Online User Reviews as a Design Resource

Bokyung Lee, KAIST, South Korea, boing222@kaist.ac.kr
Froukje Sleeswijk Visser, TU Delft, Netherlands, F.SleeswijkVisser@tudelft.nl
Daniel Saakes, KAIST, South Korea, saakes@kaist.ac.kr

Abstract

User-centered design processes are comprised of several methods and are deployed to gain insights about user needs and experiences. Many of these methodologies require qualitative studies with small groups of users based on set guidelines and are time and resource intensive. In this paper, we propose a new technique, termed User Review Analysis, which makes use of big data to uncover user needs. The technique involves collecting and analyzing online User Reviews on shopping sites such as Amazon.com. The basic idea is that due to the fast and cyclic nature of consumer product development, reviews of Today's products inform designers on the next product generation. As the data is based on actual product-use experience with similar products, the aggregated insights provide product-in-use experience and brings to light several product design aspects and complement the existing methods.

user reviews; user-centered design method; product experience

Currently, the relationship between designers and users is rapidly becoming closer (Sanders & Stappers, 2008). In the past, industrial designers were focused on developing physical objects and considered users as customers. However, with User-Centered Design, the perspective towards users changed from passive consumers to experts of their own experiences (Sanders, 2002). User Experience (UX) is defined as "a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service" according to ISO 9241-110:2010 (clause 2.15). Kujala (2009) argues that since UX offers information about user interactions with certain products, it should be considered from the start of the design process. Not only when to use the UX is important, but also how to use the UX within the process should be addressed. According to Sleeswijk Visser (2009), the product being studied only plays a minor role in the experiences of people in their everyday lives. People's experiences and interactions with a product are governed by the underlying situation and the context in which the product is used. Therefore, she suggests studying the "context of product use," which provides a more realistic perspective on user experiences from a holistic point of view. Analyzing user-generated contents including narratives,

comments, pictures and other activity results, is a key means of understanding the user's context (Olsson & Salo, 2012; Korhonen et al., 2010). Some of the more well-known techniques conducted at the fuzzy front end of the design process are Focus Groups, Contextual Inquiries, Interviews and Contextmapping (Visser et al., 2005). These methods all support designers by providing information and inspirations for new products.

Although these methods are considered to be essential during product design and are commonly applied, they come with several limitations. Most of these methods require controlled environments, willing volunteers, copious amount of time, and a generous budget (Opdenakker, 2006). For research teams on a budget, these constraints unavoidably lead them to conduct their studies with a non-representative and insufficient subject pool. A lack of the general applicability of their datasets can often lead to skewed information. However, the ongoing advances in information technology and online social platforms open new avenues for such user-generated experience data gathering.

In the last few years, online shopping has become immensely popular, as have online reviews (UR), where people review and discuss merchandise online (Chen & Xie, 2008). These online reviews (UR) are a rich pool of data, including both positive and negative product experiences with existing products (Zhu & Zhang, 2010; Hennig-Thurau et al., 2004; Stauss, 2000; Schlosser, 2011). Hedegaard & Simonsen (2013) argue that User Reviews contain a significant amount of usability and UX data. Although their findings imply the existence of UX data within the User Reviews, they have not explored how the data can be used as a design resource. On the other hand, Van Kuijk et al. (2007) indicates that after sales feedback offers great potential for gaining insight into real-world product usage and usability issues, and argues to use those data for ergonomics designs. As User Reviews are, in essence, a type of after-sales feedback, combining the results of the aforementioned studies suggests a way to view User Reviews as a viable source of information in the design process.

In this paper, we investigate the practical usage of User Reviews during the design process and propose a new technique, which is termed: User Review Analysis (URA). We focus on how designers can use User Reviews for the design of the next iteration of a product within a certain category (e.g., a new handbag), and how information distilled from User Reviews can complement other user research methods. Although any large data repository of User Reviews can be used, Amazon was selected in this study, and products from a few categories on the website were analyzed. Workshops with design experts were undertaken to study the influence of User Reviews in the design process. Finally, the value of User Reviews as user-generated data and the insights gained from the workshops are presented and discussed.

