FROM MASS CUSTOMIZATION TO COLLABORATIVE CUSTOMER CO-DESIGN

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Abstract

The idea of integrating users into the design and production process is a promising strategy for companies being forced to react to the growing individualization of demand. The use of e-business applications has been discussed as a approach for mass customization for over one decade. There is a huge amount of literature on manufacturing and information systems for mass customization. However, there has been little research looking at the role of the customer within the co-design process. Customers face new uncertainties and risks ("mass confusion") when acting as co-designers. We discuss possible risks evolving during the interaction between customers and suppliers. We propose solutions for the "mass confusion" problem, and we challenge the assumption made by most mass customization researchers that offering customized products requires an individual (one-to-one) relationship between the customer and the supplier. We envision a different way of addressing the problem by using communities instead of one-to-one relationships. The objective of our paper is to build and explore the idea of communities for customer co-design.

1 INTRODUCTION

In Toffler's book "The Third Wave", Robert H. Anderson, former Head of Information Systems of RAND Corporation predicted that *"the most creative thing a person will do twenty years from now is to be a very creative consumer… Namely, you'll be sitting there doing things like designing a suit of clothes for yourself or making modifications to a standard design, so the computers can cut one for you by laser and sew it together for you by NC machine."* (Toffler 1980, p. 274) Toffler's book was written almost three decades ago. But today it is still unlikely that people devote their spare time to design or personalize shoes or clothing that will afterwards be manufactured specifically for this customer. Most consumers are still buying made-to-order products manufactured in a mass production system. Consumers are far from being a "very creative consumer" in the way Anderson described it in his visions. This is especially surprising as there has been an intensive discussion on *mass customization* for more than a decade, talking about approaches exactly addressing the prediction of Anderson. In the mass customization concept, goods and services are produced to meet individual customer's needs with near mass production efficiency (Tseng & Jiao 2001). "Mass customization" was coined by Davis (1989) with an explicit reference to the above mentioned Anderson and Toffler. The term was later developed into a business approach by Pine (1993) and by many other authors following his approach (e.g. Duray 2000; Piller 2003; Tseng & Jiao 2003). It became popular in academia and was adapted by practitioners as an e-business approach (Fulkerson & Shank 2000; Lee et al. 2000).

The number of papers published on mass customization has increased threefold in the last decade (see Tseng & Piller 2003 for an overview). An increasing number of pioneering companies have entered special markets with initiatives and products that go beyond the paradigm of mass production. In these companies, products and services are not being mass produced for an anonymous market but customized in a high variety for each individual customer following the mass customization paradigm. However, despite of heavy investments and much praise by media and consumers, most of these concepts still capture only small niches of particular markets. *But why are most customers still not benefiting from research findings and company endeavors?*

This paper addresses the limits of mass customization from yet another perspective: the view of the customer. We look into the limits of mass customization that have their origin in a lack of customer interaction and customer integration. Within mass customization, customers are *integrated* into value creation by defining, configuring, designing, matching, or modifying their individual solution out of a list of options and pre-defined components. These co-design activities, performed in an act of company-to-customer *interaction*, are the necessary prerequisite of mass customization – the fulfillment of needs of individual customers. However, those activities are also a major driver for a combination of increasing complexity and perceived risk from the customers' perspective limiting the success of a mass customization strategy. Pine coined the term "*mass confusion*" (in: Teresko 1994) as a metaphor to describe the burdens and drawbacks for the consumer as a result of the mass customization configuration process.

We see mass confusion as one major explanatory factor for the delay in adoption of mass customization technologies. In this paper, we propose a *collaborative co-design environment* with the objective to reduce the mass confusion phenomenon. We will use data from exploratory case studies to outline how *collaboration in communities* can contribute to reduce mass confusion and to help customers to co-design a customized product. In doing so, we will further transfer established knowledge on the use of communities in e-business environments (communities of transaction) to a new application area – "*communities for co-design*". We challenge the implicit assumption of most mass customization researchers that providing customized products requires an individual (one-to-one) relation between the customer and the supplier. This perspective can be found in various papers dealing with the communication aspects of mass customization (e.g., Riemer & Totz 2003; Rieck 2003; Squire et al. 2003; Wind & Rangaswamy 2001). The major proposition of our paper is that customization may not be mistaken with one-to-one relations between a firm and a single customer.

