
Comparison of affective perception by country for emerging IT products and services

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Abstract: Affective engineering research on products and services has been actively conducted, but there is little research on affect regarding newly emerging information technology products and services and analysis of cultural differences by country. This study used network analysis to collect the major affective vocabulary of individuals in the USA, China, Indonesia, Korea, and Russia for emerging IT products and services, and thereby analysed cultural differences. Affective vocabulary was collected related to virtual reality devices, fitness trackers, drones, a call taxi service, mobile pay, and virtual currency. Vocabulary collected through a survey was categorised into major affective vocabulary through network analysis. Social awareness of products/services was confirmed through analysis of the positive/negative aspects of the vocabulary. The affect of the target IT products/services was compared and interpreted with reference to Hofstede theory. The results of this study may be used as a basis for the development of IT products and services.

Keywords: affective perception; semantic network analysis; SNA; IT products; IT services; cultural differences; Hofstede.

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1 Introduction

For information technology (IT) products and services to be successful in the market, the user's impression of them is critical; that is, affect is an important factor (Schütte, 2005; Park et al., 2013a, 2013b; Kim et al., 2015). The affect of users influences their intention to purchase the product/service, and affective perception is particularly related to loyalty, recommending the product to others, satisfaction with the product, and enhanced user experience (Chaudhuri, 1997; Bei and Chiao, 2001; Pullman and Gross, 2004; Fan et al., 2017b). One of the primary purposes of affective research is to create more satisfying products and services (Nagamachi, 1995), which leads to more purchases and repurchases (Seiders et al., 2005). To date, affective research has been conducted regarding automobiles (Lisetti and Nasoz, 2005; Katsis et al., 2008), mobile devices (Kim et al., 2016; Elhai et al., 2016), electronic products (Han et al., 2001; Chuang and Ma, 2001), and clothing (Kwon, 1994; Moody et al., 2010). Affect-related research has been predominately limited to products and services that have been commercially available for a long time; research into new and emerging IT products and services is relatively limited.

With the development of hardware and software technologies, IT products and services are emerging and disappearing faster than ever before. Examples include IT products (extinct products include smart TV and smart glass), 2D social network services (extinct products include Myspace classic), and web service the IT product smart TV was launched in anticipation of expanding the TV market, in a similar manner to smartphones and tablet PCs, but it did not achieve the expected results (Shin et al., 2015). Google's smart glass left the market shortly after its release, due to privacy infringement problems that were not solved (Hong, 2013; Due, 2014). The music-focused 2D social networking service Myspace was the world's most popular social networking site until early 2008. However, with the advent of Facebook, the popularity of Myspace classic declined and the site eventually disappeared (DeWolfe et al., 2003–2005). There is an ongoing process whereby various types of web services are newly introduced and modified to promote

positive user affect, and then eliminated by competition (Bar-Ilan and Peritz, 2004). New IT products and services are required to continue to gain popularity to survive in the marketplace; as such, research into user affect is essential, and constant change must be pursued accordingly.

Consumer affect is driven by the consumer's interaction with the product/service in a culturally dependent manner (Furrer et al., 2000; Ko et al., 2004; Kim et al., 2010). Because IT products and services are no longer sold exclusively to specific countries but are spread around the world, it is very important to recognise cultural differences in targeted international markets (Mehta et al., 2006; Efrat, 2014; Fan et al., 2017a; Song et al., 2019). Several studies have assessed cultural preferences for widely commercialised IT products/services. Kim and Lee (2005) suggested that for smartphones, a global product, it is necessary to develop an interface that appropriately reflects the characteristics of cultures. Their study assessed user interface (UI) elements of smartphones that are thought to be influenced by culture. The study found out that Korean users performed better on concrete icon design than American users. Shin and Choo (2012) compared differences in perceptions of smartphones in South Korea and the USA and it was suggested that in the global marketing of products, cross-cultural strategies should be chosen. Harris et al. (2005) compared differences in user experience (UX) for M-commerce services in the UK and Hong Kong, confirming that attitudes to services differ from country to country depending on cultural and structural factors. In the same context as these studies, researches that analysed new IT products and services from a cultural point of view are needed.

This study consisted of affective research on three IT products [a virtual reality (VR) device, a fitness tracker, and a drone] and three IT services (a call service, mobile pay, and virtual currency). The reasons for choosing these products and services are they are

- 1 emerging products and services
- 2 they are relatively new IT products/services that had been on the market for more than one year
- 3 products and services that are considered highly likely to develop in the future.

This study collected affective vocabulary regarding the corresponding IT products and services in five countries (the USA, China, Indonesia, Korea, and Russia). The collected vocabulary was refined through semantic network analysis (SNA) and positive and negative classifications, and the core affective vocabulary for each product/service was derived. The key affective vocabulary derived by country was additionally analysed using Hofstede (1980) theory.

2 Literature review

2.1 Affective engineering

Emotion and affect have long been studied in the field of psychology. Emotion refers to a variety of psychological, mental experiences that humans feel (Cabanac, 2002). Emotion has a considerable impact on the individual, from memories to decisions (Barlow and Maul, 2000). In the 21st century, emotional responses to products/services are used to evaluate and develop existing products and new products (Desmet, 2003). In addition,

since the emergence of social media and commercial websites, it is becoming increasingly important to get emotion and opinions from users. Affect is very similar to emotion in that it is a psychological aspect of an individual. However, affect denotes the various feelings users obtain from using products and services, whereas emotion is different in that it refers to internal feelings that may be caused by numerous factors (Kim et al., 2016). This study was based on the concept of affect rather than emotion because it identified people's perceptions of products and services.

The type of affect generated by products and services has a significant impact on users' interactions with these items (Schütte, 2005; Kim et al., 2015; Park et al., 2013a, 2013b). That is, a study of the effects of consumer's feelings about products and services is needed to design products and services that can make a good impression on people. To systematically study affect, affect engineering was developed, which combines the study of affect with the methods of engineering (Nagamachi, 2016).

Affective engineering attempts to consumer-orient when developing products and services by considering the various types of affect that users express toward products and services (Nagamachi, 1995). These affects are defined in three categories: primitive affect, descriptive affect, and evaluative affect (Kim et al., 2016). Primitive affect refers to the relatively objective affect that arises as a result of the interaction of the consumer with the product/service. Descriptive affect denotes the added effect of subjectivity, which combines the user's individuality with his or her past experience with relevant products/services. Evaluative affect is the most subjective user assessment of the product/service. The interaction between user affect and products/services has been referred to as 'user value' in specific studies (Park and Han, 2013; Park et al., 2015; Lee and Park, 2018; Park and Han, 2018). The purpose of this study is to grasp the user's subjective opinion about IT products and services. Therefore, the concept of the evaluative affect was used in the study.