User Review Analysis Study

We analyzed User Reviews to extract the 'Experience of product-in-use' to confirm that they contain valuable information to inform the design process. We selected four product

categories: bags, bicycles, shoes and curtains, all having both aesthetic and functional considerations. We demonstrate our method with bags, with the other products summarized in Figure 3. Seven office bags (Figure 1) were selected on Amazon.com. For these bags, we sampled 2485 reviews on May 6, 2014, from 16:00 to 18:00 using the filtering function of 'most helpful reviews.' Each review was split into sentences manually and written down on different cards. To trace the reference product of the quotes, we used differently colored cards for different bags, as shown in Figure 2.
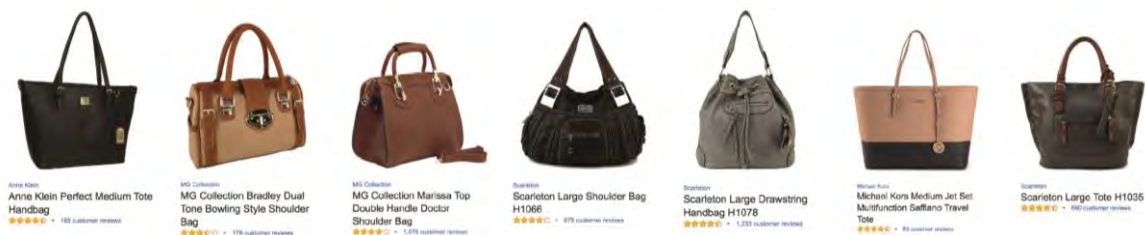

Figure 1: Bags selected for the study

Affinity Diagramming was used for the analysis procedure, allowing the evaluators to categorize the cards into groups that were perceived to be a coherent informative unit (Figure 2). While the method used by Hedegaard & Simonsen (2013) only focuses on measuring the existence of UX in User Reviews, our goal is to analyze the crux of the matter mentioned in each User Reviews and interpret the meaning. This explains why we used an open-ended analysis method such as affinity diagramming. Seven design students performed this process individually and created their groups. The participants' samples were compared and regrouped by the authors using our own terminology.
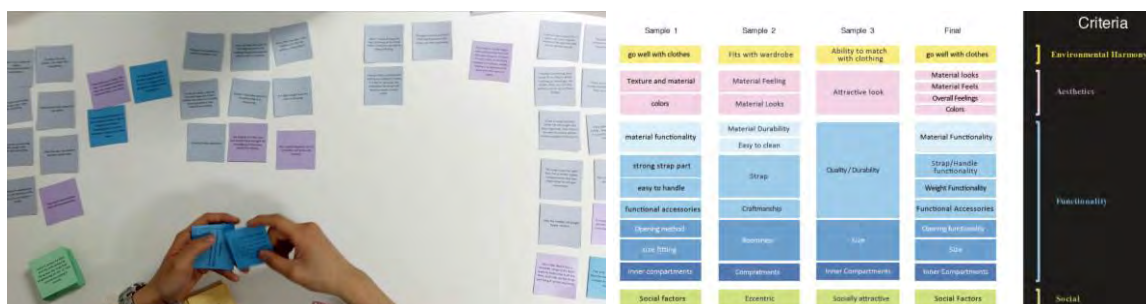

Figure 2: User Review Analysis: Categorization (on the left), result comparison process (on the right)

Results

Most of the reviews focused not on the users' holistic contexts but on specific experiences with the product's different features (e.g. material functionality, colors, size, straps) that are best described as "design aspects." From the results, 13 factors emerged, as shown in Table 1, in the column "design aspects."