We will focus our analysis on the *B2C segment* since there is more evidence of good practice. Unlike in many B2C markets, where customization is relatively common, implementation of mass customization in B2B industries has just started. Here, the principles of mass customization have greater impact and a greater degree of innovation than within companies operating in B2C markets. However, we expect that most of the findings can be also transferred to the B2B domain.

2 EMPIRICAL BACKGROUND: IN-DEPTH CASE STUDIES

Our paper is conceptual and exploratory. It presents ideas to further develop the ongoing discussion on mass customization. For this purpose, we conducted a literature review on "mass confusion" and performed a meta-analysis of empirical findings on current practice in customer co-design. In addition, we conducted case study research in different domains. Our research builds on experiences from an ongoing field research project on collaborative co-design environments. The project is a long-term cooperation with six case companies (cf. Table 1, *columns 1 and 2*). Our analysis follows the "construction strategy of empirical management research" formulated by Kubicek (1977). It looks at management research as a design science that does not stop with normative suggestions but aims to pilot and evaluate design suggestions in field experiments in order to generate real world experience as a basis for theory development (see also Gummesson 2000). This also implies longitudinal research in order to detect cause-effect-relationships in real world settings (Van de Ven 2002). We followed the three steps of empirical research proposed by Gummesson (2000) to build and support our findings:

Case	**Mass Customization Program**	**"Mass Confusion Problem"***	**Collaborative Co-Design**
Adidas Salomon AG *(online / offline)*	miadidas (customization of sport shoes, offered in Europe, US, and Japan)	• limited time during offline configuration to explore all design options (2) • high price premium leads to high perceived buying risk (3)	*today:* self organized online sports communities discuss about miAdidas *planned* (ongoing project): company-driven online platform for exchange and collaboration between customers
Lego *(online)*	various programs including soft customization (standard sets with interactive software) and hard customization (user specific prepackaging of sets)	• limited interaction skills of children to explore all possibilities of products (1)	*today:* LUGNET user community *planned:* virtual design environments where users can exchange models and co-create new models; online games based on LEGO sets
My Virtual Model *(online)*	using virtual model to provide configurator for online apparel retailers (e.g., for Land's End)	• selection of colors and styles (1) • selection of cut, applications, fashion risk (2)	use (export) of virtual models in online communities to discuss personal styles and ideas
Usertool.com *(online)*	customization of games for mobile phones	• limited creativity, experience (2) • evaluation of user design (2) • unknown future charges of provider to use own game (3)	assessment of user developments by other users (user based ranking system); online chat room to exchange design ideas;
American Eagle *(offline)*	customization of ready made garments by after-dales applications (sewing, cutting)	• complex customization possibilities (1) • style / fashion risk (2) • less support by sales clerks (3)	co-design and co-production of product in workshops in retail outlets (offline) where customers can co-create new products together (e.g., sewing tools provided)
Swatch Via Della Spiga *(offline)*	user customization of Swatch Watches (Italy)	• open solution space (1) • style / fashion risk (2)	co-design and co-production of product in workshop in retail supplied by company

* (number) relates to types of mass confusion as discussed in chapter 3.2

Table 1: Exploratory case studies used in our research

Step 1: Starting from a basic conceptual understanding in the beginning, we jointly developed the in-depth case history of collaborative customer co-design for two lead cases: Adidas Salomon AG and Lego. The objective was to explore specific challenges in the context of collaboration and customization ("Exploration I"). This step gave us a deep understanding of the specific collaboration challenges for co-design interfaces. The cases have two different perspectives:

(1) **Adidas** operates a successful mass customization program ("miAdidas"). However, customer surveys indicated a lack of support for its customers to reduce the "costs of customer integration" which will be discussed in Section 3. However, we could observe that existing communities of Adidas users (not controlled by the company, e.g., running clubs or football enthusiasts) used public online sports communities to discuss the potentials and drawbacks of miAdidas products and exchanged ideas how to utilize the customization options offered by the program.

