

**The value increment of mass-customized products:
An empirical assessment and conceptual analysis of its explanation**

Martin Schreier*

A later version of this paper is published in the
Journal of Consumer Behaviour (forthcoming)

*Vienna University of Economics and Business Administration

Department of Entrepreneurship and Innovation

Web: www.e-and-i.org

Email: Martin.Schreier@wu-wien.ac.at

Acknowledgements

The author would like to thank Nikolaus Franke (Vienna University of Economics and BA) for his fruitful insights on previous versions of this paper. This paper is part of a bigger research project funded by the WWTF, to which the author is also indebted.

Abstract:

The primary argument in favor of mass customization is the delivery of superior customer value. Using willingness-to-pay (WTP) measurements, Franke & Piller (2004) have recently shown that customers designing their own watches with design toolkits are willing to pay premiums of more than 100% (WTP). In the course of three experiments, we found that this type of value increment is not a singular occurrence but might rather be a general phenomenon, as we again found average WTPs of more than 100% for customers designing their own cell phone covers, T-shirts, and scarves. Building on this, we discuss the sources of benefits that are likely to explain this tremendous value increment. It is argued that compared to conventional standard products, a mass-customized product might render the following utilitarian and hedonic benefits: (1) First, the output might be beneficial as self-designed products offer a much closer fit between individual needs and product characteristics. In addition to this mere *functional benefit*, extra value might also stem from (2) the *perceived uniqueness* of the self-designed product. Designing one's own products might, however, also more generally change the way in which people consume products. As the customer takes on the role of an active co-designer, there may also be two general do-it-yourself effects: (3) First, the process of designing per se is likely to allow the customer to meet hedonic or experiential needs (*process benefit*). (4) As the customers themselves are the designers, they will also be likely to value the output more highly, as they will be proud of having created something on their own (instead of traditionally buying something created by somebody else) – which might be referred to as the '*pride-of-authorship*' effect.

Keywords

Mass customization, toolkits for user innovation and design, value increment, types of benefits, Vickrey auction, willingness to pay, WTP

Introduction

Generally, new products are developed in response to the average needs of a specific target market. Consequently, they are also limited to satisfying the average needs of customers. They are 'one size fits all' or at least 'one size fits one segment' products. Obviously, this traditional approach makes sense if the respective market or clustered segment is large enough, and if customer preferences within this segment are relatively homogeneous. Certain customers with very unique needs then remain, to a certain degree, unserved – even in seemingly mature markets (this can be referred to as the 'dark side of the market'). More often these customers are, however, not the exception but rather the norm. We know from prior research that a poor customer fit (a weak match between the individual's needs and the product's characteristics) has often been used to explain the high flop rates of up to 90% of all new products (Cooper, 1999; Crawford, 1979; Shanklin & Ryans, 1984).

Only recently, the coincidence of two technological developments paved the way for a radical new form of manufacturer-customer interaction which enables manufacturers to respond to each customer's individual needs with an individual product (Franke & Schreier, 2002). First, new communication tools like the Internet have allowed manufacturers to handle each customer's product needs individually and in a rapid, cost-effective manner. Second, mass-customizing production methods have reduced the fixed costs of tooling in manufacturing dramatically (Zeid, McDonough & Kamarthi, 2001). These advances in flexible manufacturing systems and modularization have brought down the costs of single-unit quantities to near mass-production efficiencies (Pine, 1993; Tseng, Jiao & Su, 1997). Consequently, there seems to be a promising opportunity to cope with the 'dark side of the market'.

In addition, empirical studies on the sources of innovation have revealed that, contrary to conventional wisdom, users might be highly innovative themselves. In both the industrial and consumer goods fields, customers, or more generally end-users, are often found to be the initial developers of products, prototypes and processes which later gain commercial significance (an overview is provided by von Hippel (2002)). Thus, it is often the users rather than the manufacturers who are identified as innovators of products first in terms of type (radical innovations) as well as major and minor functional improvements (incremental innovations). In addition, studies have demonstrated that up to 30% of respondents reported having developed a new product for personal or in-house use, which supports the idea that innovative customers are not a rare occurrence (Von Hippel, 2002). Thus, users might have a lot more to share than vague information about their needs, that is, they might be highly innovative and take on problem solving tasks themselves.

Against this background, it seems both possible and reasonable to outsource certain tasks of designing new products to customers. This is where mass customization comes into play: A manufacturer can equip its customers with a set of tools which enable them to convert their ideas, preferences, and tastes into products. Their final, individual solutions are then produced by the manufacturer, who takes advantage of mass customization production systems.

Customers equipped with design toolkits can already create their own unique products, such as shoes, watches, or bags (see www.mass-customization.de for further examples). Hence, customers with heterogeneous needs are given the opportunity to get exactly what they want.

Recent empirical work in the field of mass customization has revealed that customers designing their own products with design toolkits might be willing to pay premium prices. Whereas Kamali & Loker (2002) found that users designing their own T-shirts are generally prepared to pay more for individualization, Franke & Piller (2004) aimed to measure this value increment explicitly through real auctions. Employing a watch toolkit, they revealed that on average the value increases by up to 100% on an *interpersonal* level.