Table 1: Result of User Review Analysis Study for Bags

Criteria	Design Aspects	Review Examples
Environmental Harmony	Harmony with Wardrobe	*"It is very simple and elegant, for the corporate look that I was looking for"*
Aesthetics	Material Looks	*"Doesn't look fake and isn't too shiny."*
	Overall Feelings	*"It's classy in appearance, but it's not formal..."*
	Colors	*"I was worried the color of this bag would end up looking cheap/gaudy..."*
Functionality	Material Feels	*It is soft as butter..."*
	Material Functionality	*Easy to clean even though the surface has a slight woven texture."*
	Functional Accessories	*"...No zip to the top."*
	Opening Functionality	*"It is good quality, but the opening is narrow."*
	Size	*"I was able to store almost everything I needed... enough room for a small water bottle."*
	Strap/Handle Functionality	*"Feels very durable-strong handles..."*
	Weight Functionality	*"Light weight, comfortable and handy."*
	Inner Compartments	*"Enough compartments to easily find my stuff. Handy inside pockets."*
Social	Eccentric factor	*"You can attract more attention than you wanted..(icebreaking)."*

At a glance, the resulting groups appear to relate to four overarching criteria, labeled here as: Environmental Harmony, Aesthetics, Functionality, and Social. The Environmental criteria cover aspects that are related to other products or spaces, such as harmony with the wardrobe, which shows that User Reviews contain slight amounts of contextual information *("It's classy in appearance, but it's not formal so I can take it to any place or event")*. The material looks, feel, color and overall feelings can be combined into the Aesthetic criteria to represent the appearance of the bags in question *("Just feel like fake. The leather just like the plastics and I don't like it")*. Also, we found considerable functional factors and details about the bags as shown in the table *("I was able to store almost everything I needed…enough room for a small water bottle and iPhone.")*. The Social criteria cover factors about how people think and react to the products *("This item can be a good ice breaking item")*. The initial results (Table 1) show that it is possible to extract design aspects from User Reviews, which provide designers with potentially inspiring information a the new product based on experiences with existing products.

The extracted design aspects of the bags were compared to the other product categories as shown in Figure 3, and the results illustrate different qualities and characteristics of each product category. Interestingly, the design aspects of bicycles were focused predominantly on their functionality, which reminds us that they are performance-centric products. Shoes show a similar configuration with bags, most likely because they are both considered to be a fashion item and a functional item.

	Bag Fashion Item	Curtains Home furnishings	Bicycles Performance Item	Shoes Fashion Item
Environmental Aspectis	go well with clothes	go well with room seasonality		go well with clothes
Aesthetic Aspectis	material looks overall feelings colors	material colors material looks	colors painting quality	colors of shoe colors of shoe lace overall style look
Functional Aspectis	material feelings strap/handle function weight functionality functional accessories opening functionality size inner compartments	fabric thickness material functionality ironing cleaning tie-up easiness size	instruction usability assembly process packaging quality frame handle Bars pedals seats tires gear & chains spokes & rim brakes weight functionality	shoe material shoelace material sole insole shaping insole cushioning fitting & size weight functionality
Social Aspectis	social aspects	social aspects		

Figure 3: Design Aspects for different product groups (bag, curtains, bicycles, and shoes) extracted from User Review Analysis based on Reviews from Amazon.com 7 Bags (2485), 2 curtains (180 reviews), 4 Bicycles (290 reviews) and 3 Shoes (320 reviews)...

Design Workshop with User Reviews

In two ideation sessions with designers, we studied the value of User Reviews to inform the design process for the design of new bags for office ladies. We compared a traditional UCD ideation session to one with the use of User Review data as well.

Method

As a baseline, we prepared User-Centered Experience data obtained from contextual Interviews. The interviews involved two female office employees, who talked about their overall experiences and the holistic contexts surrounding their bags. The data was transcribed and analyzed by the authors and organized into eight Context-Cards to deliver the insight of the participants efficiently, as shown in Figure 4. For the cards, key insight phrases were written at the top, and sample quotes related to each phrase were written at the bottom. To ensure a manageable amount of data, two to five quote-samples were selected by deleting similar quotes for each insight. The User Review data from the handbags was organized on the cards in a similar manner based on the results of earlier research.

We hosted two ideation sessions each with three graduate students of design. All were recruited from the department of industrial design, and all had extensive knowledge of User Experiences, the product design process, and qualitative analysis.

Session A used only the context cards, and Session B used the context cards and the User Review cards together. The sessions were structured as follows: Introduction, data delivery, concept ideation, sketching, and final concept presentation. This one-hour process was videotaped in its entirety. After the design workshop, we interviewed the participants about their design process, and how the given User Reviews were used during the process:

1. Regarding your final concept, what inspired you to develop this concept? What specific things did you consider the most?

