Construction of knowledge base to visualize the cross-cultural difference over information

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Abstract

Aim: This research hopes to offer solutions to these issues based on real-world examples of data discrepancies between Japan and China. We're building a database of information to close the gap in Japan and China's understanding of each other across all disciplines.
Method: However, it is challenging to implement a method that addresses all aspects of cross-cultural information gaps, so it is important to find a mechanism that satisfies the criteria for information quantity, immediacy, and practicality to address the intercultural knowledge gap.
Findings: Results show that the proposed system constructs the knowledge base with the high-level immediacy to renew the information organically depending on the situation. This improves practical utility by storing information that broadly matches users' needs. Through the use of artificial intelligence, it delivers content that is tailored to each user based on their current activity. Data can be stored, updated, and searched in the system, but that's not all it can do. To fully realise the system's interactivity, we integrate post/read/reuse functions for the user comments. As a result of this research, we will be able to implement a knowledge base to address issues with cross-cultural communication.
Implications/Novel contribution: The innovative aspect of this study is that it proposes an immersive interface for consumers and expects it to be a powerful instrument for their cross-cultural exchange of ideas.

Keywords: Cross-Cultural Communication, Cross-Cultural Difference, Information Design, Knowledge Base, Media System

INTRODUCTION

The evolution of information technology has modified the conditions for communication. Particularly, it made it easier for people worldwide to communicate with one another across national boundaries. For example, a recent study found that with Internet access, people can use social networking sites, Internet telephony, and video chat to communicate with others worldwide at no cost (Cuyugan et al., 2017; Huang, 2017).

In contrast to international phone calls, these options are much more cost-effective. It is also becoming more common for people to work remotely online even though they are physically located in another country. Enrolling in courses offered by universities in other countries and graduating with their degrees also became feasible. Because of the Internet's role in facilitating unprecedented levels of globalisation, our ways of life have undergone profound transformations for the better.

The rapid pace of globalisation has led to several issues. For instance, "Sekiguchi (1998)" discusses the new types of communication troubles arising from the intercultural information disparity in the activated communication across borders with the Internet. The author has spent many years immersed in a multicultural setting and still feels ashamed of the knowledge gap between cultures.

Differences in language are only one factor in the information gap between cultures. A study of intercultural counselling found that while language barriers may contribute to some misunderstandings, they are not always the root cause of friction across cultural boundaries (Inoue, 1995; Li, 2017). The foundations of racial culture, customs, and society are laid by underlying and subtle differences.

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Unfortunately, no workable answers have been discovered as of yet. Thanks to information and communication technology advances, people from all over the world can now easily engage in real-time communication with one another (Information and Communication Technology). However, the problem of the information gap between cultures is not easily resolved by the majority of the available resources.

Books, websites, videos, and mobile apps aimed at bridging cultural gaps in communication are published regularly.

Most of these tools are state-of-the-art regarding ease of use, efficiency, and content depth. However, it remains doubtful that such materials can provide a foolproof answer to the challenges posed by cultural differences. These materials help spot cross-cultural issues but do not answer the underlying problems.

This research endeavours to address the issues that have surfaced due to the gap in understanding between cultures by creating a system to address the issue. Focusing on how those differences can be represented visually, this research proposes a knowledge base that can help users pick them out among a sea of others, regardless of their cultural background.

When compared to a database, a knowledge base is far more useful. It's a method for converting and storing data that goes beyond merely indicating the truth. Data storage, refreshment, and retrieval were all part of the original database's design.

This research was conducted to develop a working knowledge base system that would aid users in understanding cultural differences and bridging them in conversation (Okano, 2001; Owusu, 2016).This system builds data as practical knowledge, which is crucial to effective communication.

The system also uses AI to improve the user experience. Using data on cultural differences between Japan and China, the paper demonstrates how the system is built.

LITERATURE REVIEW

The Situation of Globalization

According to the surveys in the fields of national conditions (Japan Foreign Office, 2017; Japan Student Services Organization, 2017). Today, globalization shows a consistent tendency to increase.

Globalization is defined as "Exchanges of capitals or information conducted on the global scale across the existing borders of the countries and regions in the aspects of politics, economics and cultures (Weblio dictionary: Current-events term dictionary).

In short, globalization means the activities on a worldwide scale. The history of globalization can be traced to the "Pax Mongolica" in the 13th century. It had extended the influence dramatically in The Age of Discovery of the 15th and 16th centuries. In a narrow sense, the globalization began from the 19th or early 20th century. The current world is definitely in the heart of the Second Globalization (Shibayama, 2013).