(2) **Lego** actively encouraged users to create communities and exchange ideas in the process of introducing their mass customization offerings (e.g., Lego Mosaic, Lego Custom Trains). The company provides special software for children to virtually create Lego models and share these models online with friends and discuss about look, functionality, etc. Once this "community of friends" approves a new model, the custom creation can be ordered at Lego.com where it will be commissioned in a dedicated factory specifically for the developer (the child).

Step 2: After analyzing these two cases, we saw the opportunity for communities to support mass customization, and we developed our first ideas for the design of those communities for co-design. Building on case research we explored a specific case study database maintained by our research group. The database contains more than 250 in-depth case studies in the field of customization and customer integration covering experiences from more than 15 years. Our objective was to identify other cases using collaborative approaches for customer co-design ("Exploration II"). In this step, we identified four other cases: two cases about B2C Internet applications, MyVirtualModel and Usertool.com, and two companies using communities for customer co-design in offline environments: American Eagle, a US clothing retailer, and Swatch Via Della Spiga, a design store of the Swatch company in Milan, Italy. We felt that learning from offline communities could provide important insights into the tasks performed in a co-design community.

Step 3 is currently in progress and builds upon what we learned from exploration I and II. It aims at the implementation and evaluation of a pilot application for a community for customer co-design at miAdidas. We are in the process of developing an improved miAdidas customer interface based on the newly developed conceptual understanding. Accompanying cross-industry evaluations will help us to further refine the new interface.

3 THE CUSTOMER'S PERSPECTIVE: HIGH VARIETY OR MASS CONFUSION?

3.1 Toolkits for Customer Co-Design

Customer co-design describes a process that allows customers to express their product requirements and carry out product realization processes by mapping the requirements into the physical domain of the product (Helander & Khalid 1999; Tseng & Du 1998; von Hippel 1998). As a result, the customer chooses an individualized combination of product specifications from a finite set of options. During this process of elicitation, the customer is being integrated into the value creation of the supplier. The customer becomes a "prosumer" (Toffler 1980). However, as the main part of the interaction with the customer takes place during the configuration and therefore the design of a customer specific product, it seems appropriate to call the customer rather a co-designer than a co-producer. Customer co-design is a distinctive principle of mass customization (Piller 2003) and the source of its competitive advantage. However, as we will discuss in the following, co-design can also lead to a complex, risky and uncertain buying situation counterbalancing the benefits of customization from the customers' perspective.

Customer co-design is performed with the help of dedicated tools (Franke & Piller 2003; Khalid & Helander 2003). These systems are the primary instrument to reduce cost and to create a positive design experience. Known as configurators, choice boards, design systems, toolkits, or co-design-platforms, these systems are responsible for guiding the user through the configuration process. In these systems, different variants are represented, visualized, assessed, and priced with an accompanying learning-by-doing process for the user. Whenever the term "configurator" or "configuration system" is quoted in literature, it is used for the most part in a technical sense

addressing a software tool. Taking up an expression from von Hippel (2001), we use the term "toolkit".

3.2 Value and costs of mass customization

For customers, the decision to buy customized products is basically the result of a simple economic equation (Franke & Piller 2003): if the (expected) returns exceed the (expected) costs, the likelihood that customers employ mass customization will increase. *Returns* are twofold: firstly possible rewards from the design process such as flow experience or satisfaction with the fulfillment of a co-design task, and secondly the value of customization, i.e. the increment of utility a customer gains from a product that fits better to her needs than the best standard product attainable (Du & Tseng 1999).

Costs of mass customization for consumers are (i) the premium a customer has to pay for the individualized product compared to a standard offering and (ii) the drawbacks of the customers' active participation at (integration into) value creation during the configuration process. We focus our discussion on the latter "costs" of co-design. Especially in consumer markets, customers often do not have sufficient knowledge for the definition of the product specification, which corresponds to their needs (Huffman & Kahn 1998). In order to get an overview of the reception of the co-design process from the customers' perspective, we reviewed some of the (few) empirical studies available in this area (Table 2; see for further references Dellaert & Stremersch 2003; Franke & Piller 2003).