2. (Session B) How did you use/organize the User Reviews during the design process, and why?

3. What are your thoughts on the use of User Reviews? Were they useful? Do you think they can be useful?

The interview was done to understand the design direction, design process, and the designer's thoughts to the extent that these were not intuitively noticeable through observation. A comparison of the 'design process', 'designer's discussion flow' and 'final concept' with and without the use of User Reviews allows us to determine the influence of User Reviews during the design cycle.
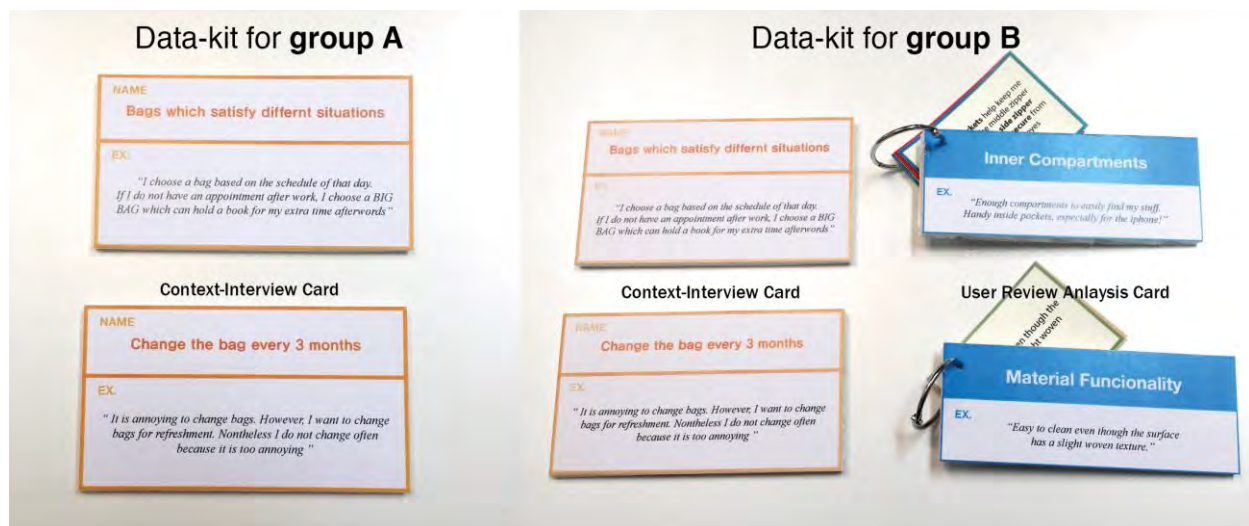

