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Acceptance factors for the use of video call via smartphone by blind people

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ABSTRACT

Using video call via smartphones is a new technology for blind people which can be applied to facilitate their daily lives. This video call technology is different from old technology and the technology acceptance has changed users' behavior in society, culture, and especially attitude toward using new technology. This research studied the intention and the need to use video call via smartphone by blind people according to the Technology Acceptance Model, a famous and widely-accepted theory for the indication of the intention to use technology. The survey data collected from a sample of 30 blind people who lived in the Bangkok Metropolitan Region and used smartphones in their daily life were analyzed using Pearson's Correlation Coefficient. The results found the perceived ease of use factor and the perceived usefulness factor have similar direction and relation. These two factors also have similar roles and relation to the attitude toward using and behavioral intention to use video call via smartphone in the daily life of blind people. The group of blind people who had not experienced using video call via smartphone had similar direction and relation in technology acceptance at a higher level than the group of blind people who had experienced except for the relation between the attitude toward using factor and the behavioral intention to use factor.

Introduction

Presently, humans are experiencing more problems with vision. Such issues are caused by the deterioration and degeneration of eyes resulting from disease, accidents, ageing or the improper use of eyes in an inappropriate environment. According to the statistics of the World Health Organization (WHO), in 2002, it was estimated that globally, there were 37 million blind people and as many as 124 million people with low vision. Ninety percent of them were from developing countries. Furthermore, 82 percent of blind people were aged 50 years or older. In addition, the World Health Organization estimates that in 2020, the number of blind people will increase to 46 million (Pornmanuchatip, 2010).

Such an increase in number is the main reason the current study adopted the approach of helping blind people through the use of video call via smartphone. Assistive technology has been developed which is suited to each type of disability and allows disabled people to have more mobility and independence in their daily life (Chonlatanon, 2002). Such technology can be basic or advanced; for example, a mobile phone which has big numbers and letters on the buttons so that people with low vision can use it or a mobile phone which uses a speech synthesis system to allow blind people to perceive and access various functions (Phuntachat, 2004). Nowadays, communication technologies play an inevitably important role in our daily lives. Technological development has advanced rapidly—it

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changes our daily lives and makes us more comfortable. Mobile phones have become important, every-day gadgets for communication and data exchange. They have been developed to become more efficient (Chumchu, 2012) and have evolved into the smartphones that we see today. Smartphones have greater abilities than a normal phone; they can be compared to portable computers with operating systems that work together with applications to enhance performance and offer diverse services which suit users' needs better (Prakrobtum & Ajchariyakiat, 2012). Most importantly, these days, smartphones have been developed to enable blind people to access and use a screen reader program through the operating system of the smartphone without any additional expense. The operating systems are also widely used such as iOS and Android. As a result, blind people can use iPhones or smartphones more conveniently when they have these operating systems (Jayant, 2010). Also, according to the study, it was discovered that the use of video call via smartphone can be applied to help blind people in various aspects (Maneesaeng, Punyabukkana, & Suchato, 2015), including navigation, reading messages, giving information about colors and patterns of clothes or other types of assistance offered by helpers who describe the pictures from video calls via an online social network (Lasecki, Thiha, Zhong, Brady, & Bigham, 2013). The use of video call via smartphone is a new technology which has been applied to facilitate a blind person's daily life. This technology is different from the old technological facilities. In addition, since acceptance is important for the construction of behavioral change which will also result in social and cultural change in a way that affects the use of innovation, this research studied the intention and the need to use video call via smartphone by blind people according to the Technology Acceptance Model (TAM), a famous and widely-accepted theory for the indication of the intention to use technology (Davis, 1989), The acceptance factors for using video call via smartphone by blind people were studied.