Reference	Research question, method, sample	Findings
Dellaert (2001)	*How do consumers handle choice of modularized products?* Survey (n=728), simulation; subject of research: customers Tourism: customization of travel packages	Under modularization, producers of products with structural utility benefits are better off offering their competitively weaker modules separately while bundling their competitively stronger modules with weaker modules
Dellaert & Stremersch (2003)	*What influences consumers' choice whether or not to participate in different mass customization processes?* Survey / experiments (online consumer panel of n=431); subject of research: customers; design toolkit for mass customized PCs ("copy of Dell")	(1) Willingness to use a design toolkit depends from the perceived mass customization utility (function of product utility and perceived complexity when going through a co-design process). (2) Tension between product utility and perceived process complexity as drivers of mass customization utility. (3) Negative effect of perceived process complexity on product utility.
Franke & Piller (2004)	*How differs willingness to pay (WTP) between user-designed products and standard products? Does "mass confusion" effect WTP?* Survey / experiments (n=165, n=155, N=220); subject of research: customers, online design of a watch	(1) Despite large variety of choice, users demand more options. (2) Willingness to pay for user-designed products is higher than for comparable best-selling standard models in the same market.
Huffman & Kahn (1998)	*Does complexity inherent with a wide number of options lead to customers' dissatisfaction "mass confusion"?* Survey / experiments (n=79 and n=65); subject of research: customers: (a) Customization of stay in hotels; (b) Customization of sofa	(1) Attribute based presentation is preferred to alternative based presentation of customization items; (2) Process satisfaction is related to degree of input in an inverted u-shaped fashion (3) Retailers should explicitly inquire customer's preferences and help consumers to learn their own preferences
Kamali & Loker (2002)	*What influences satisfaction and willingness to pay of consumers using online mass customization toolkits?* Survey / experiments (n=72); subject of research: customers, on-line involvement of consumers in product design of a T-shirt	(1) Higher satisfaction with a web site's navigation and usability as involvement increased. (2) Controlling for the level of channel knowledge and use, increased interactivity provided by design involvement motivated consumers to purchase and may increase the willingness to pay.
Oon & Khalid (2003)	*How does web site design and usability of online configurators influence user satisfaction and site efficiency in supporting design activity ?* SURVEY (N=48); SUBJECT OF RESEARCH: CUSTOMERS, THREE MASS CUSTOMIZATION WEB SITES (CLOTHES, WATCHES, BICYCLES)	(1) In comparison to other sites, Idtown was found to be significantly flexible to navigate (during configuration); however, users complained about too little information. (2) Highest willingness to purchase product at Idtown side. (3) Hierarchical structure of product components allows users to complete the design (configuration) task better

Table 2: Empirical research on customer co-design

From this review, we could differentiate the drawbacks of customers, resulting from co-design, i.e. the reasons behind mass confusion, in three types of mass confusion:

(1) Burden of Choice. One limit of mass customization often quoted is that *excess variety* may result in an external complexity (Huffman & Kahn 1998; Kamali & Loker 2002; Oon & Khalid 2003). Users might be overwhelmed by the number of possibilities. Everyone who has experienced decision situations in the face of numerous choice possibilities – e.g. in a Chinese restaurant facing a menu with 500 meals – knows that to equate a high number of possibilities with high customer satisfaction would be starry-eyed optimism. The number of choices on typical mass customization web sites exceeds these well-known decision problems by far. The burden of choice may simply lead to an information overload (Neumann 1955), resulting from the limitations of the human capacity to process information (Miller 1956). As a result, the configuration process may last quite long, and customers may experience an increasing uncertainty during the transaction.

(2) Matching Needs with Product Specifications. In addition to large variety and the burden of choice, customers often do not have the knowledge nor the skills to make a "fitting" selection, i.e. to transfer their personal needs and desires into a concrete product specification (Dellaert 2001, 2003; Franke & Piller 2004; Huffman & Kahn 1998). Even a standard and rather simple product like a pair of Adidas sport shoes becomes a rather complex product if one has to decide explicitly between different widths, cushioning options for the insole, patterns for the outsole, and color options. In the case of miAdidas, consumers regularly reported in customer surveys that they are not sure if they have chosen the right specifications. Also, customer of American Eagle may feel not sure if their own designs matches the latest fashion trend.

