. (Braun & Clarke, 2006).
<b>Production of a report</b>	This final step requires telling a convincing story that ‘draws’ sense from all the analysis and illustrates arguments with sufficient data extracts. (Braun & Clarke, 2006).

Table 3.10. Summary of stages in thematic analysis.

The design of the interview (page 69) had two main sources: it used an evolving process of interview design (inducing data from previous design iterations) as well as deductive methods from, for example, Ariadi et al. (2012) and Franke & Schreier (2010), (see 3.1.2 Inference Style, page 58). Likewise, in the data analysis, some of the codes used were data-driven (extracted from the collected data) and others were inferred from theory (theory-driven codes),



particularly from the aforementioned studies (the full details of the coding structure can be found on pages 145 and 146). The reason for identifying codes from existing literature was to better understand what constitutes a relevant code in the context of this study. Examples of this are the 'Time investment' and 'Effort' codes used. Ariadi et al. (2012) interviewed participants in a study evaluating their use of a specific customisation toolkit, and some respondents compared the experience of using that toolkit against buying a pre-designed product. In that scenario, consumers' time investment and effort could be considered a relevant variable in the evaluation. Another example is "process effort" and "perceived process enjoyment" when customising, which characterised Franke & Schreier's (2010) interview design. This research also adopts the use of five-point Likert scales to collect quantitative data (Ariadi et al, 2012, Franke & Schreier, 2010). This was done in order to help 'anchor' salient areas or themes, highlighting potential codes in the thematic analysis of the qualitative data. A full statistical analysis, typically focusing on quantitative data within a positivist paradigm (see section 3.1.1) was not fit for purpose in view of the objective, approach and design of this research.

In both of the aforementioned studies, it is possible to visualise two sections in the interviews (and therefore in the data collected): one section covering the engagement with the process and the other section covering the attachment to the product, or some sort of preference fit. Following the interview design (page 69), codes in this research can also be allocated to one of two areas (Table 5.3, page 135, shows how the questions were organised by area): those related to engagement with the process and those around attachment to the product (see for example Table 4.7, page 127 for codes from pilot #4). Further, this research proposes that the codes can be grouped in four tighter, more accurate themes, explained in the studies Data Analysis chapter (Table 5.4, page 145, shows the codes from study stage#1).

### **3.5.1. Transcript style**

Whilst often regarded as adequate for familiarising with the raw data, the transcription of audio recordings for TA characteristically demands high consumption of researcher resources, namely time (Neal et al. 2015; Braun & Clarke, 2006; Rowley, 2012 and Boyatzis, 1998). The number of hours of audio recordings collected during the interviews for this research presented a challenge at the time of conducting the data analysis. Braun & Clarke (2006: 88) explain that there are "various conventions" when transcribing and "what is important is that the transcript retains the information you need". They add that the analyst could code aiming for particular (and even limited) features of the data, as opposed to the entire data set.

Different approaches to TA were considered in terms of cost-effectiveness (time investment and data reliability). These are presented in Figure 3.23, challenging the need for verbatim transcriptions of the entire data set.

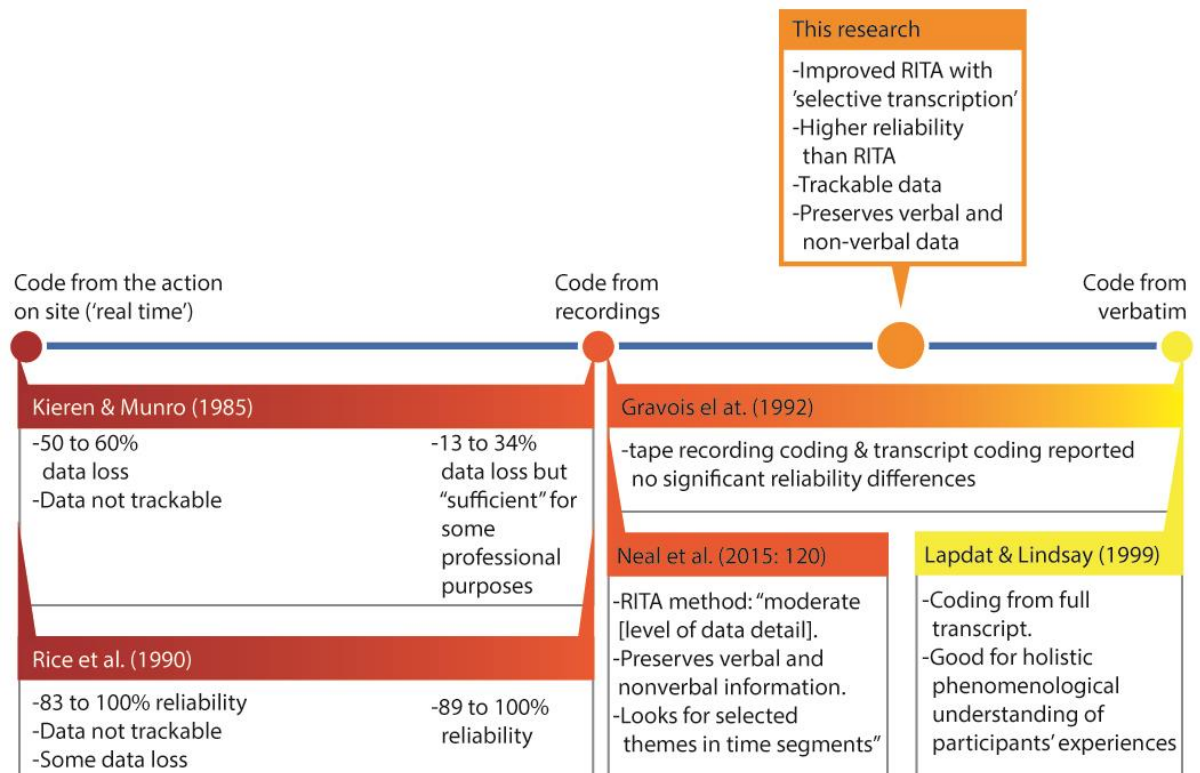


Figure 3.23. A continuum of different approaches to TA challenging the need to verbatim transcripts, where full transcripts and absence of them are on each extreme.

Gravois et al. (1992) claim that themes can be identified from audio recordings directly. Boyatzis (1998) adds that a code could be *determined* by 'segments' of data, "e.g. by 5-minute segments of audiotape" (Boyatzis, 1998: 64). Neal et al. (2015) propose an approach to TA called Rapid Identification of Themes from Audio Recordings (RITA). RITA uses 'short' time segments from audio recordings, the length of which is decided by the analyst, as "units of coding" (Boyatzis, 1998: 63). This implies *coding directly* from the recordings, as initially claimed by Gravois et al. (1992).

Neal et al. (2015) claim that RITA has a "moderate" level of coding detail compared to full transcripts, yet holding features of the data which are lost in transcriptions, such as nonverbal information and intonation. For this research, it was decided that RITA's level of coding detail could be strengthened while retaining its processing speed. To do this, 'selective transcription' was used during the coding process. For example, during three-minute coding segments, passages were transcribed and pasted into an Excel spreadsheet to illustrate the formulated

codes. This adaptation of RITA was beneficial as the origin of the formulated codes became traceable and provided more robustness both to the process and the results.

The first stage of the TA, familiarisation with the data, is crucial to understand the narrative of each interview. There are special software packages to aid in that process, such as NVivo. Strengths of the software include automatically making calculations (e.g. code frequency) and grouping codes. However, its efficiency ultimately depends on the accuracy with which the data is entered and coded in the first place. Another strength of the software is that it can hold the information in its library and make sections of it accessible on demand. With NVivo, the detachment with the data sets is a detriment to the visual familiarisation with it, because each section of data becomes visible only when recalled. Arguably, in practice with large data sets, a researcher could fail to identify new overarching themes, codes or data patterns that would become apparent when closely manipulating the data (Welsh, 2002).

The data analysis required a 'more visual' interface, as such interaction enables familiarisation with the data. To this end, MS Excel spreadsheets were used, where the columns represent the time segments of audio (in 3-minute intervals) and each row contains an identified code. The transcribed segments of data are placed in the cells, under the corresponding time slot (thus making them easily traceable), aligned with the respective identified code. When a new code is identified, a new row is added. The full spreadsheet is available online and can be accessed via Appendix (page 225).

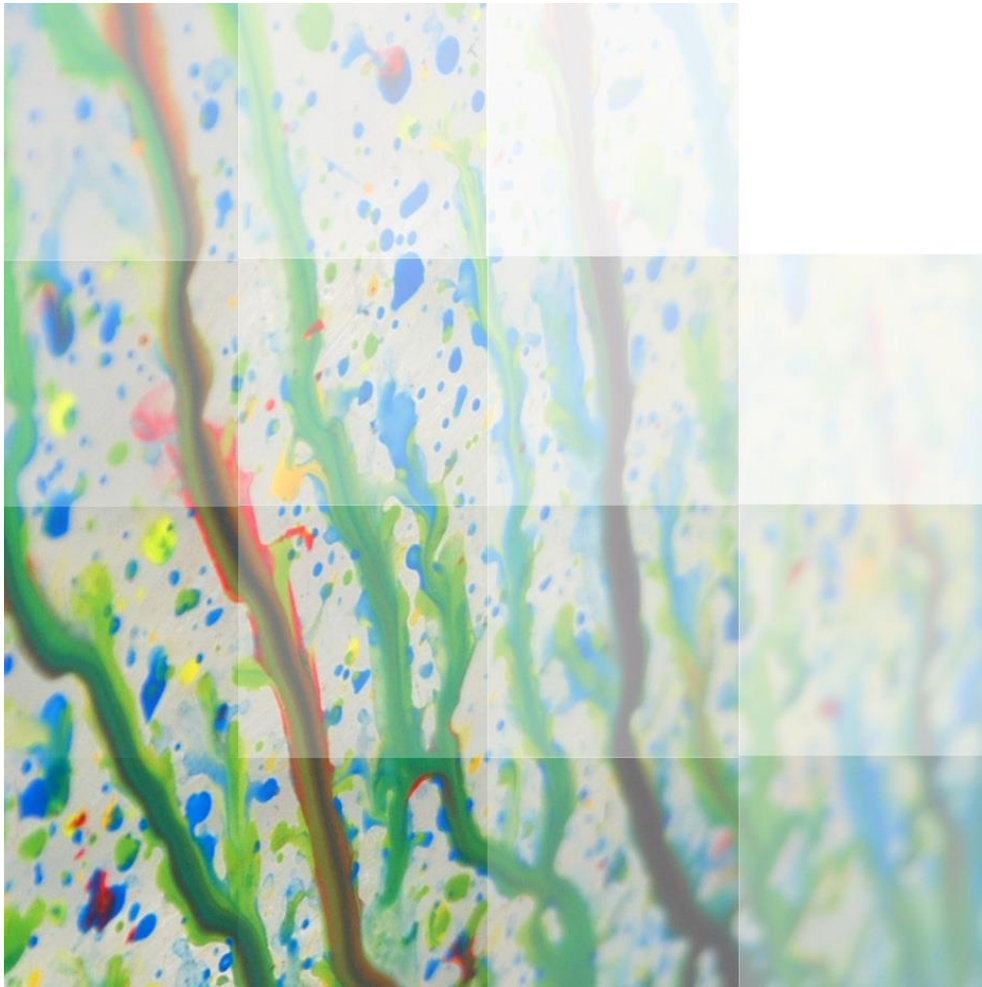
This approach entails a rather 'manual', labour-intensive data analysis process compared to using NVivo. Indeed, the proposed method is neither faster nor more efficient than NVivo and does not allow the insertion of audio or video files. Instead, the benefit lies in the close familiarisation with the data. Each new interview is stored in a new 'tab' in Excel, meaning all the transcribed segments of a whole interview are displayed, easily accessible and searchable.

## 3.6. CHAPTER SUMMARY

This chapter covered the range of theoretical underpinnings of the research. It considered possible methodology paradigms, families, approaches and methods, offering a route map that justifies the decisions taken as the research progressed.

The chosen research methods and the criteria for sampling were explained, providing a consistent rationale for the study. The ethical considerations for the project were also presented. The chapter then described how the data collection instruments worked in alignment with the overall rationale and how data would subsequently be analysed.

The next chapter presents the analysis of the data collected during the four iterations of pilot studies. It starts by sharing the results from the pilot, as well as how those results impacted on the study stages.



## 4. DATA ANALYSIS: PILOTS

## INTRODUCTION

This chapter presents the analysis of the data collected during the four pilot iterations. The iteration of pilots enabled the design, test and refinement of the methods and instruments used in the study.

A summary of each pilot is presented in this chapter. Pilots #1 and #2 offered an overall idea of what consumer reactions to an individualisation process are like. Pilot #2 contributed to the research by highlighting topics that could be relevant when designing interviews for the main study, as well as identifying possible consumer types, which later shaped the sampling criteria. Pilots #3 and #4 were important for the design and development of interviews as well as the design of three exercises later administered to respondents.

This chapter concludes with a summary of the key findings, limitations and implications of each pilot on the subsequent study iteration, described in chapter 5.

## 4.1. CUSTOMISATION AND INDIVIDUALISATION

Customisation is the tailoring of goods to the requirements of a consumer, as it was practised before the industrial revolution (Piller, 2010). There are different techniques to customise products, and they can be differentiated depending on how the consumer participates in the customisation process. For example, among other forms of customisation, this research has defined 'full customisation', 'mass customisation' (page 20), 'individualisation' and 'personalisation' (page 21). Earlier research suggests that customisation processes help to nurture an emotional attachment to the resulting artefact (Mugge et al. 2010; Press & Cooper 2003, among others). This is particularly true when a consumer invests time and effort in said process (Mugge, 2007): Time + Effort = Attachment ( $T+E=A$ ). Figure 4.1, below, represents product customisation as a generic term that contains different techniques to customise.



Figure 4.1.  $T+E=A$ : Time plus Effort invested customising, leads to emotional attachment to the product.

For a number of years we have seen the successful application of automated systems, such as computer algorithms, to address product optimisation problems, for example in engineering, the medical sector, aerospace and architecture, as a strategy to improve the performance of engineering products (Yang and Bouchlaghem, 2010). This method to generate 'forms' or objects, has been, until recently, unrelated to product design (Figure 4.2).

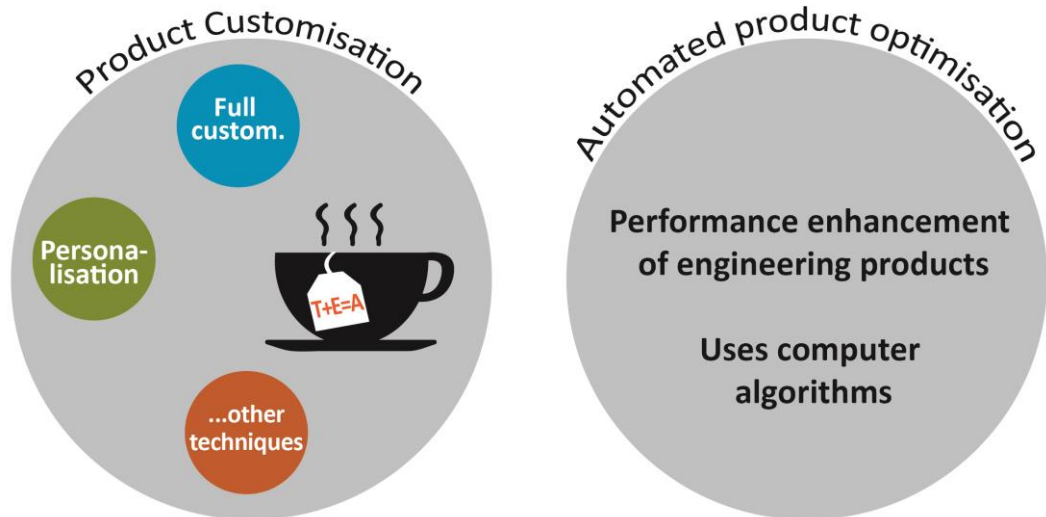


Figure 4.2. Product customisation unrelated to automated processes of form optimisation.

Product individualisation is one of the many product customisation techniques (see definition, page 21) and it emerges from the application of those systems of form generation for the automated creation of unique designs (Figure 4.3). Examples of this are the Bone Chair by designer Joris Laarman, as well as the Icon jewellery by Lionel Dean and the Iceberg collection by Jonathan Keep, amongst others.

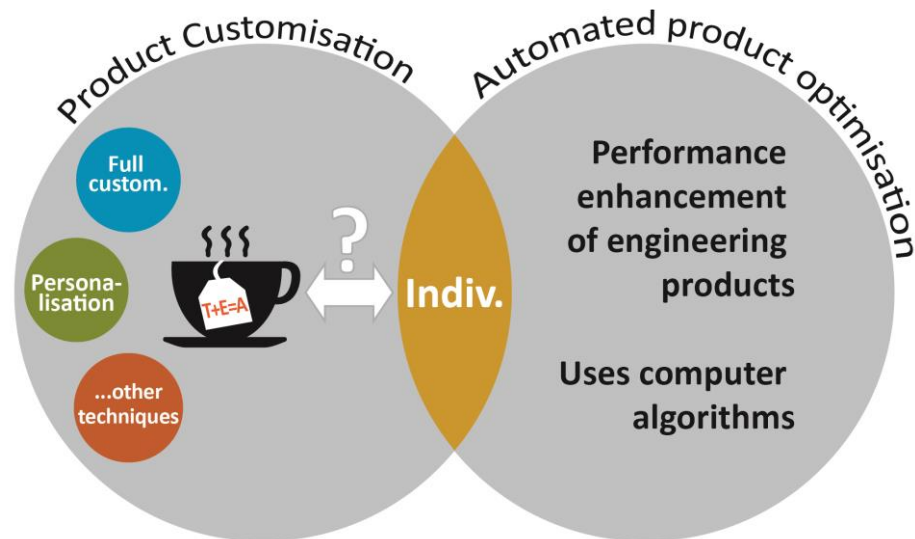


Figure 4.3. The intersection of the two domains gives birth to individualisation processes.

Because individualisation derives from automated processes, the investment of time and effort required to achieve a result could potentially be reduced (i.e. the consumer engagement in the process could decrease). Therefore it is relevant to ask if and how individualisation



processes can generate an impact on product attachment, as observed when using other customisation techniques. The following data collection pilots and study were designed to address this concern.

In this research, the term individualisation refers to the automated process of product customisation. As such, all individualised products are customised products, and all **automatically** customised products are individualised products. Individualisation processes do not imply using a particular technology as long as the data input to generate forms, colours or textures is governed by automated means (which can also be randomly generated, e.g. using a dice). To this end, the pilots and studies described in this chapter were designed so that participants perceive the impression of a customisation process taking decisions automatically, on their behalf.

## 4.2. RESULTS FROM THE PILOT STUDIES

Pilots #1 and #2 consisted of interviews with managers and customers of different companies, as described in Table 4.1, below:

Company #	Relevant for Pilot #	Area of activity	Role of person interviewed	Number of interviews
Company #1 (C#1)	Pilot #1	Retailer of collectable and customisable action figurines	Shop managers	2
	Pilot #2		Customers	9
Company #2 (C#2)	Pilot #1	Jewellery	Company director and designer	1
Company #3 (C#3)	Pilot #1	Luxury leather accessories	Company director and designer	1
Company #4 (C#4)	Pilot #1	Additive Manufacturing sector	Consultant	1

Table 4.1. Breakdown of interviews during pilots #1 and #2

Pilot studies helped to develop the interview design as well as the sampling criteria for the subsequent study.

### 4.2.1. Summary of Pilot #1

Pilot #1 consisted of interviews with two store managers from C#1, two directors or designers from C#2 and C#3 and a consultant from C#4. This pilot aimed at gathering the opinions of those involved in the application of customisation processes for consumers.

The two interviewed store managers from C#1 concurred in that, whilst individualisation could offer a range of unique results, their long-standing customers find value in the manual craft of making the figurines by themselves as well as in the social interaction of playing the games (which often happens inside the shop premises).

The thematic analysis of the two interviews with C#1, highlight the following areas or 'thematic codes' when evaluating their current product customisation offer:

- Social interaction (customers customise pieces and play games within the shop premises)
- Hand labour (sometimes valued as positive or negative)
- Attractive hobby or pastime

- Expression of creativity
- Entertainment
- Pride on the final creation
- Uniqueness of the pieces
- Identification of a set of figurines

Codes extracted from the two interviews with C#1 shop managers could be interpreted in two groups: those related to the activity and the ones related to the products themselves, as shown in Table 4.2. This separation is relevant for this study as it looks at the relationship between the engagement with a process of product customisation and the attachment to the manufactured result.

Codes related to the activity	Codes related to the products themselves
Social interaction Hand labour Attractive hobby or pastime Expression of creativity Entertainment	Pride on the final creation Uniqueness of the pieces Identification of a set of figurines

Table 4.2. Codes extracted from analysing interviews with C#1 shop managers.

Codes from both groups reflect areas of perceived value (positive or negative value, for example when a customer finds a struggle, e.g. in hand labour). When the customer finds added value on the activity (listed to the left of Table 4.2), it triggers an attachment to the product itself, adding value to it. Both respondents highlighted the social interaction between hobbyists as one of the most important values, the result of meeting in the shop premises both to play and customise the figurines.

Interviewees from C#1 suggested that new customers (as opposed to their regulars) might value a less labour-intensive and faster processes to achieve customised products (for example by 3D printing individualised figurines). Further, they explained this could be possible, as new customers have to develop the attraction for the product and activity they offer, a process that requires time and practice. Arguably, because of a less-hands-on process, the attachment and perceived value from a 3D printed individualised figurine might not be the same as those made by current manual methods.

C#2 and C#3 offer customisation services where a professional designer always mediates the consumer engagement with the customisation process (therefore very different from that on

C#1). The interviewees explained that a process like individualisation could be valuable for their businesses, offering a simpler and faster process to achieve the unique. However, in their experience, the manufacturing technologies to exploit a process such as individualisation are still behind.

Key factors identified when evaluating individualisation as an alternative customisation service for C#2 and C#3, were:

- Simplification of the customisation service
- Speed to achieve results
- Costs and available technology
- Reduction of customisable features
- Design as a feature of added value

The interviewee from C#2 explained that individualisation could speed up a client's selection process when looking for unique jewellery design, increasing the perceived value. He explained that today his clientele value a designer's authorship and not so much the value associated with the handmade object. It could be said that those characteristics align with what individualisation could offer: the designer's authorship could be reflected on any piece automatically customised with individualisation software (therefore better exploiting the value of the authorship) and the manufacture would be automated (reducing costs where value is not perceived). However, interviews with C#2 and C#3 indicate that the value individualisation could bring to their businesses rely solely on technical grounds (speed and automated design). The respondents did not consider if value could be added by engaging their consumers in the customisation process (e.g. experience value) by using an automated approach such as individualisation (i.e. removing the designer as a mediator within the process).

Finally, C#2 explained that to exploit the benefits of such an offering better (i.e. uniqueness with speed), a 3D printer capable of producing a satisfactory plastic model in 15 minutes would be necessary.

A consultant from C#4 explained that the "hype" to customise intensively will dissipate over time. The novelty factor of customisation possibilities persuades consumers to try new things. However, he continues, consumers become tired of spending time with software that allows them to select numerous features (and potentially overwhelms them with choices). Consumers would instead value opportunities to obtain 'the unique' with less effort. This, he explains,

would be particularly the case for consumers with strong buying power. The respondent suggested that consumers with strong buying power often find the process of product customisation “dirty” (i.e. not worthy of their time), and are inclined to delegate the task to someone else, paying for such services. This could explain why respondents from C#2 and C#3 (specialising in high-value consumer products) do not consider ‘experience’ a value-adding feature for their customers, who would not find it engaging.

#### ***4.2.1.1. Lessons learned from Pilot #1***

Pilot #1 served its purpose by offering a formative experience and the first tranche of data to learn from, as well as the basis from which new questions could be developed.

To summarise the findings, in the eyes of the interviewed entrepreneurs, individualisation could:

- be perceived by consumers as an avenue to achieve customisation with little effort (physical or intellectual)
- be attractive to consumers who are not willing to invest time in the customisation process
- benefit companies looking for faster and less labour-intensive customisation processes, compared to traditional processes
- be unattractive for consumers who engage in more hands-on (less automated) processes
- be impractical for some industries as current rapid manufacturing technologies are not efficient enough to produce satisfactory results

#### ***4.2.1.2. Limitations***

Fifteen designers, entrepreneurs and company managers were contacted via email but only five interviews were possible. A higher number of interviews with entrepreneurs and shop managers of relevant and diverse sectors would have been beneficial, as they would have strengthened this pilot study.

#### ***4.2.1.3. Implications for subsequent studies***

Responses obtained as part of this pilot suggested that interviewing customers from those (or similar) companies was necessary, ideally aiming for a higher number of respondents in order to establish stronger findings. This was achieved in pilot #2.

#### 4.2.2. Summary of Pilot #2

The figurines that C#1 sells come in pieces. Customers have the chance to interchange parts from one figurine to another and paint them as they please, achieving customised results. For pilot #2, nine customers were interviewed to find out what they value the most as consumers of C#1's products and what they thought individualisation could offer them.

As the store managers from C#1 had anticipated during pilot #1, their customers reported that they valued and enjoyed the manual craft and 'DIY'. Cutting the figurines out from the sprues (the frames onto which the parts of the disassembled figurines are attached) and customising them often generated a degree of emotional bonding with their final pieces. The following quotes illustrate this:

- "It's a hobby, it's an escape, so I wouldn't want someone to have done..." "For me, I would still want to do everything myself" (Participant C, circa 14 years' experience customising figurines)
- "I like having unique, different and personal [pieces and] I like to make the call on what makes it unique and different" (Participant F, circa 30 years' practicing the hobby)

The respondents explained both the manual craft and the game often take place within the shop premises (which offers its customers the relevant space facilities) meaning the hobby has a social aspect too. Asked about the key values of engaging on this activity, two respondents matched the opinions of the C#1 store managers during pilot #1:

- "Maybe the social element really. Because I get to come out to a shop and meet and talk to random people I have never met before and stuff like that, some wonderful people like that guy over there [laughs]". "It gets me out and about, doing stuff" (Participant H, less than four weeks' experience customising figurines).

Asked about what they could see as advantages of using an individualisation method, responses were divided in finding benefits and disadvantages, as can be seen in Table 4.3, page 111 (see the first four themes). The following quotes illustrate this:

- “It would simplify making the uniqueness of something and I suppose in some way it would take out some of the fun element... but... there is the question of the fun...” (Participant B, circa 30 years’ experience)

- “The physical part of actually doing it and seeing the pieces in front of you, I think is that, that I would miss.” “I think I probably prefer that more than actually playing the game” (Participant E, circa 20 years’ experience)

One long-standing customer, however, declared:

- “It would certainly be very useful for the hobby in general” and “I have lots [of figurines] that need painting and I hate painting them!” Finally, he added: “First, the most important thing is the game” leaving the craft on a second plane.

Participant H, who identified himself as a ‘new’ customer with less than four weeks’ experience customising figurines, argued that whilst he did enjoy building and painting the figurines, he “would definitely like to personalise it or maybe randomise it and pick one of my favourite versions of it”. Again, this aligns with what respondents from C#1 suggested during pilot #1 (new customers might value a less labour-intensive process).

Table 4.3 shows the data collected from pilot #2 divided by the themes identified during the interviews.

Themes identified	Less than 5 years into the hobby	More than 5 years into the hobby	Totals
Interest in trying individualised sprues	H	D E I	4
No interest in individualised sprues		C F	2
Eliminates frustration when customising	G	A B F I	5
Sees disadvantages: Removes the hand labour	H	B C E F	5
<b>Below: What do they value from the hobby as is today?</b>			
Hand labour	G H	A B C E F I	8
Collecting different pieces		B	1
The game itself		D F	2
Social aspect	H	D	2

Table 4.3. Participants’ responses grouped by themes.

#### **4.2.2.1. Lessons learned from Pilot #2**

Pilot #2 served its purpose: it was quickly carried out, contributed to the design of interview questions for subsequent iterations and provided a valuable insight into possible responses that might be expected at a later stage, during the study.

The findings from pilot #2, in summary, indicate that consumers of C#1's products suggest individualisation could:

- be attractive for new consumers-hobbyists to achieve customisation through a less labour-demanding alternative (aligning to suggestions by store managers during pilot #1)
- be an interesting method to try (although not as a definitive alternative over current practices)
- take the fun out of the hobby
- eliminate frustrations when customising
- hinder the social value of meeting up to customise the figurines (as consumers would not go to the shop premises to customise pieces collectively)

#### **4.2.2.2. Limitations**

Short interviews like these from pilot #2 would have been beneficial with consumers from C#2 and C#3. The very particular features of those customers (and the fact that they do not normally gather in a shop as with C#1) made it impossible to materialise interviews with them. In addition, pilot #2 could have benefitted from testing individualised sprues (e.g. 3D printing disassembled figurines). Timeframe, logistics and budget limitations did not allow a deeper investigation during pilot #2. However, it was important for pilot #2 to yield results in a short period of time, which made the development of pilot #3 possible.

#### **4.2.2.3. Implications for subsequent studies**

With pilots #1 and #2, it could be argued that individualisation is not alien to features that characterise customisation and personalisation methods (defined under Terminology in the Literature Review chapter, pages 20 and 21) in order to generate a product with an emotional bond. For example, perception of choice, a reduced time investment for the consumer and the stimulation of engagement with the process, (e.g. making it a memorable experience with physical and intellectual activities). Pilot #3 proposes customisation exercises where a number of volunteers engage physically and intellectually, while conducting an interview.



### 4.2.3. Summary of Pilot #3

Pilot #3 recruited nine volunteers from within De Montfort University (staff and students) to be interviewed. Participants were invited to interact with three exercises to customise or individualise products (Terminology, page 20), using either a computer-based toolkit or a hands-on approach, i.e. physically manipulating the products. Pilot #3 served as a platform to design and test the research methods to be used in the study.

Sampling factors such as age and gender were considered when working on pilot #3 as explained in the Methodology chapter (see page 72). Table 4.4 presents the participants of pilot #3.

Participant number & code	Occupation	Age/Gender	Completed exercises
1 – P3P1	Research student at Health & Life Sciences	30 / Male	1, 2, 3
2 – P3P2	Learning designer	30 / Female	1, 2, 3
3 – P3P3	Design lecturer	35 / Male	Incomplete
4 – P3P4	Research assistant in architecture	26 / Male	1, 2, 3
5 – P3P5	Research student in Business & Law	28 / Female	1, 2, 3
6 – P3P6	Research student in heritage architecture	33 / Male	1, 2, 3
7 – P3P7	Researcher in engineering	41 / Female	1, 2, 3
8 – P3P8	Research student in engineering	39 / Female	Incomplete
9 – P3P9	Research student in computer sciences	25 / Male	1, 2, 3

Table 4.4. Participants of pilot #3

The type of product participants considered for individualisation was characterised as inexpensive consumer item (e.g.: a phone cover, a t-shirt) and not a high value consumer product, such as jewellery. Others interpreted individualisation as a form of art (rather than design) and said they would use it for decorating long lasting belongings, such as fine cutlery or home ornaments.

Franke & Schreier (2008) suggest that consumer satisfaction is derived from the perceived uniqueness of the self-designed product. Expectations from participant three (with background in art and design) exceeded the possibilities of the exercises' toolkits and his frustration increased throughout the exercises to a point of non-completion. Therefore, responses by that volunteer were discarded. Language barriers with participant eight meant some responses were incomplete, hence was discarded too. Later, these experiences helped designing the sampling criteria for subsequent studies. A total of seven full interviews were used to analyse pilot #3.

#### 4.2.3.1. Pilot #3 – Exercise One

The exercise required the participant to choose a piece of jewellery (the Icon pendants designed by Dr Lionel Dean, see Figure 3.11-a, Figure 3.11-b, Figure 3.11-c, same as in page 84, chapter 3) from three different possible choices:

- 1- a 'standard' pendant design already made, representing a mass manufactured product, as shown in Figure 3.11-a, below.
- 2- an individualised pendant design already manufactured, chosen from ten available variants in a box, as shown in Figure 3.11-b (below, centre), (time spent choosing was noted).
- 3- an individualised pendant design created by a toolkit on a computer screen. The toolkit showed a different Icon pendant design on a screen every time the spacebar was pressed. A screenshot of the toolkit is shown in Figure 3.11-c (below, right).