Literature Review

Use of Smartphones by Blind People

Nick Bilton interviewed Dorrie Rush, the Marketing Director of Accessible Technology, an agency for vision rehabilitation and education for the blind. She mentioned that the old belief that the use of communication technology for blind people must be concerned with devices that blind people can perceive through their sense of touch has become obsolete. In the past, blind people had to use mobile phones which had small buttons and a small screen. Later on, the early iPhone model was developed with big fonts for those who were visually impaired. In 2009, iPhone was further developed to enable blind people to use it more conveniently by providing the gesture-based screen reader or the voiceover program. When the fingers of the user were moved back and forth on the screen, there would be a notification sound with each program. Also, the use of fingers in different manners enabled a user to use the phone more easily. Such technology also allowed blind people to read and write messages (Bilton, 2013). Subsequently, Google (the developer of the Android operating system) installed the screen reading program called "Talkback" which enabled the blind to use smartphones as well (Bilton, 2013).

Concepts to Help Blind People Use a Smartphone

Hestnes, Brooks, and Heiestad (2006) reported an experiment in 2005 to send video signals and voices from mobile phones by the 3G network system to test the resolution and detail of video images which were sent at high speed. The research was carried out with a sample of 10 blind people and 10 helpers who provided them with information from the videos that they saw. Everyone used a mobile phone which had a video camera and could receive and send internet signals. The experiment tested the usage in daily life at work and at home, including trips to various places such as to help check the colors of clothes to make sure they matched, to help look at merchandises in supermarkets or to help describe surroundings. The results of the test revealed that the resolution and the size of images as well as the internet signal were the important factors which provide efficient usage (Hestnes et al., 2006). In April, 2012, Janet Ingber wrote an article to introduce three Object Identify Application programs: VizWiz, Digit-Eyes, and LookTel Recognizer. These programs were used in iPhones and had similar objectives to describe pictures for blind people. VizWiz was a free program and was easy to use. A user only had to take a picture and add a voice recording asking a question about the picture and send the data to the helper who could be a volunteer, a friend in online social networks (Facebook, Twitter), an e-mail contact or software for picture identification (IQ Engine). Digit-Eyes by Digital Miracles L.L.C. was a program for scanning bar codes and providing descriptions of images by voice. It was applicable to Universal Product Codes (UPC) or European Article Numbers (EAN). Moreover, it could create its own bar codes. This program cost USD 29.99. Finally, LookTel Recognizer's recognition system could select objects from pre-recorded pictures and audio files which described the pictures. It could also be used to scan bar codes. This program was sold for USD 9.99 (Ingber, 2012). Later, in July 2013, Bill Holton wrote an article to recommend additional Object Identify Application programs which were used with iPhones. They were TapTapSee, CamFind, and Talking Goggles. TapTapSee still required a human helper to help describe pictures, unlike Talking Goggles which used OCR (Optical Character Recognition) and therefore, was able to better describe texts from labels or publications (Holton, 2013). Additionally, the CamFind program could display the data of the identified objects, including the details of such objects, places of distribution, maps, price comparisons, and promotional videos.

Nevertheless, the programs mentioned above were used to identify an object from a still image and to send the data back to the sender of the image, which might take a while before the answer was available. Furthermore, sometimes the answer did not correspond to the user's need due to the lack of real-time interaction between the sender and the provider of the data (Ingber, 2012). For example, a blind

person uses a smartphone to take a picture that the user wants to identify. The picture taken and sent of a can of drink may be of the front or the back of the can. Based on the image received, the data provider may give information about the picture which is not required by the sender.

The 3G mobile network can receive and send a huge amount of data at high speed. It has been incorporated into a smartphone which comes with a high-definition video camera that produces high-resolution images. The smartphone is also equipped with various applications which help facilitate communication using one or more of the common social networks. It helps send news and data, including text, symbols, sounds, images, or videos. Also included is the use of video call which is a type of communication allowing both video and sound to be received and sent simultaneously. A video call allows a helper to see real-time video during the conversation and to describe the details to the blind person. Therefore, the blind person obtains the information wanted and understands the information presented. However, this online social network program is not designed for blind people to use conveniently with the screen-reading program (Maneesaeng et al., 2015) for registration, searching for contacts, calling and hanging up, switching to camera mode, and so on. Since the creators of online social network programs do not consider the Web Content Accessibility Guideline (WCAG) in their program designs, blind people are unable to use the screen reading program to control the functioning of a video call using such online social network programs (Maneesaeng et al., 2015). In addition, a blind person needs to use video call to communicate with a helper to describe real-time video which might have unclear details and involve incomplete imagery or be taken at an inappropriate distance. As a result, the helper may not be able to describe the video to allow the blind person to understand it accurately (Maneesaeng et al., 2015).

