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## Why customers value mass-customized products:

### The importance of process effort and enjoyment

#### Abstract

*In this study, we analyze which factors prompt customers to attribute value to products they design themselves using mass customization (MC) toolkits. Developing and implementing such a system involves costs, and it only makes economic sense if it also yields benefits. The assumption that self-design delivers superior customer value is fundamental to the concept of MC toolkits and can be found in almost any conceptual work in this field. However, spectacular failures reinforce the practical relevance of developing a deeper understanding of why and when MC toolkits generate value for customers – and when they do not.*

*Research to date has assumed that the closer fit between the self-designed product's characteristics and the preferences of the customer is the dominant source of value. In our research, we ask whether the enjoyment and perceived effort of the self-design process have an additional impact on the perceived value of self-designed products. This question is interesting because one could argue that a rational actor would hardly be willing to pay ex post for an economic good already consumed.*

*We test our hypotheses on 186 participants designing their own scarves with an MC toolkit. After completing the process, they submitted binding bids for "their" products in Vickrey auctions. We therefore observe real buying behavior, not merely stated intentions.*

*We find that the subjective value of a self-designed product (i.e., one's bid in the course of the auction) is indeed not only impacted by the preference fit the customer expects it to deliver, but also by (1) the process enjoyment the customer reports, (2) the interaction of preference fit and process enjoyment, and (3) the interaction of preference fit and perceived process effort.*

*In addition to its main effect, we interpret preference fit as a moderator of the value-generating effect of process evaluation: In cases where the outcome of the process is perceived as positive (high preference fit), the customer also interprets process effort as a positive accomplishment, and this positive affect adds (further) value to the product. It appears that the perception of the self-design process as a good or bad experience is partly constructed on the basis of the outcome of the process. In the opposite case (low preference fit), effort creates a negative affect which further reduces the subjective value of the product. Likewise, process enjoyment is amplified by preference fit, although enjoyment also has a significant main effect, which means that regardless of the outcome, customers attribute higher value to a self-designed product if they enjoy the process.*

*The importance of the self-design process found in this study bears clear relevance for companies which offer or plan to offer MC systems. It is not sufficient to design MC toolkits in such a way that they allow customers to design products according to their preferences. The affect caused by this process is also highly important. Toolkits should therefore stimulate positive affective reactions and at the same time keep negative affect to a minimum.*

**Keywords:** Mass Customization, Toolkits for User Innovation and Design, Self-Design, Willingness to Pay, Vickrey Auction, Customer Integration, User Design

## **Why customers value mass-customized products:**

### **The importance of process effort and enjoyment**

#### **1. Introduction**

In this study, we analyze which factors prompt customers to attribute value to products they design themselves using mass customization (MC) toolkits. New communication technologies and flexible manufacturing systems have only recently started to enable companies to respond to each customer's individual preferences by providing individual products with (almost) mass production efficiency (Pine, Victor, and Boyton 1993).

Therefore, companies like Nike, Adidas and many others provide MC toolkits which allow customers to design their own individual products online. These toolkits allow trial-and-error experimentation and deliver immediate (simulated) feedback on the potential outcome of design ideas (von Hippel 2001, von Hippel and Katz 2002). Once a satisfactory solution is found, the design can be transferred into a firm's production system and subsequently delivered to the customer (Dahan and Hauser 2002, Dellaert and Stremersch 2005, Kaplan and Haenlein 2006, Randall, Terwiesch, and Ulrich 2007).

Developing and implementing such a system involves costs (Piller, Moeslein, and Stotko 2004), and it only makes economic sense if it also yields benefits. The assumption that self-design delivers superior customer value is fundamental to the concept of MC toolkits and can be found in almost any conceptual work in this field (e.g., Pine 1999, Peppers and Rogers 1997, Wind and Mahajan 2001). Empirical studies conducted by Franke and Piller (2004) and Schreier (2006) confirm that the user's willingness to pay (WTP) for self-designed products can be much higher than in the case of standard products (with technical quality held constant), suggesting that MC holds the potential to be a profitable marketing strategy. On

the other hand, some pioneers in the field, such as Levi Strauss (with its "Original Spin" jeans), have discontinued their MC operations (MC Newsletter 2004), and some researchers have expressed doubts that empowering customers with MC toolkits generates customer value (Zipkin 2001). This reinforces the practical relevance of research efforts aiming to explore the effectiveness of MC strategies from a consumer perspective – in particular, what we need is a deeper understanding of why and when MC toolkits generate value for customers (Dellaert and Stremersch 2005, Huffman and Kahn 1998).

In our research, we thus analyze which factors prompt customers to attribute value to products they design themselves and thus make the customer willing to pay more for self-designed products than for their standard counterparts. In particular, we argue that the design *process* should be considered *in addition* to the self-designed product itself (i.e., in addition to the preference fit it delivers) (Williams 2004, Dellaert and Stremersch 2005, Fiore, Lee, and Kunz 2004, Randall, Terwiesch, and Ulrich 2007). We specifically ask whether the perceived effort and enjoyment of the self-design process have an additional impact on the perceived value of self-designed products.

