Study on User Experience of Live Streaming Sales Based on ISM and Kano Quality Model

Yu-Liang Feng\textsuperscript{1, #,}, Chia-Hui Huang\textsuperscript{2,*}

\textsuperscript{1}Nanjing Vocational University, Nanjing, 210023, China, Associate Professor
\textsuperscript{#}Arts Department, Huangshan University, Huangshan, 245041, China, Associate Professor
\textsuperscript{2}Tung Fang Design of University Graduate Institute of Cultural and Creative Design, Gaoxiong, 82941, China, Associate Professor
\textsuperscript{*}Corresponding author’s e-mail:judy_huang@mail.tf.edu.tw

Abstract. With the development of the Internet economy, live streaming sales have become a new marketing method, which is popular among users. This paper explores quality attributes of live streaming sales based on the experience of their users. In this study, 56 factors, including the original and abstract reasons for and the specific item of user experience of live streaming sales, were first obtained with the evaluation grid method according to the semi-structured interview of highly involved people. Then, 5 experts formed a focus group for discussion and determined 11 key factors influencing user experience as analysis factors of the ISM theoretical model. Results are obtained through the statistical analysis of the ISM theoretical model, and four major dimensions are defined, namely the first-level demand dimension, the second-level interaction dimension, the third-level good quality dimension and the fourth-level extension dimension. Finally, the relationship between attractive quality attributes in different dimensions and the Kano two-dimensional quality classification and user satisfaction is analyzed based on the Kano two-dimensional quality questionnaire. A satisfaction coefficient matrix diagram is drawn to analyze the key quality attributes. Research conclusions and suggestions are made according to the results of data analysis so as to provide reference value for subsequent improvement of related designs and help designers improve user experience.

1. Introduction

With the development and interconnection of the Internet, the rapid popularization of mobile terminals has provided massive hardware and users for live streaming. According to relevant research data, the number of Chinese live streaming companies rose from 25 to 116 from 2012 to 2016, an increase to nearly 5 times within 4 years. According to statistics released in the 44\textsuperscript{th} China Statistical Report on Internet Development, the number of live streaming viewers in China reached 433 million by June 2019. The live streaming platform is a new social networking method. Users watch the live broadcast of an anchor through network and social platforms. Live streaming is currently divided into three main types by the broadcast content, namely live shows dominated by entertainment, singing, dancing and chat such as Inke and Momo, live games dominated by game commentaries such as Douyu and YY, and e-commerce live streaming focusing on sales such as Taobao Live, Tik Tok Live and JD Live. In 2018, Viya created sales amounting to more than 300 million yuan during Taobao's Double Eleven period. The 2020 Tik Tok live data map shows that the 3-hour network broadcast of Luo Yonghao on Tik Tok...
on April 1 created a total transaction volume of more than 110 million yuan and attracted over 48 million online viewers, becoming a network hotspot. Live streaming sales have developed extremely rapidly within three years and created a very high turnover.

Foreign scholars Gandolfi (2016)[1], Pires, Simon (2015)[2], Dougherty, Audubon (2011)[3], Hamilton, William & Garretson (2014)[4] et al. explored and studied the live streaming content model. Bruce, Zorah and Neill (2018), Mcgirt (2014), Jeremy and Hook (2017), et al. conducted research from the perspective of users to verify the motivation and social behavior of users experiencing live streaming [5]. Chinese scholars Cai and Wang (2001) et al. discussed the related research on the integration of traditional media and live streaming. Zhao (2016) et al. analyzed the research on the status quo and development of live streaming. Zhao (2017) et al. conducted in-depth research on the negative aspects of ethical misconduct in live streaming. Wei (2019) discussed key marketing factors in the user experience of live streaming from the perspective of technology acceptance model. According to analysis on Chinese and foreign live streaming related literature, many scholars have conducted research on live streaming in terms of platform characteristics, communication strategies, anchor marketing categories, marketing strategies, Internet celebrity economy and legal and ethical rules, but there is little research on attractive quality attributes in the user experience of live streaming. How to improve service quality and user satisfaction of live streaming sales is of great significance to their development and growth. Kano (1984) proposed a two-dimension quality model and believed that quality attributes of service products had two-dimensional characteristics [6]. He also considered that designers should meet the potential needs of users to the greatest extent, develop innovative qualities and tap potential attractiveness deeply to make products new so as to generate the power to attract users. Therefore, it is urgent for designers to determine which service quality attributes are attractive qualities and incorporate them into service design to improve service quality.

