Designing for Positive User Experience in Product Design:
A Qualitative Analysis of Toolkit Design Elements and their Implications on Emotional Reactions and Perceptions

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Abstract
Companies increasingly equip their customers with toolkits for user innovation and design to address the challenges of growing customer demand for unique products and increasingly heterogeneous customer preferences. Yet, compared to buying a product off the shelf, customizing products through toolkits requires higher efforts, time, and expertise from customers. To outbalance increased efforts, toolkits need to be designed in a way that makes the product design task fun and engaging. Based on marketing, human-computer interaction, and information systems research, toolkits can be designed as hedonic or utilitarian toolkits. We use focus groups to qualitatively analyze “visualization” and “detailed information” as toolkit design elements to generate hedonic or utilitarian experience, and their implications on toolkit users’ emotional responses and perceptions. Our findings show that visualization and detailed information both help in enhancing users’ realistic product understanding. We found that particularly visualization stimulates creativity and enjoyment in product design.

1. Introduction
In the twentieth century, innovations have primarily been generated through in-house research and development. Nowadays, companies increasingly open up their innovation processes for external stakeholders such as customers or suppliers [1]. In this context, customers are seen as one of the key sources of innovations [1, 2]. Customers can provide input such as ideas, concepts, or product designs [3]. These customer inputs can be generated by companies using different customer integration methods including idea competitions, toolkits for user innovation and design, or lead user workshops [3].

Toolkits for user innovation and design allow companies to tailor products to individual customer preferences. This is particularly important as customer preferences have become increasingly heterogeneous in some markets. At the same time, customers’ demand for unique and customized products has increased [4, 5]. This is reflected by a steadily growing number of companies including DELL, General Mills, or Nike that provide toolkits on their websites allowing customers to design their own laptops, cereals, and running shoes [6]. Toolkits are design interfaces that enable customers to customize products to their individual preferences in a trial-and-error process. The product configuration is transferred to the company’s production system and delivered to the customer [7].

From a customer perspective, the task of actively designing a product requires more effort, time, and expertise than simply buying products off the shelf [8]. However, customers can also derive value in the form of pride and enjoyment from designing their own product [9]. Therefore, toolkits need to fully engage customers into the design activity by providing a positive user experience that outbalances design costs. Yet, there is a paucity of research focusing on the toolkit interface between the user and the company, and the experience customers gain from self-designing their products [7]. There is little guidance for companies on how to design for a positive experience in product design. Existing studies propose rather generic design elements including a trial-and-error process, a library of standard modules, or an appropriate solution space [10-12]. Therefore, we answer the following research question: What toolkit design elements constitute a positive user experience and what are the implications of the toolkit design elements on users’ emotional reactions and
perceptions? We take a qualitative research approach to systematically analyze toolkit design elements, and the emotional reactions (e.g., enjoyment, satisfaction) and perceptions (e.g., product understanding, decision support) they cause. Knowing about toolkit design elements and their implications, allows companies to design toolkits that elicit desired emotional reactions and avoid or mitigate undesired reactions.

Based on human-computer interaction [13], information systems [14], and marketing research [15, 16], the differentiation in utilitarian and hedonic is taken as a theoretical lens for our study. In the context of an experiment, we implemented three toolkit interfaces (hedonic, utilitarian, control) and conducted focus groups with participants of an experiment after using the toolkits to design a car. Our research has implications for designers of toolkits focusing on the user experience the toolkit is able to provide. We identify visualization as an important design element determining enjoyment, flow, playfulness, creativity, and realistic product understanding.

The remainder of the paper is structured as follows. First, we describe the theoretical background on toolkits as well as the concepts of customer and user experience. Second, we present our research approach. Third, we present our research findings and discuss their relevance for toolkit designers applying Garrett’s 5 layer model “the elements of user experience” [17, 18]. Finally, we conclude with limitations and future research possibilities.

