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Research Article

Towards Multiple Perspectives of Cross-National Culture Using Self-Organizing Map (SOM)

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ABSTRACT
This study integrates the previous cross-cultural literature and aims to construct an analysis model of cross-national culture with multiple dimensions from three important cultural dimension theoretical models commonly used in cross-cultural studies: Hofstede, Global Leadership and Organizational Effectiveness (GLOBE) and World Values Survey (WVS). Traditional statistical analysis seems to be unable to solve the problem of the integration of relevant scales and units in different dimensions of cultural analysis. Therefore, this study uses a self-organizing map (SOM) as an analysis method to integrate 17 cultural variables from this multicultural dimension for cluster analysis and explains the cultural types in 26 countries based on the results. This study explores the differences and similarities of different countries in different cultural dimension analyses and provides a comparative model of multicultural analysis. This study takes samples from three cross-cultural analysis databases as data sources and employs the self-organizing map for analysis based on a neural network algorithm that can be used for type discrimination, map analysis, process monitoring, and error analysis. The results identify the cross-cultural groups of 26 countries and reveal their key cultural similarities and differences. We also elaborate upon the findings of these cultural characteristics and multi-cultural dimensions. The signification of this study is presented as a reference for subsequent studies of transnational and cross-cultural analysis and its applications.

1. Introduction

At the end of the 20th century, many scholars adopted large sample empirical methods, which have become the mainstream of current research on cultural differences. Representative scholars include Hofstede [1], [2], Hampden-Turner and Trompenaars [3], Trompenaars and Hampden-Turner [4], Schwartz [5], and Hanges and Dickson [6]. Although Hofstede's theory is the most representative, there are still some bottlenecks. For example, the samples are from the employees of a single company (IBM), the dimensions of cultural differences are insufficient, the sampling is limited, and the cultural dimensions are not dynamic and developmental. Many studies on national culture have emerged successively, such as the GLOBE (Global Leadership and Organizational Effectiveness) project conducted [7]. GLOBE expanded Hofstede's five dimensions into nine dimensions, retaining "power distance" and "uncertainty avoidance". Hofstede's "individualism and collectivism" were divided into "group collectivism" and "public collectivism", while " masculine and feminine culture" was divided into "gender equality and decisiveness". The "short- and long-term orientation" was changed to "future orientation". "Humanistic orientation" is consistent with Kluckhohn's dimension of "views on human nature", and the dimension of "performance-orientation" was added.

In addition to the above two analysis models of cross-national culture, the World Values Survey (WVS) has also gained increasing attention in recent years. WVS

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originated from the European Values Survey (EVS) conducted in 1981 for 10 countries of Western Europe. The findings are instructive in terms of cultural change and can be extended globally. Generally speaking, this transnational survey covers a wide range of topics, including social values, social norms, social issues, social distance, work issues, labor organization, employment issues, political attitudes, national democracy, gender issues, environmental issues, marriage, and family and child rearing issues. The literature of the past decade shows that cross-national culture is an important topic in the field of international enterprise research [8], . Relevant contextual factors such as cultural distance, cultural value, long-term orientation, individualism and physical distance can all predict different national cultures [9], [10], [11].

After reviewing the past studies, we find that there are many different perspectives and features in the related cross-cultural studies. *This study focuses on the application of the self-organizing map to explore the multi-dimensional cross-cultural analysis model.* A self-organizing map neural network can gather a large amount of information with similar characteristics through the self-organizing map and then compare and analyze multiple models based on the cluster data. Therefore, this study explores the differences and similarities of various countries under different cultural dimension analyses and provides a comparative model of multicultural analysis. Samples from three cross-cultural analysis databases are used as data sources.

2. Research Design

2.1. Research Method: Self-Organizing Map

A self-organizing map neural network can gather a large amount of information with similar characteristics through the self-organizing map. Since SOM is a neural network for unsupervised learning, the target output value of web-based learning does not have to be defined in advance. Cluster rules can be derived according to data similarity in order to distinguish the differences among data groups. It is an effective analysis tool for Data Mining. Self-Organizing Map (SOM) is an unsupervised artificial neural network model, proposed by Kohonen [12]. SOM is especially suitable for representing the distribution of high-dimensional data vectors in a multidimensional space. The high-dimensional data vectors can be mapped into two-dimensional space, so that a user can understand the relationship between the original data structures, and the number of data groups can be reduced.