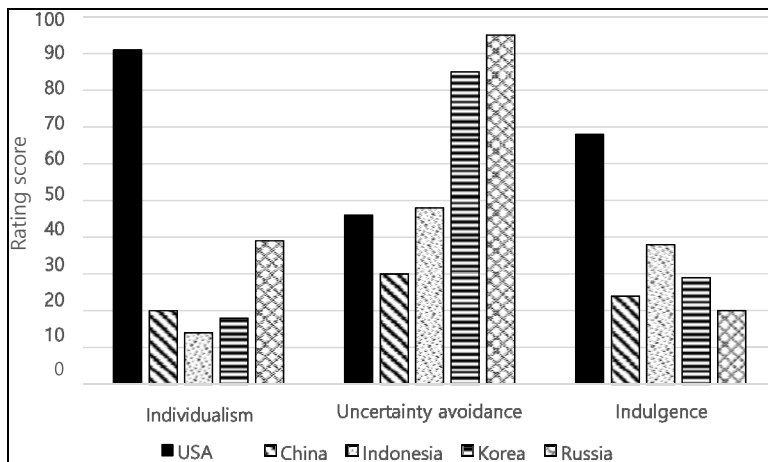
2.2 *Network analysis*

In order to identify the linkage pattern of keywords for IT devices and services, we used SNA to analyse the data. SNA is a method of identifying meaningful connections among entities that occur in complex network patterns (Van Atteveldt, 2008). SNA presents the relationships among people or activities in a network through the relationships among keywords that appear in the complex network. These features can be used to analyse online social platforms such as Facebook (Erétéo et al., 2009). SNA can be used to formulate new knowledge and to support various analyses through the search for keywords and mutual influence between keywords; the method is also being combining with cultural context (Stohl, 1993; Drieger, 2013; Rhie et al., 2017). In this study, recently, SNA has also been used to identify the fundamental causes of various problems that arise to identify people's perceptions. Li et al. (2018) investigated different party's perceptions of fuel cycle risks. Moro et al. (2020) used Facebook to mining consumers' comments from their posts and extracting important vocabularies through text mining. Kim and Jang (2018) used SNA to compare different expert groups' perceptions of the national scientific agenda. Kim and Ju (2019) applied SNA to analyse people's perspectives on IT from the textual data of blogs.

2.3 Cultural differences

Various studies of cultural differences have been conducted (Hofstede, 1980; Hampden-Turner and Trompenaars, 2001; Scholz et al., 2002; House et al., 2004). Of these, Hofstede theory is the most widely used analytical tool (Kirkman et al., 2006; Sheldon et al., 2020). Hofstede theory was derived via an analysis of cultural differences in IBM employees across countries worldwide in the 1970s. Each country is divided into six dimensions [power distance, individualism, masculinity, uncertainty avoidance, long-term orientation, and indulgence (Hofstede, 1980)].

Figure 1 Evaluations for five countries, as defined by Hofstede



Since the Hofstede analysis was conducted in the 1970s, there have been concerns that the scores for each country might have changed over time (McSweeney, 2009; Tung and Verbeke, 2010). The current study, applied measures that have changed over time but have not changed relative to each country (indulgence and individualism), and a measure known to be less varied over time (uncertain avoidance). The three scales are as follows.

- Individualism: A measure of the degree of interdependence that society maintains among its members.
- Uncertainty avoidance: A measure of the degree of anxiety about unknown future situations.
- Indulgence: The degree to which members of a society try to control their desires and impulses.

Figure 1 shows Hofstede evaluation scores for each country (the USA, China, Indonesia, Korea, and Russia) on three scales [indulgence, individualism and uncertainty avoidance (Hofstede, 1980)]. Each score falls on a 0–100 scale, while the scale midpoint (50 points) is used to divide the tendencies of each country. For example, in individualism in Figure 1, the scores of China, Indonesia, Korea, and Russia are less than 50; as such, they are defined as countries with strong collectivism tendencies. In contrast, the score for the USA is more than 50; accordingly, it is defined as a country with a strong tendency toward individualism.

3 Method

3.1 Participants

Participants consisted of 33 American students at Texas A&M – Corpus Christi (19 men, 14 women; mean age = 25.1 years, SD = 12.3), 30 Chinese students at Fudan University and Peking University (10 men, 20 women; mean age = 29.6 years, SD = 7.02), 42 Indonesian students at Bandung Institute of Technology (29 men, 13 women; mean age = 22 years, SD = 3.4), 34 Korean students at Incheon National University (23 men, 11 women; mean age = 24.5 years, SD = 1.5), and 31 Russian students at Samara State Technical University (25 men, 6 women; mean age = 20.7 years, SD = 2.3).

3.2 Target devices and services

Affect was compared for three IT products (VR device, fitness tracker, and drone) and three IT services (call taxi service, mobile pay, and virtual currency). The selected products and services were required to meet three conditions:

- 1 emerging IT products and services
- 2 relatively new IT products/services that had been on the market for more than one year
- 3 products and services that are considered highly likely to develop in the future.

VR technology is currently attracting the attention of the enthusiast or hobbyist community and is being developed gradually by skilled technologists (Burdea and Coiffet, 2003). Several recent studies of VR exist, such as the development of indicators related to motion sickness in the VR environment (Kim et al., 2018), and the study of VR input devices (Choe et al., 2019). The core technology of fitness trackers is of great interest to users today and is a promising technology for the future (Bajpai et al., 2015; Wei and Kang, 2019). Regarding drones, more than 50 organisations have operational approval for drone use, and the number of users is increasing (Pasztor and Emshwiller, 2012). According to Gartner (Panetta, 2019), VR technology and drone were selected as the Gartner Top 10 strategic technology trends for 2020.

With respect to call taxi service and mobile pay, many people are familiar with previous methods, such that these services are not yet popular. However, these services are becoming simpler and more convenient, and consequently more popular, particularly with the millennial generation (Straus and Howe, 1991; Williams, 2014). The virtual currency has become known to people relatively recently, in a virtual form called 'Bitcoin'. Virtual currency is a service based on blockchain technology, which is attracting attention due to its high efficiency and impact (Swan, 2015; Crosby et al., 2016). According to Gartner (Panetta, 2019), blockchain was selected as the Gartner Top 10 strategic technology trends for 2020.

3.3 Data collection


Data were collected using the questionnaire shown in Figure 2. After translating the questionnaire into each national language, the same questions were asked of the participants. Translation and survey were conducted by a native human factor expert

from the respective national university. First, to help users understand each product/service, a definition of each was provided, along with an example of a current commercial product. The questionnaire asked for the following:

- 1 recognition of the product/service
- 2 experience with the product/service
- 3 duration of using the product/service
- 4 willingness to use the product/service
- 5 words related to the product/service
- 6 reasons for entering each word.