On this basis, the aim of this paper is to extend the preliminary findings of Franke & Piller (2004). In particular, we set out to analyze whether this value increment is a singular finding or rather a general phenomenon. For this purpose, we measured the value increment perceived by customers designing their own cell phone covers, T-shirts, and scarves using various design toolkits. In addition, our experiments are designed to measure the value increase on an *intrapersonal* level.

The paper is structured as follows: The next section gives a brief overview of the core of this manufacturer-customer interaction from the customer's perspective, that is, the design toolkits themselves. This is followed by a brief literature review of the potential outcome of mass customization – the value increment of self-designed products. Next, we describe the method applied in the study and then present our empirical findings. On this basis, we discuss the types of benefits that are likely to explain the value increment of mass-customized products. We conclude by pointing out a number of future research possibilities.

¹ To enhance this 'incorporation' of possessions, people are often observed to personalize mass-produced consumption objects both symbolically and physically (Belk, 1988; Belk, Wallendorf & Sherry, 1989; McCracken, 1986).

Manufacturer-customer interaction using design toolkits

Mass customization is a buyer-centric strategy where the locus of control – with regard to product design – resides with the individual customer (Wind & Rangaswamy, 2001). In this light, it seems obvious that the success of outsourcing certain design tasks to customers, that is, the success of mass customization, depends heavily on efficient and effective manufacturer-customer interaction. The interaction systems for mass customization, known as configurators, choice boards, design systems, co-design platforms, and toolkits (we will use the last term, coined by von Hippel, 2001), are responsible for guiding the customer through the design process (Franke & Piller, 2003). In practice, however, toolkits are very heterogeneous in terms of what the customer can do and how he can do it.

Based on his exploratory studies, von Hippel (2001) proposes that successful design toolkits support five important functions: Problem solving in general and problem solving with regard to product development and design are usually carried out by means of trial and error and learning by doing (e.g. Barron 1988, Rosenberg, 1982). (1) Hence, toolkits have to enable complete trial-and-error cycles when customers create their designs. A high *fidelity* of the interim and final user designs provide customers with relevant feedback. The complete iterative design process, including testing, evaluation and any necessary improvements, can then be handled by the individual customer. (2) Next, successful toolkits should offer an appropriate *scope*. The scope of the toolkit describes the customer's design possibilities, that is, the degrees of design freedom. Whereas a toolkit with a very narrow scope might only enable the user to choose components *passively* from lists (such as typical mass-customization websites like www.cannondale.com, which offers 8 million different frame and color variations in its bicycles), a wider scope will allow users to create novel designs *actively* (like the toolkit for cell phones at www.designyourhandy.de). (Of course, the customer can only be

given as many degrees of design freedom as are available within production constraints). (3) Furthermore, successful toolkits allow users to work in their own design language. Thus customers can use the skills they already have within a user-friendly toolkit (*user-friendliness*). (4) Module libraries should be offered to customers, as their design will rarely be novel in all parts of the product and their creative work can be focused on certain aspects. This should guarantee an efficient investment of customer-based resources. (5) Finally, once the customer finds a satisfactory solution, his design is automatically translated into the language of the production system without requiring revisions by the manufacturers.

Empirical findings of the value mass-customized products deliver to customers

The evolving literature on mass customization does not yet provide a deeper understanding of the value creation of self-designed products from the customer's perspective.

An exhaustive literature review (Franke & Piller, 2003) reveals that most pertinent research efforts, however, have been devoted to the analysis of technical aspects of toolkits and the associated production environment. Only few studies try to understand mass customization from the perspective of the customer (Bee & Khalid, 2003; Dellaert et al., 2001; Huffman & Kahn, 1998; Kamali & Loker, 2002, Khalid & Helander, 2003; Meuter et al., 2002; Ng, 2000). The basic research questions here are how consumers handle opportunities for choice and which factors drive their satisfaction.

As noted above, the main objective of mass customization is to provide superior customer value (Tseng & Jiao, 2001). Thus, it is assumed that the value increment for the customer stems from increased satisfaction due to the individualized product. Experimental evidence on this is provided by Huffman & Kahn (1998). Furthermore, it is often argued theoretically that this value increment makes customers willing to pay price premiums for mass-customized

products (e.g. Wind & Rangaswamy, 2001) – as long as the premium is commensurate to the perceived added value (Broekhuizen & Alsem, 2002). Despite the fundamental relevance of this aspect, only one very recent study has *explicitly* aimed to *assess* the value created by mass-customized products (Franke & Piller, 2004). In the course of four experiments (n=467) they measured the user's willingness to pay (WTP) for both self-designed and standard watches. Irrespective of the method employed (contingent valuation method or Vickrey auctions), they found an enormous value increment between self-designed products and standard products. The mean WTP for a standard watch using the theoretical contingent valuation method (or the Vickrey auction, alternatively) was €23.20 (€7.10). In contrast, the average WTP for the self-designed watch is €48.50 (€15.50), implying an astonishing value increment of 109% (118%) (Franke & Piller, 2004).

