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Short Research Paper**Research on Influencing Factors of User Satisfaction of Knowledge****Paid Products -- from the Aspect of Heuristic-Systematic Model***Yufei Han¹, Chuyu Jiang², Yanping Zeng^{3*}*¹School of Information, Central University of Finance and Economics, China²School of Information, Central University of Finance and Economics, China³School of Economics and Finance, University of International Relations, China

Abstract: Zhihu Live, a knowledge paid product, is a special virtual product of real-time interactive voice experience. Information seekers cannot obtain complete content before making payment decisions. Therefore, they need to evaluate the perceived usefulness of Live information through systematic and heuristic clues to make payment decisions. After acquiring complete knowledge, users will score or evaluate user satisfaction based on the difference between perceived usefulness before the payment stage and actual quality of knowledge. Zhihu Live allows speakers to describe knowledge in text and voice. Based on this, this paper explores how heterogeneous information features transmit different clues, enhance users' perceived usefulness of information, and then influence the final user satisfaction of the product. Combining the Information Foraging Theory, Information Acceptance Model and Heuristic-Systematic Model, we set up knowledge characteristics of heterogeneous information on the impact of user satisfaction measurement model of knowledge paid product, and to test text and voice characteristics effect on user satisfaction, and the moderating effect that theme features have on user satisfaction.

Keywords: user satisfaction, Information Acceptance Model, Heuristic-Systematic Model, Zhihu Live

1. INTRODUCTION

With the development and promotion of the concept of knowledge sharing, combined with the promotion of Internet and other new technologies, knowledge sharing has broken the inherent characteristics of the original free, and started the road of monetization. From then on, the era of "paying for knowledge" in China has officially kicked off. After several years of precipitation, knowledge payment industry has begun to take shape, but it has also entered the bottleneck period of development. According to the Annual Report on the Development of China's Sharing Economy, the direct financing scale of knowledge and skills in China's sharing economy was about 46.4 billion yuan in 2018, up about 75.4% year on year. In 2019, the financing scale reached 31.4 billion yuan, a year-on-year increase of -32.3 percent. From the data performance, 2018 has been the peak year of knowledge sharing, and after 2019, the scale of direct financing in the market has shown a trend of decline, which shows that investors are not optimistic about the future of knowledge sharing, which may be related to the use experience of investors. Therefore, how to improve the user satisfaction of knowledge paid products, enhance the perceived usefulness of users' information, and then motivate them to make knowledge payment decision has become a difficult problem for knowledge payment service providers to solve.

Zhihu Live is a kind of real-time Live interactive knowledge paid products. Speakers share knowledge and skills through real-time voice, pictures, Live broadcast and other diversified information forms. The audience can interact with the speaker through questions and answers. Compared with other information, the right to use the product can only be acquired after the cost of knowledge acquisition is paid. In order to prevent the problem of information asymmetry, Zhihu Live added relevant information to the product page to help users understand the applicability of the product, including content introduction, outline information, rating stars, popularity,

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feedback and evaluation clues ^[1]. Under the limitation that users can't get all the information, the Live speakers convey the quality clues of knowledge paid products by carefully designing the content introduction information and audio audition information of the Live page, and enhance users' perceived usefulness of knowledge so as to arouse users' impulse of knowledge payment. Users will form a first impression of Live based on the text clues provided by Live speakers, and combine with the audio audition function to form a perceived usefulness of knowledge of the audio quality. When the user's usefulness reaches a certain threshold, they choose to make a payment decision to accept this information. After paying for the information, users can submit comments or score the Live event to express their satisfaction with the quality of the information or experience ^[2].

2. LITERATURE REVIEW

2.1 Heuristic-Systematic Model

There is no agreement on the specific definition of heuristic behavior and systematic behavior. Chaiken (1980) believes that Heuristic-Systematic Model divides individual information behavior process into heuristic behavior and systematic behavior ^[3]. Heuristic behavior is based on intuition, usually based on the external clues of information to make simple judgments; Systematic behavior, on the other hand, is based on rationality and requires the use of sufficient cognitive resources to evaluate information. Shi et al. (2020) use the Heuristic-Systematic Model to distinguish these signal clues ^[4]. This model holds that users will process and obtain relevant information through heuristic clues and systematic clues, in which heuristic clues are usually related to external information such as information release source and content creator, and knowledge seekers need to pay less cognitive effort. Systematic cues are relevant to the content itself and require sufficient cognitive effort.

