COMPARING KOREAN AND CHINESE AFFECT INFLUENCED BY VIRTUAL REALITY HEADSETS

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Abstract. *Both Korea and China are located in East Asia, but their cultural traits are different. In this regard, comparing perceptions of a particular product or service in terms of academic and business aspects is a significant task. In particular, previous research on the marketing of new products is lacking. This study attempts to compare and analyze how Korean and Chinese participants perceive a VR headset emotionally. In this study, through a survey targeting 34 Koreans and 30 Chinese, 1) the words associated with VR headsets were extracted, 2) a co-occurrence matrix for the words was configured, and 3) a network analysis was conducted. As a result, in the affective vocabulary of Koreans, terms related to personal preference, such as "interest" and "heavy", appeared frequently, while the Chinese were interested in indicators relevant to the field of technology itself, such as "frontier" and "technology". The methodology utilized in this study is expected to be helpful in developing future products and services that specialize in customer culture.*
Keywords: VR headset, Affect, Network analysis, Comparing Korean and Chinese behavior

1. **Introduction.** As society changes, products and services have developed from being production-centered to being consumer-centered. Moreover, with globalization, developing a product or service that addresses a variety of customer affect in different cultures is a significant challenge. If there are great cultural differences in a product or service, these differences should also be reflected in the products and services, or at least in the marketing. The cultures of the countries in East Asia seem similar, but their features are definitely different.

Of course, previous research that compares behavior and beliefs in different cultures has been conducted [1,2]. There are various analysis methods and some researchers have tried to study the concept of affect [3]. However, studies that compare the perception of new modern conveniences that have not yet been established in both communities have been insufficient, especially regarding IT products and services. Moreover, there may be a preconception that perceptions are similar in both countries, since Korea and China are both in East Asia.

The objective of this study is to identify differences between Koreans and Chinese in their affective recognition of a new IT product and service. This study chose virtual reality (VR) headsets that have been marketed recently. A VR headset is a device that primarily enables the user to experience a virtual world made by the machine through audio-visual stimuli. In response to a recent upsurge of interest in VR, VR headsets from various manufacturers (e.g., Oculus and Samsung) have been widely used for many years. The user can have an indirect, animated three-dimensional experience using these devices. VR headsets are used diversely in games, medical, and other content areas.

The study surveyed Korean and Chinese participants in order to compare affect perceptions between the two countries and a network analysis based on the data was conducted.

The concept of affect and related studies were introduced in Section 2. Then the data collection method was described in Section 3. Section 4 shows how the network analysis was applied. In the network analysis, a visualization method based on degree centrality and eigenvector centrality was used. In Sections 5 and 6, limitations of the study and possible consecutive works were discussed. The results are expected to be utilized as useful information for comparisons between different cultures regarding the affect perception of a product or service.

2. **Affect Model.** As technologies develop daily, products and services are not only produced and sold, but are also developed in a way that considers consumers' convenience and satisfaction. The product value can then be determined by the satisfaction of human affect [4-9].

As affect is also a word for a product image or feeling [5], it can be called "Kansei" and "emotion" [10,11]. In the field of cognitive psychology, [12] defined core affect as "a neurophysiological state consciously accessible as the simplest non-reflective feelings evident in moods and emotions". [4] categorized and organized affect into primitive affect, descript affect, and evaluative affect according to the intervention of the subjective judgment or experience.

This study defined the overall feelings, thoughts, and images that are associated with a VR headset as the affect. That is, according to the definition by [4] and [12], the affect is derived from a product. In this study, participants were asked to view pictures of VR headsets and list the associated words, which were not classified according to a specific standard.

3. **Methods.** Our study included a total of 64 participants, consisting of 34 Koreans (average age: 24.5, standard deviation: 1.50) and 30 Chinese (average age: 30.0, standard deviation: 6.50). Evaluation was carried out via surveys in Korea and China, respectively, and the language used was the mother tongue of the participants. In Korea, students in the Incheon National University were surveyed and in China, students in the Peking University, Nankai University, and Fudan University were surveyed.

Among the participants, the numbers of Korean and Chinese participants that knew about VR headsets were 30 (88.2%) and 22 (73.3%), respectively. Among them, the numbers of Koreans and Chinese that had an experience with a VR headset were 6 (17.6%) and 2 (6.7%), respectively. Meanwhile, the number of Koreans and Chinese who wanted to buy a VR headset in the future was 21 in both groups (61.8% and 70%, respectively).