Figure 4: Provided User Data Card for each participant group

Result

Each of the sessions delivered a new bag design concept at the end of the workshop, which was represented as visual sketches with short descriptions (Figure 5). **Session A** led to the design of a bag with a detachable strap such that the user can select the strap based on her taste. The main body of the bag was designed in such a way that the size of the bag could be transformed by selecting which clasp to use when closing the bag. **Session B** introduced a bag with a controllable thickness through the use of a zipper on the lower and side edges. Users could change a large tassel on the side to their liking as a customizable accessory of the bag. Compared to **session A**, **session B** defined the inner structure of the bag, its color, materials, and accessories in more detail. The participants made detailed decisions regarding the size of the inner pocket, the use of zippers on the pockets, the colors of the zippers, and the materials for each section through thoughtful discussions.
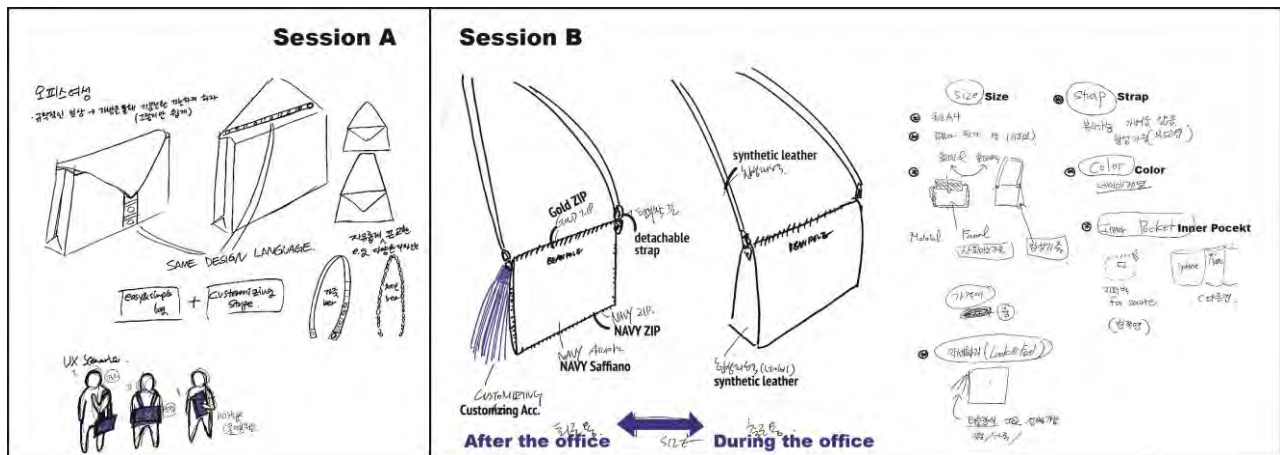
Figure 5: Design Outputs from session A and session B. Session A: A bag the user can change the size and strap type based on their daily feelings. Session B: An ordinary bag that supports functional demands for office workers that can adjust the thickness of the bag or accessories (tassel or strap) to use after work hours.

We reviewed the recorded video clips of the workshops and transcribed all verbal comments and nonverbal behaviors expressed by the participants, labeling noteworthy comments together with the insights they conveyed (as shown in Table 2). We compared the insights from both sessions, to analyze the impact of using User Review Analysis and describe the results in four themes: perceptions of User Reviews, the process of concept ideation, concept detail definitions, and evaluations.

Table 2: Deconstructing the process of design workshop

Time	Comments	P	Insights
50"	"Interview cards are focused on office bag context, but reviews are more concentrated on Aesthetics and functionality. We need to mix appropriately."	B2	Way of matching two data
5'20"	"Let's start talking about size."	B1	Starting from product detail
7'45"	(Pointing out Interview data) This has information about size, but it does not mean that it should be BIG.	B3	Linking context with product detail
10'33"	Office lady who drive her car and the other office who use public transportation might have a big difference.	B3	Persona decision
09'11"	The leather is easy to clean. But if the bag is made of canvas, we have to wash it. Quite annoying. Leather is easy to manage.	B2	Pointing out cleaning situation-detail aspects

Perceptions of User Reviews; Indirect Expression vs. Direct Expression

The review data was referred to with phrases such as 'this functionality part', 'this product aspect', 'aesthetic factors' and 'the product factors that affect people' while the interview data included phrases similar to 'office life', 'what they want', 'the way of they live' and 'their lifestyle.' They tended to use the Interview data to understand the target users' needs by grasping their whole life context and indirectly extrapolating aspects of the product on which to focus. For example, when the user expressed that she wanted to "change her bag once every three months," the participants extrapolated the need for the product to be able to show off a different feel on a regular basis. In contrast, the designers perceived User Reviews as direct indicators that show specific design aspects noticed by users. (i.e., Material Functionality: users interact with material functionality while cleaning their bags.)

User Reviews for the Concept ideation

The designers in both sessions attempted to absorb the holistic context of the user by reading the Interview cards and combining their personal experiences with those contexts. As a result, they defined a persona to represent the target user. The designers in session A selected women who work in offices and who do not take frequent business trips, while in session B they selected female employees who use public transportation. Surprisingly, both sessions resulted in a similar concept of a transformable and customizable office bag.

> A1: "Users want a different bag based on their situation. Maybe, a bag that changes? "
>
> A2: "Yeah, transformable bag design could be a concept!"

Although the basic concept from session B was similar to that of session A, the design process indicates that the User Reviews affected the concept ideation stage. The participants in session B simultaneously considered the design aspects as well as the user's contexts while they developed the concept. For example, although they had an interesting concept resulting from their understanding of the context, they reconsidered it based on the User Reviews.

