Evaluating User Experience in Product Development Process

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ABSTRACT--- *Chinese parents have been increasingly concerned about the quality of their children's product. Due to the popularity of parent-child travel, the demand of children's luggage is also increasing, and parents have higher requirements and expectations for children's luggage. User experience (UX) evaluation can ensure high-quality UX of children's luggage. However, the methods for evaluating UX in the product development process are still inadequate. Therefore, there is a need to originate a method to evaluate UX of children's luggage in order to enhance the quality of children's luggage. An Experience Map was created to evaluate the UX of children's luggage. Using the map, a total of 12 UXs of children's luggage was identified. Then, a survey was conducted to evaluate the 12 UXs of children's luggage. Finally, a strategic decision was made to enhance the quality of children's luggage. The main contribution of this study was to provide a user experience evaluation method (UXEM) for children's luggage.*

Keywords--- *User Experience Evaluation, Product Development Process, Experience Map, Children's Luggage.*

I. INTRODUCTION

According to the 2019 China Big Data and Benchmarking Cases of the Global Tourism Industry Survey Report conducted by iiMedia, the scale of parent-child travel has gradually expanded in China since 2014, causing children's luggage to be segregated by the luggage enterprise because children's luggage is a highly connected parent-child travel commodity. Because parent-child travel in China has been seen as a second mode for children's education, children's luggage can be an educational tool such as a school bag to help children grow and learn during the travel. However, the sales of children's luggage were very low based on CBNData's 2019 Tmall Luggage Industry Trend Report. The report shows that the Tmall online store's sales of small-sized luggage accounted for less than 5 percent of all luggage in 2019. This means the child has to buy a piece of luggage but the parents have no intention of buying the children's luggage. This means that the child needs to buy a piece of luggage, but the parents have no intention to buy the luggage for the child. This situation would hinder the development of the children's luggage industry.

Zhang et al. (2017) stated that in the context of the rapid development of information technologies and manufacturing technologies, users have an important role to play in creating an efficient product in the product development process. Moreover, Obrist et al. (2009) indicated high-quality user experience (UX) in mature consumer

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markets has become a key strategic consideration for product development. Therefore, evaluating the UX of children's luggage is required in children's luggage development. However, an available user experience evaluation methods (UXEMs) endorsed by most of the researchers is missing because of the lack of agreement on the requirements of UX (Vermeeren et al., 2010). Therefore, this study aims to explore the essential characteristics of UXEM and originate a method to evaluate UX of children's luggage in order to enhance the quality of children's luggage.

II. METHODOLOGY

This study explores the requirements of UXEM based on the previous researches and finds that the Experience Map can be used as a tool for evaluating the UX of children's luggage. Then, an Experience Map of children's luggage was created to evaluate the UX of children's luggage and deployed in three different contexts:

1. Finding UX categories of children's luggage by building a user journey.
2. Conducting a survey to obtain consensus for all UX categories of children's luggage on a five-point scale, and quantifying the evaluation results by quantitative analysis. The total sample consists of 106 parents in China who have children aged 6-12.
3. Making strategic decisions according to the evaluation results.

III. CURRENT VIEWS ON USER EXPERIENCE (UX) AND USER EXPERIENCE EVALUATION (UXE)

1) User Experience (UX) and User Experience Evaluation (UXE)

The term user experience (UX) emerged in the industry and is now a term that is commonly used in academia. According to ISO 9241-110:2010, 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. As UX research provides a new viewpoint on user-oriented perception of interactive product quality, many previous researchers from various disciplines and backgrounds have been contributing to the UX field over the last 10 years (Mahlke, 2008). Law et al. (2009) have sorted out agreements of 275 respondents on the statements of UX, finally, Vermeeren et al. (2010) stated user experience explores how a person feels about using a product, i.e., the experiential, affective, meaningful and valuable aspects of product use.

Since UX is very context-dependent, UXE should not be carried out solely by examining the completion of the user's task in a laboratory study, but a wider range of considerations must be taken into account (Roto et al., 2009). UXE aims to help choose the best design, to make sure the implementation is on the right track or to determine whether the final product meets the original UX goals (Vermeeren et al., 2010). "Product development process" is a common term in industrial design, as it is recognised as a key element for ensuring long-term organizational success and sustainability (Seram et al., 2016). Because the growing and changing base of users shifts the parameters of demand for interactive products (Hassenzahl & Tractinsky, 2006), the existing products may be eliminated from the

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market if they are undeveloped. Therefore, UXE can ensure the high-quality of product in product development process.