The Heuristic-Systematic Model provides a theoretical explanation for users to search for information, process information, evaluate information, receive information and make payment decisions in the context of knowledge payment. In Zhihu Live page, knowledge seekers can learn about the scope of the Live argument and the story elaboration style of the Live presenter from the text information such as the content introduction and outline. They can also learn about the content expressive force of the Live presenter in the actual voice interaction process from the audio information with the help of the trial listening function of Live. Therefore, in this paper, we regard text information and voice information as systematic clues in this study. In addition, knowledge seekers can clearly know the reputation clues such as the number of likes and fans received by the speakers. They can also judge the popularity of the Live course by the number of participants and the number of comments. Here, the number of paying users and the speaker's reputation information are regarded as heuristic clues in this study.

2.2 Research status of user satisfaction of knowledge paid products

For the study on user satisfaction of knowledge paid products, scholars mostly use questionnaires or interviews and other research methods to analyze and empirically test the model through structural equation model. Jin Xiaopu et al. (2020) designed relevant questionnaires to analyze the current situation of user satisfaction of knowledge payment platforms from four aspects ^[5]. In addition to the indicators in questionnaires and interviews, Huang Jiahui et al. (2018) measured the service utility with two variables: the number of appointments and the number of post-consultation reports ^[6]. Wang Hui (2019) uses the high praise rate as the proxy variable of user satisfaction ^[7].

The influencing factors of previous researches on product user satisfaction include non-product variables such as review information, information communicator and information source. There are few researches on quantifying the influence of information characteristics on user satisfaction with actual secondary data, which makes it difficult to match product user satisfaction at the level of actual product quality. Just study also

indicated that, information readability ^[8], persuasive information ^[9] and emotional tendency ^[10] affect product performance text information characteristics, such as, characteristics of information about their goods is introduced, the influence of user satisfaction research is still less, Live speaker itself provides information of text and voice features can affect user satisfaction of knowledge paid product and influence mechanism path is lack of exploration. As an important information clue that affects users' subsequent purchasing decisions and feedback evaluation, text information bears the task of introducing information content context, text structure and key knowledge points to information seekers. Voice messages can highlight context and semantics more, and information seekers can better grasp the real feelings of Live speakers and the actual experience during the Live broadcast through voice messages.

Perspective, so this article is based on user satisfaction of knowledge paid product to praise rate as proxy variable of user satisfaction, focusing on the analysis of knowledge distributors to provide knowledge information quality characteristics, to explore the influence factors of user satisfaction and the characteristics of different information to the user satisfaction with the role of the path.

2.3 Research status of Heuristic-Systematic Model and user satisfaction

Heuristic-Systematic Model has been applied more and more to the research of network information behavior, but less to the field of knowledge sharing in virtual community. Chen Minghong et al (2015) empirically concluded that knowledge sharing satisfaction is influenced by both systematic factors and heuristic factors based on structural equation model and questionnaire survey ^[11]. Based on stepwise regression and structural equation model, Tao Xiaobo et al. (2020) empirically found that the major factors of classification and recognition of heuristic cues and systematic cues have a positive effect on information adoption behavior ^[12]. Therefore, based on the Information Acceptance Model, when the user's perceived usefulness of the product reaches the threshold value and carries out the knowledge payment operation, the subsequent knowledge payment operation caused by the perceived usefulness can be regarded as the information acceptance behavior. The user's perceived usefulness of the product is caused by systematic factors and heuristic factors. After the user adopts the operation of information adoption, they can get the opportunity to experience the complete product. However, there will be a certain gap between the feeling after the experience and the perceived usefulness at the beginning, which is defined as the user satisfaction.

2.4 Summary of this chapter

To sum up, the marginal contribution of this paper is expected to be as follows: First, HSM model is applied to the study on the user satisfaction of knowledge paid products, from the dual-processing theoretical model of individual behavior process, namely Heuristic-Systematic Model, to better understand the influence and mechanism of heterogeneous information characteristics on user satisfaction; Secondly, voice information, a quantifiable index, is introduced into the heterogeneous information feature analysis to quantitatively analyze the influence of voice information features on user satisfaction from multiple dimensions, such as voice duration and voice clarity. Thirdly, in order to further understand the influence mechanism of user satisfaction, it explores whether text or voice features are more suitable for Zhihu Live under different theme types.