The features of the First Globalization were notably the distribution of material resources and human labors on the world scale. Today, the intercultural fusion amongst the nations or communities, and the interpersonal information sharing on a world scale are the core in the Second Globalization (Japan Cabinet Office, 2017).

The most significant factor that advances the Second Globalization is the development of IT (Information Technology). The progress of the Internet and information media has been improved the convenience in the information communication enabling the real-time information transfer and sharing. However, the globalization by the information revolution comprises the several serious subjects that follow the innovations of the society. The development of IT also brings the confusion to the culture (Hasegawa, 2017).

The most typical problem is cross-cultural communication. Nowadays, the incomplete cross-cultural communication may cause the serious troubles, which might lead to the disputes. For example, a large-scale anti-Japanese protest in 2012 is still fresh in people's memory. The protest was caused by the territorial problem between Japan and China. Some Chinese people who goaded by the "patriotism" assaulted the Japanese companies in China, and broke the Japanese brand motorcars and rioted at the Japanese Embassy.

Those lawless behaviors were the severe problem and vitiated greatly the relationship between Japan and China. Except for the connivance of Chinese Government to arouse the public opinions and increase the pressure to Japan, the trigger behind that problem could be cited as the incorrect peoples recognition of the situation in the

two countries. The mostly damaged by the riot is the fellow Chinese countrymen and the impression of China in the international society.

This kind of serious problem internationally would not naturally occur so often. In contrast, in our daily lives, the endless uncomfortable conflicts and subtle problems between different cultures are springing up one after another.

The primal factor of these subjects can be considered as the grasp of intercultural difference information. The mutual inconsistency of opinions, the misinterpretation of views and the confrontational actions led by that discordance are also listed.

Precedent Solutions

There are plenty of the routes to recognize the intercultural difference information. Notably, for the development of information media, numerous contents are on the web pages and apps. Especially the method to exchange information interactively with SNS became widespread.

As for the instance of Mafengwo, which is the general information site for the personal travelers in China, it provides the services like hotel reservation, airplane ticket booking, tour application, and travel guide information. In addition, it has the community function; users can post their experiences in the site and communicate with other users on line.

Certainly, also in Japan, the sites and apps, SNS are actively applied for the purposes such as travel, study and work. They are the popular routes that users always use to recognize the intercultural difference information.

In spite of the convenience of those routes, all of them cannot enable the users to recognize the cross-cultural difference information effectively in a complete sense. They are only the information site or information service, and almost same as "Guidebook".

The first reason why those contents cannot solve the problems of the intercultural information disparity can be considered; it is hard for them to cover all of the fields of information which users are interested in. In the most cases, users cannot obtain information enough by one route, and that forces them to gather information by other routes.

The second reason is the immediacy of information. To respond to the individual users' needs, the real-time renewal of information is required. A blog would not be useful for today's lives if it has not been renewed for years. The expired information cannot meet the users' needs.

Recently SNS has been used as a tool with high- immediacy. Even though the reliability of information on SNS is a great concern because of the unfettered information transmission, it is attractive for the users to get the newest information with high update frequency.

The third reason is the practicality of information. Can users access the information that they need? Is the information actually practical for their cross-cultural experiences?

In the author's examination, information provided by the most precedent routes is the general theory, and it only targets the general situation. For example, despite a user wants to visit some local littleknown spots, most information only suggests the common places such as Tokyo tower or Mt.Fuji.

The guidebooks of studying abroad may teach us the differences of the curriculums in the foreign colleges, however it does not mean that we can acquire more knowledge how to communicate with foreign students than usual through that.

In this way, there are mainly three factors that can be considered as the problems to be solved in the current situation of cross-cultural communication. Especially, the third factor: practicality of information, in other words, the lack of the information route to meet the users' practical needs, is the most important factor for the recognition of the intercultural difference information.

METHODOLOGY

To solve the intercultural information disparity, a tool that meets requirements for information quantity, immediacy and practicality is ideal, however it is difficult to implement the tool that covers all the fields of the cross-cultural differences in information. Focusing immediacy might lack of novelty because information

transmission/reception in SNS is major in today's society and all of information is summarized for communication in real-time.

Therefore, this study puts the focus on the practicality of information and proposes a solution. The standard to evaluate the practicality depends on the objects and the situations of the users. In this study, the practicality of the intercultural difference information is considered as the goal for the users' purpose. The users can obtain information that meets their demand and apply the information effectively in the cross-cultural situations. This study would not investigate the general visible differences in the cross-cultural situations such as languages, the structures of societies and the policies of governments.

