Research on the Symbiosis Mechanism of Handicraft Gene and Smart Technology in Agricultural Product Innovation under the Perspective of Design Ethics

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Abstract

Against the backdrop of agricultural modernization and intelligent development, agricultural product design is confronted with ethical crises such as cultural discontinuity, ecological imbalance, and technological alienation under the dominance of technical rationality. From the perspective of design ethics, this paper takes the theoretical system of "symbiotic design" as its core to explore the interaction logic andsynergistic mechanism between craftsmanship genes and intelligent technologies in agricultural product design. It analyzes the cultural symbols, ecological wisdom, and industrialization dilemmas of traditional craftsmanship, while reflecting on the risks of technological hegemony driven by intelligent technologies. The paper proposes symbiotic approaches including "cultural translation", "modular deconstruction", and "collaborative innovation", and constructs ethical evaluation criteria covering cultural continuity, ecological sustainability, and technological controllability. It addresses relevant issues through paths such as "distributed collaboration" and "reversible design", aiming to reconstruct the triadic relationship among humans, technologies, and objects. From philosophical and design perspectives, this study demonstrates that the symbiotic mechanism between craftsmanship and intelligent technologies can bridge the gap between instrumental rationality and value rationality, providing an ethical paradigm for agricultural product design that balances technological innovation, cultural inheritance, and ecological responsibility, and contributing to rural revitalization and the sustainable development of agricultural products.

Keywords

Design Ethics, Agricultural Product Innovation, Handicraft Gene, Smart Technology

1. Introduction: Paradigm Crisis and Ethical Turn in Agricultural Product Design

1.1 Research Background

In the process of agricultural modernisation, traditional handicrafts are facing a serious decline dilemma. Take bamboo and straw weaving craft as an example, in Renli Village, Yongtai, Fujian, the craft has a 60-year history of inheritance, and became a characteristic industry of the whole village in the late 1990s, with more than 30 factories and 1,000 people working in the village at its heyday [1]. However, with the change of time and the emergence of a large number of plastic substitutes, it gradually lost its market as a daily necessity, and the young people went out of the village, so the inheritance encountered great challenges. In sharp contrast, smart technology in the field of agriculture shows a unidirectional penetration trend. From the wide application of intelligent agricultural machinery to the flourishing development of agricultural e-commerce platforms, smart technology has profoundly changed the mode of agricultural production and sales. However, this development often ignores the rich cultural value and ecological wisdom contained in traditional handicrafts, resulting in an imbalance between culture and technology in agricultural product design.

From the perspective of design, there is a serious lack of humanistic care in agricultural product design, the phenomenon of cultural fault is very obvious, the traditional agricultural cultural symbols gradually disappeared in today's agricultural product design, so that most of the current agricultural products have lost their own cultural attributes. Such as some agricultural products packaging design to pursue modernisation, do not pay attention to the combination of regional, traditional, in the process of ignoring the expression of the local traditional farming culture, it is difficult to provoke people's emotional resonance [2]; ecological responsibility on the massive use of unsustainable materials as means of production, and the process of generating energy consumption is huge, the environmental damage is more serious [3]; the phenomenon of technological alienation is serious, the phenomenon of technological alienation is serious. In this case, there is often only scientific and technological development and no human-machine relationship [4]. For example, a variety of new agricultural machinery and equipment intelligent, but too complex control, will make agricultural producers difficult to manage, which is contrary to the agricultural equipment for people to serve the original design intention.

1.2 Research Significance

Unlike the traditional "instrumental rationality" [5] of agricultural product design, which focuses on the efficiency and functionality of designing industrial and agricultural products, the cultural and ecological values and the subjectivity of human beings embedded in handicrafts are neglected. However, for agricultural product design, it is of great practical significance to promote the transformation of design concept from "instrumental rationality" to "value rationality". "Value rationality" is expressed in the human behaviour as a way of activity to understand, in order to ensure that people are how rather than what to become. It is a guarantee that how one practices moral principles, i.e. produces something, is subordinate to a certain form of production. Therefore, we should pay attention to the issue of technological ethics, we should combine handicraft technology and intelligent technology, so that the two are organically combined, on the basis of which we can make products that are more in line with the market demand, and at the same time pay attention to the value of agricultural production, and make use of the means of product design to enhance the characteristics of each region. Finally, we hope to do a good job in the integration of technology and humanities in agricultural product design, and avoid one-sided emphasis on the importance of a certain technology in agricultural product design [6].

