

Fuzzy Evaluation Analysis of Surprise Elements in User Experience Design

사용자 경험 디자인에서의 서프라이즈 요소에 대한 퍼지 평가 분석

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Abstract

In today's fiercely competitive market environment, experience design has become a crucial factor for businesses to acquire user satisfaction and gain a competitive advantage. This study aims to explore the elements of surprise in experience design, facilitating designers to comprehensively understand the relationship between user expectations and surprise design. Firstly, grounded theory is employed to conduct research analysis on users, resulting in seven main categories and three core theories. Secondly, the fuzzy comprehensive evaluation method is adopted to comprehensively consider users' emotional and cognitive feedback, quantifying and assessing the impact of surprise elements on user experience. The research findings indicate that users have three core categories in experience design: user expectations and emotional experiences, the novelty and individual differences of experiences, and social influence and brand identity. Among them, the top three categories in terms of comprehensive weight are emotional experiences (0.227), unexpectedness and novelty (0.178), and expectations and anticipation (0.169). By deeply understanding user expectations, providing surprise elements, and implementing personalized design, designers can better meet customer needs, create enjoyable and memorable user experiences, thereby enhancing the competitiveness and market value of products or services.

Keyword

User Experience Design(사용자 경험 디자인), Surprise Elements(놀람 요소), Fuzzy Evaluation(퍼지 평가)

요약

오늘날의 치열한 시장 환경에서 체험 디자인은 기업이 사용자 만족도와 경쟁 우위를 확보하는 핵심 요소가 되었다. 이 연구의 목적은 디자이너가 사용자의 기대와 놀라움 디자인 간의 관계를 완전히 이해할 수 있도록 체험 디자인의 놀라움 요소를 탐색하는 것이다. 먼저 뿌리 이론을 사용하여 사용자를 조사하고 분석하여 7가지 주요 범주와 3가지 핵심 이론을 얻은 다음 퍼지 종합 평가 방법을 사용하여 사용자의 감정과 인지 피드백을 종합적으로 고려하여 깜짝 요소가 사용자 경험에 미치는 영향을 정량화하고 평가한다. 연구 결과에 따르면 사용자의 경험 설계의 3가지 핵심 범주는 사용자의 기대와 감정 경험, 경험의 참신함과 개인차, 사회적 영향과 브랜드 정체성이며 그 중 주요 범주의 종합 가중치는 상위 3개 범주에서 감정 경험 0.227, 의외성과 참신성 0.178로 기대와 기대치가 0.169이다. 사용자 기대를 깊이 이해하고, 놀라움 요소를 제공하고 개인화된 디자인을 구현함으로써 디자이너는 고객 요구를 더 잘 충족시키고 즐거운 및 잊지 못할 사용자 경험을 창출하여 제품 또는 서비스의 경쟁력과 시장 가치를 향상시킬 수 있는 '프로세스를 추가로 제시할 필요가 있다.

Contents

1. Introduction

- 1-1. Research Background and Objectives
- 1-2. Research Scope and Methods

2. Theoretical Investigation

- 2-1. Studies on Surprise Design

2-2. Grounded Theory

2-3. Fuzzy Comprehensive Evaluation

3. Research Methods

- 3-1. Comprehensive Evaluation User Needs Analysis Based on Grounded Theory
- 3-2. The fuzzy comprehensive evaluation of surprise elements

4. Discussion and analysis

5. Conclusion

1. Introduction

1-1. Research Background and Objectives

With the intensification of market competition and users' continuous pursuit of unique and delightful experiences, experience design has received widespread attention as an important means of innovation. In addition to the basic functional requirements of products, users are increasingly concerned about what special experiences products or services can provide them with, and how to create unique sensation¹⁾. In the current situation of severe product homogenization, competition among enterprises has gradually shifted to the experiential level²⁾. By providing unforgettable experiences that exceed expectations, companies can stand out in the market, winning recognition and loyalty from users. In experience design, the introduction of surprise elements is considered an effective way to deepen the emotional connection between users and products, services, or brands, thereby enhancing user satisfaction and loyalty³⁾. Modern psychological research also indicates that emotional, cognitive, and situational factors collectively shape user experiences⁴⁾. Therefore, understanding user expectations and reactions, especially to surprise elements in the experience, becomes crucial in promoting user satisfaction

1) Surprise Creative Products Designed by Nando Studio" [J]. Industrial Design, 2015 (01), P.93+92.