Instead, this study deals with the cultures and traditional customs, and the particular experiences in real lives, which are difficult to grasp but definitely shape the human personalities and the characteristics of the nations. Xu (2012) discusses those aspects as the essential prerequisite elements of the intercultural communication.

For example, they are what we call as "common sense", or the terms, "regulation", "moral" and "empathy" which have been shared in the group-activities for years (Ito, 2004). This kind of information on "tacit knowledge" exists in the all cultures and has a significant effect on our daily lives, especially in the aspects of the communication. To gather such as this kind of information, the effective way is obtaining the knowledge from the real lives in the cultures.

The tacit knowledge does not have the clear standard unlike the words or grammars of the languages, and comprises many opaque parts. For that reason, to recognize that tacit knowledge generally requires people to enter and feel the target culture with the actual experiences. This study visualizes the tacit knowledge as the practical information, and presents it to the users.

RESULTS AND DISCUSSION

Overview of System
Figure 1 indicates the image of the structure of the proposed system.
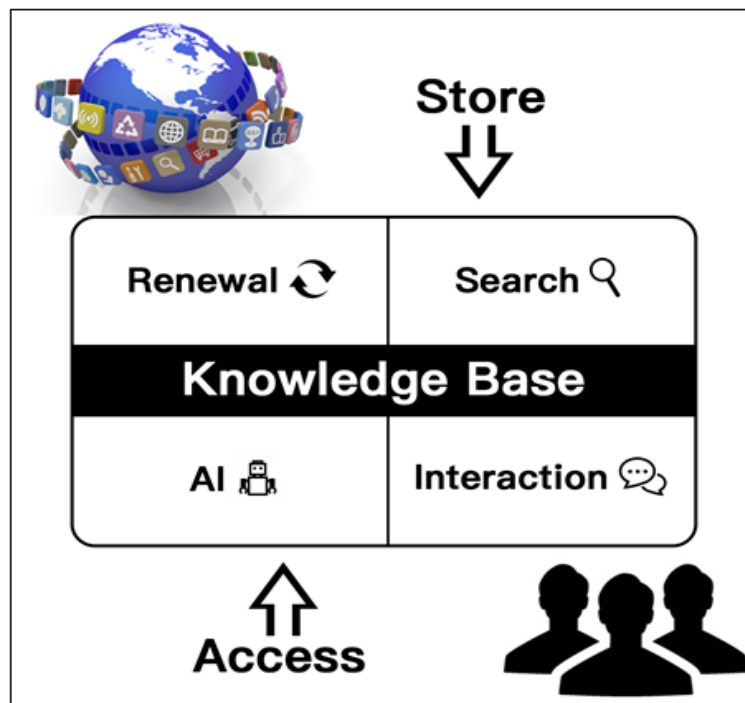

Figure 1. Image of the system structure

This system allows users to recognize the intercultural difference information correctly by the visualization. This system design refers to the theory of information design, from Fujimoto (2015). The feature of this system is storing the practical knowledge to encourage the users to grasp the cross-cultural information, instead of just

a database as the aggregation of data. For the certain purpose to provide the information that meets the users' particular needs, rather than just gathering data as it is, the system summarizes, designs, and expresses the data.

As explained in Figure 1, this system stores the intercultural differences information into the knowledge base, and the users can access to the system to apply those knowledge.

The system incorporates the communication function for the users and the AI function, which improves the system convenience, in addition to the functions of renewal and search that the usual databases have had.

The communication function allows the interactive use for the users. This system focuses the point of the interaction design, the aspects of functionality and the comfortableness of use (Nagai, 2009).

Referring to the SNS that are popular among youth, this function enables the users to communicate each other, post their comments and read others'. Through this function, the users can improve their learning abilities and grasp the information provided in the system more effectively. Moreover, the user communication will be activated to be useful for the users' particular application of the cross-cultural experiences.

This system is also equipped with the AI function. AI technology is much developed recently; AI Siri of Apple, and Google Assistant of Google are the well-known examples in our lives. The greatest feature of AI is to reduce the users' labor and workload when they operate the system.

For example, when searching a restaurant for lunch, in the usual way, they have to run the web browser to access to the search engine and type the keywords as "Local Lunch Restaurant" to start the search. Then, they look for the best information from the list of the results.