1.3 Theoretical Framework

With the development of design theory, the combination of design ethics and symbiosis theory has been a general trend, which is also brought about by the current era of the value of design and the actual demand for the sustainability of design. This paper proposes "symbiosis design" [7] from the perspective of design ethics, which provides a new thinking direction for deepening and improving the theoretical system of design practice.

The use of symbiosis theory to analyse interactive product design is essentially to examine the human activity of making things from the perspective of nature. This shift in perspective brings a new theoretical filling and methodological guidance for product interaction design. In fact, the exploration of symbiosis theory in the field of design has a long history. As early as the 1980s, Pan Changhou, a professor at Tsinghua Academy of Fine Arts, proposed the symbiosis theory of design, pointing out that "the beauty of this world lies in their mastery and subordination, complementarity and mutual help, and symbiosis and coexistence. The resulting coexistence and prosperity of science and art, classical and modern, marks the fusion of contemporary science and art in design, which is more directly materially and spiritually concerned with the value judgement based on human beings, human beings as the core, human beings as the destination, and human beings as the ultimate". This viewpoint lays an important foundation for the subsequent research. At the same time, in foreign countries, the exploration of symbiosis theory is also in parallel. 1950s, the psychologist J.C.R. Lickider tried to determine how man and machine can interact gracefully and harmoniously, and called it "symbiotic relationship" Norman greatly respected this concept, he thinks that He believes that symbiosis will improve the quality of our lives, and that it is a co-operative and mutually beneficial relationship. To this end, Norman cites the classic example of the horse + rider, which vividly illustrates how horse and rider form an exquisite symbiotic system - the horse controls the instinctive layer, the rider controls the reflective layer, and the two overlap on the behavioural layer, with the horse attempting to exert influence on the reflective layer. and the horse tries to influence the reflective layer. After the 1980s, Kisho Kurokawa put forward the concept of symbiosis and discussed it as a basic concept of architecture, in terms of the symbiosis of heterogeneous cultures, the symbiosis of man and technology, the symbiosis of inside and outside, and the symbiosis of man and nature, etc. In practical application, the concept of symbiosis has been used in a variety of ways. In practice, Kisho Kurokawa applies some unique techniques, such as the way he advocates the equal importance of the part and the whole, the extension of the interior to the exterior, or the bringing of the exterior into the interior, etc., all of which are means of symbiosis in practice, as well as the means themselves. Therefore, his works are more inclined to construct symbiosis from different sides.

The so-called design ethics, as one of the important theories in the design discipline, not only focuses on various moral and value issues arising from the design process, but also requires that the design must take the long-term interests of human beings and sustainable development as the starting and ending point. We integrate design ethics into symbiosis theory to form "symbiosis design", and use the concept of biological symbiosis theory in "symbiosis design" to explore the possibility of mutual symbiosis and mutual growth of the handicraft gene of agricultural products and intelligent technology in agricultural product design. Agricultural product design to do a good job of agricultural product design in the agricultural product of handicraft genes and intelligent technology genes complement each other and collaborate with each other. One of them is to fully study the regional attributes of traditional handicrafts, because different regions have their own characteristics of traditional farming tools, which carry certain regional characteristics of culture; the second is to pay attention to the value of traditional handicrafts as a kind of cultural heritage, and to pay attention to how to coordinate the relationship with intelligent technology in the design of agricultural products; only from the cultural [1], ecological [3], and technological [4] aspects to explore the relationship between the two. Only from the cultural [1], ecological [3], technological [4]aspects to explore the symbiosis of the two and explore a symbiotic practice path, it is possible to better promote the development of agricultural product design, make up for the gaps in the current theoretical study of agricultural product design, so that the theoretical system of agricultural product design is more complete.