2) Tiger Sniff, Baidu Baike.(2024.01.21)
URL: <https://www.huxiu.com/article/361423.html>

3)Gross A, Thüning M. Encountering the Unexpected: Influencing User Experience through Surprise[C]//UMAP Workshops. 2013, P.1-7.

4)程相鸣.形态设计带来的无限惊喜——从中日韩创意产品看惊喜设计的形态表现[J].青春岁月,2013 , P.71-72 +70.

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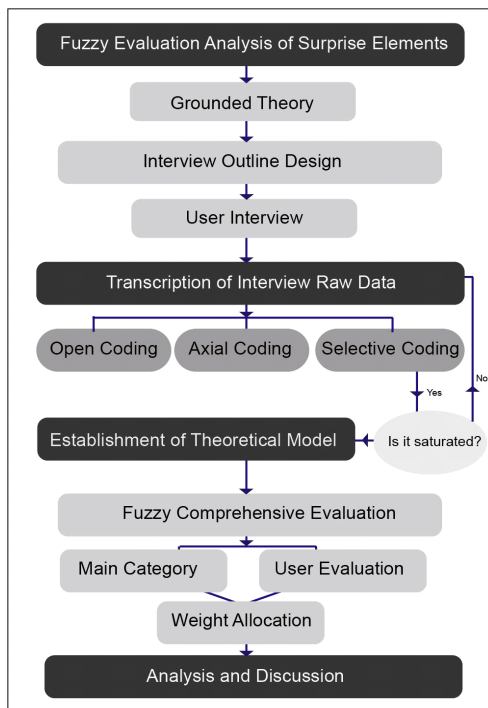
and brand loyalty. However, despite designers' awareness of the importance of surprises, how to accurately understand users' expectations for surprise elements in experience design remains a complex and worthy of further investigation. Traditional market research methods struggle to capture users' authentic feedback on unconventional and non-obvious expectations. Therefore, this study aims to delve deeper into users' expectations for surprise elements in experience design by combining Grounded Theory and fuzzy comprehensive evaluation, providing designers with more insightful and practical guidance.

1-2. Research Scope and Methods

This study primarily focuses on elements that users perceive as having unexpected, novel, and delightful qualities, ensuring a clear understanding of the core concept of "surprise." The research group targets a diverse range of user demographics, including individuals of different ages, cultural backgrounds, and usage scenarios.

This ensures that the research results are both universal and representative. The scope of the study primarily covers product experiences in the field of experience design. The research methods mainly involve in-depth interviews and fuzzy comprehensive evaluation, aiming to gain insights into users' expectations for surprise elements in experience design. Firstly, semi-structured interviews are conducted to engage users in semi-open conversations, exploring their genuine feelings and expectations for surprise elements in experience design. This helps uncover users' emotional feedback and latent needs, providing deep insights for the research. Secondly, fuzzy

comprehensive evaluation methods are applied to quantify users' expectations for different surprise elements, providing specific weights and relative importance for design. This establishes a more objective and actionable evaluation system to guide the design process and offers a more comprehensive and in-depth understanding of the field of experience design. This, in turn, provides designers with more concrete and practical guidance, driving forward the advancement of experience design.