In contrast, if the users apply AI to the operation, only by saying "Lunch" to the smartphone, AI will automatically acquire the users' locations and displays the results of the restaurants. The application of AI enables the users to finish their tasks more effectively with the intuitive operation and curtail the ineffectual works and the processes of tasks.

The function of predictive transform is also a salient feature of AI. It is the function to provide the optimized service for the users' needs by the prediction of the users' trend from the usage history, such as "Recommended Goods" in Amazon.com.

It analyzes the users' consumption trend by gathering the data of products and services that the users have used or bought. Based on the result, then the information of products that users might like will be summarized (of Internal Affairs & Japan, 2016). The user experience is improved by the accurate information presentation.

This system incorporates those effective and maneuverable AI functions into the system. Specifically, the AI mechanism in this system summarizes the stored data by the several related keywords, and list up the corresponded information that matches the keyword input by the users.

It also records the search and browsing history to provide the information that is suitable for each user's use situation. Qualified use experience of the system can be expected by the implement of AI.

Development of System

The system is implemented as the smartphone app for the consideration of convenience. Applying the system on the web application may cause the deterioration of contents or the unusable instances by the conditions of the network environment.

It cannot be accessed in the region with interrupted Internet connection and as for the instance of China, there are quite a few disabled web sites by the information regulation of the government. On the other hand, if the users download the apps, they can avoid the worst case that the whole functions and contents become unavailable. Figure 2 illustrates the mechanism of the system.

This system is designed as the navigation apps to enable the users to recognize the intercultural difference information based on the characteristic of smartphone as the medium. The design principle takes the focus on the users' particular applications in the daily lives, besides the construction of a knowledge base.

The app was developed to meet the usability standard by designing the suitable interface for smartphones. The app aims to achieve the smooth and accurate cross-cultural communication.

Cross-cultural communication does not just refer to the conversations with languages. It is the interpersonal activity to convey so-called "tacit knowledge", the indigenous customs and cultures of the particular nations or

regions that are hard to express with languages, under the different cultural situations (Sakuma, 2003). Most people consider that the biggest problem of cross-cultural communication is the difference of the languages. However, if they observe the daily lives attentively, they will find a different answer.

For example, there is a Japanese man having a meal at an American restaurant, and he cannot speak English with fluency. He can order a dish showing a menu to the waiter by pointing a meal picture of with fingers without saying fluently, " I'd like a medium rare steak with white sauce". Conversely, even ones with the perfect language ability, the communication may be failed if they have no knowledge about the local culture. For instance of America, some regions interdict caffeine and alcohol for the religious reasons.
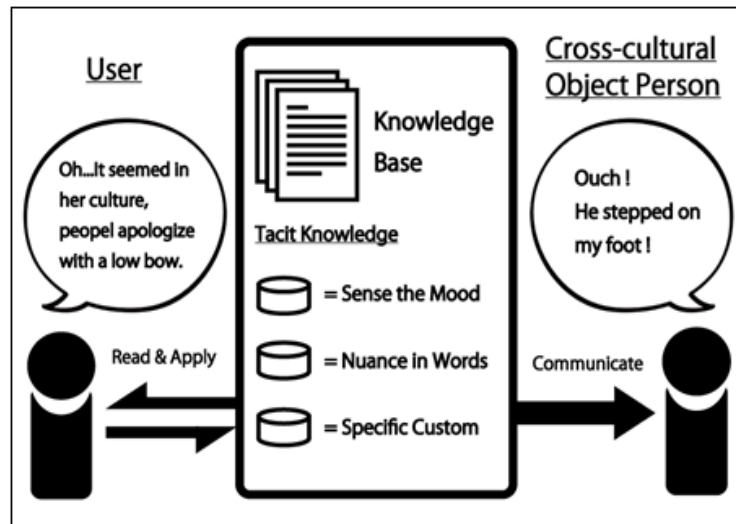

Figure 2. Mechanism of system

The miscommunication would occur when people try to order coffee, cola or alcoholic drink at restaurants. The fluent English ability would not be useful for anything.

The words we usually use in our own countries might have a problematical meaning, or, what is worse, can be a taboo to our intercultural partners. A behavior that presents the kindness in mother country, can be insult for them (Yamaguchi, 2017).

Language is the indispensable factor in cross-cultural communication. However, it is not essential. According to a study of intercultural communication (Ishiguro, 2005), the most important factors can be considered the ability to recognize the differences regarding the way of thinking in each culture, and the ability to express his or her own idea correctly to the communication partners. In short, it is the action of mutual understanding. This study considers them as the ability of the tacit knowledge communication.