In step 5, users were encouraged to write down at least five impressions/images/words for each IT product and service.

Figure 2 Example of survey form (for VR device) (see online version for colours)

1. VR Device	
Description	A device provides immersive virtual reality for the wearer
Companies	Oculus, Samsung, Google, Valve, OnePlus, Sony
Images	 <p style="text-align: center;"><Oculus Rift></p> <p style="text-align: center;"><Samsung Gear VR></p> <p style="text-align: center;"><Google Cardboard></p> <p style="text-align: center;"><3D printable VR headset for OnePlus></p>
1-1. Product recognition	<input type="checkbox"/> I already know what the product is <input type="checkbox"/> I've never seen the product
1-2. Experience of use	<input type="checkbox"/> I've ever used the product (go to 1-3) <input type="checkbox"/> I haven't used the product (go to 1-4)
1-3. A device in use	Which product you're currently using? () When did you buy the product? ()
1-4. Purchase intention	<input type="checkbox"/> I'm willing to buy it, if the price is reasonable <input type="checkbox"/> I will not buy it
1-5. Please write down the associated word (more than 5) when viewing the products	<div style="border: 1px solid black; height: 100px; width: 100%;"></div>
1-6. Please providing he reasons or opinions for the words	<div style="border: 1px solid black; height: 100px; width: 100%;"></div>

3.4 Analysis

3.4.1 Semantic network analysis

After collecting words through the survey, the correlations between words were analysed. The languages collected by country were reviewed by three human factors experts and translated into consistent English. Network analysis was conducted using the correlations between the translated words. The key measures of the network analysis were degree centrality, eigenvector centrality, and edge weight. Degree centrality is defined by the number of connected nodes (word in this case) (Borgatti, 1995). As the number of people

who report a node increases, the degree centrality score increases. In other words, a large degree of centrality score means that many people have responded. Eigenvector centrality is a measure of the degree of influence between nodes, which reflects the degree centrality of different nodes. Eigenvector centrality values increase as more nodes are connected, and as nodes with high degree centrality values are connected. Edge weight means the number of times that two words are answered simultaneously.

The top 20 nodes were extracted based on the degree centrality scores of the nodes. Among the selected nodes, those that satisfied the following conditions were additionally removed. First, if the names of products and services appeared in the selected vocabulary, they were deleted because they were not included considered affective words. Second, if degree centrality was relatively high, but eigenvector centrality was very small, then the word was deleted because it did not affect the correlations between words.

Two network programs were used to visualise the data analysis: Gephi-0.9.1 and UCINET. Gephi can visualise a large range of networks quickly and accurately, control various operations on the network in a simple manner (Bastian et al., 2009). UCINET has the advantage of easily expressing Excel data as a network relationship between cohesive subgroups (Borgatti et al., 2014).

3.4.2 *Affective vocabulary analysis*

Twenty Korean participants (10 men, 10 women; mean age = 22.9 years, SD = 1.5) classified the 235 unique words obtained from the five countries into three categories: positive, neutral, and negative. Neutral words represented non-affective vocabulary. Each word was classified based on the category for which it received the most responses. If the number of responses for positive or negative and neutral was the same, the word was considered as affective vocabulary. For example, the word 'sight' received ten positive and ten neutral responses. In this case, the word was defined as positive. For the word 'filming', six people answered positive and 14 people answered neutral. Therefore, the word was defined as neutral.

In addition, the ratios of positive, neutral, and negative words were analysed for each product/service in each country. Because the number of words extracted by country for each product/service was not constant, the following formula was used.

$$((\text{Positive, negative, or neutral frequency})/(\text{total number of words})) \times 100\% \quad (1)$$

Additionally, the following formula was used to calculate the ratio of affective vocabulary for each product/service in each country.

$$\frac{((\text{Positive words} + \text{negative words}) / (\text{positive words} + \text{neutral words} + \text{negative words})) \times 100\%}{(2)}$$

4 Results

4.1 Results of survey

Table 1 shows the sum of the words generated by the participants of each country, without removing duplicate words within the country. Table 2 shows the average and standard deviation of the total number of words generated per participant.

Table 1 Overall number of words generated

Overall word	VR device	Fitness tracker	Drone	Call taxi service	Mobile pay	Virtual currency	Total
USA	97	84	83	82	78	54	478
China	148	146	128	147	138	101	808
Indonesia	187	170	181	187	145	149	1,019
Korea	162	162	164	158	162	116	924
Russia	105	137	107	120	105	71	645

Table 2 Average number words generated per participant

Overall word	VR device	Fitness tracker	Drone	Call taxi service	Mobile pay	Virtual currency	Total
USA	2.9 (±2.5)	2.5 (±2.4)	2.5 (±2.5)	2.5 (±2.3)	2.4 (±2.3)	1.6 (±2.2)	2.4 (±2.4)
China	4.9 (±1.2)	4.9 (±1.1)	4.3 (±1.7)	4.9 (±0.7)	4.6 (±0.9)	3.4 (±1.9)	4.5 (±1.4)
Indonesia	4.5 (±0.8)	4.0 (±1.2)	4.3 (±0.9)	4.4 (±1.0)	3.5 (±1.6)	3.5 (±1.5)	4.0 (±1.2)
Korea	4.8 (±1.0)	4.8 (±0.9)	4.8 (±1.0)	4.6 (±1.0)	4.8 (±1.2)	3.4 (±2.0)	4.5 (±1.3)
Russia	3.4 (±1.9)	4.4 (±1.4)	3.6 (±1.5)	3.9 (±1.5)	3.4 (±1.6)	2.3 (±1.9)	3.5 (±1.7)

4.2 Results of SNA

Table 3 shows affective words with the highest degree centrality, the highest eigenvector centrality, and the affective word pair with the highest edge weight, by country and product/service, as obtained in the SNA.

Figures 3–8 show the visualisations generated using Gephi and UCINET for specific products/services by country and for all countries. The size of each node represents the magnitude of eigenvector centrality, and the thickness of the lines between nodes increases with the number of simultaneous occurrences of both words.

4.3 Affective vocabulary analysis

To determine the affective vocabulary collected in the five countries, words were classified as positive, neutral, and negative. Table 4 shows the classifications of the representative 10 out of 235 words, after removing duplicates.