On the basis of the research background and descriptions above, this study focuses on the user experience of live streaming as the research object, explores the factors and dimensions influencing user experience with the combination of the evaluation grid method of Miryoku engineering and the interpretative structural modelling method, and confirms the two-dimensional quality classification of quality attributes and key quality attributes in user experience based on Kano two-dimension quality model so as to provide them for entrepreneurs and designers of live streaming sales, improve user satisfaction and thereby increase live streaming sales and benefits.

This study has three main research objectives:

(1) Determine the dimensions and factors influencing the user experience of live streaming sales with the evaluation grid method and ISM.

(2) Determine the classification of two-dimensional quality characteristics of quality attributes in the dimensions and factors above based on Kano quality model, and verify that there are two-dimensional quality classifications for the dimensions and factors influencing the user experience of live streaming sales.

(3) Construct a Kano user satisfaction matrix diagram and summarize key quality attributes that affect user experience.

2. Literature discussion

2.1. Evaluation grid method of Miryoku engineering

In 1985, Japanese scholars Junichiro Sanai and Masao Kanai proposed the concept of Miryoku engineering based on the research of psychologist Kelly. It is mainly a research method including the acquisition of cognitive concepts of users or consumers and their statistical processing in tabular form.

The evaluation grid method (EGM), one of the representative research methods in the research of Miryoku engineering, can capture abstract feelings of users, verify the specific corresponding relationship of products and deeply analyze the relationship between specific and abstract factors of things.
EGM is specifically divided into three aspects, namely the original reason, specific item and abstract reason. First, we must confirm the "original reason" and seek backward for the "abstract reason" and forward for the "specific item". For example, we can ask the interviewee, "Why are you attracted by live streaming sales?" If the interviewee replies "Kill time", we extract "kill time" as the original reason. Then we ask in detail based on the original reason, "What of live streaming makes you feel that you can kill time?" If the interviewee replies "Interesting", we extract "interesting" as the abstract reason. Finally, we ask, "What is the specific thing that makes it interesting?" If the answer is "Anchor's speech", we extract "anchor's speech" as the specific item.

An "evaluation grid chart" of the user experience of live streaming is finally made based on the interview.

2.2. Interpretative structural modelling method
The interpretative structural modelling method (ISM) is an analysis method proposed by Professor Wallfeldt in 1973 and applied to modern systems engineering. The theory is applicable for systematically clarifying problems with uncertainties, numerous factors and complex relationships and finally creating a multi-layer progressive interpretative structural model as shown in Figure 2. [7]

Hwang & Lin (1987) proposed the following steps for analyzing the relationship of various factors based on ISM, as shown in Figure 2:

Step 1: Establish a relation matrix of factors, in which 0 means no relation and 1 means the existence of a certain relation, and make pairwise comparisons;
Step 2: Get the reachability matrix based on ISM operations;
Step 3: Convert the reachability matrix into a hierarchical matrix;
Step 4: Make a hierarchy diagram;
Step 5: Obtain the D+R-D-R scatter diagram, in which D refers to the horizontal sum of the reachability matrix and R refers to the vertical sum of the reachability matrix. The first-level elements lie in the main problem area, and the second-level elements in the main target area, as shown in Figure 1. [8]