(3) Information gap about behavior of manufacturer. For many consumers, customizing a product is still an unfamiliar process. In this regard, uncertainty exists also about the behavior of the provider (Franke & Piller 2004; Kamali & Loker 2002). The cooperative character of the configuration results in an asymmetrical distribution of information – a typical principal agent problem: The customer (principal) orders (and pays) a product she has never seen at a manufacturer she often doesn't know and has to wait some days or even weeks to get the product. This problem is also common for catalog order (online) retailers. However, compared to distance shopping of standard goods, customers of customized goods often have much higher problems to claim that they do not like a product after receiving it. Without a clear reference point for the definition of an optimal performance it is difficult to judge whether a case of warranty arises compared to purchasing standard mass-produced goods.

These uncertainties and the efforts can be interpreted as additional transaction costs for the customer. In Table 1 (see above, *column 3*), we list some of the most challenging mass confusion problems perceived in our case companies. From this analysis, we can conclude that one of the most important tasks of a mass customizer is to ensure that the customer's expenditure is kept as low as possible, while the benefit she experiences has to be clearly perceptible. The co-design process as well as the co-design environment needs to be carefully planned in order to successfully reduce the complexity and risk of the configuration process. Only, if customers do not experience "mass confusion", it is likely that they place an order within a mass customization environment – enabling firms to capture the benefits of a mass customization strategy.

4 COMMUNITIES AND COLLABORATIVE CUSTOMER CO-DESIGN

4.1 Individuality does not always mean one-to-one

In order to find a solution for the mass confusion phenomenon, discussions with managers from miAdidas and Lego, our two primary case studies in this research, indicated potential benefits of using interactions between customers as a means to reduce mass confusion. As we will discuss in the following, communities and customer-to-customer interaction are often mentioned in the e-business literature as a promising way to abolish some of the hurdles of integrating customers into the value chain. Based on this indication, we queried our case study database (see description above) to identify other mass customization firms that are already using some forms of customer collaboration to reduce

a specific situation of mass confusion (refer again to Table 1, *column 4*). These cases provide evidence that other customers may support co-design processes by jointly performing the design process or giving each other feedback and inspiration during this process. This notion, however, challenges an implicit assumption of most of the literature on personalization and customization (e.g., Riemer & Totz 2003; Rieck 2003; Squire et al. 2003; Wind & Rangaswamy 2001): (mass) customization & personalization is about offering each individual customer a customized product or service according to his or her personal needs. Thus, mass customization is reduced to the interaction between a firm and one customer. However, we argue that two of the three generic dimensions of customization – (aesthetic) design/taste, functionality, and fit/size (Piller 2003) – are often influenced by the requirements or constraints of a group rather than that of a single person. (1) Customization in regard to (aesthetic) design is often influenced by peers and the taste of a community rather than by the individual taste of a single person. In many cases customers are not only following their own "individual taste" when selecting a customized offer but are often guided by a special design, which is likely to appeal to their peers. Often, consumers (especially the younger ones) are trying to copy the look of a role model. This notion was very strong in the cases of American Eagle and Swatch Via Della Spiga (see Table 1).

(2) Also, customization in regard to functionality is often defined by the needs of a group of users. Interface requirements, network effects, security standards, etc. ask for a customized solution that matches exactly the solutions of others, and not just of a single person. In our case studies, this is the situation at Lego where kids want matching themes of the toys to play with each other, and at Usertool.com where the self-created online game has to meet specific technical requirements, especially if users play it in a shared environment.

In these cases, groups of customers – communities – set (restrict) the range of customization. But communities may also provide support for users during their own customization process. We will further explore the idea of how communities influence individualization, and thus customer co-design.