We formulate these research questions as hypotheses and test them on 186 participants designing their own scarves with an MC toolkit. We define "process enjoyment" as a positive affective reaction elicited by the process of self-designing the product and "perceived process effort" as the subjective perception of the time and mental energy invested in designing the product (c.f., Huffman and Kahn 1998, Dellaert and Stremersch 2005). We define "perceived preference fit" as the customer's subjective evaluation of the extent to which the product's features correspond to her preference system (Dellaert and Stremersch 2005, Randall, Terwiesch, and Ulrich 2007). We conceptualize "value" as the maximum price a customer is willing to pay for a product (referred to as willingness to pay, or WTP) (Werthenbroch and Skiera 2002). As the dependent variable, we take the customer's WTP for her self-designed

scarf minus her WTP for the scarf she most prefers among ten standard scarves (of identical technical quality) in order to capture the *added* value of self-designed products. We measure WTP using incentive-compatible Vickrey auctions, in which the participants' bids are sealed and the item is awarded to the highest bidder at a price equal to the *second*-highest bid (Vickrey 1961). All bids were binding, which means that real money was at stake and participants eventually bought scarves if they won the auctions. This measure was used because it reduces the risk of "cheap talk" from participants when indicating perceived value (cf. Cummings and Taylor 1999) and should therefore improve the validity of the findings.

We find that the value customers attribute to MC toolkit-designed products is not only impacted by perceived preference fit, but also by process enjoyment and perceived effort. If customers perceive the process as enjoyable, they will value the resulting product more highly. This effect is independent of the product's preference fit. However, we do not find a corresponding main effect in perceived process effort. A closer inspection of interaction effects gives an indication of why this could be the case: Customers tend to interpret effort differently depending on the success of the self-design process. If the resulting product is perceived to have a low preference fit, then effort is interpreted as a (negative) strain, which in turn (further) reduces the value of the product. If the resulting product is perceived to have a high preference fit, the effort involved is interpreted as a (positive) accomplishment which even increases the subjective value of the product. In sum, our findings suggest that the affective reaction induced by the design process is important for the value customers derive from self-designed products. This has significant implications for companies which offer or plan to offer MC toolkit systems.

## **2. Why self-designed products create value for customers**

### **2.1. Overview of literature and aim of research**

Why and when do MC toolkits generate value for customers? Research addressing this question takes different avenues. In one line of research, scholars analyze *which attributes* of MC toolkits generate the most value for customers. For example, Randall, Terwiesch, and Ulrich (2007) contrast parameter-based toolkits (where users directly specify values for design parameters of the product, like the size of a PC's hard drive) with needs-based toolkits (where users specify their needs, such as the wish to store a large quantity of data on the PC). They find that whereas the former seem to suit expert users, the latter offer a better fit for novice users. Dellaert and Stremersch (2005) analyze the relationship between types of toolkits, perceived complexity and product utility. They find that more modules (i.e., the number of product features to be manipulated) and more module levels (i.e., the number of alternatives per feature) do not significantly increase perceived complexity, but they do allow users to achieve higher product utility. Huffman and Kahn (1998) find that the way in which information is presented in MC toolkits has an effect on satisfaction. Users are more satisfied and perceived complexity is lower if information is presented on the basis of attributes (i.e., the customer indicates her preferences for each product attribute) as opposed to alternatives (i.e., the customer indicates her preferences by comparing complete product alternatives).

In another line of research, scholars ask *which customers* are most likely to derive value from MC. Fiore, Lee, and Kunz (2004) analyze consumers' (hypothetical) willingness to design fashion products themselves with MC toolkits and find that the personality trait of "optimum stimulation level" appears to be an important predictor toward this end. Simonson (2005) proposes that mass customization might be most suited to customers who have well-defined and stable preferences, as only those customers might appreciate customized products. Finally, Kaplan, Schoder, and Haenlein (2007) studied the newspaper market and found that a consumer's base category consumption has a positive impact on her behavioral intention to buy a mass-customized product.

We aim to complement existing research by adopting a third perspective. Instead of analyzing the consequences of particular toolkit characteristics or studying the characteristics of customers prone to using MC toolkits, we analyze which factors prompt customers to attribute value to products they design themselves and thus make the customer willing to pay more for self-designed products than for their standard counterparts.

So far, the literature on toolkits and MC has primarily emphasized product-related benefits as a source of value for self-designed products (Addis and Holbrook 2001, Broekhuizen and Alsem 2002, Du and Tseng 1999, Pine 1999, Franke and Schreier 2008, Randall, Terwiesch, and Ulrich 2007, and von Hippel 2001). Self-designing means that the customer can adjust product features to her own unique preferences. Assuming that the product features to be manipulated by the MC toolkit are of any relevance to the customer, the resulting product should exhibit higher preference fit than standard products of the same technical quality. It is a straightforward economic argument that such products also generate superior value for customers (Franke and von Hippel 2003). As noted above, we conceptualize the value customers derive from MC products as "hard currency," as we define this value as the maximum amount of money customers are willing to pay (WTP) (Wertenbroch and Skiera 2002).

A large number of MC systems emphasize the fact that the customer takes an active role in the buying process as she is the designer or co-creator of the product. Therefore, in explaining why customers value products they design using such MC toolkits, we argue that the design *process* and the psychological reaction elicited by the process should be considered *in addition* to the subjective evaluation of the self-designed product itself (i.e., in addition to the preference fit it delivers) (Williams 2004, Dellaert and Stremersch 2005, Fiore, Lee, and Kunz 2004, Randall, Terwiesch, and Ulrich 2007). In our research, we particularly ask

whether the perceived effort and enjoyment of the self-design process have an additional impact on the perceived value of self-designed products.

## **2.2. Process effort and the value of self-designed products**

First of all, the process of designing a product oneself involves effort. The customer actively engages in potentially strenuous and time-consuming problem-solving activities (Bendapudi and Leone 2003). She has to figure out how the toolkit works, which actions lead to which outcomes, which pre-defined design modules exist, etc. Choice task complexity theory (Bettman, Johnson, and Payne 1990, Johnson and Payne 1985) suggests that the number of cognitive steps necessary for consumer decision-making will increase perceived complexity (Bettman, Johnson, and Payne 1990), which in turn requires greater consumer effort (Johnson and Payne 1985).