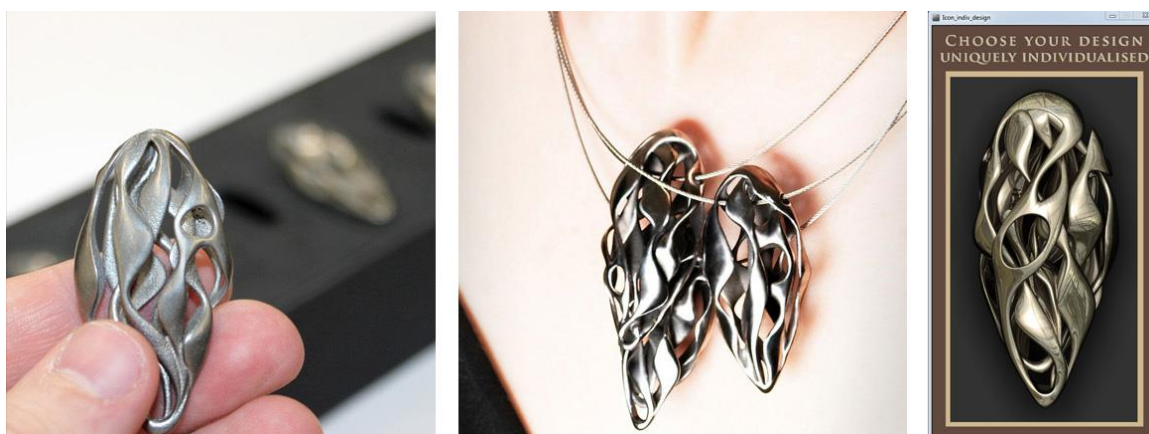


Figure 3.11-a (left) A 'standard' Icon pendant used for choice 1. Figure 3.11-b. (centre) Features examples used for choice 2. Figure 3.11-c. (right) Screenshot of the toolkit in operation for choice 3. (all three figures from the previous chapter).

For choice three, the physically finished individualised product could not be made available, which represented a limitation.

#### 4.2.3.2. Pilot #3 – Exercise One – Results

Figure 4.4, shows the results from the Likert scales used when collecting data from seven participants. They were asked to rank the three statements indicated in the figure from 1 to 5, 1 being "strongly disagree" and 5 "strongly agree". Each coloured square represents the answer of one respondent.

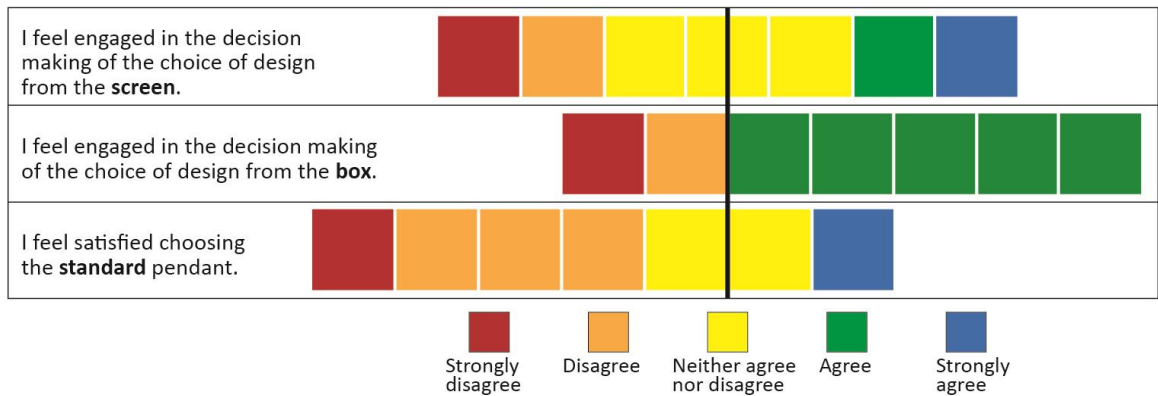


Figure 4.4. Seven respondents completed the Likert scale questions for exercise 1.

Results showed preference for an individualised pendant from a box as in choice 2, above. The limited scope of ten designs was preferred by five respondents (in green colour in Figure 4.4). It was perceived as more ‘controllable’ than the ‘infinite’ choices on screen, allowing the opportunity to compare between a defined set of offerings. Participants appeared more comfortable using the box, feeling they had picked the absolute ‘best’ possible item as opposed to picking one they liked without knowing if the toolkit was able to produce something they could have liked more. The physical feedback was also interpreted as a key factor for that preference. Five participants valued the toolkit ‘in principle’ for the opportunity of choice, but too much choice seemed to have been a determinant mass confusion factor. Indeed, only two participants effectively choose a pendant from choice 3 (the on screen toolkit). Meanwhile, the standard pendant of choice 1 had four ‘disagrees’ (oranges and reds in the figure) and two “Neither/nor” (and only one “Strongly disagree”). The value perceived from having a unique design was mentioned by one participant.

A toolkit that produced ‘infinite’ number of designs in choice 3, generated the perception of mass confusion (see Terminology, page 26), with a sense of ‘risk’ given by the perceived randomness of the designs, as well as the impossibility to revisit and compare previous choices. This is reflected on the Likert scales under “I feel engaged in the decision making of the choice of design from the screen”, where responses seem to spread with no clear agreement or disagreement. It is important to note that the toolkit actually produced a fixed number of results although the participants were told it was infinite, which could indicate the toolkit worked successfully giving the impression of spontaneous design generation.

Also, the preferred choice 2 benefitted from a physical interface (sensory feedback with ready-manufactured pendant confirmed the report by Gyi et al. 2009).

#### 4.2.3.3. Pilot #3 – Exercise Two

Exercise two worked with the same ‘standard’ Icon pendant shown earlier (as in Figure 3.12-a, Figure 3.12-b and Figure 3.12-c, page 85 in the previous chapter). In this case the exercise offered to place a coloured stone over the pendant, comparing the engagement experience of customisation against individualisation processes. The exercise had three choices (all toolkits-based):

- 1- a ‘standard’ stone setting with a green stone on the centre-left (see Figure 3.12-a)
- 2- using an individualisation toolkit: six different stones colours in 20 pre-established positions arranged by the toolkit’s algorithm every time the spacebar was pressed (Figure 3.12-b, below, shows a screenshot of the toolkit). The number of times the spacebar was pressed was noted.
- 3- using a customisation toolkit: participants picked a stone and placed it over the pendant (from six available colours and 20 pre-established positions). Time spent customising was measured (Figure 3.12-c).

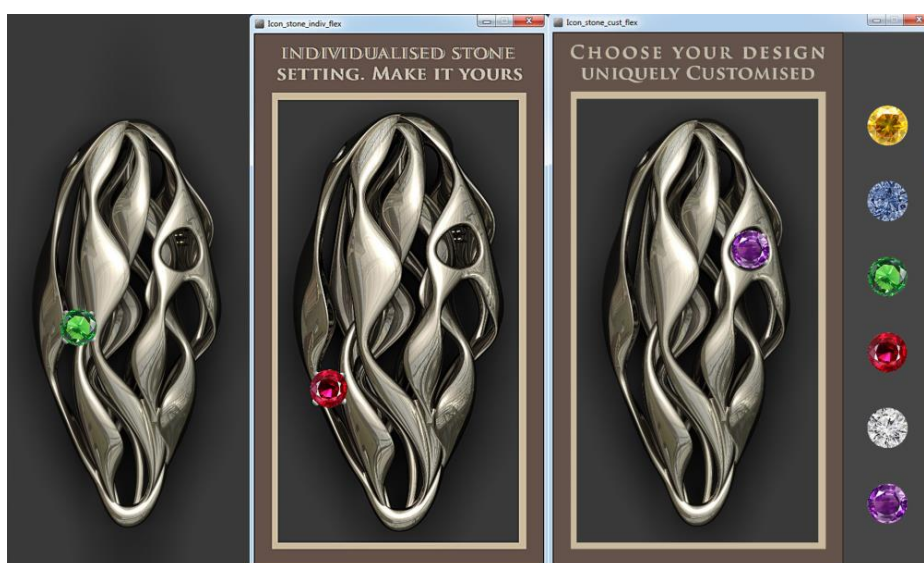


Figure 3.12-a (left) Screenshot of ‘standard’ stone setting. Figure 3.12-b (centre) Individualisation toolkit. Figure 3.12-c (right) Customisation toolkit. (all three figures from the previous chapter).

#### 4.2.3.4. Pilot #3 – Exercise Two – Results

Female participants spent longer than males using the toolkits, one of them producing 134 individualised results, and another one spending three minutes customising until satisfied. Males produced a maximum of 29 iterations and spent a maximum of 65 seconds customising.

Figure 4.5 shows results from data collected through Likert scales from seven participants. Volunteers were asked to rank the three statements indicated in the figure from 1 to 5, 1 being “strongly disagree” and 5 “strongly agree”. Each coloured square represents the answer of one respondent.

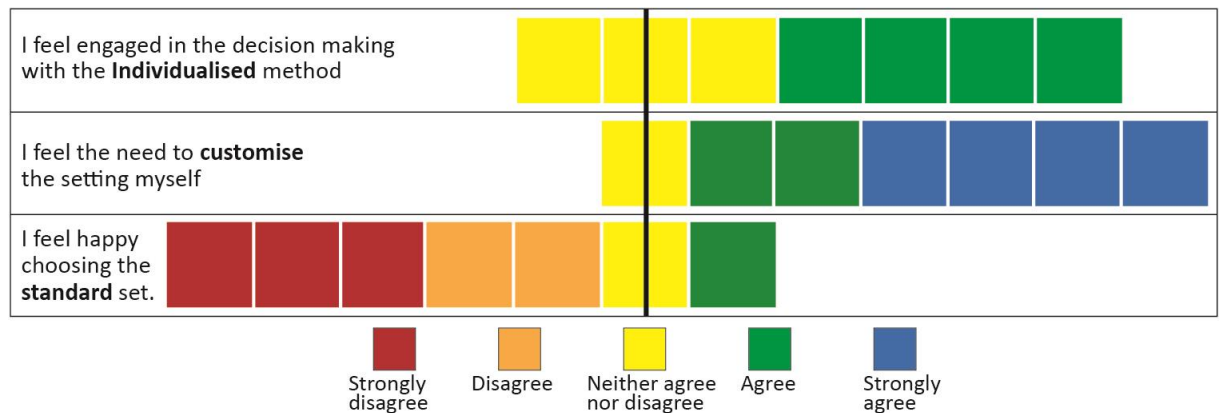


Figure 4.5. Likert scales results from seven respondents for pilot #3, exercise 2.

Whilst the individualisation method offered through choice 2 (see the three choices described in section 4.2.3.3, page 116) was not rejected, results show that participants preferred customisation over individualisation, as the former allowed the participants to do what they wanted: “It is just a matter of placing [the stone] there” (P3P9) and “I don’t have to wait [for] the algorithm to do what I want” (P3P6). Six out of seven responses agreed with the assertion “I feel the need to customise the setting myself” (the remaining one was neutral). Participant 8 however, liked the product she customised but expressed being overwhelmed by choice in the process, finding individualisation a more “pleasant experience”.

Option one (the standard stone setting design) was prepared by a designer who controlled colour and visual balance. The statement “I feel happy choosing the standard set”, had 5 ‘disagree’ responses (three of which “strongly disagreed”). However, participants 4 and 5 preferred the standard option because that particular design was attractive or because it was closer to their ideal. In particular, P3P4 explained that if what he wanted was not 100% achievable, he would rather take the standard and not pay for any customisation process. P3P6 did not report added value from uniqueness as a result of a customised design: “If you are offering a ‘cheap-run-off-the-mill’ version which has the same materials [as a customised] and you are offering a customisable one, you are devaluing the customisable one”.

No signs of mass confusion were identified during this exercise (apart from the experience by P3P8) as the options seemed ‘more quantifiable’ than in exercise 1 (the range of possible

choices was better perceived). Participants were aware of the possible colours and approximate positions of the stones and some could rapidly imagine a preferred outcome. Customising the product without waiting for an algorithm to do it was perceived as more favourable.

#### 4.2.3.5. Pilot #3 – Exercise Three

Exercise three offered participants the opportunity to customise and individualise a t-shirt with a coloured pattern design, using three possible methods:

1- an individualisation toolkit

2- a customisation toolkit

3- a dice as a source of data input (replacing the toolkit's algorithm). This pattern was then painted over a real t-shirt, applying paint with syringes.

The exercise was designed to observe the different engagement experiences with either customisation method and a possible resulting emotional attachment to the t-shirt (participants were allowed to keep the t-shirt). Options one and two worked with toolkits similar to options two and three from exercise two (above). The number of times the spacebar was pressed was noted and the time spent customising was measured. Figure 3.13 (as in page 86) shows a screenshot of the toolkit.



Figure 3.13 (from the previous chapter). Screenshot of the toolkit to create a t-shirt. The toolkit featured 36 possible paintable areas over the t-shirt on a grid of six by six. (Number of times spacebar was pressed was noted and time customising was measured).

For this exercise, participants were allowed to use the individualisation toolkit any number of times until they found a design they liked (i.e. closing the software and re-opening it again as required). Figure 4.6 shows two resulting t-shirts from pilot #3.



Figure 4.6. Two t-shirts from pilot #3

#### 4.2.3.6. Pilot #3 – Exercise Three – Results

Results from the individualisation toolkit do not show substantial differences between males and females, producing similar number of iterations. Participants showed enthusiasm for the end result, were keen to see how the colours combined and mixed on the fabric and tried different techniques when pressing the syringes with paint.

Two participants showed signs of frustration (exhaling heavily, nodding and verbal cues) as the toolkit didn't produce the results they wished.

During Exercise 3, the digital individualisation and customisation experiences were compared first, with the latter reportedly being the most engaging and valuable, as shown in the Likert scale result in Figure 4.7. Similar to Exercise 2, participants declared that having a direct input (i.e. selecting what they wanted) was more valuable as it allowed them to secure their desired result.

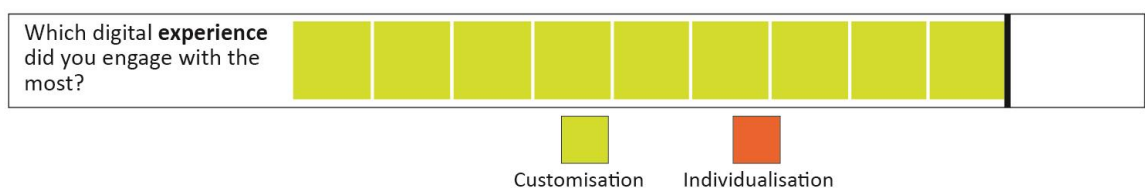


Figure 4.7. All seven participants said they engaged more with the customisation toolkit than the individualisation one.

One participant expressed that if there had been an actual t-shirt printed as a result of the screen exercise, the customisation toolkit would have been more engaging. However, the individualisation process was more 'enjoyable' as it could offer an alternative route to achieve acceptable results with less intellectual effort.

Then, the analogue individualisation experience (choice 3, i.e. the hands-on process) was compared with the digital customisation experience (i.e. on screen), which all participants reported as the most engaging so far. All respondents found the analogue individualisation experience more engaging and fun than customising on screen (and therefore than the digital individualisation too) even though using the individualisation process did not allow them choose the colours to make the t-shirt.

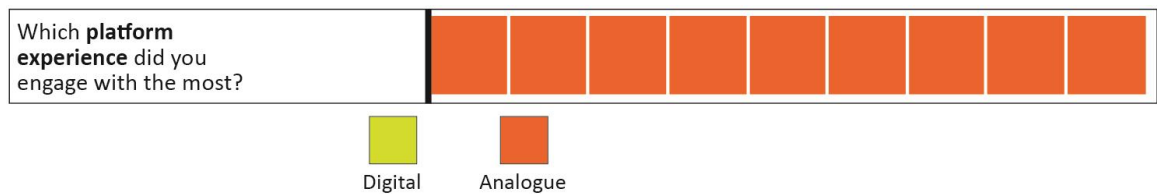


Figure 4.8. All seven participants reported more engagement with the hands-on individualisation experience than the customisation toolkit.

Only one participant pointed out that whilst she found the hands-on experience (of the analogue individualisation) was more engaging and fun, the digital customisation toolkit had more value, as it would allow her produce the t-shirt she really wants.

Figure 4.9 shows the results from the Likert scales from exercise 3. Participants using individualisation toolkits (which allowed little participation) reported lower engagement with the process than using a customisation one. However, an individualisation process that required both an intellectual *and* physical interaction (generating a “fun” experience), triggered emotions and engagement with the process, reportedly adding value to the final product (supporting Mugge et al. 2009). Analogue individualisation in exercise 3 (despite restricting consumer input as they followed instructions given by rolling the dice), stimulated physical and intellectual participation: how participants pressed the syringes resulted in different printed patterns. Each coloured square represents the answer of one respondent.



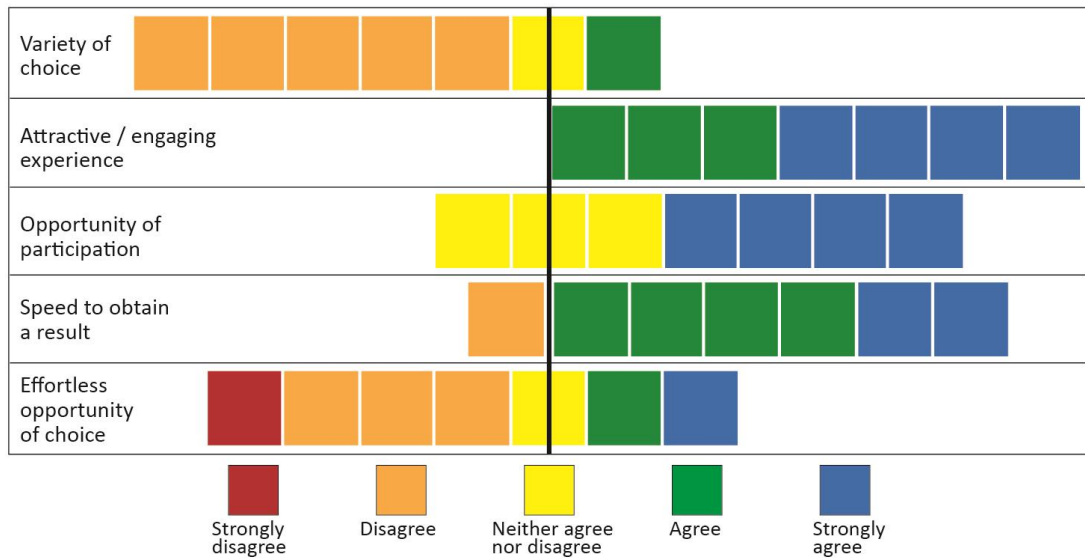


Figure 4.9. Likert scales results from seven respondents in exercise 3.

Participants felt the process was an attractive and engaging one, which offered them an opportunity for participation and speed to obtain a result, even though choice was limited through individualisation (nearly all respondents said “Disagree” when asked if individualisation offered “Variety of choice”, as shown in Figure 4.9). Most participants felt they had to make some effort to achieve a finished t-shirt.

#### 4.2.3.7. Lessons learned from Pilot #3

All three pilots and exercises contributed towards the design of the instruments used in Pilot #4. For example, expectations from one volunteer during pilot #3 (with a background in art and design) exceeded the possibilities of the toolkits and his frustration increased throughout the exercises to the point of non-completion. Therefore, responses by that volunteer were discarded and further sampling adjustments would be required. Such behaviour showed the first indication from the interviews that participants with a background in art and design could offer different answers to other respondents, aligning to findings suggested during pilot #2 (see item 4.2.2.1 in Lessons learned from pilot #2, page 112). Also, the rationale behind the toolkit design, effectively generated the perception that the software was designing unique pieces every time, avoiding “choice paralysis”.

The use of Likert scales to collect quantitative data served its purpose as it helped in understanding the participants’ behaviour.

Finally, using a t-shirt as the vehicle to run exercise 3, seemed to encourage more risk-taking by the participants at the moment of applying the paint and more engagement with the

process, offering rich and deep data. The t-shirt worked effectively as a material 'motivator' to attract participants, whilst using it as the 'vehicle' to run the experiments.

#### **4.2.3.8. Limitations**

Each interview during pilot #3 required over 50 minutes to complete. This often represented an inconvenience to participants' personal schedules and potentially affected the results of the last exercise, when participants started to feel tired.

Whilst a low number of respondents did not allow for generalisable findings, it did prompt the revision of instruments and interview design to progress to the next round of pilots.

#### **4.2.3.9. Implications for subsequent studies**

The sampling criteria required refinements to align it with the exercises proposed. Such refinement meant better responses were obtained in subsequent studies and therefore resources were better used during sampling, interviewing and data analysis. The revised sampling criteria is briefly explained in pilot #4, next (see also the "Sample" section in the Methodology chapter, page 72, for more details). Likewise, the exercises required changes in order to maximise participants' time during the interview. Interviews in pilot #4 required between 30 and 35 minutes to complete, which helped to persuade more participants to take part.

#### **4.2.4. Summary of Pilot #4**

Pilot #4 initially consisted of three exercises (see Methodology chapter page 87), similar to those in pilot #3, designed to compare the relationship between engagement in the process of customisation and individualisation and a possible resulting emotional attachment to a proposed product.

Exercises #1 and #2 were still limited as the finished product was not available for the interview, meaning that the exercises were conducted on-screen only. Responses were mostly similar to those in exercise #3, with the exception that the latter generated noticeable interest in the participants, producing richer data. Upon consultation, exercises two and, later, exercise one were discarded, due to the continuous process of refining the focus of this study, making the interview session shorter, concentrating on the richest and most useful data from exercise three.

Nineteen participants were recruited for pilot #4 as described in Table 4.5. Responses from one participant were discarded as the interview was incomplete, making a total of 18

completed interviews, divided into two sample groups (for additional details, see pages 75 and 76 in the Methodology chapter):

**Group Active Consumers (AC)** – Individuals who express an interest in art or design activities, by profession, study, hobby or keen interest and who are interested in receiving a customised t-shirt in white fabric.

**Group Passive Consumers (PC)** – Individuals with no particular interest in art or design activities and who are interested in getting a customised t-shirt in white fabric.

Participant number	Occupation	Profile	Completed exercises
1	Research student at health & life sciences	PC	1, 2, 3
2	Research student in architecture	AC	1, 2, 3
3	Student in marketing	PC	1, 2, 3
4	Student in marketing	PC	1, 2, 3
5	Research student in architecture	AC	1, 2, 3
6	Student in marketing	-	Incomplete
7	Research student in design	AC	1, 2, 3
8	Research student in digital design	AC	1, 2, 3
9	Research student in design	AC	1, 2, 3
10	Student in media production	AC	1, 2, 3
11	Research student in business and law	AC	1, 2, 3
12	Research student in business and law	PC	1, 2, 3
13	Design entrepreneur	AC	1, 3
14	MA student in design management	AC	1, 3
15	MSc student in technology	AC	1, 3
16	Employed, waitress	AC	1, 3
17	Student in design management	AC	1, 3
18	MA student in interior design	AC	1, 3
19	MA student in design management	AC	1, 3

Table 4.5. Breakdown of participants in pilot #4. 14 AC and four PC.

The exercise asked participants to create four design patterns for the t-shirt:

1- using an individualisation toolkit

2- using a customisation toolkit

3- using a dice as a source of data input; this pattern would then be painted on the front of a t-shirt

4- customising the back of the same t-shirt used in point 3, also painting it with syringes.

Both groups of participants (AC and PC) experienced the individualisation process using a dice. Both groups averaged a similar amount of time using the toolkit, between 1 and 1.5 minutes. They also averaged a similar number of attempts using the toolkit, between 3.5 and 5 attempts.

Participants were asked about their experience with the individualisation process by giving a value between 1 and 5 to five statements about what the process offered them, 1 being “Strongly disagree” and 5 “Strongly agree”. These statements are explained in Table 4.6.

“Individualisation offers me...”	Meaning
...variety of choice”	The perception of a diverse range of offerings
...an engaging experience”	An activity that captures the participant’s interest.
...opportunity to participate”	The chance to have an active role in the design process
...speed to obtain a result”	The chance to achieve a customised product easily and quickly.
...effortless opportunity of choice” (or with little effort)	A small amount of physical and intellectual work required to achieve variety of choices

Table 4.6. The phrases used on the left and their meaning to the right.

Figure 4.10 illustrates participants’ responses to the phrases, separated by group (AC, PC).

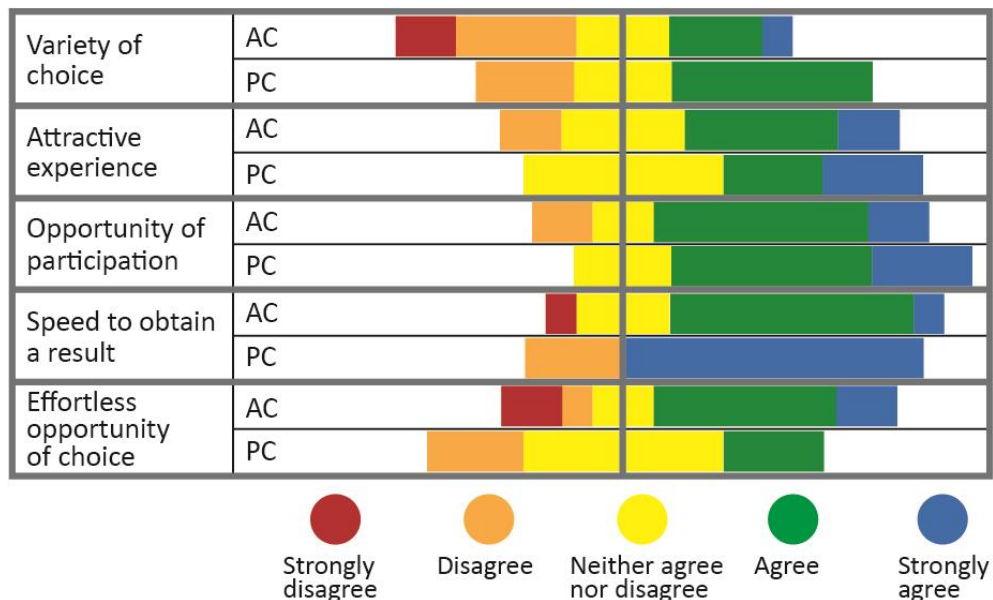


Figure 4.10. Results of Likert scales from pilot #4, with 14 AC and 4 PC. The size of the bars are built so that cohorts can be compared.

The AC (active consumer: individuals who express an interest in art or design activities, by profession, study, hobby, keen interest or self-identify as designers or artists, see pages 75 to

76) group did not generally feel comfortable with the individualisation process and signs of frustration were more frequently noticed than with PC (passive consumers: individuals with no particular interest in art or design activities and do not self-identify as artists or designers) group. Responses of “Strongly disagree” were only registered with group AC on ‘Variety of choices’, ‘Speed to obtain a result’ and ‘Effortless opportunity of choice’. A semi-automated algorithm affected their perception of ‘Variety of choice’ and some ACs added comments such as:

- “Freedom is taken away from me” (P4P13)
- “I’m just told what to do” (P4P19)
- “Too much risk involved” (P4P19)
- “It is so random, I have no input. Someone might as well give me any old t-shirt” (P4P16)
- [the individualised t-shirt] “Didn’t feel my own” (P4P10)
- “I should be given a free hand and not be restricted by the dice or computer” (P4P15).

The profile described for group AC suggests their ability to take emphatic decisions when engaged in art/design activities without having to wait for an algorithm to do the work for them. It could be argued it was for that reason that “Speed to obtain a result” also scored “strongly disagree” responses, illustrated by the following answers:

- “Uncertainty takes longer to make a decision [sic]” (P4P11)
- “Individualisation takes time” (P4P7) and (P4P11)

Some ACs responded following the expected behaviour, saying that individualisation would only be useful for someone how does not have a clear idea of what he or she wants. Illustrative quotations are:

- [Individualisation] “Is good if you had no idea and want to try something new” (P4P17)

- "If I had nothing in my mind, pre-set" (P4P19)

'Effortless opportunity of choice' registered a portion of each response, where ACs recognised the benefits of a system that does the job for them, whilst others perceived it as an obstacle to arrive at a result. Some verbal cues were recurrent expressions of frustration, captured during the use of the toolkit and painting the t-shirt, such as:

- "Arrgh! C'mon!" (P4P15)

- "That's mean!" (P4P13)

The signs of frustration illustrated with all the quotes above could be interpreted as the experience not meeting their expectations: participants were invited to create a t-shirt, without an explanation of how this would actually happen.

There were, however, eight ACs showing signs of approval while painting the t-shirt, as they found an opportunity to have some degree of input, such as "Is so fun!" (P4P13). There were also positive comments related to the element of chance involved, where some ACs enjoyed using a dice, some even rolled them twice and one justified the final design saying "It's my luck" (P4P5).

Responses from one AC participant suggested possible differences within the AC group. Whilst most criticised the lack of freedom, she praised the limitations:

- "Sometimes it is good that you have limitations" and "I don't like too many choices" (P4P18)

The size of the bars for each cohort in Figure 4.10 (page 124, above), is scaled in order to make them comparable. Group PC had 4 participants in this pilot. PCs perceived the individualisation process as a much faster route to achieve a result than ACs did. Also, PCs reported relief in delegating decisions to the software in exchange for the opportunity to enjoy the process, for example:

- [the] "Random may lose the stress in choosing" (P4P4)

- "It takes away the worry of getting a bad design" (P4P12)

- “Not having the total choice of colours adds a bit of mystery. I kind of like that” (P4P14)

The profile described for group PC suggests their inexperience in artistic/design activities. This might explain why they perceive a semi-automated process as a faster route to achieve customised goods and a ‘safer’ approach too (they delegate difficult decisions to the toolkit). For example, participant 14 expressed herself in favour of the individualised design as opposed to the customised side of the t-shirt: “The decision making spoiled the experience”.

In spite of the lack of control, PCs still identified themselves as authors of the final piece and some felt a sense of achievement and pride:

- “It is still unique because I pressed the buttons” and “It does give me freedom” (P4P12).

- “Is customised because I rolled the dice” and “Is made with love” (P4P14).

The data collected from pilot #4 confirmed the importance and benefit of separating the cohort into the two aforementioned groups. This separation helps to visualise characteristics of each type of consumer as they face a process of individualisation. It also helps by making each group work as ‘control group’ for the other.

The analysis of the data from pilot #4, helped to build a tentative set of codes in anticipation of the data analysis for the study, as shown in Table 4.7.

Engagement with the process	Attachment to the product
<ul style="list-style-type: none"> <li>-Random process</li> <li>-Process is too risky</li> <li>-Fun experience</li> <li>-Chance and luck</li> <li>-Lack of freedom</li> <li>-Too much freedom</li> <li>-Frustration</li> <li>-Mass confusion</li> <li>-Fear of indecisiveness</li> <li>-Lack of skill</li> <li>-Time investment</li> <li>-Too much decision making</li> <li>-Too little decision making</li> </ul>	<ul style="list-style-type: none"> <li>-Uniqueness</li> <li>-Memories</li> <li>-Ownership</li> <li>-Sense of achievement</li> <li>-Reaction after painting the t-shirt</li> <li>-Comparing the t-shirt with the ‘standard’ alternative</li> <li>-Interest in getting the t-shirt</li> </ul>

Table 4.7. Codes extracted from analysing pilot #4

The emerging codes were grouped in two areas of relevance for this research: engagement with the process and attachment to the product (or perception thereof). The latter includes

participants' attitude towards receiving their t-shirts once the paint dried up overnight (which implied participants had to contact the researcher again to either pick up t-shirt or ask for it to be delivered).

#### ***4.2.4.1. Lessons learned from Pilot #4***

Pilot #4 made it possible to test the new sampling criteria, which seemed appropriate for its application in the subsequent study. It evidenced important differences between cohorts. The reduction of time required to complete an interview was also beneficial, not only to avoid any inconvenience for participants, but also to concentrate on the most usable data for subsequent analysis.

#### ***4.2.4.2. Limitations***

The t-shirt exercise as implemented in pilot #4 compared the relationship between engagement in the process of customisation and individualisation, and a possible resulting emotional attachment to a proposed product. Upon consideration, it was understood that data from pilot #4 only partially and tentatively responded to the research questions (particularly question 2: "Is this value and emotional attachment dependent on the **level** of engagement in the individualisation process?"). The comparison between customisation and individualisation would only offer a partial response.

#### ***4.2.4.3. Implications for subsequent studies***

A comparison between different **levels** of individualisation processes would offer more comprehensive responses to the research questions. The exercises for the study (below) were adjusted accordingly.

The proposed design of the painted t-shirts seemed 'unusual' (particularly for PCs) with painted marks anywhere on the fabric and received conflicting opinions. A more 'streamlined' or 'conventional' design could help the research design to collect better quality of data by making the participants concentrate on evaluating the experience. For example, printing the pattern in only one area on the t-shirt. The first stage of the study addressed these observations.