2. Theoretical background

2.1 Toolkits for user innovation and design

Companies increasingly provide toolkits to their customers to transfer their preferences and ideas into real products [9]. In practice, there is no generic toolkit design. Toolkits are very heterogeneous in terms of what customers can do [19]. According to previous research, effective toolkits consider five aspects: an iterative trial-and-error process, an adequate solution space, user friendliness, module libraries, and an error free realization of the product configuration [10-12].

Trial-and-error processes facilitate customers in learning about their preferences by providing simulated feedback on their product configuration that can be iteratively evaluated and improved [11, 12]. A toolkit’s solution space defines the user’s design possibilities and limits the possible variations and combinations of product configurations that a user can make [11, 12, 20]. User friendliness describes how users perceive the interaction with the toolkit. Expenses in terms of perceived effort, time, and expertise influence the user’s experience from interacting with the toolkit [11, 12, 21]. Module libraries contain commonly used elements and predefined solution items that users can choose from and incorporate into their product configuration. Further, toolkits need to allow an automatic and error free translation of the customer’s final product configuration into the language of the company’s production system [11, 12].

An excessive variety of possible variations and combinations provided by toolkits results in high levels of perceived complexity that can overwhelm customers [21]. Especially novice toolkit users lack experience in designing their own product due to missing strategies for the customization process [22]. This challenge can be mitigated by the provision of adequate information to support customers in successfully customizing the product to their specific preferences [23]. According to Chang and Chen [23], extrinsic cues including ratings and discussions are in particular beneficial for experience products. In contrast, intrinsic cues provided through information from the retailer about product specifications such as color, size, or functions are more compatible for search products [23]. Further, interactive 3D product visualization can be implemented to assist customers in examining search attributes (e.g., colors) [23].

To sum up, previous mass customization and customer integration research provides some guidelines for the design of toolkits. However, these guidelines and toolkit design elements are rather general [9]. Thus, there is little theoretical evidence on the appropriateness of particular toolkit design elements based on users’ reactions that result from interacting with a toolkit [7, 8, 23]. This calls for a systematic analysis of toolkit design elements that generate positive user experience [5, 8].

2.2 Customer experience and user experience

Experiences can be defined as private and intangible events occurring in response to some stimulation such as a being exposed to a marketing campaign, or directly participating in activities [24].

Under the concept of customer experience, marketing research studies the comprehensive management of touchpoints of a customer with a company [17, 25]. Examples for touchpoints are a company’s marketing campaigns, service personnel, or product. Positive experiences are reflected by positive emotions and behavioral intentions (e.g., willingness to pay, positive word-of-mouth) [26]. In contrast, negative experiences result in negative feelings of frustration or failure and are more likely to be avoided by customers in the future [27]. Therefore purposefully creating and managing customer
experience has been increasingly acknowledged by companies [25]. In marketing, customer experience is distinguished in utilitarian and hedonic experience [15, 16]. Utilitarian experience refers to consumer behavior in which pragmatic goals are in the foreground. For instance, shopping all items on a shopping list. Hedonic experience relates to multisensory and emotive benefits (e.g., enjoyment) that result from an activity [15, 16, 26].

In contrast to customer experience, the concept of user experience focuses on the appropriate design of a single, often digital touchpoint. According to the international standard on ergonomics of human-system interaction (ISO 9241-210), user experience is defined as “a person’s perceptions and responses that result from the use or anticipated use of a product, system, or service” [28]. In terms of user experience, human-computer interaction research initially concentrated on the instrumental (i.e., pragmatic, utilitarian) goals of systems including ease of use, usefulness, and achievement of behavioral goals in work settings. This narrow perspective on user experience was expanded by more non-instrumental (i.e., hedonic) aspects including joy of use, aesthetics, and mental stimulation [13]. Similarly, information systems research distinguishes in utilitarian (or productivity-oriented) and hedonic (or pleasure-oriented) information systems [14].