Table 3 Top affective vocabulary by country and product/service

<i>Country</i>	<i>Product/service name</i>	<i>Max degree centrality</i>	<i>Max eigenvector centrality</i>	<i>Max edge weight</i>
Overall	VR device	Expensive	Expensive	Expensive and cool
	Fitness tracker	Health	Health	Health and expensive
	Drone	Expensive	Expensive	Convenient and fast
	Call taxi service	Convenient	Convenient	Fast and cheap
	Mobile pay	Convenient	Convenient	Convenient and fast
	Virtual currency	Safe	Safe	Virtual and currency; virtual and safe; virtual and investment
USA	VR device	Interesting	Interesting	Interesting and new
	Fitness tracker	Fitness	Fitness	Convenient and useful; fitness and work-out; useful and new
	Drone	Fun	Fun	Fun and technology
	Call taxi service	Convenient	Convenient	Convenient and safe
	Mobile pay	Convenient	Convenient	X (almost all edges are the same)
	Virtual currency	Useful; sketchy	Useful	Useful and sketchy; useful and convenient
China	VR device	Technology	Technology	Expensive and frontier
	Fitness tracker	Health	Health	Exercise and trend; practical and convenient; light and convenient
	Drone	Filming	Filming	X (one-third of the edges are the same)
	Call taxi service	Convenient	Convenient	Convenient and fast
	Mobile pay	Convenient	Convenient	Convenient and fast
	Virtual currency	Virtual	Valuable	Bitcoin and mining
Indonesia	VR device	Expensive	Expensive	Expensive and cool
	Fitness tracker	Expensive	Expensive	Expensive and useless
	Drone	Expensive	Expensive	Expensive and advanced
	Call taxi service	Easy; cheap	Cheap	Fast and cheap
	Mobile pay	Simple	Simple	Fast and easy
	Virtual currency	Money	Money	Money and safe; money and expensive; money and investment
Korea	VR device	3D	3D	Movie and game
	Fitness tracker	Health	Health	Health and exercise
	Drone	Helicopter; delivery	Helicopter; delivery	Filming and delivery; toy and helicopter
	Call taxi service	Convenient	Convenient	Convenient and safe
	Mobile pay	Convenient	Convenient	Convenient and security
	Virtual currency	Hacking	Hacking	Hacking and currency

Table 3 Top affective vocabulary by country and product/service (continued)

Country	Product/service name	Max degree centrality	Max eigenvector centrality	Max edge weight
Russia	VR device	Game; entertainment	Game; entertainment	Movie and game
	Fitness tracker	Health	Health	Sport and watch
	Drone	Entertainment	Entertainment	Entertainment and game
	Call taxi service	Comfort	Comfort	Comfort and quick
	Mobile pay	Convenient; smartphone	Convenient	Smartphone and purchase
	Virtual currency	Currency	Currency	Currency and internet

Figure 3 Semantic network among all countries for products and services

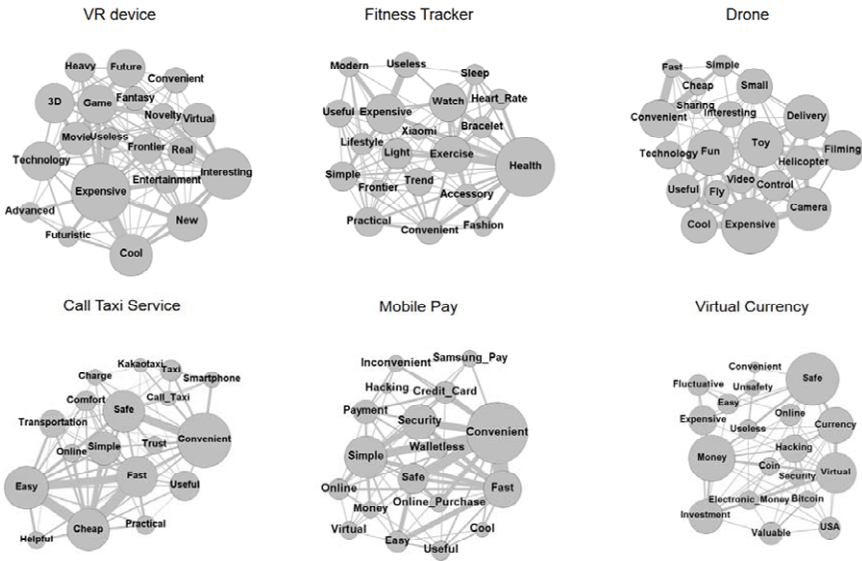


Table 4 Classifications of words as positive, neutral, or negative (10 out of 235 words shown)

Number	Name	Positive	Neutral	Negative	Result
1	Filming	6	14	0	Neutral
2	Control	8	6	6	Positive
3	Distribution	7	11	2	Neutral
4	Expensive	1	2	17	Negative
5	Fun	20	0	0	Positive
6	Small	1	11	8	Neutral
7	Novelty	14	6	0	Positive
8	Interesting	20	0	0	Positive
9	Heavy	0	6	14	Negative
10	Future	15	5	0	Positive

Figure 4 Semantic network for products and services assessed by Americans

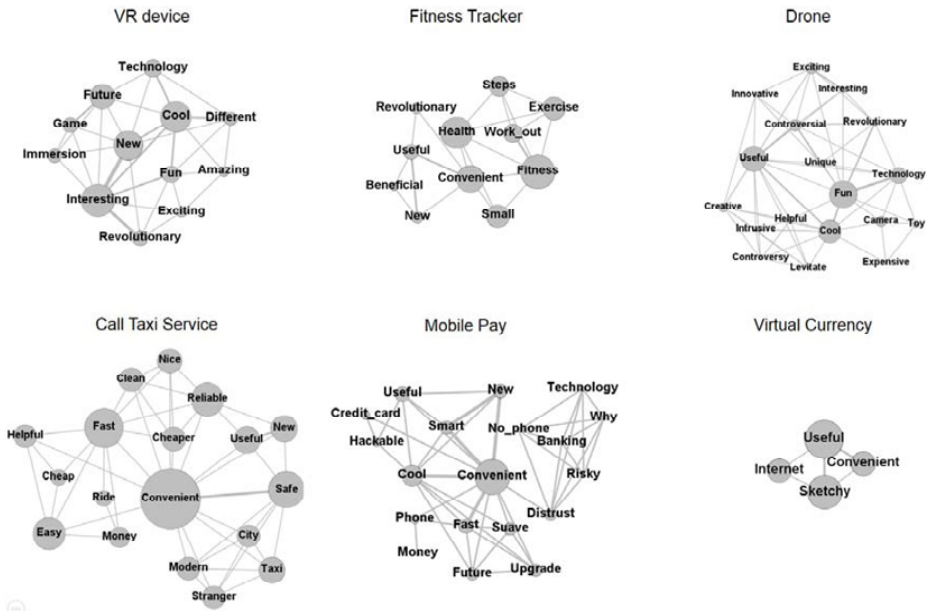


Figure 5 Semantic network for products and services assessed by Chinese individuals