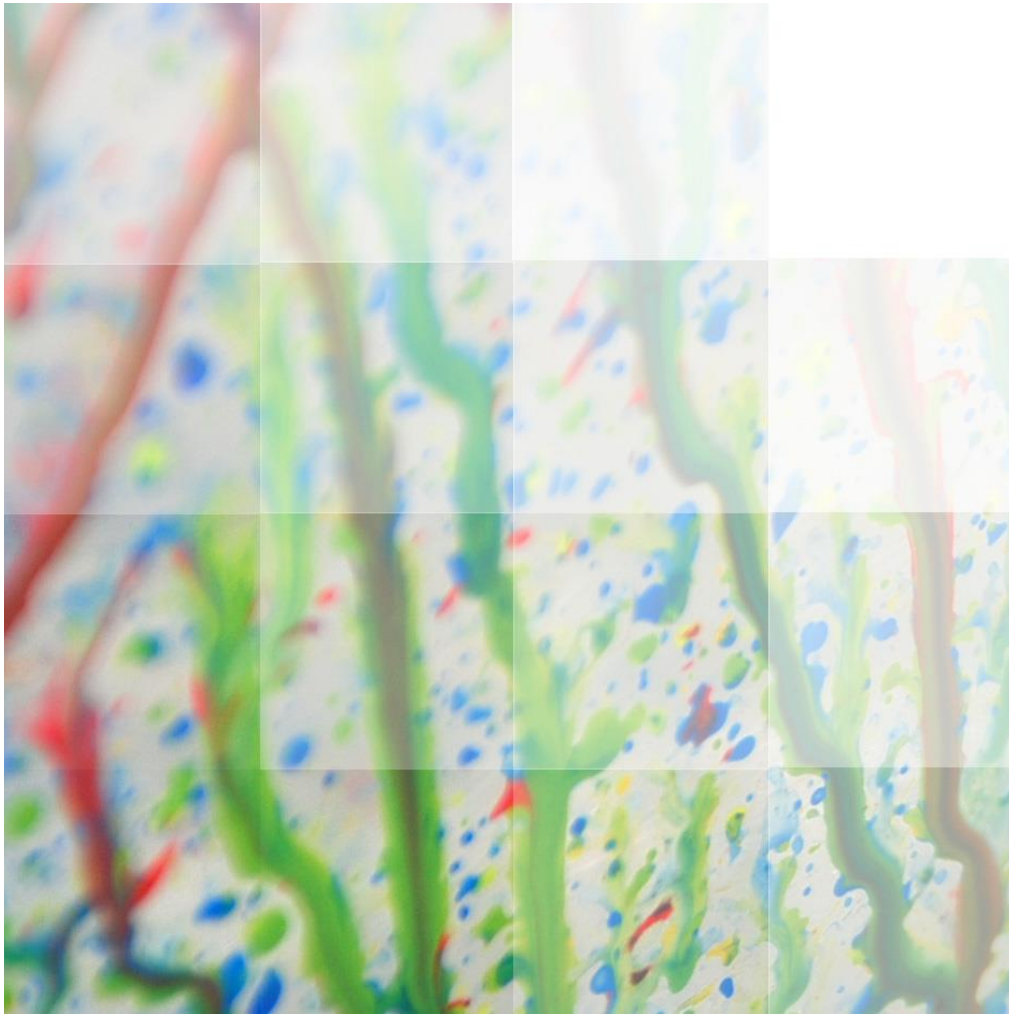
## 4.3. CHAPTER SUMMARY

This chapter presented the analysis of the data collected during the four pilot iterations. Each pilot presented sub-sections describing lessons learned, limitations and implications. Table 4.8 presents a summary of those key findings and limitations of each pilot, as well as implications for the subsequent study.

	Key findings	Limitations	Implications for the next phase of the research
Pilot #1	Individualisation could attract consumers looking for effortless results. Unattractive for consumers who engage in more 'hands-on' customisation processes.	Only five interviews were made possible.	Higher number of respondents would be necessary in order to establish stronger findings. Respondent numbers easier to achieve if approached directly.
Pilot #2	Individualisation could be attractive to consumers depending on their willingness to be involved in the process. Guidelines of interview design for the study.	Similar interviews not possible with customers of high-value consumer products (e.g. jewellery). Individualised sprues to replicate the consumer experience, not possible due to time, logistic and budget limitations.	Interview exercises must show opportunity of choice, speed and stimulate engagement with the process, (e.g. making it a memorable experience with physical and intellectual activities).
Pilot #3	Respondents with interests in art and design could offer different answers to those with other interests. T-shirts were effective material 'motivators' triggering rich data and do not have gender or age-specific style or features. Toolkit design avoided "choice paralysis" but required improvement. Exercise design guidelines for the study.	Long interviews often represented an inconvenience to participants' personal schedules and potentially affected the results of the last exercise, when participants started to feel tired.	Sampling criteria refinement: relevant factors (occupation, hobbies). Redesigned exercises avoid duplicated data and are shorter to complete, helping to attract more participants. New structure to paint t-shirts.
Pilot #4	Differences emerged between cohorts, defined by new sampling criteria. Shorter interviews worked effectively and focused on the most usable data for analysis.	Exercises 1 and 2 produced similar responses to exercise 3. Comparing customisation and individualisation only offered a partial response to the research questions, so only part of the data was usable. The proposed design of the painted t-shirts received conflicting opinions.	A more 'streamlined' or 'conventional' t-shirt design with more variety of paint marks. Interview adjustments to compare different levels of individualisation processes for more comprehensive responses to the research questions

Table 4.8. Summary of the four pilots' key findings, limitations and implications for the subsequent main study.

The four iterations of pilots enabled the design, test and refinement of the methods and instruments used in the study. The next chapter will present the data analysis from the main study, conducted in two stages.



## **5. DATA ANALYSIS: MAIN STUDY**

## INTRODUCTION

This chapter presents the analysis of the data collected during the study through well trialled and tested instruments. The study was conducted in two stages. The first stage collected the largest and richest tranche of data, whilst the second stage verified and validated the findings from the first stage by re-running the exercises in a different setting.

The analysis of data from the first stage of the study is presented strictly by theme, each illustrated with quotes and field notes captured during the interviews. The data samples selected for this purpose are the ones that best illustrate the respective theme. The analysis therefore uses quotations that can be considered representative of the dataset under each of the themes. This chapter ends with a summary of the key findings, limitations and closing remarks.

## 5.1. RESULTS FROM THE STUDY

Benefitting from the 4 previous pilot stages, study stage #1 collected the first tranche of data through well trialled and tested instruments. Initial data patterns from the earlier phases suggested changes to the exercises (see study stage #1, page 91 in the Methodology chapter). For example, concentrating on one of the three exercises, as well as comparing and contrasting two levels or 'degrees of individualisation' against two types of consumers (Active Consumers: AC, and Passive Consumers: PC, see page 76), resulting in 4 groups or 'cohorts'. Study stage #2 had the intention of evaluating the results obtained from the stage #1 by re-running the study in a 'live' setting (as opposed to a 'lab' setting).

The thematic analysis section of the Methodology chapter (page 96) explained that this research uses theory-driven codes (codes inferred from existing literature) as well as data-driven ones (extracted from the collected data). The reason for using codes from existing literature was to understand better what constitutes a relevant code in the context of this study (for example from Ariadi et al. 2012 and Franke & Schreier, 2010) and therefore help to identify the data-driven ones.

### 5.1.1. Study stage# 1

Study #1 recruited 35 participants who matched either of the two criteria profiles (AC or PC), who were interviewed on a one-to-one basis within a controlled environment. Two interviews were discarded due to incomplete answers, bringing the total number of completed interviews to 33, 18 with ACs and 15 with PCs. Table 5.1 provides basic details about the participants who took part in study stage #1.

Participant number	Age	Gender	Occupation	Profile	Exercise
1	28	Female	Research student in health & life sciences	AC	A
2	38	Male	Administrative staff at De Montfort University	AC	Incomplete
3	27	Female	Research student in health & life sciences	PC	B
4	34	Female	Lecturer in health and life sciences	AC	A
5	22	Female	Research student in health & life sciences	PC	A
6	21	Male	Undergrad student in health and life sciences	AC	B
7	22	Female	Undergrad student in health and life sciences	PC	B
8	37	Female	Undergrad student in health and life sciences	PC	A
9	22	Male	Research student in health & life sciences	AC	B
10	35	Male	Lecturer in music and sound design	AC	A
11	37	Female	Research student in health & life sciences	PC	B
12	20	Female	Undergrad student in health and life sciences	AC	Incomplete
13	22	Male	Administrative staff at De Montfort University	PC	B
14	21	Male	Administrative staff at De Montfort University	AC	A
15	31	Female	Administrative staff at De Montfort University	AC	A
16	51	Female	Research assistant in health and life sciences	AC	B
17	30	Male	Research student in health & life sciences	PC	B
18	22	Female	Undergrad student in business and law	PC	B
19	40	Male	Lecturer in health and life sciences	AC	A
20	34	Male	Research student in health & life sciences	AC	A
21	25	Male	Undergrad student in health and life sciences	PC	B
22	38	Male	Research student in health & life sciences	PC	A
23	22	Female	Research student in health & life sciences	PC	A
24	28	Male	Research student in health & life sciences	PC	B
25	29	Male	Research student in health & life sciences	AC	B
26	23	Male	Research student in health & life sciences	AC	B
27	26	Female	Research student in health & life sciences	AC	B
28	21	Male	Research student in health & life sciences	PC	A
29	27	Female	Employed and film history student.	AC	A
30	28	Female	Masters student in museum studies	AC	B
31	31	Male	Research student in health & life sciences	PC	A
32	19	Female	Undergrad student in fine arts	AC	B
33	24	Female	Masters student in health & life sciences	PC	A
34	23	Female	Masters student in product design	AC	B
35	23	Male	Undergrad student in computer sciences	AC	B

Table 5.1. Breakdown of participants in study stage #1. 18 ACs and 15 PCs.

These thirty-three in-depth interviews with participants (17 female, 16 male; average age 28) each required between 30 to 45 minutes to complete. This was designed following the literature, both in relation to sample size (Griffin and Hauser, 1993, recommend 20 to 30 in-depth interviews) and length (Rowley, 2012, suggests 12 interviews of approximately 30 minutes). The recruited participants were evenly distributed across the four groups, as described in Table 5.2, below.

The study consisted of two versions of the t-shirt exercise, one more restrictive than the other. Exercise A allowed the participant to decide on two variables of the design: the number and size of the paint marks they wanted on the t-shirt, whilst colour and position of the marks was decided by the toolkit. Exercise B gave no decision power to the participant: it required the participant to roll a dice to determine the number of paint marks, whilst the size, colour and position of the paint marks were decided by the toolkit. Participants from both groups used one of the two exercises, making four sub groups:

	<b>Exercise A (less restrictive: participants decide the number and size of the paint marks)</b>	<b>Exercise B (more restrictive: a dice determines the number and size of the paint marks)</b>
<b>Active Consumers</b>	8 (ACA) (average age 32 - 4 males, 4 females)	10 (ACB) (average age 27 - 5 males, 5 females)
<b>Passive Consumers</b>	7 (PCA) (average age 28 - 3 males, 4 females)	8 (PCB) (average age 27 - 4 males, 4 females)

Table 5.2. Profile and number of participants on each exercise type.

Next, results from the quantitative and qualitative data sources are presented.

### 5.1.2. Study stage# 1 – Quantitative data sources – Results

In addition to the qualitative data, quantitative data was collected through five-point Likert scales. The quantitative data covered the two key areas of interest: engagement with the process and attachment to the product. Table 5.3 shows the statements used in conjunction with the five-point Likert scale.

Statements about Engagement	
“Individualisation offers me...	Meaning
...a fun experience”	An activity that is entertaining and enjoyable.
...an engaging experience”	An activity that captures the participant’s interest.
...opportunity of choice with little effort”	A small amount of physical and intellectual work required to achieve variety of choices.
...a product that makes me different from the crowd”	Perception of uniqueness (identified as valuable factor on product attachment studies).
...opportunity to participate”	The chance to have an active role on the process.
...speed to obtain a result”	The chance to achieve a customised product easily and quickly.
...variety of choice”	The perception of a diverse range of offerings.
...a product as I wanted it”	A process that facilitates a result as the customer envisioned it after using the computer toolkit.
Statements about Attachment	
Description	Meaning
I am satisfied with the design	Refers to accepting the resulting product as valuable.
I would wear this t-shirt	Assesses the intention to create a bond with the item.
I feel ownership over the t-shirt	Assesses their feeling of ‘possession’ (somewhat ‘identification’).
I designed it myself	Feeling the product is the result of one’s creative skills and decisions.
I feel in charge of the decision making	Feeling in command of how to design the product.
I would rather pay for a standard t-shirt	Valuing more a non-customised product than a customised one (for whichever reason the customer considers relevant).
I would rather ask someone else to do it	Finding the effort to individualise is not worthy of the investment in exchange for X result. Finding the process too complex, unengaging or being better off delegating the task.

Table 5.3. Statements used for the Likert scales and their meaning.

The quantitative data helped to create visual aids to better understand the behaviour for each group.

Figure 5.1 shows the overall results of the analysed data collected from questions through five-point Likert scales for each group. Results of Engagement answers for each individual participant were added up and then the median values calculated. The same was done for the Attachment answers. Each group (see Table 5.2, page 134) therefore had a median value for Engagement and one for Attachment. Those values were plotted on a Cartesian diagram,

where the X and Y axes represent the added-up values. The perpendicular coloured lines across the central values represent the maximum and minimum values of each median.

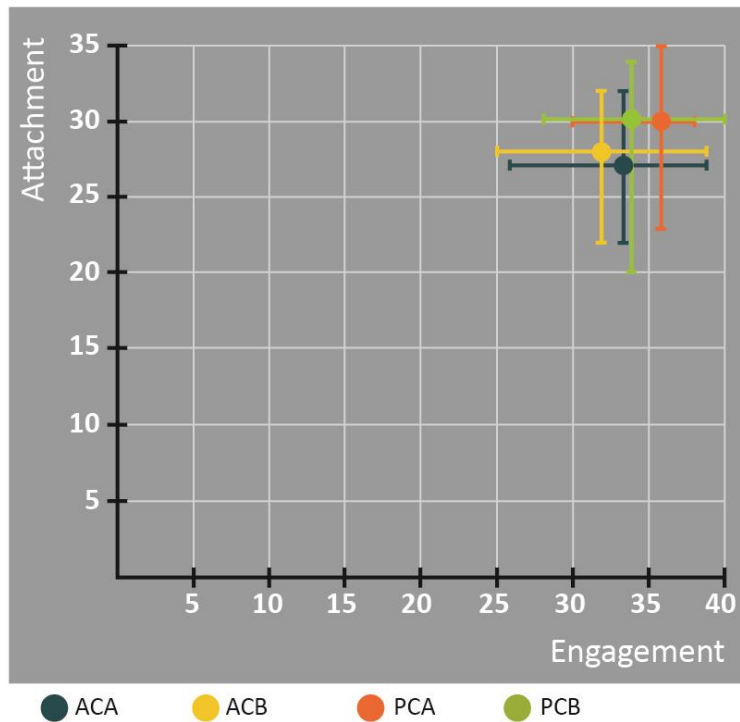


Figure 5.1. Overall results of the Likert scales from study stage #1

Figure 5.2 shows the results of each Likert scale using the median values from each group of participants.

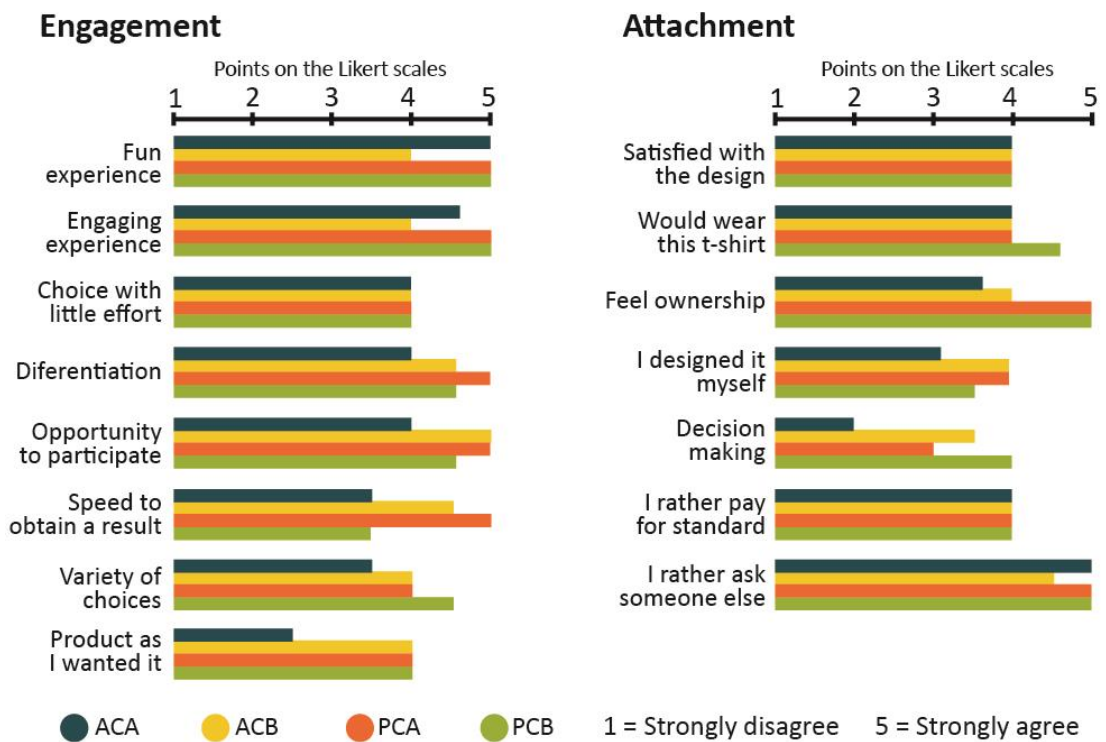


Figure 5.2. Results from each group per question. Results reflect the median value for each result.



Figure 5.3 and Figure 5.4, below, build on Figure 5.2 by offering a different representation of the data, making the four groups easier to be compared against each other.

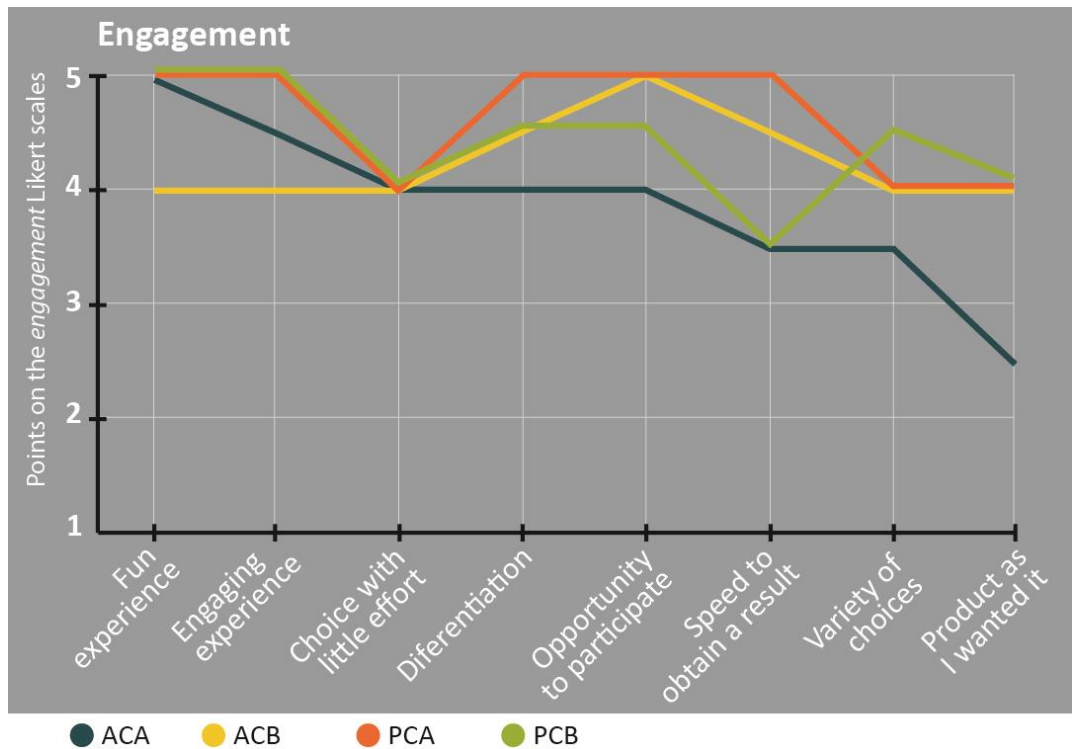


Figure 5.3. Median values of each group for 'Engagement' questions from the Likert scales.

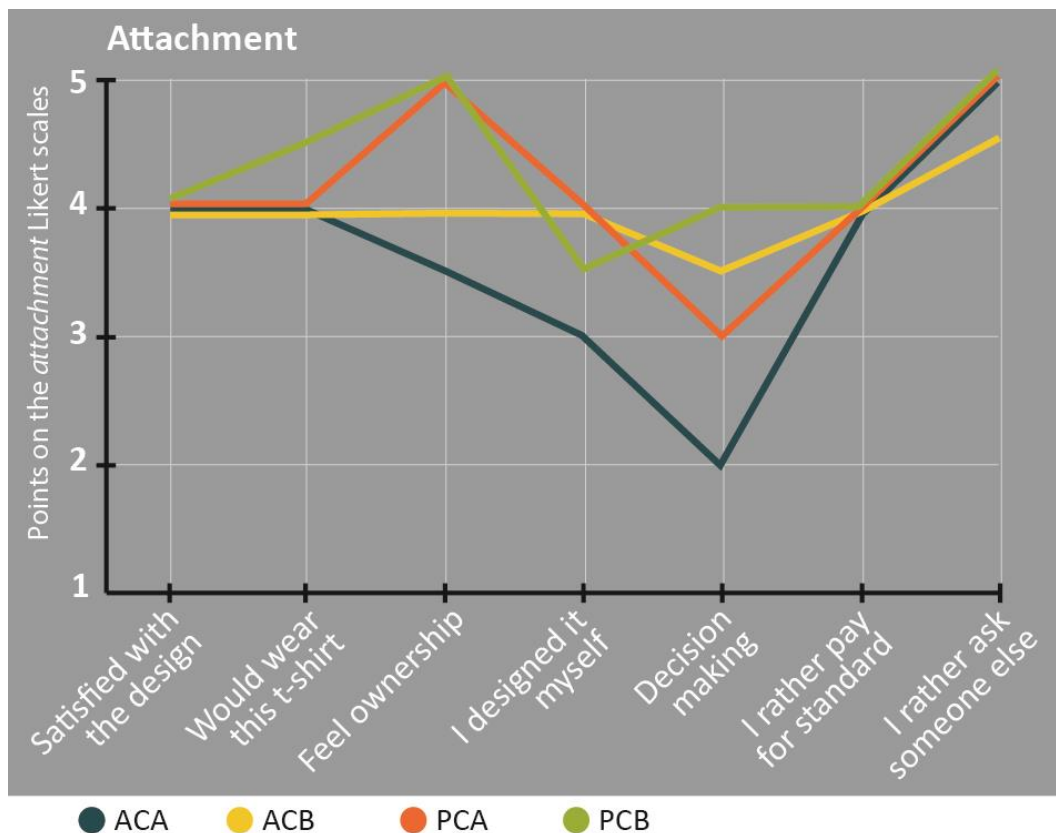


Figure 5.4. Median values of each group for 'Attachment' questions from the Likert scales.

Most participants from all four groups expressed that they had a fun at some point during the exercise.

The quantitative data shown in Figure 5.1, Figure 5.2, Figure 5.3 and Figure 5.4, allow us to highlight important aspects of the qualitative data. The following can be observed:

1- Both AC groups were overall the least engaged with individualisation and the ones that reported having less fun than PC groups did. This could be due to their expectations of creating a t-shirt not being met. The little effort required from them to complete the task could translate into low engagement in the process. Expressions of frustration were recurrent during interviews with ACB participants, such as:

- “ahh... bulls\*\*\*!” while using the toolkit (S1P25)
- “Well, that's not much of a customised t-shirt” (S1P30)
- “I didn't find it unpleasant but it just wasn't that fun” (S1P32)

Non-verbal cues were also noted, such as body language indicating discontent (shaking head, sighs and pulling faces).

2- ACA found the process was generally slow, did not deliver the product they thought they could achieve and did not provide the decision making power they would have liked to have had. They often arrived excited about customising a t-shirt as promised, but lost interest as they found out they were not allowed to do what they wanted (the drop of interest was noticed in verbal and non-verbal cues). The following quotes are illustrative of the general perception of the ACA group:

- “I could probably continue on doing this for hours” (S1P10)
- “Being a creative type, I didn't like being restricted” (S1P4)
- “The designing part was probably a bit annoying because you want it to be a certain way but you can't control it” (S1P12)

PCB also found the process to be slow, but unlike ACA, exercise B required a dice to start with, meaning an extra step in the process, which later caused expressions such as:

- "Oh god! I might spend forever!" (S1P17)

- "I bet this is the longest anyone has sat here doing this" (S1P7)

In spite of the perception of a slow process, virtually all respondents were inclined towards "Strongly disagree" when asked if they would delegate the task to someone else.

**3-** Groups PCA and PCB were the most engaged overall and the most attached to the product, as can be observed in Figure 5.1 (page 136). Indeed, both PC groups reported the highest perception of product ownership. Consistently throughout the Likert scales, either one of the PC groups scored equal or more than the AC groups (Figure 5.2, page 136). Considering the PC participants' profiles (page 76 in Methodology chapter) using exercise A and B, it could be said those participants had to make a greater intellectual effort than ACA or ACB for the same activity. Particularly, it was noticed that PCA perceived more benefits of individualisation more than PCB:

- "I didn't spend a lot of time on it, and like I said it was quite quick to do" (S1P23 – PCA).

- "The dice gave me 7 [shots]. What if I wanted more?" "But overall I'm happy; at least I get 50% [of the design on the computer screen]" (S1P3 – PCB. This participant further customised the t-shirt later on and wore it several times on and off campus).

Previous research indicates that a high engagement with the customisation process is consistent with a strong attachment to a product. Both PC groups reported a higher engagement and attachment than AC groups (as shown in Figure 5.1) even though the task PC did was the same as that of the AC groups (and the products' design and quality were similar). Therefore, it could be argued the behaviour of the PC groups responds to the participants' effort and pride in achieving a result. The discussion chapter provides additional insights into this result.

The time spent using the toolkit was measured as an indication of engagement in the process.

The average time spent by each groups was:

- ACA: 2 minutes and 49 seconds.
- ACB: 2 minutes 30 seconds
- PCA: 3 minutes and 36 seconds
- PCB: 4 minutes and 10 seconds

(one outlier was identified in group PCB, spending 32 minutes and 12 seconds using the toolkit, which if included in the calculation, would further increase the already highest measured time).

The average times show that PC groups spent between one and one and a half minutes longer than ACs engaging with the toolkit.

4- The evidence presented under the previous point can be interpreted as PCAs and PCBs make a greater effort than ACA and ACB for the same task. However, PC groups reported a higher engagement with the process by acknowledging benefits in the automated decisions taken by the toolkit. In other words, PCA's and PCB's engagement with the process appears associated with a rather passive role (i.e. not a linear relationship: the lower demand of intellectual and physical effort, the more engaged the person is). The PC groups, as described in this study, do not regularly engage in art and design related activities and therefore might prefer as little involvement with the process as possible in order to value it positively. This effect was noticed in both the study stages as well as in pilot #4, for example:

- "The decision making process I think spoiled a bit the experience..." (P4P14)
- "Because I am not very creative, it took the worry [out] of whether it was going to be good enough out of it" (P4P12)
- "If I wanted to put my colour, I would never decide which colour I can put [giggles]" (S1P33)

AC groups also identified that effect as a possible benefit for those who are “not artistic” (S1P35) or “not really a visual designer or artist” (S1P10), or consumers in particular circumstances:

- “Sometimes you don't fully understand what you like, but if the computer shows you something and you like it, is then for you” (S1P9).
- “Something to get people going, because many people are not artistic, they are like 'Oh, where to start?' So this could be a starting point” (S1P35).
- “It is faster. is the most efficient thing, because you would configure certain things but then [...] I could just click through it and at some point just say 'this is fine” and “...let's say someone who is not really visual designer or artist, to have some kind of guided system that would still lead to visually pleasing results” (S1P10).
- “I think you will get different results and different outputs from people from the creative industry than other people from life and sciences [...] People coming from art and design, they have their creativity” (P4P7).

The above does not imply that PC groups did not report any discontent with the toolkit's restrictions. Some participants did, yet they then reported higher level of attachment to the product than AC groups:

- “I wasn't allowed to do certain things that I might have wanted to do, like pick my colours, and obviously there were restricted colours...” (S1P23 – PCA. This participant wore the t-shirt during a festival occasion where more paint was involved).

5- ACA scored lower than the other groups in most Likert scales. For example they disagreed on the “product as I wanted” and on the “decision making” statements (yet they reported not being willing to delegate the task to anyone else). It was expected that AC groups would score lower than PC groups. In particular, ACB was expected to score lowest because they were using the more restrictive toolkit of the two. However, ACA resulted to be the one scoring predominantly lowest of the two AC groups: only three of the 15 statements show ACA scoring higher than one of the other three groups as shown in Figure 5.2, Figure 5.3 and Figure 5.4 (pages 136 to 137).

6- The “I feel in charge of the decision making” Likert scale shows a particular situation (see Figure 5.4, page 137), where PCA and ACA scored the lowest, and PCB and ACB scored highest. This was despite exercise B being the most restrictive toolkit. The fact that the same behaviour was observed in both PC groups and both AC groups, could indicate the **perception of decision-making power** seems dependent upon the participant’s perception of the available choice and freedom. For example, if a customisation exercise offers a ‘limited’ amount of decision power (such as in exercise A), it could be perceived as ‘too limiting’. However, an exercise with no decision power to be handed to the participant (such as in exercise B) could pre-empt any perception of ‘too open’ or ‘too limited’, preventing a negative perception of the experience. This effect is illustrated in Figure 5.5, which takes the Likert scales results, groups them by exercise A or B and finds the median values, generating two major groups as opposed to the previous four.

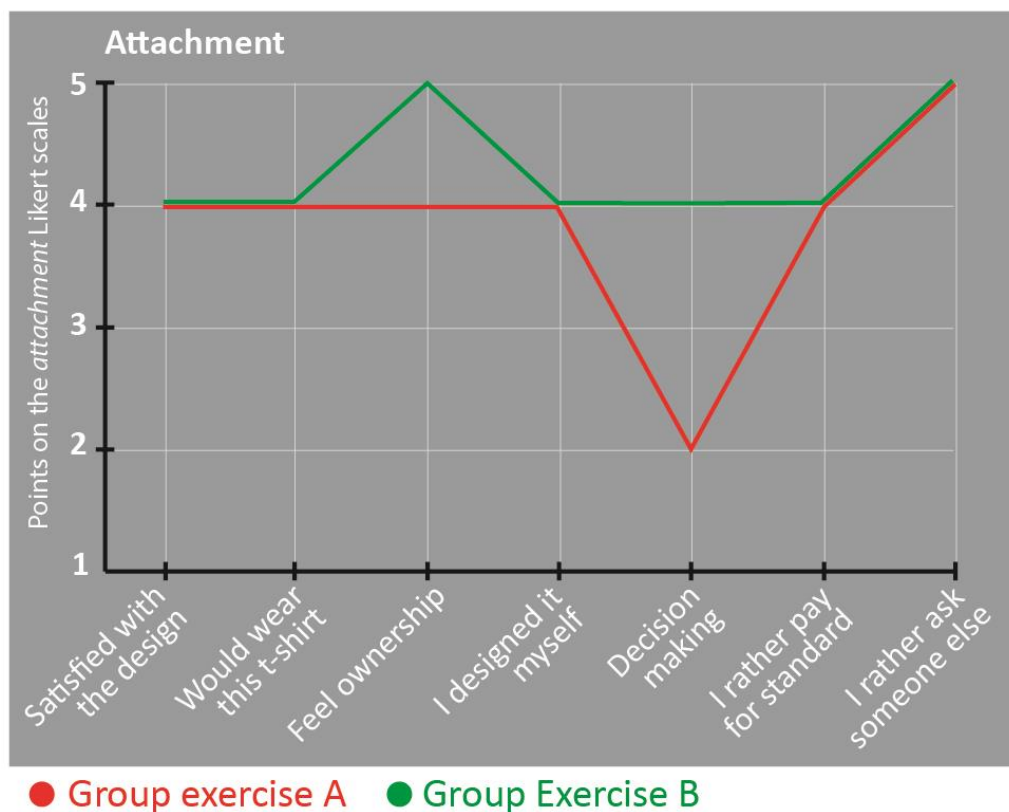
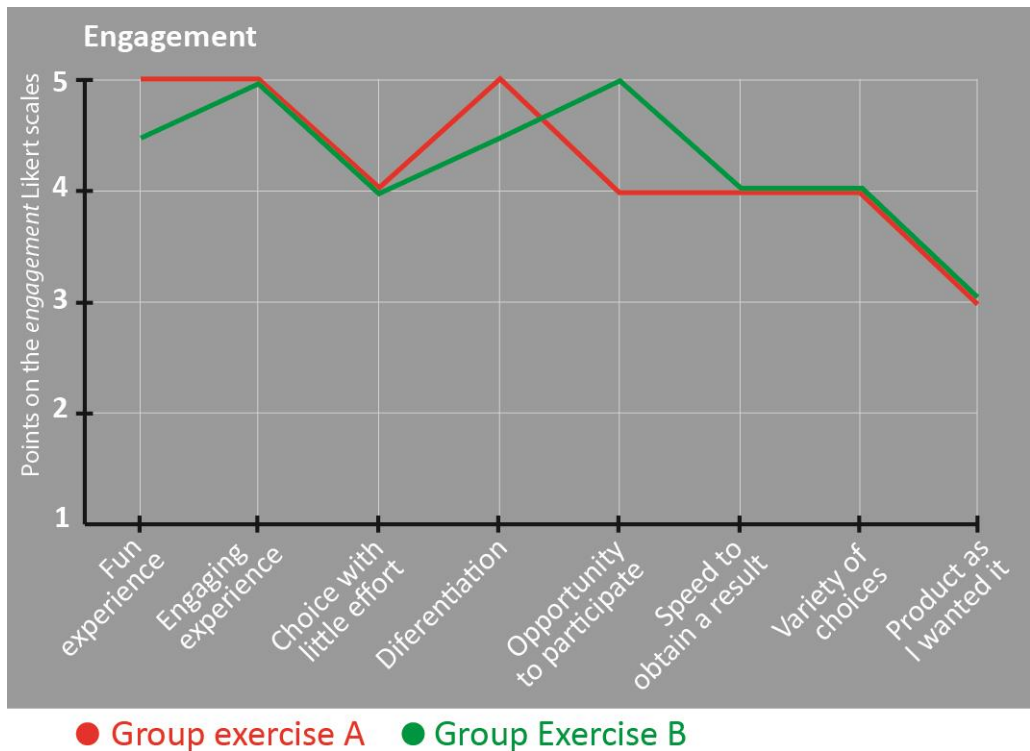


Figure 5.5. Median values of ‘Attachment’ grouped by exercise show users of exercise A felt less attached to the product than their counterparts using exercise B.