2.3. Kano two-dimension quality model
Producers recognized quality as one-dimensional quality in the early stage. That is, users are satisfied when a certain quality factor is sufficient, and vice versa. This concept cannot cover all actual situations. When the quality is judged by users, the one-dimensional quality concept is impractical, and even the higher the quality attribute, the lower the user satisfaction. Therefore, the two-dimension quality concept came into being. Herzberg (1959, 1993) first proposed the two-factor theory "Motivation-Hygiene Theory", which was the earliest two-dimension quality concept theory. Kano (1984) proposed the Kano two-dimension quality model on the basis of Herzberg's two-factor theory and divided quality attributes into five categories: 1. Attractive quality element (A); 2. One-dimensional quality element (O); 3. Must-be quality element (M); 4. Indifferent quality element (I); and 5. Reverse quality element (R), as shown in Figure 2.
Users' cognition and feelings when each quality attribute is available and unavailable are collected through questionnaires to judge its classification. CQM (1993) obtained the cumulative frequency of the classification of different two-dimensional quality characteristics through quality attribute classification. If the frequency is the same, the judgment criterion is M>O>A>I[9]. The Kano questionnaire was designed as two-way paired questions about quality attributes. The answers include "like", "deserved", "no feeling", "tolerable" and "dislike".

Matzler & Hinterhuber (1998) revised the Kano two-dimension quality model and proposed a "two-dimensional quality element classification table" as shown in Table 1.

| Insufficient  | Like 5 | Deserved 4 | No feeling 3 | Tolerable 2 | Dislike 1 |
|---------------|-------|------------|--------------|-------------|-----------|
| Sufficient    |       |            |              |             |           |
| Like          | Undecidable | A | A | A | O |
| Deserved      | R | I | I | I | M |
| No feeling    | R | I | I | M |   |
| Tolerable     | R | I | I | M |   |
| Dislike       | R | R | R | Undecidable |   |

Matzler & Hinterhuber (1998) also proposed the "user satisfaction coefficient" to obtain the possible increased user satisfaction and reduced user dissatisfaction when a certain quality attribute element is improved for use as the reference point for the improvement of service quality. The coefficient is calculated by the formula below:

Increased user satisfaction coefficient = \((A+O)/(A+O+M+I)\) \hspace{1cm} (1)

Reduced user dissatisfaction coefficient = \((O+M)/(A+O+M+I)\) \times (-1) \hspace{1cm} (2)

The classification table and the user satisfaction coefficient can help in the classification of two-dimensional quality attributes in the user experience of live streaming sales and the confirmation of key user service quality for the improvement of user satisfaction and the reduction of user dissatisfaction[10].

3. Empirical analysis

3.1. Identification of factors influencing preferences in user experience of live streaming sales

3.1.1. Experimental samples

Sample definition: This study is mainly aimed at mobile short videos in live streaming, in which user experience of live streaming was discussed and representative picture samples were selected for judgment mainly in terms of the anchor, platform interface and functions, and products.

Sample collection: Samples were collected mainly based on the live streaming platform download rankings, the rank list of network anchors based on the number of fans, Chinese and foreign websites, magazines and books. A total of 112 pictures were retained after preliminary elimination of those difficult for judgment.
Sample selection: Pictures with unclear anchor characteristics and inapparent platform function performance were excluded again according to the judgment basis of defined samples. 40 experimental samples were finally obtained and square color cards 10CM*10CM were made.

Selection of test objects: Eight respondents who had been highly involved in live streaming for more than one year, aged 18 to 40, were selected as in-depth interviewees.

3.1.2. Extraction of attractive factors and preparation of an evaluation grid chart
A total of 56 factors are proposed according to the research procedure of the evaluation grid method after analysis of the interviewees. An evaluation grid chart is drawn based on the relationship of factors, involving the original reason (median), abstract reason (higher) and specific item (lower).

The following is obtained according to statistics of the frequency of the interviewees which is 4 times and above:

In terms of the original reason, "anchor's prestige as a celebrity" has been mentioned for 7 times, "high-quality platform" 4 times and "user demand" 5 times. The three dimensions, also the three important components of live streaming, are more concerned factors in the user experience of live streaming. Therefore, we should improve the user experience from these three aspects. First, we must enhance the anchor’s professional accomplishment, specialization, appearance, language logic and affability. Second, we need to improve the interactive mode, display mode and atmosphere in terms of platform optimization. Finally, in terms of users, it is necessary to enhance the exploration of user demands, increase user demand functions timely and improve the adhesion of users to live streaming.