2. Analysis of Handicraft Gene in Agricultural Product Design

2.1 Cultural Semiotics Dimension

Traditional agricultural tools are rich in certain regional symbolic representations. Take the Yellow River waterwheel as an example, the large frame and huge spokes made of wood, as well as the way driven by the water flow, are the creation of the people in the Yellow River basin who have adapted to the local environment and agricultural production over the years. Waterwheel is not only a simple tool, in the Yellow River basin, more as a symbolic carrier, a symbol of the local people and the natural attitude of the world. And from the form, material, use method and so on have certain regional attributes. It is different from other regions and has its own distinctive regional cultural visual and behavioural expression.

Handicrafts are "living culture", and they contain an extraordinary narrative function. As a matter of fact, many intangible cultural heritage projects have a large number of handicraft forms, such as traditional embroidery, weaving, etc., which can be applied to agricultural product design, and they can present the unseen and unheard stories of the region in the form of handicrafts. Therefore, in some places, local traditional embroidery skills are embroidered on the packaging of agricultural products, and these local representative patterns are integrated into the design of agricultural products, and special patterns, such as crops symbolising a good harvest, and animals symbolising joy and good fortune, are used to convey auspicious motifs, special culture and traditional folklore, which are more understandable to consumers. In this way, it is possible for handicrafts to convey regional culture, and it becomes the best path for agricultural products to help regional culture inheritance and dissemination.

2.2 Technical Philosophy Dimension

Handicraft has rich ecological wisdom. In terms of materials, traditional handicrafts prefer to use inexhaustible and inexhaustible local natural materials, for example, bamboo weaving is commonly used in local production of fast-growing and renewable bamboo, which is strong and elastic and suitable for making a variety of agricultural tools and daily necessities, which also reduces the carbon emission caused by transporting materials, and at the same time ensures that natural resources of this piece of land have been fully utilised. Utilisation. As for human-computer interaction, handicrafts are a low-entropy existence, focusing more on the process of direct contact between people and materials, and people and tools during the production process, and valuing human experience and skills. For example, when making handmade traditional agricultural tools, the shape and size of the handles will be polished according to ergonomic principles combined with the living habits of local people to make a size more suitable for human hands to grip. This is to facilitate people's use, to reduce their labour intensity, and also to reduce physical exertion.

2.3 Design Ethics Dilemma

Industrialised reproduction destroys the uniqueness of regional culture. With today's industrialised mass production, most agricultural products and packaging designs tend to be uniform. For example, in the agricultural machinery market, many brands of agricultural machinery do not pay attention to the characteristics of agricultural production in different regions and the needs of local farming culture, do not have a sense of localisation in the design, for the different regions of the agricultural culture can not be presented as a special, and thus lose the connotation of regional culture. In a sense, most of the packaging of agricultural products is a high degree of homogenisation, such as a thousand and one simple and modern style is dominant, less will reflect the cultural elements of the region. This makes the product less individual characteristics, and then the cultural elements of the whole region will be worn out, which will weaken the possibility of people's perception of regional culture, which is not conducive to the development of regional culture.

3. Transformation of Agricultural Design Paradigm Driven by Intelligent Technology

The application of intelligent technology to agricultural design has significant value. Precision sensors and data analytics support precision in all aspects of agricultural production, such as precise irrigation and fertiliser application, increasing resource utilisation and reducing waste. Modular design combined with smart technology enables mass production, consistent quality and low cost, while supporting targeted assembly and customised design to enhance the user experience. For example, smart agricultural machinery adopts modular design, replacing modules according to different operations or crops to enhance versatility and adaptability.