High effort in a process might therefore reduce the value a customer obtains (Wright 1975).

While it is plausible that high expected effort decreases the *ex ante* likelihood that a customer will engage in self-design processes (Dellaert and Stremersch 2005, Huffman and Kahn 1998), it is not clear why the perception of high effort should impact the value attributed to *the resulting product* once the process is finished. By the time the final buying decision is made, process effort is already sunk. What remains is a product with a certain perceived preference fit. From a strictly economic perspective, sunk effort should not impact the value the customer derives from the product.

However, we argue that the negative affect elicited by the strenuous customization process ("That was hard work!") might carry over to the evaluation of the process outcome and thus bias the customer in her WTP. This is consistent with "affect as information" literature, which suggests that people tend to misconstrue their affective reactions to extraneous stimuli as reactions to the product under evaluation (Pham 1998, Schwarz and Clore 1983). When



consumers evaluate products, they rely in part on feelings originating from relevant as well as irrelevant sources, such as salesperson friendliness, in-store music, scents, weather, etc. (Bosmans 2006). When customers assess the value of products they have designed themselves, their valuations might be also impacted by the negative affect elicited by the perceived effort of the self-design process.

Therefore:

*HYPOTHESIS 1. The higher the perceived process effort of self-designing a product with an MC toolkit, the lower the value the customer attributes to the self-designed product (measured as WTP relative to the WTP for a standard product).*

### **2.3. Process enjoyment and the value of self-designed products**

A similar argument can be made for the other dimension of process perception, that is, the enjoyment customers might derive from the self-design process. At first sight, this appears redundant, as work is defined as dis-utility in the conventional economic model, and therefore situations involving high effort would correspond to low enjoyment and vice versa. In reality, however, we often observe that work is done voluntarily, and obviously people derive benefits despite the effort involved. Programmers contributing to innovative open source software (Hertel, Niedner, and Herrmann 2003, Lakhani and Wolf 2005) and users engaging in joint offline product development (Franke and Shah 2003) point to the "fun" involved in certain activities and show that this enjoyment is an important motivator for people to engage in these activities. Enjoyment is more than the absence of effort; although the perception of effort and enjoyment might be (negatively) correlated, they are conceptually independent. Beyond the mass of activities that are *either* enjoyable *or* strenuous, many processes are *both* (e.g., climbing mountains or writing academic articles) or *neither* (e.g., short and

uncomplicated "routine" processes such as dialing a telephone number or pressing a button). Therefore, including both dimensions of the process experience appears to be justified. Tests of discriminant validity show that these considerations are correct (see below).

A number of authors have proposed that customers who engage in designing their own products will experience such positive emotions during their interaction with the MC toolkit. Huffman and Kahn (1998), for example, suggest that "some consumers may find learning their preferences about a product to be fun" (p. 509), and Dellaert and Stremersch (2005) presume that consumers might "enjoy mass customizing a product" (p. 226).

Theoretical support for the existence of such positive emotional reactions can be drawn from self-determination theory (Gagné and Deci 2005, Ryan and Deci 2000), which states that people have a need to feel competent and autonomous, and that certain activities satisfy these needs (Gagné and Deci 2005). The enjoyment associated with an action might be highest if the outcome is endogenous to the activity (Kruglanski 1975). In this way, behavior and rewards become strongly associated, so that the behavior itself is experienced as rewarding (Freitas and Higgins 2002). Studies on self-service technologies have already revealed that one of the reasons why customers prefer an active role in the production of services is the enjoyment they derive from it (Dabholkar 1996, Dabholkar and Bagozzi 2002, Meuter et al. 2005).

As in Hypothesis 1 (in which we established why negative affect might impact the perceived value of the product), we conjecture that the customer might carry this positive affect over to her valuation of the self-designed product (Pham 1998, Schwarz and Clore 1983).

Thus:

HYPOTHESIS 2. *The higher the perceived process enjoyment of self-designing a product with an MC toolkit, the higher the value the customer attributes to the self-designed product (measured as WTP relative to the WTP for a standard product).*

### **3. Study method**

#### **3.1. Overview of procedure and sample**

For our study, we prepared six PCs to enable participants to design their own individual scarves using a real MC toolkit. The participants were 186 management students from the authors' university. As a result, our data is biased in favor of young and fairly adept persons who are familiar with the Internet. At the same time, however, this particular group also represents the majority of B2C toolkit users (Franke and Piller 2004). The participants (50% females) were 23 years old on average (SD: 3.02) and had a monthly disposable income of 300 to 400 euros.

The participants were first shown a set of ten standard scarves. We asked them to choose the one standard product they liked most and measured their WTP for that product. The participants were then introduced to the functionality of the toolkit, after which they started their individual design processes. The setting ensured that no interaction between participants was possible during the entire study. There was no time limit, and participants were offered free coffee and soft drinks to create a natural environment which came close to sitting at their own PCs at home. Once they had finished, we asked them to compare their self-designed product with the standard product they had chosen previously, to fill out a questionnaire containing items to measure independent variables, and to indicate their WTP for the self-designed product. This allowed us to use the intra-individual difference between WTP for the *self-designed* product and WTP for the most preferred (chosen) *standard* product as a dependent variable; this difference is referred to as delta-WTP.

### **3.2. Research objects**

*The MC toolkit.* We selected a toolkit typical of B2C markets which allows the user to design individual scarves ([www.wildemasche.de](http://www.wildemasche.de)). The toolkit offers a huge set of predefined design options (more than 66 background designs and more than 140 pieces of clip art), and the user can create any text in different colors, sizes, and styles. In the design process, the user can move elements back and forth until the desired placement is found. The toolkit provides the user with some very basic design tools, such as a paintbrush or a pen to create drawings. Overall, this toolkit allows customers to adapt the design of the scarf to their individual preferences. Functional changes (e.g., different types of wool) are not possible. In terms of usability and design freedom, this toolkit does not differ from most B2C MC toolkits, and it is largely congruent with the general conceptualization of toolkits as described by von Hippel (2001).