For the specific item, six items have been mentioned for more than 6 times, including the anchor's image (7 times), network influence (7 times), after-sales protection (7 times), good quality and low price (7 times), demonstration (6 times) and shopping demand (6 times), of which 5 are factors in the "user demand" dimension, demonstrating that respondents are more concerned about user demands and that we should be more focused on the design in the aspect.

For the abstract reason, 9 items have been mentioned for more than 6 times, including trustworthy (6 times), sexy (7 times), fast (6 times), relieved (6 times), guaranteed (7 times), safe (6 times), favorite (6 times), quality (7 times) and preferential (7 times). 5 of them are factors in the “user demand” dimension, demonstrating that respondents are more concerned about user experience. Therefore, it is required to strengthen safety, guarantee and preference factors in user experience.

3.2. ISM analysis of user experience of live streaming sales

3.2.1. Key factors of ISM theory
An evaluation grid chart is drawn based on preliminary interviews, and a total of 56 factors affecting user experience are collected and analyzed. Five experts in digital media design related fields were invited to form a focus group, who made further discussions and selected a total of 11 common acceptable elements.

3.2.2. Establishment of a relation matrix
The focus group discussed and determined the relationship of various elements. A relationship list is developed (see Table 2) and transformed into a relation matrix (see Table 2).

| S1  | S2  | S3  | S4  | S5  | S6  | S7  | S8  | S9  | S10 | S11 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Items and elements | Anchor's prestige as a celebrity | High-quality platform | User demand | Domain expert | Anchor's image | Demonstration | Network influence | After-sales protection | Brand | Entertainment | Good quality and low price |
| S1  | 0   | 0   | 1   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   |
| S2  | 0   | 0   | 1   | 0   | 0   | 1   | 1   | 0   | 0   | 0   | 0   |

Table 2 Relationship list
3.2.3. Establishment of a reachability matrix

The relation matrix M is combined with the identity matrix I (basic matrix) to become a matrix B containing causality (Table 3). B is substituted into the Boolean algebraic operation and converted into a "reachability matrix". The matrix B no longer changes when B is multiplied with the Boolean operation. Yang et al. (2003) concluded through successive operations with $\log_2(N-1)+1$ that the reachability matrix can be obtained with biquadratic operation when the identity matrix is 11-order [11].

The specific operation is $M+I=B^{\log_2(N-1)+1}=B^4$, as shown in Table 4 and Table 5.

### Table 3  Relation matrix M and identity matrix I

|       | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 |
|-------|----|----|----|----|----|----|----|-----|-----|
| User demand | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 0   |
| Domain expert | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |
| Anchor's image | 1  | 0  | 1  | 0  | 0  | 1  | 0  | 0   | 0   |
| Demonstration | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |
| Network influence | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |
| After-sales protection | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |
| Brand | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |
| Entertainment | 0  | 0  | 1  | 0  | 0  | 0  | 1  | 0   | 0   |
| Good quality and low price | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0   | 0   |

### Table 4  Matrix B

$$B = \begin{bmatrix}
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
\end{bmatrix}$$

### Table 5  Reachability matrix

$$B^4 = \begin{bmatrix}
1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\
0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\
\end{bmatrix}$$
Table.6 Reachability matrix list

|    | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | S10 | S11 | D | D+R | DR |
|----|----|----|----|----|----|----|----|----|----|-----|-----|---|----|----|
| S1 | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 2   | 6 | -2 |
| S2 | 0  | 1  | 1  | 0  | 1  | 1  | 0  | 0  | 0  | 0   | 4   | 6 | 2  |
| S3 | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0   | 1   | 12 | -10|
| S4 | 1  | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0   | 3   | 4 | 2  |
| S5 | 1  | 0  | 1  | 0  | 1  | 0  | 1  | 0  | 0  | 0   | 4   | 5 | 3  |
| S6 | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 0  | 0   | 2   | 5 | -1 |
| S7 | 0  | 0  | 1  | 0  | 0  | 1  | 0  | 0  | 0  | 0   | 2   | 7 | -3 |
| S8 | 0  | 1  | 1  | 0  | 0  | 1  | 1  | 1  | 0  | 0   | 5   | 6 | 4  |
| S9 | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 1  | 0  | 0   | 3   | 4 | 2  |
| S10| 0  | 0  | 1  | 0  | 0  | 0  | 1  | 0  | 1  | 0   | 3   | 4 | 2  |
| S11| 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 1   | 2   | 3 | 1  |
| R  | 4  | 2  | 1  | 1  | 1  | 5  | 1  | 1  | 1  |      |    |   |    |