Although this highlights the tremendous potential of mass customization, it remains questionable whether this is a singular occurrence or a general phenomenon. Do mass-customized products create value in general, or is this finding specific to the underlying watch toolkit? In addition, it remains unanswered whether their findings are valid with regard to measurement aspects, as they measured the value increment on an *interpersonal* level. In the course of one experiment, probands designed their own watch and then participated in the auction (which yielded the WTP for the self-designed watch). In another experiment, other probands bid on selected standard watches (yielding the WTP for the standard watches). Will these findings still hold in an *intrapersonal* setting?

This paper aims to provide answers to these questions by means of the study described below.

Study Method

Setting

The study was designed as an experiment with probands using a PC to design their individual products using the toolkit. Before starting, the probands were given an explanation of the toolkit's functionality. Having finished the design process (no time constraints), probands compared their created products with the best standard product (which they could select from the predefined set). Next, probands were asked to submit *binding sealed bids* for both the self-designed and the standard product (by means of a Vickrey auction, see below). Hence, this study aims to analyze the value increment on an *intrapersonal* level. Once they had submitted their bids, probands completed a brief questionnaire (containing questions related to validity issues of the WTP measurement). Note that probands were instructed that if both bids were accepted, a random draw would decide on which of the two products the proband received, thus strategic behavior could be avoided (e.g. bidding high on one and low on the other; Skiera & Revenstorff, 1999, Rothkopf & Teisberg, 1990).

Research objects

As noted above, toolkits themselves are heterogeneous in practice. Therefore, we selected three different toolkits in order to increase the external validity of our study. One toolkit allows users to design cell phone covers (www.designyourhandy.de), another to create T-shirts (www.shirtcity.com), and the third to design a scarf (www.wildemasche.de). These toolkits constitute a good representation of the toolkits in practical use in the B2C arena. The toolkit to design cell phone covers, for example, offers a relatively high degree of solution space (thus enabling *active* design). On the other hand, this set of tools does not provide the user with a module library, thus requiring the customer to start his design completely from scratch. The T-shirt toolkit offers a high degree of user-friendliness. In addition, customers

are given the opportunity to draw from a rich module library. The toolkit to design a scarf, in contrast, is rather complex to use and the fidelity of the scarf design is rather weak. This impression was confirmed by expert ratings: 26 experts in the field of mass customization evaluated these toolkits on the basis of the toolkit's scope, user-friendliness and fidelity (see Figure 1). All mean differences are significant (see Appendix 1 for details).

Insert figure one about here

In order to measure the value increment, we also needed a valid reference point. Therefore, we selected a set of standard products for each product category, that is, ten standards for each toolkit. These standards were of exactly the same quality as their potential self-designed counterparts. In a pilot study (n=48), we observed that every proband found a satisfactory standard product responsive to his needs (out of the ten standards). Furthermore, when interviewing probands we found that the standards were consistently perceived as highly realistic (representing 'real-life' offers). Thus, we were able to support the assertion that our measurement of the value increment is not in danger of inducing a 'straw man' effect (which in this case would imply consciously selecting 'ugly' objects of comparison to 'produce' high differences, cf. Murphy & Myors, 1998). We have to note, however, that we do not claim to measure the WTP difference between self-designed and *best-selling* standard products as Franke and Piller (2004) did. In addition, we have to point out that the quantitative supply (i.e., ten standard products) might underestimate real supply. From this point of view, one might argue that the absolute size of the value increment might be slightly overestimated (as the best standard product in the course of the experiment might not represent the best standard available in reality). On the other hand, we know from prior research that customers do not like too much choice, indicating that too much supply might lead to information overload.

Consequently, too many alternatives may lead to poor quality in consumer choices (Jacoby et al., 1974ab, Malhotra, 1982).

Sample

A total of 187 students at the Vienna University of Economics and Business Administration were surveyed. Proband's were 23 years old on average (SD: 3.18), with 49% being female and 51% male. 60 probands designed their individual cell phone covers (subsample characteristics: average age: 23; SD: 3.75; sex: 50% male). In addition, 63 subjects designed their own T-shirts (subsample characteristics: average age: 23; SD: 3.23; sex: 51% male), and 64 probands designed scarves (subsample characteristics: average age: 22; SD: 2.34; sex: 52% male). There are no statistical differences between subsamples with regard to age and sex.

Measuring the value increment

The value increment of a self-designed product compared to a standard product is measured by the customer's WTP (e.g. Wertenbroch & Skiera, 2002). The difference between a user's WTP for the mass-customized product and the standard product yields the value increment of self-designed products (WTP). Going into more detail, we employed Vickrey auctions to obtain valid measurements of willingness to pay. A Vickrey auction is an auction in which the participants' bids are sealed and each bidder is unaware of the other bids. The item is awarded to highest bidder at a price equal to the second-highest bid. Thus the winner pays less than the highest bid (Vickrey, 1961). It can be shown both empirically and in terms of game theory that the dominant strategy of a bidder is to bid the actual maximum willingness to pay (e.g., Cox et al., 1982, Hoffmann et al., 1993). Vickrey auctions are a widely accepted method of mapping WTP in various academic fields such as economics (e.g., Blume & Heidhues, 2004,

Coursey, Hovis & Schulze, 1987, Kagel & Levin, 2001, Lucking-Reiley, 2000). Although they are fairly new to the discipline of marketing, applications are gaining more and more importance (e.g., Hoffmann et al., 1993, Franke & Piller, 2004). Skiera and Revenstorff (1999), for example, have tested the Vickrey auction's validity in measuring consumers' WTP for different mobile phone rate packages with highly encouraging results. Furthermore, Noussair et al. (2003) have shown that Vickrey auctions are a valid set of tools to depict consumers' WTP for private goods.

