Design path of hybrid bean planting machine based on human-machine symbiosis aesthetics theory

ZHAO aili 1, GUO zhanbin1, WANG liming1*, QU qingfeng1, QIN haibin1

1Heilongjiang Bayi Agricultural University  DaQing 163000
*Corresponding author’s e-mail:573053416@qq.com

Abstract: Based on the theoretical study on the creative design theory of hybrid bean planting machinery, and combined with the aesthetic characteristics of hybrid bean planting machinery modeling of perceptual engineering-promoted symbiosis mechanism, an innovative design path based on man-machine symbiosis aesthetics of hybrid bean planting machinery was constructed to realize the innovative design style of hybrid bean planting machinery under the background of intelligent age, and thus improving the design level of agricultural machinery finishing.

1. Introduction
The No.1 Central Document in February 2019[1] actively advocated the development of related industries such as miscellaneous grains and hybrid beans. This policy signal indicates that with the development of the intelligent era, the miscellaneous grains and hybrid beans industry and planting machinery will achieve comprehensive development. At the same time, the "human-machine symbiosis" era of agricultural machinery is also approaching. Therefore, how to realize the harmonious symbiosis of human and machinery and optimize the experience is the trend and goal of the future development of hybrid bean planting machinery.

2. Research status of hybrid bean planting machinery
Considering the current status of domestic theoretical research, scholars have conducted related research on human-machine symbiosis and agricultural machine design, but the research on hybrid bean planting machinery is relatively inadequate. Through literature analysis and empirical research, Zhang Yue pointed out in the "Study on Human-Computer Symbiosis Based on Intelligent Product Design" that the rapid development of science and technology has accelerated the process of informationization, and more products are developing in the direction of intelligence. Humans and machines have also become inseparable, and from the background of intelligence, the key factors in product design and the physiological and psychological needs of modern people are studied to explore the symbiotic relationship between man and machine in products. Therefore, some key characteristics and general laws are summarized in the human-computer symbiosis relationship, which provides some ideas for future intelligent product design. [2] Aiming at the problems of small plots, difficult to operate large machinery, lack of small machinery, inconvenient purchase of fuel, and high labor intensity in the hilly and mountainous areas of Shanxi Province, Ma Li studied and designed the self-propelled machine in "Design and Experiment of Self-propelled Small Grain Multigrain Seeding Fertilizer" type electric miscellaneous grain sowing and fertilizing machine. The development of hybrid bean planting machinery lies in the co-ordination and trend of "function" and "aesthetics". [3] However, through the above analysis, it is found that the current research mainly focuses on how to develop functions, and how to combine engineering and aesthetics is blank. Moreover, the research on human-computer
symbiosis is only at the theoretical level, which has not been applied to deeper content such as innovation practice and path exploration. Therefore, in-depth research is needed.

Considering the current status of foreign research, the research content is rich and diverse, but has similar characteristics to domestic research, mainly focusing on mechanical principles and other aspects. For example, Research on 2BJYM-4 Type Precision Seeder for Interplanting Corn with Soybean pointed out that intercropping of corn and soybean is an effective yield-increasing technology, but a seeder capable of simultaneously seeding corn and soybean has not yet been formed. The innovative design of hybrid grain planting machinery started late in China, but has developed rapidly. Combined with the current rough design and poor experience of China's hybrid grain planting machinery, based on the concept of human-machine co-existence, exploring the aesthetic model of hybrid bean planting machinery and carrying out innovative design practice exploration is the only way for the development of agricultural machinery. Through the exploration of this innovative path, the bean planting machinery will enhance its emotional properties on the basis of realizing its intelligent function improvement, and activate the bean planting machinery through systematic and logical research in modeling design, user experience, aesthetics innovation and promote the development of hybrid bean planting industry.

3. Innovative design trends of hybrid grain planting machinery

3.1 Industry development adaptability trend

From the perspective of industry development, the innovative design of hybrid bean planting machinery based on the theory of human-machine symbiosis can systematically sort out its aesthetic rules and development direction, and innovate for independent hybrid bean planting machinery brands from aspects such as modeling, experience, and aesthetics. The design provides certain reference basis, so as to improve the overall level of the design of hybrid bean planting machinery, meet the development needs of the intelligent era, enable research and development products to be compatible with future development trends, and enhance the competitiveness and influence of hybrid bean planting machinery in China.

3.2 Market-oriented adaptation trend

From the perspective of marketization, the aesthetic model construction and human-machine analysis carried out by the innovative design of hybrid bean planting machinery based on the human-machine symbiosis theory can promote its rapid market-oriented response capabilities. This design can make the research and development of hybrid bean planting machinery not only have a certain function, but also reflect the corresponding aesthetic education, improve farmers' aesthetic level of the design of hybrid bean machinery, and thus promote the market of miscellaneous cereal machinery benign development.