The design of a toolkit as a digital touchpoint determines the user experience the toolkit is able to provide. Given this differentiation in utilitarian and hedonic in marketing, human-computer interaction, and information systems research, a toolkit for user innovation and design can be designed in two ways: 1) as a utilitarian toolkit, or 2) as a hedonic toolkit.

3. Research methodology

Taking a qualitative research approach, we investigated the impact of toolkit design elements on users’ emotions and perceptions that result from using a toolkit for product design. To this end, we implemented three different toolkit interfaces (hedonic, utilitarian, control) similar to typical toolkits that can be found on the Internet. The CYLEDGE configurator database (http://www.configurator-database.com/) provides an overview of existing toolkits. Figure 1 illustrates our three toolkit interfaces which are described in the following.

Hedonic experience originating from interactions with virtual environments is related to mental stimulation, pleasure, and enjoyment [26]. Web sites reflecting more hedonic characteristics involve high resolution images and graphics as well as interesting and humorous product commentary [29]. Interactive 3D product presentations can nurture playfulness as this design element allows users to inspect the virtual product and examine search attributes such as color and exterior design [23, 30]. Therefore, the hedonic toolkit provided instant visual feedback on the options through a mouse over function. Additionally, the toolkit provided an interactive visualization that showed the effects of selecting and combining different options (see Figure 1 A).

Utilitarian experience in contrast is related to cognitive and instrumental benefits that customers gain [15]. Web sites incorporating more utilitarian characteristics provide customers with the ability to obtain in-depth product and price information [29]. Hence, our utilitarian toolkit provided detailed information on the various product attributes and how their modifications affect the product’s overall functionality (see Figure 1 B).

To control for the impact of the toolkit design elements visualization and detailed information, the control toolkit provided no visualization and no detailed information for the design activity. This toolkit illustrated in Figure 1 C) served as a baseline or worst-case scenario providing minimal support for participants to customize their car. This research design allowed us to systematically and separately investigate the influence of a single design element on the emotional reactions and perceptions of individuals.

3.1 Experiment task and design

Our qualitative analysis using focus groups was part of an experiment with 302 participants. Table 1 summarizes the demographics of the 302 participants.

| Table 1. Participant demographics |
|-----------------|------------------|
| Mean age        | 24.60 years      |
| Gender          |                  |
| Male            | 218 (72.2%)      |
| Female          | 80 (26.5%)       |
| N.A.            | 4 (1.3%)         |
| Education       |                  |
| Students        | 262 (86.8%)      |
| PhD students    | 40 (13.2%)       |
| Car owner       |                  |
| No              | 183              |
| Yes             | 119              |

Participants were randomly assigned to one of the three toolkits. The participants had to design a car as cars are common products that are easy to grasp and customize. Further, product and service components are included in a car which need to be adapted to customers’ individual needs. Many car manufacturers provide toolkits to allow their customers to customize their cars.

The participants had to customize six different product attributes. For the engine, extras, services, and rims the participants could select from six options.
respectively. For the exterior color and the seat design, there were eight possible options respectively. The average time spent for customizing the car was 30 minutes. The experiment was conducted at a laboratory equipped with computers and separating walls between each workplace. The laboratory includes some older computers that require more time to load pages (e.g., show car in selected color). This allowed us to analyze the effect of page loading time on users’ emotional reactions and perceptions.