Figure 5.5 illustrates that the attachment to the resulting product is lower for those using exercise A (the less restrictive of the two), whilst the engagement with each exercise remains stable, as shown in Figure 5.6.



● Group exercise A ● Group Exercise B  
 Figure 5.6. Median values of 'Engagement' grouped by exercise show similar results for both groups

Exercise B handed less decision power over to the participant than exercise A, but B helped to generate higher levels of attachment to the product. Consequently, it could be said that participants valued the opportunity to use an automated process.

7- Finally, from the quantitative data, the general feeling of each group of participants when experiencing individualisation could be summarised as follows (Figure 5.7):

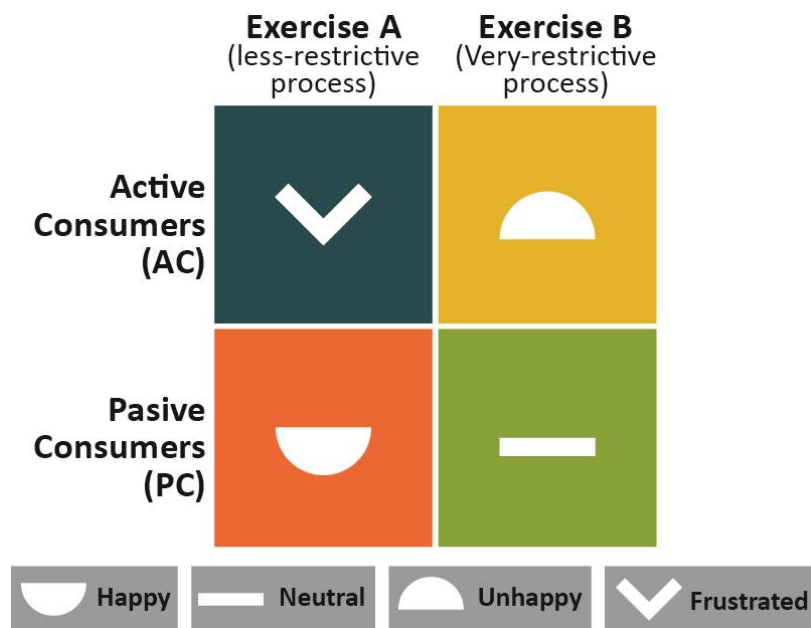


Figure 5.7. A summary of participants' feelings when experiencing individualisation.

### 5.1.3. Study stage# 1 – Qualitative data sources – Results

The design of the interviews for this research (see pages 65, 69 and 74 in the Methodology chapter) had two main sources: it used an evolving process of interview design (inducing data from previous design iterations), as well as deducing methods from, for example, Ariadi et al. (2012) and Franke & Schreier (2010). Similarly, for the data analysis, some of the codes used were data-driven and others were inferred from theory, particularly from the aforementioned sources.

Identifying theory-driven codes from existing literature helped in understanding what constitutes a relevant code for this type of study. Examples of this are the 'Time investment' and 'Effort' codes used. Ariadi et al. (2012) interviewed participants in a study evaluating their use of a specific customisation toolkit. Some respondents compared the experience of using that toolkit against buying a product already designed. In such a scenario, consumers' time investment and effort could be considered relevant variables in the evaluation. Also in that study, five-point Likert scales were used to collect quantifiable data, highlighting potential codes without embarking on a full statistical analysis. Another example is "process effort" and "perceived process enjoyment" when customising, which characterised Franke & Schreier's (2010) interview design. That research also used Likert scale questions to collect quantitative results.

In both aforementioned studies it is possible to visualise two sections in the interviews (and therefore the collected data) they make: engagement with the process and attachment (or some sort of preference fit) to the product. Codes in the present research can also be arranged in two major themes (following the interview design): those related to engagement with the process and those around attachment to the product. Following the analysis of the audios, this research proposes four, more accurate themes to 'encapsulate' the codes, as described in Table 5.4. The left column lists the codes extracted and the right column offers a description of each code.



Codes	Description
<b>Theme: Engagement with the process</b>	
- Attempts participating	Effort investment; intent to get an attractive design
- Foreseeing the benefits	Recognising benefits of the system for the user
- Algorithm and randomisation	How the toolkit influences the experience
- Attitude towards the dice	Perception of luck; game; gamble and luck
- Physical participation	Excitement; connection with the t-shirt; effort
- Memories	Memories during participation and during ownership
- Enjoyment designing	Enjoyment picking designs and the role as user.
<b>Theme: Satisfaction with the product</b>	
- Uniqueness	Perception of uniqueness as a benefit for the user
- Further customising	Investing more effort and strengthening attachment
- Design	References to the resulting t-shirt design
- Further attachment	(after 6 to 8 weeks), having worn the t-shirt or not
- Relating with the product	Comments on care of the t-shirt, where it is kept
- Visual associations	Liking the design due to a visual link with the user
- Attitude getting the product	Comments and effort to receive the finished t-shirt
<b>Theme: Willingness to invest</b>	
- Interest through the session	Unprompted comments about the experience
- Time investment	Perceiving individualisation as a fast process
- Seizing an opportunity	An opportunity for those without art & design skills
- Insecurity and frustration	Too much or too little freedom; random; no control
- Sense of achievement	Perceiving the t-shirt as result of one's participation
- Perception of decision making & authorship	Assertion or hesitation on final design's authorship
<b>Theme: Sense of ownership</b>	
- Ownership	Perceiving the t-shirt as a personal belonging
- Reaction towards instant ownership	Comparison to standard design
- Pride	Acknowledgement of effort invested and result
- Reaction towards finished product	Instant comments after last mark of paint
- Unwanted goes to waste?	Preference over standard design to avoid wasting it
- Self identification	Perceiving the final design as a uniquely personal

Table 5.4. Codes extracted from analysis of study stage #1

Figure 5.8 (page 146) shows the codes in light colours and rounded corners, mapping into their respective greater themes represented with solid colours and sharp corners.

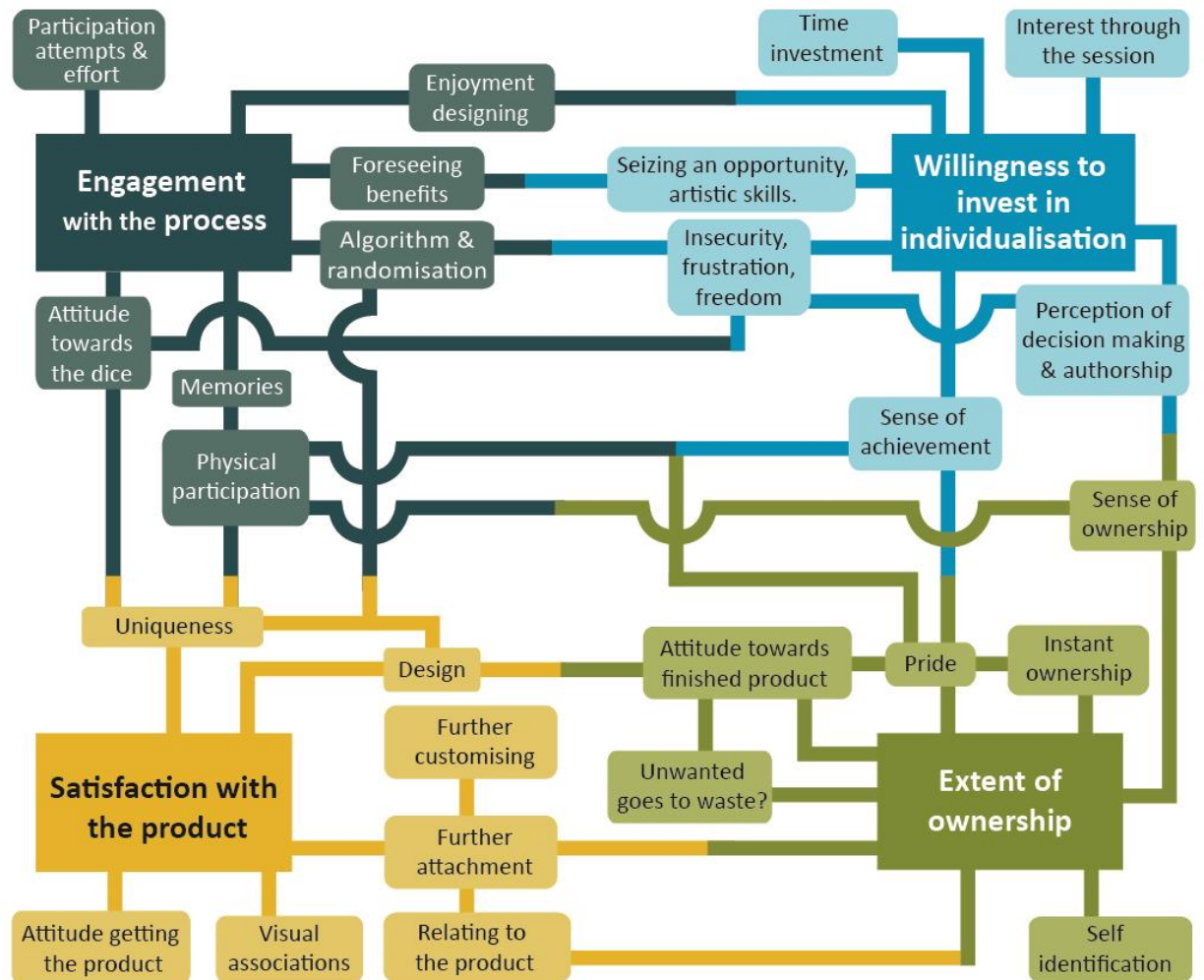


Figure 5.8. Map of codes and themes.

The codes presented here were identified within the first 18 analysed interviews. The analysis of the remaining 15 interviews helped to strengthen the importance (or hierarchy) of certain codes over others, which will be explained later.

Figure 5.8 shows how certain codes connect to other codes and to other themes, meaning that a participant’s responses to one question were often connected to more than one aspect of the exercise, generating richer responses and leading to new questions. For example, participants talking about the ‘Satisfaction with the Product’ pointed at features of the t-shirt’s final design, which lead to making observations about the uniqueness value of the product. Respondents often associated uniqueness not only with the resulting design, but also with their physical participation in painting the t-shirts, i.e. their ‘Engagement with the Process’. Additionally, participants related the use of the randomised algorithm and their “luck” rolling the dice during the engagement with the process as the causes of unique results, therefore generating the link in the diagram above. The following phrases illustrate the point:

- "...I clicked 7 times and I'm very sure even if someone comes and do this, there is a likelihood that they might not get the same pattern as I have, so is nice" (S1P3)

- "it gives a bit of a uniqueness that it was by chance or by the computer algorithm" (S1P9)

- "I guess it goes back to that ownership sort of thing, because I feel there is a connection I guess to this particular t-shirt" and " I think is for the sole fact that I went through the whole process" (S1P14)

Earlier, P4P14 had offered a similar view:

- "It's like fate vs my awkwardness. I really enjoyed the experiment" and "I still feel like is customised because, again, I used the dice so is kind of my mind that has chosen the colours.... Not really a psyche thing but... I still feel like attached to it..."

At the same time, the physical participation was not only partially responsible for the uniqueness of the design, but also triggered the sense of achievement and pride in the outcome, directly associated to the perception of ownership:

- "If I hadn't done it, I would be like 'it looks a bit messy', but I think, because you do it on the computer first and you go through those sort of stages of design, you weight and pick, but it feels more like that's my t-shirt" (S1P23)

- "Is quite satisfactory because you can't replicate this in exactly the same way so is something really-really mine" and "I couldn't have total control over how it looks" (S1P21)

- "I did the splashing thing, that was up to me, so that made me feel like ownership of it" (S1P35)

Respondents identified benefits offered by the individualisation exercise (particularly for those with a PC profile) related to different participants' art and design skills and the opportunity to customise a product. This effect was also observed in the quantitative data collected through the Likert scales such as "speed to obtain a result", "I feel in charge of the decision making" and "I designed it myself", described earlier.

Satisfaction with the product was also identified through participants' comments of visual associations between the resulting design and figurative forms (smiley faces, cartoon characters, initials and objects):

- "It does look cool because it looks like a smiley face. It makes it look different" (S2P4).
- "This one looks like a pattern [...] something like a boat, an ark and then it holds something in the middle, so I think is nice" (S1P3).

More connecting codes were identified through the coding. For example, the reluctance to invest time or effort in using individualisation again in the future (particularly by AC) due to the sense of insecurity in achieving a satisfactory result (associated with the amount of freedom allowed in the exercise). The randomised toolkit and the dice were often associated with that insecurity.

- [I would use this again] "if you are given unlimited attempts to change the layout and the parameters"; "the algorithm is too random [...] you end up with something that is a bit messy" (S2P4).
- "You might not get the paint job where you want it, it may be frustrating for someone who is trying again and again" (S1P9).

Finally, only two participants (AC) commented about the risk of waste from unwanted customised results. They justified that could happen given that the exercise did not allow them to customise exactly as they initially wished. This did not seem to be a relevant issue for the PC group. One of two aforementioned AC participants proposed to take with her the customised result in spite of preferring the 'standard' design, in order to avoid it going to waste. It was explained to the participant that unwanted t-shirts would be donated to charity at the end of this research.

The analysis of all the interviews also showed indications of some codes could be more relevant or important than others. For example, identifying one code more times than others during the interviews, or mentioning it with more intensity or enthusiasm, could indicate that code is more important; suggesting codes' hierarchies. Indeed, Henerson et al. (1988) propose a system to measure children's attitude at school, in which the coder assigns a value from 1 to

5 (1 being “almost never” and 5 “almost always” based on the coder’s subjective impressions) to a list of possible actions of the children in class. The values are then added up, producing the final attitude score for a given child. Boyatzis (1998:133) also suggests using a score that “would represent the intensity” of codes. However, he proposes a system when coding written text, such as essays, based on the number of sentences mentioning a particular code per page of text, as opposed to scoring live behaviour as in Henerson et al. (1988).

This research used an adapted version of Henerson et al.’s (1988) system because it deals with the spoken word rather than written text. The adapted version of the system is called ‘emphasis’, as described in Table 5.5.

Three factors were taken into account to establish a hierarchy of codes: frequency of the code (how often it is mentioned), emphasis with which it appears in the dataset and finally, positive or negative connotation. Table 5.5 explains each factor.

Hierarchy factors	Description
Frequency	Represents how many times each code is mentioned. Codes were identified when mentioning a particular word or when referring to it with other words, which also accounted for frequency. For this research, no special software was used and instead it was calculated manually.
Emphasis	Estimated the enthusiasm or intensity used to mention a code. Every recurrence of each code was scored between 0 and 2 depending on voice intonation, volume and body language (from field notes). Scores from every recurrence were added up, making a final score for each code.
Positive or negative connotation	Captured positive and negative opinions each time a code was mentioned, receiving a score of +1 or -1. Results were added up to find a final value. This factor is useful to compare how ACs and PCs valued each code.

Table 5.5. Description of the factors considered to designate code hierarchy.

Figure 5.8 (the map of codes on page 146), is the researcher’s interpretation of how the identified key topics are related. The benefit of presenting the codes in such a diagram is that it offers a possible explanation of each code’s causality, backed up by illustrative and representative segments from the interviews. The value that a hierarchy of codes (however subjective) can add to the study, builds on the map of codes. It allows the reader to see what were the most influential parts of the experience for the participants, thus better understanding the subjective composite of their opinions about individualisation. The Discussion chapter argues why this hierarchy is appropriate, particularly the ‘emphasis’ factor, acknowledging its subjectivity (section 6.4.3.1, page 182).

Figure 5.9 presents the hierarchy of codes in a bubble chart, featuring frequency (some codes mentioned only once and others mentioned 187 times) and bubble sizes representing emphasis score (emphasis scores are simplified into five different sizes). Positive and negative values are introduced in subsequent figures, to compare ACs and PCs.

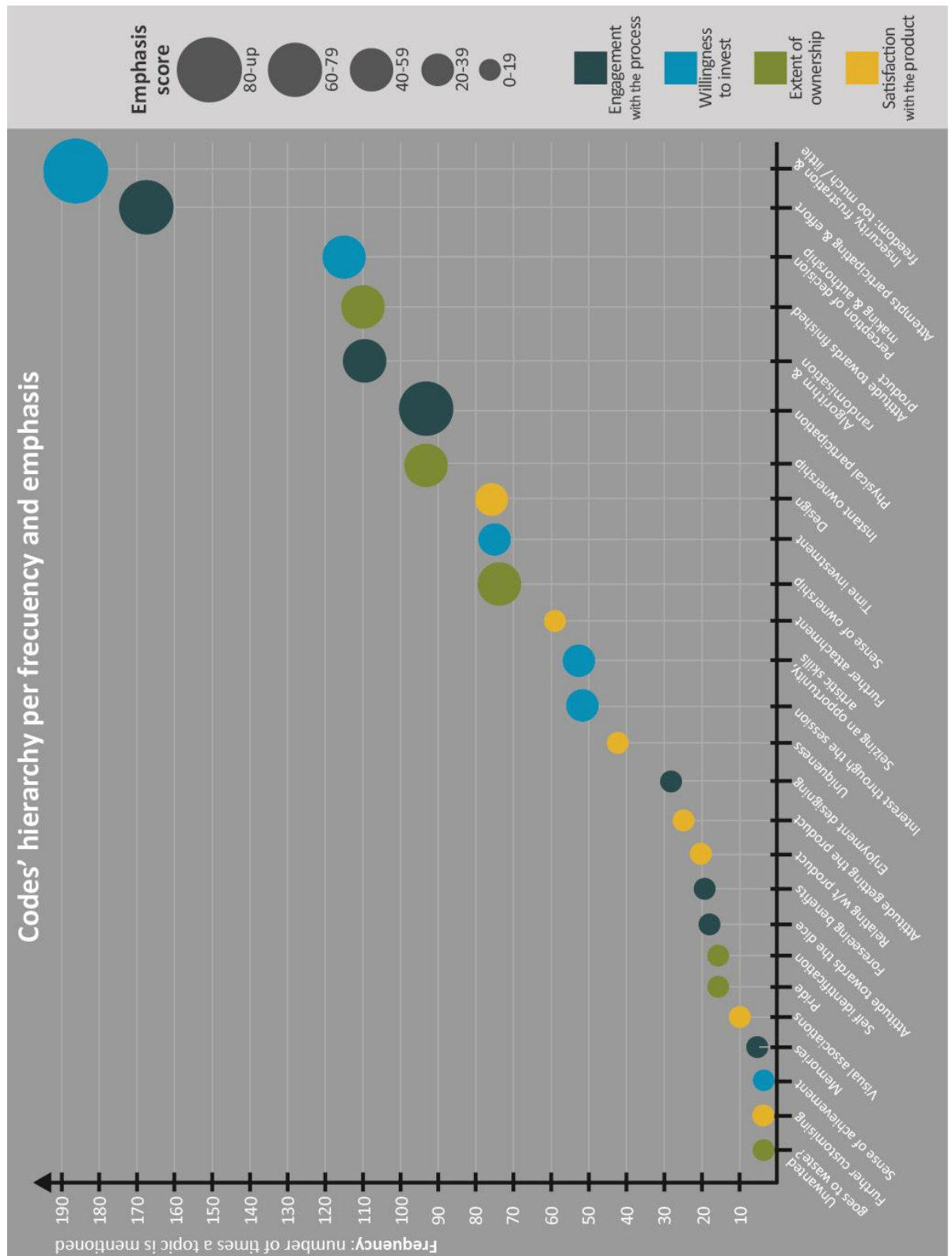


Figure 5.9. Bubble chart of codes' hierarchy per frequency and emphasis.

As can be observed from Figure 5.9, the codes “Attempts participating & effort” and “Insecurity, frustration & freedom” were the ones most frequently mentioned. Those two together with “Physical participation” were the three codes that generated the most emphatic reactions. The themes “Engagement with the process”, “Willingness to invest” in the process and “Extent of ownership”, dominate the highest scores in frequency as well as emphasis, reflecting where the biggest differences lay between groups, as also reflected in Figure 5.3, Figure 5.4 and Figure 5.5.

This research was designed to gather the data during the face-to-face interviews. A small supplementary questionnaire was sent to the participants between six and eight weeks later via email, as explained in section 3.2. This was not a longitudinal research design. It could be said that was the reason why “Satisfaction with the product” theme scored generally lower than the others, as it covered topics that could perhaps generate more responses in the long term (i.e. participants had little opportunity to comment on those aspects).

Figure 5.10 and Figure 5.11 include positive and negative codes valuations, plotting the hierarchy of codes for ACs and PCs respectively, highlighting the groups’ differences.

## Codes' hierarchy for Active Consumers as per Frequency, Emphasis and Value (positive or negative)

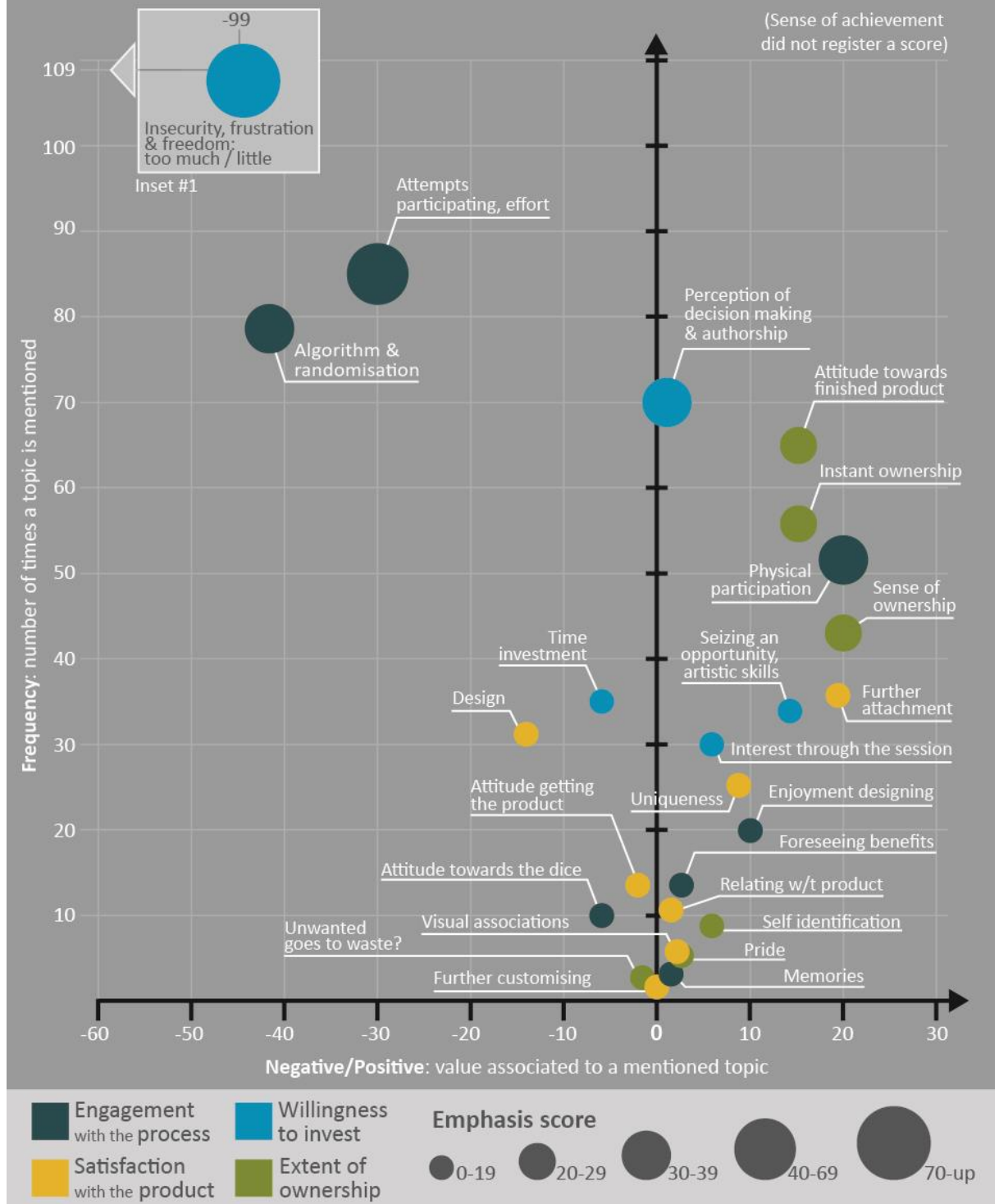


Figure 5.10. Bubble chart of codes' hierarchy per frequency, emphasis and positive/negative value for AC.



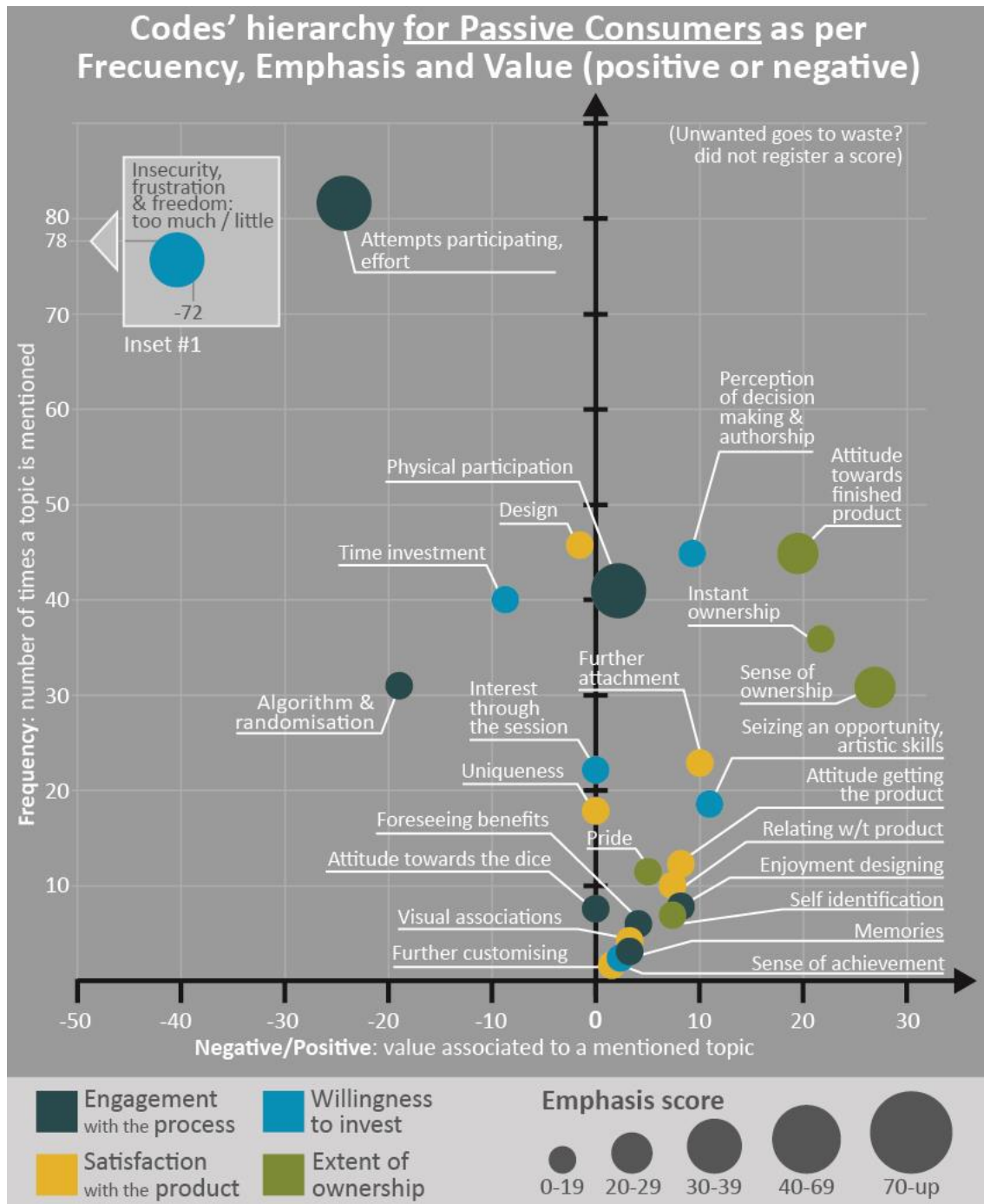


Figure 5.11. Bubble chart of codes' hierarchy per frequency, emphasis and positive/negative value for PC.

Differences between the hierarchy of codes from the two groups (AC and PC) support the results described earlier. For example, the code 'insecurity, frustration and freedom' was a more relevant topic for ACs than PCs. Indeed, ACA and ACB were the groups that reported the least engagement with individualisation and attachment to the product. Likewise, code 'perception of decision-making power and authorship' (related to the insecurity and frustration in the process) was more relevant for ACs as they spoke about it more frequently, emphatically and negatively. Another clear example is the code 'Algorithm and randomisation',

which, while it was predominantly negative for both groups, was substantially less of a detriment for PCs' experience than it was for ACs.

PCs referred to the resulting design of the t-shirt more positively and frequently than ACs. Indeed, PCs later showed a better attitude towards getting the t-shirt once the paint was dry (although their further attachment dropped compared to that of AC). The code 'Sense of achievement' did not register a score for ACs.

The code 'Physical participation' highlights a particular difference that characterises the two profiles, AC and PC. Whilst the emphasis of that code on either diagram is similar, ACs talked about their physical participation more positively and frequently than PCs even though ACs showed signs of frustration with the overall experience (which included the use of a restrictive toolkit).

Figure 5.12 summarises the differences between hierarchy of codes on the basis of their emphasis score.



Figure 5.12. Hierarchies of codes for ACs and PCs.

Beyond the data gathered through Likert scales earlier in this chapter, which answer specific questions, the bubble charts highlight areas of the participants' generic perception of individualisation. In particular, Figure 5.10, Figure 5.11 and Figure 5.12, make it possible to further understand the differences between the two consumer types, highlighting where the value of individualisation lies.