4. Analysis of innovation path

4.1 Path content

(1) Investigation and extraction of hybrid bean planting machinery

The research of bean planting machinery should be based on perceptual engineering, using field surveys, field research, etc. It is necessary to conduct in-depth research on the man-machine size and human-machine experience of hybrid bean planting machinery, classify and summarize the results, and extract data to provide a basis for subsequent transformation. In this way, theoretical analysis and practical exploration of the human-machine symbiosis aesthetic construction and innovation of hybrid bean planting machinery can be realized.

(2) Construction of a human-machine symbiosis aesthetic model for hybrid bean planting

By analyzing problems and designing "pain points" between various system environments related to the bean planting machinery, you can use design methods such as "scenario maps" and "scene descriptions" to conduct research, and explore its human-machine symbiosis logic to construct aesthetic models and determine the design direction. Based on the aesthetic principles, you can analyze the artistic
characteristics of the research on the aesthetics of mechanical design of hybrid bean planting, explore the rules of mechanical design aesthetics, and interpret and analyze them.

(3) Innovation practice and analysis of hybrid bean planting machinery

Combining the previous human-machine measurement data and the aesthetic model architecture, you can carry out innovative design of hybrid bean planting machinery from the aspects of appearance design, human-machine experience, and aesthetic factors. Based on the psychological experimental platform, the sensible engineering test of the realization and transmission of its human-machine symbiosis aesthetics can fully realize the design case of hybrid bean planting machine in the new era, which can meet the needs of consumers and have the ability of rapid market response.

4.2 Innovation point analysis

By using the perceptual engineering theory to study the human-machine symbiosis aesthetic law of hybrid bean planting machinery, and use this as a basis for innovative practical exploration. And you can systematically study the basic factors such as the technology, art, and economy of the bean planting machine, introduce the creative thinking and research methods of the bean planting machine, and conduct scientific and rigorous research on the shape and experience of the grain planting machine.

First of all, this method can realize the fusion of the technical beauty and experience beauty of hybrid bean planting machinery in the process of human-machine symbiosis aesthetics construction and innovative design research of hybrid bean planting robots, and finally conduct perceptual engineering experiments to form a fusion of engineering and aesthetics. The research method of "service design" is introduced into the innovative design research of hybrid grain planting machinery to realize the innovative research method of human-machine symbiosis aesthetics.

Secondly, the psychological cognition of human-machine symbiosis aesthetics was proposed in the process of researching the innovative design style of hybrid bean planting machinery. Strengthen the "technical and artistic" style of hybrid bean planting machinery by realizing the design, human-machine experience and aesthetic path of hybrid bean planting machinery. This unique innovative practice path can adapt to the development of the intelligent era and promote the improvement of China's hybrid bean planting machinery.

![Design path analysis diagram](image1)

![Analysis of mechanical innovation points of miscellaneous bean planting](image2)
5. Path achievement indicators

5.1 Construction index of man-machine aesthetic model of hybrid bean planting robot
When observing and measuring the bean planting machinery, collecting data, determining the quantitative relationship, designing the human-machine symbiosis aesthetic relationship, conducting analysis and inference, and clarifying the aesthetic creativity and transmission power indicators, you can make the interaction relationship reaches the optimal value. In terms of shape, function and technology, it achieves a balance, subverts and reproduces the rigid mechanical aesthetics, realizes flexible interaction, and has a higher service feedback mechanism.

5.2 Innovative design indicators of hybrid bean planting machinery
By constructing a complete innovative design system of human-machine symbiosis, and clarifying the realization goals of modeling design, user experience, aesthetics, etc., we can achieve the "innovative development" of product appearance modeling changes, the application of material surface texture and color "Time trend", "emotional transmission" in human-machine experience between human and machine

6. Conclusion
The research strives to analyze the human-machine symbiosis aesthetic law and development direction of hybrid grain planting machinery through systematic combing, and provide a certain reference for the innovative design of China's independent hybrid grain machinery, thereby improving the overall level of the design of agricultural machinery in China. It aims to improve the aesthetic level of the innovative design of hybrid machinery by agricultural machinery users through theoretical and practical means of human-machine symbiosis, so as to promote the healthy development of the hybrid machinery market.

Acknowledgment
Fund Project: Characteristic discipline project of " coarse cereals production and processing"(Project Number:102/2042070008)

References:
[1] Ministry of Agriculture and Rural Affairs of the People’s Republic of China. No.1 Central Document, [EB/OL]. 2019-2. http://www.moa.gov.cn
[2] Zhang Yue. Study on Human-Computer Symbiosis Based on Intelligent Product Design[J]. Computer Products and Distribution.2018, (11) :124.
[3] Ma Li. Design and Experiment of Self-propelled Small Grain Multigrain Seeding Fertilizer [J]. Agricultural Engineering.2019, (06) :93-96.
[4] QU Zhe, YU Yong-chang. Research on 2BJYM-4 Type Precision Seeder for Interplanting Corn with Soybean [J]. Soybean Science.2014, (04) .