Scenario-Driven Configuration Systems – Examining the Influence of Product Types and Mind States on Customer Satisfaction in Product Configuration Processes

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Abstract

Potential customers leave product configuration processes before completion for a variety of reasons. Using Social Cognitive Theory, explanations for this behavior are derived based on the two dimensions of 1) customer mind states within the process, in combination with 2) type of product to be customized. It is shown, that both dimensions have considerable impact on why customers abort configurations at various stages throughout the process. Product configuration system models therefore need to be stronger aligned with the products they are later supposed to be used for instead of providing all-purpose functionality. As a result, scenario-driven models and strategies for enhancing customization are provided. Counter intuitively, technically more advanced models do not necessarily increase customer satisfaction in all application scenarios.

Keywords

Product Configuration Process, System Design, Motivational Factors, Social Cognitive Theory.

1   Motivation

Mass Customization has been referred to as an innovative strategy of satisfying customer needs in general. (Pine, 1993) In order to amplify commercial success, a variety of factors acting as barriers for completion of product configuration transactions have been identified in literature: inadequate user interfaces in product configuration implementations (Ardissono, Felfernig, Friedrich, Jannach, Schäfer et al., 2001), insufficient knowledge modelling (Männistö, Peltonen, & Sulonen, 1996), problems in the field of back-end logistics coordination (Mesihovic & Malmqvist, 2000). The issue of restrained configuration possibilities (Inakoshi, Okamoto, Ohta, & Yugami, 2001) has been discussed as well as the notion of insecurity of using product configuration systems due to a wide variety of options from an end-user's perspective. (Franke & Piller, 2004) Users have been modelled in order to enhance the degree of personalization. (Hansen, Scheer, & Loos, 2003) Recommender systems have been proposed for integration into configuration frameworks in order to better assist the customer in the configuration process. (Blecker, Abdelkafi, Kreutler, & Friedrich, 2004) All these considerations share the underlying presumption of the existence of some generic matters relating to causing customers not to engage in the concept of mass customization.

This contribution calls for a change in understanding which issues mass customization and more precisely product configuration processes are facing. We argue based on analysis of resistance causes in mass customization, that there is not one typical product configuration process requiring optimization. Rather the configuration process of each individual type of product to be customized causes different issues with the customer and therefore needs individual attention and technological support.

Emphasizing the need of situational factors of influence on the configuration process, concepts useful for configuration of one type of product can be obstructive in a different customization setting. We argue that customers are not generally dissatisfied with functionality and option range of current product configuration systems but decide for a variety of situational reasons to not complete the product configuration process.

The transition from consumption of standard to customized goods is a change process that on an individual level – as with every change process – can be agreed on or can be resisted. In order to stronger establish Mass Customization in the mainstream market, reasons why customers refuse to undergo this change process, despite the potential of higher satisfaction with configured goods, needs to be addressed. Recommendations for actions need to be derived for optimizing utilization of configuration systems.

2 Customer Resistance in Mass Customization

2.1 From Rejection Notion to Resistance Behavior

Resistance behavior is traditionally a negative connoted term describing failure to comply with something new that is perceived to be correct and useful from a judgmental perspective. (Zaltman & Duncan, 1977) Going back to (Freud, 1900), the term has originated in the field of psychotherapy, where it is used to characterize clients' degrees of opposition to therapy and therapist. (Leahy, 2003; Newman, 2002) The term has since been used intensively in the field of business administration, such as within marketing (Penaloza & Price, 1993; Ritson & Dobscha, 1999) or change management (Egan & Fjermestad, 2005; Stanley, Meyer, & Topolnytsky, 2005).

For Mass Customization, resistance describes a behavior of a potential customer, who despite initial interest refuses to complete a configuration process for a variety of both rational and irrational reasons. Differentiation between resistance as behavioral instance and rejection as result of both perception and evaluation needs to be emphasized in this context. (Hodas, 1993) Product configuration systems serve as interfaces between potential customers and product seller. They need to be intentionally accessed for usage by the customer.