Different reactions were noticed from the AC groups, both in pilot #4 and study stage #1, which is linked to the notion of different types of consumers. This research focuses on two main groups, yet it could be possible to identify more sub-groups, discussed in the Conclusions chapter. Some AC participants had a more 'exploratory' approach than others. This resulted in ACs not feeling particularly attached to the resulting product, but who did engage with the process. That process offered them an unexpected opportunity, a new form of expression in art or design and arguably even of physical expression in the act of pressing the syringes; for example:

- "Is just the methodology thing that I am really-really engaging [with] even if you don't get the results you want..." (P4P7)

- "I didn't find it [the toolkit] unpleasant but it just wasn't that fun" and then added: "I kind of like this splodge thing" (S1P12)

Study stage #1 provided the core data for this research, following good practice while maximising financial, technical and logistical possibilities (see Methodology, sections 3.1.5 up to 3.2.3, pages 63 to 77, and Discussion, section 6.2.1, page 170). All data was collected in the same environment and following the same guidelines, allowing a systematic thematic analysis with sufficient number of codes and themes to generate a robust body of evidence. Participants, mainly from within university campus, were invited to participate, by explaining what the research was about via email, telephone or face to face. Interviews were fully completed within the possibilities and resources available (section 3.2.1 on Interview Design in the Methodology chapter, page 69).

Study stage #2, with a further 11 participants, was a re-run of the same exercises in a different setting from study stage #1. It was carried out with the intention of evaluating the results obtained so far.

#### ***5.1.3.1. Lessons learned from study stage #1***

Study stage #1 collected the main tranche of data to address the research questions, whilst providing evidence for the effectiveness of the research design and methods. The study demonstrated differences between AC and PC groups and patterns of behaviour depending on the exercise they were doing.

The approach to the thematic analysis was effective in order to process large amounts of data accurately, whilst maintaining the ability to collect quotes to illustrate specific findings. This approach allowed the coding of all the data and the identification of four major themes that form the basis of the Discussion chapter.

#### ***5.1.3.2. Limitations and Implications for the final stage of the study***

Study stage #1 collected information from participants interviewed in a controlled space, in one-to-one meetings. Participants were recruited and contacted via email where all the necessary information was supplied, meaning that they arrived at the interview with, at least, a basic idea of what the research was about and what they would be required to do.

The next and final iteration would follow the research design of study stage #1 in order to generate comparable data. Study stage #2 was used to validate the design and the results obtained so far.

#### **5.1.4. Study stage# 2**

This second study stage had a 'live' setting (as opposed to the 'lab' setting of study stage #1) with the intention of evaluating the results obtained from the previous iteration.

Study stage #2 was set up as a pop-up shop for one day within the university campus, where 11 passers-by were interviewed. The spontaneous nature of this new iteration and the limited time that participants made themselves available for meant that interviews were shorter than previous studies and therefore fewer questions could be asked. No quantitative data was collected. In order to make the whole process shorter, only exercise A was offered, which did not require the dice.

During the interviews, participants were categorised as either AC or PC, so that the data could be contextualised and analysed in a manner that was consistent with previous iterations. From 11 participants, eight were identified as AC and three as PC.

Table 5.6 presents a breakdown of the volunteers.

Participant number	Occupation	Profile	Exercise
1	Librarian	PC	A
2	Student in audiology	PC	A
3	Student in audiology	AC	A
4	Student in audiology	AC	A
5	Student in audiology	PC	A
6	Student in art	AC	A
7	Student in art	AC	A
8	Student in art	AC	A
9	Student in art	AC	A
10	Student in art	AC	A
11	Student in art	AC	A

Table 5.6. Eleven passers-by volunteered for the exercise, eight AC and three PC.

Results from the second stage of the study show a similar pattern to study stage #1: ACs seemed less attached to the product than PCs. From the eight AC participants, six did not collect the t-shirt after it dried up. Only two ACs did. One of them gave it to someone else the same day, leaving only one AC still owning her t-shirt. All three PC participants collected their t-shirts, suggesting a stronger attachment between the participant and the product.

ACs' lack of attachment to the product could be explained by their moments of frustration experienced while participating:

- "Oh, you don't know what colours they are going to be though" and "I would have liked to have chosen the colours and I probably would have spaced them out a bit more [...] you know, to make my own design" (S2P3)
- "May be I should have done less dots. May be a few more bigger ones, but ... of course I didn't have choice of where they went" (S2P4)
- "Oh! Fff..." [while using the toolkit] (S2P6)

When asked if they felt ownership over the t-shirt, some ACs responded affirmatively, however only one actually claimed her t-shirt to keep it. Others directly responded they did not feel ownership:

- "Mmm yeah, I guess..." (S2P6)

- "Yeah.... I made it" (S2P8)

- "Not at the moment because it is in a big box, but... Mmm Yeah... a little bit" (S2P4).

This AC participant was the only one who did collect the t-shirt and kept it. During the interview she mentioned feeling "Proud" for doing her t-shirt.

- "No, probably not, no. I enjoyed doing it, but I would have been more strategic" (S2P3). This participant was casually met on campus weeks later and asked about the t-shirt. She evidenced there was low attachment to the product: "One of the other students took a liking to my t-shirt after I collected it from you. So I gave it to him. I'm not sure what he's doing with it now" (S2P3)

Some AC participants did express engagement with the process, although it proved to be insufficiently strong to generate an attachment to the product, as only two of them actually collected their t-shirts. Those signs of engagement evidenced the attribution of value to uniqueness and enjoyment of the experience:

- "It's really fun spraying the paint" and "It does look cool because it looks like a smiley face. It makes it look different" (S2P4)

- "I kind of like that. I just kind of like this effect" (S2P6)

- "I like the positions in which the splats are arranged" and "The shape is to my taste" (S2P9)

PC participants showed signs engagement with the process, resulting in four of them collecting the product once the paint dried, and arguably more attachment to it than ACs:

- "I quite enjoyed making this. That was rather more fun than I was anticipating this lunch time" (S2P1)

- "Ho-ho! Look at that!"; "This is looking good"; "This is going to be totally unique to me. My t-shirt"; "I love that red" (S2P2)

- "I like that" (S2P5)

When asked about ownership, PCs were more assertive than ACs:

- "Well, yeah... is mine [laughs]. I sprayed the paint on it so I guess it will be my personality 'cos I picked the design I liked I guess" (S2P5)

"I pressed the buttons on the computer; I still had to decide the circles so is still mine";  
"Is unique"; "Is just mine" (S2P2)

- "I created it probably myself, 'cos I was assisted with the design process, but I probably would wear it" (S2P1)

Consistent with the quantitative data analysed in point 6 from the first stage of the study (page 142), the perception of decision-making power played an important role in how AC participants felt. S2P10 explained that a "parameter" limiting his actions made him aware of the restrictive toolkit:

- "You are limited, whereas if you had no power, you wouldn't know the difference"; "If I hadn't had any hand in creating it, then I would not had any power. But the fact that I had a bit of a hand and a bit of it was out my control, made me notice [that there was a limit]" (S2P10)

The thematic analysis of study stage #2 generated similar, but fewer, codes to those from the first stage, possibly due to the shorter interviews. Table 5.7 lists the codes identified.

Engagement with the process	Attachment to the product
<ul style="list-style-type: none"> <li>- Attitude towards the algorithm: (Negative, Randomisation)</li> <li>- Response towards participation with toolkit: (Attempts, Excitement).</li> <li>- Physical participation: (Excitement, Insecurity)</li> <li>- Time investment</li> <li>- Enjoyment designing</li> <li>- Seizing an opportunity: (For me, For others, Artistic skills)</li> <li>- Foreseeing the benefits</li> <li>- Insecurity and frustration: (Lack of freedom, Too much freedom)</li> <li>- Perception of decision making power: (Positive, Negative, Hesitant on authorship)</li> <li>- Sense of achievement</li> </ul>	<ul style="list-style-type: none"> <li>- Reaction towards finished product: (Happy, Disappointed, Indifferent)</li> <li>- Ownership (Pride)</li> <li>- Behaviour towards getting the t-shirt</li> <li>- Uniqueness</li> </ul>

Table 5.7. Codes extracted from analysis of study stage #2



The selection of codes found in this smaller data set were also found in study stage #1, strengthening the validity of the data analysis during the earlier iteration and suggesting which of those codes and themes could be the most important ones.

#### ***5.1.4.1. Lessons learned from study stage #2***

This second stage of the study validated the research design by re-running the exercises in a 'live' setting (with passers-by) and obtaining similar responses to those from the first stage, where one-to-one interviews were used in a controlled environment. The short interviews produced fewer, but similar, codes and themes to those from study stage #1. Repeated codes highlight some of those identified as most important in the hierarchy analysis (Figure 5.9).

#### ***5.1.4.2. Limitations***

Because of the short time available to interview passers-by, only exercise A was run. Time constraints also meant contact details were obtained from only four participants (to contact them later for further questions). During the 5 to 10-minute interviews only qualitative data was collected (which supported the findings from study stage #1), however, it was not possible to obtain additional field notes.

## 5.2. CHAPTER SUMMARY

Table 5.8 summarises findings and limitations of the two study stages.

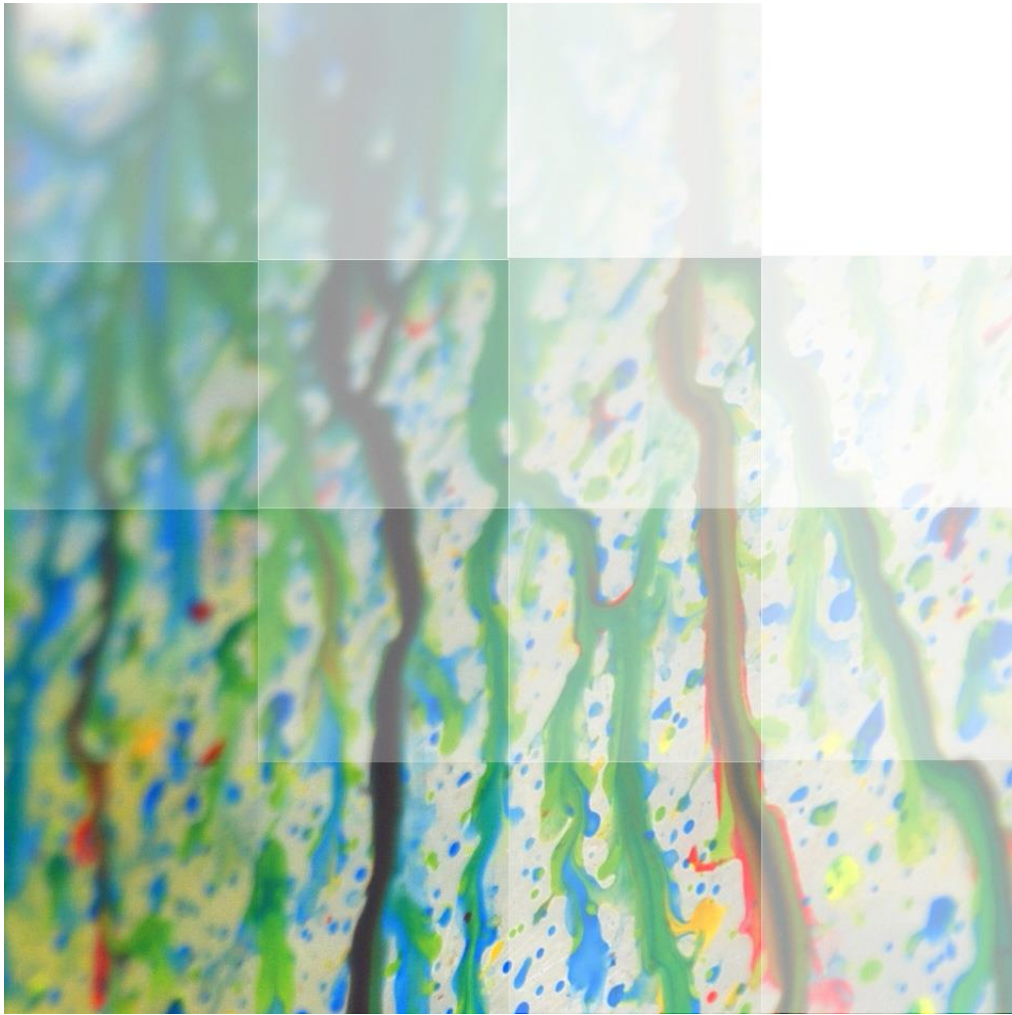
	Key findings	Limitations	Implications for the next phase of the research
Study stage #1	Benefits in individualisation for PCs, while ACs reject them. Key coded topics under four main themes. Confirmed initial observations differentiating AC and PC groups. Research design, methods and thematic analysis worked effectively.	Data was collected within a controlled space in one-to-one meetings. Participants were recruited via email with all the necessary information supplied. They arrived at the interview with at least a basic idea of what the research was about and what they would be required to do.	A last round of exercises applying similar methods but in a 'live' setting (i.e. outside lab-settings). Necessary to test the methods used in study stage #1 and to replicate results, providing strength to the collected data.
Study stage #2	Stage #2 validated the methods and data by re-running the exercises in a 'live' setting and obtaining similar responses to study stage #1 with passers-by.	Short time available to run each interview with passers-by and only exercise A was possible to run (as is the shortest of the two exercises). Only qualitative data was collected (but no field notes).	If more studies were run in a live setting, it would be beneficial to run exercise B, to replicate results from study stage #1. Also, have a helper to collect field notes, quantitative data and preparing the setting for the next participant.

Table 5.8. Summary of studies' key findings, limitations and implications.

Study stage #2 demonstrated that participants identified with the PC profile engaged with the process of individualisation and generated an emotional bond with the product, which drew them to collect it once the paint was dry. Participants expressed joy, excitement and generated further conversation about the experience with other passers-by, particularly highlighting things like uniqueness and decision power over the output, yet acknowledging the co-design between them and the computer. They were also more assertive than ACs when claiming ownership.

AC participants gave some signs of engagement with the process. However, the experience of making a t-shirt with the proposed toolkit did not fulfil their desire to create new things. Further, not even the offer to get a free t-shirt was persuasive enough for some of them to trigger attachment.

Study stage #2, designed in a different setting from stage #1, attracted participants in spontaneous action (i.e. less preparation on the part of the participant), validating the findings from study stage #1. The next chapter will discuss these results.



## 6. DISCUSSION

## INTRODUCTION

This chapter discusses the findings from data collected from the 44 interviews presented in the data analysis of the main studies (chapter 5).

The growing interest in the use of computer algorithms for automated processes of product creation and customisation has made it possible to find novel solutions to design optimisation problems in fields such as design engineering, medicine, aerospace and architecture (Yang & Bouchlaghem, 2010; Belmonte et al. 2014). In other words, these advancements in generative design are central to strategies to improve the performance of engineering products.

This research evaluates consumer emotional attachment to individualised products and the value that consumers allocate to such products. In particular, the study explores the extent to which the level of engagement with an individualisation process can be a determining factor in the level of attachment to the resulting product. As part of the research, two different types of producers-consumers ('prosumers') using individualisation techniques, have been studied: Active Consumers (AC) and Passive Consumers (PC). The AC group is characterised by individuals who express an interest in art, design or craft activities, by profession, study, hobby or keen interest and possess the necessary skills and 'critical eye' to carry out such activities on their own. On the other hand, the PC group is characterised by individuals with no particular interest in art, design or craft activities and therefore have not developed those skills nor possess that critical knowledge that ACs have. These differences will be further explained in 6.4.2.2, page 180.

Using a mixed-method approach (see page 65), the study collected data following an iterative process "of design, enactment, analysis, and redesign" (Wang & Hannafin, 2005: 6): four pilots and one main study (the latter was executed in two stages) conducted over a period of 18 months. The pilot iterations enabled the test and refinement of the research methods and instruments. Each pilot built on the lessons learned and limitations of the previous ones. At the end of the fourth pilot, it was possible to establish the design of the final interviews and exercises, as well as adequate sampling criteria within the target groups. This provided a solid foundation for the two main study stages. The first stage of the study collected the larger tranche of data of the two, using tried and tested methods in a controlled environment. The second stage of the study validated the methods and the results from the first by replicating them in a different, real-life setting. Forty-six participants in total were interviewed for both stages of the main study (two interviews were discarded due to non completion).

## 6.1. STRUCTURE OF THIS CHAPTER

This chapter begins with a summary of the methods used in the study. An outline of the findings is then presented, with an in-depth discussion of each. The limitations of the research are outlined and discussed at the end.

From the thematic code analysis (see sub-section 5.1.3, page 144), the study identified four main themes:

- Engagement with the individualisation process
- Sense of ownership
- Willingness to Invest (time and effort in that process)
- Satisfaction with the product

The codes were identified with the first 18 analysed interviews and a 'map of codes' was proposed as a visualisation tool to understand better the complex composite that constitutes the value of the individualisation process (see Figure 5.8, Data Analysis chapter for the main studies, page 146, featuring again under section 6.4.3.1, page 182). From the thematic analysis of the interviews, it was also possible to assign hierarchical values to each code. With the 'map of codes' and their hierarchical values, it was then possible to plot the interrelations between those codes, and ultimately understand how the participants were able to *allocate value* to individualised products. This process is illustrated with Figure 6.1, a simplified version of the original map of codes.

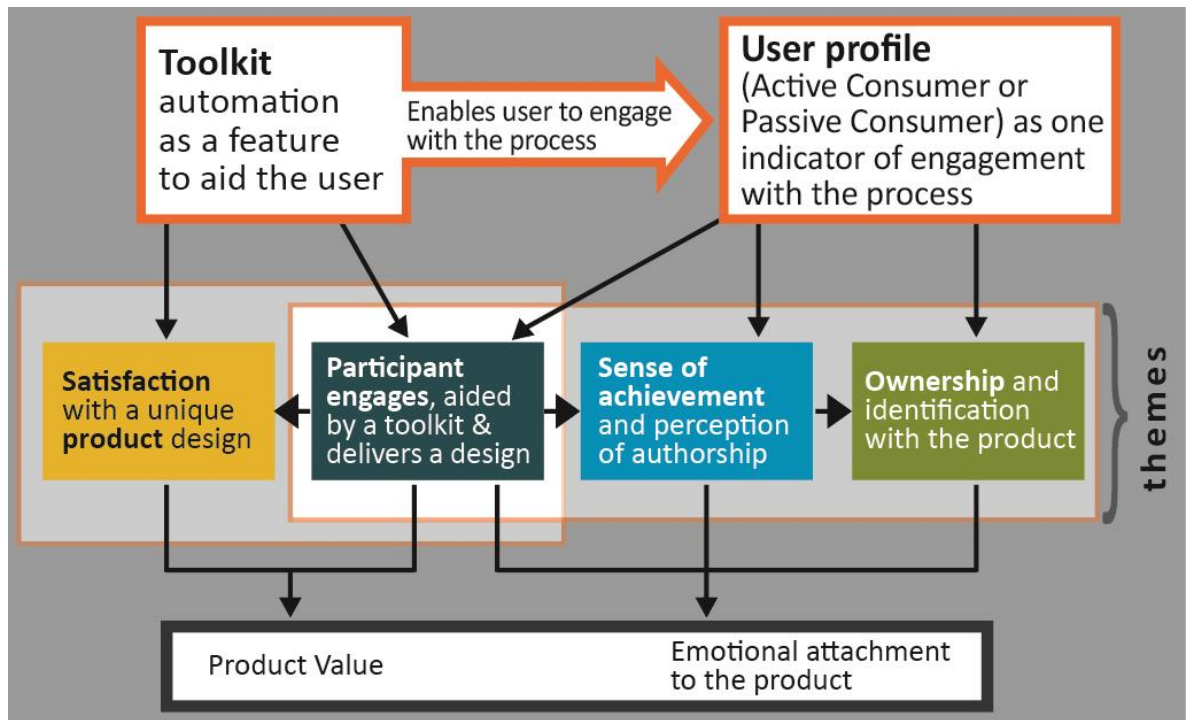


Figure 6.1. Key themes presented and discussed in this chapter.

Figure 6.1 shows that participant engagement in the individualisation process (the dark green theme box in the centre of the diagram) is key to the perception of a satisfaction with a product, as well as sense of achievement and ownership of that finished product. That engagement in the process is the result of an individualisation toolkit (automated or semi-automated) that enables a user to participate and who might (or might not) have an interest in interacting with the toolkit, depending on his or her profile (Active Consumer: AC, or Passive Consumer: PC).

A personal sense of achievement and ownership with an individualised product is the result of a participant who engaged with an individualisation process, as illustrated with the small horizontal arrows pointing to the right. The evidence suggests that participants linked the sense of ownership and achievement to their interaction with the process, rather than to the toolkit, meaning that the toolkit is only indirectly related to achievement and ownership.

To the left of Figure 6.1, satisfaction with the product is the result of the participant using a toolkit that helped him or her achieve an individualised result. The evidence suggests that participants (particularly PCs) valued and were satisfied with the product as they were aided by the toolkit that ensured a better design than if they had to do it themselves without any help. Participants also attributed uniqueness value to the product as the process involved them directly, through clicking the computer mouse to operate the toolkit, rolling the dice or

pressing the syringes. For this last reason, the user profile is only indirectly related to satisfaction with the product, which explains the absence of an arrow from one box to the other in Figure 6.1.

Figure 6.1 also serves as a logical guide to structure this chapter. The chapter will discuss findings in relation to:

- The toolkits
- Groups of participants (AC and PC)
- Themes and codes from the thematic analysis

The chapter will then continue by discussing:

- Implications of the findings in relation to the research questions
- Limitations and summary

## 6.2. SUMMARY OF METHODS USED

The first stage of the study recruited 35 respondents and stage two recruited a further 11 participants (see page 91 in Methodology chapter for an overview of the design of the study). Two interviews were discarded due to non-completion. The group of 44 male and female participants with completed and usable interviews, fit within the target audience, characterised by consumers who grew up with mass manufactured products and are able to decide on their own purchases. Those consumers demand more personal products with which they can make an affective connection. They are also normally familiar with computers, software, online shopping, modern communication channels, interaction with retailers and the idea of customising their purchases to obtain “exactly what they want” (Bardakci & Whitelock, 2003: 464). There are multiple examples of customisation processes applied to consumer goods and services frequently used by this target audience. They range from electronics manufacturers with online toolkits for consumers to customise their devices, wearable accessories manufactured via 3D printing, insurance companies allowing to select and customise the type, cover and excess of a policy, to online t-shirt customisation companies where consumers can apply different patterns and images on the fabric.

Interview participants were grouped into two sets of consumers, called Active Consumers (AC) and Passive Consumers (PC), defined as follows:

**Group Active Consumers (AC)** – Individuals who express an interest in art or design activities, by profession, study, hobby or keen interest.

**Group Passive Consumers (PC)** – Individuals with no particular interest in art, design or craft activities.

All participants were interested in receiving a customised t-shirt in white fabric. The criteria for the allocation of participants to the aforementioned groups can be found in the Methodology chapter, under sub section 3.2.2.1 Active and Passive consumers, page 75.

During the interviews, participants had to do one of two possible product individualisation exercises using computer toolkits (i.e., software). The allocation of individuals to each exercise type was done to obtain comparable numbers of participants in each group, with a similar



representation of males and females (Table 5.2, page 134). Data analysis progressed in parallel to data collection during the study, which allowed the use of emergent findings throughout the research process, as described on page 59, in the Methodology chapter).

The exercises used during the interviews consisted on individualising a t-shirt with a pattern of painted coloured marks within a rectangular space on the front of the t-shirt. Participants used the toolkits by clicking a computer mouse over the image of a t-shirt on a computer screen. Every click of the mouse produced a coloured mark over the t-shirt on the screen:

Exercise A – the toolkit automatically determined the position and colour of the paint marks. Participants using this toolkit could choose from six different sizes available for those marks and the number of marks they wanted between two and twelve (Figure 3.18-a in Methodology chapter, page 92) to individualise the t-shirt.

Exercise B – the toolkit automatically determined the position, colour and size of the paint marks (Figure 3.18-b in Methodology chapter, page 92). The number of paint marks was determined by rolling two dice. Participants using this toolkit clicked over the t-shirt on the screen as many times as determined by the dice.

Exercise A was less restrictive than exercise B, allowing participants to have more say (i.e. ‘decision making power’) over the process. Participants were allowed to use the toolkit as many times as they wanted and were told to stop whenever they liked the t-shirt produced on screen. The toolkits produced one design at a time, not allowing participants to compare possible designs.

Participants from both groups, AC and PC, used one of the two exercises, creating four sub-groups: AC using exercise A (ACA), AC using exercise B (ACB), PC using exercise A (PCA) and PC using exercise B (PCB). Table 6.1 shows how the 44 participants over the two stages of the study are distributed.

	Exercise A – less restrictive	Exercise B – more restrictive
AC	(ACA) 16 participants	(ACB) 10 participants
PC	(PCA) 10 participants	(PCB) 8 participants

Table 6.1. A total of 44 participants took part in the study: 33 during study stage #1, and 11 during study stage #2.

The 33 participants with completed interviews in the first stage of the study (which collected the largest tranche of data), were divided as follows: ACA (eight participants), ACB (ten

participants), PCA (seven participants) and PCB (eight participants). Each of the four groups had an even representation of females and males (apart from group PCA, featuring four females and three males). The age range in the groups in study stage #1 was also predominantly similar in the cohorts, averaging between 27 and 32 years old (as shown in Table 5.2, page 134), which assured similar representation from each group. Participants were frequent visitors of the university campus and had comparable interests: they were all engaged with academic life, as either undergraduate or postgraduate students, staff members at the university, or external participants who were also students. The occupation of the participants did not determine their profile as either AC or PC.

### 6.2.1. Using t-shirts as a research artefact

This section discusses why using t-shirts as a vehicle to run the interviews rendered the process fit for the purposes of this research.

Campbell et al. (2013), Merle et al. (2010), Merle et al. (2008), Piller (2010) and Bardakci & Whitelock (2003), suggest that depending on the product type, customers would be happy to pay a premium for customised goods. Woudhuysen (2013), Dean & Pei (2012) and Ford & Dean (2013) suggest three intrinsically linked elements that can determine what product consumers choose to customise, as illustrated in Figure 2.4, (see page 35 in the Literature Review chapter for more details). They explain that a *premium* design requires *premium* materials for manufacture and therefore a *premium* process of production, and that a *premium* design again.

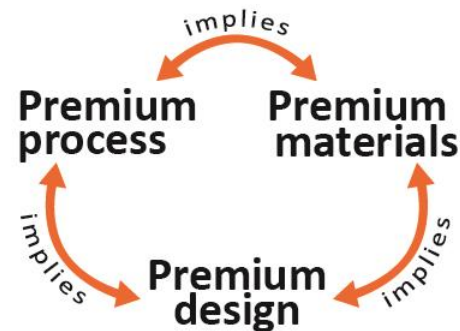


Figure 2.4 (from chapter 2). The three elements that can determine what product consumers customise.

This is particularly true if we consider customising fine jewellery, where a premium design with complex geometries could require a premium manufacturing process and, in turn, such a premium process would justify (or even require) the use of premium materials. Finally, one could argue that premium materials would justify premium designs. Further, Bardakci &

Whitelock (2003) talk about a product's "demand pattern": if the pattern is functional (e.g.: table salt, screwdrivers), there is a lower interest to customise. All t-shirts were white with no recognisable brands visible that could suggest a premium item. The t-shirts could be perceived as either purely functional, or as a white canvas offering a chance to engage creatively with it, depending on the context (e.g. how, when or where the consumer plans to wear it) and the type of consumer. Choosing t-shirts as vehicles to run individualisation exercises meant that:

- T-shirts kept within a multidirectional balance where none of the factors required were 'premium'
- They can be perceived as having the potential to accommodate an innovative demand pattern. Indeed, they are a highly customisable item
- They fitted this project's budget, schedule and most importantly, the research design and methods (page 65). Also they were an effective material "motivator" to attract participants (see page 70)
- T-shirts encouraged participants to customise and engage with the toolkits by avoiding a sense of risk associated when getting a 'wrong' result (the t-shirts were perceived as non-premium products)

For these reasons, using white t-shirts met the key research criteria and requirements given the aims and design of this research, rendering them an appropriate vehicle to collect data. Using t-shirts also implied limitations for this study, which are discussed below (page 193).



Figure 6.2. Photos during interviews, featuring some of the tools and instruments used.

## 6.3. SUMMARY OF FINDINGS

The key findings are summarised below, following the structure shown in Figure 6.1. The discussion of these findings is presented in section 6.4, page 174.

### 6.3.1. The toolkits

- A toolkit with limited user freedom can be designed to generate value and elicit an emotional attachment to the product

- Groups PCA and ACA scored the lowest, and PCB and ACB scored highest in the “I feel in charge of the decision making” question, despite exercise B being the most restrictive toolkit.

- Both PC groups generally reported the highest engagement with the process by acknowledging benefits in the automated decisions taken by the toolkit, which ACs reported as frustrating. The AC groups also identified that effect as a possible benefit for participants who have a PC profile.

### 6.3.2. Groups of participants

- Both PC groups (PCA and PCB) were the most engaged overall and the most attached to the product. Considering the PCA and PCB profiles, it could be claimed that those participants had to make a greater intellectual effort than ACA or ACB for the same activity, as explained later in the Discussion of findings section 4.4.2, page 180.

- The two proposed types of consumers (AC and PC) showed distinct behavioural characteristics, as evidenced through their response to the exercises. For example, PCs referred to the resulting design of the t-shirt more positively and frequently than AC. Both AC groups were overall the least engaged with the individualisation exercises (A and B). They reported having less fun than the PC groups did. ACA found the process was generally slow, did not deliver the product they thought they could achieve and did not find the decision-making power they would have liked to have. ACB also found the process to be slow, but unlike ACA, exercise B required rolling a dice to start with, meaning an extra step in the process. In spite of

the perception of a slow process, virtually all respondents from all four groups were inclined towards “Strongly disagree” when asked if they would delegate the task to someone else.

### 6.3.3. Themes and codes

- Codes ‘perception of decision-making power and authorship’, ‘insecurity, frustration and freedom’ and ‘Algorithm and randomisation’ were more relevant for ACs as they spoke about it more frequently, emphatically and negatively.

- ACs talked about their physical participation more positively and frequently than PCs even though ACs showed signs of frustration with the overall experience (which included the use of a restrictive toolkit), highlighting the differences that characterise the two groups. The physical interaction in the exercise (e.g. using painting tools) was a challenge for PCs, who referred to it less positively, but triggered the sense of achievement and pride at the end.

- The ‘Satisfaction with the Product’ code related to the t-shirt’s final design and its uniqueness value. Codes belonging to this theme came after codes from the other three themes.

Participants cited the interaction with the random algorithm of the toolkit, their “luck” rolling the dice and their physical participation as the causes of unique results. Satisfaction with the product was also identified from participants’ comments of visual associations between the resulting shape of the paint marks and imagery that were familiar to them.

- ACs were more reluctant to use again in the future the type of individualisation researched here, due to the sense of insecurity in achieving a satisfactory result, which they associated with the reduced freedom in the exercise. The randomised toolkit and the dice were also often associated with that insecurity.

## 6.4. DISCUSSION OF FINDINGS

This section discusses and interprets the findings in the context of relevant earlier research. It follows the same structure as the section above, however overlaps between areas are inevitable. For example, the discussion around the different reactions that characterised each type of consumer (AC and PC) is relevant to both the groups' features and the toolkits they were using during the interviews.

### 6.4.1. The toolkit

The design of a toolkit is key to a successful customisation experience. Its main function is to guide consumers through the customisation process, feeding information and product choices in an organised manner, sometimes controlling the 'amount' of choice (Matzler et al. 2007). This section discusses how an automated or semi-automated toolkit that limits user interaction can generate value and emotional attachment.

#### 6.4.1.1. *Limiting freedom can generate value*

Previous research indicates that consumer engagement with a product customisation process correlates with consumer attachment to the customised product. de Beer et al. (2009), Mugge et al. (2009) and Ariadi et al. (2012) suggest that an emotional bond with a product could result from the combination of customers' time and effort invested in the customisation process. The following equation is proposed to summarise the concept:

<b>Time</b> customising + <b>Effort</b> (intellectual & physical) customising = Emotional bond with product
---

PC groups reported higher engagement and attachment than AC groups (as shown in Figure 5.1, page 136) even though the task they took part in was the same and the products' final design and quality were similar. For the equation proposed above to apply to the collected data, in the context of the PCA and PCB profiles (see Summary of methods used, section 6.2, for participants groups' profiles, page 168, above), it could be argued that PC groups had to make a greater effort than AC to complete the same activity. The higher engagement with the process and attachment to the product could correlate with the PC groups' effort and pride in achieving a result. However, PC groups reported a higher engagement with the process by acknowledging benefits in the automated decisions taken by the toolkit. It is therefore argued that PC participants might have preferred less involvement with the process in order to value it

positively. This is, the lower the investment of effort in the process, the higher the engagement (and consequently, higher attachment to the product).

It is possible to consider that the equation proposed earlier is true for the PC participants up to an 'inflection' or 'tipping' point: "a maximum; beyond that point, higher contributions are increasingly perceived as effort, not as additional value" (Franke et al. 2010: 137).