Such problems have led to the design of a prototype application for video calling via smartphones for convenient use by blind people by following the design approach of WCAG. WCAG was developed by The World Wide Web Consortium (W3C) and set the global standard for web structure and information accessible on the web to meet the needs of individuals, governments, and the private sector. WCAG helps deaf, blind, and elderly people to be able to access information on the web conveniently including text, symbols, sounds, images, and videos so that blind people can use the screen reading program to control the functioning of video call via smartphones such for registration, searching for contacts, calling and hanging up, switching to camera mode, and so on. It also includes the control of a real-time video call function which helps reduce the problems that may occur while the blind person is communicating with a helper such as zoom and capture video call function so that the helper can provide efficient assistance.

Technology Acceptance Model

Acceptance is important for the construction of behavioral change. It also results in social and cultural change in a way that affects the use of innovation. Therefore, this research studied the intention and the need to use video call via smartphone by blind people according to the Technology Acceptance Model (TAM), a famous and widely-accepted theory for the indication of the intention to use technology (Davis, 1989) (Figure 1). The principles of TAM requires studying the four main factors which influence behavioral intention to use technology as follows:

1. Perceived usefulness (PU)
2. Perceived ease of use (PEOU)
3. Attitude toward using
4. Behavioral intention to use

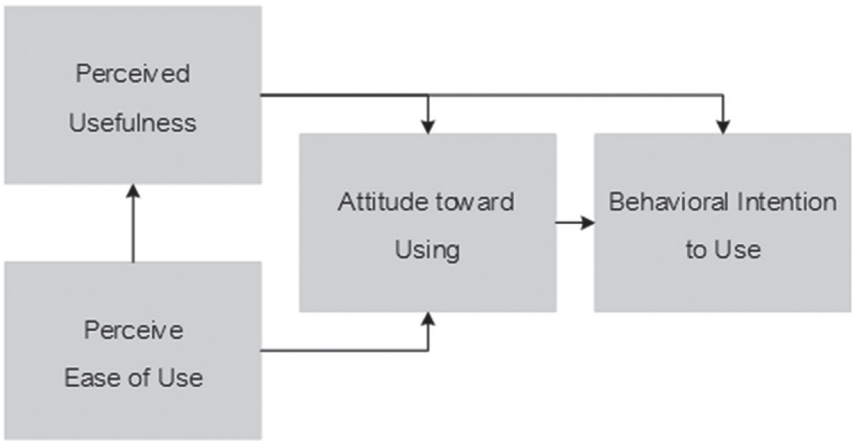

Figure 1 Model of relationship between factors in technology acceptance model

The model indicates that perceived ease of use has an influence on perceived usefulness, and that it is the factor which determines individual perception. Also, attitude toward using technology can help develop performance. It is