Based on zhihu Live as the empirical object, combining the Information Foraging Theory, Information Acceptance Model and Heuristic-Systematic Model, from the heuristic characteristic clues and systematic features two perspective to study its effect on product user satisfaction, and on this basis to explore the perceived usefulness and theme type in this influence to play a role. Specifically, this paper aims to solve the following problems : (1) How do heterogeneous information characteristics affect product user satisfaction? Do systematic information and heuristic information have different action mechanisms or influence degrees on user satisfaction of knowledge paid products? (2) For Zhihu Live under different theme types, what text/voice features should speakers adopt to effectively improve user satisfaction of the product?

In this paper, the measurement index of heterogeneous information characteristics is constructed at the theoretical level to promote the evolution of machine learning methods such as text analysis in the context of knowledge payment. In practice, it is helpful for paid knowledge lecturers to further improve the form and style of information, determine a reasonable range of information price and cost and release information clues that can satisfy users. Service developers to better understand the user's information, and thus targeted to improve the quality of information service, help to consider what information the extension form knowledge payment platform, and platform should provide voice value-added services to provide decision-making reference for detection, and strengthen the social attribute of knowledge platform.

3. RESEARCH HYPOTHESIS AND MODEL BUILDING

3.1 Theoretical basis

3.1.1 Information Foraging Theory and Research

According to the Information Foraging Theory, users' evaluation of information content quality depends on the background of Information provided. They will actively search, select and identify Information. After selecting Information, they will evaluate the actual information quality through signals and finally decide whether to adopt the Information. The theory of information seeking explains the adaptive relationship between information seekers and information providers. Information signals refer to clues, such as text or visual clues, that help information seekers to determine the potential value of specific information in a specific background. For Zhihu Live, information seekers, that is, users, can evaluate the quality of information provided by information providers on the page, and then decide whether to accept relevant information or not.

3.1.2 Information adoption model and its research

Information adoption behavior is a process in which the subject purposefully selects, evaluates, accepts and uses information, and this process will ultimately affect the subject's subsequent behavior. In order to explain the Information Acceptance behavior of users, Sussman et al.(2003) proposed the Information Acceptance Model, which regarded the process of Information influencing people's decision as the process of Information Acceptance, and regarded the quality of arguments and the credibility of information sources as the central path and the edge path of influencing Information Acceptance respectively ^[13].

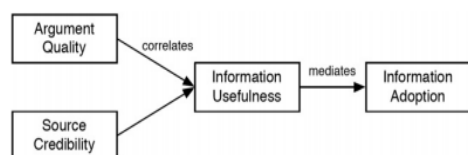


Figure 1. Information Acceptance Model

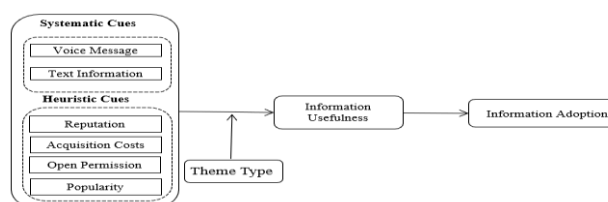


Figure 2. Model constructed12

3.2 Research hypothesis and model proposed

3.2.1 The influence path of systematic cues on user satisfaction

(1) The influence of text information characteristics on user satisfaction

Thematic correlation degree refers to the cosine similarity degree between Zhihu Live outline and title. When the outline description is more consistent with the theme, it indicates that the outline plays a good supplementary role for the theme, which helps users to grasp the theme content and avoid too big psychological gap for the theme content after paying for the operation, thus helping to improve user satisfaction.

In addition, the number of knowledge points displayed in an article, whether the sentences are concise and

whether the sentences are lengthy will affect the user's reading experience. Especially when the information provider is verbose and obscure, it tends to affect the user's understanding, resulting in low perceived usefulness. Based on the above analysis, the following hypotheses are proposed:

H1a: Thematic relevance is positively correlated with user satisfaction.

H1b: The amount of information is negatively correlated with user satisfaction.