> B2: "Why not a bag with which the user can change the thickness by folding it?"
>
> B1: "That's also possible, like a paper shopping bag."
>
> B3: "But that does not make sense when we think about material aesthetics. If leather is folded, there would be a crease."

After session B had defined their persona, they started the discussion with the specific design aspects mentioned in the User Reviews, but the discussion smoothly transitioned into a debate regarding the Interview data, which laid the foundation of their concept. This shows that although the User Reviews are more focused on specific product properties, the combination with the Interview Data did not constrain the idea generation process.

> B2: (Picking up the User Review card) "Let's start with the size."
>
> B1: (Pointing to the Interview Card) "There is a point about the size."
>
> B3: "It says, they prefer a bag to be small when they are leaving the office - especially when they have a date after work, but at the same time it also seems weird to bring a small bag to the office in the morning"
>
> B1: "Then, how about a transformable bag that changes size?"

User Reviews for the Concept Details

The designers from session A spent most of their time brainstorming to devise a better concept, and most of the details, such as the strap material or pocket structures, were finalized without deep consideration of any. For instance, they selected leather as their main material because leather looks formal. However, they did not consider how users interact with a leather bag, how easy it is to manage leather, and other related factors.

In contrast, the designers of session B, who were provided with User Review data, discussed concept details at length. The User Reviews contain information about specific design aspects or human-product interactions obtained through actual interactions with existing

solutions. On the other hand, the interview data tells the participants about a specific user's needs and their life. Although the aforementioned data types are expressed with a different focus, the participants noted the relationships between these data and mapped them during the discussion, thus bringing in-depth details.

> B1: "Then, what should the material be?"
>
> B2: "There might be too many things to consider!"
>
> B3: "According to these User Reviews, we not only have to consider the aesthetics but also the functionality of the materials… managing processes. Feelings…ease of cleaning."
>
> B2: (pointing to the Interview Card) "Also, the user wants a practical and conventional bag. This point is also connected to materials. Material functionality, and the material weight are related to the practical use of the bags, and the material color is related to an ordinary bag"
>
> B1: "For an ordinary, day-to-day bag, leather is better, but for aesthetics, Saffiano is better."
>
>
>
> B2: (Pointing to the Interview Card) "It says here that the users additionally put various small pouches into their bags. I think they need more appropriate inner pockets."
>
> B1: "Let's have a look at the inner pocket usage scenario from various people. (reading User Review samples) Most of them put mobile phones into the inner pockets!"
>
> B3: "Also, the User Reviews say that the zipper on the inner pocket gives a reassuring sense of security when putting small valuables in it."
>
> B1: "Then, let's concentrate on the inner pockets that allow the users to use them flexibly based on their purposes."

It is apparent that these two different data types are not mutually exclusive. In more detailed example, a context card (User-Centered Experience) tells that the user prefers a more conventional bag, as it allows them to fit in better to their work environment. The User Reviews used in the workshop corroborated this by expressing one user's approval of a bag for not standing out, referring to the color. These two different data points both contain the same information: conventionality being a need for users. The difference is that the context cards give contextual reasons for such needs, while the User Reviews express in what way the *product's aspects* must be manipulated to satisfy that need. The fact that the two data types are not mutually exclusive could explain why session B engaged in a more in-depth discussion during the workshop process. With both datasets, the session received complementary information that outlined the needs and solutions in multiple focuses with respect to the users' contexts and specific product *aspects*. This can be seen more clearly in the mapping diagram (Figure 6) produced by session B during the workshop. This overall thought process that kept both the users' needs and important product aspects in mind facilitated session B in designing their bag in greater detail.
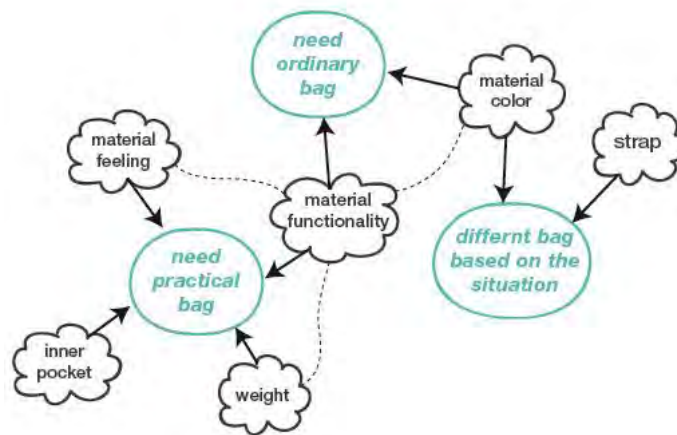
Figure 6: The map, which shows how participants (session B) linked design aspects and user needs during the process