### 3.2 Focus groups

After customizing a car in the experiment, we randomly selected four to six participants from each experiment session. Overall, from the 302 experiment participants, 64 subjects participated in 15 focus groups (5 hedonic, 5 utilitarian, and 5 control focus groups). We compensated the subjects with a reward of 10 €/hour or credit points in a course. The same person, a co-author of the paper, has moderated all focus groups. We used a semi-structured guideline for all 15 focus groups to ensure comparability of our findings. Participants were asked about the aspects of the design task and the toolkit that made the customization process most / least enjoyable, why they experienced these aspects as most / least enjoyable, what they want to see changed, and what kind of information they want to see added if they had the possibility to use the toolkit again. Data was collected from July to August 2014. We conducted the focus groups in German and translated a selection of illustrative quotes into English for the purpose of this publication. The focus groups lasted on average 11.39 minutes, and were voice recorded and transcribed. The collected data was analyzed using qualitative content analysis [31]. Building on our interview guidelines, we iteratively developed a coding scheme. We coded ideas for improvements, toolkit design elements, and aspects that made the product design task most / least enjoyable. Based on this coding, we extracted toolkit design elements and linked them to emotions and perceptions caused by these design elements. We compared the findings from the different focus groups.
(hedonic vs. utilitarian vs. control) to examine whether there are differences in participants’ perceptions and emotions due to the three different toolkit interfaces.

4. Results

4.1 Results of hedonic focus groups

The participants evaluated the hedonic toolkit positively. It provided hedonic experience through visualization of the options and instant visual feedback of the product configuration. The focus group participants suggested improving the hedonic toolkit by using more advanced visualization techniques including 3D visualization, videos, animations, and a 360-degree view of the car. Further possibilities to foster a hedonic, multi-sensory experience are the selection of different backgrounds to view the car in different environments, e.g. car in the forest vs. car in the city. Apart from visually experiencing the car, participants desired to experience the car with other senses. Therefore, toolkits should also incorporate sounds: “It would be great to hear the car, how the engine sounds.” Our hedonic toolkit design did not provide any detailed information. Yet, the hedonic toolkit users found that detailed descriptions, in particular of the functional car attributes, would be beneficial.

4.2 Results of utilitarian focus groups

To generate a utilitarian experience, participants were provided with detailed information. The utilitarian toolkit users felt supported by this information, especially in customizing functional aspects such as the extras or the engine: “The detailed information made the options transparent. One can clearly understand what one gets for selecting and buying an option”. However, the utilitarian focus group participants outlined the importance of an appropriate information amount and structure to improve utilitarian experience. Additionally, information on the customization progress through a progress bar, or information on finances by providing forecasts on running costs (e.g., taxes, insurances, fuel consumption) would be beneficial.

The utilitarian toolkit did not provide any visual support in the product design task. This was reflected by participants’ feedback: “The toolkit was useful and purposeful, but using the toolkit was not fun. I missed some pictures of the car.” To incorporate some more visual and multi-sensory experience, participants desired pictures, videos, sounds of the car, and 3D printers providing the customer with a prototype of the product before actually ordering the product.

4.3 Results of control focus group

The control toolkit did not provide detailed information and visualization of the product attributes and the options that could be selected. Positive feedbacks mentioned by the participants referred to the toolkit’s ease of use and the fast customization process since the missing toolkit design elements visualization and detailed information prevented participants from clicking and playing around. However, the control group participants missed a visualization of the product as the following statements underline: “With visualization it would have been easier to decide […].” “I could not imagine anything of the car”. Similar to the participants of the hedonic and utilitarian focus groups, the control focus group participants mentioned the necessity of detailed information and an adequate information amount and structure to support the product design task. Further, the users of the control toolkit desired the possibility to specify a prize limit, a forecasting of running costs, a bigger solution space, and a progress bar. Additional ideas to improve the control toolkit were a save and export function to show and discuss the final car configuration with friends and family as well as access to contact persons and retailers.

4.4 Cross-focus group analysis

We compared the focus group results to identify similarities and differences. We observed similarities regarding the desire for visualization, a bigger solution space, and detailed information on the different options that can be selected and their costs. In all focus groups, participants outlined the importance of providing visualization. The participants that were provided with the hedonic toolkit for customizing the car mentioned that the visualization not only helped for customizing visual aspects (exterior color, seat design, rims), but also in understanding the functional product attributes (engine, extras, services): “For example, the park distance control: When I saw the pictures I immediately knew "Ok, this is meany"”; “One can clearly grasp and understand the options. This supports in [...] deciding for the best option.”