The questionnaire was designed to compare the affect recognition of Koreans and Chinese regarding VR headsets. The tasks were conducted in three stages: 1) basic recognition investigation, 2) writing down words that sprang to mind, and 3) stating the reasons or opinions for the words. In the basic awareness investigation, the representative VR headset manufacturers' names (e.g., Oculus, Samsung, Google, Valve, OnePlus, and Sony) and the pictures related to the manufacturers (e.g., Oculus Rift, Samsung Gear VR, Google Cardboard, and 3D printable VR headset for OnePlus) were presented. Next, the participants were asked to write down the words that sprang to mind when they viewed the VR headset information and pictures. Finally, they described the reasons or opinions why they associated the words with the VR headsets.

Based on the survey results, a co-occurrence matrix was formed to conduct a network analysis. At first, it was supposed that the words a participant listed had some sort of relationship among pairs of all the words in any order. For this, a matrix was constructed that had words stated by participants as rows and was defined as a co-occurrence matrix. For example, as a total of 34 Koreans took part in the experiment, a co-occurrence matrix for Koreans has 34 rows. After deriving the two co-occurrence matrices representing the
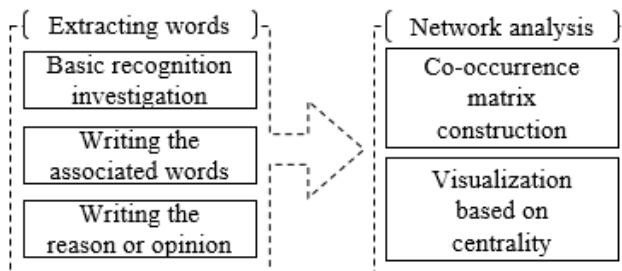
FIGURE 1. Network analysis procedure

affect of the Koreans and Chinese, visual representations of the respective matrices were made (Figure 1).

4. **Results.** The survey results were visualized using network analysis tools. At first, 20 nodes were selected by means of degree centrality. In this process, both a 20th node and a node tied in degree centrality with a 20th node were included. Second, the sizes of nodes and names changed according to eigenvector centrality and the edge thickness changed according to degree centrality. Note that degree and eigenvector centralities have been widely used as intermediate measures in the network analysis. The visualized network analysis results are shown in Figures 2 and 3.

Each associative relationship appeared to be similar, but there were differences between the important vocabularies. For example, a similarity between the two countries was the predominance of words associated with games, movies, 3D, VR, etc. One difference was that in the case of Koreans, a remarkable vocabulary was "3D", while that of China was "frontier".

The results sorted according to degree and eigenvector centrality are presented in Table 1. In the case of Korea, the important words were "3D", "interest", "VR", "movie",
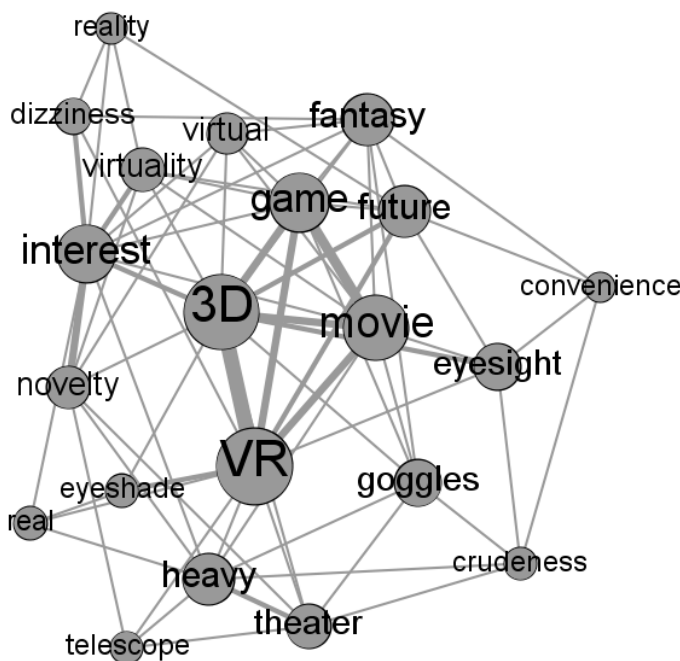

