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論文の内容の要旨

Chinese Traditional Color Culture（CTCC）has a history of thousands of years. The Chinese traditional color system is complex and huge, it had derived the world-famous Dunhuang Mogao Grottoes murals, tri-color glazed pottery of Tang dynasty, blue and white porcelain, Tibetan Thangkas, colorful folk crafts, etc. It has great influence and value in the field of art throughout China and the world. Traditional color culture is an indispensable part and important social element in the development and change of every social stage. The changes in various social stages have inherited and developed the traditional color culture of the previous society. But the CTCC as intangible cultural heritage is too complex to understand and usage in the real project, it required lots of professional knowledge that is an uneasy thing for most people. To be better make people comprehend CTCC, and make it easy to use. Accordingly, to inherit the CTCC and CTCH, it should be studied with scientific theories and principles, it needs to cater to the aesthetic and mentality requirements of society and people, it needs to meet the need of development of age and era, and using it should be practice with new tech approach.

This study intends to make art and aesthetics with a scientific approach. The purpose of this research is to inherit Chinese traditional color culture. The objective of this dissertation is to inherit Chinese traditional color harmony (CTCH) with digitization manner. This dissertation aims to present the method of digitization of inheritance and application for the CTCH that contains conservation, improvement, development (CID) which can be a circulation system. Strikingly, the contents of this research are based on theory and principle from the tradition which is the root of the culture for future innovation.

The CTCC is an intangible cultural heritage, how to protect and conserve it that is a hard problem. Digital processing technology is an important means of information preservation. The first contribution is the proposed extraction approach with a digitization color scheme for Chinese traditional artwork. The research work takes the Chinese traditional color scheme (CTCS) as the research objective, combined with color science, to build up the method to extract and record CTCH

via the dataset. Based on the CTCS results and evaluation from the method of this work, are more suitable for cognition degree and aesthetic of participations compare with others` methods.

The CTCH has a history of thousands of years, it has strong historical characteristics, and it needs to be integrated into modern society in a new way. The second contribution is the proposed improvement approach that is based upon the deep learning method for the CTCH, with the common aesthetic preference of contemporary people. In the viewpoint of research that the CTCC should meet the needs of the development of the times, cognitive, and aesthetic characteristics of contemporary people. To achieve the goal, research work had built up the model and architecture which were used for the generation and optimization of CTCH had been proposed.

As tacit knowledge, CTCC and CTCH are hard to comprehend for most people, it needs to be transformed through a process that can offer an easy way for people to understand. The third contribution is proposed the development method with two kinds of interactive system which is included approach of web color matching application and VR learning. First, the website interactive color matching system had been proposed which is the case of high-speed railway. Second, the VR interactive learning system had been proposed. Via this part, the CTCH color scheme application is based upon the CTCH dataset, aesthetic perceptual factors, and knowledge model had been explored that, how to use the CTCH in practice way with applications.

Finally, based upon four parts of the work, a novel inheritance method named the CID systematic method had been constructed. The method is based on the combination of theoretical methods and practical methods. Through each part of the evaluation which testifies the CID approach is successfully achieved the research aim set in begin of this work. This research is both deepening Chinese traditional aesthetic theory and expansion of the practice and application approach for CTCH. More importantly, the CID method is not only suitable for CTCC and CTCH but also can provide a reference for related color culture research. Nevertheless, inheriting CTCC and CTCH is the long way demand to go further and deeper, it is also required supplement and enrichment by related disciplines and fields. It is hoped that more and more cultures and civilizations in the world will be conserved and usage that no matter how small it is, they are all significant cultural heritages and important knowledge of mankind, that are the source of innovation and foundation for future.

Keywords: Inheritance Method; Aesthetic Renew; Color Scheme Harmony; Color Scheme generation and optimization; Interaction System;

論文審査の結果の要旨

本論文は、中国文化特有の色彩調和に関する文化(CTCC)をデジタル技術で継承することを目的としたものである。本論文の貢献は以下の 3 点である。

１つ目の貢献は、中国の伝統的な美術品のためのデジタル化カラースキームを用いた保存手法の提案である。色調調和（CTCH）の知識は無形文化遺産であり、それをどのように保護し保存するかは難しい問題である。これに対し、古い衣服や陶磁器などを写した資料を多く集め、色彩学と組み合わせて、

形式知化した。

2 つ目の貢献は、現代人に共通する美的嗜好を取り入れた色彩調和の改善アプローチの提案である。CTCC は歴史的特性が強く、現代社会に新しい形で融合させる必要がある。CTCC が時代の発展のニーズを満たし、現代人の認知的、審美的特性に適合するように機械学習を取り入れた色彩調和の最適化手法を提案した。

3 つ目の貢献は、2 種類の対話型配色システムの提案である。まず、高速鉄道の内装の配色デザインを対象とした Web サイト対話型カラーマッチングシステムを提案した。つづいて、VR を用いたインタラクティブな学習システムを提案した。CTCH カラースキームのアプリケーションを知覚要因の定量的モデルに基づいて開発し、実践的に活用する方法を提案するとともに、脳波計測による配色デザインの結果に対する分析も行っている。

そして、CID (Conservation, Improvement, and Development)システマティック方式と名付けた新しい色彩調和文化の継承方法を提案した。この方法は、理論的手法と実践的手法の組み合わせに基づいている。この研究は、中国の伝統的な美学理論を深めるとともに、CTCH の実践と応用のアプローチを拡大するものである。さらに重要なことは、CID 法が CTCC と CTCH に適しているだけでなく、関連する色彩文化研究への貢献が期待できる点である。

以上、本論文は、配色に関する文化的伝統を保存、改善、発展するためのデジタル化継承について有用な実践を系統的に提示したものであり、学術的に貢献するところが大きい。よって博士（知識科学）の学位論文として十分価値あるものと認めた。