[Fig 1] Research Flowchart

2. Theoretical Investigation

2-1. Studies on Surprise Design

Surprise design, as part of user experience design, has gradually garnered attention in academia with the development of society, culture, and technology. Initially, surprise was perceived as a sudden and pleasurable experience. As Cheng pointed out in the research, "surprise design" initiated by designers from Europe and America brings about

differentiated visual and tactile experiences for product users through changes in materials and forms, thereby generating favorable impressions and a sense of dependence on the product⁵⁾. However, as research progresses, scholars have begun to delve deeper into how surprise is generated, evoked, and affects user emotions. Current research tends to view surprise as an emotional experience, emphasizing its strategic application in product and service design. Xia, for instance, explored surprise design in books, highlighting that books themselves represent three-dimensional reading spaces. The embodiment of three-dimensionality in book form design is a continuation and innovation of the essence of traditional book design. The charm of three-dimensional book construction lies in the surprise it brings to readers on every page⁶⁾. Jelinčić D A J K found that visual arts and music are particularly effective in evoking emotions when exploring surprise in museum experience design. There are many visual and auditory cues that influence the reactions and behaviors of museum visitors⁷⁾.

Researchers recognize that surprise design is not only a means to enhance user experience but also a strategic design decision. By cleverly introducing surprise elements, companies can shape a unique brand image in a competitive market, enhancing the awareness and memorability of products or services. Therefore, an increasing number of studies are beginning to focus on how to consciously integrate and manipulate surprise elements in design to achieve longer-term strategic goals. Ramírez E R R pointed out strategies employed by designers in

- 5) 程相鸣, 形态设计带来的无限惊喜—从中日韩创意产品看惊喜设计的形态表现[J]. 青春岁月, 2013, P.71-72+70.
- 6) Xia Kang. "Surprises on Paper – Three-Dimensional Construction in Book Form Design" [J]. Art Education, 2019, P.218-220.
- 7) Jelinčić D A J K, Jelinčić K. Surprise me Softly: The Element of Surprise in Designing Museum Experiences[J]. Muzeológia a kultúrne dedičstvo, 2021, P3.

the design process: using prototypes in unexpected environments/objects, challenging appearance assumptions, magical interactions, doubling the intelligence of things, and unexpected scaling⁸⁾.

2-2. Grounded Theory

Grounded Theory is a qualitative research method proposed by Barney G. Glaser and Anselm L. Strauss in 1967⁹⁾. The basic principle of this theory is to develop theories gradually from the actual data through systematic analysis of the data. Unlike traditional qualitative research methods, Grounded Theory emphasizes the induction of theories from raw data rather than interpreting data through pre-existing theoretical frameworks. The main research process is divided into three stages, as detailed in Table 1.

[Table 1] The three steps of Grounded Theory

Research Steps	Specific Content
Open Coding	In the initial stage of research, researchers conduct open coding of the data, which involves line-by-line analysis of the data and the generation of preliminary concepts, free from the constraints of prior theoretical frameworks.
Axial Coding	Building upon open coding, researchers engage in axial coding, which involves deeper organization and categorization of concepts to identify their intrinsic relationships.
Selective Coding	The final stage is selective coding, where researchers choose core concepts and construct an explanatory overarching theory that can interpret phenomena and predict future behavior.

Grounded Theory has yielded fruitful research results in the field of social sciences, providing researchers with a flexible and in-depth method

to explore practical experiences. It offers an innovative approach to theory generation and development. Qi applies Grounded Theory to conduct in-depth analysis of consumer demand values in coastal cities, exploring the design path of marine cultural creative products, and effectively aligning supply and demand in the product market¹⁰⁾. Zhang applies the research method of Grounded Theory to conduct text mining and theoretical analysis of online comments, rationally excavating the real consumer demand for cultural blind box design products, and exploring the design ideas and implementation strategies for sustainable development of museum blind box cultural and creative products¹¹⁾. Through relevant research, it is understood that the strength of Grounded Theory lies in its ability to provide a profound, flexible, and participatory research experience, enabling researchers to better understand and explain complex social phenomena. The core of this study's application of Grounded Theory is to generate theory from actual data, allowing for an in-depth understanding of users' expectations for surprise elements in experience design. In this study, Grounded Theory offers advantages of depth, flexibility, participation, and data-driven analysis in user expectation analysis and fuzzy comprehensive evaluation in experience design. This enables researchers to better understand and address user expectations, thereby creating designs with more surprise elements.