Figure 6.3 is proposed as illustrative of the 'tipping' point using a generalised view of the data collected for this research: the more time and effort individualising a product, the more attachment to the product (represented in yellow); up to the point where more attachment is achieved by reducing the amount of effort required to customise (represented in green). Or else, if more effort is required, the attachment diminishes (represented in blue).

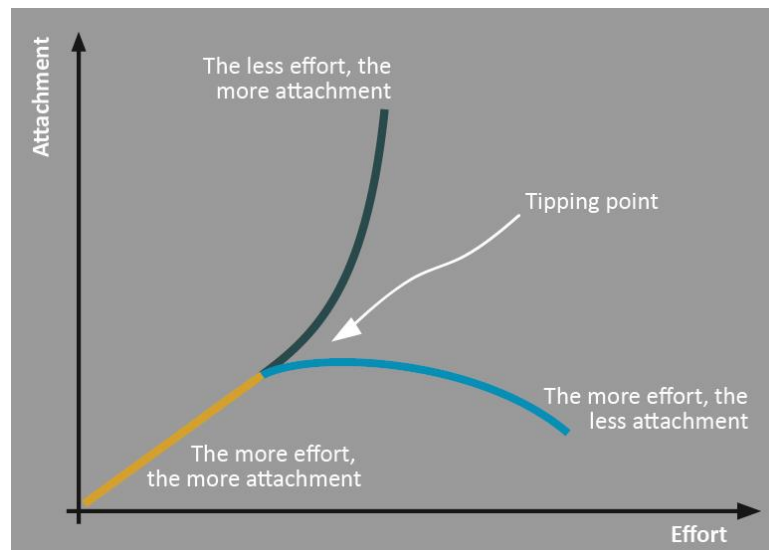


Figure 6.3. Beyond the 'inflection' or tipping point, reducing effort would increase attachment. The diagram does not associate one group to one colour/curve, as this happens to either group, though presumably AC's tipping point would be later in the process.

This finding is also broadly consistent with inferences from Merle et al. (2010) and Shankar et al. (2006) in that less choice could be attractive for some users unwilling to invest time and effort to achieve customised products. Seemingly, an automatic, albeit restrictive, process of product customisation could persuade PCs to experience new creative possibilities to customise. Indeed, from Sinclair & Campbell (2009) and Campbell (2013) it could also be understood that consumers could benefit from a customisation approach that enables them to achieve a result quickly, without the need for special technical skills or software whilst assuring a 'good', manufacturable and safe design.

This research challenges the argument that restrictive toolkits can obstruct the emotional bond with customised products (Mugge et al. 2009) in cases where the consumer matches the PC group profile. This research supports instead the claim that toolkits should "limit user freedom" (Campbell et al. 2012: 7) in order to secure standards of safety, functionality and manufacturability. Such a 'limit' should coincide with the 'inflection point' explained above, if the toolkit is to be successful, generate value and an emotional bond with the product. The inflection point, or 'limit' in the toolkit, is different for each consumer profile. For example, PC participants would need to reach the inflection point earlier than AC because PC might be unwilling to invest significant time and effort to achieve individualised products. Meanwhile, this research suggests that ACs are likely to prefer to keep control over the customisation process for longer, meaning their 'limit' might occur later in the customisation process.

This research designed two toolkits, each with a different degree of user freedom (or inflection point), and administered them to two types of consumer participants to collect data, generating the four groups mentioned earlier: ACA, ACB, PCA and PCB (Table 6.1, page 169). Having four groups helped to assess where such an inflection point could be located in each case. However, as will be discussed later, it is possible that more than two types of consumers should be considered, and arguably each would expect a different degree of freedom within a toolkit. This research cannot determine a definitive formula to identify the precise inflection point for every type of consumer. However, the research claims that such an inflection point exists, it explains how it works, suggests that it is different for ACs and PCs, and what could be the effects if the inflection point is ignored by stakeholders (e.g. entrepreneurs or designers). An example of this claim is presented in the next sub-section, which discusses decision making power over the individualisation process.

#### **6.4.1.2. Perception of decision-making power in individualisation**

To assess the statement "I feel in charge of the decision making", the research used a five-point Likert scale. Group PCA scored lower than PCB (see Figure 5.4 in the Data Analysis, page 137), despite exercise B being the most restrictive toolkit. This could indicate that users' *perception of decision-making power for individualisation processes* is not only dependent on their consumer type profile (AC or PC), but also on their perception of the proposed exercise. For example, if a customisation exercise offers a 'limited' amount of decision power (such as in exercise A), it could be perceived as 'too limiting'. However, a toolkit that hands no power to the participant (such as the one used in exercise B) pre-empts any views of 'too open' or 'too limiting', preventing a negative perception of the experience altogether. Although exercise B offered less decision power than exercise A, PC groups' responses show they valued the



opportunity to use an automated process (exercise B), without worrying about having to make design decisions themselves.

Groups ACA and ACB also registered a similar pattern to PC groups in the “I feel in charge of the decision making” question. It is therefore arguable that ACs also experienced a tipping point in the relationship Effort / Attachment, although the tipping point would appear to occur after more effort is invested than is the case for PCs, as per Figure 6.4, below. This stance confirms that the perception of decision-making power is not dependent on the groups’ profile, but on their perception of the exercise. It could therefore be claimed that a toolkit designed to offer generous decision-making power could engage consumers to individualise, whilst in reality the toolkit is keeping control of the result. Arguably, this would be “overplaying genuine individual choice” (Knott, 2013: 47), but it would also be assuring product quality and safety standards.

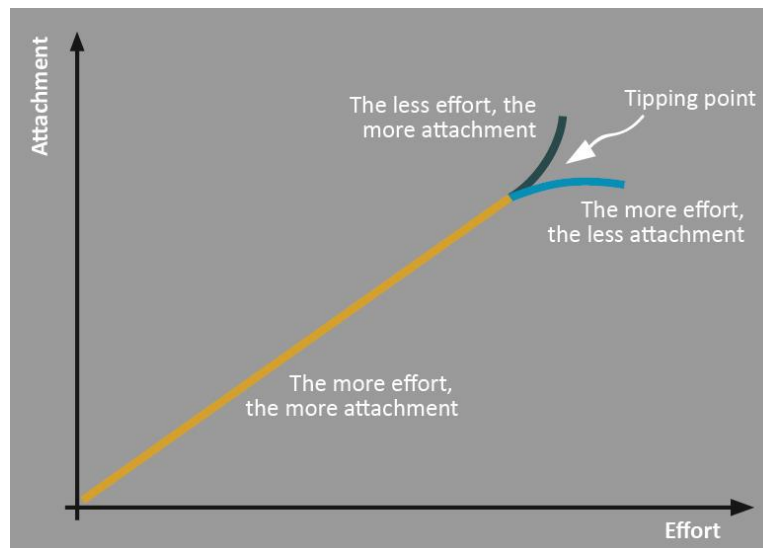


Figure 6.4. The tipping point for ACs would take place later than for PCs.

Despite the “I feel in charge of the decision making” results from ACs (as described above), the data (collected through their responses to open-ended questions and through observing their interaction with the exercise), would indicate that a replacement of AC’s decision power by a toolkit (such as the one used in exercise B), is not entirely desirable. Figure 6.5 illustrates what happens when the toolkit takes over decision-making from ACs: it causes a frustrating experience and an impersonal product as the person barely participates. When very little effort is required, the experience results in no sense of achievement or ownership and as the toolkit does the entire customisation job, the product is deemed irrelevant to the participant. This research proposes that a similar effect could apply to PCs if they feel completely excluded from the experience at the expense of a ‘dominating’ toolkit.

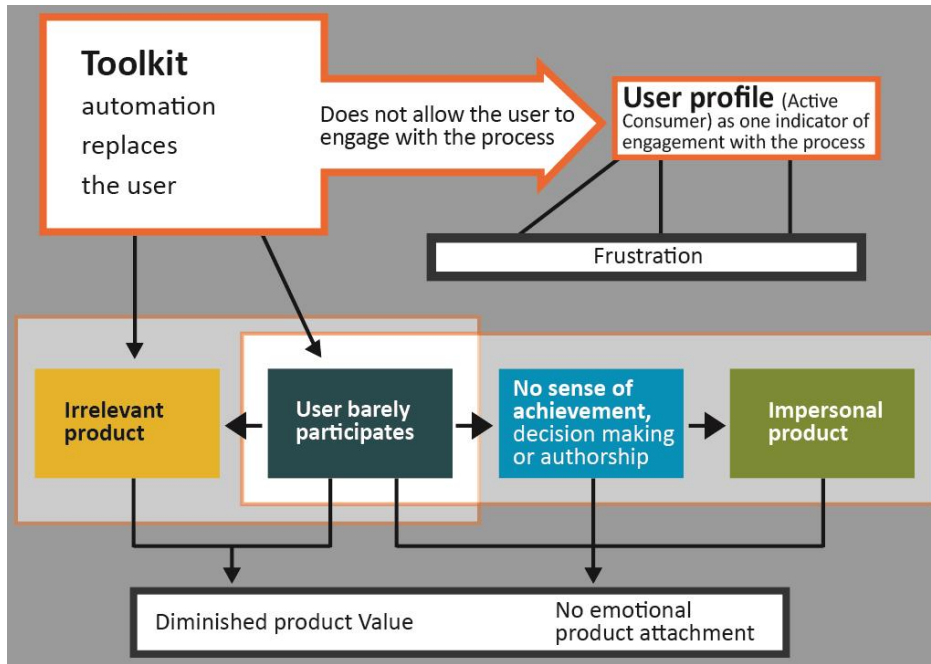


Figure 6.5. AC's interaction replaced by an overtaking toolkit did not allow them to engage with the process

Figure 6.6, as opposed to Figure 6.5 above, illustrates a toolkit that demands much more effort from the users. This scenario represents the PC groups when using exercise A, causing insecurity as well as frustration in the process to customise a product without the necessary help of the toolkit. In this case, a PC struggles to customise without the aid of a toolkit to achieve a satisfactory product, resulting in a low sense of achievement and ownership. The value and emotional attachment to the product are also low or non-existent as a consequence.

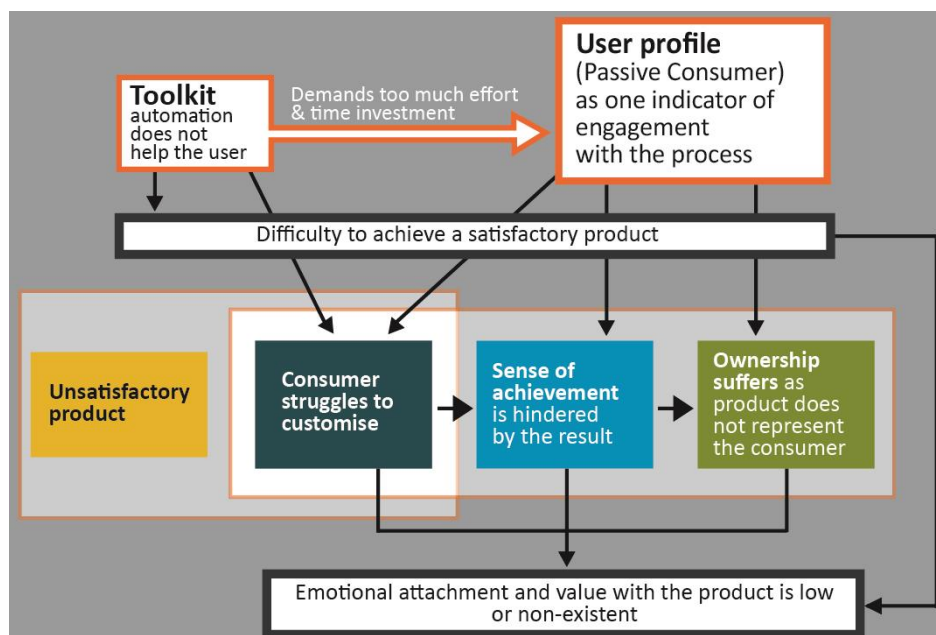


Figure 6.6. PCs struggle to customise without the aid of a toolkit and risk being dissatisfied with the product.

This research also proposes that a similar effect to what Figure 6.6 illustrates could apply to ACs if the customisation process demands too much effort, as the final result may not be seen to be worth the effort invested.

#### ***6.4.1.3. Passive Consumers engagement and the benefits of an automated toolkit***

Results from measuring the time spent using the toolkits by each group show that, on average, PC groups invested 47 seconds longer in exercise A, and 100 seconds longer in exercise B, than ACs did. This finding is in line with the result shared earlier, in that PCs engaged more with the process than ACs. Whilst PCs invested more time to achieve a result, they also highlighted the automated characteristics of the toolkit as beneficial, meaning they welcomed making less intellectual effort and allowing the toolkit to make decisions for them instead. ACs' perception of a slow process, in spite of the shorter time spent using the toolkit, could reinforce the assertion that they found the overall experience as frustrating. It is not entirely clear if ACs spent less time using the toolkit as they required less time to achieve a result, or (most probably) as a result of growing frustrated with it. It could be said it is the latter because either toolkit worked in the same way for both groups of participants.

PCs may not like the result they thought they wanted (Syam et al. 2008). As suggested in the Literature Review, individualisation offered 'safety zones' or 'islands' (i.e. 'correctly' customised products) along a continuum between a standard and a customised product (see page 31). Whilst it was up to the participants to select an individualised t-shirt design, the toolkit helps the participant by guaranteeing each result is within a 'safety island' given that the algorithm behind the toolkit follows a designer's initial instructions. Indeed, PC participants expressed relief at not having to make the choices.

The toolkits for this research were designed so that only one t-shirt design was offered at a time, not allowing the participant to compare a t-shirt design with previous design iterations. The idea behind this toolkit design was to highlight the perception of uniqueness in every design, as well as offering unlimited choice whilst avoiding "choice paralysis" (see Terminology in Literature review, page 26) by controlling the availability of options. Such a toolkit design was a learning outcome from the toolkit designed for pilot #3 – Exercise 1 (page 121 in Methodology chapter). Participants were then left with two options: either select the design shown on screen or use the toolkit again for a new design, albeit facing uncertainty about what exactly the next iteration would look like. As explained earlier, the group PC expressed benefits in relation to the automated nature of the toolkit, yet the uncertainty was often perceived as

hindering the experience, characterised by randomness and not play, accounting for the “insecurity and frustration” code in the thematic analysis.

## **6.4.2. Participant Groups: Active Consumers and Passive Consumers**

This section highlights how different types of consumers have been identified in the literature and how this research aligns with it. This section also discusses how the two types of consumers considered here helped to interpret the data.

### ***6.4.2.1. Passive Consumer groups engaged more and made more intellectual effort***

PC participants engaged better with the individualisation process and referred to the resulting t-shirt more positively and frequently than ACs. It could be argued that the PC participants had to make a greater intellectual effort than ACA or ACB for the same activity and that PCs reaction was due to their lack of experience in art, design and craft (which aligns with their profile), meaning that they were more satisfied with both the automated toolkit and the resulting design, than ACs. However, as explained earlier, the PC group using exercise B (the most restrictive of the two exercises), reported engaging more by acknowledging the benefits of the automated toolkit, meaning they did not have to make a greater intellectual effort. Meanwhile, ACs approached the exercise with more developed skills and higher expectations of the design they would generate. The difference between their reactions helped to visualise benefits and drawbacks of individualisation and ultimately also helped in understanding and locating the value of this approach to product customisation. PCs later showed a more positive attitude towards receiving the t-shirt once the paint was dry, although their subsequent attachment dropped compared to that of ACs.

### ***6.4.2.2. Consumer types and alignment to previous research***

Shankar et al. (2006) explain that power to make decisions “does not emanate from somewhere or someone [...] is not a thing that is owned or lost [...] say from producers to consumers. Rather, power creates both producers and consumers within discourses of knowledge” (Shankar et al. 2006: 1016) and therefore of skill. Responses obtained from ACs and PCs are broadly consistent with the types of consumers described by Knott (2013) and Hermans (2014), as explained next.

Hermans (2014) proposes a continuum of “lay designers” expanding between “passive consumer” and “professional designer” (Literature review, page 40). He explains: “The notion of a continuum is adopted and appropriate since the lay designer is neither a passive consumer nor a professional designer” and the level of participation “depends on the layperson’s

intention, motivation, knowledge and skills” (Hermans, 2014: 25). Evidence from this research suggests that Herman’s continuum might offer a valid visualisation of the spectrum between AC and PC. For example, Figure 6.7 shows how the two types of consumers identified in this research would fit within Hermans’ continuum, where the proposed “Passive Consumer’ type aligns with Herman’s “passive consumer” and “adapter”, while the proposed ‘Active Consumer’ potentially aligns with the types on the right of Herman’s continuum.

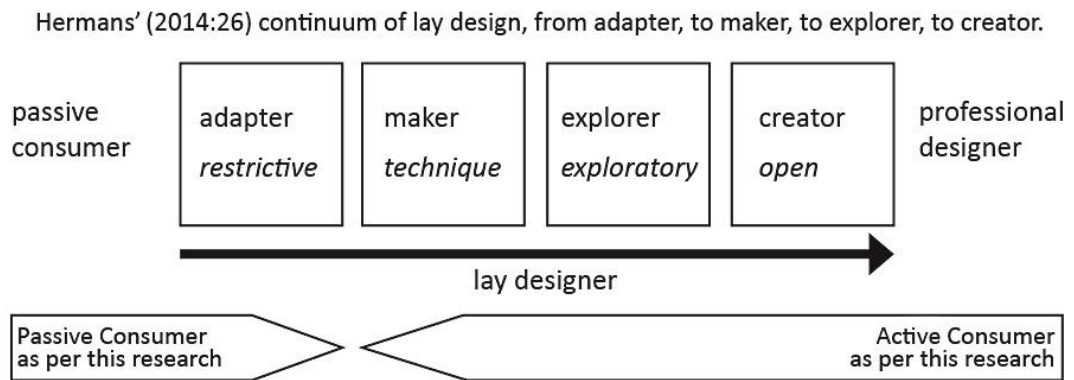


Figure 6.7. This research’s proposed PC and AC types aligned against Herman’s (2014) continuum (as in Figure 2.6).

Figure 5.10 and Figure 5.11 in the Data Analysis chapter of the main study (see pages 152 and 153 for AC and PC respectively) show hierarchical differences in the codes, but also similarities. The difference between the size and position of the same code in Figure 5.10 and Figure 5.11, could be interpreted as a continuum between PC and AC. For example, the toolkit marks a difference between groups: the code “Algorithm and randomisation” was over twice as negative for ACs (-42) as it was for PCs (-19). However, that code has a predominantly negative evaluation in both groups, giving the impression that there could be a similarity: most ACs fully rejected the toolkit, yet some suggested it could open an opportunity for creativity. Meanwhile, most PCs relied on the toolkit to take decisions they wanted to avoid, yet some found it too restrictive.

Also in line with this research, Knott (2013) proposes defined prosumer types instead of a continuum. Knott describes three types of prosumers while this research reduces the spectrum to two (AC and PC). However, we could align Knott’s prosumer “who follows the rules (i.e. tools and advice)” with the PC profile, which highlights the benefits of following the toolkit with precise instructions, so that the consumer can “feel a sense of pride” (Knott, 2013: 53) in achieving a result. However, Knott claims that in doing so, PCs would conform to “just another false illusion of individuality within the expanded choices offered” (Knott, 2013: 50), as they settle for toolkits that restrict their freedom of choice. ACs, on the other hand, rejecting the

directives given by the individualisation toolkit, could be aligned with Knott's other two prosumers: "the one who rejects such provision and pursues self-sufficiency" and "the one who adapts tools and materials in the process ad hoc bricolage" (Knott, 2013: 45). Therefore, as the individualisation toolkit did not allow participants' "self-sufficiency" or adaptation of tools, ACs found the process frustrating.

Finally, Knott (2013:50) claims that customisation practices are "less about consumer control [...] and more about corporate cost-cutting and profit maximization". Accordingly, Mustak et al. (2013) explain that the cost-cutting effects of customisation are then marketed as benefits for the consumer. Whether the development of customisation processes has the intention of reducing company costs, benefiting the consumer, or both, this research argues that participants can still benefit from individualisation. Findings suggest the PC cohort would otherwise not regularly experience engagement in a customisation process seeking unique products or have an emotional attachment to the result, all of which constitute parts of a product's added value (see Added Value, page 28).

Only two participants (both ACs) commented on the risk of waste from unwanted customised results, given that the exercise did not allow them to customise exactly as they initially wished. This did not seem to be a relevant issue for the PC group.

### **6.4.3. Themes and codes**

Codes used in the thematic analysis were both data-driven and theory-driven, as explained in chapter 2 (page 96). The coding process summarised and brought to light participants' key thoughts during the experience, all of which, in different measure for each participant, determine their personal view of individualisation. This section will initially discuss the map of codes generated from the data and the hierarchies that were produced as a result of the analysis. Each item from the corresponding section in Summary of findings is then addressed and discussed.

#### ***6.4.3.1. Map of codes and their hierarchy: a composite subjective impression***

Participants' key thoughts were interconnected and could be grouped under four main themes, represented with the map of codes (Figure 5.8, shown earlier on page 146 and shared again below). Analysing those thoughts was a complex process. This research concurs with Franke & Schreier (2010:1025) in that the main themes are a "composite subjective impression" and therefore difficult to analyse objectively. This research offers a qualitative,

thematic code analysis, to help understand better that subjective composite. For example, the map of codes successfully represents the components' relationship within the composite. There are codes that connect to other codes and to more than one overarching theme, meaning that participants' responses were often connected to more than one aspect of the exercise, evidencing a rich experience and showing the composite nature of their opinions.

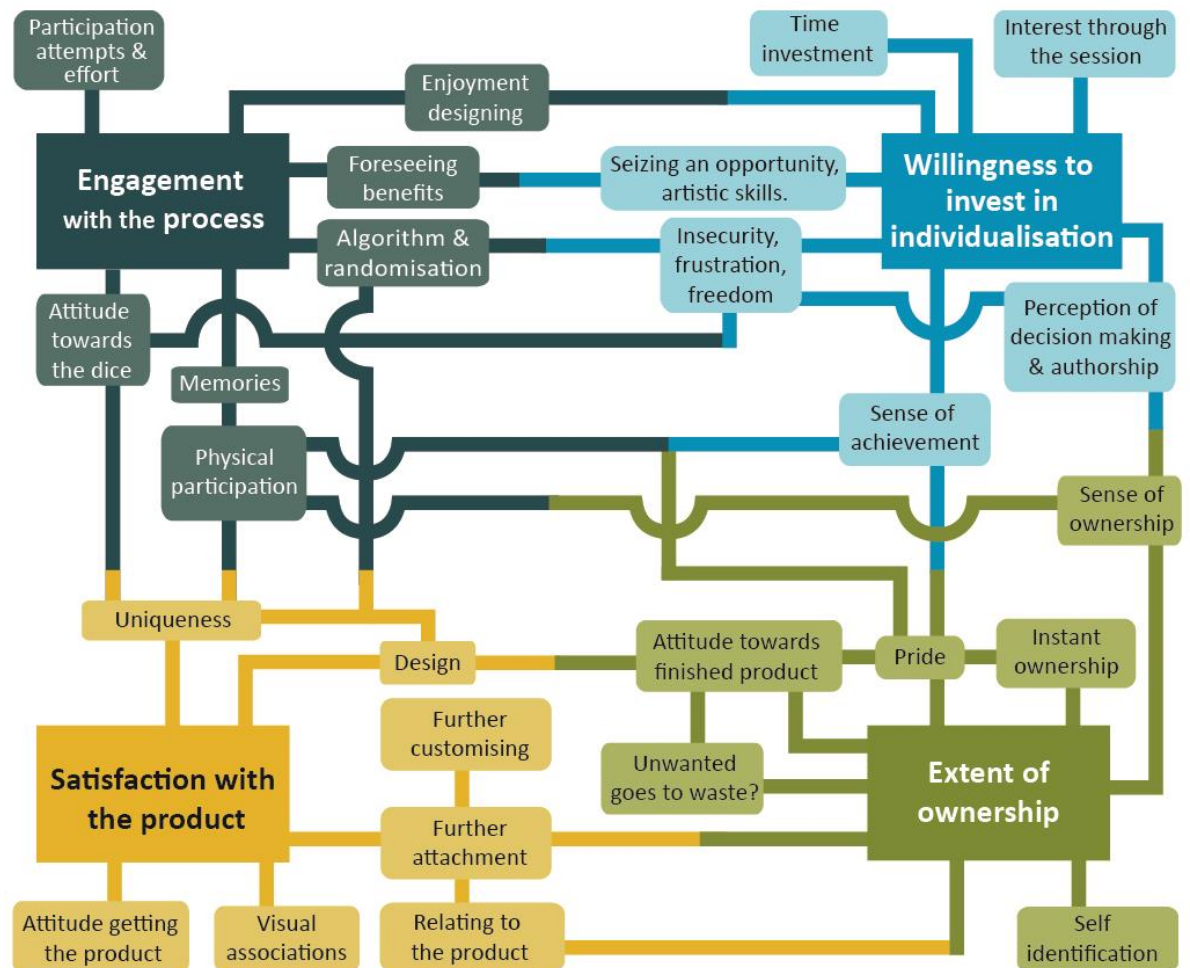


Figure 5.8 (from Data Analysis of the main study – chapter 5). Map of codes (round corners and pale colours) and themes (sharp corners and solid colours)

The map of codes also shows subjective impressions that portray the value of individualisation as an approach to customisation. However, it does not offer an indication of the hierarchy of codes. Both the map of codes and their hierarchical values contributed significantly to the analysis by offering a comprehensive picture to aid understanding of the composite. For this hierarchy, three factors were considered:

- Frequency of use of a code: refers to how many times each code is mentioned.

- Code emphasis: refers to the enthusiasm or intensity expressed by the participant.
- Degree of positive or negative connotation: shows whether a code was mentioned in a positive or negative way.

This research adapted Henerson et al.'s (1988) method to calculate emphasis, as it deals with the spoken word rather than written text, for which Boyatzis (1998) would have been more appropriate. This consisted of ranking the codes depending on the emphasis with which participants mentioned them (further explained in the Data analysis chapter, page 149). The hierarchical arrangement of those codes (four figures were produced, one from AC's interviews: Figure 5.10, one from PC's: Figure 5.11 and two generic: Figure 5.9 and Figure 5.12, from pages 152 to 155), helps us to understand how individualisation can deliver value to which consumers, supporting the findings discussed in the next sub-section

Building a map of codes is not alien to qualitative studies. Maps of codes (and in this research their hierarchical values too, discussed below) are always the result of a researcher's interpretations. Proposing a hierarchy of the codes, however subjective, aligns with the paradigm that offers the theoretical underpinning of this research: a hybrid between experientialism and constructivism (Methodology chapter, page 57). For example, the value that the 'emphasis' factor can add to this work when creating a hierarchy of codes is ultimately dependent on the researcher's interpretation of the social construction of reality between the interviewer and the respondent (Braun & Clarke, 2013; Braun & Clarke, 2006 and Bryman, 2008), and as such it offers one interpretation of reality. It could therefore be argued that the research has limitations if seen through a positivist lens (more on limitations in section 6.6, page 193, below). This interpretation of reality is theorised directly from peoples' experiences: "...sometimes referred to as *naïve realism* [it assumes a] perfect correspondence between reality and the term used to describe it" (Bryman, 2008: 14). Following rigorous qualitative research guidelines, it can be claimed that this approach is appropriate for the analysis of subjective impressions.

#### **6.4.3.2. Salient codes for Active Consumers**

Comments on the toolkit and freedom of choice were more relevant topics for ACs than PCs. ACs reported the least engagement with individualisation and attachment to the product by talking about frustration more often and more emphatically. This aligns to previous findings and highlights how their behaviour matches that described about similar groups identified in literature.



The code 'perception of decision-making power and authorship' (related to the insecurity and frustration in the process) was more relevant for ACs as they spoke about it more frequently, emphatically and also more negatively. It could be said that ACs' behaviour responds to a frustrated expectation in the face of an automated or semi-automated toolkit that does not offer the creative possibilities they might have expected to customise the t-shirt according to their wishes (we should bear in mind that participants were invited to customise a t-shirt but were not told how this would happen).

Another example of how understanding the hierarchy of codes supports the findings described earlier, is the code 'Algorithm and randomisation', which was a predominantly negative code for both groups. Earlier findings show that PCs engaged more with the exercise and were more satisfied as the toolkit helped them to achieve a satisfactory result. Accordingly, the hierarchy reflects that for PCs' experiences, the algorithm and randomisation was a less frequent topic, less negative and talked about it with less enthusiasm, meaning that it impacted on the experience less negatively than it did for ACs. As a result of this last point, PCs referred to the code 'design' (their final individualised designs) more times and more positively than ACs. The fact that the three codes 'insecurity, frustration and freedom', 'perception of decision-making power and authorship' and 'algorithm and randomisation' scored more positively and were less important for PCs than for ACs, suggests the former considered individualisation as a valuable approach to customisation. Such a result supports the observations listed earlier in sub-sections 6.4.1.3 and 6.4.2.1 (see pages 179 and 180).

A further review of the hierarchy of codes also illustrates differences between the AC and PC groups beyond data gathered through the questionnaire, and those differences help in understanding where the value of individualisation resides. The sample design was done based on previous literature that suggests participants can be divided as per the type of producer-consumer they are, depending on their characteristics such as skills and interests (see Sample in Methodology, page 72).

#### ***6.4.3.3. Physical participation: Engagement with the process and Extent of ownership***

In the Data Analysis for the main studies, it was pointed out that the code 'Physical participation' presented a particular difference between the groups (see page 154). Physical participation refers to the physical effort (as opposed to intellectual effort) an interview participant puts towards individualising the t-shirt, for example pressing the paint syringes with different force to obtain different patterns over the fabric. Further, physical effort is also

regarded as a key component to elicit an emotional bond with the product (Mugge et al. 2009). ACs talked about their physical participation more positively and frequently than PCs did, even though ACs showed signs of frustration with the overall experience, which included the use of a restrictive toolkit. This was an unexpected finding, as the participants' physical interaction with the process was guided by the result on the computer screen. The most likely explanation for this finding is that in spite of the benefits PCs find in individualisation, they do not regularly engage in art, design or craft-related hands-on activities, thus the act of painting the t-shirt following the on-screen design represented a challenge. For ACs, however, the requirement of physically engaging in painting the t-shirt seemed interesting and exciting.

According to Peck & Shu (2009), even if PCs did not consider their physical participation as a particularly positive experience (just above 0 in the Negative/Positive axis, see Figure 5.11 in the main studies Data analysis, page 153), they would still report a sense of ownership and positive evaluation of the product through the manipulation of on-screen imagery and the painting tools (this is also true for the AC groups). Peck & Shu (2009) explain that imagery of a product can increase the perceived value of that product as well as a sense of product ownership (particularly relevant for online retailers). For example, the exercises used for data collection implied that all interview participants virtually manipulated a t-shirt on screen by adding marks of paint. Additionally, "perceived ownership and affective reaction can mediate the effect of touch on valuation" (Peck & Shu, 2009: 435). Indeed, the participants then also physically manipulated the painting tools, the paint itself, the dice to decide number of paint marks, and had the t-shirt displayed in full, behind a protective clear acrylic (more details of the instruments used can be found in the Summary of methods used, section 6.2, page 168). Participants in this research started developing a sense of ownership and positively valuing the product even before the t-shirt became theirs, while they manipulated the toolkit and painting utensils. The affective reaction (i.e. product attachment) however, would only develop by investing time and effort in the customisation process, as per de Beer et al. (2009), Mugge et al. (2009) and Ariadi et al. (2012).

These findings may be particularly relevant for online retailers: although they can trigger product ownership through the manipulation of imagery, they could face a challenge in terms of consumer engagement because the consumers of individualised offerings would not regularly engage in a customisation processes.

#### **6.4.3.4. Uniqueness value and the Satisfaction with the product**

As can be observed in the map of codes (Figure 5.8, see page 183), near the centre of the figure there is an important node connecting three themes: Engagement with the automated process, Extent of ownership with the product and Willingness to invest in that process. The codes that appear at the top of the hierarchy list (Figure 5.12, page 155) do indeed belong to those themes and capture the main elements of the product's emotional attachment. It is then arguable that the theme Satisfaction with the product is the fourth in importance. In other words, whilst the value that individualisation can deliver in terms of uniqueness and design stands in its own right, the product emotional attachment, (the experience by which the consumer arrives at a design) is central to that value. By the same token, if the experience is negative (e.g. the participant does not engage with the activity, does not feel ownership of the product or cannot be persuaded to invest effort), then there is no satisfaction with the product, rendering it an irrelevant product with diminished value (as illustrated in Figure 6.5 and Figure 6.6, page 178). This is then broadly consistent with the literature, in that the overall added value of a customised product is the result of the value of the customised product itself plus the value of the experience generated while customising it. This research, however, challenges Merle et al. (2010) when they claim that the hierarchy of this twofold value ranks the product value above experience value and the latter can influence the overall perceived value and lasts longer than the product value. The findings from this work would indicate the experience value is hierarchically higher than the product value. This is in line with Figure 6.1 (page 166, above), as Engagement with the process takes a key role amongst the other themes for individualisation.

