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Understanding User Customization Needs: Requirements for an Augmented Reality Lamp Customization Tool

Abstract

Nowadays, people are willing to pay for personalized items that satisfy their preferences and distinguish them. Previous work has provided generic customization tool design guidelines. User requirements were gathered for the design of an Augmented Reality (AR) application for lamp customization in context. These are required to define a product configurator that allows users to meet their specific needs. The results of three user studies show that customers' needs are preference fit, inspiration and help; freedom and support during the customization process; and trustworthy visualizations.

Keywords

User research; user needs; product customization

1. Introduction

Small-scale, decentralized and personal production processes are becoming highly valued. Willingness to pay is higher for self-designed products than for standard products. Customers perceive the value of self-design products as higher when they meet their preference system (preference fit) [1]. To ensure the delivery of personalized products with high preference fit, users must have access to customization tools. Albeit rich, previous work's guidelines for customization are generic and insufficient to design customization tools for specific product cases. This work focuses on understanding user needs for the design of a lamp customization tool for citizens who have growth, experience, success, materialism, and enjoyment as core values. Our main goal is to define the requirements for a customization tool of self-designed lamps by (1) exploring user needs and customizable attributes; (2) prioritizing and selecting a set of attributes and needs to define requirements for a lamp customization tool; and (3) proposing a design to cover these requirements. User requirements were drawn from four sources. A Literature Review (LR) provided general requirements. Contextual Inquiries (CI) explored users' thoughts and interests on customizing products. A participatory study (Co-constructing Stories, CCS) gained more insights into the customization process of lamps in particular. Next, a Survey (S) was conducted to prioritize user needs and to define a final set of requirements. Finally, a design of a customization tool using these requirements is presented.

2. Literature review

Consumers are willing to pay extra for products that they have customized according to their preferences [1]. The added value of customization can be explained with the Ikea effect [2]. However, the effort put into the customization process alone does not increase the

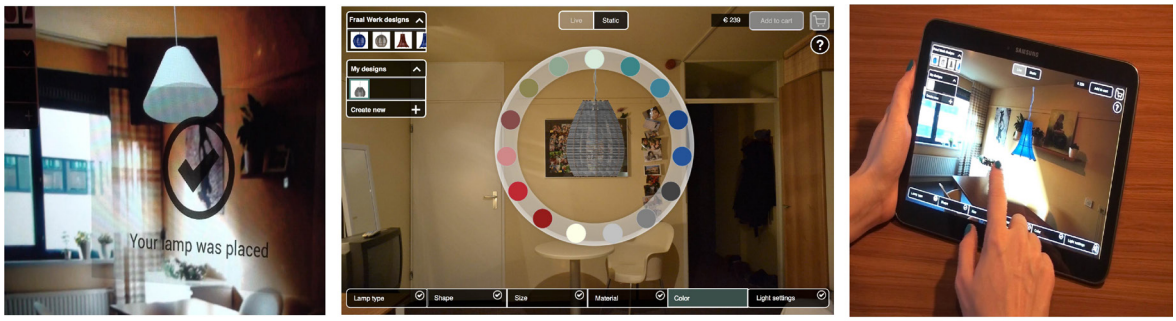

Fig. 1. A mockup of an Augmented Reality (AR) customization tool design providing different starting points, a limited set of customizable attributes, and increasingly realistic visualizations.

perceived product value. An enjoyable customization process and a high preference fit are required as well to result in a higher subjective product value when using mass-customization toolkits [1]. Product customization requires consumers to build their own product. The difficulty of decision-making increases as the number of alternatives and attributes increases, if a specific attribute is difficult to process, or if there is uncertainty about the values of attributes [3]. Considering too many options can lead to decision-making errors because there is too much to decide [4]. An optimal limit of options was found to be six when choosing among gourmet jams and chocolates [5]. Dysfunctional effects of information overload emerge with ten or more alternatives when choosing houses [6]. The order of attribute presentation is also influential. When attributes with relatively few options follow attributes with relatively many options people are more likely to accept default options in the context of custom-made suits and automobile choice [7]. The perceived comfort and preference fit increase with the user's expertise in the context of consumer laptop computers [8]. Not all customers are interested in fully exploiting the potential of customization. Hence, several initial designs should be provided as starting points [8]. By their very nature, customized products are likely to be unique. This makes it difficult for consumers to anticipate their post-purchase experience [8]. Additionally, several product attributes can be intangible which makes it hard to show or explain them on a screen. Also, the context in which the products are presented is important. Because of this, AR systems overall satisfaction is higher than when using traditional e-commerce stores [9].

3. User Studies

3.1 Methods

Participants. 12 volunteers (25-66 yo, 3 designers) visiting, buying, or selling products that could be customized during the Dutch Design Week participated in the CI. 10 volunteers (5 female, 5 novices) participated in the CCS. 29 participants completed the Survey (12 male, Mean = 28.29 yo, SD = 2.49). Detailed protocols are available in [10].