*The reference products.* In order to measure delta-WTP on the individual level, we had to define reference objects. For this purpose, we asked the participants to choose among ten randomly chosen standard products from the same company. The participants were informed that the standard scarves were of exactly the same technical quality as the self-designed products and only differed in the design aspect. We had tested the appropriateness of the standard sets in a pilot study (n=48) preceding the main study. When interviewing the participants, we found that all of them had identified a reasonably satisfactory product in these sets and evaluated them as highly realistic offers.

### **3.3. Measurement**

*Dependent variable.* As noted above, our dependent variable is delta-WTP – the intra-individual difference between WTP for the self-designed product and WTP for the most

preferred (chosen) standard product. In order to measure the two WTP levels for each participant, we employed Vickrey auctions. In this type of auction, the participants' bids are sealed and the bidders are 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). This mechanism is incentive-compatible, which means that the dominant strategy of a bidder is to reveal one's actual maximum WTP (Cox, Robertson, and Smith 1982, Hoffmann et al. 1993). Empirical studies have confirmed the high validity of Vickrey auctions as a technique to measure consumer's WTP for private goods (Noussair, Robin, and Ruffieux 2004).

In both auctions, the bids were binding, which means that participants signed an agreement to buy the product if their bid turned out to be the highest. We explained to the participants that if they won both auctions (i.e., for the standard and for the self-designed product), chance would decide which of the two products the participant would receive. This helped to discourage strategic behavior, for example bidding high on one product and low on the other (Rothkopf and Teisberg 1990). One week after data collection, the winners of the two auctions were informed about the outcome and asked to pay the price (the second-highest bids were 49 euros for the self-designed scarf and 30 euros for the standard scarf), which they readily did.

In order to test the validity of our measurements, we followed the procedure proposed by Wertenbroch and Skiera (2002). WTP for the self-designed scarf should be positively correlated with the participants' general interest in such a customized product and with the perceived importance of the aesthetic design of a scarf (both measured on a five-point scale where 1 = very low and 5 = very high). As expected, we find positive and significant correlations ( $r = .12$  and  $r = .15$ , respectively;  $p < .05$ ). Moreover, we correlated WTP for the self-designed scarf with WTP for the standard scarf. As both measures should be affected by

the participants' general WTP for the underlying product category and by situation-specific variables (e.g., bidding on a product at university), a valid measurement would require a positive correlation between those two WTP measures. Indeed, we find a strong and significant correlation ( $r = .58, p < .001$ ). In sum, this indicates a valid measurement of the dependent variable.

*Independent variables.* In our model we include perceived preference fit which is seen as the main value driver of self-designed products in the literature. We operationalize this construct as a reflective latent variable as it is obviously impossible to calculate this fit “objectively” by subtracting fulfillment from requirements specified along each product attribute. First, aesthetic products contain very many attributes, second these fits along each product attribute cannot simply be aggregated as there are probably numerous interactions between attribute levels, and third preference structures of individuals are almost likely multimodal. Therefore, we proceed similar to Franke and Schreier (2008) and Randall, Terwiesch, and Ulrich (2007) who measure preference fit as a composite subjective impression. Perceived preference fit and perceived process effort (H1) are measured using three items (adapted from Randall, Terwiesch, and Ulrich 2007 and Dellaert and Stremersch 2005). Perceived process enjoyment (H2) is measured using five items (taken from the established Intrinsic Motivation Inventory; see <http://www.psych.rochester.edu/SDT>).

All items are listed in Table 1 (all but one item are measured on five-point scales where 1 = strongly disagree and 5 = strongly agree; one item in the preference fit dimension is measured on a ten-point scale).

Insert Table 1 about here

All three scales yield an alpha greater than .70, which points to a satisfactory degree of reliability. Exploratory factor analyses (EFA) for each variable show that the explained variance of the first factor extracted is greater than 50 percent in all three cases and that the respective factor loadings are greater than .70 throughout (see Table 2).

We also assessed convergent validity by subjecting the three latent constructs to confirmatory factor analysis (CFA) (Anderson and Gerbing 1988/1992). The overall measurement model achieves satisfactory fit ( $\chi^2/df = 1.80$ ; GFI = .94; AGFI = .90; IFI = .96; CFI = .96; RMSEA = .07). We find that all factor loadings are positive ( $> .50$ ) and significant ( $p < .01$ ), and that the average variance extracted (AVE) exceeds the threshold value of .50 for all three variables. These findings indicate convergent validity.

Discriminant validity is assessed using both EFA and CFA. In subjecting all items in our three variables to EFA, we extracted three factors which confirm our three theoretical constructs; all items show factor loadings of  $> .50$  for the "expected" factor, and factor loadings of  $< .40$  for the "non-expected" factors. Using the CFA results, we compared the AVE with squared correlations for all relevant pairs of factors (Fornell and Larcker 1981). The results reveal that the AVE in each measure is clearly higher than the squared correlations for all pairs of factors, which again provides support for discriminant validity. Overall, we conclude that our measurement of independent variables is also valid. In testing our hypotheses, we used composite scores (averaged means) for our independent variables. The descriptive statistics and intercorrelations of the measures are shown in Table 2.