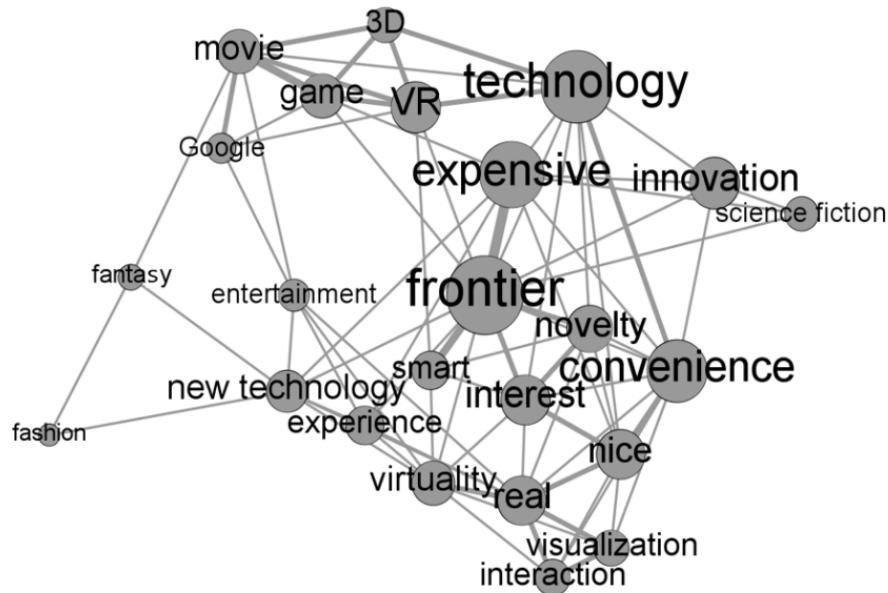FIGURE 2. Semantic network of representative nodes for Korean

FIGURE 3. Semantic network of representative nodes for Chinese

"heavy", "fantasy", and "game", while the significant words in China were "frontier", "technology", "expensive", and "movie". The degree centrality of China was higher than that of Korea because there were words such as "frontier", "technology", and "expensive" in common.

Regarding the contents, in the Chinese matrix, words related to technology itself stood out, such as "frontier", "technology", and "innovation". The Korean participants especially used expressions concerning content or preferences for content, such as "interest", "movie", "fantasy", and "game". Meanwhile, unlike the responses from China, numerous negative expressions, such as "heavy", "crudeness", and "dizziness", appeared in the Korean responses. Note that eigenvector centrality is one of several node metrics that characterize the global prominence of a vertex in a graph. That is, eigenvector centrality is to compute the centrality of a node as a function of the centralities of its neighbors.

5. **Discussion.** In this study, a quantitative analysis was conducted to examine how Korean and Chinese participants affectively recognize new forms of IT services and products using a mathematical model, as well as a qualitative analysis. If our results are directly reflected in the further development of IT services, besides products, they would be applicable in the development of products that appeal to more customers.

In the semantic analysis, the results seem somewhat distorted because the survey was conducted separately in Korean and Chinese. Distortion can be caused by words that do not exist in one country, but appear in other national languages. For example, in Chinese, "便捷" means convenient and fast, but no word in Korean has the same meaning as "便捷". There are also problems with ambiguous words. For example, in Chinese, "酷炫" can be interpreted as nice or popular.

Meanwhile, there are differences arising from cultural differences [2,11]. One of the participants in Korea made an association with a singer that was often shown wearing the box in the media, but there was no similar singer in China. Moreover, more Koreans than Chinese made associations with individualistic words: "interest", "movie", "fantasy", and "game". The Chinese thought that words that were difficult to explain in the first-person were important: "frontier", "new technology", and "innovation". Because of totalitarian tendencies, the Chinese were mostly interested in technology in terms of the national dimension. However, the Koreans showed interest in the content itself because they tend