4.2 Communities for customer co-design

Despite of the fact that there is a vast amount of literature on virtual communities (VC), there is still no consensus among researchers regarding the appropriate definition for the term (Hillery 1955; Preece 2000). There have been propositions for classification schemes (Armstong & Hagel 1996; Schubert 1999; Markus 2002; Mathwick 2002) but neither of them has really been accepted and adopted by the scientific community. In the context of this paper, it is important to notice that there are two fundamentally different kinds of communities which have been discussed controversially in VC literature: business communities and socially oriented communities. Hagel and Armstrong were the most prominent authors to discuss the value of business communities. There is a vast amount of literature on potential benefits of virtual communities for business purposes (Armstrong & Hagel 1996; Barnatt 1998; Brown et al. 2002; Bughin & Hagel 2000; Hagel & Armstrong 1997; Horrigan 2001; Jones & Rafaeli 1998; Rothaermel & Sugiyama 2001; Schubert & Ginsburg 2000; Williams & Cothrel 2000). In the context of our paper, we are dealing with VC as groups of customers who are drawn to the Internet in order to perform online purchasing transactions and collaborate in the process of product purchases. We refer to them as "V*irtual Communities of Transaction*" (Schubert 1999). These communities are supported by electronic commerce platforms which offer special community features (such as feedback, discussion, voting, ratings, etc.). Electronic product catalogues often form the core of such electronic shopping environments (e-shop). The combination of an e-shop (based on an electronic product catalog) and a community platform has been termed "Participatory Electronic Product Catalogue (PEP)" by Schubert (2000). The PEP allows the creation of a link between the product description (e.g. a book on Amazon) and contributions from customers (e.g. a rating, review, recommendation of a particular book). Based on the aggregated customer profiles, special community features become feasible, e.g. recommendation services, personalized newsletters and alerts, chat rooms, etc.

The coordination mechanisms are a necessary instrument to leverage subgroup preferences (e.g. using collaborative filtering) and to exploit the intelligence embedded in prior transaction histories and experiences. To provide such vital pathways, systems must support the notion of these virtual communities of buyers as they cultivate the process of a collective awareness. Virtual communities of buyers and seller offerings can be merged in a single locus, the electronic product catalog (EPC). To coordinate the buyers, the EPC can usefully be extended as a Participatory Product Catalog (PEP) – which combines aspects of product information and community building into a common approach for a modern business medium.

A *community for customer co-design* represents a similar approach. Special community features are used to support the individual or collaborative design process. This means that a "community of co-design" is a group of people who participate in an environment for co-design. Involving different customers and breaking down the barriers among users of a co-design toolkit opens several possibilities for improving the customization process. Community platforms, which support communication among people, can be used for collecting information about these people (to be used in automated personalization), for collecting (trusted) comments from users, and for establishing direct relationships and communication among customers. Communities for co-design are similar to "user developer communities" in new product development (e.g. the Linux developer communities; see Franke & Shah 2002), but differ from those by the number of members. In communities for co-design, almost all customers are members of the community instead of just some lead users as in the case of developer communities. The scope of the collaborative design tasks is geared at the creation of trust, sharing experiences, fostering aesthetic creativity instead of the joint solving of technical problems.

Applications which realize personalization strategies based on member profiles represent a key strength of these communities. However, in the course of personalization as a supporting instrument for customer co-design, the customer has to be involved in the profile gathering and usage process (Schubert & Koch 2002). Additionally, aggregation of customer data is not feasible unless there are low barriers to communication between the customers. Communities (of transaction) support this communication among the customers and provide intermediation mechanisms for the settlement of purchase transactions.

Thus, supporting whole communities of customers instead of individual customers may enable customers to co-design and solve some of the mass confusion problems. A community perspective could open the way to foster creativity in customer co-design, and may finally make use of the production capabilities of companies to deliver mass customized goods. We argue that communities of customers could hold three major potentials in the course of customer co-design: (i) generation of customer knowledge to provide a better starting (pre-) configuration, (ii) support of collaborative co-design fostering joint creativity and problem solving, and (iii) building of trust and the reduction of the perception of risk. The three potentials will be further discussed in the following sections.