Insert Table 2 about here

## **4. Findings**

### **4.1 Descriptive findings: The value customers attribute to self-designed products**

In the descriptive findings on WTP measurement (see Figure 1), we find a significant and very large intra-individual delta-WTP. Whereas the mean WTP for a self-designed scarf comes to 10.21 euros (SD = 9.23), the mean WTP for the chosen standard scarf is only 5.35 euros (SD = 5.93) ( $p < .001$ ; t-test for paired samples). Therefore, the average WTP for the self-designed scarf is 191% of the average WTP for the most preferred standard scarf. We also find substantial variance in intra-individual delta-WTP (SD = 7.51), which indicates that some participants were willing to pay far more for MC products than for standard products, whereas others did not discriminate very much between the two options in terms of WTP. This underscores the importance of research aiming to analyze which perceptual factors lead to high or low attributions of value to products self-designed with a given MC toolkit.

Insert Figure 1 about here

#### **4.2 Test of hypotheses: The effects of product and process perception on delta-WTP**

We test H1 and H2 using OLS regressions with delta-WTP as our dependent variable and with preference fit, process effort (H1) and process enjoyment (H2) as our predictor variables. Overall, two of the three paths prove to be significant (see Table 3). First, we find support for the impact of perceived preference fit which is in line extant research. The higher the perceived preference fit of the self-designed product, the higher the perceived economic value increment measured as delta-WTP ( $b = 1.31$ ;  $p < .05$ ). Second, we cannot confirm H1. Customers do not carry negative affect over from perceived process effort to their product evaluation as hypothesized ( $b = .47$ ; n.s.). Third, we do find support for H2: The participants' delta-WTP was influenced heavily by their enjoyment of the product design process ( $b = 2.46$ ;  $p < .01$ ).



Insert Table 3 about here

#### **4.3 Exploratory analysis: Does perceived process effort really have no effect?**

Our hypothesis tests show that perceived process effort has no main effect on the perceived value of the product, meaning that H1 had to be rejected. In this section, we explore possible reasons why this is the case.

One plausible ex post explanation is the existence of interaction effects between the independent variables. It may well be that the participants do not have a clear, pre-existing and consistent sense of whether the process and their perceived effort represent a good (value-generating) or bad (value-reducing) experience. Research into the construction of preferences reveals that in many situations people do not know a priori what they like or dislike, or whether an experience is good or bad (Slovic 1995, Fischhoff 1991). Instead, people tend to "construct" the criteria when confronted with a concrete situation and situational factors, and certain cues might impact the construction process heavily. This effect is illustrated by the classic story of Tom Sawyer and the fence, in which Tom manages to "frame" the tedious chore of whitewashing a fence as a rare opportunity – thus persuading his friends to pay him for letting them work. In a recent study, Ariely, Loewenstein, and Prelec (2006) showed that such effects are not fictional: Simple non-normative cues manipulate participants to interpret the same task (listening to Professor Ariely reciting poetry) as either a desirable experience for which they are willing to pay or an unpleasant task for which they demand to be paid.

In our setting, we surmise that the outcome of the process might serve as such a cue. If the self-designed product actually exhibits a close fit to the customer's preferences (i.e., she really likes what she has designed), she might interpret the effort involved as something positive, like a mountaineer who makes it to the top of the mountain and retrospectively interprets all the laborious hours of climbing and sweating as a (positive) achievement in which she can

take pride. If such a mountaineer fails (i.e., does not reach the top), she might interpret a similar process as (negative) drudgery. Similarly, a customer who fails to self-design a product she likes might be negatively biased in her ex post interpretation of the process. In MC settings, we therefore reason that subjective success in designing one's own product (i.e., the closeness of preference fit achieved) moderates the value a customer derives from process effort at the moment of the buying decision. A similar argument can be made for process enjoyment: If the product design turns out to look just as the customer desires, this might amplify the positive perception of the process (and vice versa). We therefore analyze whether in addition to its main effect the perceived preference fit attained moderates the effect of process enjoyment and perceived process effort on WTP.

Technically, we do so using moderated regression analysis (Aiken and West 1993, Homburg and Fürst 2005). We standardized the composite scores of the independent variables, created the interaction terms and conducted a hierarchical regression (with the interaction terms entered in the second step of the analysis, as suggested by Frazier, Tix, and Barron 2004). The findings are summarized in the second part of Table 3.

Our main finding is the existence of significant interaction effects. First, we find a moderately significant interaction between preference fit and perceived process effort ( $b = .91$ ;  $p < .10$ ). Second, we also find a significant interaction effect between preference fit and process enjoyment ( $b = 1.11$ ;  $p < .01$ ). In order to examine the nature of these interactions more closely, we plotted the predicted values of delta-WTP for representative groups (-1 SD and +1 SD from the means of perceived preference fit and process effort/enjoyment, respectively; see Aiken and West 1993).

Insert Figures 2 and 3 about here

It is particularly interesting to see how the interpretation of *effort* is impacted by the preference fit achieved (see Figure 2). In cases where a participant failed to self-design a scarf she liked (low preference fit; represented by the lower line in Figure 2), a higher level of perceived effort does lower her perceived value of the product (the predicted delta-WTP for self-designed vs. standard product is reduced from 3.12 to 2.64 euros), as conjectured in H1. Effort in such situations appears to be interpreted as an "expense" which further reduces the value of the product.

An entirely different situation arises when the participant actually manages to self-design a product with a high perceived preference fit (represented by the upper line in Figure 2). In such situations, higher levels of perceived effort even have a *positive* effect on value (the predicted delta-WTP for self-designed vs. standard product increases from 4.35 [low process effort] to 7.52 euros [high process effort]). This strongly supports the considerations above: If the customer successfully manages to self-design a product she likes, then effort is interpreted as a (positive) achievement, while unsuccessful effort is interpreted as (negative) drudgery.