2) Considerations of an Available User Experience Evaluation Method (UXEM)

Since the UXEMs in product development are still inadequate, many experts have investigated the existing UXEMs and obtained their considerations of an available UXEM in the past 10 years. This study summarises the considerations of UXEMs based on previous research, where three main requirements of an available UXEM were identified in this study.

Four building blocks of an available UXEM: Mahlke (2008) came up with the inadequacy of the existing UX research approaches by analysing previous researches, then he summarised a conclusion that a complete approach to UX research should integrate four building blocks: theoretical considerations, methodological contributions, empirical results, and recommendations for application. Similarly, originating an available UXEM should also consider the four building blocks mentioned above.

Three main components of an available UXEM: A study (Obrist et al., 2009) indicated that a common requirement for all UXEMs is that it can provide the information about how users feel about using a product. Based on the previous researches, Thuring and Mahlke (2007) summed up the components of UX according to the connection between the existing approaches of UX, namely the CUE-Model. These three components of UX are instrumental qualities, non-instrumental qualities and emotional user reactions. Mahlke (2008) explained the CUE-Model in more detail and expounded the interrelations of UXEM components. The UX stems from the interaction of a technical system. The characteristics of human-technology interaction are influenced by system properties, user characteristics, and context parameters. The interactions directly influence the perception of instrumental and non-instrumental qualities, then lead to emotional user reactions. Finally, the qualities of UX determine the consequences of the experience. Therefore, it is important to understand the interrelations of UXEM components and to enable an access to the information about how users feel about a product being used.

Eighteen essential characteristics of an available UXEM: In order to identify an available UXEM, Vermeeren et al. (2010) carried out an analysis on revealing the development needs for UXEMs based on their multi-year effort. A total of 96 methods varied on a number of attributes from academia and industry were conducted and the characteristics of these methods were analysed. They revealed that the essential characteristics of UXEM include 18 components: name, main idea, general procedure, availability, information source, location, product development phase, period of experience, type of collected data, applications/designs, time requirements, other requirements, origin of the method, strengths, weaknesses, references describing the method, references discussing quality issues, general comments. Accordingly, originating an available UXEM should reference the essential characteristics.

3) Experience Map Addresses the Requirements of an Available User Experience Evaluation Method (UXEM)

To originate an available UXEM, the three requirements (i.e. four building blocks, three main components and eighteen essential characteristics) of an available UXEM should be addressed. Theoretically, Experience Map is a

tool to illustrate the experience a user has while experiencing a product within a given domain, it can systematically show the actions, thoughts, emotions and potential route reach a particular goal. Thus, Experience Map can provide the information about how users feel about a product being used and can define the overall UXs of a product. This can be the first part of the Experience Map that addressed the three main components of EXEM. After the overall UXs have been identified, UXE can be performed. Kalbach (2016) has indicated that the elements and arrangement of an Experience Map can be changed according to the needs of the objective. Thus, UXE results can be built as the second part of the Experience Map to meet the needs of UXE. Finally, the strategic decisions can be made based on the UXE results, and this can be the third part of the Experience Map. Besides, in order to accurately identify and evaluate the UXs of a product, the eighteen essential characteristics of an available UXEM can be applied to the contents as the Experience Map guidelines. Overall, the process of creating an Experience Map involves four building blocks: theoretical considerations, methodological contributions, empirical results, and recommendations for application. Therefore, the elements of Experience Map can be adjusted to address the three requirements of an available UXEM. Since the Experience Map has not been used to evaluate the UX of children's luggage, this study aims to increase the knowledge on creating an Experience Map to evaluate the UX of children's luggage.