2.2. Research Subjects and Data Sources

The data sources for this study are from three important cultural dimension theoretical documents and databases commonly used in cross-cultural studies: Hofstede (Geert Hofstede's Websites), Global Leadership and Organizational Effectiveness (GLOBE), and World Values Survey (WVS). Table 1 lists the data of the cultural dimensions of 26 countries.

Table 1 List of Country Information

Culture Cluster	*Country*	*Ctry. Code*
Anglo Cultures	USA	US
	Canada	CA
	England	UK
	Ireland	IE
	New Zealand	NZ
	South Africa	ZA
	Australia	AU
Latin Europe	France	FR
	Italy	IT
	Portugal	PT
	Spain	ES
	Swiss	CH
Middle East Cultures	Morocco	MA
	Turkey	TR
	China	CN
	Hong Kong	HK
Confucian Asia	Japan	JP
	Singapore	SG
	South Korea	KP
	Taiwan	TW
	Brazil	BR
Latin America	Argentina	AR
	Colombia	CO
	El Salvador	SV
	Mexico	MX
	Venezuela	VE

Date source: World Value Survey

3. Research Results

When data processing is completed, the SOM clustering method can be performed. This study uses MeV V4.9, which is one of TIGR's microarray analysis packages and stands for MultiExperiment Viewer. The general microarray analysis tool uses various algorithms to cluster, count, display, and analyze the formatted microarray data to carry out SOM and uses its visualized U-matrix graph to find the number of groups after SOM clustering. This study analyzes SOM data from Hofstede (Geert Hofstede's Websites), Global Leadership and Organizational Effectiveness (GLOBE), and World Values Survey (WVS) in different cultural dimensions of 26 countries in order to obtain the following clustering results.

3.1 Hofstede 6 cultural dimension clustering results

For cultural dimension clustering results, two groups of country clustering can be found. Based on geographical

regionality, they are named H1 (Eastern Culture Group) and H2 (Western Culture Group) respectively.

3.2 GLOBE 9 cultural dimension clustering results

Three groups of country clustering can be found. After analyzing the values of cultural dimensions of each cluster group, we name them as G1 (High GLOBE-value) -high GLOBE culture group, G2 (Medium GLOBE-value) -medium GLOBE culture group, and G3 (Low GLOBE-value) -low GLOBE culture group, respectively. A special finding is that TW (Taiwan) is independent of G2 (Medium Globe-value) -medium GLOBE culture group
.

3.3 WVS 2 cultural dimension clustering results

The aim of WVS is to provide a comprehensive measure standard of all major areas of human concern, covering religion, politics, economic, and social life. The evaluation has two dimensions: (1) Traditional/Secular-Rational (T/R) and (2) Survival/Self-expression values (S/S). These two dimensions can explain more than 70% of the analysis of influencing factors of cross-national variation [13]. Four groups of country clustering can be found. After analyzing the values of cultural dimensions of each cluster group, we name them as W1 (High T/R & LOW S/S) culture group, W2 (High T/R & High S/S) culture group, W3 (Low T/R & Low S/S) culture group, and W4 (Low T/R & High S/S) culture group. Among them, most east Asian regions or countries such as Taiwan, Japan, China, Hong Kong, and South Korea are in the W1 (High T/R & LOW S/S) culture group, which seem to be related to the long-term influence of Confucian culture and rapid economic development in this region.

3.4 Clustering results of multi-cultural dimensions

This study finally analyzed the data from the cultural dimensions of 26 countries, including Geert Hofstede's Websites, Global Leadership and Organizational Effectiveness (GLOBE), and World Values Survey (WVS) and obtains two groups. We find that the analysis results of the above three cultural dimensions are close to the clustering results of GLOBE 9 cultural dimensions.