TABLE 1. Centrality of representative nodes

	Korea			China		
	Node	Degree	Eigenvector	Node	Degree	Eigenvector
1	3D	13 (1)	0.98 (2)	frontier	26 (1)	1 (1)
2	interest	11 (2)	0.69 (5)	technology	24 (2)	0.81 (3)
3	VR	11 (2)	1 (1)	expensive	22 (3)	0.73 (6)
4	movie	10 (4)	0.81 (3)	movie	19 (4)	0.36 (19)
5	heavy	9 (5)	0.59 (8)	convenience	17 (5)	0.88 (2)
6	fantasy	9 (5)	0.59 (6)	VR	17 (5)	0.46 (14)
7	game	9 (5)	0.71 (4)	real	15 (7)	0.79 (4)
8	future	8 (8)	0.59 (7)	innovation	15 (7)	0.47 (12)
9	goggles	7 (9)	0.51 (9)	game	13 (9)	0.40 (18)
10	theater	7 (9)	0.47 (11)	nice	12 (10)	0.71 (7)
11	virtuality	7 (9)	0.46 (12)	virtuality	12 (10)	0.70 (8)
12	novelty	7 (9)	0.44 (13)	interest	11 (12)	0.77 (5)
13	eyesight	6 (13)	0.51 (10)	new technology	11 (12)	0.57 (10)
14	virtual	6 (13)	0.42 (14)	novelty	10 (14)	0.69 (9)
15	crudeness	5 (15)	0.28 (18)	smart	9 (15)	0.46 (13)
16	dizziness	4 (16)	0.33 (15)	visualization	9 (15)	0.45 (15)
17	convenience	4 (16)	0.23 (21)	interaction	9 (15)	0.45 (15)
18	real	4 (16)	0.29 (16)	science fiction	9 (15)	0.28 (20)
19	reality	4 (16)	0.25 (20)	3D	9 (15)	0.27 (21)
20	telescope	4 (16)	0.28 (19)	experience	8 (20)	0.54 (11)
21	eyeshade	3 (21)	0.28 (17)	entertainment	8 (20)	0.42 (17)
22	–	–	–	Google	8 (20)	0.22 (22)
23	–	–	–	fantasy	8 (20)	0.14 (23)
24	–	–	–	fashion	8 (20)	0.10 (24)

to be more individualistic than the Chinese are. For reference, [1] proposed classification at the individualism – collectivism level. People in collective cultures act as members of groups or organizations for life, while people in individualistic societies emphasize personal fulfillment and rights.

6. **Conclusion.** In this study, whose focus was selected considering industry size and growth engines, VR headsets were used to compare the affect recognition of Korean and Chinese participants. Moreover, concrete differences were identified in the affect of Koreans and Chinese with respect to VR headsets. The Chinese mostly emphasized technology and innovation, reflected in terms such as "frontier", but the Koreans mainly emphasized the contents in terms such as "interest" or "game". In particular, the Koreans even stated somewhat negative expressions, such as "heavy", "crudeness", and "dizziness".

The results can be used in basic research and development related to a comparison between Korea and China. In addition, affect vocabulary may be derived from our results for diverse product and service groups besides VR headsets. Furthermore, our findings can be used for comparisons between different cultures in future research.

REFERENCES

[1] G. H. Hofstede, *Culture's Consequences: Comparing Values, Behaviors, Institutions, and Organizations across Nations*, Sage Publications, 2001.

[2] D. Oyserman, H. M. Coon and M. Kemmelmeier, Rethinking individualism and collectivism: Evaluation of theoretical assumptions and meta-analyses, *Psychological Bulletin*, vol.128, no.1, pp.3-72, 2002.

[3] J. E. LeDoux, Emotion circuits in the brain, *Annual Review of Neuroscience*, vol.23, pp.155-184, 2000.

[4] H. K. Kim, S. H. Han and J. Park, Identifying affect elements based on a conceptual model of affect: A case study on a smartphone, *International Journal of Industrial Ergonomics*, vol.53, pp.193-204, 2016.

[5] J. Park and S. H. Han, Defining user value: A case study of a smartphone, *International Journal of Industrial Ergonomics*, vol.43, no.4, pp.274-282, 2013.

[6] J. Park, S. H. Han, H. K. Kim, S. Oh and H. Moon, Modeling user experience: A case study on a mobile device, *International Journal of Industrial Ergonomics*, vol.43, pp.187-196, 2013.

[7] J. Park, S. H. Han, H. K. Kim, Y. Cho and W. Park, Developing elements of user experience for mobile phones and services: Survey, interview, and observation approaches, *Human Factors and Ergonomics in Manufacturing & Service Industries*, vol.23, no.4, pp.279-293, 2013.

[8] Y. Cho, J. Park, S. H. Han and S. Kang, Development of a web-based survey system for evaluating affective satisfaction, *International Journal of Industrial Ergonomics*, vol.41, pp.247-254, 2011.

[9] J. Park, S. H. Han, H. K. Kim, H. Moon and J. Park, Developing and verifying a questionnaire for evaluating user value of a mobile device, *Human Factors and Ergonomics in Manufacturing & Service Industries*, vol.25, no.6, pp.724-739, 2015.

[10] K. Chen, S. Chiu and F. Lin, Kansei design with cross cultural perspectives, *Lecture Notes in Computer Science*, vol.4559, pp.47-56, 2007.

[11] A. M. Lokman and M. K. I. Zolkefley, Cross-cultural kansei measurement, *Communications in Computer and Information Science*, vol.545, pp.242-251, 2015.

[12] J. A. Russell, Core affect and the psychological construction of emotion, *Psychological Review*, vol.110, no.1, pp.145-172, 2003.