This is different to marketing or change management settings, where the resisted object is pushed towards the individual without any required action on his side. (Dent & Goldberg, 1999) Resistance can only occur when the potential customer is already within a configuration process and decides to abort it. Strong intention to resist based on rejection of the idea causes the individual to not access product configuration sites in a first place, thus avoiding any configuration process to be initiated.

Rejection towards a defined object is one pole on a notion scale with motivational acceptance being at the opposite end. (Ellis, 2002) It has two potential characteristics:

1. The user is not aware of potential benefits of configured goods in which case it is a marketing issue.

2. The user decides not to engage in product configuration despite the advantages configured goods offer. In this case, there are other factors of influence that overrule customer's at least partially positive context evaluation such as expectations or projections regarding high shipping costs and waiting periods.

Commonly, the will to act is not based exclusively of only rejection or motivational acceptance. Rather, it consists of both motivational acceptance and rejection notions (Zeleny, 1982): there is as in most decision situations at the same time a certain amount of desire to engage in product customization while other factors limit the intention to act.

Resistance in Mass Customization is instead an action that only appears, once a certain level of motivational acceptance has already been reached. The customer has accessed the online configuration system due to interest or curiosity. Reasons for not completing a transaction are:

1. The products offered or the kind of configuration possibilities of these products do not suit customer's personal taste. As such, the reason to abort the configuration process is based on rational thought.

2. There are generic technical aspects such as slow response times that bar the potential customer from completing the transaction. This is an aspect that has been repeatedly researched in the field of information systems.

3. The customer aborts the configuration process as doubts grounded in customer's rejection notion are not addressed or are even amplified. In this case, there are apparent specific situational issues regarding the used product configuration system.

Underlying idea of various publications on product configuration is that architectures and models of product configuration systems are applicable to several kinds of products. We argue that not only the customer group determined to interact with the system (Ardissono, Felfernig, Friedrich, Jannach, Schäfer et al., 2001), but the kind of product to be customized should have an impact on the design of the product configuration system it is used with. A closer analysis of causes of rejection notion influencing the will to act illustrates the need for differentiation.

2.2 Classification of Product Types

Classifications of products can be approached from a variety of angles e.g. concerning target audiences, product specifications or availability measures. We choose monetary value as primary dimension for classification due to the following reasons:

1. Buying behavior and decision making differs considerably between expensive and less expensive goods. (Bamberg & Coenenberg, 2004)

2. Customizable expensive products are expected to contain usually higher complexity than lower cost products. As such the monetary value may have direct influence on the requirements of product configuration architectures.

In order to describe product types in more detail, we use status level as an additional dimension. This dimension describes the level of status gain that an item is expected to earn from an external observer. With expensive products often considered to be high status goods, it is obvious that primary and secondary dimensions are non-exclusive. High status goods either have low or high

monetary value. They could therefore be also classified into one of the value categories. The focus of status level however goes beyond the price of a product. Less expensive but externally visible products can also attract high status, such as a pair of customized brand jeans. At the same time, far more expensive products such as back-end acquisitions in general such as an installment of a new heating do not attract status gains in regards to the broad public.

We use high status goods for products, where motivation to customize is clearly driven by the desire of improving status. We use high value goods for description of products generally perceived to be expensive with less obvious focus on status improvement. Low value goods describe less expensive customizable products ranging from food products to entertainment items without specific focus on status improvement. In order to reduce complexity and due to limited differentiation to the category of low value goods, we omit low status goods from separate analysis.

This leaves overall three non-exclusive categories:

1. High value goods (e.g. personal computers)

2. Low value goods (e.g. food items)

3. High status goods (e.g. brand clothes)

2.3   Customer States within Product Configuration

Within the product configuration process a number of key states need to be highlighted. Each of these states determines the outcome of a subsequent decision to continue in or to drop out of the configuration process. Most notably, three states have to be considered:

1. State of motivation: Realizing Mass Customization offerings as being able to increase personal satisfaction.
2. State of taking action: Deciding on actively taking action in order to personally experience a selected customization setting.
3. State of process completion: Deciding on sending out the order for a customized product.