However, there are risks associated with the use of smart technologies, with ethical risks dominating, as the design process becomes increasingly data-dependent, creating technological hegemony and undermining traditional knowledge systems. Data models and algorithms are used extensively in smart agriculture design, but most of this data is obtained under modern technological conditions and summarised using modern technological methods, thus ignoring the accumulated knowledge and experience of farmers. In some places, when engaging in smart agriculture, they only follow the data model to make decisions on planting and raising plants, regardless of the actual local situation, for example, they do not pay attention to what the local people know, their own soil quality, climate and other local conditions, and they only rely on the data to make the decision, so they are ineffective in the process of development.

In order to realise the rebalancing of "people-technology-objects", it is necessary to return to the origin of "people-technology-objects" and to face up to the current application of intelligent technology: virtual reality (VR) simulation technology can make it easier for people to learn some agricultural knowledge or better complete agricultural work in a

more intuitive way. Knowledge or better complete the agricultural production practice and other work, but it will make people relatively little contact with the real agricultural scene, people can not personally experience the joy of labour. This requires us to focus on the use of technology, in the use of virtual technology at the same time but also consider the feelings of people, so that people and the actual agricultural production better combined together, so that the technology to better serve people's production and life.

The use of intelligent technology to transform traditional agricultural culture symbols, stories and other digital language, and then the use of multimedia and other means of visual communication, display, so as to play a role in the dissemination of agricultural products to be applied; the use of modern visual communication technology, some of the traditional agricultural tools or non-heritage patterns of the form of the digital design, embodied in the design of packaging of agricultural products or agro-tourism publicity, etc., so that the traditional culture with the new era. Traditional culture and the new era are in line with each other.

4. Symbiotic Logic of Handicrafts and Intelligent Technology: Practical Path of Design Ethics

4.1 Theoretical Model of Symbiotic Mechanism

Transform traditional handicrafts into digital semantic codes to reconstruct and reshape them. By extracting the core symbolic elements of craftsmanship and applying digital technology for simulation, deformation and redesign, it can be transformed into smart products and digital media symbols. For example, the complex structure of agricultural tools is simplified into the interface icons of intelligent agricultural machines, which not only retains the cultural memory, but also adapts to contemporary usage habits.

According to the idea of unitisation, the elements of traditional skills are separated and decomposed to form a unitised self-supporting system, which is fused and embedded with intelligent technology, for example, by means of agricultural robots. Take agricultural robots as an example, in the traditional farming techniques through its sowing, weeding, harvesting and other processes of technical decomposition after the formation of modules, and then the combination of such technical modules with the robot mechanical structure, control system design, and this technical module into the robot to perform the operation of the action and the way. This will not only improve agricultural productivity and technology, but also preserve the traditional skills.

Farmers as "culture holders" play a role in promoting the innovation of agricultural products, in promoting the development of agricultural science and technology innovation needs to guide the farmers to participate in the research and development and application of intelligent technology, to promote the synergy of the two technologies. Taking the construction of the "Digital Countryside" project as an example, in some areas, farmers participate in the trial and feedback of intelligent agricultural equipment, and the suggestions based on farmers' actual production experience are integrated into the design of intelligent technology to make it more suitable for local agricultural production; in addition, at the community level, we promote the transformation of traditional handicrafts into intelligent development, and integrate traditional handicrafts and farming culture into the development of rural villages. handicrafts and farming culture and rural tourism closely together to create unique local agricultural products and agricultural cultural tourism projects.

4.2 Ethical Evaluation Index System

An ethical evaluation index system is established in accordance with the relevant research on intelligent design technology of agricultural machinery, and the symbiotic practice of handicrafts and intelligent technology in agricultural product design is evaluated from the perspective of cultural continuity, ecological sustainability, and technological controllability [8].

In terms of cultural continuity, it mainly depends on whether the regional culture can be integrated into the product design, and whether the formal essence and cultural kernel of traditional handicrafts can be retained in the form of such products [9]; just as the intelligent product design of agricultural machinery attaches importance to culture, the product design should also dig down the local characteristics, so that the traditional patterns used in the packaging design of agricultural products can accurately convey the characteristics of the place, and make the traditional handicrafts have the characteristics of the place. The traditional patterns used in the packaging design of agricultural products should accurately convey the characteristics of the place, so that the value of traditional handicrafts can be continued and developed in modern design works [10].