4.3 Generation of customer knowledge to provide better starting (pre-) configuration

Knowledge generating processes within a community are a source for customer data which represent the backbone of a personalization strategy for mass customization. The ability to deliver automated personalization rests upon the acquisition of a customer profile and the availability of meta-information about existing options. Communities may facilitate access to this data. Whereas in traditional (electronic) shopping environments users are often skeptical and cautious regarding the revelation of personal information, users are usually more willing to share such information in an online community (Schubert & Koch 2002). Additionally, people tend to spend time in the community, offering possibilities for the system to gain implicit user information by observing their behavior (provided that the users approve of this procedure). Within a community, knowledge is created and shared collaboratively (Ishida 1998). Thus, users may mutually support each other in finding a solution, which fits best to their needs. In addition to this, the evaluation of different options can be supported. This support is given – at least in the theory of a perfect community – by the users

themselves and not by the supplier of the customized good – thus increasing the interaction and configuration efficiency of the supplier as well as trust.

Peppers and Rogers (1997) speak about "affinity groups", which they describe as sub-communities of customers with similar taste. By linking affinity groups with the recorded purchase transactions of a big number of customers a knowledge base emerges which can be used for the forecast of the future buying behavior of individuals. One of our case companies, MyVirtualModel, applies this mechanism to support the personalization of online apparel shopping. Customers can rate products on a scale from one to five. This information is stored in a database where people with similar taste patterns are put into affinity groups. Based on the buying behavior of the respective peer group, customers receive recommendations for future purchases without the need to look at a broad range of products. This is a good example of how preference and transaction profiles can support buyers in recurring purchases. Once individual settings have been stored, any future transaction can consist of only one "confirmation click" of the compiled product.

4.4 Support of collaborative co-design fostering joint creativity and problem solving

Current work on personalization usually focuses on automatic (collaborative) filtering processes in which a single customer does not get in contact with other customers. The community setting for customer co-design described in the last paragraph empowers an individual design process by sharing knowledge (social navigation; cf. Munro et al. 1999; Höök et al. 2002), providing a better fitting pre-configuration. Another interesting option is the provision of support for interactive collaborative filtering where users directly interact on the co-design platform (Twidale et al. 1997). *Collaborative co-design*, on the other hand, refers to a design process that is performed collaboratively by different actors. Collaboration is one of the (often forgotten) core features of communities and customer behavior in the real world. In (virtual) communities of transaction recommendations for initial set-up configurations can be provided directly by other users. These configurations can be used for co-design toolkits or selections from possible configuration options.

Twidale and Nichols (1996) investigated this form of collaboration for the task of searching for information. Their findings can also be applied to collaborative customization for mass customization. By using dedicated design toolkits, customers can jointly work on a customizable product, either delivered to just one member of the group or to all of them. Collaborative co-design can foster creativity and stimulate better solutions due to the effect of intrinsic motivation on innovation-related activities (self reward and exchange of information). Early examples of communities of end users *developing* (not co-designing) products jointly came from the sports goods industry. Franke and Shah (2002) found high proportions of innovators in four samples of snowboarders, canyonists, handicapped cyclists, and sailplaners. Also, new product development was not performed by single users alone but was a result of joint efforts of a (real life) community of athletes. In these cases, a collaborative innovation process in a community stimulated innovation. During these collaboration processes, users take the role of being the innovators: the "information about needs" are converted into a solution at the locus of the user without costly shifts of the information from the customer to the manufacturer (von Hippel 2001). The open source movement is another example of these kinds of communities.

Another example where we find collaborative design features in a mass customization setting is the non-commercial LEGO User Group Network (Lugnet, www.lugnet.com). Within this community, hundreds of users create virtual and real worlds out of (existing) LEGO blocks, using a powerful configuration system (a CAD system based on the LEGO product architecture). Lugnet is a fascinating example of how users make use of a modular product structure (a typical mass customization situation) in combination with a dedicated interaction system for collaborative co-design to create new products and foster creativity. The LEGO Company is currently investigating possibilities to use the potential of this community and the community processes in general to support their product

marketing and sales – and to enable their regular users (kindergarten and school children) to interact with their products more easily.