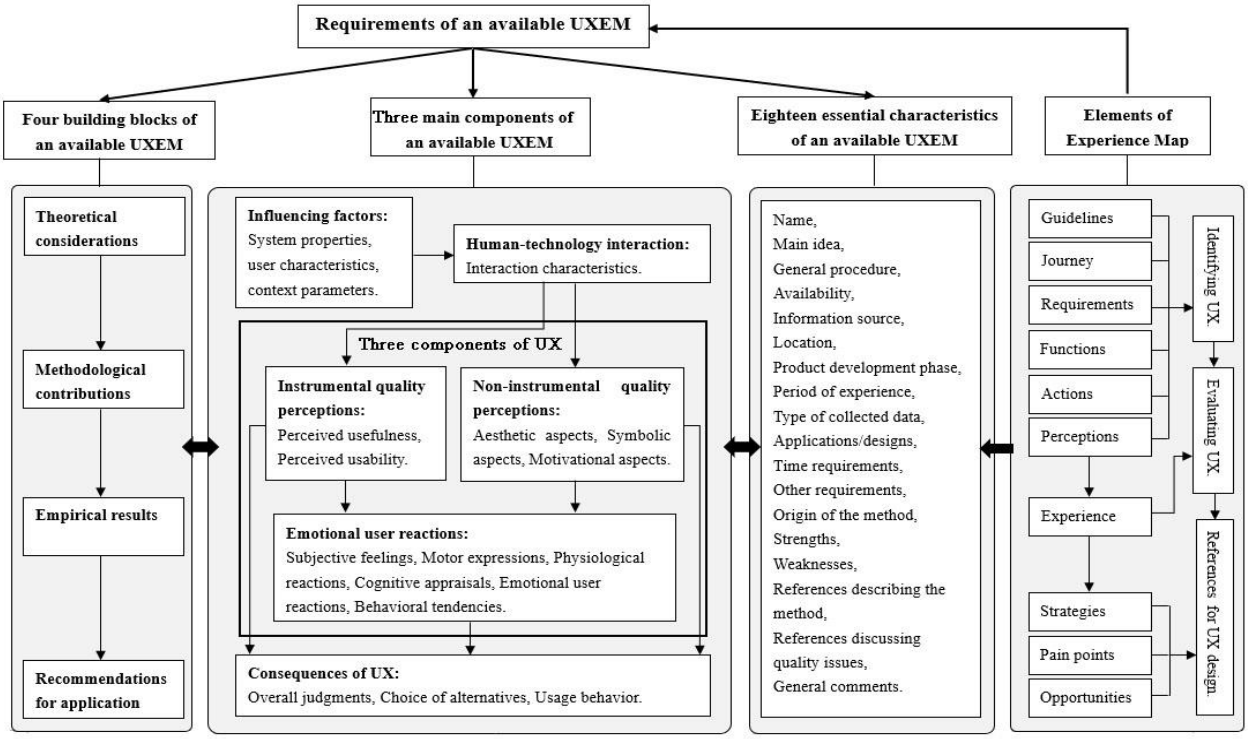

Figure 1: Experience Map addresses the requirements of user experience evaluation method (UXEM)

IV. RESULTS AND ANALYSIS

Based on the previous researches on UXEM and Experience Map, this study summarised the requirements of creating an Experience Map to evaluate the UX of children's luggage. First, Experience Map should identify the UXs

of a product. Second, it can conduct a survey to evaluate the UXs that identified in the first step. Third, it can make a strategic decision for children's luggage development according to the evaluation results. Based on the requirements of creating an Experience Map, this study proposed a procedure of creating an Experience Map of children's luggage as follows:

Step 1: Understanding the objective. An Experience Map is created to evaluate the UX of children's luggage and the result will support the designers to make a strategic decision to enhance the UX in the children's luggage design.

Step 2: Identifying the UXs of children's luggage. To create an Experience Map for identifying the UXs of children's luggage, this Experience Map needs to understand the journey of children's luggage first. Children's luggage is created as an equipment for children when they are travelling, thus, the journey of children's luggage can be the journey of the travel. Because the go and return scenarios are the same, this journey only takes the go scenarios as an analysis. Based on different scenarios, the journey of children's luggage can be segmented into 5 phases: departure, transition, transportation, transition, destination.

Actions can be the touchpoints to identify the particular UXs of children's luggage, because actions can reflect the situation of children's luggage ergonomics. On the basis of the journey segmentation, the chronological actions of the journey are Carrying, Opening, Placing, Carrying, Pulling/Pushing/Riding/Sliding/Remoting, Carrying, Watching/Playing, Carrying, Pulling/Pushing/Riding/Sliding/Remoting, Carrying, Opening, Removing, Closing and Carrying. A study has proven that the UX can be fit into usability experience and enjoyability experience (Zheng et al., 2017). The first category is about the actual operation of the good or service, while the second category is about the emotion. Based on the attributes of the actions, carrying, opening, placing, pulling, pushing, watching, removing and closing are the necessary actions of children's luggage, thus the experience associated with necessary actions can be part of the usability experience. Furthermore, riding, sliding, remoting and playing are the optional actions of children's luggage, thus the experience associated with optional actions can be part of the enjoyability experience.