State of motivation describes the situation right before any initial evaluation about the potential usefulness of Mass Customization has been made. State of taking action is the result of the evaluation based on perceived usefulness of the concept for improving the personal situation. It can be aligned with rejection and motivational acceptance notions. State of process completion requires the prior certain level of motivational acceptance that caused the customer to initiate the configuration process. Alignment can be made with causes of resistance.

3   Impact of Product Type and Customer Mind States on Product Configuration System Design

3.1   Research Approach

Combining identified customer mind states within product configuration with product type classifications leads to a 3*3 matrix. Given this matrix structure, causes of resistance behavior specific to product configuration need to be identified for each segment of the matrix. While there is extensive research on causes of resistance available, none pertains to a comprehensive analysis in the field of Mass Customization. As such, instead of transferring lists of causes

related to other application domains, causes are derived systematically from theory. For this task, we select Social Cognitive Theory (SCT) (Bandura, 1986) for a number of reasons:

1. Social Cognitive Theory is widespread and well respected. It can be considered as the foundation of many psychotherapeutic approaches such as cognitive therapy (Beck, Rush, Shaw, & Emery, 1979) or rational emotive therapy (Ellis, 2002).

2. Due to its comprehensive focus on behavioral, cognitive and social aspects, the theory is well-balanced.

3. It can well be applied to the research context regarding the defined product configuration phases.

SCT is a theory to describe human behavior. It was developed based on social learning theory (SLT). It states in contrast to traditional behaviorists that behavior is driven by cognitive processes. These processes utilize three main influence factors that are seen to be: inner personal aspects, environment and behavior. (Bandura, 1986, 2001) takes a constructivist view of reality: he emphasizes selective perception and thus the self construction of personal reality.

3.2 Research Design

Figure 1 summarizes factors that are applicable to explain reasons for process abortions as deduced from SCT. The reasoning behind terms given for each segment of the matrix is detailed below. Arrows indicate causal influences to be considered in the context of succeeding states or states relating to other product types.

	State of Motivation	State of Taking Action	State of Completion
Low Value Goods	A1 Habit	A2 Benefit analysis	A3 Expectation level
High Value Goods	B1 Observational Learning	B2 Forethought Capability	B3 Self Efficacy
High Status Goods	C1 Context Realization	C2 Sunk Costs	C3 External Approval

Figure 1: Research Matrix

3.2.1 Low Value Goods

Segments A1-3 describe factors related to states for low value goods. While the frequency of purchase of low value goods varies, purchases generally can be expected to appear more frequent than regarding higher priced product types. Examples include grocery shopping, which is not only limited to repetitions of product buying patterns but is further also supported by recognition of in-store product locations. (Bandura, 1986) speaks of the perceived lack of necessity of reevaluating internalized behavior due to habitual routine. State of Action is characterized by conducting benefit analysis. If the expected level of benefit does not succeed the perceived effort needed to obtain the customized product, benefit of customizing is considered marginal. Rejection notion succeeds motivational acceptance, thus no intention to initiate product configuration is triggered.

State of completion describes the state or rather multiple states while using the configuration interface. Reasons for resistance as behavioral expression towards the concept of customization are closely related to the causes driving rejection notion. While interacting with the configuration system, the formerly abstract idea of product configuration is broken down into options and option values, allowing the customer to realize and understand the degree of offered customization. For low value products, this causes an issue with the expectation level. In case of perceived benefit of the customized product being initially low, users might not have continued within the configuration process after state of action. If the perceived benefit is expected to be high and users still continue in the process, this expectation needs to be fulfilled in order for customers to complete the order. (Riemer & Totz, 2003)

Lower priced goods however are expected to offer a comparing low degree of customization due to a smaller net profit on each sold item. As such there is a gap between the expectation of the potential customer necessary to start the configuration process and the fulfillment of this expectation during interaction with the configuration system. Transaction theory (Hill, 1990) further fuels the gap between unfulfilled expectations and realization of rather high additional transaction costs. Examples to illustrate are two well known Mass Customization business models by Procter & Gamble. Both businesses are no longer active. Millstone Personal offered individualized coffee, MyCereal focused on providing individualized cereals. In both cases, customization choices could be reduced to different combination ratios of ingredients while at the same time rather complex ordering procedures and disproportional shipping costs were in place.