The appropriateness of this method for our study is outlined briefly below.

Reliability is assessed by comparing WTP (for self-designed and standard products) and WTP means (difference between WTP for self-designed and WTP for standard products) across subsamples (Green, Tull & Albaum, 1988, Wertenbroch & Skiera, 2002). We therefore compared each third of our sample with one another (with regard to the time of data collection) using variance analysis. The WTP means for the self-designed and the standard cell phone covers do not vary significantly between subgroups ($F=0.142$, $p>0.10$ and $F=0.656$, $p>0.10$, respectively). The same holds true for T-shirts ($F=1.269$, $p>0.10$; $F=0.156$, $p>0.10$) and scarves ($F=0.332$, $p>0.10$; $F=0.096$; $p>0.10$). In addition, we did not observe any differences with regard to WTP (cell phone cover: $F=0.433$, $p<1$; T-shirt: $F=2.312$; $p<1$; scarf: $F=0.770$; $p<1$). These results suggest a reliable measurement of WTP for both self-designed and standard products.

Validity is assessed by correlation analysis between WTP and selected measurement items (Skiera & Revenstorff, 1999, Wertenbroch & Skiera, 2002). The results are summarized in Table 2. The WTP for *standard* products should generally correlate positively with product

interest and purchase intention. All coefficients show the expected positive direction and are highly significant. The WTP for *self-designed* products also correlates positively with product interest and purchase intention. In addition, the WTP for self-designed products as well as WTP is positively and significantly correlated with product satisfaction and perceived product superiority (compared to the standard product). This points to a sound degree of validity.

Insert table 2 about here

Findings

The results of our WTP measurement in the course of Vickrey auctions are summarized in Table 3. The self-designed cell phone cover produces an astonishing and highly significant value increment of 207% (mean WTP for standard product: €3.7; mean WTP for self-designed product: €11.4). This indicates that on average subjects were ready to pay €7.6 more for designing their own product as opposed to picking a standard product. The self-designed T-shirt delivers a 113% value increase (mean WTP for standard product: €6.0, mean WTP for self-designed product: €12.8). Thus, self-designed T-shirts skim €6.8 on average.

Furthermore, probands are ready to pay an average of 106% more for a self-designed scarf, implying a WTP of €5.2 (mean WTP for standard product: €4.9; mean WTP for self-designed product: €10.1). All differences appear to be highly significant ($p < 0.001$). Across all three subsamples, the average bids come to €4.9 for a standard product and €11.4 for a self-designed product. This corresponds to an average value increment of 134% (see Table 2). Thus it seems that the recent findings of Franke & Piller (2004), who identified an average

WTP of 118% in the watch market, do not constitute a singular occurrence. Mass-customized products do appear to create explicit value for customers in general.

Insert table 3 about here

Going beyond mean statistics, however, we found that toolkits for mass customization in general are not suited to every customer (von Hippel, 2001). The absolute value increment ranges from €13 (!) to €40 (!). This implies on the one hand that these mass-customized products do not deliver *any* value ($WTP = 0$) for a certain fraction of our sample (12%). On the other hand, however, there is also a group of subjects who seem to benefit strongly. If we consider, for instance, the upper 50% or 25% of the entire sample, WTP jumps from €6.5 to €11.9 (SD: 7.1) or to €19.3 (SD: 6.9), respectively.

Although each of the three subsamples delivers significant value increments, the toolkit itself also seems to impact the value created. The scarf toolkit, which has the most restricted scope, the lowest level of user-friendliness and the weakest fidelity, also delivered the lowest value increment (106%) and showed the highest rate of 'non-value creators' (19% with $WTP = 0$). On the other hand, the toolkit to design a cell phone cover, which offers the highest degree of design freedom, generates the highest increment (204%). The T-shirt toolkit, which turned out to be the most user-friendly tool and easy to use, shows the lowest $WTP = 0$ -rate of 6%. In total, however, it has to be noted that although the three toolkits differ substantially, all of them create value for the customer. Therefore, we might conclude that mass-customized products create value in general.

Discussion: Types of benefits of mass-customized products

Our empirical findings suggest that mass-customized products create value for all three toolkits studied. Irrespective of the underlying tools of interaction between manufacturer and customer (i.e., the toolkits themselves), we found value increments of more than 100%.

The high variance of the value increment within all three subsamples implies that specific factors might underlie the value creation of mass-customized products. Knowledge regarding this *value composition* is not merely of theoretical interest. It constitutes success factors for mass customization in general and for the design of future interaction toolkits in particular. To date, hardly any explanations are available as to what causes users to attribute high value to designing their own products with mass customization toolkits. On this basis, this section is devoted to a discussion of the types of benefits that are likely to explain the value increment.