From the perspective of ecological sustainability, consider the overall design, the impact on the ecological environment in the selection of materials, processing, use, etc., whether to achieve the requirements of low-carbon, environmental protection, which is precisely the intelligent design of agricultural machinery on the requirements of sustainable development, to be reflected in the design process, therefore, the product packaging materials selected in the product design needs to be degradable, as far as possible, do not damage the ecological environment; in the production process, attention needs to be paid to the environmental impact of the packaging design. In the production process, we need to pay attention to the degree of impact on the environment, so that the production of all resources can be used effectively, in which attention to the production of energy saving and consumption reduction issues, and to ensure that the ecological environment as far as possible to ensure the good development.

From the perspective of technical controllability analysis, consider whether the application of intelligent technology can always remain within the effective control of people, will not appear technology out of control; whether there are potential technical risks and hidden dangers, whether it is contrary to the development of technology and social ethics and moral norms, etc.; Drawing on the intelligent design of agricultural machinery on the reliability of the technology and the safety requirements, in the design of intelligent agricultural machinery, the application of the process of paying attention to ensure the use of security In the design and application process of intelligent agricultural machinery, attention should be paid to ensuring the safety of use, avoiding personal casualties and property losses due to technical failures; attention should also be paid to protecting the user's data and information, and not letting them be leaked, so as to make the application of intelligent agricultural machinery technology safer and more reliable, in order to satisfy the requirements of social ethical and moral norms.

5. Practical Path of Agricultural Product Design Based on Cultural Self-awareness

Functional translation of the structure of traditional agricultural tools, extracting the mechanical principles and design wisdom contained therein, and combining them with modern intelligent agricultural machinery; the power principle of the waterwheel can be transformed into the energy-saving drive device of the modern intelligent irrigation system, and the water resources can be used accurately by means of digital control; the use of computer technology to parameterise the non-heritage patterns, and then the use of computer technology to analyse and model the traditional patterns, generating Various kinds of changing patterns are applied to the packaging design of agricultural products and the design of agricultural cultural and creative products to complete the reproduction and dissemination of local symbols in the digital era.

For intelligent agricultural machines, human factors engineering and cultural adaptation should be fully considered in the design, and on the basis of understanding the visual behaviour and cognitive characteristics of farmers' eyes during the driving of intelligent agricultural machines through eye movement experiments and other means, the operation interface and human-machine interaction of agricultural machines should be optimized, so as to make them more humane and suitable for farmers to use. In the process of designing cultural and creative products, we should adhere to the idea of "reversible design", adopt materials that can be recycled or degraded, and design products that can be recycled after completion, so as to reduce the damage to the natural environment and do our best for the earth.

Establishing a distributed collaboration model between village craftsmen and smart factories to optimise the design process. Rural artisans with exquisite skills in traditional handicrafts will carry out product design innovation and embed cultural symbols for smart factories; smart factories will make use of their advanced production equipment and digital technology to turn the design ideas of rural artisans into commodities and realise large-scale production; through the two types of production organisations with different natures carrying out collaboration with complementary strengths in different segments and in different ways, the cultural inheritance function of rural artisans will be brought into full play, and the cultural inheritance function of smart factories will be enhanced, thus giving full play to the cultural inheritance function of rural artisans. Through the collaboration of the two types of production organisations in different links and in different ways, the cultural heritage function of rural artisans is given full play to, the cultural added value of the products of smart factories is improved, and the industrial development and employment expansion in rural areas are promoted.

6. Reconstruction of Humanistic Value and Agricultural Design Responsibility

Design should produce local knowledge through agricultural product innovation and repair and continue regional culture. For example, in the "double water, double green" model, ecological culture and farming elements are integrated into the design, combined with production and cultural dissemination, to create regional characteristics of agricultural products with both economic value and cultural carriers. At the same time, through the landscape design to protect the use of traditional farmland and water conservancy facilities, rural settlements and other elements, so that the traditional agricultural landscape renewed, retaining the inheritance of rural culture.