3.2.2 High Value Goods

Segments B1-3 describe factors related to states for high value goods. High value goods are characterized by occasional purchases. Decision making processes are therefore expected to be more complex and thorough than concerning products of daily consummation. Observational learning describes in this context the process of triggering thought processes based on other people's choices and behaviors. Considering customized goods as a selection choice requires the realization or presumption of additional benefit gained through individualization.

With product configuration not yet being fully established in the mainstream market, perceptions of other people's buying choices is oftentimes limited to traditional buying patterns. One of the primary factors influencing states of action is human forethought capability. Being able to expect future outcomes again serves as trigger to initiate configuration processes. At the same time, it

induces diffuse fear of taking an alternate path to traditional buying especially regarding the considerable investments. This excels within the state of completion into what Bandura calls self-efficacy. (Bandura, 1977) Options and option values are provided in order for the customer to combine values that fit personal requirements best. As such, values contribute differently to the users' configuration aims. Two aspects have to be considered:

1. Customer needs to be aware of which option selections would be best for the specific configuration objective.

2. Customer needs to be able to understand how option values relate to each other in order to not pick the single best attribute for one option but rather the option values, that overall in combination provide the best results.

As such there is a trade-off between the freedom of configuration and the burden of relying exclusively on self-expertise. With self-efficacy being a complex construct determined by a large amount of constituting indicators (Marakas, Yi, & Johnson, 1998), it is non-trivial to forecast the strength of self-efficacy regarding the expected product target audience.

3.2.3 High Status Goods

Segments C1-3 describe factors related to states regarding high status goods. With higher status arising from products that are considered rare or desirable, a correlation to the factors identified for high value goods can be expected. While this turns out to be true, there are specifics to be highlighted. Status gains do not primarily emerge from the purchase of certain products but through perception and judgment of these products through third parties.

Personal satisfaction with dedicated status products depends therefore on the degree of social acceptance of the individualized product. This social acceptance of customized goods varies individually from person to person. (Lynn & Harris, 1997) The status of products in general differs furthermore regarding cultural and social background. The process of gaining status includes a subconscious prediction about products status within the peer group.

While certain products have proven to trigger desired perceptions, configured products are different in a way that they can either be specifically approved for their uniqueness or also be rejected for not complying with social terms. This thought process escalates during the state of motivation. Knowing there is a risk of not sticking with standardized goods proven to fulfill the objective, the issue of 'sunk costs' on the person who decides to customize is getting urgent. Potential benefits of successful customization are superposed by projection of undesired scenarios. The decision is no longer driven by the desire to gain additional benefits but by the fear of investment which might not pay off as desired.

In analogue to high value goods, the potential customer utilizes forethought capability to not only see benefits but also negative impacts choices might have. Specific to status goods however, these products necessarily underlie external evaluation. On the one hand, there is the desire of creating a product to excel status.

On the other hand, there are merely heuristics of what causes status and social approval in the peer group. The aspect of self-efficacy therefore causes an evaluation about one's own perceived abilities and the expectation of what it takes to create the desired product within the state of motivation. If the evaluation is negative, the user will drop out before completing the purchase due to:

1. lack of precise knowledge of which values cause social status in the peer group

2. doubt whether the selected values are the best choice for status gains

3. doubt whether own skills are sufficient for creating a desirable product.

4   Consequences for Product Configuration System Design

Product configuration models and architectures have been designed to be suited for application with different kinds of products. Realizing, that the type of product has significant influence on the reasons for process abortions, product configuration systems themselves need a stronger adaptation towards the kind of product type to be configured on them. Differentiating between the previously defined product types of low value goods, high value goods and high status goods allows deducing the following more detailed guidelines for design and set up of product configuration systems.