(2)The influence of voice message characteristics on user satisfaction

Voice interactivity refers to the number of messages that are answered to a paying user's questions during each Live audio session. If users' questions in Live can be answered quickly and effectively, it can enhance users' sense of participation and contribute to the improvement of user satisfaction. For different real-time Live services, a short voice tone provided on a page before payment will also appeal to different groups of users. For Live, which is about entertainment, a voice that is too serious and rigid is less popular with users, while for topics related to stating facts, such as history, it is more expected. In this study, the voice timbre was measured from the main timbre category and timbre score of the Live speakers. And the voice clarity of the speaker is also an important dimension of the effect of speech information on user satisfaction. The higher the mandarin level and pronunciation score of Live speakers is, the better product experience will be brought to users, which will help to improve user satisfaction. Based on the above analysis, the following hypotheses are proposed:

H1c: Voice interactivity is positively correlated with user satisfaction.

H1d: Voice timbre is positively correlated with user satisfaction.

H1e: Voice clarity is positively correlated with user satisfaction.

3.2.2 The influence path of heuristic cues on user satisfaction

Presenter reputation is measured by the number of fans and the number of approvals of the presenters. The higher the reputation of the keynote speaker, the stronger the authority and presentation ability of the keynote speaker, which is conducive to the user's consumption experience. Open access refers to Live's open access to users, that is, whether to listen according to the chapter, seven days for no reason refund, unlimited listening back and other permissions. The more open access, it will help users to listen to Live lectures again after the event, which can well improve user's consumption experience and enhance user satisfaction. Popularity refers to the popularity of Live, or how popular Live is. The more popular Live is, the higher the quality of Live is, which is worth viewing for users with potential demand, and user satisfaction will not be very low. Based on the above analysis, the following hypotheses are proposed:

H2a: Speakers' reputation is positively correlated with user satisfaction.

H2b: Open permissions are positively correlated with user satisfaction.

H2c: Live popularity is positively correlated with user satisfaction.

3.2.3 The moderating effect of theme type

Live in a social Q&A community is organized by topic for easy retrieval. Li Wu et al. (2019) also found that theme type can moderate the influence of content fun on content expression^[14]. Based on the above analysis, heuristics and systematic information characteristics of different topic types may have great differences in their impact on user satisfaction. Therefore, the following hypotheses are proposed:

H3: Theme type can moderate the influence of heterogeneous information characteristics on user satisfaction.

4. RESEARCH DESIGN

4.1 Data capture and cleaning

In this paper, the crawler is used to collect the relevant information of 931 Live events and Live speakers from September to December 2020 at an interval of 10 days. The data were preprocessed, and the evaluation star

level was eliminated (when the number of Live participants was small, the evaluation star level was not displayed) and the Zhihu Live sessions that had not been started, and 893 Live sessions were retained as the research data. On the basis of crawling the text data of Live real-time page, the data is classified and then text analysis is carried out, including text semantic analysis, text word frequency analysis and text style recognition.

4.2 Variable measurement and description

The specific variable measure is shown in Table 1, but some individual variables need to be specified.

4.2.1 Explained variable measurement

In Zhihu Live, paying users can give star ratings to Live content after buying knowledge Live products. The star score can represent the psychological gap between the user's perceived usefulness before acquiring the product and the psychological gap after paying for the product. Here, the number of Live reviews is used to measure the user satisfaction of paid knowledge in the user group, and the Live praise rate is used as the proxy variable of user satisfaction in the robustness test.

4.2.2 Explanatory variable measurement

Presentation style measure is by reading about the Live text, based on the theory of Aristotle's rhetoric and grounded theory, and based on social computing to Harbin Institute of Technology and information retrieval research center of synonym word Lin (extension) on the semantic analysis of persuasive language can be divided into five kinds: resorting to credible, resort to return, resort to emotional appeal to logic and state the fact. With the help of sound recognition software, the voice characteristics of Live in the samples were analyzed in terms of voice duration, voice interactivity, voice timbre and speech clarity.

4.2.3 Adjusting variable measurement

Zhihu Live topics include 17 categories, which are subdivided into two categories for simplicity. Theme division is based on reference to the theme division method of Fu Shaoxiong et al (2019)^[15]. The final topic partition results are shown in Table 1. The financial and economic, law, business, professional subject delimit social field. Design, art, and reading and writing delimit the cultural field. Areas of life contains travel, food, music, film and television and games, lifestyle, medical and health and sports. Education field consist of education, science and technology, Internet and psychology.