Step 3: Conducting a survey to evaluate the UX of children's luggage. In the second step, 12 UXs of children's luggage were identified. In this step, this Experience Map conducts a survey using 5-point Likert scale to evaluate the 12 UXs. For usability experience, this Experience Map will evaluate the satisfaction of each usability experience, such as "Is it easy for children to carry?". For enjoyability experience, this Experience Map will evaluate the importance of each enjoyability experience, such as "Is it necessary to have riding function for children's luggage?". The rest can be seen in Figure 1. Participants are the Chinese parents who have children aged from 6~12 years old, because parents are the best candidates to feedback the UX of children's luggage. The questionnaires are sent and recovered through a professional survey service website, namely Questionnaire Star. A total of 106 questionnaires were successfully recycled. After proving the validity of the questionnaire, the evaluation results for each UX can be counted. Then, a two-dimensional map can be made according to the evaluation results.

Step 4: Making a strategic decision to enhance the UX in children's luggage design. According to the evaluation results of the survey, the strategic decision can be made. Usability experience with high scores means the action is easy for children to operate, in contrast, it has obstacles to this action execution, this is the pain points of children's luggage. A pain point is a specific problem that the company is experiencing, and it needs to be solved. Enjoyability

experience with high scores means the function also important for children's luggage, this opportunity is a chance for the company to develop the product, that should be designed into the children's luggage. In contrast, enjoyability experience with lower scores, it should be removed from the children's luggage design. For this study, the watching usability experience with lower scores, thus, it needs to make strategies to solve this problem. For instance, the riding, sliding, removing and playing enjoyability experiences with higher scores, thus these experiences should be incorporated while designing the children's luggage. Therefore, the strategies decisions of children's luggage design have been made according to the evaluation results. Through four steps, an Experience Map to evaluate the UX of children's luggage was created completely, as shown in Figure 2.