Procedure CI. We observed attendants and inquired about people's preference to customize products and their previous experiences with it. Additionally, designers were asked whether they usually set design limitations for users in the customization process and why.

Procedure CCS. In the sensitizing part, questions about previous experiences choosing and buying lamps and ideas about lamp customization were asked. In the elaboration task, participants were asked to design their own lamp while thinking-aloud. Diverse materials and tools were provided to inspire participants and to enable the observation of the participants' use or interest in (1) different levels of abstraction; (2) prototyping and visualization of tangible and non-tangible tools; and (3) possible lamp attributes. Participants used both lo-fi and hi-fi prototyping tools or a combination of both. For example, participants would draw the shape of their lamp on paper and use a real fabric to explain the material. Also, the attributes or needs mentioned by the participants and the levels of abstraction of the tools and their tangibility was registered.

Procedure Survey. 19 customization aspects elicited in the CCS were rated in random order on a 5-point Likert scale (5: extremely useful).

3.2 Results and discussion

The contextual inquiry confirmed several customization requirements suggested by the literature. Most participants value the concept of customization, but they still find having a competitive price crucial. People valued the customization of both functionality and style. Style features should promote uniqueness and creativity. Already made products should be also available. Visualizations of the products should provide accurate feedback to let the user see the impact of every choice on the final product. People care about the quality of the end product, so they often seek advice from experts and they value their personal connection with them. *"You need skills, if you cannot visualize it, the disappointment could be big."* - Garment customization designer 1

In the co-constructing stories sessions we observed that trustworthy, full and realistic impressions about the product should include light effects. Decisions on the customization of technical parts of the lamp and other functionalities should be made by an expert. Moreover, users know what they do not want, but they are not certain about what they actually want. Thus, examples are useful to imagine the final product. Additionally, support in the decision-making process is required, by providing a good overview over all the options and allowing comparison of different products. Next, users should be able to iterate and decide the order they want to follow by themselves. They should also choose from a starting point: from scratch, from a basic model, or from a pre-designed alternative. A summary of the obtained requirements is shown in Table 1.

The survey ratings of each customization variable were ranked in order of importance. The top needs and attributes were the beauty of the product, the type of the lamp, the purpose of the lamp, the type of light, the fact that the lamp matches the interior, and price. These are mainly need-based attributes. This is probably because the respondents were novices [13]. Nevertheless, to support expert users as well, these need to be translated to parameter-based customization variables. Therefore, we suggest to use lamp shape, color, material, and lamp dimensions as parameters that can contribute to create a combination that can be beautiful for each particular user.

General requirement	Description	Source
Limited options at a time	Between 6 and 11 options at a time.	LR, CI
Different starting points for different users	(1) scratch or free-form interface; (2) a model or combined configuration; and (3) a pre-designed alternative.	LR, CI
Trustworthy visualizations in context	Increasingly richer, realistic visualizations in context to let the user understand the final outcome.	LR, CI, CCS
Overview of the options for decision-making support	Side-by-side comparison of saved configurations and their characteristics.	CCS
Price and value	Price visible to account for every change.	CI, S
Customer-designer relationship support	A designer or expert should be available to guide or advise the customer.	CCS
Post-editing and iteration possibility	Iterations in the design process, bookmarks, and going back to previous designs.	CCS

Table 1. Final user requirements. The sources are LR: Literature Review, CI: Contextual Inquiry, CCS: Co-Constructing Stories, S: Survey

4. From requirements to design

The user requirements can be directly translated into design elements in an AR customization application. First, AR allows to place and show the product in context. A 3D model of the lamp can be placed and visualized in the desired room position (Fig. 1 (a)). The realism of the 3D model can be increased as the user selects the desired attributes. However, the final visualization should be trustworthy and exactly represent the product they are going to receive. Second, multiple starting points should be provided for different types of users. Users can explore pre-designed lamps or start from scratch with their own design. Additionally, tips on each customizable attribute

could be shown to provide support to the user. Users can change each attribute in the order they like and go back and forth. However, the set of customizable attributes should be limited each time. In the example shown in Fig. 1 (b), there are only six customizable attributes: shape, size, material, color, and light settings. After selecting one of them, only few options for that attribute are shown around the lamp 3D model. Finally, it is important to prevent fatigue when using AR. Therefore, users should always be able to switch from a Static- to Live-view. The Live-view provides real time visualization of the lamp in AR, allowing the user to see different lamp perspectives. The Static-view shows a picture representing one particular view of the room as a background for the lamp customization (Fig. 1 (c)).

5. Conclusion

This work defined a set of relevant requirements of user needs for an AR lamp customization tool. These requirements are (1) inspiration and help; (2) freedom and support during the customization process; and (3) trustworthy visualizations. From the broad and generic guidelines available, the methods applied enabled us to specify a set of concrete attributes and needs to meet user needs when customizing lamps in context using Augmented Reality. Such methods and techniques can also be used to define specifications for other types of products.

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