4.1   Configuration System Design for Low Value Goods

As deduced using Social Cognitive theory, customization of low value goods is suffering from two main obstacles: At first, the customer's imagination needs to be triggered using marketing measures that he is expecting a benefit exceeding the additional transactional costs as described in transaction cost theory. Then this expectation needs to be fulfilled in terms of a configuration system back-end flexible enough to allow for customizations as expected by the customer. However, considering the state-of-the-art of low value goods online-customization, the perceived transactional cost has so far been usually higher than the perceived benefits of what most customization business outfits had to offer. As a result, mass customization offerings in the low value goods segment have significantly diminished. Closer analysis of the nature of transactional costs reveals the following factors:

- Requirement of spending time for configuration and payment process
- Requirements of installation of additional software or browser plug-ins
- Additional production and delivery times
- Considerable shipping costs in relation to product value
- Lack of trust in online vendor

Traditional configuration systems accessed from the users' home via internet are due to their structure rather unable to solve these kinds of problems. One option to avoid these issues and to strengthen the position of low value goods customization is through cooperation with brick and mortar companies. (Piller, Reichwald, & Schaller 2003) Using internet-based product configuration terminals in stores right along standardized product offerings reduces issues regarding the state of motivation.

Product specifications are configured in the store and directly sent to the producing company. Customized products are then returned to the brick and mortar store for pick up at the next visit. Customer cards can be used for identification, thus giving stores an additional benefit of participating. Configuration of products gets internalized as an alternative purchasing option within the traditional shopping process. In order to enhance look-and-feel, customization templates can be exhibited. (Figueiredo, 2000) With brick-and-mortar companies acting as front-ends to the customer, the trust issue regarding the producing company potentially diminishes as

well as disproportional shipping costs due to combined shipping of customized products of various users. Summarizing, the focus for lower value goods should in a first step focus less on technical architectures of configuration systems but rather on the business side on optimizing strategic partnerships. Front-ends being independent from webdesign requirements run on dedicated software platforms could be used to address the users' desires right at that time, when a purchase of that type of item is planned anyway.

4.2 Configuration System Design for High Value Goods

Purchasing high value goods imposes the pressure of losing considerable amounts of money in case the product is not perceived to be satisfactory. In case of individually configured goods, the possibilities of returning a product due to displeasure are additionally limited. As such there is the belief issue whether trust in own skills is sufficient in order to risk customization completion. Literature has repeatedly focused on providing assistance mechanisms such as recommender systems in order to help the customer in cases of preference lacks. (Blecker et al., 2004; Scheer, Hansen, & Loos, 2003) In a first step, it seems necessary to even stronger address the issue of self-efficacy.