2-3. Fuzzy Comprehensive Evaluation

The fuzzy comprehensive evaluation method is a decision-making and evaluation approach based on the theory of fuzzy mathematics, used to deal with problems that involve uncertainty and

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9) Glaser B, Strauss A. Discovery of grounded theory: Strategies for qualitative research[M]. Routledge, 2017, P. 3–5.

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11) 张嘉欣, 梅芷悦. 基于扎根理论的博物馆盲盒消费需求分析及其设计策略研究[J]. 包装工程, 2024, P.339–347.

fuzziness. This method allows for the incorporation of fuzzy or imprecise information into the evaluation process to better reflect the complexity of real-world problems¹²⁾. Fuzzy comprehensive evaluation is a typical method for generating data when data is not available, as most data is obtained through surveys and questionnaires. This method is widely used in decision-making, risk assessment, quality evaluation, and other fields, particularly excelling in the handling of complex systems and fuzzy problems¹³⁾. By introducing concepts from fuzzy mathematics, this method can more flexibly address the uncertainty present in practical problems, thus enhancing the reliability of decision-making and evaluation. Li, in exploring the user experience process of household products, established a multi-level, multi-index design evaluation model based on sensory, interaction, brand, and technology aspects from the perspective of user experience. The weights of each index were then determined, and fuzzy comprehensive evaluation methods were applied to evaluate the design¹⁴⁾. Li utilized the fuzzy analytic hierarchy process to comprehensively evaluate packaging solutions for turnout machines, obtaining comprehensive evaluation results for three schemes and determining Scheme 2 as the preferred option¹⁵⁾.

In summary, fuzzy comprehensive evaluation can effectively handle the uncertainty and fuzziness present in problems. In practical

decision-making and evaluation, many factors are difficult to quantify precisely, and fuzzy comprehensive evaluation, by introducing the concept of fuzzy mathematics, allows for the fuzzy description of these factors, better reflecting the complexity of reality.

3. Research Methods

3-1. Comprehensive Evaluation User Needs Analysis Based on Grounded Theory

Grounded Theory emphasizes the raw materials obtained from experiments. It is a "discovery method" that decomposes collected data, identifies phenomena, conceptualizes them, and then re-abstracts concepts in an appropriate manner to extract categories. The data collection in this study mainly involved semi-structured interviews with users. Based on the current state of research on surprise design, the interview outline included basic information about the interviewees and their experiential feelings. The questionnaire design followed the basic principle of "starting with easy questions and progressing to difficult ones," guiding the participants to discuss detailed issues during the usage process starting from their overall feelings. A total of 12 participants were interviewed in this experiment, including 7 males and 5 females. The interviews were conducted from November to December 2023. In accordance with the qualitative requirements of Grounded Theory, each interview with the participants lasted for more than 20 minutes, focusing on the questionnaire outline¹⁶⁾. During the interview process, participants were encouraged to expand on relevant content outside the interview outline based on their actual usage experiences.

In Grounded Theory experiments, theoretical saturation refers to a state where no new

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- 12) Han Li, Mei Qiang, Lu Yumei, et al. Analysis and Research on AHP-Fuzzy Comprehensive Evaluation Method [J]. Journal of Chinese Safety Science, 2004, P.89-92+3.
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concepts and categories emerge during the analysis process. In this study, interviews and coding analysis were conducted simultaneously, with the criterion for ending interviews being the repetition of newly added interview information for three consecutive times without providing new nodes.

3-1-1. Open coding

Open coding is the first step in information coding, with all primary categories derived solely from interview transcripts, without any subjective thoughts or judgments¹⁷⁾. During the coding analysis process, all information contained in the interview data remains open. Researchers conduct a meticulous analysis of the selected comment texts, labeling them word by word and sentence by sentence. Through iterative comparison and content organization, effective information is gradually summarized and merged, transforming the raw interview data into initial categories. A total of 216 pieces of valid information were obtained through the organization of the original interview data. After removing duplicate content and merging similar concepts, 20 initial categories were finally identified. The corresponding initial categories and original statements are listed in Table 2.