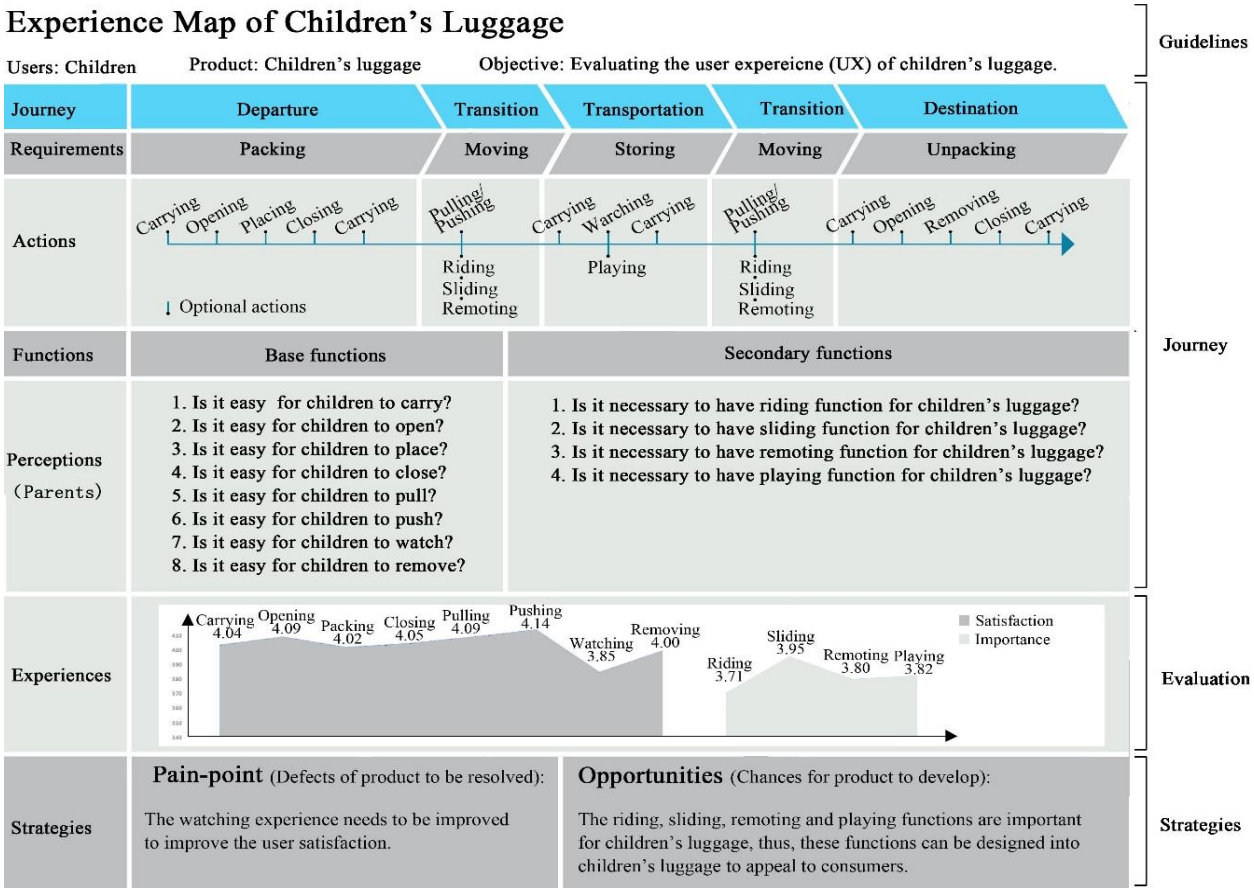

Figure 2: Experience Map of children's luggage

V. DISCUSSION

Through creating the Experience Map, 12 UXs of children's luggage were identified and evaluated. Carrying, opening, placing, pulling, pushing, watching, removing and closing are the necessary actions that related to the usability experiences of children's luggage. Riding, sliding, remoting and playing are the optional actions that related to the enjoyability experiences of children's luggage. The evaluation results show that parents are satisfied with the usability experiences, except for the Watching experience. All the enjoyability experiences identified by this Experience Map are important for children's luggage. This means although the enjoyability experience is not a must-

have feature of children's luggage, they are also very important, and they can greatly enhance the attractiveness of children's luggage. These results can provide a reference for designers when they are designing children's luggage, thus, children's luggage can be used more comfortably and efficiently.

This study illustrated a procedure of creating an Experience Map, it can help beginners to apply the Experience Map. The template of Experience Map created by this study indicated that the Experience Map can be used as a tool to evaluate the UX of a product in helping to develop the product. This Experience Map contains guidelines, journey, evaluation and strategies parts as shown in Figure 2. Guidelines part is to accurately identify and evaluate the overall UXs of children's luggage, thus researchers can make scientific strategic decisions. This part addresses the requirements of eighteen essential characteristics: name, main idea, general procedure, availability, information source, location, product development phase, period of experience, type of collected data, applications/designs, time requirements, other requirements, origin of the method, strengths, weaknesses, references describing the method, references discussing quality issues, general comments. In order to make the Experience Map more intuitive, this experience map shows only the key information according to the objective needs. Journey part is to identify the overall UXs of children's luggage, it addresses the requirements of three main components: instrumental qualities, non-instrumental qualities and emotional user reactions. This Experience Map only uses behavioral experience as a case for demonstration. Evaluation and strategies parts are the outcomes to addresses the research objectives. The entire process of creating an Experience Map involves four building blocks: theoretical considerations, methodological contributions, empirical results, and recommendations for application.

Overall, this study provided a framework for creating an Experience Map that addressed the three requirements of UXEM, as shown in Figure 1. It summarised the requirements of originating an available UXEM from the previous researches on UX. Afterward, this study creates an Experience Map of children's luggage according to the requirements of originating an available UXEM. This Experience Map can meet the needs of the UXE of children's luggage, and the research framework can also be applied to other products' UXE. Evaluating products directly addresses the need to ensure that the products designed for users. Therefore, the research framework of this study has significance for UXEM in the product development process.

VI. CONCLUSION

The framework of this study offers a method to originate an available UXEM of children's luggage. An Experience Map to evaluate UX of children's luggage was created, in the meantime, a procedure of creating an Experience Map was introduced in detail. This can be used as a guide for the designers in the implementation of evaluating UX in product development process. And the evaluation results can provide a reference for children's luggage design, this helps to improve the quality and enhance the UX of children's luggage.

Because an Experience Map is inconvenient to present too much content, thus the Experience Map created by this study only focused on the usability of children's luggage. Actually, it is also possible to add more categories of UX as needed. This is just an example to illustrate that the Experience Map can be used to evaluate the UX of a product.

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UXE should address a range of subjective qualities of a product (Vermeeren et al., 2010). Evaluating all UX in all aspects can help to exceed user expectations. Thus, to be able to evaluate the UX of a product more comprehensively and systematically, it can consider to use multiple Experience Maps to evaluate different categories of UX, and then, integrating them together for an overall discussion. Henceforth, this paper suggests that future research can analyse UX in more perspectives, thus the Experience Map that used to evaluate UX of a product can be utilised to reach optimum capability.

VII. ACKNOWLEDGEMENTS

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