Specifically, this app visualizes the typical tacit knowledge between Japan and China, and provides that to the users enabling them to promote better understanding of the intercultural differences and miscommunication. The recognition of the tacit knowledge leads to the more accurate communication among the people in cross-cultural situations.

The prototype system proposed in this study mainly focuses on the significant tacit knowledge between China and Japan. "Sense the mood", "Nuances in words" and "Specific custom" are the common tacit knowledge used in Japanese daily lives, and are the difficult ideas for Chinese people to grasp.

The tacit knowledge has the dramatic influence on the smooth cross-cultural communication between Japan and China. The users can solve the problem of the disparities of intentions in their cross-cultural communication by this app.

The absolute difference between this app and usual measures as "guide book" or "information site" is the usage of data (knowledge). Usual tools mainly aim to collect and show the data with a general explanation. In this app, the goal puts the focus on the practical application of the data in the users' daily lives.

Especially, this study picks up the tacit knowledge, which has not been paid attentions to before, and focuses the primal parts in communication. Cross-cultural communication will be unavoidable in the overseas-stay, and the language is not the solitary problem at that time. The most users would be confused by the implications that are specific to a certain culture in the cross-cultural communication.

This app enables the users to recognize the intercultural difference information by the equipped knowledge base. The users will realize a smooth communication with the accurate grasp of their partners' cultural backgrounds.

The information provided in this app excelled in practicality. It indicates how to communicate based on the tacit knowledge, in addition to showing the reality of that. This app functions as a navigation app for the cross-cultural communication and illustrates the route of communication.

When people experienced the troubles in the cross-cultural communication, most of them would attempt to search the reason. In short, they conduct communication in the cycle of "cross-cultural communication → problems occur → reflection → adjusting communication". This app supports the users specifically in the stage of "problems occur reflection".

When the users faced a problem in their cross-cultural communication, they can search the reason in this app and acquire the tacit knowledge by learning the specific analysis and application of the problem.
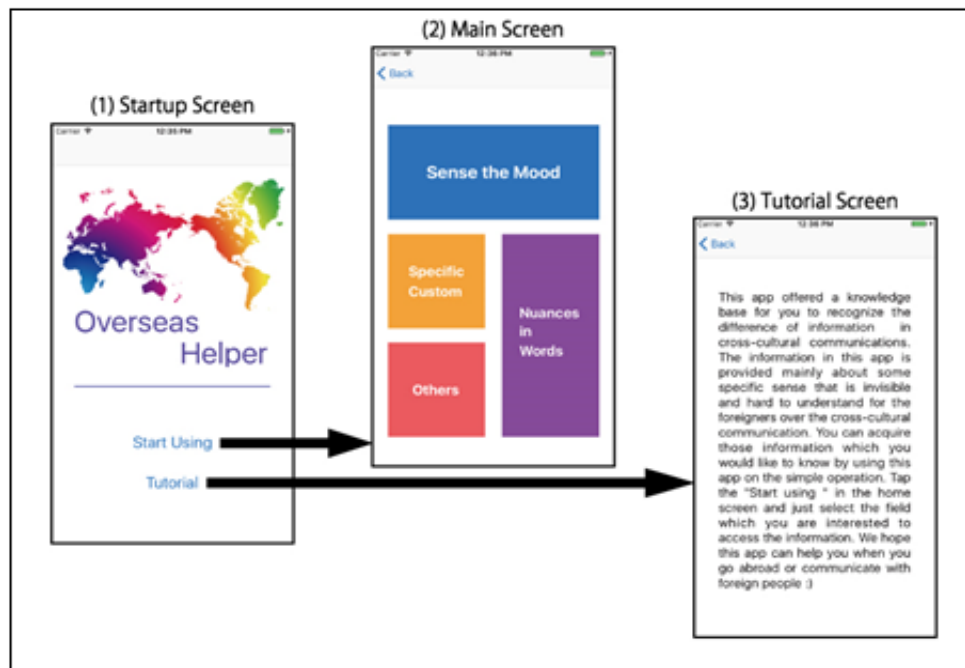

Figure 3. The screen transition of app

In Figure 3 indicates the start screen of app. The users tap "Start Using" button to start the app. "Tutorial" (Figure 3) has the explanation of app, and the users can confirm how to use the app in this screen.

At the current stage, this app was developed as the knowledge base with the tacit knowledge of "Sense the mood", "Nuances in words" and "Specific customs" for China and Japan, according to the concept to visualize the difference information on the intercultural tacit knowledge (Figures 2, 3).