3.2.4. Establishment of a hierarchical matrix

To make clear the hierarchical relationship of various factors, the reachability matrix in Table 6 is converted into a hierarchical matrix. First, the reachability matrix is converted into a "relationship list of reachability set and antecedent set", where the horizontal direction of the reachability matrix shows the reachability set and the vertical direction shows the antecedent set, as shown in Table 7.

Table.7 Relationship list of reachability set and antecedent set

| Element | Reachability set R | Antecedent set A | R∩A |
|---------|--------------------|------------------|-----|
| S1      | S1, S3             | S1, S4, S5, S9   | S1  |
| S2      | S2, S3, S6, S7     | S2, S8           | S2  |
| S3      | S3                 | S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11 | S3  |
| S4      | S1, S3, S4         | S4               | S4  |
| S5      | S1, S3, S5, S7     | S5               | S5  |
| S6      | S3, S6             | S2, S6, S8       | S6  |
| S7      | S3, S7             | S2, S5, S7, S8, S10 | S7  |
| S8      | S2, S3, S6, S7, S8 | S8, S9, S10     | S10 |
| S9      | S1, S3, S9         | S9               | S9  |
| S10     | S3, S7, S10        | S10              | S10 |
| S11     | S3, S11            | S11              | S11 |

The condition of R=R∩A should be met for the same level based on the relationship list of reachability set and antecedent set. That is, the reachability set R is dominant and the R∩A relationship is obtained by comparison. For example, when the element S3 in the reachability set R is the same as the S3 in R∩A, S3 is at the first level. Then all S3s are deleted. It is found through comparison that S1, S6 and S7 in R are the same as S1, S6, and S7 in R∩A. So they are at the second level. It is concluded after successive operations that S2, S4, S5, S9, S10 and S11 are at the third level, and S8 is at the fourth level, as shown in Table 8.

Table.8 Hierarchy Table

| Level   | Item               |
|---------|--------------------|
| First level | S3                |
| Second level | S1, S6, S7        |
| Third level  | S2, S4, S5, S9, S10, S11 |
| Fourth level | S8                |
3.2.5. **Hierarchy diagram**

A hierarchy diagram is drawn based on the relationship list (Table 1) and the hierarchy table (Table 7), as shown in Figure 3.

According to the interview about user experience of live streaming sales and the statistical analysis of the focus group, the final ISM model is divided into 4 levels, as shown in Figure 5.

S3 (user demand) is at the first level, indicating that both interviewers and experts pay attention to user demand which is the most important factor. The first level is therefore defined as user demand.

S1 (anchor's prestige as a celebrity), S6 (demonstration) and S7 (network influence) are at the second level, indicating that the anchor's personal quality, specialization and affability in the live broadcast process are important indicators that affect the user experience. The second level is defined as interaction.

S2 (high-quality platform), S4 (domain expert), S5 (anchor's image), S9 (brand), S10 (entertainment) and S11 (good quality and low price) are at the third level, indicating that the improvement of these factors is important to improve the user experience. The third level is defined as good quality.

S8 (after-sales protection) is at the fourth level, indicating that good after-sales protection can improve the user experience. However, excessive after-sale protection cannot greatly improve the user experience of consumers. The fourth level is defined as extension.

4. **Analysis of user experience of live streaming sales based on Kano quality model**

4.1. **Kano questionnaire design and implementation**

Four dimensions and 11 specific factors were obtained as the basis of the two-way questionnaire, as shown in Table 8, based on the evaluation grid method and the ISM research results. The five-point Likert scale was used for the Kano questionnaire survey about quality attributes in the user experience of live streaming sales. Testees selected among 1 to 5 points for answer based on their own feelings. 5 points indicated "like", 4 points "deserved", 3 points "no feeling", 2 points "tolerable" and 1 point "dislike.