4. **Conclusion**

This study used a self-organizing map (SOM) as an analysis method to integrate 17 cultural variables from this multicultural dimension for cluster analysis and explains the cultural types in 26 countries based on the results. Moreover, this study explored the differences and similarities of different countries under various cultural dimension analyses and provided a comparative model of multicultural analysis. Its sourced samples from three cross-cultural analysis databases. The self-organizing map is for analysis based on a neural network algorithm that can be employed for type discrimination, map analysis, process monitoring, and error analysis. The results identify the cross-cultural groups of 26 countries, reveal their key cultural similarities and differences, and help elaborate upon these cultural characteristics and multi-cultural dimensions. The significance of this study is presented as a reference for subsequent studies of transnational and cross-cultural analysis and its applications.

Table 2 summarizes the comparisons of cross-cultural analysis patterns in multiple dimensions. Table 2 shows that there are Eastern cultural group and Western cultural group in Hofstede 6 analysis. There are three groups in the analysis of GLOBE 9: high, medium, and low GLOBE cultural groups. WVS 2 analysis shows four groups of country clustering: W1 (High T/R & LOW S/S) culture group, W2 (High T/R & High S/S) culture group, W3 (Low T/R & Low S/S) culture group, and W4 (Low T/R & High S/S) culture group. Among them, most east Asian regions or countries such as Taiwan, Japan, China, Hong Kong, and South Korea are in the W1 (High T/R & LOW S/S) culture group.

The results in Table 2 help us analyze the distribution of 26 countries after the analysis of four cross-national cultural analysis modes by SOM. It is interesting to find that there are two groups in Hofstede 6 analysis: H1 and H2; and the countries of H2 are the same as the countries of G1 and G3 after GLOBE 9 analysis; i.e., Hofstede's Western culture group is equal to the high and low cultural groups of GLOBE, and Taiwan belongs to G2 (i.e., medium GLOBE culture group) in GLOBE 9 analysis. Among the 26 regions or countries, only Taiwan belongs to this group. The cultural attribute and classification of Taiwan are worth discussing, and subsequent research should further analyze its causes.

presents four groups of country clustering. Most countries fall into two of these categories. One part is in the W1 (High T/R and LOW S/S) cultural group, and Taiwan belongs to this group. The other part is in the W4 (Low T/R and High S/S) cultural group, and many advanced countries belong to this group. The W2 (High T/R and High S/S) culture group has both tradition and self-expression ability, represented by two countries: New Zealand and Switzerland. Countries in the W3 (Low T/R & Low S/S) culture group are Australia, Morocco, Turkey, and Singapore. The analysis results of the above three cultural dimensions are close to the clustering results of GLOBE 9 cultural dimension analysis.

Table 2 WVS 2 cultural dimension clustering analysis

cultural dimension / Country	Hofstede		GLOBE			WVS			Integration model		
	H1	H2	G1	G2	G3	W1	W2	W3	W4	M1	M2
USA(US)		✓	✓						✓		✓
Canada(CA)		✓	✓						✓		✓
England(UK)		✓	✓						✓		✓
Ireland(IE)		✓	✓						✓		✓
New Zealand(NZ)		✓	✓				✓				✓
South Africa(ZA)		✓	✓						✓		✓
Australia(AU)		✓	✓					✓			✓
France(FR)	✓		✓			✓				✓	
Italy(IT)	✓				✓	✓					✓
Portugal(PT)	✓				✓				✓	✓	
Spain(ES)	✓				✓	✓				✓	
Swiss(CH)		✓	✓				✓				✓
Morocco(MA)	✓				✓			✓		✓	
Turkey(TR)	✓				✓			✓		✓	
China(CN)	✓		✓			✓					✓
Hong Kong(HK)	✓		✓			✓					✓
Japan(JP)	✓		✓			✓				✓	
Singapore(SG)	✓		✓					✓			✓
South Korea(KP)	✓				✓	✓				✓	
Taiwan(TW)	✓			✓		✓				✓	
Brazil(BR)	✓		✓						✓	✓	
Argentina(AR)		✓			✓				✓	✓	
Colombia(CO)		✓			✓				✓	✓	
El Salvador(SV)		✓			✓				✓	✓	
Mexico(MX)		✓			✓				✓	✓	
Venezuela(VE)		✓			✓				✓	✓	

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