In brief, a customer employing a mass customization toolkit may perceive the self-designed product (1) to be more tailored to his individual needs (*functional benefit*) and (2) to be more unique (*perceived uniqueness*). In addition, there might also be some 'Do-It-Yourself Effects' (as the user actively engages in problem-solving, instead of rather passively shopping through the malls). (3) Therefore, the *process* of using a mass customization toolkit itself implies additional costs and potential benefits to the user – potentially influencing the value created (*process benefit*). (4) Fourth, as the user himself is the designer, he will also be likely to value the output more highly, as he will be proud of having created something on his own (instead of traditionally buying something created by somebody else) – which might be referred to as 'pride of authorship'. Each component is discussed in detail below.

(1) Functional benefit. In general, a customer may be able to accomplish specific tasks using a given product. Therefore it is the product's properties, such as its physical characteristics

and features, that create value in the sense that the product helps the user to reach an intended outcome in a satisfactory manner (Fournier, 1991; Prentice, 1987). Ceteris paribus, the customer is likely to pick the best product available – the product that promises the most successful and thorough performance with regard to his underlying needs (Thaler, 1985). In general, the value of individualization is defined as the increase in utility a customer derives from the individualized product compared to the best possible standard product (Chamberlin, 1962; Du & Tseng, 1999). The literature on mass customization highlights the functional benefit a user potentially obtains from a self-designed product – the product's functional uses.

Von Hippel (2001), for example, argues that toolkits allow the customer to conduct efficient learning-by-doing experimentation. The customer gets instant feedback on his 'interim solution' or 'working prototype' and is able to reveal and fix errors and make further adjustments. Hence, trial-and-error loops can be performed until a satisfactory solution is found. Consequently, a customer will come up with a product solution that is potentially much closer to his unique needs than a standard product. In other words, mass customization might be a promising opportunity to exploit the 'dark side of the market' within existing or emerging markets.

Overall, functional benefit refers to objective product attributes (which, of course, are perceived and valued subjectively). They include technical aspects as well as design aspects, thus covering a broad spectrum of possible characteristics depending on the product category in question. In the case of a user-designed watch this might be the unique design, while in the case of statistics software it might be a new econometric test.

(2) Perceived uniqueness. In general, 'people buy things not only for what they can do, but also for what they mean' (Levy, 1959, p.118). In addition to the product's functional uses, purchasing a product also implies a symbolic product meaning (Ligas, 2000). The possession of goods, for example, has often been observed to assist in establishing one's identity (Csikzentmihalyi & Rochberg-Halton, 1981). "Apparently, in claiming that something is *mine*, we also come to believe that the object is *me*" (Belk, 1988). Hence, people attach meanings to their products in such a way that possessions are regarded as parts of themselves – the extended self (for an overview see Belk, 1988).¹

More specifically, the symbolic benefit of products becomes most understandable from the perspective of the social context of consumption (Fournier, 1991). Consumers often acquire things in order to *feel* different from others, and selected material possessions are used to *express* the customer's individuality. This need for uniqueness (Tian, Bearden & Hunter, 2001) drives customers to purchase novelty or original goods (Kron, 1983), handcrafted goods, vintage or antique goods that are not available in mass quantities (Tian, Bearden & Hunter, 2001), or they can decorate, arrange, and display (a composition of) goods in such a way that they are one of a kind (Belk, Wallendorf & Sherry, 1989; Kron, 1983). Furthermore, customers may also convert standard products into unique products by creatively altering or using them (Tepper, 1997).

Furthermore, people attribute greater value to products that are unique than to ones that are common, *ceteris paribus* (Brock, 1968; Fournier, 1991; Fromkin, 1970). In an empirical study, for example, this effect was assessed in the following way: 248 BA students were

asked to evaluate 125 standard plastic watches. They had to state their WTP for the watch they personally preferred most on a contingent valuation scale (median: €45). Next, they were asked how much they would pay if they were guaranteed that the respective watch would be unique. Surprisingly, this option increased their WTP from a median of €45 to €70, indicating a value increase of 64 % (Schreier, 2004).

Even simple mass-customizers offer an almost endless number of options. Against this backdrop, it seems very likely that self-designed products might also deliver this value of uniqueness.

(3) Process Benefit of Self Design. As the customer devotes his time and effort (which actually incurs costs to the user) to designing his own product, it seems more than plausible that this will have a negative impact on the likely value of the outcome (compared to the reduced effort involved in picking a standard product off the shelf). Irrespective of the time needed to design one's own product, the customer's exposure to complexity is especially likely to be perceived in a negative light. One argument often used against mass customization is the excess variety customers have to deal with (Huffman & Kahn, 1998), which Pine (1993) termed 'mass confusion'. Thus, the burden of choice may lead to information overload (Maes, 1994). This in turn may have a negative impact the perceived value of the outcome.