User Reviews at the Evaluation stage

The designers in-session B used the User Reviews as a checklist, with which they evaluated their concept before finalizing it. At the end of their process, one of the members from session B said:

> B1: "Are we done? Didn't we miss anything?"

> B2: "Let's check the factors to see if there's anything we missed."

> B1: "Wow. We didn't intend it, but, fortunately, our final solution meets these product aspects! (pointing to the user review card written as social aspects) Our customizable tassel design will make the users unique, and that can bring out some conversation."

Discussion

The ideation sessions indicate the potential of the method and show that designers benefit by including the process of User Review Analysis in the design process, specifically when used in conjunction with other methods, as its informational characteristics are complementary. However, there are several limitations of this research. This study was performed with only a small amount of data and with a few designers. Future studies are planned to extend our initial results to more product categories with professional design teams in the field.

In this study, we analyzed User Reviews manually, which was a tedious task. Advances in machine learning (Gamon et al., 2005; Kim & Hovy, 2006) and big data indicate the feasibility of applying these technologies in future studies. In this way, larger datasets can be explored, and several categories and repositories could be cross-referenced.

Whereas we focused on physical products in this study, we plan to apply a similar approach to services in the future. For instance, online reviews of accommodation sites such as 'booking.com' could be a good example, as those data also include the experience of the user after using the service. (Vermeulen & Seegers, 2009; O'Mahony & Smyth, 2009) This data would provide service designers with the context in which the shopping service is being used and with information about the directions the service's aspects should take to improve.

User Reviews to inform the design of a next-generation product

Most design processes start with a thorough understanding of existing solutions or past experiences with a target product or a target circumstance. Sleeswijk Visser et al. (2005) states that the design process starts by understanding past experiences, continues by studying what led up to the present circumstance, and ends by making the designer conceptualize a product for the future. The various methods that embody this process are mapped in Figure 7 on the timeline of a typical design cycle.
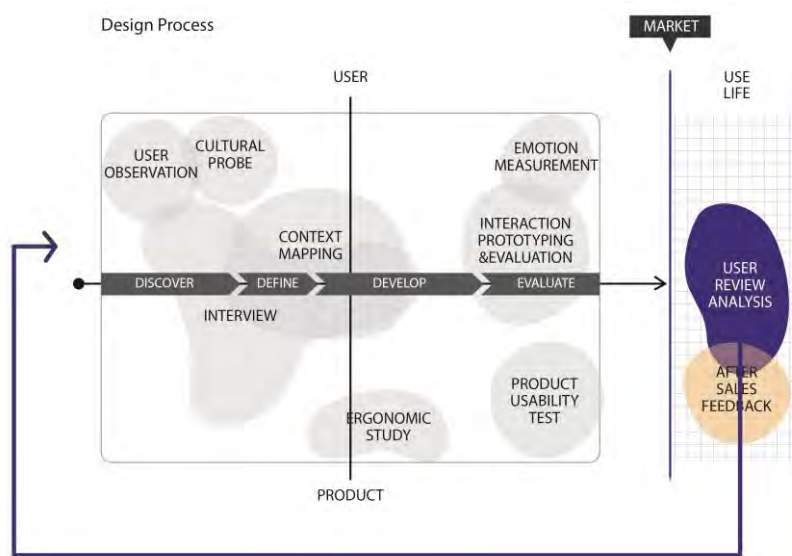

Figure 7: 'User Review Analysis' as input for the fuzzy front end of the design process

The data that is generated after the design cycle ends, and when the product is on the market and used by the users, are is currently an untapped resource. Online User Reviews, 'after-sales feedback' and 'after service surveys' offer experience data about a product's use, which would be useful for developing the next generation of that product. Just as after-sales feedback data could be used to determine usability issues or the ergonomics of a design (Kuijk et al., 2007), we argue that User Reviews can be used to understand multiple users' views on a product and provide a complementary resource at the start of the design process. Because such User Reviews are suggestions about the outcome of the design cycle, starting another design cycle with this experiential data in mind could lead to the development of a more improved design.