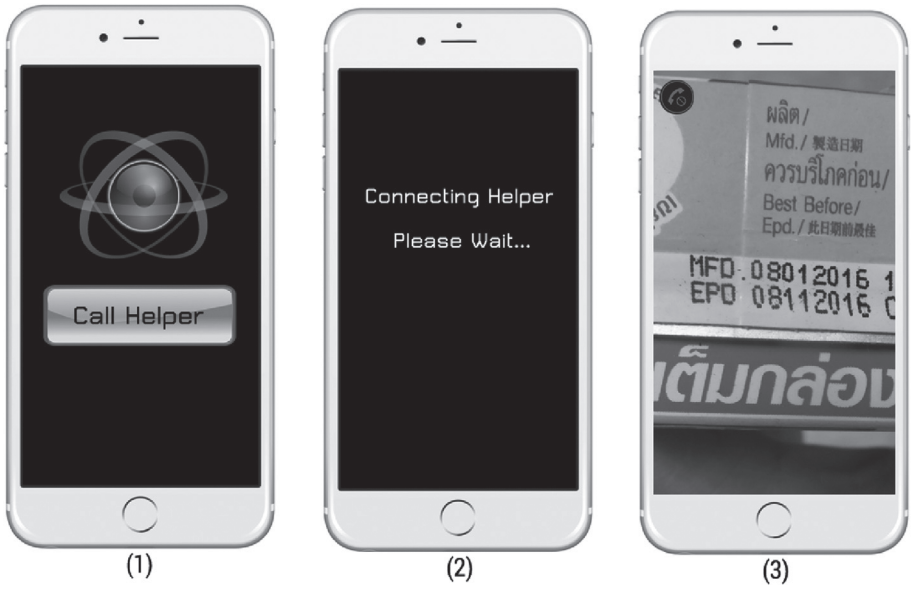

Figure 2 Design prototyping of video call via smartphone for the blind

also the factor that directly affects behavioral intention to use. Furthermore, perceived ease of use is also the factor which determines whether the volume or achievement is in line with the desire or expectation. In addition, it is the factor which has an impact on perceived usefulness. Attitude toward using is influenced by perceived usefulness and perceived ease of use while behavioral intention to use is influenced by attitude toward using and perceived usefulness, which finally results in acceptance of real use (Chaveesuk & Vongjatupat, 2012).

Research Methodology

According to TAM (Davis, 1989), the study of the acceptance factors for the use of video call via smartphone by blind people was carried out using a survey of 30 blind people who lived in the Bangkok Metropolitan Region and used smartphones in their daily lives. Non-probability sampling (purposive sampling) was applied. The researcher presented the design prototyping of the use of video call via smartphone by blind people to the people in

Figure 3 Design prototyping of video call via smartphone for the helper

the sample so that they understood it before undertaking the survey. Such design prototyping was designed according to the WCAG to enable blind people to use the screen reading program to make a video call via smartphone conveniently as shown in Figure 2.

There was also control of the real-time video call function for the helper to reduce the problems that may occur while the blind person was communicating with the helper to ensure the smartphone's camera was in the proper position at an appropriate distance. The helper is able to zoom and capture the video call to describe the real-time video to the blind person as shown in Figure 3.

The tool used for data collection was a questionnaire using closed questions that the researcher created and were divided into two parts:

Part 1: General information on the respondent consisting of eight questions.

Part 2: Opinion toward acceptance factors and patterns of the use of video call via smartphone divided into various aspects consisting of perceived usefulness (six questions), perceived ease of use (three questions), attitude toward use (five questions), and behavioral intention to use (three questions).

The consistency between the questions and the objectives or content validity was checked by the method of IOC (Index of Item Objective Congruence) before the collection of data. Afterward, the results of the study were analyzed and summarized.

Results

Expert checking of the content validity of the questions by the method of IOC resulted in an average score of 0.67.

Table 1
Attributes of respondents

Attribute	Number	Percentage
Sex		
- Male	20	66.67
- Female	10	33.33
Age		
- 21–40 years old	13	43.33
- 41–60 years old	12	40.00
- Over 60 years old	5	16.67
Education		
- Elementary	5	16.67
- High school	8	26.67
- Bachelor degree	13	43.33
- Higher than bachelor degree	4	13.33
Occupation		
- Student	6	20.00
- Government employee	4	13.33
- Private company	4	13.33
- Freelancers	12	40.00
- No job	4	13.33
Income per month (THB)		
- Less than 10,000	8	26.67
- 10,000–30,000	18	60.00
- More than 30,000	4	13.33
Cause of visual impairment		
- Since birth	13	43.33
- After birth	17	56.67
Experience in using video call		
- Experience	21	70.00
- No experience	9	30.00