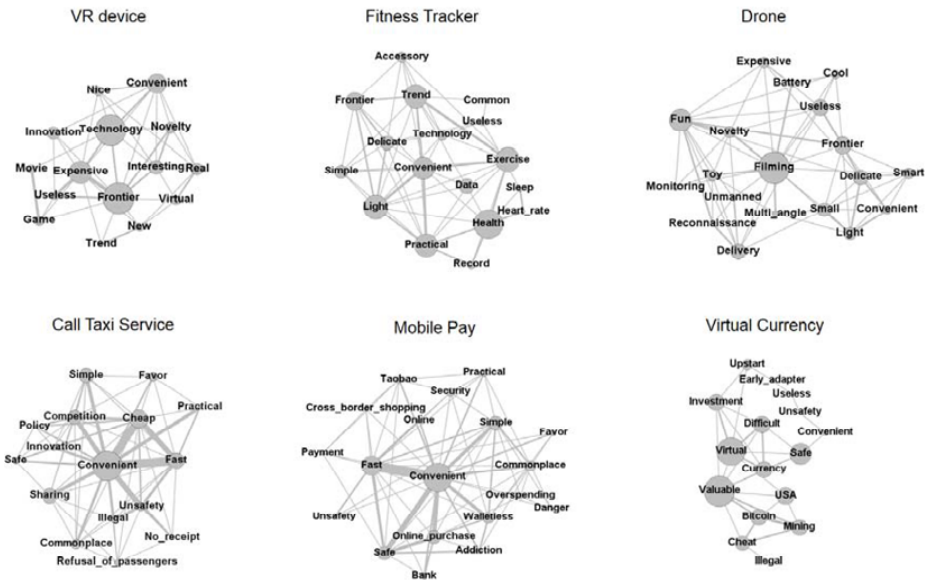


Figure 9 compares the number of positive, neutral, and negative words collected for each product/service by country. For example, for ‘drone’ in Korea, the number of words extracted by Gephi was 15. Of these, seven were positive words [i.e., 46.7% by equation (1)]. Figure 9 illustrates that people in China reported negative vocabulary for all product and service groups, whereas in Indonesia, negative vocabulary appeared for all products and service groups, except call taxi service. Four products/services were

attributed to negative vocabularies in Korea: VR device, drone, mobile pay, and virtual currency. Russian individuals only assigned negative vocabulary to ‘drone’, and Americans only provided negative vocabulary for ‘drone’ and ‘mobile pay’.

Figure 6 Semantic network for products and services assessed by Indonesians

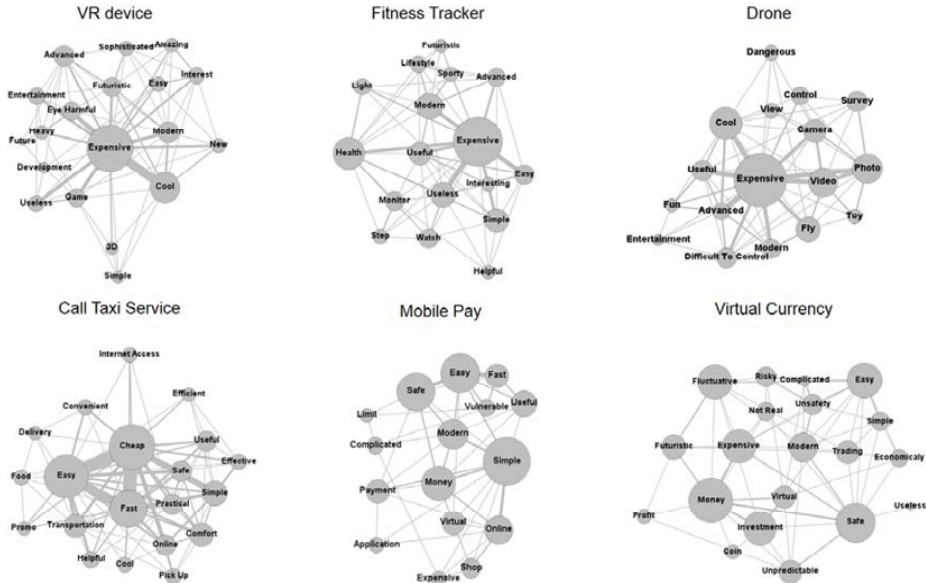


Figure 7 Semantic network for products and services assessed by Koreans

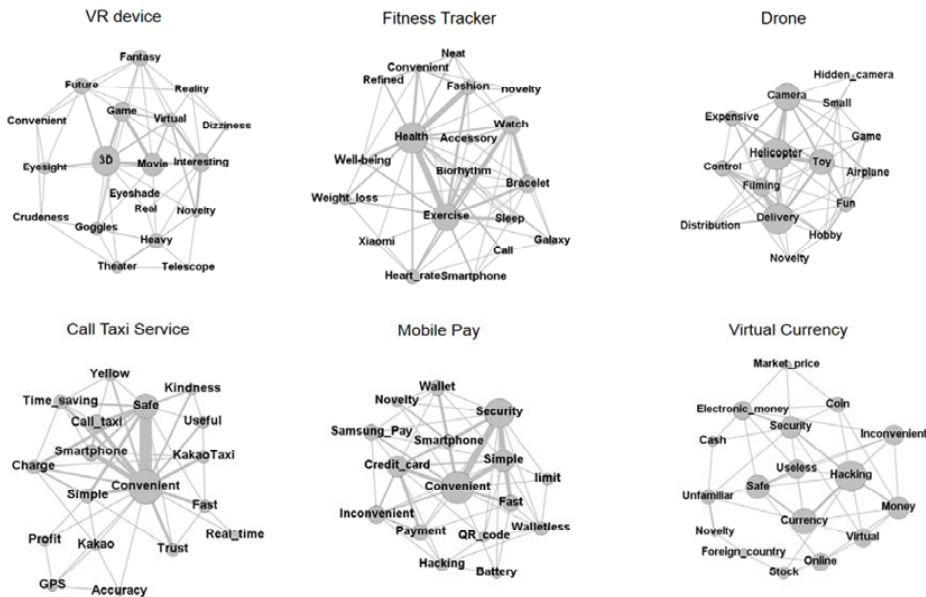


Figure 10 represents the proportion of the affective (positive and negative) vocabulary shown in Figure 9, using equation (2). The proportion of affective words decreased in the

order of the USA, Russia, Indonesia, Korea, and then China. Table 5 shows the proportion of affective vocabulary for each product and service. The equation used to calculate the proportion was $((\text{number of affective words in one country} / \text{sum of affective vocabulary among five countries})) \times 100\%$. The table confirms which countries had a large proportion of affective vocabulary per product and service.