Before the formal implementation of the Kano questionnaire survey, 40 questionnaires were pre-tested and the spss data analysis software was used for statistical "reliability analysis". The analysis result was that the Cronbach's Alpha value was 0.846≥0.6, indicating that the scale in the study had reliable consistency. Some questions in the questionnaire were appropriately modified after the pretest, and then the questionnaire survey was formally implemented. A total of 195 questionnaires were collected, including 5 invalid and 190 valid.

4.2. **Analysis with the Kano two-dimension quality model**

4.2.1. **Reliability and validity analysis**
According to the evaluation of 11 factors in the four experience dimensions of testees, the KMO value of the overall questionnaire is 0.924 and it is 0.929 and 0.931 respectively under the condition of sufficient and insufficient quality elements. According to statistical validation, KMO> 0.9, indicating appropriate relevancy of sampling. Meanwhile, the extracted factors show a significant effect. Besides, the Bartlett test of sphericity shows the significance level, indicating that the above data is appropriate for correlation analysis. According to Cronbach’s α reliability, the α value of the overall questionnaire is 0.929, and it is 0.885 and 0.930 respectively under the condition of sufficient and insufficient quality elements. All the α values are more than 0.7, indicating high reliability. According to the result of factor analysis, the total cumulative interpretative variation of the overall questionnaire is 61.529%, indicating that the degree of interpretation is reached, as shown in Table 9.

### Table 9: Reliability and validity of the questionnaire

| Item                        | Kmo value | Bartlett sphericity value | Cronbach’s α | Cumulative interpretative variation (%) |
|-----------------------------|-----------|----------------------------|---------------|-----------------------------------------|
| Sufficient quality elements | 0.929     | 0.000                      | 0.885         | 60.076                                  |
| Insufficient quality elements | 0.931    | 0.000                      | 0.930         | 59.011                                  |
| Overall questionnaire       | 0.903     | 0.000                      | 0.929         | 61.529                                  |

#### 4.2.2. Kano two-dimensional quality classification

The two-dimensional quality characteristics of user experience of live streaming sales can be classified, as shown in Table 10, according to the results of the two-way Kano two-dimensional quality questionnaire combined with Table 1. According to analysis, 4 attributes are judged as attractive quality elements, 1 as one-dimensional quality element, 1 as must-be quality element and 5 as indifference quality element. This result shows that quality attributes influencing the user experience of live streaming sales can be classified into different two-dimensional quality elements under the Kano two-dimension quality model. According to statistics of the classification of two-dimensional quality characteristics based on quality dimensions of user experience, demand is a one-dimensional quality element, interaction is an indifferent quality element, high quality is an attractive quality element and extension is a must-be quality element.

### Table 10: Classification of Kano two-dimensional quality attributes

| Dimension       | Quality element | A | O | M | I | R | Quality |
|-----------------|-----------------|---|---|---|---|---|---------|
| Demand          | User demand     | 33| 67| 37| 53| 0 | O       |
| Interaction     | Anchor's prestige | 28| 20| 34| 102| 6 | I       |
| Demonstration   | 18              | 7 | 33| 85| 47|   | I       |
| Network influence | 97             | 8 | 0 | 63| 22|   | A       |
| Domain expert   | 87              | 12| 0 | 71| 20|   | A       |
| Anchor's image  | 61              | 10| 19| 86| 14|   | I       |
| High-quality sales platform | 25              | 45| 50| 70| 0 |   | I       |
| Brand           | 53              | 9 | 23| 84| 21|   | A       |
| Entertainment   | 88              | 9 | 0 | 75| 18|   | A       |