Although provided with visualization, especially the hedonic focus group participants were creative about further enhancements of the product visualization. Participants recommended advanced visualization technologies including 3D visualization, 360-degree views, videos, and animations to experience the product. Such richer formats can make the product design task more real, involving, fun, and playful: “To see how it is to get inside of the car. [...] This is much more involving and makes the product
much more real.” It is important to note, that participants mentioned real-life pictures and animations instead of computer-based imitations. However, many toolkits provided by companies on their websites include such imitations.

All participants acknowledged the importance of detailed information on the product attributes and the options that can be selected. This information is particularly important in terms of functional product attributes: “Especially for the extras, the service packages and related contracts, reading on how the options work is important.” Providing detailed information to toolkit users is important as it allows users to learn about the product and to satisfy product-related informational goals: “I most enjoyed reading the information on the technical product attributes and options of the car to inform myself about the current state of technology: from a technical or engineering perspective, what is possible? What are the latest technical innovations? [...].”

According to the participants, this detailed information should only be visible if desired by the toolkit user through a mouse over function or by clicking on an information button. Further, this information needs to be provided in an adequate amount and structure that supports users in eliciting relevant information for attribute evaluation and product design: “The presentation of information is incredibly important. When I have to read a lot of running text, this is exhausting, boring.”

Further, in all focus groups (hedonic vs. utilitarian vs. control) we identified the need for clear depictions of the costs to enhance transparency on how the modifications of the product attributes affect the overall price of the product configuration. This allows participants to evaluate trade-offs between the desire for certain options and their willingness to pay for these options. This evaluation presents a challenge and nurtures playfulness: “Precisely that is the interesting and fun thing about using a toolkit [...]. I can start with designing my car, and if this configuration exceeds my budget I can iteratively adjust options until I reach a satisfactory configuration that is affordable and still satisfies my needs.”

Regarding information on the costs, the toolkit should be designed as an intelligent system that allows the user to specify a prize limit. The toolkit can indicate when the maximum budget is reached and recommends alternative options that are within the pre-defined budget. Alternatively, the toolkit can exclude very expensive options from the solution space. This avoids feelings of frustration: “I would like to specify the budget I have, e.g. [...]. Based on this input, the system can exclude too expensive options. This avoids frustration due to unaffordable options.”

However, we also found some different patterns across the focus groups. Especially participants that did not have visualization of the customized product felt rather insecure about their choices and desired more support for the customization process itself and information on the product configuration: “It was difficult to get a clear picture of the different options that can be selected. Due to the missing visualization and conception of the product in my mind, it was difficult to select suitable options. As a result I have not been sure about my selections and not very happy with my configuration.” In order to get some more support, the utilitarian and control toolkit users wished to save, print, export, and prototype their product configuration to discuss it with experts, or family and friends before actually buying the product: “It would be so cool and supportive to save the product configuration. Then I would see a friend who is an expert in this field. I would ask him whether he thinks this configuration suits me well. Or the possibility to save the configuration as a link [...] would be super convenient.”

The discussions in the hedonic focus groups were more vivid than in the utilitarian or control focus groups. Thus, visualization enhances the toolkit’s support for users to be creative and articulate their preferences. Several statements of the subjects underline this: “The pictures helped in getting a clear understanding and imagination of the car”; “One can clearly grasp and understand the options. This supports in confidentially and quickly deciding for the best option.” Participants using a utilitarian or control toolkit were more frustrated and in a more negative mood than participants that used the hedonic toolkit: “The missing visualization made the customization process very tedious and very abstract. There were no playful elements.”