Figure 8 Semantic network for products and services assessed by Russians

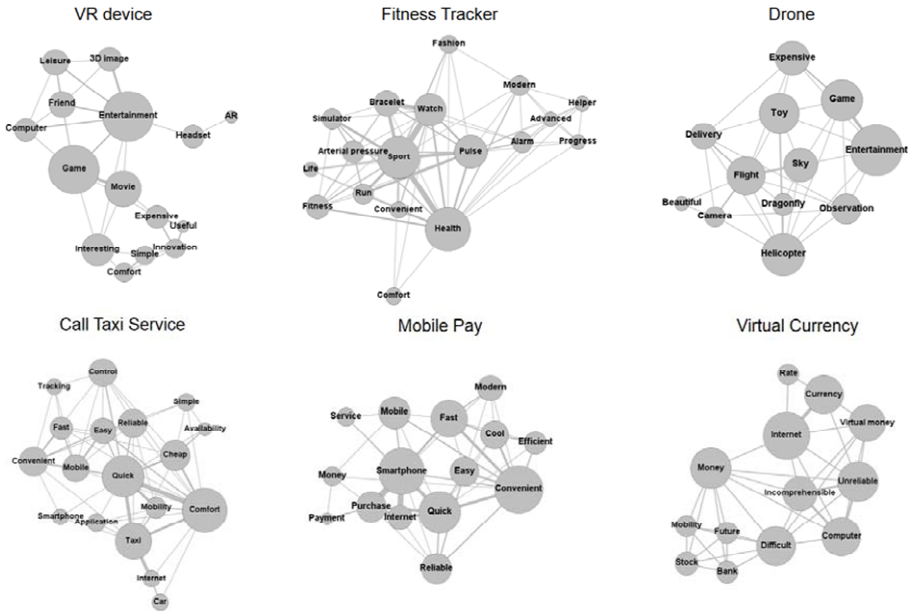


Figure 9 Proportions of positive, neutral, and negative vocabulary in five countries

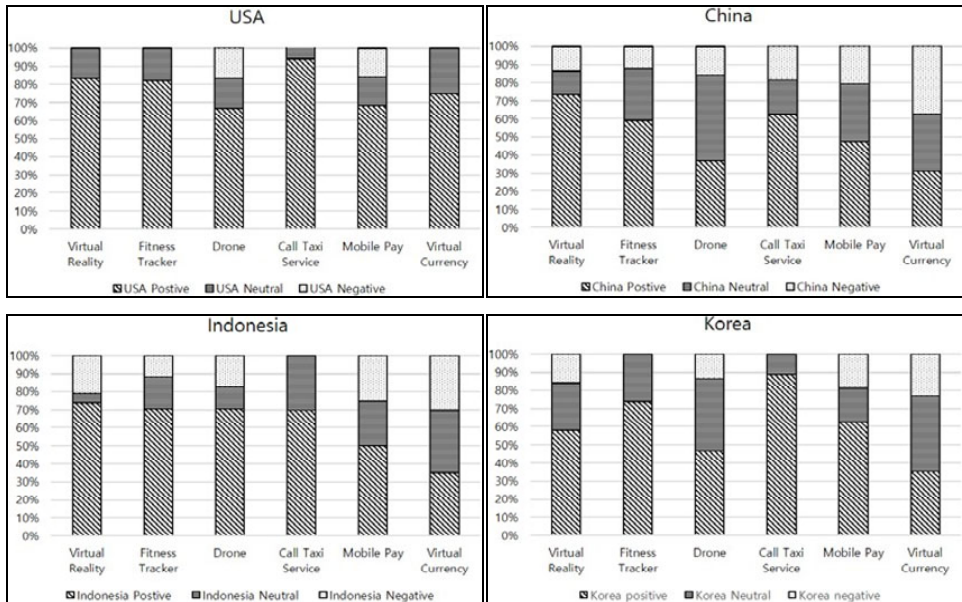


Figure 9 Proportions of positive, neutral, and negative vocabulary in five countries (continued)

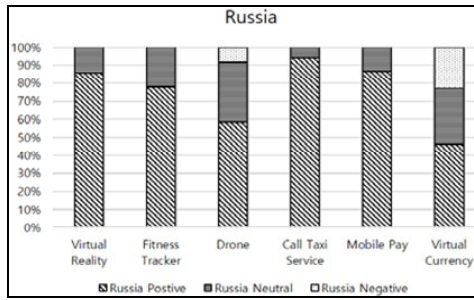


Figure 10 Comparison of affective vocabulary among five countries

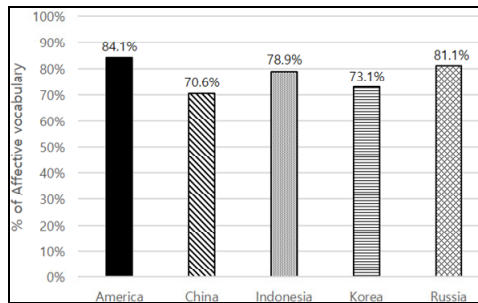


Table 5 Percentage of affective vocabulary per product and service

	<i>VR device</i>	<i>Fitness tracker</i>	<i>Drone</i>	<i>Call taxi service</i>	<i>Mobile pay</i>	<i>Virtual currency</i>
USA	20%	21%	24%	22%	21%	22%
China	20%	18%	15%	19%	17%	20%
Indonesia	22%	21%	25%	16%	19%	19%
Korea	17%	19%	17%	21%	21%	17%
Russia	20%	20%	19%	22%	22%	21%

5 Discussion

5.1 General word analysis

Figure 3 is the result of the analysis of affective vocabulary among all countries. First, in the case of VR device, the price was considered the most important issues, while most people perceived the product favourably. Additionally, there was high recognition that the product is innovative, as evidenced by the use of terms such as ‘new’, ‘novelty’, ‘ingenuity’, and so on. Second, fitness trackers were characterised as an expensive watch or an accessory related to health and exercise. Many words directly related to daily life were generated (e.g., ‘lifestyle’, ‘health’, and ‘sleep’). Third, most people perceived drones as expensive but convenient and fast. The vocabulary was generated related to the functional characteristics of drones, such as ‘filming’, ‘delivery’, and ‘camera’ and to the

appearance of drones, such as ‘helicopter’ and ‘toy’. In summary, for the product group, the affective word ‘expensive’ commonly appeared. Fourth, for the call taxi service, ‘convenient’ showed the highest eigenvector, confirming the core affective vocabulary. In addition, the words ‘fast’, ‘safe’, ‘easy’, and ‘cheap’ were collected. Fifth, for mobile pay, the highest eigenvector was also for ‘convenient’. Several words were generated regarding safety (e.g., ‘security’, ‘hacking’, and ‘safe’) and cost (e.g., ‘payment’, ‘money’, and ‘credit card’), because these services are directly related to money. Finally, in the case of virtual currency, many words were generated regarding safety (e.g., ‘unsafe’, ‘security’, ‘hacking’, and ‘safe’) and cost (e.g., ‘expensive’ and ‘money’), because these services are also directly related to money. To summarise the service group, safety and cost were greatly influential.