In view of the monopoly of intelligent technology in the intelligent era, design science needs to take the initiative to assume social responsibility, establish a sound cultural feedback mechanism, resist data hegemony and other undesirable behaviours in design practice, and add traditional handicraft culture and regional characteristics into the process of innovating intelligent technological products, so that the technology will have more cultural value. For example, it is important to incorporate more knowledge about traditional agriculture and the culture associated with it into the design and promotion of intelligent agricultural products, so as to enhance the public's knowledge of regional culture and sense of identity, thus avoiding problems such as cultural singularity or homogenisation due to the development of technology.

In the age of intelligence, digital twin technology and other methods are used to maintain the continuity of the spirit of the countryside. Digitally record and store traditional skills, use virtual museums, online cultural experience and other ways to convey the idea of traditional agricultural culture to more people, use the packaging of agricultural products to create a regional cultural symbol represented by the spirit of the vernacular, and apply it to the packaging of products, so that agricultural products become a part of the inheritance and development of agricultural civilisation after they enter the market circulation, so as to paint a good picture for the development to paint a good picture.

7. Conclusion and Prospect

The paper is based on analysing the symbiotic mechanism of handicraft gene and intelligent technology in agricultural product design. After revealing the current situation that technology is more important than humanity in agricultural product design, the paper takes the ethical model of "symbiotic design" as the basis, and applies the relevant knowledge of cultural semiotics, philosophy of technology and other relevant knowledge to construct the path of symbiosis between the two, which not only enriches and improves the design science in rural revitalization, but also improves the design science in rural revitalisation. This not only enriches and improves the theoretical boundaries of design in rural revitalisation, but also injects a new kernel into the theoretical system of agricultural product design; on the other hand, it stresses that we should strengthen the protection of the value of handicraft culture based on the process of technological development, focus on eco-civilisation and humanism, and seek synergies between technology and humanities, so as to realise the development and progress of human civilisation.

In the future, we can focus on two aspects of digital twin and meta-universe research: firstly, the application of digital twin and meta-universe technology fusion research in the protection of traditional arts and crafts, under the high simulation of digital twin and meta-universe, we can set up realistic digital immersive experience scenes, break the time and space shackles of traditional arts and crafts, and bring the audience to enter into the scene of creation of traditional arts and crafts, so that they can experience the beauty of traditional arts and crafts; at the same time, with the help of the digital twin and the meta-universe, we can build up the digital immersion experience scenes, breaking the time and space shackles of traditional arts and crafts, and bringing the audience to enter the site of traditional arts and crafts creation, and experience the beauty of traditional arts and crafts. At the same time, with the help of big data to accurately collect market demand, cultural preferences and other information to provide data support for the inheritance and innovation of traditional arts and crafts, traditional arts and crafts from resource excavation to the transformation of market value to form a complete industrial chain, and then traditional arts and crafts of the digital era of the new pattern; second, to explore the study of AI Generative Design (AIGD) ethical risks in the process of designing agricultural products, to formulate AI The second is to explore the issue of ethical risks of AI Generative Design (AIGD) in the process of agricultural product design, formulate a specification for the use of AI cultural data for handling handicrafts, and guarantee that the AIGD design can fully undertake and carry forward the local characteristics of culture and traditional handicrafts from the angle of cultural continuity; from the angle of ecological sustainability, clarify the ecological and environmental impacts of AIGD in the entire process of agricultural product design, and achieve the design concepts of low-carbon and environmentally friendly; from the angle of technological control, confirm that the application of AIGD is within the scope of human control, and there should not be any risk due to technical problems. From the perspective of controllability of technology, it is confirmed that the application of AIGD is within the scope of human control, and there should not be any risks and hidden dangers due to the technology, and the development of technology should comply with the social ethical and moral norms, so as to determine the ethical standards and evaluation standards to abide by the bottom line of the red line of cultural inheritance and ecological protection, and to further deepen the fusion of handicrafts and intelligent technology, and to explore new breakthroughs in the design of agricultural products.

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