The interaction effect is also visible in the case of process enjoyment, which is depicted in Figure 3. If the outcome of the self-design process exhibits a high preference fit (represented by the upper line in Figure 3), then process enjoyment also generates substantial value (the predicted delta-WTP for self-designed vs. standard products increases from 2.15 [low process enjoyment] to 9.72 euros [high process enjoyment]). This effect is weaker where lower preference fit is perceived in the outcome of the self-design process (represented by the lower line in Figure 3; predicted delta-WTP increases from 1.32 [low process enjoyment] to 4.44 euros [high process enjoyment]).

## 5. Discussion

With this study, we have complemented the existing literature on self-design using MC toolkits. To our knowledge, this is the first empirical attempt to analyze the impact of process perception on the subjective value of the self-designed product. We found that the subjective value of a self-designed product, measured as WTP (which is "hard currency"), is not only impacted by the preference fit the customer expects it to deliver, but also by (1) the process enjoyment the customer reports, (2) the interaction of preference fit and process enjoyment and (3) the interaction of preference fit and perceived process effort. Perceived process effort alone does not have an independent impact. We discuss these findings and their implications below.

First, we have found support for our newly proposed *process enjoyment hypothesis*. The perceived enjoyment of self-designing a product leads to a higher WTP for the resulting product, regardless of the preference fit achieved. This may seem surprising at first, as the benefit from an activity per se should be sunk when the activity is finished. A rational actor would hardly be willing to pay ex post for an economic good already consumed. The effect found becomes more understandable if we introduce the psychological factor of the customer's affective response. A positive and rewarding process experience creates a positive "mood" which is carried over to the assessment of product value. The result is a product which is perceived as more valuable due to the enjoyable self-design process.

We measured the perceived process enjoyment ex post, when the process was already finished and the participants were ready to make their WTP assessments. We did so because this moment is crucial in the eyes of the manufacturer: If the subjective value of the product is higher than the price, the customer will probably buy the product; if the subjective value is lower, she will not. At that moment, the (longitudinal) experience of the past process is integrated into the customer's (ex post) evaluation. It seems plausible, however, that a

customer might undergo different levels of enjoyment during the process, with feelings ranging from initial enthusiasm (= high enjoyment) to frustration (= low enjoyment) along the way to attaining a positive feeling (= high enjoyment) in the end. It is not clear how these different levels are integrated to form an affective reaction once the process is finished and the buying decision is being made. It would be very interesting to measure the (potentially different) affective reactions during the design process in a longitudinal study; such information could, for example, enhance our understanding of why these processes are abandoned.

We had also hypothesized that perceived process effort could induce a negative affective response, which in turn might impact the assessment of product value (*process effort hypothesis*). However, we did not find support for such an effect and thus had to reject our hypothesis.

In order to understand this "non-finding" more fully, we examined interaction effects more closely and found that the perceived preference fit attained exhibits significant interaction effects with process enjoyment as well as perceived process effort. We interpret preference fit as a moderator of the value-generating effect of process evaluation: In cases where the outcome of the process is perceived as positive (high preference fit), this causes the customer to interpret the process effort as a positive accomplishment, and this positive affect adds (further) value to the product. It appears that the perception of effort stemming from the self-design process as a good or bad experience is partly constructed on the basis of the outcome of the process.

In the opposite case (low preference fit), effort creates a negative affect which further reduces the subjective value of the product. These two opposing effects (process effort has a positive or negative effect on WTP, depending on the preference fit of the resulting product) might be

the reason why we did not observe an independent main effect of perceived effort: There is no such independent effect. Perceived effort is interpreted ex post on the basis of the outcome.

Process enjoyment is also amplified by preference fit. However, the moderator changes only the magnitude of the main effect, not its direction. Overall, these findings indicate that – in addition to the resulting product – process enjoyment and even perceived effort can also generate value for customers when they self-design a product using an MC toolkit. However, it is important to bear in mind that the cross-sectional nature of our data precludes hard tests of causality. Moreover, we introduced the interaction effects post hoc. This suggests that there is a need for further studies, in particular controlled experiments and longitudinal studies which repeatedly measure the affective reactions of customers designing products themselves using MC toolkits. The emerging field of neuroeconomics offers methods which may prove valuable in such studies (Camerer, Loewenstein, and Prelec 2005).

The importance of the process bears clear relevance for companies which offer or plan to offer MC systems. The value customers derive from self-designed products was measured as their WTP, which determines the price that can be obtained on the market. Hence, WTP is "a key element in the profit equation and therefore is directly linked to profitability" (Homburg, Koschate, and Hoyer 2005, p. 84). The finding that the affect caused by the self-design process is highly important for the WTP of the resulting product bears the conclusion that it is not sufficient to design MC toolkits in such a way that they allow customers to design products according to their preferences. Toolkits should also stimulate positive affective reactions and at the same time keep negative affect to a minimum. A number of scholars have already begun to analyze how the latter can be achieved (e.g., Huffman and Kahn 1998, Randall, Terwiesch, and Ulrich 2005/2007), and our findings underscore the importance of their endeavors.

We are not aware of any academic research devoted to the question of how MC toolkits should be designed in order to trigger *positive* affective reactions of customers during their self-design activities. In light of our findings, this is likely to be an important task for future research in the field of MC. We believe that much can be learned from the literature on users' affective responses to computer games (e.g., Chumbley and Griffiths 2006, Johnson and Wiles 2003), to the Internet (e.g., Wallace 1999), or to computers and software in general (Picard 1997). However, the specific nature of the MC self-design process, in which an object to be bought is created virtually (and which is distinct from "normal" user-computer interaction), calls for specific theory-based empirical research. Key psychological factors might be the consumers' need for competence and autonomy (Gagné and Deci 2005) or "flow" feelings (Csikszentmihalyi 1990).