Table 2
Level of opinion in terms of perceived usefulness

Perceived usefulness	$\bar{x}$	SD	Opinion level
- The use of video call via smartphone by blind people helps them perceive more information.	3.93	1.05	High
- The use of video call via smartphone by blind people helps them perceive and understand messages on publications.	3.73	0.87	High
- The use of video call via smartphone by blind people helps guide them to their destinations safely.	3.40	1.04	Moderate
- The use of video call via smartphone by blind people helps them make transactions via ATM.	3.20	1.26	Moderate
- The use of video call via smartphone by blind people helps them choose merchandises that they want in supermarkets.	3.13	1.33	Moderate
- The use of video call via smartphone by blind people helps them choose clothes which have the colors and patterns that they want.	2.93	1.23	Moderate

Opinion level: 1.00–1.80 = lowest, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = highest

Table 3
Level of opinion in terms of perceived ease of use

Perceived ease of use	$\bar{x}$	SD	Opinion level
- The process of using video call via smartphone by blind people is easy to understand and clear.	3.83	0.91	High
- Blind people can use video call via smartphone by themselves without having to rely on other people.	3.73	0.94	High
- Learning to use the video call via smartphone by blind people is easy.	3.70	1.06	High

Opinion level: 1.00–1.80 = lowest, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = highest

Table 4
Level of opinion in terms of attitude toward using

Attitude toward using	$\bar{x}$	SD	Opinion level
- The use of video call via smartphone by blind people is caused by the desire to perceive more information.	4.23	0.82	Highest
- The use of video call via smartphone by blind people helps make their daily life more convenient.	4.10	0.71	High
- The use of video call via smartphone by blind people helps them live an independent life.	3.83	0.79	High
- The use of video call via smartphone by blind people helps compensate for their visual impairment.	3.77	0.82	High
- There is an expectation of help from the helper in the use of video call via smartphone by blind people.	3.77	0.82	High

Opinion level: 1.00–1.80 = lowest, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = highest

Table 5
Level of opinion in terms of behavioral intention to use

Behavioral intention to use	$\bar{x}$	SD	Opinion level
- There are the intention and the desire to use video call via smartphone by blind people in daily life.	4.10	0.76	High
- There are the intention and the desire to immediately use video call via smartphone by blind people.	3.97	0.81	High
- There are the intention and the desire to regularly use video call via smartphone by blind people.	3.87	0.68	High

Opinion level: 1.00–1.80 = lowest, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = highest

The data were collected and the results of the study analyzed. The sample of 30 respondents were divided by their attributes, with 66.67 percent being males and 33.33 percent being females. The respondents were aged mostly between 21 and 40 years (43.33%) and many had a bachelor's degree (43.33%) and worked as freelancers as Thai massagers, street musicians, and lottery ticket sellers (40.00%). Their incomes were mainly between THB 10,000 and THB 30,000 per month (60.00%). Of the sample, 43.33 percent were blind from birth while the remainder became blind during their life, with this latter group having a different picture and vision perception from those who had been blind since birth. Seventy percent of respondents had experienced using video call via smartphone (Table 1).

The results of the study of perceived usefulness showed the level of opinion which gained the highest score from the sample group was the one which indicated that the use of video call via smartphone helped them perceive more information ($\bar{x} = 3.93$, SD = 1.05), followed by the level of opinion which indicated that it helped them perceive and understand messages on publications ($\bar{x} = 3.73$, SD = 0.87). The average scores of the level of opinions were: 1.00–1.80 = lowest, 1.81–2.60 = low, 2.61–3.40 = moderate, 3.41–4.20 = high, 4.21–5.00 = highest (Table 2).

The results of the study in terms of perceived ease of use showed that the level of opinion which gained the highest score from the sample group was the one which indicated that the process was easy to understand and clear ($\bar{x} = 3.83$, SD = 0.91), followed by the score of the level of opinion which indicated that blind people could use it by themselves without having to rely on other people ($\bar{x} = 3.73$, SD = 0.94) (Table 3).

The results of the study in terms of attitude toward using showed that the level of opinion which gained the highest score from the sample group was the one which indicated that the use was caused by the desire to perceive more information ($\bar{x} = 4.23$, SD = 0.82) (Table 4).