On the other hand, the process of designing one's own product per se might also add value if it is perceived as a self-rewarding process, like going shopping or exercising at a fitness center. We often observe that people seem to derive an intrinsic benefit from 'doing it themselves'. Csikszentmihalyi (1996), for example, found that individuals seek out engaging activities like rock climbing or chess because they are intrinsically motivating. Intrinsically rewarding activities in general are associated with characteristics like the satisfaction of curiosity, opportunities to experience and attain mastery of a particular topic, entertainment value, and novelty (Kruglanski, 1975). Furthermore, an action is said to be especially enjoyable when people perceive themselves as doing it for its own sake rather than for an external reward such as money (Deci, Koestner & Ryan, 1999; Lepper & Henderlong, 2000).

A study of the traditional do-it-yourself (DIY) market² revealed that a majority of German do-it-yourselfers actually do so because it is an enjoyable, fun experience (Institut für Freizeitwirtschaft, 1997, see also Williams, 2004), and they perceive it more as hobby than as work (Puhe, 1986). In addition, parallels can also be drawn from theoretical and empirical work on open-source software. Here people participate in software development for free because they enjoy working on creative tasks and perceive writing or improving software as fun, creative, and interesting (e.g. Gabriel & Goldman, 2001; Shah, 2003).

In the field of mass customization, it also seems likely that a customer designing his own product will enjoy the design act itself. As the reward of the process (the customer-designed product) is endogenous to the activity (the act of designing) and both are closely linked, the

² The DIY market is the second largest leisure market in Germany after tourism, with a sales volume of DM 64.5 billion, 29 million do-it-yourselfers, and 2.5 billion leisure hours spent on DIY activities (Institut für Freizeitwirtschaft, 1997). DIY activities range from gardening to tinkering and repair work. In addition, Spring (1993) found that DIY activities turned out to be among the most common leisure pastimes in the United States.

³ According to Shah & Kruglanski (2000) a singular relation between behavior and reward leads to the highest intrinsic action enjoyment (when single behavior x leads to single reward y).

behavior itself is bound to be experienced as rewarding (Freitag & Higgins, 2002).³ Thus, it seems likely that this positive process benefit will in turn impact the value of the outcome of the process, that is, the self-designed product.

'Pride of Authorship'. Whereas the positive effect of designing one's own product constitutes an intrinsic process-oriented benefit (the benefit of *doing* it oneself), the pride-of-authorship effect describes the output-oriented benefit of *having done it* oneself. The user might derive a feeling of enthusiasm and the enjoyment of success arising from one's own performance. Consider, as an extreme example, people who accomplish 5000-piece jigsaw puzzles. The self-rewarding process of accomplishment explains why people *do* so, but not why they *display* jigsaw puzzles. Thus, the outcome of the process is also perceived positively far beyond the objective value. Although the picture itself – as a jigsaw puzzle and not a high-quality photograph – is of mediocre quality, the owner values the outcome very highly.

Explanations may be drawn from the general literature on pride and again from the theory of the extended self. First, pride in general is defined as an emotional response to an evaluation of one's competence (Harter, 1985). In particular, pride is associated with achievement and depends on a favorable outcome attributed to one's own efforts (Lea & Webley, 1997; Weiner, 1985). Weiner (1985) illustrates this by quoting Kant: "everyone at a meal might enjoy the food, but only the cook could experience pride." Thus, a user designing his product with a TUID can take all the credit for having done it on his own. Second, Sartre (1943) already argued that objects in general may be incorporated into the extended self either by

control or mastery, by creation or purchase, and by knowledge – be it a tangible or an intangible product.⁴

By investing attention, time, and effort in an object, 'psychic energy' is transferred from the self to the object (Csikszentmihalyi & Rochberg-Halton, 1981). Thus, the evolving objects have grown or emerged from the self (Belk, 1988). It is for this reason that an artist may find it difficult to sell his work, that is, to separate himself from an object in which he has invested both his energy and himself and of which he is proud of having accomplished. Support for the pride-of-authorship proposition is also found in research on traditional DIY markets. 'The pride of one's own performance' was found as one of the prime motives for people to engage in do-it-yourself activities (Institut für Freizeitwirtschaft, 1997).

It seems that the positive outcome of such processes constitutes positive feedback, which gives the individual the highly motivating feeling of his own competence and of being efficacious. Parallels can also be drawn from research on industrial work and organizational psychology. Hackman and Oldham (1975, 1976) suggest that, among other things, task identity in particular (completing an entire piece of work), autonomy (having choice and discretion), and feedback (obtaining feedback about performance from the job) influence psychological states such as the experienced meaningfulness of the work, experienced responsibility, and knowledge of results, which in turn promote work satisfaction, internal work motivation, and work performance. In addition, many scholars have shown that Bandura's self-efficacy – the belief in or perception of one's capability of performing a

⁴ In order for the object to become part of the extended self, the person doesn't necessarily have to own it. A rock climber, for example, might claim the Matterhorn as his when he has reached the peak, demonstrating that he has asserted control over the mountain and that he has mastered the challenge (Sartre, 1943).