5.2 *Cultural comparison*

5.2.1 *American semantic network descriptions*

Figure 4 is the result of the analysis of affective vocabulary in the USA. First, for VR device, most of the American sample perceived it as an exciting new product. There were many words generated related to the usability of products (e.g., ‘cool’, ‘fun’, ‘interesting’, ‘exciting’, ‘amazing’, ‘new’, and ‘revolutionary’). Second, most people perceived fitness trackers as useful and convenient products related to health and exercise. Unlike other countries, vocabulary related to the external characteristics of the product did not appear. There were many words generated related to the usability of products (e.g., ‘useful’, ‘new’, ‘convenient’, ‘beneficial’, and ‘revolutionary’) and affective words (e.g., ‘fitness’ and ‘health’). Third, in the case of drones, most participants perceived them as interesting techniques. Unlike in other countries, many words were generated related to the usability (e.g., ‘exciting’, ‘Interesting’, ‘cool’, ‘fun’, ‘creative’, and ‘useful’) rather than to functional characteristics. In summary, for the product group, words related to the usability of the product were commonly found in the main affective vocabulary. Fourth, for the call taxi service and mobile pay, ‘convenient’ exhibited the highest eigenvector, confirming the core affective vocabulary. In addition, for call taxi service, the words ‘fast’, ‘safe’, and ‘easy’ were collected, and for mobile pay, the word ‘cool’ was generated. There were several words generated regarding safety (e.g., ‘safe’, ‘distrust’, ‘risky’, and ‘hackable’) and cost (e.g., ‘cheap’, ‘money’, and ‘banking’), because these services are directly related to money. Finally, for virtual currency, the vocabulary was smaller than that for other products and services, which represents the service’s unfamiliarity to Americans. In summary, for the service group, convenience was highly influential.

5.2.2 *China semantic network descriptions*

Figure 5 is the result of the analysis of affective vocabulary generated by people in China. First, for VR device, most Chinese individuals perceived it is a new, innovative, expensive, state-of-the-art technology product. Second, fitness trackers were generally perceived as convenient and trendy accessories related to health; many affective words directly related to life were generated (e.g., ‘sleep’, ‘health’). Third, in the case of drones, most of the individuals perceived them as filming products. The vocabulary was generated related to the functional characteristics of drones, such as ‘battery’, ‘delivery’,

and ‘multi-angle’, and to the appearance of drones, such as ‘toy’. In summary, in the case of the product group, the Chinese participants attended to the advanced technology and confirmed that price reduction and improved function and appearance are important. Fourth, for the call taxi service and mobile pay, ‘convenient’ showed the highest eigenvector, confirming the core affective vocabulary. In addition, for the call taxi service, the words ‘fast’ and ‘cheap’ applied, and for mobile pay, ‘fast’ and ‘safe’ were collected. Several words regarding safety (e.g., ‘safe’, ‘unsafe’, and ‘security’) and cost (e.g., ‘cheap’, ‘payment’, and ‘bank’) were generated because these services are directly related to money. Finally, in the case of virtual currency, most individuals perceived this as a virtual, valuable service. Several words were generated regarding safety (e.g., ‘safe’, ‘unsafe’, and ‘security’) and cost (e.g., ‘currency’), because these services are directly related to money. In summary, for the service group, safety and cost were considered important.

5.2.3 Indonesia semantic network descriptions

Figure 6 is the result of the analysis of affective vocabulary generated by Indonesians. In all three product groups, ‘expensive’ was collected as a core affective word. In addition, in the case of VR device and drone, the words ‘cool’ and ‘advanced’ were obtained, and for fitness trackers, ‘health’ was collected. In the case of the drone, words were generated related to functional characteristics, such as ‘photo’, ‘camera’, ‘fly’, and ‘control’, and to the appearance, such as ‘toy’. Most products, and especially fitness trackers, were deemed expensive and useless accessories. For the call taxi service and mobile pay of the service group, core affective vocabulary consisted of ‘easy’, ‘cheap’, ‘fast’, ‘simple’, and ‘safe’. Several words were generated with respect to safety (e.g., ‘safe’), cost (e.g., ‘cheap’, ‘money’, and ‘payment’), because these services are directly related to money. Finally, virtual currency is primarily an expensive investment type service; thus, many words were generated pertaining to safety (e.g., ‘safe’ and ‘unsafe’) and cost (e.g., ‘expensive’ and ‘money’). For the service group, safety and cost were considered important; the Indonesian sample was very sensitive to price.

5.2.4 Korea semantic network descriptions

Figure 7 is the result of an analysis of affective vocabulary in Korea. First, for VR device, most Koreans perceived the product as a 3D game or movie. They also perceived this as an innovative product with fantasy and novelty aspects. Second, most perceived fitness trackers as a watch, bracelet, or accessory related to health and exercise. Many affective words were generated (e.g., ‘sleep’ and ‘health’) directly related to life. Third, in the case of drones, most individuals perceived them as toys or delivery helicopters. The vocabulary was generated related to the functional characteristics of the drone, such as ‘camera’, ‘delivery’, and ‘control’, and to drone appearance, such as ‘helicopter’ and ‘toy’. Fourth, in the case of the call taxi service and mobile pay, ‘convenient’ showed the highest eigenvector, confirming the core affective vocabulary. In addition, ‘safe’ was assigned to the taxi service and ‘security’ and ‘simple’ to mobile pay. There were several words generated regarding safety (e.g., ‘safe’, ‘security’, ‘trust’, and ‘hacking’) and cost (e.g., ‘charge’, ‘credit card’, and ‘payment’), because these services are directly related to money. Finally, most individuals perceived virtual currency as currency with a risk of hacking. The service was not familiar, as evidenced by words such as ‘useless’ and

‘foreign country’. There were many words generated regarding safety (e.g., ‘safe’, ‘security’, and ‘hacking’) and cost (e.g., ‘money’, ‘cash’, and ‘market price’). In the case of the service group, safety and cost were considered important. In Korea, the major affective vocabulary was similar to that generated by the Chinese participants, although the frequency of safety-related vocabulary was higher in the Korean sample.

5.2.5 Russia semantic network descriptions

Figure 8 is the result of an analysis of affective vocabulary in Russia. First, most of the Russians perceived VR device as a game, movie, or entertainment. Second, fitness trackers were generally perceived as a watch related to health; there were many affective words (e.g., ‘life’ and ‘health’) directly related to life. Third, drones were generally perceived as a toy helicopter, and a form of game or entertainment. The vocabulary was collected related to the functional characteristics of the drone (e.g., ‘camera’, ‘flight’, ‘delivery’, and ‘observation’) and to its appearance (e.g., ‘helicopter’ and ‘toy’). Fourth, most individuals perceived the call taxi service as comfortable and fast services; vocabulary was also generated regarding cost (e.g., ‘cheap’). Fifth, most perceived mobile pay as a fast and convenient service using smartphones; vocabulary was produced pertaining to cost (e.g., ‘payment’ and ‘money’). Finally, the virtual currency was generally perceived as a problematic internet currency. Like other IT services, vocabulary was generated regarding cost (e.g., ‘currency’, ‘bank’, and ‘money’). The unusual aspect of the service group among the Russian sample was that fewer safety-related words were produced than by individuals of other countries; the Russian sample was less sensitive to the safety of products and services.