The results of the study in terms of behavioral intention to use showed that the level of opinion which gained the highest score from the sample group was the intention and the desire to use in daily life ($\bar{x} = 4.10$, SD = 0.76) (Table 5).

Analysis and Discussion

To analyze the relationship between such factors, the means of opinion levels from the variables of each factor were considered. The factor in terms of perceived usefulness which allowed blind people to perceive more information, helped them read messages on publications and helped guide them to their destinations had higher means than the help to make transactions via the ATM, the help to buy items, and the help to choose the colors of clothes. In terms of perceived ease of use, the application was easy to understand and clear; there was no need to rely on other people and learning to use it was easy. The factor in terms of attitude toward using was caused by the desire to perceive more information which made daily life more convenient and made it possible to live an independent life. The factor in terms of behavioral intention to use it in daily life immediately and frequently was analyzed using Pearson's Correlation Coefficient on the means of opinion levels of those sampled who were experienced in using video call via online social networks by smartphone and the

Table 6
Correlation coefficient between the variables of the group experienced in using video call via online social network by smartphone

	Perceived usefulness		Perceived ease of use		Attitude toward using		Behavioral intention to use	
	Correlation	*p*	Correlation	*p*	Correlation	*p*	Correlation	*p*
Perceived usefulness	1.000							
Perceived ease of use	.426**	.001	1.000					
Attitude toward using	.328**	.009	.428**	.000	1.000			
Behavioral intention to use	.294*	.019	.442**	.000	.518**	.000	1.000	

*$p < .05$, **$p < .01$

Table 7
Correlation coefficient between the variables of the group not experienced in using video call via online social network by smartphone

	Perceived usefulness		Perceived ease of use		Attitude toward using		Behavioral intention to use	
	Correlation	*p*	Correlation	*p*	Correlation	*p*	Correlation	*p*
Perceived usefulness	1.000							
Perceived ease of use	.451*	.018	1.000					
Attitude toward using	.366	.060	.460*	.016	1.000			
Behavioral intention to use	.462*	.015	.515**	.006	.462*	.015	1.000	

*$p < .05$, **$p < .01$

remained who were not experienced users. It could be concluded that the factor in terms of perceived ease of use was related to the factor in terms of perceived usefulness in the same direction, which was related to the factor in terms of attitude toward use by blind people in the same direction. Similarly, the factor in terms of perceived ease of use was related to the factor in terms of attitude toward using in the same direction. Finally, the factor in terms of attitude toward using was related to the factor in terms of behavioral intention to use in the same direction. In addition, the group of blind people who had no experience in using video call via smartphone had similar direction and relation in technology acceptance which was higher than for the group of blind people who had experience, except with respect to the attitude toward using factor and the behavioral intention to use factor (Tables 6 and 7).

Conclusion and Recommendations

The results of the study revealed the relationships between the acceptance factors of the use of video call via smartphone by blind people and the factor in terms of perceived ease of use (easy to understand and clear), no need to rely on other people, and easy to learn, which were related in the same direction to the factor in terms of perceived usefulness which enabled the perception of more information, helped to read messages on publications, and helped to guide the way. These two factors were related in the same direction to the factor in terms of attitude toward use by blind people who wanted to perceive more information, to make their daily life more convenient, and to live an independent life, which was also related in the same direction to the factor in terms of the intention and the desire to apply it in daily life immediately and frequently. These results were in accordance with the TAM (Davis, 1989) which is an indicator of intention to use technology caused by perceived ease of use and has an influence on perceived usefulness which finally affects the attitude and the intention to use (Chaveesuk & Vongjatupat, 2012). Nevertheless, blind people should be able to access and use such technology. The video call should be designed and developed according to the Web Content Accessibility Guideline which will enable blind people to conveniently use it with the screen reading program. Furthermore, the video picture quality should be controlled for helpers to help reduce the problems which occur when blind people use a smartphone camera during a video call, which is in accordance with the factor in terms of perceived ease of use which is related to the factor in terms of behavioral intention to use. According to the study, the acceptance of such usage can guide the approach to develop innovations and technologies to assist blind people in the future.

Conflict of interest

There is no conflict of interest.

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