The customer should be given the freedom to customize to just the degree he desires. He however should not be forced to build the product from bottom up by himself. Customer-specific product models should therefore not be initially blank but rather always be filled with a preset, that optionally can but not necessarily has to be modified (see figure 2).
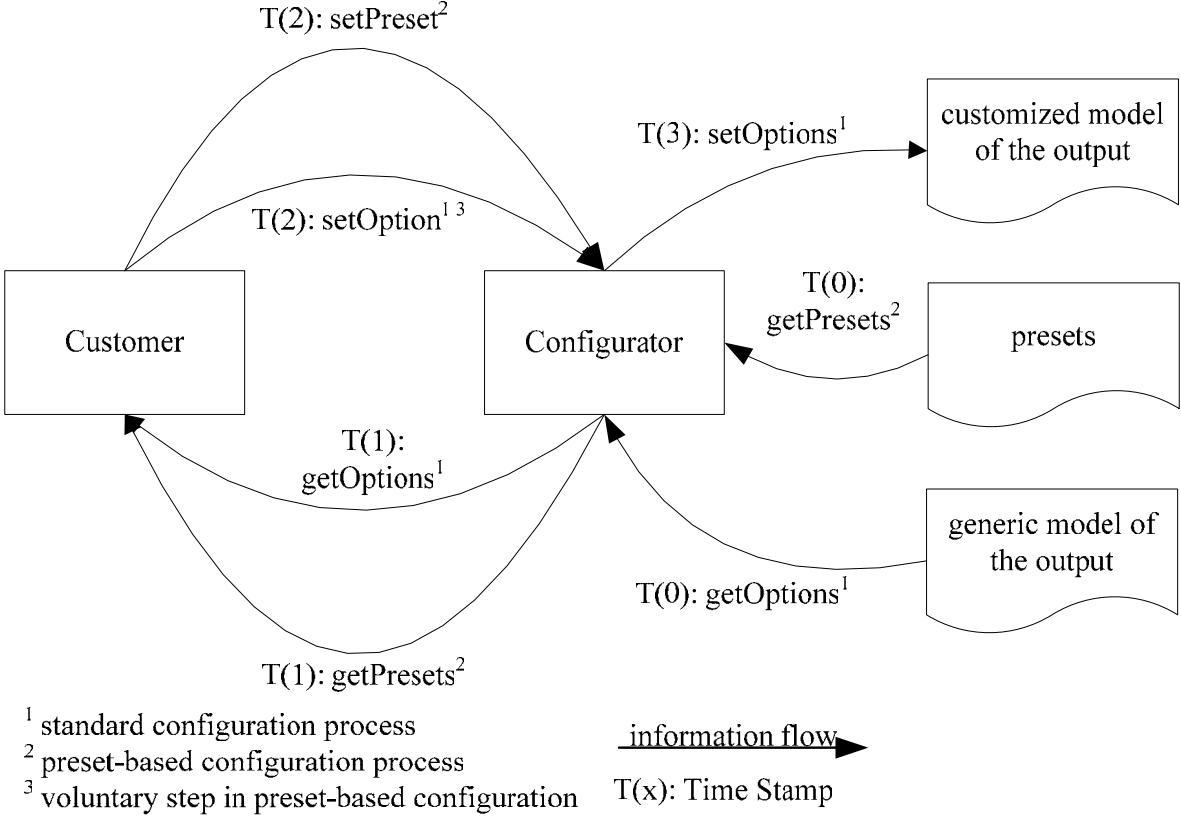
Figure 2: Preset-based product configuration

By offering defined goods with an optional configuration possibility, the perceived change in buying patterns from standard to individualized goods is significantly decreased. Furthermore,

the degree of customization is exclusively determined by the customer. As such, preset based configuration for high value goods offers expert users the full range of customization functionality while at the same time allowing for the purchase of goods even requiring no customization at all if desired.

Alternatively, an implemented dialogue on semantic level can help the customer define basic requirements and translates these semantics into a syntax using an inference mechanism such as a predefined rule base. In order to reduce complexity, the rule based translation does not work on single-part rather than on assembly level. Users can then make fine adjustments to the proposed model if desired without having to explicitly call for help for all options they are not explicitly familiar with (see figure 3).
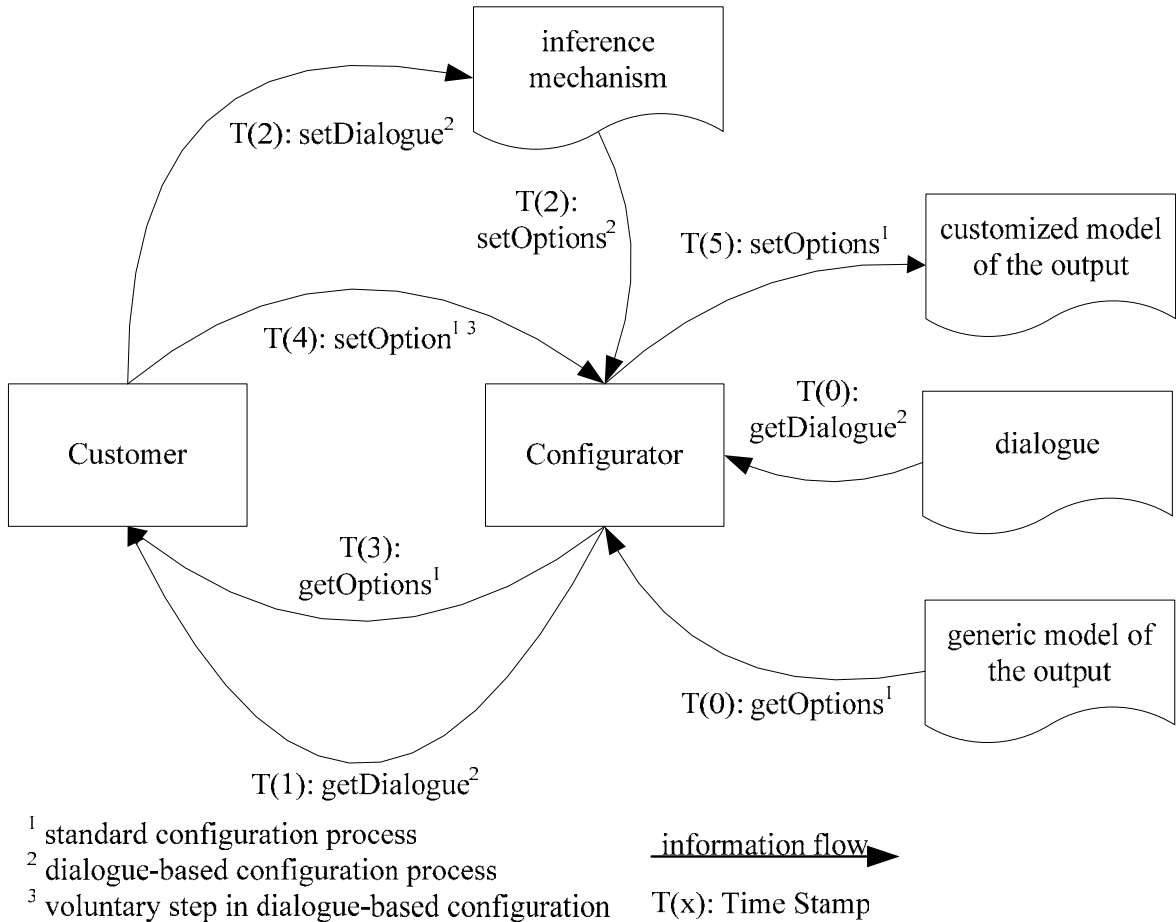