[Table 2] Initial coding process of user interviews

Original Statements	Initial Categories
I expect the product to meet my basic needs, such as completing a task quickly and efficiently.	Functional Expectations
After completing a complex task, I always feel a sense of accomplishment, which makes the whole experience more meaningful.	Sense of Satisfaction
I prefer graphical interfaces, and I would be pleasantly surprised if a product had some visual	Cognitive style differences

17) Song Na, Mao Yaqi, Xiao Zhi, et al. Research on Mongolian Ethnic Cultural and Creative Product Design Based on Grounded Theory [J]. Packaging Engineering, 2023, P.343–351.

innovations.	
I expect the interaction design of a product to be smooth and natural, but unexpected interaction experiences during use would definitely surprise me.	Interactivity
I expect the product design to be sleek and elegant, but I also hope for some unique design elements to give a refreshing feeling.	Design expectations
My lifestyle influences certain design elements, and if a product takes these differences into account, I would feel understood and respected.	Cultural and background
The subtle buttons in the product design make me want to explore; this curiosity is quite intriguing.	Curiosity and exploration
The social sharing feature makes me feel like I can enjoy surprises with others, and this experience is quite enjoyable.	Social experience
Customization features are what I expect, but having some unexpected customization options would be fantastic.	Personalization expectations
Discovering that the brand story behind the product aligns with my values is a pleasantly surprising experience.	Resonance with the brand story
As a tech enthusiast, I'm very interested in advanced settings for products, so discovering unexpected advanced features is a pleasant surprise.	Usage habits
When a product offers rich interaction options and features, I feel more engaged, which is a delightful surprise.	The depth of interaction
The brand has maintained a consistent design style and voice.	Brand consistency
Meeting new friends through the product has made me feel the power of social connections, which is a special delight.	The pleasure of social connection
I prioritize a pleasant overall user experience, and unexpected interactive elements would make the experience even more enjoyable.	Experiential quality
Receiving instant feedback and interaction while using the product makes me feel truly engaged with it, which is a delightful surprise.	Instant feedback and interaction
I felt delighted when I discovered that this product has a very interesting animation	Joy

effect.	
Discovering that my content is recommended or featured on the homepage is a pleasantly surprising experience for me.	Reward for user-generated content
The design of the product gives a sense of familiarity, making it feel like conversing with an old friend.	Closeness
The brand introduced some unique designs and features in the product, which innovation pleasantly surprised me and also enhanced my affinity towards the brand.	The brand's innovation

3-1-2. Axial Coding

At this stage, the coding builds upon the open coding mentioned above, further exploring the associations between concept clusters and the initial categories as well as individual categories¹⁸⁾. The 20 initial categories obtained were restored to the original language data, and the associations between each concept and the logical relationships between concepts and categories were analyzed. Subsequently, the associations between categories were established and divided. On this basis, seven main categories with greater abstraction and representativeness were distilled, namely Expectations and Anticipations, Unexpectedness and Novelty, Emotional Experience, Individual Differences, Social Influence, Brand Values and Identity, and User Engagement. These seven main categories cover the 20 initial category concepts mentioned above and serve as intermediate factors for users' expectations of surprise design elements in experience design, as shown in Table 3.

3-1-3. Selective Coding

The core part of grounded theory coding is

selective coding, which aims to extract core categories. Initially, qualitative analysis is conducted on the main categories to distill the core categories that play a leading role, representing macro factors¹⁹⁾. Next, through multi-level coding and in-depth analysis, the core categories are interconnected with other categories to form a theoretical model.