Function of "Sense the Mood"

"Sense the mood" is the one of the specific tacit knowledge in the Japanese culture. In other words, the tacit knowledge of "sense the mood" is a difficult sensibility to grasp for the people in others nations.

Japanese people are educated on the ethical standard that one must not cause others inconvenience from their childhood. They tend to use the circuitous wording and the euphemistic expressions to avoid harming the person's feeling even for the truth. The "mood" referred to here means "atmosphere".

"Sense the mood" is practicing the suitable behavior for the atmosphere in the situation based on understand-

ing of the atmosphere and the communication partner's nuances instead of the truth or personal opinions. The partner also "senses the mood" to make more peaceful atmosphere.

Exchanging conversations with the attention of the partner's feeling each other is the rooted common sense in the Japanese life style. In Europe, the United States, and China, expressing ideas directly is the common sense, and such the tacit knowledge of "sense the mood" is perplexing to them. Conversations in this way will confuse them and they will receive the meaning of the euphemistic wording just as it is and the discord of conversations will occur. Sometimes, it may lead to the severe troubles.

In this way, to have conversations with Japanese people is the laborious work for the foreign people. They have to intricately recognize the situations and the atmosphere of the moment. This function constructs the knowledge base to encourage the users to recognize this specific Japanese tacit knowledge-"sense the mood".

Function of "Nuance in Words"

The tacit knowledge of "nuance in words " is also the incomprehensible sensibility for the people from other nations. "Caring Nuance in words" is the technique to exchange conversations transforming the intent and sense of words depending on the talker's intention and the situation on each occasion.

It forces people to grasp the words not just with the natural meaning of the words. This tacit knowledge is similar to "sense the mood", however it is the more trivial technique optimized for wording.

For example, it is not preferred to say "NO" directly in Japan. In Japanese sense, "NO" might be grasped for as the negation of the personality. Instead of "NO", people apply the method to dissent or reject indirectly. Therefore, the expression of words with positive looking that actually means denial (or vice versa) is often used in Japanese conversations. This function constructs the knowledge base to encourage the users to recognize this specific Japanese tacit knowledge-"nuance in words".

Function of "Specific Custom"

"Specific custom" illustrates the differences of the way of thinking by the national and racial characteristics under the cross-cultural backgrounds.

For instance of China, when people present the gift to someone, they tend to praise their gift to express warm-hearted friendly feelings. That behavior implies the meaning, "You are such a good person, and this wonderful good suits you".

In contrast, the logic to express affection is the opposite in Japan. The words that Japanese people often say when they give someone present is "Though here is a little something...". From the Chinese people's point of view, they would think: "Give me a better one if you think the gift is not good enough".

However, the real meaning of this behavior to despise the one's own gift personally implies respect and adoration. It means, "Definitely you are a great person. So nothing can correspond to your value. This is why any gift will be poor in front of your value". This kind of specific customs are often found commonly in cross-cultures, and they are also the tacit knowledge that is only grasped by the actual experiences of the cultures.

This function constructs the knowledge base to encourage the users to recognize this Japanese tacit knowledge-"specific custom". When the users select the function that they want to use, they can view the definite knowledge as shown in Figure 4.

Figure 5 and 6 shows the images of the AI functions and the interaction function. AI function provides the suitable information for the users based on the analysis of the users' usage trend.

For example, if the users trend to view the information of the category "nuance in words", that usage situation will be recorded and the related information will be listed, and then AI would recommend that information to the users.

In interaction function, the users can create a " community" with other users (Figure 6). Understanding the tacit knowledge requires the actual experiences of the target culture. For that reason, the grasp of tacit knowledge tends to be extremely subjective.

It can be expected that sharing suggestions and the new ideas of the tacit knowledge will be realized in the community by the users' mutual communication. The transmission of information to serve for each member's