Another, much simpler example is American Eagle, an US-based fashion retailer. Instead of investing in customization technologies for the manufacturing process or interaction toolkits which are used before purchasing the product, the firm provides customization *after* the purchase: Selected shops offer special workshop areas where customers can transform from-the-rack-clothes into individual garments with the help of shop assistants (by literally cutting holes in t-shirts and so on). What sounds like an obscure marketing idea proofed to be a large success – mainly because of the joy and experience of jointly post-designing clothing in a group of customers. Customers inspire themselves and get a positive feedback from their counterparts in the shop. They also share ideas and creative inputs. The workshops became major meeting points in shopping malls and increased customer traffic in the stores significantly. The company is now bringing this collaborative co-design solution to their Web site. Swatch (in general not a mass customization company) recently explored a similar approach with a design workshop for customers in Milan's Via Della Spiga. Here, customers can build together their very own watches in a group of friend.

4.5 Building trust and reducing customers' perception of risk

If a customized solution is jointly developed by a group of users, the result is often more robust and considered more trustworthy. In a traditional mass customization system, users have to trust their own configuration skills. In a system of collaborative customization, trust is generated jointly and thus stronger. Since a vendor has a vested interest in the promotion of his products, customers feel an uncertainty about his behavior especially when receiving recommendations or any kind of marketing information. This problem of asymmetric information may also be addressed through communities of buyers. Users might not always trust the automatically generated system recommendations – a major problem of traditional personalization approaches, which we mentioned earlier.

Trust in recommendations is usually higher when the recommendations stem from peers and are e.g. based on ratings that will affect the provider's reputation. (Virtual) product communities where users can interact with each other can help in generating trusted recommendations (Schubert & Ginsburg 2000). The opinions about different product configurations, components and functionalities exchanged in these communities can be traced back to real people. Even when the recommendations are exchanged automatically, the link to real peer customers and the possibility to check this customer's reputation or contact her helps in building trust in the recommendation and reducing the risks of customization.

5 CONCLUSIONS

Recently, a number of prominent companies have introduced mass customization offerings. However, the number and intensity of mass customization applications in reality falls far behind the number of publications on mass customization. In this paper, we have discussed one reason for this gap that is based on the customers' perception of the mass customization process. Based on six case studies and a review of earlier empirical studies, we could identify three types of "mass confusion problems" which may bare one explanation for the slow adoption of mass customization: (1) the burden of choice to find the fitting option from a large number of customization options; (2) the difficulty to address individual needs and transfer them to a concrete product specification; and (3) uncertainties (based on missing information) about the behavior of the provider.

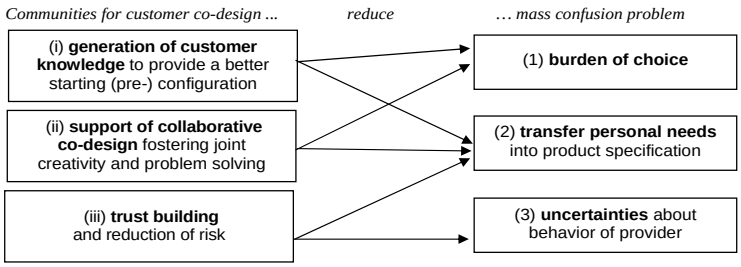

Figure 1: Contributions of communities for co-design to reduce mass confusion problem

In e-business literature, virtual communities are often mentioned as a potential solution to overcome information gaps and uncertainties of online buying. Also, discussions with managers from miAdidas and Lego, our two primary case studies in this research, indicated potential benefits of using interactions between customers as a means to reduce mass confusion. Communities for customer co-design can support an individual or collaborative design process, at the same time minimizing the mass confusion problem. The approach of using communities hides a wealth of possibilities which allow consumers to become creative co-designers. In more detail, we identified three community applications which can help to overcome the mass confusion phenomenon: (i) generation of customer knowledge to provide a better starting (pre-) configuration, (ii) support of collaborative co-design fostering joint creativity and problem solving, and (iii) building of trust and the reduction of the perception of risk. Figure 1 displays the match between the "problem solving mechanisms" of a customer co-design community and the three types of mass confusion. We believe that the perspective of forming virtual communities of co-designers and gaining advantage from customer profiles is vital for the success of future co-design and mass customization environments. The understanding of the effective use of electronic business media will be key to designing a socially and technically efficient virtual environment that suits the needs of buyers and sellers alike. With more of these applications in place the promise of mass customization could become true in the near future – and the visions of futurists like Toffler or Anderson could finally become reality.

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