[Table 3] Category refinement process

Core categories	Main categories	Initial categories
User expectations and emotional experiences	Expectations and anticipations	Functional expectations
		Design expectations
		Personalization expectations
	Emotional experience	Satisfaction
		Curiosity and exploration
		Joy
		Closeness
Novelty of experience and individual differences	Unpredictability and novelty	Interactivity
		Experiential quality
	Individual differences	Cognitive style differences
		Culture and background
		Usage habits
Social Influence and Brand Identity	Social influence	Social experience
		The pleasure of social connection
		Rewards for user-generated content
	Brand values and identity	Resonance with the brand story
		Brand consistency
		The brand's innovativeness
	User engagement	Instant feedback and interaction
		The depth of interaction

3-2.The fuzzy comprehensive evaluation of

18) Wu Yue'e. Growth Process and Influencing Factors of National Tide Brands from the Perspective of Cultural Confidence: An Exploratory Study Based on Grounded Theory [J]. Journal of Sichuan University of Science and Engineering (Social Sciences Edition), 2024, P.16–26.

19) Xu Zejun, Liu Jian, Zou Feng. Exploration of User Delight Design Strategies Based on Grounded Theory [J]. Packaging Engineering, 2021, P.167–173.

surprise elements

Using Grounded Theory, we conducted an in-depth analysis of users' expectations for surprise elements. To better understand the proportion of more explicitly defined categories of user needs, we developed evaluation indicators for surprise elements. We employed a fuzzy comprehensive evaluation method to quantitatively analyze users' expectations of surprise elements, aiming for a more accurate understanding of their weights and impacts. For this, we selected main categories from Grounded Theory, as they play a bridging role between initial and core categories, offering a balanced scope. The questionnaire primarily focused on seven main categories for satisfaction assessment. Response options included "very satisfied," "satisfied," "not very satisfied," and "unsatisfactory." Additionally, the questionnaire explored users' ranking preferences and ratings for these seven categories, scored from 1 to 5. In total, 103 questionnaires were distributed, with 96 valid responses collected. Among these, 55% were from males and 45% from females. The average values for each category are presented in Table 4.

[Table 4] Average numerical values of user evaluations

	Very satisfied	Quite satisfied	Not very satisfied	Terrible	Factor proportion(B)
Expectations and anticipations(A1)	0.3	0.4	0.25	0.05	0.17
Emotional experience (A2)	0.5	0.4	0.1	0	0.23
Unpredictability and novelty (A3)	0.35	0.5	0.15	0	0.18
Individual	0.25	0.55	0.2	0.1	0.11

differences A4					
Social influence (A5)	0.2	0.63	0.12	0.05	0.14
Brand values and identity (A6)	0.3	0.52	0.16	0.02	0.10
User engagement (A7)	0.13	0.45	0.3	0.12	0.07

Through the above-mentioned average values, we utilized the fuzzy comprehensive evaluation method with a bounded multiplication operator to compare the final fuzzy weightings of each requirement. The weight vector for the seven evaluations is as follows:

$$P_1 = B_1 * A1 = (0.051, 0.068, 0.043, 0.009)$$

$$P_2 = B_2 * A2 = (0.115, 0.092, 0.023, 0)$$

$$P_3 = B_3 * A3 = (0.063, 0.09, 0.027, 0)$$

$$P_4 = B_4 * A4 = (0.028, 0.061, 0.022, 0.011)$$

$$P_5 = B_5 * A5 = (0.028, 0.088, 0.017, 0.007)$$

$$P_6 = B_6 * A6 = (0.003, 0.052, 0.016, 0.002)$$

$$P_7 = B_7 * A7 = (0.009, 0.032, 0.021, 0.008)$$

Next, the values obtained for $P_1 - P_7$ are summed, and the resulting sum is normalized according to the formula to obtain the final comprehensive evaluation result. Here, E_j represents the total sum of $P_1 - P_7$, and W_j represents the final evaluation weight, as shown in Table 5.