Regarding the aspects of the customization process or the design elements of the toolkits that made the product design activity most enjoyable, we clearly identified visualization as a driver of fun, interactivity, and playfulness, while the type of product attributes had no influence. Some participants favored the design of the visual car attributes, and others most enjoyed designing functional attributes of the car. This was independent of gender, but rather influenced by personal preferences and expertise: “I am a very functional person. Therefore, the customization of the functional attributes was more interesting and meaningful to me. I do not care about the car’s color”; “For me it was most interesting to select the extras and the engine. But that might be a personal thing”; “Customization of the exterior, color etc. was most satisfying for me, although there was no visualization.”
### Table 2. Toolkit design elements and caused emotional reactions and perceptions

<table>
<thead>
<tr>
<th>Toolkit design element</th>
<th>Implication</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualization (instant visual feedback, pictures)</td>
<td>Perception</td>
<td>Realistic product understanding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Clarity, transparency</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Imagination</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Outcome directly visible and assessable, trial-and-error</td>
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<td></td>
<td></td>
<td>Decision support</td>
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<tr>
<td></td>
<td></td>
<td>Emotion</td>
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<tr>
<td></td>
<td></td>
<td>Satisfaction, uncertainty, ambiguity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aversion</td>
</tr>
<tr>
<td>3D visualization</td>
<td>Perception</td>
<td>Realistic product understanding, involving</td>
</tr>
<tr>
<td>360-degree view</td>
<td>Perception</td>
<td>Realistic product understanding</td>
</tr>
<tr>
<td>Video</td>
<td>Perception</td>
<td>Virtual experience of the product</td>
</tr>
<tr>
<td>Animation</td>
<td>Perception</td>
<td>Virtual experience of the product</td>
</tr>
<tr>
<td>Backgrounds</td>
<td>Emotion</td>
<td>Fun, enjoyment</td>
</tr>
<tr>
<td>Multi-sensory: sounds</td>
<td>Perception</td>
<td>Virtual experience of the product, product understanding</td>
</tr>
<tr>
<td>Utilitarian design element</td>
<td>Implication</td>
<td>Illustrative quote</td>
</tr>
<tr>
<td>Detailed information</td>
<td>Perception</td>
<td>Clarity, transparency</td>
</tr>
<tr>
<td></td>
<td>Perception</td>
<td>Need for learning, intellectual stimulation, product understanding</td>
</tr>
<tr>
<td></td>
<td>Perception</td>
<td>Decision support</td>
</tr>
<tr>
<td>Information overload</td>
<td>Perception</td>
<td>Information overload</td>
</tr>
<tr>
<td>Information presentation format</td>
<td>Perception</td>
<td>Decision support, exhausting, boring</td>
</tr>
<tr>
<td>Comparison</td>
<td>Emotion</td>
<td>Playful</td>
</tr>
<tr>
<td>Solution space</td>
<td>Emotion</td>
<td>Annoying, depressing</td>
</tr>
<tr>
<td>Customer profile, pre-configurations</td>
<td>Perception</td>
<td>Decision support, ease of use</td>
</tr>
<tr>
<td></td>
<td>Perception</td>
<td>It would be nice if the system asks - Are you a frequent car driver? [...] - In order to create a buyer profile and then provide a preconfigured car, or different suitable preconfigured options.”</td>
</tr>
<tr>
<td>Emotional bonds</td>
<td>Perception</td>
<td>Trade-off, trial-and-error process</td>
</tr>
<tr>
<td>Costs</td>
<td>Emotion</td>
<td>Fun, playfulness, mental stimulation, challenge</td>
</tr>
<tr>
<td></td>
<td>Frustration</td>
<td>“I would like to specify the budget I have, e.g. [...] Based on this input, the system can exclude too expensive options. This avoids frustration due to unaffordable options.”</td>
</tr>
<tr>
<td>Specify price limit</td>
<td>Perception</td>
<td>Decision support</td>
</tr>
<tr>
<td>3D printer</td>
<td>Perception</td>
<td>Product understanding, decision support</td>
</tr>
<tr>
<td>Save and export</td>
<td>Perception</td>
<td>Social feedback</td>
</tr>
<tr>
<td>Access to contact persons, retailers</td>
<td>Perception</td>
<td>Social feedback, professional support and feedback, considerate decision-making</td>
</tr>
<tr>
<td>System slow page loading</td>
<td>Emotion</td>
<td>Frustration</td>
</tr>
</tbody>
</table>
Another important factor influencing enjoyment of the product design activity is functionality, smoothly running systems, and fast page loading. We randomly provided some participants with a toolkit requiring longer page loading times. Therefore, the selection of an option was not immediately visualized, which was negatively evaluated by the toolkit users: “It took quite some time to load pages and the selection of the options did not work immediately. That was very frustrating.” Table 2 summarizes the identified toolkit design elements, and the emotional reactions and perceptions they caused in our study.