Figure 3: Dialogue-based product configuration

4.3   Configuration System Design for High Status Goods

Configuration of high status goods comprises the risk of failed social approval of the created product as worst-case scenario. As such, human forethought capability causes self doubts regarding the quality of the own product specification in comparison to a product designed by a professional. Customization of high status value goods, such as quality clothing, therefore requires a form of external approval by a simulated social environment. This could either be in the form of an online advisor who can be contacted in real time via online groupware functionality or more economical, an intentional time delay before production.

Customers need to be able to configure the desired product specification by themselves. This specification should then undergo intentionally time-delayed review and quality check by company employees before getting approved for production. Providing product configuration systems with the technical ability of having configured high-status products, such as clothes, go right into production without any time-delaying oversight counter intuitively reduces customer satisfaction.

Marketing should rather focus on communicating the idea of created specifications being product requests, which only after thorough check will be approved if defined quality measures are met. Constraints usually operating in the configuration front-end and applied in real-time should therefore be accompanied with additional human back-end analysis (see figure 4).

Validation

T(2): setPreset[2]

T(Delayed): setOptions[1]

customized model of the output

T(3): setOption[1]

T(2): setOption[1][3]

T(0): getPresets[2]

Customer

Configurator

presets

T(1): getOptions[1]

generic model of the output

T(0): getOptions[1]

T(1): getPresets[2]

[1] standard configuration process
[2] preset-based configuration process
[3] voluntary step in preset-based configuration