9
4.2.3. Kano user satisfaction coefficient and preparation of matrix diagram

The quality classification of user experience is obtained according to statistical analysis of the Kano two-dimensional quality questionnaire, but it cannot provide sufficient information for managers or creators to improve user satisfaction and benefits. Therefore, we can distinguish which quality attributes of user experience can improve user satisfaction greatly after improvement based on the matrix diagram of user satisfaction coefficient. First, we calculate the coefficient of increased user satisfaction and that of reduced user dissatisfaction (see Table 11) based on the classification result of two-dimensional quality characteristics in the user experience of live streaming sales and formulas (1) and (2) under the Kano model discussed in the literature.

| Dimension          | Quality element | Quality classification | Increased satisfaction coefficient | Eliminated satisfaction coefficient | Coefficient of satisfaction increase by the dimension | Coefficient of satisfaction elimination by the dimension |
|--------------------|-----------------|------------------------|------------------------------------|------------------------------------|-----------------------------------------------------|--------------------------------------------------------|
| Demand             | User demand     | O                      | 0.52                               | -0.55                              | 0.52                                                | -0.55                                                  |
| Interaction        | Anchor's prestige | I                      | 0.26                               | -0.29                              | 0.353                                               | -0.207                                                 |
|                    | Demonstration   | I                      | 0.17                               | -0.28                              |                                                     |                                                        |
|                    | Network influence | A                      | 0.63                               | -0.05                              |                                                     |                                                        |
| High-quality       | Domain expert   | A                      | 0.58                               | -0.07                              |                                                     |                                                        |
|                    | Anchor's image  | I                      | 0.40                               | -0.16                              |                                                     |                                                        |
|                    | High-quality sales platform | I | 0.37                               | -0.50                              | 0.38                                                |                                                        |
|                    | Brand           | I                      | 0.37                               | -0.19                              |                                                     |                                                        |
|                    | Entertainment   | A                      | 0.56                               | -0.19                              |                                                     |                                                        |
|                    | Good quality and low price | A | 0.43                               | -0.30                              |                                                     |                                                        |
| Extension          | After-sales protection | M                      | 0.15                               | -0.61                              | 0.15                                                | -0.61                                                  |

Then, a user satisfaction matrix diagram is drawn with the coefficient of increased user satisfaction as X axis and the coefficient of reduced user dissatisfaction as Y axis. The center lines of X and Y indicate the general average of the coefficients of satisfaction increase by 11 quality attributes and those of dissatisfaction reduction by the same respectively. Figure 4 shows the user satisfaction matrix diagram. Both coefficients range from 0 to 1. When the coefficient is closer to 1, user satisfaction can be improved more when the quality attribute is improved.

The quality attribute falling within the first quadrant (green area) in the matrix diagram is a key quality attribute for improving the user experience of live streaming sales. There are 3 key quality attributes in total, including "user demand" which is a one-dimensional quality element and "good quality and low price" which is an attractive quality element. In terms of quality dimensions of user experience, it is found based on the matrix diagram of user satisfaction coefficient that "user demand" is the key quality dimension.
5. Conclusion

A total of 56 elements affecting the user experience of live streaming sales were extracted through semi-structured interview of highly involved people with the evaluation grid method. Eleven important influencing factors were obtained for ISM statistical analysis according to the discussion and analysis of the focus group of experts. Four major dimensions were concluded, namely demand, interaction, high quality and extension.

The 11 quality attributes of user experience of live streaming sales were classified by their two-dimensional quality characteristics based on the Kano model, including 4 attractive quality elements, 1 one-dimensional quality element, 1 must-be quality element and 5 indifferent quality elements. Therefore, managers, designers and creators should focus on the four attractive quality attributes, i.e. "network influence", "domain expert", "entertainment" and "good quality and low price", to improve the quality continuously, which will result in constant improvement of user satisfaction. However, the user satisfaction will not be reduced due to the decrease of such quality elements. "User demand" is a one-dimensional quality element, which means that the user satisfaction will increase proportionally when its quality is improved, and vice versa. Therefore, it is necessary to ensure its quality level and meet user demands. "After-sales protection" is a must-be quality element, indicating that customers think they deserve it when it is satisfied and their satisfaction will be reduced when it is not. Therefore, the "after-sales protection" must be satisfied, but it is not necessary to overemphasize its input component. Other quality attributes are indifferent quality elements, which will not affect user satisfaction whether sufficient or not. It is unnecessary to be concerned about them. The order should be "after-sales protection" > "user demand" > "network influence", "domain expert", "entertainment" and "good quality and low price" in terms of attention.