Table 1. An introduction to variable measure methods

Variable Types	Measuring Dimensions	Variable Name	The Meaning
Explained Variable	User Satisfaction	Review_volume	The number of people who paid for and commented on the Live event.
		Review_valence	Ratio of the number of people giving the Live event 5 stars to the number of total reviews
Explanatory Variables (Systematic Clues)	The text Information characteristics	Thematic_relevance	Cosine similarity between Live outline and Live title
		Outline_count	Number of Live syllabus points displayed
		Presentation_style	Text presentation style for Live content profiles
	voice Information characteristics	Live_duration	The duration of Live real-time speech
		Live_interactivity	The number of messages that were answered by a paying user during Live Live
		Live_timbre	Live the dominant tone of the speaker
		Timbre_score	Live presenter's tone rating
Live_clarity	Live speakers' mandarin level		
Moderating Variable	The topic type	Live_genre	The subject category in which Live is located

Variable Types	Measuring Dimensions	Variable Name	The Meaning
Explanatory Variables (Heuristic Clues)	Presenter reputation	Reputation	The sum of the number of fans and the number of approvals of the keynote speaker is standardized
	Acquisition costs	Live_Price	Live's price tag
	Open access	Open permissions	[Listen according to the chapter] [refund for seven days without any reason] [free listening for members] [unlimited listening back] and other Live open permissions
	popularity	Live_popularity	Live heat

4.3 Empirical model construction

In order to study the influencing factors of user satisfaction based on Heuristic-Systematic Model, the model is constructed as follows:

$$Review_volume = \beta_1 \times Heuristic + \beta_2 \times Systematic + \varepsilon_1 \quad (1)$$

$$Review_volume = \beta_1 \times Heuristic + \beta_2 \times Systematic + \beta_3 \times Live_genre + \varepsilon_2 \quad (2)$$

$$Review_volume = \beta_1 \times Heuristic + \beta_2 \times Systematic + \beta_3 \times Live_genre + \beta_4 \times (Heuristic \times Live_genre) + \beta_5 \times (Systematic \times Live_genre) + \varepsilon_3 \quad (3)$$

Among them, to be sure, because the part has not been empirically explore, just explain that are relevant to all possible variables listed in table 1, but in the end is not necessarily all use, so not to formula (1) the introduction of the interpretation of the specific variables, but expressed as a heuristic clues to the heuristic feature variables, systematic on behalf of the entire system type variable characteristics of cues. Equation (2) introduces the moderator variable of topic type on the basis of Equation (1), and Equation (3) introduces the interaction terms of moderator variable and all heuristic characteristic cue variables and the interaction terms of moderator variable and all systematic characteristic cue variables on the basis of Equation (2). Each β represents the standardized regression coefficients of their respective variables, $\varepsilon_1 \sim \varepsilon_3$ is the residual term.

Firstly, the structural equation model can be selected to verify the research hypothesis proposed above, or ordinary OLS regression or negative binomial regression can be selected to test the hypothesis, and the different influence paths of heuristics and system variables on user satisfaction can be obtained. Secondly, the moderating effect of theme category is analyzed by general regression. On this basis, a simple slope test and an interaction graph are also conducted to compare the influence of heuristic information cue and systematic information cue on user satisfaction under the moderating effects of topic type. Finally, the robustness test of the model is carried out. The preliminary idea is to use another proxy variable of the explained variable to conduct regression analysis again, and analyze whether the conclusion of the model is robust according to the results.

5. SIGNIFICANCE AND DEFICIENCY OF THE RESEARCH

5.1 Research significance

According to the research content of this paper, it can be of great reference value to information providers. Specifically, the two points are as follows: First, according to the relationship between heuristic and systematic variables and user satisfaction, the core factors affecting user satisfaction can be clearly recognized, and the corresponding information requirements can be further improved to bring better user experience; Secondly, the influence mechanism of heuristic and systematic characteristic variables is not necessarily the same under different theme categories, so that information providers can better manage their Live topics according to different topic categories.

5.2 Shortage of research

As Zhihu Live platform is selected for research and analysis, the externality of the research conclusion could not be guaranteed. Later, we can try to study the mechanism of Heuristic Systematic Model on user satisfaction under different knowledge payment communities.

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