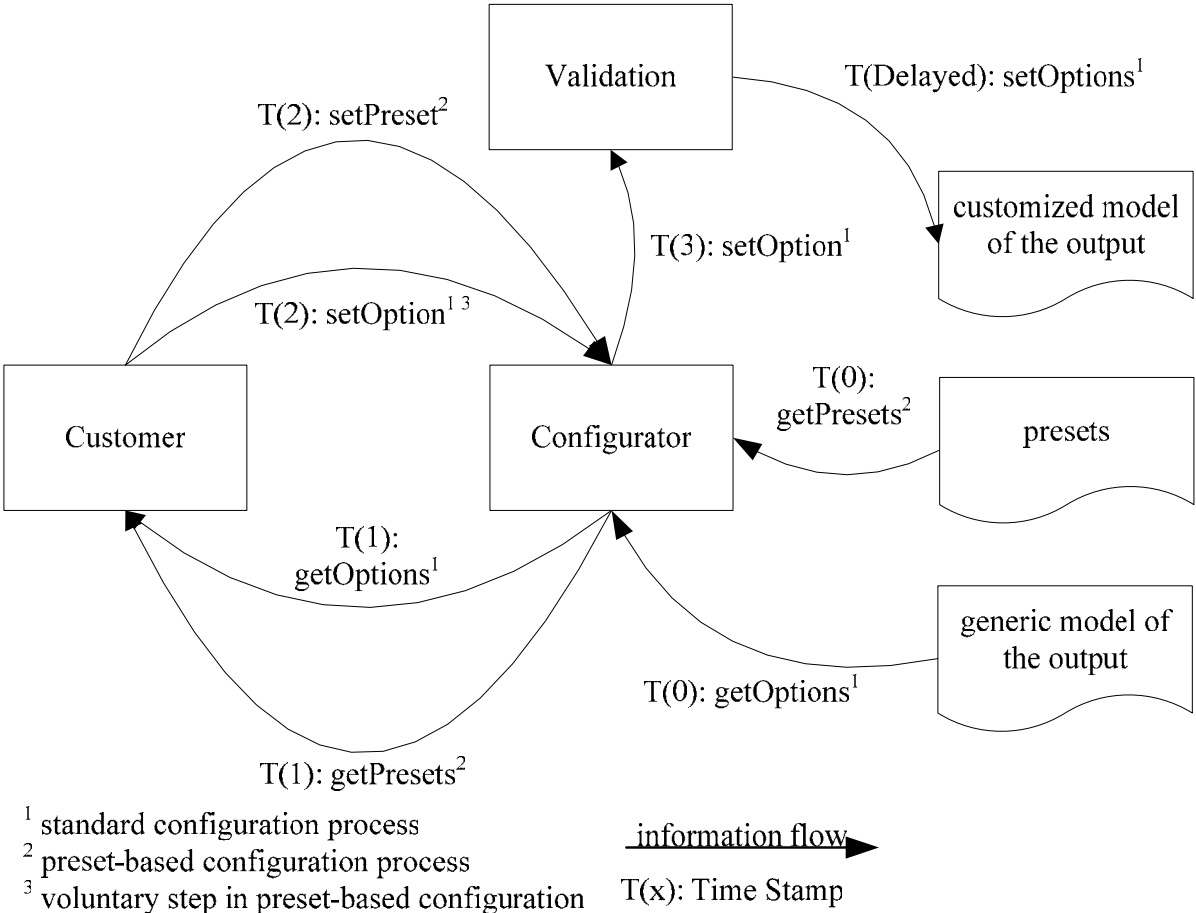information flow

T(x): Time Stamp

Figure 4: Time-delayed preset-based product configuration

Constraints in configuration system front-ends do not make any judgments about the quality of a specified product. They only ensure technical feasibility. However for high status goods, requirements imposed by the customer include confirmation and approval of the specification on a more quality-assuring level. If approval is not explicitly granted, it is less risky to decide on a standardized product designed by company experts if perception of own skills and abilities is rather negative.

5   Conclusions

In order to reduce the amounts of configuration process abortions and to increase customer satisfaction with the concept of mass customization in general, configuration processes need to be examined closer regarding type of product to be configured and relevant customer perceptions within each process step. Based on Social Cognitive Theory, we have shown that reasons for aborting configuration processes are not generic but situation-specific. Features that enhance the usability of product configuration systems in one application setting seriously limit customer satisfaction in another. We have identified different reasons for process abortion in regards to low value goods, high value goods and goods purchased primarily for status gains. Models and strategies for enhancing configuration systems have been provided for all three product types.

In future research, there is the need of focusing more on the specification of architectures that consider the type of configuration scenario and the type of product to be customized. This supplements research on side of both back-end product families (Mannistö, Soininen, & Sulonen, 2001) as well as front end interface design issues (Ardissono, Felfernig, Friedrich, Jannach, Zanker et al., 2001).

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