situation is possible because the community consists of the users who all encounter intercultural experiences.
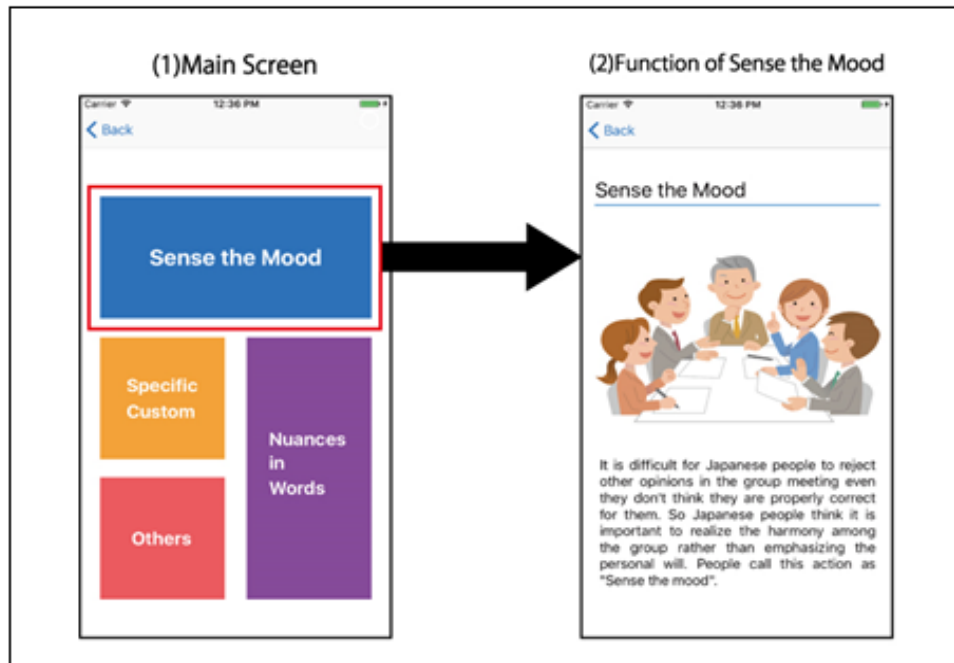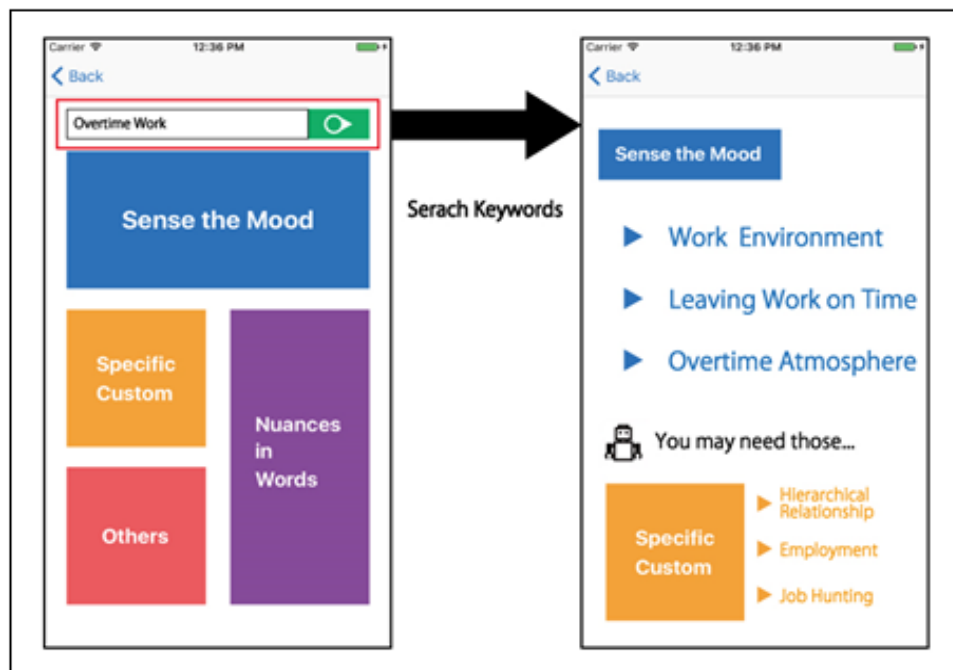