5.3 Affective vocabulary comparison and explanation

5.3.1 A cultural difference perspective

First, the individualism scale scores were 91 points for the USA, 20 points for China, 14 points for Indonesia, 18 points for Korea, and 39 points for Russia (Figure 1). According to Hofstede’s standards, the USA is an individualistic society, whereas the other countries are defined as collectivist societies. An individualistic society emphasises individual autonomy and self-realisation, in which individuals express their wishes and needs clearly (Hofstede, 1980; Oyserman et al., 2002). Therefore, an individualistic society is more autonomous than a collectivist society. The results of this study also showed that the use of affective vocabulary was largest for American participants as compared with those in other countries (Figure 10).

In the case of the uncertainty avoidance scale, the USA scored 46, which is below the scale midpoint (Figure 1). According to Hofstede (1980), countries with an uncertainty avoidance of less than 50 are more generous with respect to the free expression of opinions on new ideas, innovative products, and technologies. This appears consistent with the large affective vocabulary ratio of the American sample (Figure 10). In the case of Indonesia, the autonomy of expression is low as a collectivist society, but because of the low uncertainty avoidance score, members of this country expressed a high affective vocabulary ratio compared to China and Korea.

Table 6 Negative vocabulary by product and service

	<i>VR device</i>	<i>Fitness tracker</i>	<i>Drone</i>	<i>Call taxi service</i>	<i>Mobile pay</i>	<i>Virtual currency</i>
USA			Intrusive Controversial Expensive Delicate Useless Expensive	Unsaftey Illegal Refusal_of_passengers	Distrust Hackable Risky Overspending Addiction Danger Unsaftey	Cheat Bitcoin Unsaftey Difficult Useless Illegal Expensive Risky Unsaftey Unpredictable Complicated Useless Hacking Useless Unfamiliar Inconvenient Unreliable Incomprehensible Difficult
China	Expensive Useless	Useless Delicate				
Indonesia	Expensive Eye harmful Heavy Useless	Expensive Useless	Expensive Difficult to control Dangerous		Expensive Complicated Vulnerable Limit	
Korea	Heavy Dizziness Crudeness		Expensive Hidden_camera		Inconvenient Hacking Limit	
Russia	Expensive		Expensive			

Regarding the indulgence scale, the USA is an indulgent society, as evidenced by its score of 68 points, whereas the other countries are restrained society (low indulgence scores). Hofstede (1980) referred to a society that has relatively weak control over impulses as 'indulgent', whereas a society that has strong control over impulses was termed 'restrained'. While indulgent societies permit the expression of positive emotions, restrained societies are known to have less expression of positive emotions, and stronger tendencies toward pessimism and cynicism (Hofstede, 1980, 2011). In the current study, the proportion of affective vocabulary used by the American sample was larger than that of other countries (Figure 10), and the number of negative words generated by Americans was smaller than in other countries (Figure 9 and Table 6).

5.3.2 Positive and negative affective analysis

There have been numerous studies on the influence of positive and negative aspects of products on consumers, suppliers, and marketers, each of whom buys products and services.

Research has shown that negative information has a greater impact on consumers than positive information (Berlyne, 1954; Skowronski and Carlston, 1989; Henry et al., 2004; Lacznik et al., 2001; Tomczak and Zjawiony, 2018). The products and services covered in the current study tended to be expensive products that are directly connected to money; as such, negative impacts are considered to be much greater. Fiske (1980) and Feldman and Lynch (1988) suggested that negative information is generally more prevalent than positive information, and that negative information is more useful than positive information. Results can be observed in Figure 9, in which negative vocabulary data is less prevalent than positive vocabulary data. Therefore, this study elicited a relatively more negative vocabulary.

Table 6 lists the negative words collected by country, product, and service. Negative information for each product or service can be identified for each country. When introducing products and services by country, it is important to refer to such information. For example, when introducing VR device in China, it is important to emphasise the importance of price reduction and product usability. In Indonesia, 'expensive' appeared for almost all products and services. If a company aimed to market in Indonesia, the effect of price would need to be recognised and addressed. In terms of products and services, there were many negative vocabulary items generated, except for fitness trackers and the call taxi service. In particular, negative vocabulary was frequently mentioned in the case of virtual currency; thus, efforts to improve this negative image are most important.

5.4 Limitations

The current study was limited in that it included individuals aged in their '20s–'30s, who use many IT products and services among various age groups. Future studies should compare results among age groups. Next, because the experiment was conducted in a specific university in each country, it cannot represent each country. In addition, the number of participants was small (30 to 40 persons per country). Future studies should investigate/analyse large samples among various regions within each country. Next, since the results of the Hofstede analysis used in this study vary over time, it is necessary to re-examine such scores on each scale and use these updated values. Finally, Selected IT

products and services are at different stages of development and application in each country, which can influence the affective vocabulary collected. However, the purpose of this study is to compare and analyse the current affective vocabulary for new products and services in each country. Thus, the national development phase was not considered.

6 Conclusions

This study collected affective perceptions of newly introduced IT products and services in 33 Americans, 30 Chinese individuals, 42 Indonesians, 34 Koreans, and 31 Russians. Through positive/negative analysis of the semantic network diagram and vocabulary, the main affective terms relating to each country's IT products and services were analysed. First, for the product group, improving the usability of products was considered important in the USA, where individualism is strong. In the other the countries, wherein collectivism is strong, improving appearance, function, and design was considered important. In all countries, VR device was considered an innovative and positive product, fitness trackers an exercise-related product, and drones toys that deliver products and weapon capabilities. Next, for the service group, this study concluded convenience was most important to the individuals in most countries. There is an awareness of safety and cost issues related to money services in most countries. Koreans were more sensitive to service safety than individuals in China, and Russians were less sensitive to service safety. In Indonesia, prices were considered more important than the safety of products and services. In the USA, there was low awareness of virtual currency. This study identified cultural differences among the five countries in terms of perceptions of IT products and services. Future studies will include a wide range of comparative analyses, including

- 1 diverse countries that have not been surveyed
- 2 diverse regions that have not been surveyed in the countries surveyed
- 3 diverse age groups
- 4 a comparison of the same country and region, but over time.

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