⁶ For an overview see Gist and Mitchell (1992)

specific task – predicts actual performance.⁶ Self-efficacy in general changes as a result of learning, experience, and feedback (Gist & Mitchell, 1992). More specifically, enactive mastering (i.e., repeated performance accomplishments) has also proven to enhance self-efficacy (Bandura, 1982; Bandura, 1977). Next, the lower the perceived ability to control performance is, the lower one's feeling of self-efficacy will be (Gist & Mitchell, 1992). Furthermore, self-generated feedback is a persuasive form of input and therefore very likely to boost self-efficacy (Bandura & Cervone, 1984).

In the mass customization arena, similar effects are likely to occur. A user completes the entire design task in an autonomous and controllable way, with choice and discretion, and he gets instant feedback from the design toolkit through trial and error. Hence, by designing his own product, a user is likely to experience a strong feeling of self-efficacy, and he may therefore value the outcome more positively than he would value the same product as a standard or the same product designed by a 'design agent'. Implicitly, this effect is already stressed by marketers of mass-customized products. Brands are extended to the consumer by creating company-customer co-brands like 'Dell 4 ME', 'My Adidas', or 'My Yahoo' to increase perceived customization and to enhance identification of the self-designed product as 'his or her product' (Liechty et al, 2001, Wind & Rangaswamy, 2001).

On the whole, pride of authorship is likely to add value to the product independent of its functional characteristics and its uniqueness.

Conclusion and Future Research

In summary, we found in the course of three experiments that irrespective of the underlying tools of interaction between manufacturer and customer (i.e. the toolkits themselves), value

increments add up to more than 100%. Considering the findings of Franke & Piller (2004) in the watch market, we may conclude that mass-customized products create value for customers *in general*.

Now the burning question is how this can be explained. This might be particularly relevant to manufacturers employing mass customization in order to skim the market successfully.

Conceptualizing the value composition, we argue that the customer might benefit from (1) the functional benefit (better fit between individual needs and product characteristics), (2) the perceived uniqueness of the self-designed product, (3) the process benefit (meeting hedonic or experiential needs from 'doing it oneself'), (4) and the pride-of-authorship effect (taking price in having created or designed the product oneself). Future research should build on this by extending our propositions and providing empirical data. This could be done, for example, by employing structural equation modeling (with a view to explaining the WTP).

In summary, knowledge of how the customer perceives and interacts with these toolkits – which is critical to success – is very sparse at the moment, as research has long focused on the technical aspects of customer integration in new product development and design. Thus, the results of this type of research are of considerable value for the fast-growing number of manufacturers employing mass customization.

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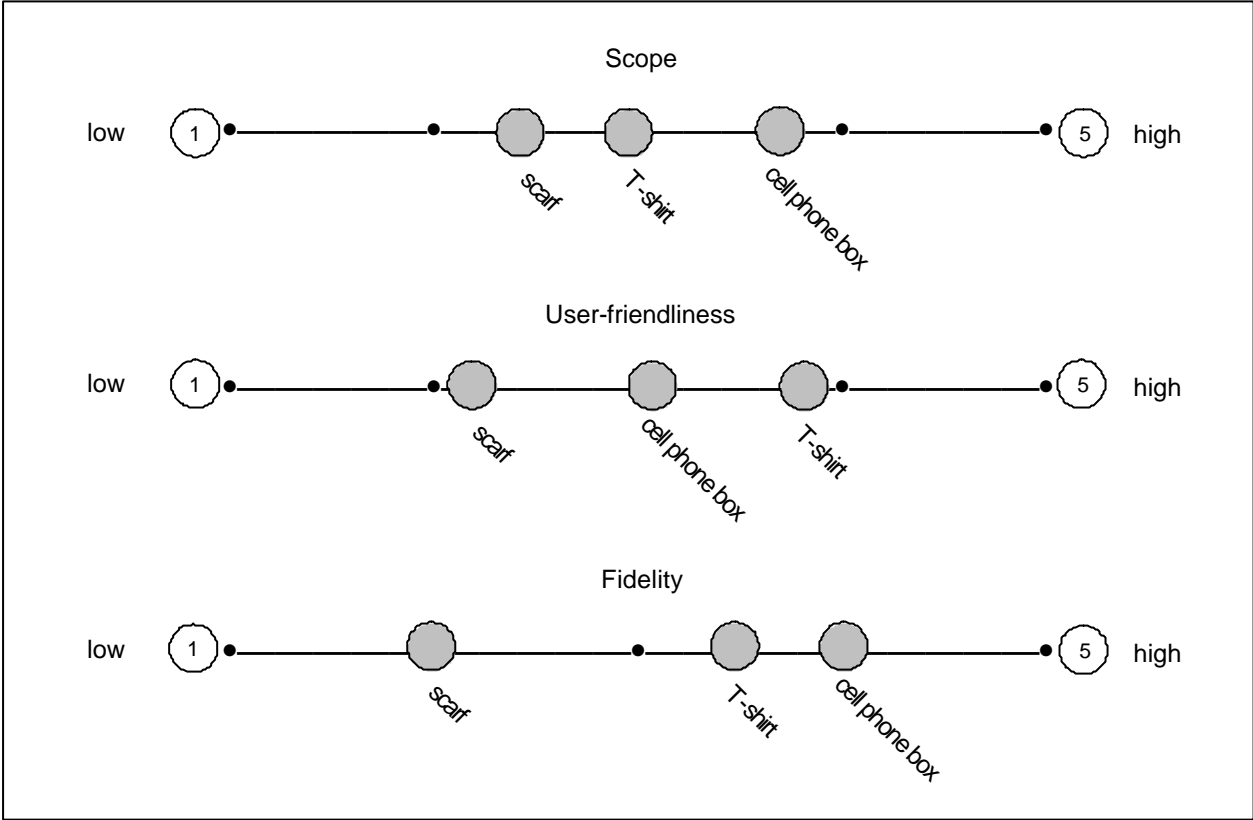