Participants reported the unique results of the designed t-shirts as connected to them, eliciting value and satisfaction with the product. The toolkit was designed so that it produces a unique design every time the computer mouse is clicked. However, the participants explained that the results each of them obtained were due to themselves clicking the mouse, i.e., some sort of fate by which no other participant would have ever generated those very designs. Other participants attributed the unique designs to their "luck" rolling the dice as well as their physical participation (i.e., their 'Engagement with the Process'). Those experiences were also reported as contributing towards the generation of an emotional bond with the product.

For PC participants, Satisfaction with the product was more noticeable than for ACs. Codes 'design', 'further attachment' and 'uniqueness' are the three ranking highest from this fourth theme (although 'design' has a negative evaluation). Tepper et al. (2001) explain that

consumers with a strong desire for differentiating from others would pay more for unique products, i.e., for a perception of exclusivity. Further, Mugge (2007: 23) claims that “people only have a few of these [unique] possessions and these products are generally not owned for their functionality”. It is clear then, that ‘exclusivity’ plays a key role in the perception of uniqueness value. If the argument that individualisation offers a democratisation of unique products is valid (guaranteed uniqueness for a given product through automated means), it is then arguable that ‘uniqueness’ does not per se add value because the product is no longer exclusive. For example, let us consider an exclusive collection of design kitchen utensils where each component is unique, yet belonging to the same family of products. If that collection was generated through an individualisation process and 3D printed, the concept of product family would remain but the collection could potentially have infinite number of components, all technically ‘unique’, meaning the value of an ‘exclusive’ collection diminishes. This is an important area of discussion for which further research is recommended.

The overarching objective of this research was to understand better the effects of individualisation on product design as a driver for consumer emotional attachment to objects. As discussed in this chapter, and demonstrated in the previous one, individualisation can indeed deliver added value as well as an emotional attachment to the resulting products. However, beyond a ‘point of uniqueness value’, it could be argued this approach to product customisation could become a victim of its own success if applied on a large scale. This is an important area for further investigation. Possible new research questions proposed in the next chapter (page 212).

#### ***6.4.3.5. Willingness to invest time and effort in the individualisation process***

AC participants were more reluctant to use the type of individualisation proposed in this research again in the future, due to the sense of insecurity in achieving a satisfactory result, which they associated with the limited amount of freedom allowed in the exercises. ACs expected to be able to achieve designs they could be satisfied with as they were invited to customise a t-shirt. However, their willingness to invest in this approach to customisation was not necessarily diminished by an unsatisfactory product, but by the frustrating experience that led to it. Likewise, for PCs, their willingness to use this method to customise products again was not directly related to the satisfaction with the t-shirt but with the experience. For this reason the map of codes does not show a direct connection between the two themes.

## 6.5. IMPLICATIONS

This section discusses the implications of the findings in the area of product design. Table 6.2, summarises the implications of each of the four themes according to the map of codes from the data analysis, for the key stakeholders. Not all the cells have been populated, particularly under the AC column, as a result of the limited amount of evidence in relation to specific themes and how they affect the stakeholders.

Summary of implications for stakeholders:				
Themes	Active Consumers (AC)	Passive Consumers (PC)	Designers & entrepreneurs	Future studies*
<b>Engagement with the process</b>	Interest in specific, applications, e.g. to 'trigger' creative ideas or to design 'fun' gifts for others at speed, with little commitment.	Interested in individualisation process, which triggers new relationship with products. Keen to engage in new, creative experiences.	New creative business opportunities generate public interest, attracting investment and further research.	What new types of consumers can be identified and how can we fine-tune individualisation processes to attract more of them?
<b>Willingness to invest in the process</b>	If potential to market individualised products that require little effort is identified (e.g. phone cases patterns, t-shirts and home decoration).	Sense of achievement can boost self-esteem, wellbeing and willingness to consume again. Could trigger desire to learn new skills.	Investment and development of online toolkits to compensate the absence of physical interaction with the product.	
<b>Extent of ownership</b>		New relationship with product can foster emotional attachment to it, lengthen ownership, delay disposal and generate positive memories.	Meaningful products for the customer potentially attract new consumers, generating loyalty and encouraging new product development. Perceived added value consistent with the automatic nature of the toolkit	What types of products would be worth individualising?
<b>Satisfaction with the product</b>	Persuaded to further customise the product. Product not particularly highly valued unless further customised.	More valuable products that are easily achieved. Interest in and appreciation for the unique. Can trigger a desire to further customise.		Can an infinite number of 'unique' designs with affordable costs, turn the unique product a 'banal' one?

Table 6.2. Summary of key themes and their implications. \* See also Further research, page 212.

As a validated customisation process, product individualisation brings along new creative possibilities, generates memories and nurtures emotions, otherwise unlikely to develop in those users who match the PC profile described in this research. As suggested under the PCs column in Table 6.2, the willingness to invest time and effort in individualisation could respond to being able to create a customised good that can develop into a sense of achievement and boost self-esteem, and as “emotions enrich a person’s life” (Mugge et al. 2009: 467) it could, in turn, contribute towards their wellbeing. For example, art activities with therapeutic purposes, especially for mental health, are currently in use by the National Health Service in the UK as well as diverse charitable organisations (e.g. NHS Lothian, British Association of Art Therapists, Learning for the 4<sup>th</sup> Age). The design of an individualisation toolkit aligned to the right purpose and environment could potentially benefit patients and will be explored in the future. The participants’ physical interaction with the painting tools during the data collection in this research, involved a degree of what appeared to be stress relief, as they pressed the syringes with different force, sometimes violently, and watched the colourful paint hit the clean fabric (Figure 6.8, below). Those acts were on occasions accompanied with verbal expressions of satisfaction and laughter. Such expressions, even physical ones, were the ones that later the participants identified as being captured in the t-shirt design, triggering a sense of ownership and attachment to the product.



Figure 6.8. Participants express themselves through the physical interaction with the painting tools.

The added value and emotional attachment towards an individualised product would also have an impact on the ownership experience over a period of time: how we relate to the product, how long we keep it, whether or not we tend to replace it and what do we do with it if it breaks. Longer periods of ownership could imply the generation of memories, suggested in the Passive Consumers/Extent of ownership cell in Table 6.2, above. It is not uncommon to keep objects due to the emotional attachment we have to them, regardless of their practical utility.

The ability to achieve unique objects deserves attention as users could have access to a potentially infinite number of variations created out of a single meta-product, meaning product families would not be set to a designed collection. The perception of product uniqueness, how we obtain them and what they mean to us in terms of value could also change, as this process could truly democratise uniqueness and exclusivity (this is one of the areas recommended for further research, as explained in the right-hand column of Table 6.2, above, and again in the next chapter). Most importantly, the findings from this work open up the space for new research and highlight other gaps in knowledge waiting to be filled.

Finally, individualisation processes could entail changes in the way products are offered to consumers and the interaction between client and designer in a shop. If we intend to apply individualisation on industrially designed products for manufacturing at scale, we should then consider the interaction with a toolkit as possibly the only viable solution (as opposed to painting t-shirts manually, in the case researched here). It is suggested that the growth in the use of individualisation processes could imply that virtual reality (VR) technology could play an important role in consumer engagement with online individualisation processes, particularly in the absence of physical interaction with the actual product. VR may have the potential to support the generation of a sense of ownership and achievement through the use of appropriate imagery as can be inferred from Peck & Shu (2009).

Similarly, additive manufacturing (AM) offers potentially practical benefits to individualisation as a cost effective and economically viable manufacturing route to produce unique designs and product batches as low as one, at no additional costs. That approach contrasts with 'traditional' manufacturing processes that require expensive tooling for each design variation, such as injection moulding. AM can work with systems that welcome consumer participation, identified as valuable for consumers (Mugge et al. 2009; Merle et al. 2010), and are key to a greater emotional attachment to individualised products. At the same time, the ability to individualise and generate a greater emotional attachment to products, could represent a benefit to the growing fields of AM and VR. Therefore, the findings presented in this research also have implications for designers and entrepreneurs, who could translate them into new creative and businesses opportunities, better exploiting the available technologies and creating unique products and experiences.

Individualisation does not necessarily work in every scenario, as explained under the Limitations section, below. Nevertheless, having demonstrated its value in principle as an

approach to customisation, individualisation studies could then join a broader discussion amongst researchers in the field, assessing how much participation consumers should have when using toolkits, which is proposed for further research in the next chapter (page 212). This is particularly relevant for individualisation because of its characteristically automated nature, yet allowing a margin of action for the user to feel involved, thus generating the emotional attachment to the output.



## 6.6. LIMITATIONS

The Data Analysis of the main studies (chapter 5) explained the specific limitations, implications and mitigation plans for each part of the study. These were later summarised in Table 5.8, page 162 (similarly, the pilots limitations, implications were summarised in Table 4.8, page 129). This section discusses the research limitations beyond those identified earlier.

The use of t-shirts as a vehicle to conduct the exercises constitutes one of the limitations, as the results cannot be generalised to all product types. Numerous research projects were reviewed where different products served as vehicles to run interviews and other forms of data collection. Attempting to individualise a product that each participant actually wants at that given time would generate rich answers. However it would be impossible to cover all product types in a single study.

In an ideal scenario, the design of the exercises for data collection would have used a product that best exploits the characteristics of individualisation as an approach to product customisation, whilst aligning with the balanced multidirectional circle shown earlier (Figure 2.4 on page 35 and featured again on page 170):

Premium product design ↔ Premium materials used ↔ Premium production process.

An example of such a product could be a piece of jewellery, which can fit in a 'premium' category whilst having an innovative demand pattern (Bardakci & Whitelock, 2003). In order to extrapolate the findings of this study to an industrially designed product, we should be able to reduce the customers' physical interaction with the customisation process (for example a product individualised on screen by the consumer, i.e. no physical interaction) whilst maintaining a degree of product attachment while it is manufactured by a company elsewhere. This approach would allow us to claim that individualisation is a valuable approach for industrially designed products and larger-scale manufacturing (as opposed to manually, one by one). Therefore, it could be applicable to a range of objects and be attractive to entrepreneurs and designers. Also, we would be in a better position to discuss the effects of individualisation as a democratising tool for uniqueness in products that are traditionally characterised as premium. We would be better placed to question their value and what makes them exclusive. This ideal scenario would enable us to discuss how those individualised products and toolkits should be offered for interaction with consumers in commercial settings.

Some aspects of the research design were subjective in their approach and, although following guidelines taken from literature on qualitative studies, they could have debatable limitations. An example of this is the process to categorise the recruited participants into PC or AC. Guidelines for identifying a participant as either AC or PC were designed based on relevant literature (see Table 3.7, page 74 Methodology chapter), defining what characterises each type in this study and the criteria to assess them (page 75). Creating these two sub-groups of participants was deemed necessary, so the research would benefit from clear results interviewing and comparing different types of prosumers in relation to individualisation. Such comparisons contributed to finding evidence-based answers to the research questions, particularly whether or not the engagement in the process was a determining factor for product attachment. In practice, this meant participants answered a short purposive 'diagnostic' questionnaire assessing their interests in art and design activities, prior to the actual interview (interviews and transcripts can be accessed online via Appendix, page 225). The assessment was ultimately down to the researcher's interpretation of participants' responses and could be seen as subjective, yet arguably reasonable within a qualitative study. In an effort to mitigate this limitation and make the study more objective and generalisable, the criteria (page 75) was followed strictly and equally in all the interviews. Additionally, during the data analysis, the recorded audio files for each interview were listened to and re-assessed to verify the attributed profile. For added reliability, an independent researcher assessed the audios of three interviews from study stage #1, yielding the same results (see a PDF document showing those results on the online Appendix, accessible through a link on page 225). Reducing the spectrum of consumers down to two types served the purpose of simplifying the designed methods, instruments, as well as data collection and analysis, whilst still making a valid contribution to the field of product design and customisation on the validity of individualisation. However, more types of consumers can be identified and should be considered in further research.

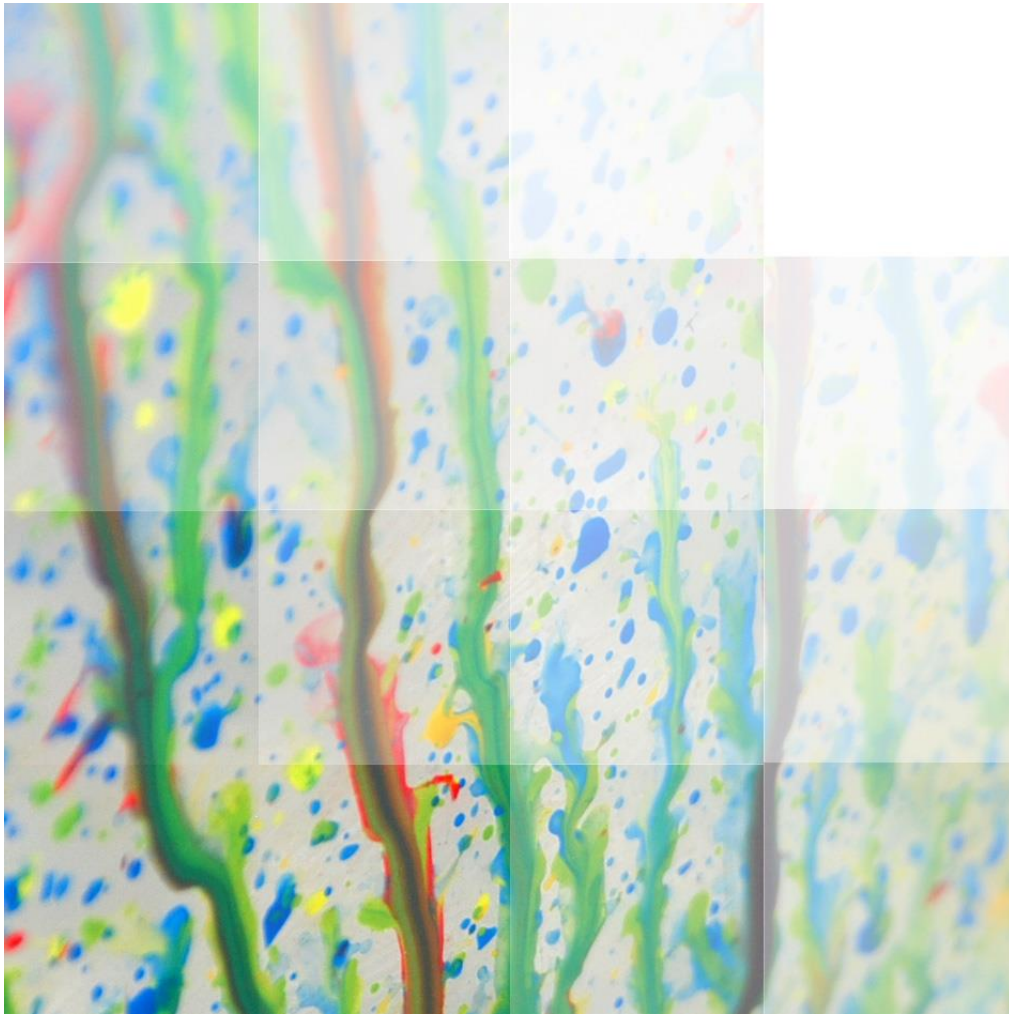
The sample design followed recommendations from the literature, and exceeded the requirements suggested by Rowley (2012) and Griffin & Hauser (1993) when it comes to sample size for in-depth interviews in product design research (see 3.2.2 in page 72). Whilst the sample size was adequate for a qualitative study, it would be insufficient for a larger-scale statistical analysis aiming to generalise findings through diverse demographic groups. Such an approach would also require a redesign of the research methods. As in other qualitative studies, this research looked at depth of data, aiming for a better understanding of reality beyond the semantic level.

## 6.7. CHAPTER SUMMARY

This chapter summarised the results from the data analysis and discussed them in the context of the literature. It explored the relevance and possible implications of the findings, as well as the limitations of the research and the mitigation plans that were put in place.

New perspectives were shared when considering particular types of consumers and approaches to product customisation. In doing so, the chapter addressed the key emerging areas, evaluated the main research findings and discussed the causes of certain unexpected findings, such as perceptions of freedom and constraint between the two proposed toolkits ('too open' or 'too limiting'). Most importantly, it located the findings of the study within a greater body of internationally recognised work in this field, showing both areas of alignment and aspects where previous research should be challenged.

Drawing from this discussion, the next chapter will present the conclusions of the study. It will explore the extent to which the objectives of the research have been met and propose answers to the research questions. It will make a case for the contribution to knowledge that this study has made and suggest areas for future research.



## **7. CONCLUSIONS & RECOMMENDATIONS**

## INTRODUCTION

First, this chapter addresses the objectives of the research and how they have been met. Second, it presents the conclusions of this study. Tentative answers to the research questions are then offered.

This chapter then discusses the possible contribution to knowledge made by this research, why that contribution can be seen as original and how relevant it can be for different stakeholders.

Finally, this chapter points to new gaps in knowledge, offers recommendations for further research, and proposes possible future research questions.

## 7.1. OBJECTIVES

The overarching objective of the research was to understand better the effects of individualisation on product design as a driver for consumer emotional attachment to objects. Those effects do not translate into a new aesthetic trend or better quality of design or new product types. Instead, the focus is on how individualisation can satisfy the consumer need for unique products through an experience that allows an emotional attachment to grow between the consumer and the product. This research has considered different aspects of the individualisation process and their impact on the consumer experience. For example, it has reviewed consumer engagement in the individualisation process, the generation of value for an individualised product, the perception of uniqueness and, most importantly, the emotional bond between the consumer and the individualised product. This study builds on a previous body of research into product customisation, as shown in the Literature review chapter (page 17). Table 7.1 details the extent to which the research objectives have been met.

Objectives of this research	How the objectives have been met
<b>To identify the validity of an individualisation approach to customisation, better understanding its effects on product design as a driver for consumers’ emotional attachment to a product</b>	The findings presented in the Data Analysis of the main Study (discussed in chapter 6, page 163) suggest that individualisation is a valuable, relevant and highly appropriate approach to product design for certain types of consumers who feel engaged to the process and emotionally attached to a resulting product.
<b>To identify consumer types that can benefit from individualisation</b>	Consumers who do not regularly have an interest in art, design or craft activities (identified as Passive Consumers [PC] in this study) have been found to benefit from an automated approach to product customisation, as the process helps them to have new experiences and unique offerings that nurture the generation of an emotional attachment.
<b>To characterise the notion of ‘added value’ in the context of product design</b>	Individualisation added value to the product design process (see Figure 6.1, page 166 in the Discussion chapter). The consumer perceives added value through the individualisation experience as well as through the product itself.
<b>To explore the relevance of this novel, digitally - enabled approach to product design. (See also section 6.4.1, page 174)</b>	The experience of the individualisation process and ownership of the resulting product bring about new creative possibilities, generate memories and nurture emotions, unlikely to develop otherwise for those users who match the Passive Consumer profile. For designers and entrepreneurs, individualisation represents a valid process to offer unique products to a type of consumer not previously engaged in customisation.
<b>To undertake four exploratory case studies (pilots), which will inform a final in depth (main) study on individualisation exercises, combining established research methods.</b>	The research design proposed a cyclical approach that successfully tested and refined the methods and instruments through iterations consisting of four pilots. This enhancement process made it possible to collect reliable data from 44 interviews during the main study.

Table 7.1. Objectives of this work and how they were met.

This study met the research objectives set at the start. The research questions are closely connected to the objectives and are addressed in section 7.3, page 206, below.

## 7.2. CONCLUSIONS

The principle of individualisation as an approach to product customisation is valuable and relevant for the Passive Consumer (PC) group of participants, as opposed to the Active Consumer (AC) group. PC participants engage with the individualisation process, which generates an emotional bond with the resulting product. The toolkit helps them to create a unique piece that they deem valuable. The individualisation toolkit enabled them to feel they were an integral part of the creation of a unique product, otherwise unlikely to be achieved on their own because of the lack of the necessary knowledge, skills or personal interest.

For Active Consumers (AC) participants, on the other hand, individualisation can be a frustrating experience as the toolkit does not allow them to customise to the extent and detail that they expect. The process therefore limits their ability to apply their expertise and design skills. For ACs, individualisation could only be valuable for specific purposes and applications, such as to 'trigger' creative ideas for them to explore further. For example, to design 'fun' gifts for others with little time commitment, but not to generate final pieces for themselves.

The next sections will present the detailed conclusions from this study, focusing on key areas following the findings discussed in the previous chapter: conclusions in relation to the toolkit, the participant groups (AC and PC), and the themes emerging from the thematic code analysis. Finally, there is a fourth set of conclusions on the research design and methods used in this study.

### 7.2.1. The toolkits

1- Added value and emotional attachment to individualised products can be achieved by limiting the level of consumer participation in the process.

Limiting the level of consumer participation in a software-based individualisation toolkit can benefit users, particularly those with a PC profile (individuals with no particular interest in art, design or craft activities, further described on page 76). Such a toolkit must make those PCs feel they participate in the process of product creation, and this triggers an emotional bond with the product. That participation should be encouraged up to a 'tipping' point, beyond which further involvement is perceived as added cost and effort, instead of added value (see

Figure 6.3 in Discussion chapter, page 175). From that ‘tipping’ point onwards, the individualisation toolkit should limit user participation, taking over the decision making to finish automatically a unique design (for example through automated mechanisms, such as computer algorithms), which contributes to value generation for the user. PC participants acknowledged the benefit of individualisation because this automated approach helped them to achieve a unique product.

**2-** Emotional attachment and allocation of value to an individualised product depend on the balance between consumer participation in the design process and toolkit automation.

The tipping point mentioned in the previous conclusion reflects the balance between participation and automation. If the automated element of an individualisation toolkit interferes with consumer participation (i.e. the tipping point occurs ‘too early’), there is limited or no consumer engagement, the product can be deemed irrelevant for that consumer and there is no room for an emotional attachment to develop. If the automated element fails to provide sufficient help to individualise, the consumer is required to make a bigger effort (i.e. the tipping point is ‘too late’). In that scenario, the consumer struggles to customise the product, resulting in a reduction in the value of the experience and the product itself.

The tipping point (Figure 6.3, page 175) can be located along the individualisation experience in as many places as types of participants, as each consumer would benefit from a different level of help from the toolkit and a different degree of participation in that experience.

**3-** PC participants value individualised products more than AC.

This is true to the extent that toolkit automation is seen as an aid to achieve a desired result in the absence of: certain skills (e.g. design skills, ability perform practical ‘DIY’ activities, making things on their own), knowledge of how to customise to meet a personal taste (e.g. of how to best combine colours, how to use them in a design and making sure the customised result meets what one wanted) or personal interest in art, design and craft by the participant.

The AC participants valued the individualised product less, because the toolkit prevented them from customising at will, blocking their interest to create a t-shirt using their experience, expertise and knowledge of art, design and craft (see the next section for a reference to the difference between ACs and PCs and page 75 for the full differentiating criteria).



### 7.2.2. Consumer types

4- Active Consumers (AC) and Passive Consumers (PC) are two distinct types of consumers and behave differently when using an individualisation system.

In this study, PCs engaged better and valued the resulting t-shirt more than ACs. PCs appear to welcome the aid of an automated system to customise a product. ACs engaged less and valued the t-shirt less, as they often found the individualisation toolkit frustrating.

Every interview for stages #1 and #2 of the study started with a short purposive 'diagnostic' semi-structured questionnaire assessing participants' interest in art and design activities (see the criteria for allocating participants to different consumer groups, page 75). Contrary to Active Consumers (AC), the Passive Consumers (PC) in this study are characterised by:

- an unwillingness to engage in DIY (Do It Yourself) activities and no intention to participate in customisation processes, interpreted as no need for differentiation. This provides a rationale for the next PC characteristic
- low aspiration to obtain unique products, an identified consumer need and a source of added product value (Tepper et al. 2001)
- seldom (or no) involvement in art, design or craft activities in the recent past, or who does it unwillingly
- a self-identification as uninterested in art, design and craft (used as validation against the previous three criteria)

Further research should identify and investigate other consumer types, as suggested on page 214.

5- Emotional attachment to individualised products is dependent upon the level of consumer engagement with the individualisation process.

The level of consumer engagement is twofold and depends on (i) the type of consumer considered, and (ii) the design of the toolkit, in particular, where the tipping point is along the individualisation continuum (Figure 6.3 and Figure 6.4, see pages 175 and 177).

A participant in an individualisation process becomes engaged if the activity is perceived as enjoyable. The overall experience is therefore positive and an emotional attachment can grow with the resulting product. However, a high level of consumer engagement can be perceived as tough and demanding. Likewise, a low level of engagement can be perceived as meaningless for the participant. In both last cases the experience is spoiled and emotional attachment unlikely to follow. For example, the PC type would not bond with a product that demands too much effort to individualise, whilst the AC type would not bond with a product generated from an automated toolkit.

### 7.2.3. Themes and codes

**6-** AC's experience is frustrated by a perceived uncertainty of the resulting product when using an individualisation toolkit.

Uncertainty in how the t-shirt pattern is designed, what the final product would look like and the lack of decision-making power over the individualisation toolkit was an unwelcome experience for ACs, leading to questions of authorship of the final design. The toolkit used an algorithm that randomised the design pattern, which ACs found frustrating.

This uncertainty was twofold:

- The toolkit was automated, limiting user participation in decision making therefore users could not customise exactly what they wanted.
- The toolkit's algorithm randomised the marks of paint on the t-shirts, meaning that there was no rationale behind the pattern design. ACs were unable to establish, in advance, how the t-shirt would turn out.

**7-** Physical participation in a customisation process can be a challenge for participants with a PC profile.

Physical participation when creating the product can be challenging for users with a PC profile. Participants in the PC group are not used to (and often not interested in) engaging in the type of activities required by a toolkit like the one used in this research. Overcoming this challenge triggered a sense of achievement, pride and identification with the product, strengthening the emotional bond.

**8-** Product uniqueness is directly associated with consumers' sense of participation (interaction with the individualisation toolkit and with the painting tools), and adds value to the individualised product.

PC participants cited the interaction with the random algorithm of the toolkit, plus their 'luck' rolling the dice and their physical participation, as the causes of unique results. ACs also acknowledged their 'luck' rolling the dice and using a randomised algorithm generated an unique result, but did not attribute special value to that uniqueness as PCs did; instead, ACs preferred to achieve uniqueness by themselves or use an algorithm that followed some sort of pattern or 'rationale'.

**9-** Product uniqueness on its own, does not necessarily add value to an individualised product. Individualisation processes could produce banal uniqueness.

Tepper et al. (2001) explain that consumers with a strong desire for differentiating from others would pay more for unique products and for a perception of exclusivity. If product individualisation is applied on an industrial design scale, unique products would be accessible for the masses. The concept of a family of products would remain but a collection could potentially have an infinite number of components, all technically 'unique', meaning that the value of an 'exclusive' collection diminishes. Page 187 summarises the limitations that would apply to this specific conclusion.

**10-** The overall value of individualised products can be traced to two key components: product value and experience value.

Broadly consistent with reviewed literature about product customisation, individualised products have two sources of value:

- Product value. The value of the customised product itself,
- Experience value. The value generated from experiencing the customisation process, which often proposes a fun and attractive activity.

See Literature review, page 28, for a more details and references on product and experience value.

The hierarchical analysis of the identified codes and themes indicate that Engagement with the process (experience value) is hierarchically higher than the Satisfaction with the product (product value) (Figure 5.9 and Figure 5.12, on pages 150 and 155 respectively). PCs' willingness to use individualisation again was not directly related to the satisfaction with the t-shirt but with the experience. Also ACs' unwillingness to invest in individualisation was because of a frustrating experience and then due to an unsatisfactory product, hence the map of codes (Figure 5.8, shared on pages 146 and 182) does not show a direct connection between the two themes. Following these findings, this research challenges Merle et al.'s (2010) claim that the product value is hierarchically more important than the experience value. More detailed explanation is available in the Discussion chapter subsection 4.4.3.4, page 187.

#### **7.2.4. Research design and methods**

This research also draws conclusions from the actual research design and methods. This is significant as it contributes to the wider field of knowledge with techniques for deeper and faster analysis in future studies.

**11-** The method of thematic code analysis as used in this study is effective, offering speed and data reliability, and is transferable to other studies.

The Rapid Identification of Themes from Audio Recordings or RITA (Neal et al. 2015) is a fast method of data analysis compared to traditional approaches of full verbatim transcriptions from the interviews. RITA was adapted and improved, adding traceability of data, offering reasonable cost-benefit in terms of quality and reliability of the data and speed to process the dataset.

**12-** Developing a hierarchy of thematic codes can help a researcher to analyse the topic of study and evaluate the constituent parts of that topic in detail.

A hierarchy of codes enables us to understand the overall meaning of the data and visualise how those codes are related. In this research, a hierarchy of codes was useful to prioritise themes and draw conclusions accordingly.

**13-** Cyclical iterations of designing, testing and refining the research methods through a sequence of pilot studies are effective to create a robust research design and can be applied in other research areas.

Action Research (AR) and Design-Based Research (DBR) approaches share a number of characteristics. AR and DBR were combined creating a cyclical research approach (see Table 3.3) that offered rigour and flexibility to adjust the methods *en route*, whilst learning about the subject in the process.

The 13 conclusions drawn here reflect the importance of this research and its contributions to knowledge, covering toolkit design for individualised products, consumer characteristics, how consumer groups value a particular approach to customisation, and in the area of research design and methods. The conclusions also point to further areas of research will be addressed later in this chapter.

## 7.3. ADDRESSING THE RESEARCH QUESTIONS

This research has met its objectives and has found possible answers to the research questions it set out to address. It can be argued that this research has contributed towards filling the gap in knowledge that was initially identified.

This study evaluated potential benefits of individualisation, such as an emotional attachment between consumers and individualised products. It put forward two research questions. Possible answers to them as presented below.

### 7.3.1. Answers to the research questions

**1- To what extent do consumers value and emotionally attach themselves to consumer products as a result of individualisation?**

Value and emotional attachment to individualised products are linked to the user's engagement with the individualisation process (i.e. their active participation) and the automated nature of the toolkit being used.

First, consumer engagement with the individualisation process is a key factor for nurturing an emotional attachment to the individualised product. That attachment is possible to the extent where a consumer engages and perceives that he or she has been part of the process, aided by the automated feature of the toolkit, (explained next).

Second, the automated nature of the toolkit that controlled the individualisation process, is a key factor influencing the value of the resulting products (both, experience value and product value, as per conclusion [10](#)). Consumers value individualised products to the extent where that automation is featured as an aid to achieve a desired result in the absence of specific skills (for example, practical 'DIY' activities, making things on their own), knowledge of how to customise to meet their personal taste (e.g. of how to best combine colours, how to use them in a design) or personal interest in art, design and craft (see conclusion [3](#))

It is the design of the toolkit (i.e. the degree of its automation and decision power handed over by the consumer) that allows the consumer to engage and perceive s/he has been a valuable

part of the individualisation process. However, the consumer profile is a very good indicator of the desire to be part of that process. The 'amount' of toolkit automation has to be carefully balanced against the degree of consumer participation, as that is precisely where value and emotional attachment to the individualised product lie. The point where consumer participation stops and toolkit automation starts, is what this research calls 'tipping point' (see conclusions 2 and 5, and Figure 6.3). For example, if an individualisation toolkit is perceived as 'too automated' (i.e. limiting the consumer's engagement in the activity), it disempowers the consumer as a decision maker who cannot participate in the process, losing the emotional attachment to the final product. On the other hand, if the consumer is required to have a hands-on approach and take most decisions during the individualisation process, this process could be perceived as too demanding, losing value for the consumer who might not be looking for an effortful experience.

With the aid of an automated system to individualise a product effectively, the experience of a consumer participating in that process can be considered successful and enjoyable, generating an emotional attachment to that product, otherwise unlikely to occur. This emotional attachment triggers a feeling of achievement, pride and ownership. It could be said that this approach 'reaches out' to those matching the 'Passive Consumer' (PC) profile (as described on page 168), because it brings new opportunities for engagement and experiences closer to them, rather than expecting the consumer to actively seek creative opportunities to create something personal. Participants in the PC cohort valued such a 'feature' more than Active Consumer (AC) participants, as that feature offered help in the absence of a range of skills to customise products.

The perceived value of individualised products and the user's emotional attachment to those products is dependent on the perception of limits imposed by the toolkit and 'scope' for user participation, i.e. the level of user engagement with the process (see conclusions 1 and 8). This aspect is further explained in the answer to the second Research Question.