5. Discussion

In the following we discuss our findings with regard to the five layers of the model “The elements of user experience” by Garrett [18] to illustrate the relevance and implementation of our findings for designers. The model is targeted for the design of websites, but is also applicable for other technical products. It consists of the five layers strategy, scope, structure, skeleton, and surface [17, 18].

The strategy, the foundation of every user experience, takes business goals and user needs into consideration [17, 18]. According to our focus groups, user needs satisfied by using toolkits are the acquisition of product-related information, information about the state of the art, customization of a product for fun, and purchase of a unique, self-designed product.

In the next layer “scope”, functional specifications and content requirements of the system are derived from user needs and business goals [17, 18]. In the underlying research, these requirements define 1) the type of toolkit to be designed, 2) the corresponding selection of toolkit design elements, 3) the design of the solution space, and 4) the design of the module library.

Based on the user segment targeted or the resource constraints (e.g., time, budget) faced by the company, the toolkits can be designed as a utilitarian toolkit, a hedonic toolkit, or a hybrid toolkit including both hedonic and utilitarian design elements. Further, the solution space can be designed from small to large. Based on our qualitative research, there are different preferences of individuals to design functional or visual product attributes. Thus, the solution space of a toolkit should be adapted to the user’s individual preferences. To this end, a hierarchically structured solution space can be implemented: Such a solution space firstly asks the user to select the model of the product, then requires the user to customize some mandatory (functional and visual) product attributes, and then asks if the user wants to customize some more optional (functional and visual) product attributes. Further, to support the product design task the module library should provide pre-configured products, information on frequently selected options, or examples for product configurations ordered by other users based on the user’s characteristics (e.g., demographics).

The “structure” refers to the user’s navigation through the website. Here, designers need to arrange information so that people can understand and use it. Decisions on the structure level need to consider how the user thinks and processes information [17, 18]. We found that detailed information enhances transparency and clearness of the options that can be selected, supports users in selecting the “best” option, and satisfies users’ needs for learning, and mental stimulation. However, this information needs to be presented in an adequate amount and structure. Unstructured information increases perceived complexity; too much information can overwhelm users leading to feelings of frustration [21]. Thus, toolkits should provide basic information (e.g., advantages, disadvantages, costs) on the options that can be selected for the different functional and visual product attributes. This information should be presented with bullet points not as a running text to satisfy users’ utilitarian needs for product-related information acquisition and to assist toolkit users in absorbing relevant information for self-designing products. Information can also be provided in a drill down structure that offers further information for interested users without overwhelming other users. Further, information should be complemented with pictures and advanced visualization techniques to further illustrate the functionality of options. Additionally, sliders to allow users to interactively evaluate the effect of options on the price can be used. In addition to information provided by the toolkit itself (intrinsic cues), links to external websites providing additional information, blogs, discussion boards or user communities (extrinsic cues) should be provided to support user in successfully customizing products. This adds a social and collaborative aspect to the product design task.