Figure 1: Expert rating of toolkits
(n=26; measured on a 5-point scale; 1=low; 5=high)

Item	WTP for standard product (n=185)	WTP for self-designed product (n=185)	WTP (value increment) (n=185)
Product interest ^a	0.190**	0.252**	n.a.
Purchase probability ^b	0.225**	0.136†	n.a.
Product satisfaction ^c	n.a.	0.149*	0.154*
Product superiority ^d	n.a.	0.231**	0.302**

†p<0.10 (two-sided)

*p<0.05 (two-sided)

**p<0.01 (two-sided)

^ameasured on a 5-point scale (1=very low; 5=very high)

^bmeasured on a 5-point scale (1=not at all probable; 5=very probable)

^cmeasured on a 5-point scale (1=not at all satisfied [with self-designed product]; 5=very satisfied)

^dmeasured on a 10-point scale (1=self-designed product corresponds to standard product; 10=is much better than standard product)

Table 2: Correlation analysis of WTP with validity measures

WTPs	Mean	Median	SD.	Minimum	Maximum	n
<i>Overall sample</i>						
WTP for standard	4.88	4.90	4.70	0.00	25.00	185
WTP for self-designed	11.41	10.00	9.25	0.00	50.00	185
WTP (percent)	6.53 (133.81)	5.00	7.61	-13.30	40.00	185
<i>Cell phone cover</i>						
WTP for standard	3.70	1.00	4.53	0.00	20.00	60
WTP for self-designed	11.35	10.00	9.47	0.00	40.00	60
WTP (percent)	7.64 (206.49)	5.00	8.48	-10.00	39.00	60
<i>T-shirt</i>						
WTP for standard	6.02	5.00	4.63	0.00	20.00	63
WTP for self-designed	12.81	13.00	8.80	0.00	40.00	63
WTP (percent)	6.79 (112.79)	5.00	6.38	0.00	25.00	63
<i>Scarf</i>						
WTP for standard	4.86	4.00	4.71	0.00	25.00	62
WTP for self-designed	10.05	7.50	9.42	0.00	50.00	62
WTP (percent)	5.19 (106.79)	3.50	7.80	-13.30	40.00	62
t-tests for paired samples			t-value	df	p-value	n
Overall sample: WTP for standard – WTP for self-designed			11.669	184	< 0.001	185
Cell phone cover: WTP for standard – WTP for self-designed			6.982	59	< 0.001	60
T-shirt: WTP for standard – WTP for self-designed			8.456	62	< 0.001	63
Scarf: WTP for standard – WTP for self-designed			5.239	61	< 0.001	62
<i>Amounts in euros</i>						
NOTE: The maximum bids for the standard and self-designed cell phone cover, the standard and self-designed T-shirt, and the standard and self-designed scarf constitute the winners of the Vickrey auction (each purchased at the second highest bid amount).						

Table 3: Willingness to pay for self-designed and standard products

Dimensions	Mean	Median	SD	n	
<i>Scope</i>					
Cell phone covers	3.69	4.00	1.16	26	
T-shirt	3.00	3.00	0.69	26	
Scarf	2.46	2.50	1.14		
<i>User-friendliness</i>					
Cell phone covers	3.12	3.00	0.95	26	
T-shirt	3.88	4.00	0.86	26	
Scarf	2.15	2.00	1.01		
<i>Fidelity</i>					
Cell phone covers	4.04	4.00	0.87	26	
T-shirt	3.50	4.00	1.01	26	
Scarf	2.00	2.00	0.94		
<hr/>					
	t-tests ^a	t-value	df	?	n
	Scope: Cell phone cover – T-shirt	3.048	25	< 0.01	26
	Scope: Cell phone cover - scarf	3.261	25	< 0.01	26
	Scope: T-shirt – scarf	1.895	25	< 0.10	26
	User-friendliness: Cell phone cover – T-shirt	-3.953	25	< 0.01	26
	User-friendliness: : Cell phone cover - scarf	3.248	25	< 0.01	26
	User-friendliness: T-shirt - scarf	6.172	25	<0.001	26
	Fidelity: Cell phone cover – T-shirt	2.158	25	<0.05	26
	Fidelity: Cell phone cover - scarf	8.326	25	< 0.001	26
	Fidelity: T-shirt – scarf	4.621	25	< 0.001	26
<hr/>					
^a for dependent samples					

Appendix 1: Expert rating of toolkits