User Reviews as a Design Resource

Our results confirm that the findings of Hedegaard & Simonsen, who showed that User Reviews include notable amounts of User Experience data. However, our findings indicate that in order to understand User Reviews as a design resource, we need to distinguish two perspectives on user experiences: User-Centered Experience and Product-Centered Experience.

Popular methods in design, such as Focus Groups and Contextmapping, consider *User-Centered Experience* and focus on the user, as depicted Figure 7a. Designers use these methods to gain a better understanding of user contexts by empathizing with the users. For instance, if a home-cook was to be studied to design a new cutting board, one may find that he or she often cuts the ingredients on the cutting board and has difficulties transferring all of the ingredients into a pot. This not only demonstrates this user's interactions with the cutting board, but also with the pot and the kitchen environment, possibly resulting in a product shown in Figure 8b.

On the other hand, User Reviews are a type of *Product-Centered Experience* data, putting the product in the center (Figure 8c), with the product usage experience information from various users is integrated together (Figure 8c). Detailed information about the user or their context is not explicitly communicated, but more specific and in-depth interaction with the product can be extracted. Consider again the home-cook problem; people may complain about the constant smell of fish on the cutting boards or express other general concerns about hygiene, which could be indicated through User Reviews and lead to a redesign, as shown in Figure 8d.

a) User-Centered Experience   b) Chop2Pot cutting board   c) Product-Centered Experience   d) Index Cutting Board
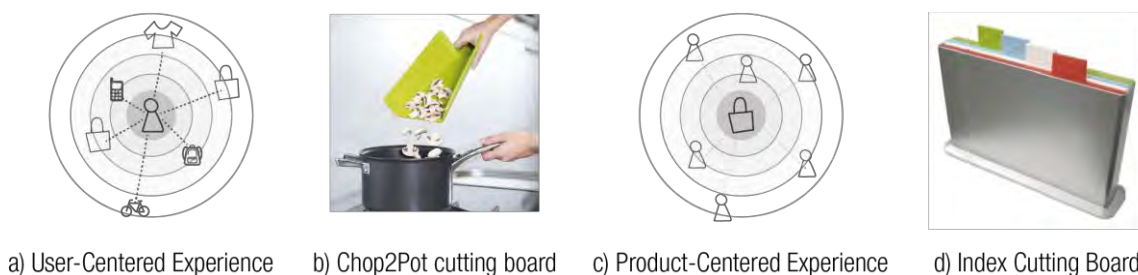
Figure 8: Concept of User-Centered Experience & Product-Centered Experience

The unique perspective of the User Reviews and the fact that they are readily available as a resource makes them valuable during the early stages of concept development. However, there are a few limitations that need to be considered when applying User Reviews as a design resource. Compared to qualitative studies such as focus groups, it is difficult to retrieve information on the demographics of review populations, as online resources usually hide personal information. Additionally, online stores, such as Amazon target consumers worldwide, making user review data both culturally and socially diverse. For instance, when preparing the sessions we noted that User Reviews discuss the need for a bag to hold A4 documents or a laptop. This was in contrast with what we learned from the interviews, i.e., office workers in Asia do not regularly bring documents home. This may well be a cultural difference between office workers from the east and west, hence, when User Reviews are presented in conjunction with other sources, such differences would become apparent.

User Reviews may also be fabricated. As more people are becoming dependent on reviews while shopping, sellers are starting to hire users to write attractive reviews, regardless of the truth. In addition, some markets provide extra coupons or mileage to those who leave User

Reviews after a purchase as a reward for giving helpful information to other customers who are deciding on their purchases. To date, a reliable way to discern these reviews has not been proposed.

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