The layer “skeleton” refers to the selection and arrangement of elements and controls (e.g., text input fields, boxes) the user will interact with. In terms of designing toolkits, the skeleton needs to clearly communicate choices available, and it needs to help the user to access relevant information of his or her choice [17, 18]. Based on our focus groups, toolkit users desire a progress bar on the top of the website, an overview on what has already been designed and selected and what still needs to be designed
somewhere on the edge of the screen (e.g., on the left), and information on how selections influence the price of the product (e.g., on the bottom). Further, information should only be shown if requested by the user by clicking on an information button. It needs to be noted that particularly the utilitarian and control focus group participants asked for a progress bar as well as an introduction to the toolkit, the product attributes, and the solution space. A reason may be a negative effect of the utilitarian and control toolkit design on a flow or playful experience. In a flow or playful experience, individuals are fully absorbed into their task and forget about time and place [32]. Thus, while the hedonic toolkit users enjoy the product design activity and are more likely to experience flow and playfulness, they are not interested about their customization progress.

Finally, the most concrete layer “surface” describes how the design supports the user and its sensory experience [17, 18]. In our qualitative research, we identified toolkit design elements and analyzed their implications on users’ emotional reactions and perceptions. Based on our focus groups, both hedonic and utilitarian toolkit design elements can positively influence users’ emotions (e.g., enjoyment) and perceptions (e.g., realistic product understanding, decision support). For instance, we found that visualization makes the product more tangible and helps users in getting a better understanding of the product. It needs to be noted that toolkit users prefer real-life pictures or videos instead of computer-based animations and imitations. When visualization was not present the participants of our study reported uncertainty and ambiguity concerning the options and their overall product configuration. They struggled in getting a realistic product understanding, being creative, and selecting options that suit their preferences best.

6. Conclusion

In our qualitative research, we identified toolkit design elements and their implications on users’ emotional reactions and perceptions. This allows companies to apply toolkit design elements as a means to purposefully create and manage user experience.

We acknowledge that there are several limitations to our study. This study was conducted with students. Therefore, future research might replicate the study with other participants. Further, this study focused on the customization of a car, which presents a relatively expensive type of product. We found that users expect rich toolkit designs including innovative technologies especially for the design of expensive products. Moreover, the design of expensive products can cause huge price differences between the standard product and the customized product, which in turn may result in feelings of frustration. In addition, the willingness to customize and buy such expensive products online might be smaller compared to more affordable products. Thus, future research should study the appropriateness of toolkit design elements with regard to the price category of the product. Further, our analysis was based on 15 focus groups (64 participants). Given this qualitative, explorative approach, this research is only a first step to understand toolkit design elements and their implications (emotions, perceptions).

Our research has implications to theory and practice. Existing studies propose rather generic design elements including a trial-and-error process or an appropriate solution space [11, 12, 20]. We contribute to mass customization literature by providing an extended list of toolkit design elements and guidance on appropriate toolkit design based on users’ emotional reactions and perceptions. Additionally, we broaden the body of knowledge by applying the concept of user experience to mass customization research. The findings of our research are also relevant for the design of other customer integration methods including lead user workshops, conjoint analysis, idea competitions, or idea communities. As our control focus groups show, customer integration methods can be designed in a way that hinders creativity. Thus, with our qualitative research we advance general understanding concerning the design of appropriate customer integration methods.

Existing user experience research primarily investigates user experience in terms of its effect on users' emotions, perception of the system (e.g., ease of use, usability), and the relationship between the user and the company (e.g., loyalty). We contribute to user experience research by including users' perceptions of a system in terms of tool support, decision support, and transparency as implications of positive user experience.

From a practical perspective, our research yields insights on the design of appropriate toolkits. We identify visualization as an important design element. It supports users in getting a realistic product understanding, in evaluating and selecting options, and articulating their preferences. Most importantly visualization leads to positive emotions and experiences, which are crucial to keep toolkit users engaged.
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7. References