In all conclusions, however, we have to bear in mind that our findings are based on a single toolkit in a single product category. Therefore, this analysis should be repeated in other fields using a broad set of toolkits with different attributes. Another possibility would be to vary toolkit attributes systematically in controlled experiments and to measure their interplay with sources of customer value (i.e., process effort as well as enjoyment and preference fit).

Researchers such as Dellaert and Stremersch (2005), Randall, Terwiesch, and Ulrich (2007), and Huffman and Kahn (1998) have already begun that task, and we can only recommend integrating process perceptions (both effort and enjoyment) in future models. Such studies appear highly promising because it seems likely that affective responses during the self-design process not only impact the value of MC products at the end of the process but also the progression of the self-design process. If the design task is perceived as enjoyable, users might also try harder to achieve a satisfactory outcome and will be less likely to abandon the design task and "leave the shop empty-handed."

Another necessary research task would be to analyze which types of customers are likely to be impacted by which sources of value. It seems very plausible that our findings are

moderated by personality variables such as optimum stimulation levels (Fiore, Lee, and Kunz 2004, Zuckerman 1971), cognitive playfulness (Martocchio and Webster 1992) and the need for uniqueness (Tian, Bearden, and Hunter 2001). Moreover, situational variables such as product involvement as well as experience with and expertise in self-design might also play an important role (Dellaert and Stremersch 2005, Kaplan, Schoder, and Haenlein 2007, Randall, Terwiesch, and Ulrich 2007). Obviously, it will be necessary to conduct additional research on the important phenomenon of customers actively designing their own products, its inherent patterns of value generation, and its consequences for firms.



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**Table 1**  
Measurement items

Construct	Items
Preference fit	<ul style="list-style-type: none"> <li>- I like the design of my self-designed scarf <sup>a</sup></li> <li>- I am satisfied with my self-designed product <sup>a</sup></li> <li>- Please compare your self-designed scarf with the best standard scarf (the one you have chosen) <sup>b</sup></li> </ul>
Process effort	<ul style="list-style-type: none"> <li>- Designing this product required much effort <sup>a</sup></li> <li>- Designing this product was exhausting <sup>a</sup></li> <li>- I perceived designing this product as "costly" (in terms of time and effort) <sup>a</sup></li> </ul>
Process enjoyment	<ul style="list-style-type: none"> <li>- I enjoyed this design activity very much <sup>a</sup></li> <li>- Designing was fun <sup>a</sup></li> <li>- I thought designing the product was quite enjoyable <sup>a</sup></li> <li>- Designing this product was very interesting <sup>a</sup></li> <li>- This design activity was fun <sup>a</sup></li> </ul>

<sup>a</sup> Measured on five-point scales (1 = strongly disagree; 5 = strongly agree)

<sup>b</sup> Measured on a ten-point scale (my self-designed scarf... 1 = is equivalent to the standard scarf; 10 = is much better than the standard scarf)

**Table 2**

Measurement results for independent variables

	M <sup>a</sup> (SD)	Alpha (EV) <sup>b</sup>	Factor loadings <sup>c</sup>	(1)	(2)	(3)
(1) Preference fit	3.75 (.86)	.78 (62.16)	> .70 > .80**	.67 <sup>d</sup>	.01 <sup>f</sup>	.25
(2) Process effort	1.93 (.82)	.81 (63.94)	> .70 > .50**	-.11 <sup>e</sup>	.52	.04
(3) Process enjoyment	3.66 (.85)	.88 (59.57)	> .70 > .60**	.50**	-.19*	.59

<sup>a</sup> Composite scores (averaged means; 1 = low; 5 = high)<sup>b</sup> Explained variance (percent) of first extracted factor (EFA)<sup>c</sup> Factor loadings based on EFA (first figure) and CFA (second figure)<sup>d</sup> Average variance extracted (based on CFA; on the diagonal)<sup>e</sup> Simple correlations (below the diagonal)<sup>f</sup> Squared correlations (above the diagonal)

\* p &lt; .05; \*\* p &lt; .01 (two-sided)