In terms of the two-dimensional quality classification of attributes in the four major dimensions, "demand" is a one-dimensional quality element, "interaction" indifferent quality element, "high quality" attractive quality element and "extension" must-be quality element. Managers, designers or creators should pay attention to and improve them in the order of "extension" > "demand" > "high quality".

According to the result of analysis on the user satisfaction matrix diagram, a quality attribute of user experience is most critical and beneficial to the improvement of user satisfaction when it has high "coefficient of increased user satisfaction" and "coefficient of reduced user dissatisfaction" at the same time. Results of research on quality attributes of user experience of live streaming sales show that "user demand" and "after-sales protection" are the key quality attributes among quality attributes of user experience, and "demand" is the key dimension. Regardless of the key quality attribute or dimension, it is required to give priority to the improvement of must-be quality services and provide users with basic "after-sales protection" during the improvement of quality in user experience. Then, efforts should be made to improve the one-dimensional quality attribute "user demand" since it will also strongly affect user satisfaction.

This study also has problems such as the small number of interviews and the absence of users' emotion. The number and quality of interviews for highly involved people will be improved subsequently, and in-depth research will be conducted on the preference for live streaming based on
different personality characteristics. References and suggestions are made above for live streaming designers and creators.

Acknowledgment
Fund project: 2018 Project of Humanities and Social Sciences Youth Fund of the Ministry of Education: (18YJC760072); 2019 School-level Key Project of Huangshan University (2019xwh006) ; 2020 Huangshan University School-level Scientific Research Project (Huizhou Culture) General Project: Research on the Inheritance and Innovation of Huizhou Folk Songs Based on Digital Media Art (2020xwh009);

References
[1] Gandolfi, E. To watch or to play, it is the game: the game culture on twitch.tv among performers, plays and audiences[J]. Journal of gaming & Virtualworlds, 2016, (1):63-82.
[2] Karine Pires, Gwendal Simon. YouTube Live and Twitch: A Tour of User-Generated Live Streaming Systems[C]. MMSys 2015 6th ACM Multimedia Systems Conference, Portland, United States, Mar 2015, 225-230.
[3] Dougherty, Audubon. Live-streaming mobile video: Production as civic engagement. [C]. Mobile HCI 13th International Conference on Human-Computer Interaction with Mobile Devices and Services, 2011, 425-434.
[4] A. Hamilton, William, Garretson, Oliver, Kerne, et al. Streaming on twitch: Fostering participatory communities of play within live mixed media[C]. Conference on Human Factors in Computing Systems - Proceedings, ACM, 2014.
[5] Hilvert-Bruce, Zorah Nell, James & Sjöblom, et al. Social motivations of live-streaming viewer engagement on Twitch[J]. Computers in Human Behavior, 2018, (2):13.
[6] Kano, N, Seraku, N. Takahashi, F. Tsuji, S. 1984 Attractive Quality and Must-be Quality. Hinshitsu (Quality, the Journal of Japanese Society for Quality Control), 14: 39-48.
[7] Sage A P. Methodolog for large scale systems [M]. New York: McGraw-Hill, 1977.
[8] Hwang Ching-lai & Lin Ming-Jeng. Group decision making under multiple criteria: methods and applications [M], Springer-Verlag. 1987.
[9] COM. 1993. A Special Issues on Kano's Methods for Understanding Customerdefined Quality. Center for Quality Management Journal, 2: 3.35.
[10] Matzler, K. Hinterhuber H. H. 1998 How to Make Product Development Projects More Successful by Integrating Kano's Model of Customer Satisfaction into Quality Function Deployment. Technovation, 18(1) 25-38.
[11] Yang Xiuwen, Yan Shang'an, Zeng Shunpeng, Hao Cheng: "Discussion on the Method of Reachability Matrix" [J], "Mathematics Practice and Cognition", No.33, Vol. 11, 2003, pp.