## **2- Are value and emotional attachment dependent on the level of engagement in the individualisation process? If so, how?**

Yes, value and emotional attachment to the individualised product are dependent on the level or depth of engagement with the process. Despite the benefits offered by an automated (or semi-automated) toolkit, the user still needs to engage as a contributor in the process in order

to relate to the product (see conclusion 5). The depth of that engagement is another key factor to nurture an emotional attachment to the product.

The research design used two variables assessing the level of engagement with the process:

- a)* the type of consumer considered: AC or PC,
- b)* the design of the toolkits, with two levels of participation permitted (page 168)

The type of consumers revealed differences in levels of engagement with the process. Those participants who align with the PC profile engaged more with a toolkit, which helped them to customise a t-shirt, thus generating a stronger emotional attachment to the product and valuating it more than ACs. The participants with an AC profile leaned towards a rejection of such help, engaging less with the process. Their attachment to the t-shirt was weaker (see conclusions 4, 6 and 7).

The two levels of allowed participation with the toolkits influenced the levels of engagement in the process in different ways. As explained earlier, one of key features of individualisation is its automation, designed to aid the user. The evidence suggests that, contrary to other approaches to product customisation, a restricted level of allowed participation with the toolkit generated a better engagement with the process and a stronger product attachment for those in the PC group (see conclusions 1 and 3).

However, the limitations imposed by the design of the toolkit should be carefully thought through so that they are perceived as an 'aid' and not as a 'constraint'. For example, during the interviews, the automated toolkits generated great frustration in participants' experiences, yet it was praised for the help it provided (particularly by the PC cohort) to achieve a customised t-shirt.



### 7.3.2. Summary of responses to the research questions

In summary, this research offers evidence-based answers to both research questions:

#### RESEARCH QUESTION 1:

Consumers value individualised products to the extent that automation in the design process features as an aid to achieve a desired result in the absence of specific art, design or craft skills. Their attachment to individualised products is possible insofar as a consumer engages and perceives that he or she has been part of the individualisation process, with the help of an automated device, as explained earlier. The 'amount' of toolkit automation should be carefully balanced against the degree of consumer participation, as that is precisely the point where value and emotional attachment to the individualised product reside.

#### RESEARCH QUESTION 2:

Value and emotional attachment to the individualised product depends on the level of engagement with the individualisation process. Participants with a Passive Consumer profile engaged more with a toolkit, helping them to customise a t-shirt, generating an emotional attachment to the product and valuing it more than Active Consumer (AC). Participants with an AC profile, rejected the toolkit's help, didn't engage with the experience, had a lower attachment to the t-shirt and valued it less.

## 7.4. INTRODUCTION TO CONTRIBUTIONS TO KNOWLEDGE

The gap in knowledge identified and addressed is the relationship between consumer engagement in the design of an individualised product, and his or her attribution of value and emotional attachment to the resulting artefact.

This study found that consumers who would not regularly engage in art or design activities, or who are unwilling to invest time and effort customising products, would instead engage in product individualisation, thereby positively influencing their emotional attachment and perceived value to those products. Those consumers enjoy and engage with product individualisation experiences using an automated toolkit to assist them in achieving a unique design. The results broadly align with inferences from Merle et al. (2010) and Shankar et al. (2006) but challenge Mugge et al. (2009) and Norman (2004) in that automating and restricting customisation processes could attract users who are otherwise unwilling to invest time and effort to achieve customised products. The balance between consumer participation and toolkit automation is characterised by a 'tipping point' where consumers perceive that investing more time or effort in individualising can deteriorate the attachment and added value to the product. These findings were identified through the iterative pilot stages of method refinement leading to the design of a final set of instruments used in a study that revealed new knowledge that suggests the likelihood of distinct consumer types as suggested earlier. This research considers 'active' and 'passive' consumers; however, findings suggest that it may be possible to identify more and different types of consumers who opt for different customisation techniques that offer engagement experiences aligned to their skills in art, design and craft activities. Therefore, this knowledge needs to be taken further in future research, as suggested in section 7.5.3 (page 214).

### 7.4.1. Key contributions to knowledge

In the context of the aim of this research, the study differs from previous ones in a number of ways. This research offers the following original contributions to knowledge:

- 1- **Product individualisation:** providing certain consumers that are willing to relinquish part of the decision making to an automated customisation process, with an appropriate toolkit that limits their ability to interact with an individualisation process, can generate added value and

trigger an emotional attachment to the manufactured result. Using such toolkit assists those consumers in the achievement of a more desirable result in the absence of art, design or craft skills, increasing their perception of product uniqueness, thereby generating added value and triggering a greater emotional attachment. This study therefore highlights how individualisation, as an approach to customisation, challenges traditional notions of 'customisation' as well as authorship and perceptions of decision-making power.

**2- A novel approach to research design in the field of individualisation:** by designing and deploying a number of pilot iterations, a researcher is able to learn and refine methods and instruments, therefore adding reliability to each data collection test stage. The combination of established methods of rapid identification of thematic codes from audio recordings with illustrative transcripts of each code improves the traceability, reliability and efficiency of data analysis process. Finally, a set of criteria to establish a hierarchy of the identified codes can help to understand the subjective impressions of qualitative data.

**3- Consumer profiles:** Another contribution to knowledge is the likely identification of distinct types of consumers characterised by their preference and background in relation to art, design and craft activities, for example 'active' and 'passive' consumers. This new knowledge could inform further research into market segmentation, not only to identify more consumer types and their characteristics but also to locate their individual 'tipping points', leading to the creation of products and customisation techniques better aligned to their preferences and expectations, as exemplified in section 7.5.3 (page 214).

It can be claimed, therefore, that a contribution to knowledge has been made in the field of product design and customisation. This contribution encompasses the topic of research itself, as well as the methodology and methods employed.

## 7.5. RECOMMENDATIONS AND FURTHER RESEARCH

Recommendations are proposed in three areas: toolkit design, product types and consumer types. The areas put forward for future research are aligned to the recommendations. However, as the three are intrinsically connected, investigating one of them in isolation from the other two might be challenging.

### 7.5.1. Toolkit design

The toolkits used in this research did not allow participants to compare resulting designs on screen, and its embedded algorithm worked randomly, e.g. it did not follow any particular pattern. Participants reported such characteristics as detriments to their experience. Future studies should test different design features in a toolkit in order to fine-tune it, so it is perceived solely as an aid to the experience. Should the study be continued and the same exercises re-run, the toolkits could be designed so that the participants can save the results they generate, so participants can compare those and pick the one they like the most. A possible research question could be:

*- What type of algorithm would best work in a product individualisation toolkit?*

In order to make individualisation an attractive (i.e. viable and profitable) process for businesses, they should be able to apply it to different types of products (see Limitations, section 4.6, page 193). It would also be necessary to investigate how a consumer interacts with a toolkit if the type of product considered requires manufacturing at a different location (as opposed to painting t-shirts in-situ), which could have an effect on the emotional attachment to the product. If we consider that individualisation implies automated processes, and an online individualisation offering implying reduced physical interaction, a possible research question could be:

*- To what extent can an online individualisation toolkit trigger emotional attachment to the product?*

It would be important to investigate the possible use of augmented reality devices to operate the customisation toolkits online in order to compensate for the lack of a physical interaction

with the actual product. This would be particularly relevant because, on top of removing the physical product and replacing it with an image on a screen, an individualisation toolkit is characterised by an element of automation and therefore already restricts user interaction.

### 7.5.2. Product types

Further research should build on this work by investigating if the findings can be replicated with other product types, thus expanding the generalisability of the results. For example, future studies could involve industrially produced and premium products. In particular, those products that are higher up in the product-process matrix (Figure 2.5, page 37), justify better manufacturing processes, materials, and the investment to generate unique pieces, for example through individualisation. Unlike painted t-shirts, a future investigation should aim for designs capable of undergoing industrial manufacturing processes. Possible research questions:

- *How can an individualisation approach be offered for industrially produced goods?*
- *What would be the implications in terms of value, emotional attachment and perceived risks, of individualising premium products such as jewellery?*

More generally, future research could also revisit areas of research as we consider a novel, automated approach to customisation:

- *What would be the effects of industrial-scale product individualisation on the 'consumer need for uniqueness' (Tepper et al. 2001)?*
- *Could an automated process such as individualisation turn unique designs into banal items?*

In turn, this would entail an investigation into product attachment when different types of consumers engage with an individualisation process involving less physical effort, for example, when engaging with the process solely online.

Syam et al. (2008) suggest that consumers are often uncertain about their "wants" and fear they might not like the product once customised. However, they explain, "additional standard

products can work to the benefit of custom products" (Syam et al. 2008: 380), because diversity of offerings would demonstrate to the consumer that there could be multiple possible 'correctly' or 'safely' customised products. Figure 2.2 (page 31), proposes a continuum between a company's standard product and a fully customised one, with a number of 'safe' alternatives between the two extremes representing that company's functional standard product options. If additional standard choices within a product line can indeed promote willingness to customise, then it would be important to ask:

*- How many standard variations of a product would a company need to provide its customers in order to promote customisation?*

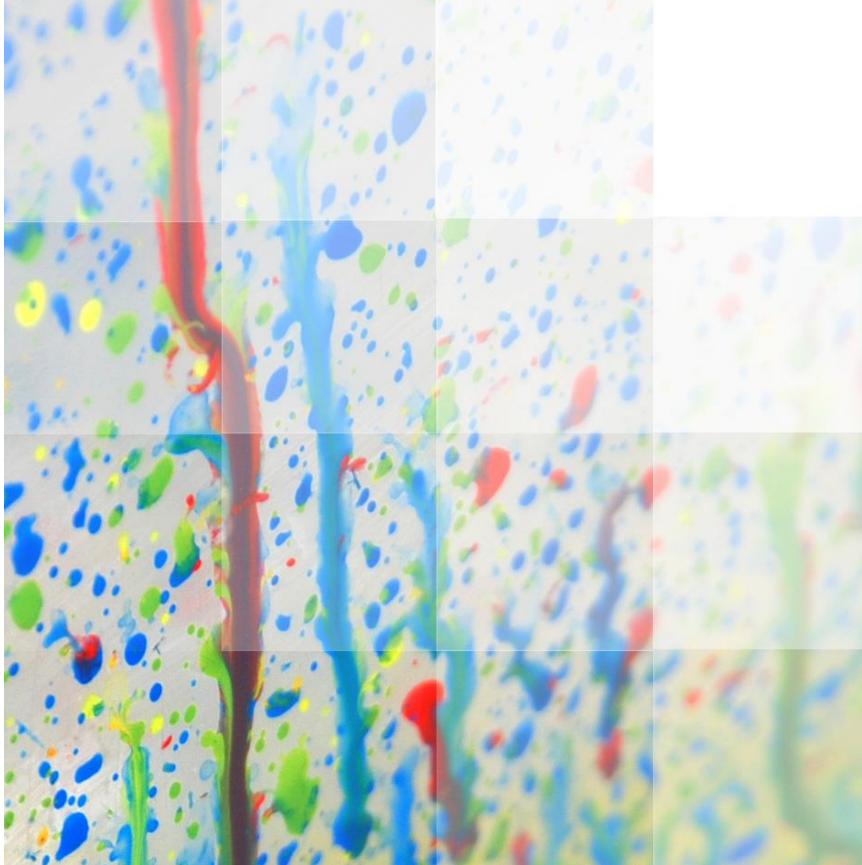
### **7.5.3. Consumer types**

The findings that characterise Active Consumers (ACs) and Passive Consumers (PCs) are consistent with previous research. However, the answers received by either group of participants suggest that future research might focus on identifying more consumer types and whether or not individualisation can benefit them. To this end, it would be beneficial to establish their characteristics and on that basis, fine-tune individualisation toolkits that offer them the best value. Possible research questions could be:

*- How can individualisation be fine-tuned to make it appealing to more consumer types?  
What would be the characteristics of those consumers?*

*- How can an individualisation toolkit be designed to attract ACs?*

The suggested future research questions are aligned to this research as they would expand on its findings. Building on this research and other work identified in the literature review, future studies focusing on those questions would generate further knowledge on product individualisation. That research would unveil potential benefits, address the limitations identified in this study and add generalisability. It would also generate new research questions, including the types of products that consumers would be willing to individualise, the associated risks, value and emotional attachment when individualising premium products.



## 8. REFERENCES

Ariadi, Y., Campbell, R. I., Evans, M. A. and Graham, I. J. (2012) 'Combining additive manufacturing with computer aided consumer design', in *Proceedings of the Solid Freeform Fabrication Symposium*. University of Texas at Austin, pp. 238–249.

Atkinson, P. (2011) 'ORCHESTRAL MANOEUVRES IN DESIGN', in Van Able, B., Evers, L., Klaassen, R., and Troxler, P. (eds). Amsterdam: Bis Publishers (Open Design Now: Why Design Cannot Remain Exclusive), pp. 24–31. Available at:  
<http://opendesignnow.org/index.php/article/orchestral-manoevres-in-design-paul-atkinson/>.

Atkinson, P. and Dean, L. T. (2003) "'Future factories": teaching techné INTRODUCTION: BACKGROUND TO THE PROJECT', *Techné: Design Wisdom: The 5th European Academy of Design Conference*. Edited by Universitat te Barcelona. Barcelona: Unpublished, pp. 1–9. Available at: <http://shura.shu.ac.uk/id/eprint/8667> (Accessed: 27 May 2016).

Atkinson, P., Unver, E., Marshall, J. and Dean, L. T. (2009) 'Post Industrial Manufacturing Systems: the undisciplined nature of generative design', in Sheffield Hallam University Sheffield, U. K. (ed.) *Undisciplined! Design Research Society Conference 2008*. Sheffield Hallam University, Sheffield, UK. Available at: <http://shura.shu.ac.uk/520/>.

Bardakci, A. and Whitelock, J. (2003) 'Mass-customisation in marketing: The consumer perspective', *The Journal of Consumer Marketing*, 20(4/5), pp. 463–479. Available at: <http://search.proquest.com/docview/220121777?accountid=10472>.

BBC (2012) 'BBC - The Culture Show - Assa Ashuach - 4 April 2012'. Available at: <http://www.bbc.co.uk/news/world-radio-and-tv-17608861> (Accessed: 15 May 2016).

de Beer, D. J., Becker, L., van der Walt, P., Mauchline, D., Campbell, R. I. and Dean, L. T. (2012) 'Additive manufacturing of alumide jewellery', in Preez, W. Du (ed.) *Proceedings of 13th Annual RAPDASA Conference*. Rapid Product Development Association of South Africa, Petroria.

de Beer, D. J., Campbell, R. I., Truscott, M., Barnard, L. J. and Booysen, G. J. (2009) 'Client-centred design evolution via functional prototyping', *International Journal of Product Development*, 8(1), p. 22. Available at:  
<http://search.proquest.com/docview/236693288?accountid=10472>.



- Belmonte, M.-V., Millán, E., Ruiz-Montiel, M., Badillo, R., Boned, J., Mandow, L. and Pérez-de-la-Cruz, J.-L. (2014) 'Randomness and control in design processes: An empirical study with architecture students', *Design Studies*, 35(4), pp. 392–411.
- Blaxter, L., Hughes, C. and Tight, M. (2006) *How to research*. 3rd edn. Open University Press. doi: 10.2307/1319404.
- Blecker, T., Abdelkafi, N., Kaluza, B. and Kreutler, G. (2004) 'Mass Customization vs. Complexity: A Gordian Knot?', pp. 890–903. Available at: <http://mpra.ub.uni-muenchen.de/5290/>.
- Bloch, P. H. (1995) 'Seeking the ideal form: Product design and consumer response', *Journal of Marketing*, 59(3), p. 16. Available at: <http://search.proquest.com/docview/227723661?accountid=10472>.
- Boyatzis, R. E. (1998) *Transforming qualitative information : thematic analysis and code development*. Sage Publications.
- Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3(2), pp. 77–101. doi: 10.1191/1478088706qp063oa.
- Braun, V. and Clarke, V. (2013) *Successful qualitative research: A practical guide for beginners*. Edited by M. Carmichael and A. Clogan. SAGE.
- Bryman, A. (2008) *Social research methods*. 3rd edn. New York: Oxford University Press.
- Campbell, R. I. (2013) 'The Future of Design: Democracy or Revolution', *Art South Africa*.
- Campbell, R. I., de Beer, D. J., Mauchline, D. A., Becker, L., van der Grijp, R., Ariadi, Y. and Evans, M. A. (2012) 'Additive Manufacturing as an Enabler for Enhanced Consumer Involvement', in *Proceedings of 13th Annual RAPDASA Conference, Pretoria*. Pretoria: Rapid Product Development Association of South Africa. Available at: <https://dspace.lboro.ac.uk/2134/11197>.

Campbell, R. I., Bourell, D. and Gibson, I. (2012) 'Additive manufacturing: rapid prototyping comes of age', *Rapid Prototyping Journal*, 18(4), pp. 255–258. Available at: <http://search.proquest.com/docview/1021818914?accountid=10472>.

Campbell, R. I., Hague, R. J., Sener, B. and Wormald, P. W. (2003) 'The Potential for the Bespoke Industrial Designer', *The Design Journal*, pp. 24–34. doi: 10.2752/146069203789355273.

Campbell, R. I., Jee, H. and Kim, Y. S. (2013) 'Adding product value through additive manufacturing', in Lindemann, U., Srinivasan, V., Se, K. Y., Lee, S. W., Clarkson, J., and Cascini, G. (eds) *ICED 13: 19th International Conference on Engineering Design*. The Design Society, pp. 259–268.

Cooney, K. M. (2007) *The cost of death : the social and economic value of ancient Egyptian funerary art in the Ramesside period*. Leiden : Nederlands Instituut voor het Nabije Oosten.

Dean, L. T., Atkinson, P. and Unver, E. (2005) 'Evolving individualised consumer products', in *6th International Conference of the European Academy of Design*. Available at: <http://eprints.hud.ac.uk/1073/>.

Dean, L. T. and Pei, E. (2012) 'Exploring the use of additive manufacture for high value consumer products'. 13th Conference on Rapid Design, Prototyping & Manufacturing (RDPM2012). Available at: <https://v00dor00001d.dmu.ac.uk/handle/2086/6120> (Accessed: 3 July 2017).

Etgar, M. (2008) 'A descriptive model of the consumer co-production process', *Academy of Marketing Science*, 36(1), pp. 97–108. Available at: <http://search.proquest.com/docview/224870463?accountid=10472>.

Ford, P. and Dean, L. T. (2013) 'Additive Manufacturing in Product Design education: Out with the old in and in with the new?', in *International Conference on Engineering and Product Design Education*. Dublin Institute of Technology, Dublin, Ireland.

Foucault, M. (1982) 'The Subject and Power Why Study Power? The Question of the Subject', *Critical Inquiry*, 8(4), pp. 777–795. Available at: <http://www.jstor.org/stable/1343197> (Accessed: 15 March 2017).

Franke, N. and Schreier, M. (2008) 'Product uniqueness as a driver of customer utility in mass customization', *Marketing Letters*, 19(2), pp. 93–107. Available at: <http://search.proquest.com/docview/204491471?accountid=10472>.

Franke, N. and Schreier, M. (2010) 'Why Customers Value Self-Designed Products: The Importance of Process Effort and Enjoyment.', *Journal of Product Innovation Management*, 27(7), pp. 1020–1031.

Franke, N., Schreier, M. and Kaiser, U. (2010) 'The "I Designed It Myself" Effect in Mass Customization', *Management Science*, 56(1), pp. 125–140. Available at: <http://search.proquest.com/docview/213185102?accountid=10472>.

Gravois, T., Rosenfield, S. and Greenberg, B. (1992) 'Establishing Reliability for Coding Implementation Concerns of School-Based Teams from Audiotapes', *Evaluation Review*, 16(5), pp. 562–569. doi: 10.1177/0193841X9201600507.

Griffin, A. and Hauser, J. R. (1993) 'The Voice of the Customer', *Marketing Science*, 12(1), pp. 1–27. doi: 10.1287/mksc.12.1.1.

Gyi, D., Cain, R. and Campbell, R. I. (2009) 'The value of computer-based product representations in co-designing with older users', *Journal of Engineering Design*, 21(2–3), pp. 305–313.

Habraken, J. (2014) *Chairgenics, Uformia*. Available at: <http://uformia.com/uformiashowcase/jan-habraken> (Accessed: 21 May 2014).

Hayes, R. and Wheelwright, S. (1979) 'Link Manufacturing Process and Product Life Cycles', *Harvard Business Review*. Boston, 57(1), pp. 133–140. Available at: <https://tinyurl.com/ybts8xsv>

Henerson, M. E., Morris, L. L., Fitz-Gibbon, C. T. and University of California, L. A. C. for the S. of E. (1988) *How to measure attitudes*. Sage Publications.

Hermans, G. (2014) 'Investigating the Unexplored possibilities of the Digital-Physical toolkits in Lay Design', *International Journal of Design*, 8(2), pp. 15–28.

Hippel, E. (2001) 'User toolkits for innovation', *Journal of Product Innovation Management*. Blackwell Publishing, 18(4), pp. 247–257. doi: 10.1111/1540-5885.1840247.

Jiao, J., Xu, Q., Du, J., Zhang, Y., Helander, M., Khalid, H. M., Helo, P. and Ni, C. (2007) 'Analytical affective design with ambient intelligence for mass customization and personalization', *International Journal of Flexible Manufacturing Systems*, 19(4), pp. 570–595. doi: 10.1007/s10696-008-9032-1.

Jiménez, F. R., Voss, K. E. and Frankwick, G. L. (2013) 'A classification schema of co-production of goods: an open-systems perspective', *European Journal of Marketing*, 47(11/12), pp. 1841–1858. doi: 10.1108/ejm-09-2011-0459.

Keep, J. (no date) *Digital Pots*. Available at: <http://www.keep-art.co.uk> (Accessed: 1 January 2015).

Knott, S. (2013) 'Design in the age of prosumption: The craft of design after the object', *Design and Culture*, 5(1), pp. 45–67.

Konczał, J. (2008) 'Identifying, Knowing & Retaining Your Customers: The "Prosumer"', *Customer Inter@ction Solutions*, 26(11), pp. 22–23. Available at: <http://search.proquest.com/docview/208141438?accountid=10472>.

Lucas, R. (2016) *Research Methods for Architecture*. 1st edn. London: Laurence King Publishing Ltd.

Matzler, K., Stieger, D. and Füller, J. (2011) 'Consumer Confusion in Internet-Based Mass Customization: Testing a Network of Antecedents and Consequences', *Journal of Consumer Policy*, 34(2), pp. 231–247. Available at: <http://search.proquest.com/docview/877900084?accountid=10472>.

Matzler, K., Waiguny, M. and Füller, J. (2007) 'Spoiled for Choice : Consumer Confusion in Internet-Based Mass Customization', *Innovative Marketing*, 3(3), pp. 7–18.

Maykut, P. and Morehouse, R. (1994) *Beginning qualitative research : a philosophic and practical guide*. Falmer Press.

Mellor, S., Hao, L. and Zhang, D. (2014) 'Additive manufacturing: A framework for implementation', *International Journal of Production Economics*, 149, p. 194. Available at: <http://search.proquest.com/docview/1498138910?accountid=10472>.

Merle, A., Chandon, J.-L. and Roux, E. (2008) 'Understanding the perceived value of mass customization: the distinction between product value and experiential value of co-design', *Recherche et Applications en Marketing*, 23(3), pp. 27–50. Available at: <http://search.proquest.com/docview/209633128?accountid=10472>.

Merle, A., Chandon, J., Roux, E. and Alizon, F. (2010) 'Perceived Value of the Mass-Customized Product and Mass Customization Experience for Individual Consumers', 19(5), pp. 503–514.

Mugge, R. (2007) 'Product Attachment'. Available at: <http://resolver.tudelft.nl/uuid:0a7cef79-cb04-4344-abb1-cff24e3c3a78>.

Mugge, R., Schifferstein, H. and Schoormans, J. (2010) 'Product attachment and satisfaction: understanding consumers' post-purchase behavior', *The Journal of Consumer Marketing*, 27(3), pp. 271–282. Available at: <http://search.proquest.com/docview/220135034?accountid=10472>.

Mugge, R., Schoormans, J. and Schifferstein, H. (2009) 'Emotional bonding with personalised products', *Journal of Engineering Design*, 20(5), pp. 467–476.

Mustak, M., Jaakkola, E. and Halinen, A. (2013) 'Customer participation and value creation: a systematic review and research implications', *Managing Service Quality*, 23(4), pp. 341–359. Available at: <http://search.proquest.com/docview/1370332764?accountid=10472>.

Neal, J. W., Neal, Z. P., VanDyke, E. and Kornbluh, M. (2015) 'Expediting the Analysis of Qualitative Data in Evaluation: A Procedure for the Rapid Identification of Themes From Audio Recordings (RITA)', *American Journal of Evaluation*, 36(1), pp. 118–132. doi: 10.1177/1098214014536601.

Norman, D. A. (2004) *Emotional design: why we love (or hate) everyday things*. New York: Basic Books. Available at: <http://bit.ly/2zYxNmG> (Accessed: 26 September 2017).

Peck, J. and Shu, S. B. (2009) 'The Effect of Mere Touch on Perceived Ownership', *Journal of Consumer Research*, 36(3), p. 434. Available at: <http://search.proquest.com/docview/215027869?accountid=10472>.

Piller, F. T. (2010) 'Mass Customization: A Strategy for Customer-Centric Enterprises - A Review of the Strategic Capabilities to Make Mass Customization Work', *SSRN Working Paper Series*. Available at: <http://search.proquest.com/docview/1095320609?accountid=10472>.

Press, M. and Cooper, R. (2003) *The design experience : the role of design and designers in the twenty-first century*. Available at: <https://tinyurl.com/ybnoaf7d> (Accessed: 26 September 2017).

Rowley, J. (2012) 'Conducting research interviews', *Management Research Review*, 35(3/4), pp. 260–271. Available at: <http://search.proquest.com/docview/928748740?accountid=10472>.

Sanders, E. B.-N. and Stappers, P. J. (2008) 'Co-creation and the new landscapes of design', *CoDesign*. Taylor & Francis , 4(1), pp. 5–18. doi: 10.1080/15710880701875068.

Schnurr, B. and Scholl-Grissemann, U. (2015) 'Beauty or function? How different mass customization toolkits affect customers' process enjoyment', *Journal of Consumer Behaviour*, 14(5), pp. 335–343. doi: 10.1002/cb.1524.

Schwartz, B. (2015) 'The Paradox of Choice', in *Positive Psychology in Practice*. Hoboken, NJ, USA: John Wiley & Sons, Inc, pp. 121–138. doi: 10.1002/9781118996874.ch8.

Shankar, A., Cherrier, H. and Canniford, R. (2006) 'Consumer empowerment: a Foucauldian interpretation', *European Journal of Marketing*, 40(9/10), pp. 1013–1030. Available at: <http://search.proquest.com/docview/237029623?accountid=10472>.

Sinclair, M. and Campbell, R. I. (2009) 'From Configuration to Design: Capturing the Intent of User-Designers', in Jarmo Suominen Frank Piller, M. R. M. T. S. J. (ed.) *Proceedings of the 2009 World Conference on Mass Customization and Personalisation*. Aalto University School of Art and Design, pp. 138–162.

Steiner, F., Ihl, C., Piller, F. and Tarman, R. T. (2011) 'Embedded Toolkits: Identifying Changing User Needs During Product Usage', *Engineering Management Journal*, 23(4), pp. 3–13. Available at: <http://search.proquest.com/docview/1014055277?accountid=10472>.

Syam, N., Krishnamurthy, P. and Hess, J. D. (2008) 'That's What I Thought I Wanted? Miswanting and Regret for a Standard Good in a Mass-Customized World', *Marketing Science*, 27(3), p. 379–397, 537, 539. Available at: <http://search.proquest.com/docview/212280307?accountid=10472>.

Tepper, K. T., Bearden, W. O. and Hunter, G. L. (2001) 'Consumers' need for uniqueness: Scale development and validation', *Journal of Consumer Research*, 28(1), pp. 50–66. Available at: <http://search.proquest.com/docview/215044074?accountid=10472>.

Toffler, A. (1980) *The Third Wave*. London: Collins.

Trochim, W. M. K. (2006) *Deduction & Induction., Research Methods Knowledge Base*. Available at: <http://www.socialresearchmethods.net/kb/dedind.php> (Accessed: 12 July 2016).

Tseng, M. and Jiao, J. (2001) 'Mass customization', *Handbook of industrial engineering*, 3, pp. 684–709.

Vignali, C. and Zundel, M. (2003) 'The marketing management process and heuristic devices: an action research investigation', *Marketing Intelligence & Plan*, 21(4), pp. 205–219. Available at: <http://www.emeraldinsight.com/doi/abs/10.1108/02634500310480095>.

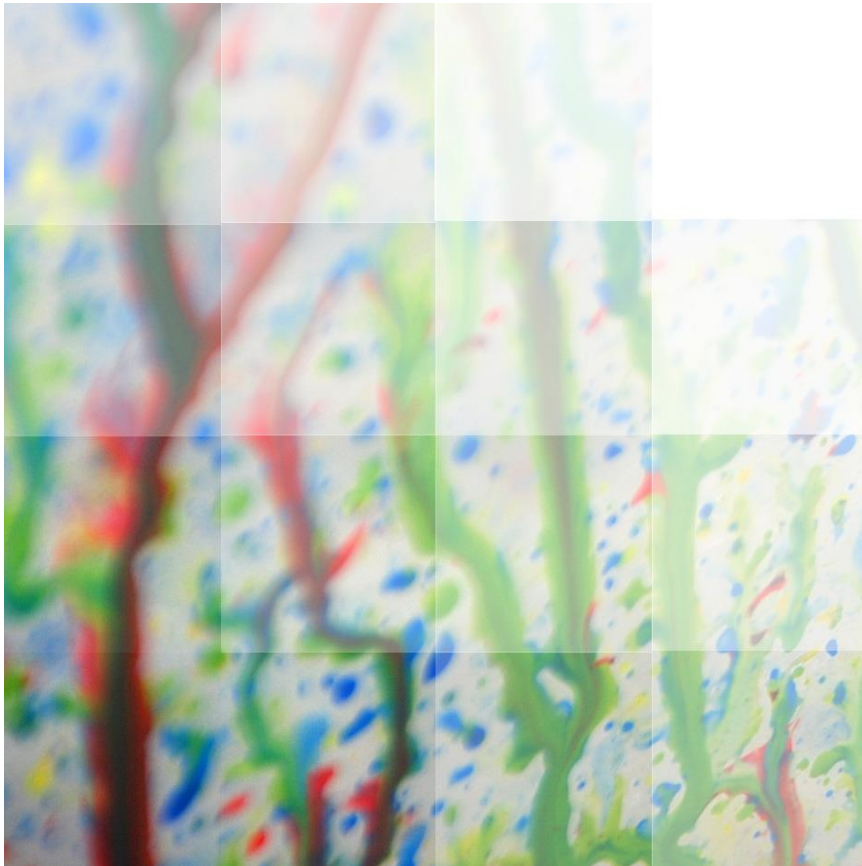
Wang, F. and Hannafin, M. J. (2005) 'Design-Based Reserach and Technology-Enhanced Learning environments', *Educational Technology Research and Development*, 53(4), pp. 5–23. doi: 10.2307/30221206.

Welsh, E. (2002) *Forum, qualitative social research, Forum: Qualitative Social Research*. Deutsche Forschungsgemeinschaft. Available at: <http://bit.ly/2zobUyj> (Accessed: 1 April 2017).

Woudhuysen, J. (2013) '3D printing: neither gimmick nor revolution', *Spiked*.

Yang, F. and Bouchlaghem, D. (2010) 'Genetic Algorithm-Based Multiobjective Optimization for Building Design', *Architectural Engineering and Design Management*, 6(1), pp. 68–82. Available at: <http://search.proquest.com/docview/213963098?accountid=10472>.





## 9. APPENDIX

All contents of the Appendix (including the publications indicated in section 9.1, below) are available online and accessible via this link:

**[Appendix for Doctoral dissertation \(opens a shared Google Drive folder in your browser\)](#)**

If the above link does not work, copy one of the following URLs and paste it on an internet browser:

**<http://tinyurl.com/armellini-phd-2017>**

<https://drive.google.com/drive/folders/0BxJNV8pug04pR1c4SIlxSUICenM?usp=sharing>

## 9.1. PUBLICATIONS

Armellini, J. & Prof. Ford, P. (2017) Uniquely for you: the individualised avenue for longer product lifetimes. In: *Proceedings of Product Lifetimes And The Environment, Delft, 2017*. Delft University Press. Available at: <http://ebooks.iospress.nl/volumearticle/47834>

Armellini, J. & Dr Dean, L. (2016) Randomized Customization: A Driver for Enhanced Product Value. *The International Journal of Designed Objects*, 10(2), 31–43.  
Available at: <http://ijgo.cgpublisher.com/product/pub.237/prod.80>