**Table 3**

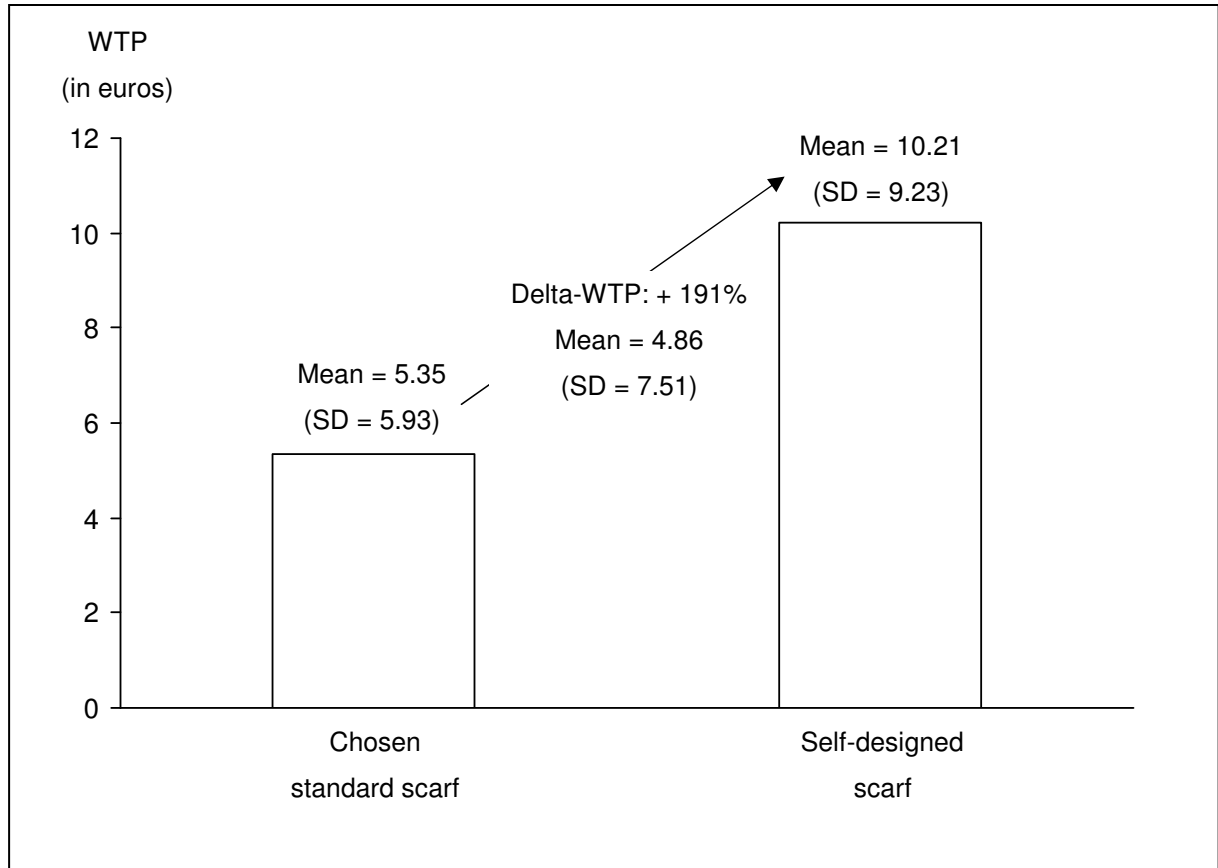
## Results

	<i>Test of hypotheses</i>		<i>Exploratory analysis</i>	
	DV: delta-WTP		DV: delta-WTP	
	b	SE	b	SE
Preference fit	1.31	.58**	1.53	.58***
Process effort (H1)	.47	.51 n.s.	.67	.51 n.s.
Process enjoyment (H2)	2.46	.59***	2.67	.59***
Interactions:				
Preference fit x process effort	-	-	.91	.50*
Preference fit x process enjoyment	-	-	1.11	.46**
r / r <sup>2</sup>	.44 / .19		.47 / .22	
Change in r <sup>2</sup> (F-value)	.19 (14.132)***		.04 (4.081)**	

\* p < .10; \*\* p < .05; \*\*\* p < .01 (two-sided)

**Figure 1**

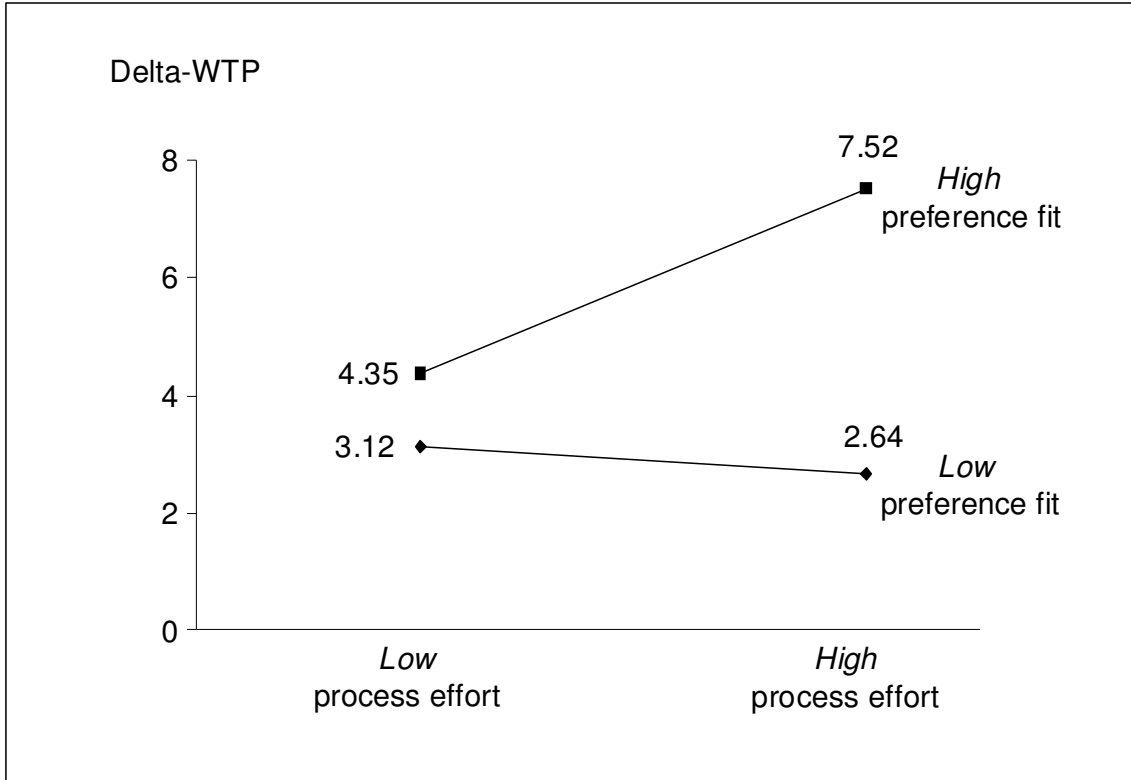
The value of self-design



Mean difference is significant at  $p < .001$  (t-test for paired samples)

**Figure 2**

How preference fit moderates the effect of process effort on delta-WTP



**Figure 3**

How preference fit moderates the effect of process enjoyment on delta-WTP