$$E_j / (\sum_{j=1}^n * E_j) (j = 1, 2, \dots, n) = W_j$$

[Table 5] Integrated weight values of main categories

	A1	A2	A3	A4	A5	A6	A7
W_j	0.169	0.227	0.178	0.120	0.138	0.099	0.069

4. Discussion and analysis

In experience design, it's crucial to introduce surprise elements to meet user expectations. Through fuzzy comprehensive evaluation, the main categories were comprehensively assessed, revealing that A2, A3, and A1 ranked in the top three in terms of proportion. Elevating surprise elements in experience design, especially in emotional experiences, is a task that requires careful consideration. This can profoundly impact users' emotional connections and memories of products or services, providing immediate and engaging feedback. For instance, providing pleasant prompts upon successful operations or handling failures with ease can enhance user emotional interaction²⁰). Airbnb, on the other hand, employs vivid language when introducing each experience, emphasizing intimate connections with locals. It showcases genuine emotional connections through user reviews and feedback. Enhancing surprise elements in experience design enhances users' experiences of unpredictability and novelty. This design approach not only keeps the product fresh in terms of functionality but also fosters a sustained sense of excitement and curiosity in users' minds.

Furthermore, increasing unpredictability and novelty requires a deep understanding of the younger demographic's pursuit of innovative and creative experiences, as well as their high demand for social interaction²¹). Taking Snapchat as an example, the product introduces real-time filters, allowing users to apply various fun effects while taking photos and recording videos, providing instant surprises for users. It also introduces interactive elements based on augmented reality (AR) technology, such as AR games and AR experiences, enabling users to interact with virtual elements and creating novel experiences for users. Tesla, on the other hand,

continuously introduces new features and improvements to vehicles through remote software upgrades, allowing owners to experience innovative driving experiences without changing hardware. For example, features like "Smart Navigation" and "Autopilot" provide users with unexpected and advanced driving experiences.

Finally, in terms of expectations and anticipations, it is essential to introduce expectations and exceed them creatively. By surpassing users' basic expectations, products can establish a stronger emotional connection with users, thereby enhancing user satisfaction and loyalty to the product²²). For example, AirPods Pro introduced active noise cancellation functionality, surpassing users' expectations and providing them with a more immersive music and calling experience. Initially, users only expected a pair of wireless headphones, but Apple exceeded their expectations by incorporating noise-cancellation technology, delivering a higher level of audio experience.

5. Conclusion

Introducing surprise elements in experience design is a crucial yet challenging task. This study, based on Grounded Theory, thoroughly explored and analyzed users' expectations and anticipations of surprises. The research identified three core categories influencing users, namely, expectations and emotional experiences, novelty and individual differences in experiences, social influence and brand identity. Among these, user expectations play a crucial role in experience design, while users' anticipations of surprise elements also significantly influence their perception and satisfaction. Additionally, through the method of fuzzy comprehensive evaluation, the contribution and overall proportion of

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21) Macedo L, Cardoso A. Assessing creativity: the importance of unexpected novelty[J]. Structure, 2002, P5.

22) Dixon M J, Victorino L, Kworntnik R J, et al. Surprise, anticipation, and sequence effects in the design of experiential services[J]. Production and Operations Management, 2017, P.945-960.

different surprise elements to user experience were successfully assessed.

The study results indicate that the thoughtful incorporation of surprise elements can significantly enhance the depth and memorability of user experiences, thus creating more positive and memorable interactive experiences. However, in practical design, balancing the relationship between user expectations and surprise elements is a complex task. Designers need to continuously monitor user feedback and flexibly adjust design strategies to ensure that the introduction of surprise elements does not exceed users' acceptance range while still eliciting positive emotional and cognitive effects in the experience.

In summary, this study provides in-depth theoretical analysis and practical guidance for surprise elements in experience design. However, it lacks in-depth research on practical application cases, making it difficult to verify the applicability of Grounded Theory in different industries and design projects. Furthermore, there is a lack of comprehensive measurement and evaluation tools to assess the impact of surprise elements on user experience. In future research, investigating the continuous iteration and optimization process of design projects to understand how Grounded Theory application can be adjusted based on user feedback and market changes in practice is necessary. Additionally, it is essential to consider users' emotional and cognitive feedback comprehensively, including physiological data, facial expressions, eye-tracking, etc., to more fully and objectively evaluate the effectiveness of experience design. This would help establish more flexible and adaptive design methods.

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