Figure 4. Viewing knowledge
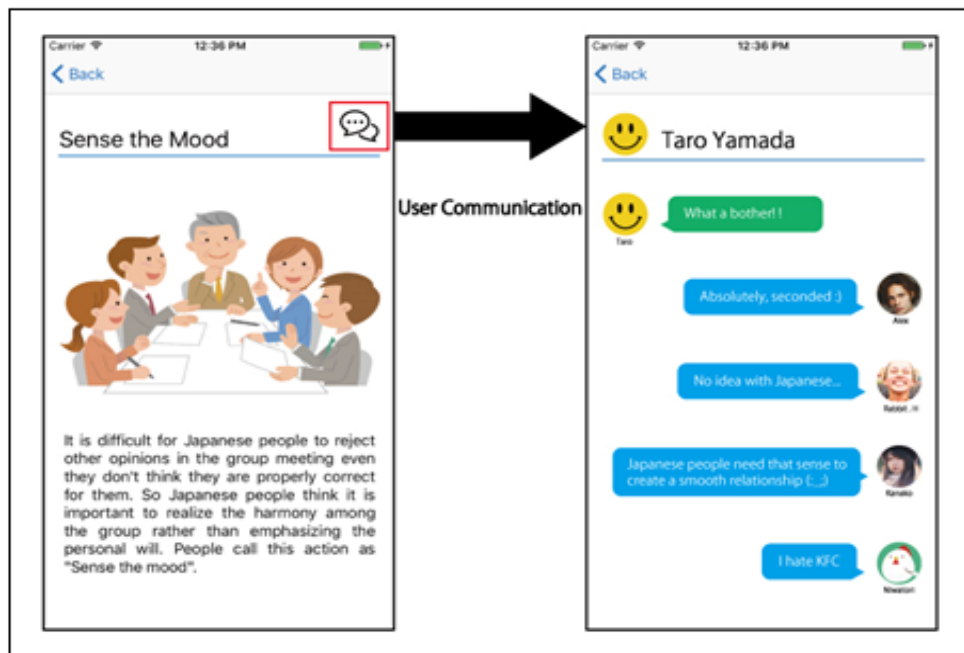

Figure 5. AI function

Figure 6. Interaction function

Discussion

The intercultural communication does not just refer the conversation with language. Okano (2001) discusses the importance of the experiences for communication in her study, and the tacit knowledge of cross-culture is exactly a significant case of that.

The most essential factor in the intercultural communication is the common knowledge (or comprehension) of multicultural backgrounds (Miyajima, 2009). The tacit knowledge effects the deep communication of people. It constructs the attitude, locution and consciousness of people when they communicate with others.

In a study of organizational communication, Daibo (2006) illustrates the skills that user recognizes the message from the other one correctly and expresses his personal ideas unerringly are essential in the communication. In this aspect, to acquire the tacit knowledge is related the smooth communication for the intercultural users.

This study proposes a system to provide the typical tacit knowledge between Japan and China as a elementaryinstance. In the recent IT society, applying the media system for the intercultural communication is the worldwide trend. SNS such as Facebook (www.facebook.com) and Twitter (twitter.com) are the popular tools used for the intercultural communication.

In a study of the application of SNS among international students, Murata (2014) discusses the spread using of SNS under the intercultural situations, and shows the beneficial implications in her study. This study proposes an interactive system to users and expects it can be an effect tool for their intercultural communication.

CONCLUSION, RECOMMENDATIONS AND IMPLICATIONS

Summary

The number of opportunities for cross-cultural communication increases dramatically by the development of IT recently. The intercultural information disparity has become a huge issue.

Today, the various contents are released for the cross-cultural understanding, even though most of the tools do not function effectively in a complete sense. This study focused on the primary factor, the lack of the practical information that meets the users' needs , and proposed the knowledge base to visualize the differenceinformation for the intercultural tacit knowledge.

The proposed knowledge base does not just store the data of difference information on the intercultural tacit knowledge, but also organize it as the practical knowledge. The system incorporates the AI function and interaction

function for the users besides the renewal and search functions that the usual databases are equipped with.

The system constructed the tacit knowledge base as the instance of the cross-cultural communication between Japan and China with three types of typical tacit knowledge: "Sense the Mood", "Nuance in Words" and "Specific Customs". Users can recognize the differences over those tacit knowledge, and acquire the ideal way to communicate in the situations of the cross culture. Consequently, this system helps the users to realize a smooth intercultural communication in their daily lives.

Future Issues

The future issues and research direction are indicated in this section. First, the improvement of the functions in the system is considered as a future work. At the current stage, the elementary development of the system has been finished. The development for the AI function and the interaction function is required.

The data expansion in the knowledge base is one of the concerns. This study conducted the survey on the most typical fields of the tacit knowledge between Japan and China. Evolving and deepening the knowledge is also another concern. The extension of the tacit knowledge in the different fields would be examined depending on the developmental processes.

Finally, the application of the system from the international point of view is expected. This study demonstrated the instances of the intercultural difference information between China and Japan. The examination of the modern culture in Europe such as Britain and France, and the culture in America will be also targets to be considered.

We expect to expand the scale of the study and examine the difference information of the major cultures in the world by conducting the survey for the people who actually have been in those countries or by experiencing the cross-cultural communication in those cultures by ourselves.

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