

Bringing Karaoke into Thai Input Methods on Mobile Phones

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Abstract—Sending message used to be a long and wasteful process. Currently, new technology allows user to send message to the others a lot easier and quickly. Therefore our work sees the significant of inputting method on mobile phone. Our study focuses on Thai language input methods on mobile phone. We focus on evaluating the usability of three methods of Thai text entry solutions on a 12-key mobile phone keypad, including the traditional method or Thai character typing in normal solution (Multi-press), using the predictive text recognition solution (T9 text input) and using English character typing in making Thai word solution (Karaoke) with novice users. Before the usability experiment starts, the KLM is applied to each input method in order to pre evaluate each method. It was found that users make more errors and mistakes with Multi-press and Karaoke than T9. Similarly to the KLM result, the results of this experiment showed that the T9 method is the quickest. Moreover, the users found it is easiest to use. However, this method is rarely used by the users initially. But when the method is introduced to the users and allowing them to learn how to use it properly, user can use it with great usability for users.

Keywords—Keystroke-Level Model (KLM); 12-key mobile phone; Multi-press; T9; short message (SMS); input methods; usability test; learnability; effectiveness;

I. INTRODUCTION

In the old days, sending message to other people is not an easy task. It does not only take time and expensive but also wasteful. This is because user needs to write a message on paper and arranges the postage. Lots of paper were used in writing letters and envelopes. At the moment, we are in the era of green living, where green means consuming fewer resources during the manufacturing stage, using components with less impact on the environment, or using less power. We do what we can to save our world. With the help of current technology, such as mobile phone and email; it lets us send short message (SMS) without creating waste to the environment. Moreover, mobile phone technology does not only let user sending message to each other within a second but it also allows user to send the message at anytime and anywhere too. Mobile phone today is not just for making a phone call but it allows users to access information from around the world through internet and cloud computing. Furthermore, a mobile phone is used to send a text message or short message (SMS), E-mail, memo of tasks and access other applications. As a result, human are able to do

multiple tasks at the same time and anywhere in mobile computing era. This means that human attention is divided to concentrate on their everyday tasks and also using mobile phone or computing devices to support their everyday tasks too. Therefore for users to work efficiently in mobile computing era, the input method on mobile phone plays a key role in human everyday life.

In this study, we investigate the usability of a typical 12-small-key mobile phone keypad on Thai input. This is because firstly, unlike English and other Roman character based languages, it shows major problem with Thai language which has many more characters (Consonant, Vowel, Tone-mark and Special Symbol) to be represented on a limited 12-small-key mobile phone keypad. As a result, there are many characters to be held on one keypad. It is challenging for users to find and input character which will be discussed in the next section. Moreover, from the studies we found that different manufacturers have their own ways of characters layout on the keypads. This shows that there have not had a standard layout for Thai language yet. Moreover, even though there are many new generation of mobile phones for example, smart phone such as iPhone or HTC, QWERTY keyboard phone like BlackBerry but due to the big size of the screen, keypad and it's expensive price limit the user to just some group. On the other hand, the common 12-keypad phone can reach more group of people especially people in developing country like Thailand which only have certain purchasing power. This is another reason for us to concentrate on the 12-key mobile phone. Furthermore, from marketing research [1] found that amount of people who are using simple 12-key mobile phone are more than amount of people who are using trendy mobile phone such as iPhone and BlackBerry. This is because of its expensive price.

II. THAI LANGUAGE

A. Characteristics

In this section we discuss the characteristics of Thai language compare to the English language in order to demonstrate the issues of the usage of Thai language on a 12-key mobile phone keypad. Then of the characters in Chinese language are discussed to demonstrate that even though there is

“Figure 1e.” [7] shows the list of characters that are mapped onto the mobile keypad buttons as follow: the consonants are mapped onto keypad buttons “1” to “6”. Keypad button “7” is for left position vowels, keypad button “8” is for upper and lower position vowels, keypad button “9” is for right position vowels and right position special symbols, keypad button “*” is for a space and changing sound profile between vibrate and sound, keypad button “0” is for tone marks and upper position special symbols and finally keypad button “#” is for changing input method and lock phone.

All of the layouts mentioned have the same problem that is there are too many characters to be represented on one small button on mobile phone. Therefore they have to represent characters by using “-” sign. This means the users have to be able to recognize the order of the characters, as all the characters that are hold in the button are not represented on the keypad button.

C. Chinese Layouts Mapping on 12-Key Mobile Phone Keypad

In this section, it shows the Chinese characters perspective in Zhu-yin layouts mapping format on 12-key mobile phone keypad. As there are many characters to fit on the 12-keypad mobile phone, Chinese language has the same issue as Thai language, different mobile phone manufacturers have their own ways of characters layout mapping on their keypads as shown in “Figure 2”.

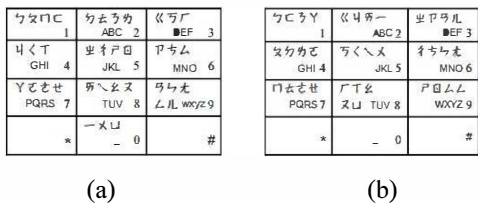


Figure 2. Chinese 12-Key Mobile Phone Keypad Layouts.

“Figure 2a.” [8] shows the list of characters that are mapped onto the mobile keypad buttons in Sony Ericsson as follow: the consonants are mapped onto keypad buttons “1” to “6”. Keypad buttons “7” to “9” and “0” for vowels, keypad button “0” is for tone marks.

“Figure 2b.” [8] shows the list of characters and vowels that are mapped onto mobile keypad buttons in Motorola.

As the following in “Figure 2”, the ambiguity of the 12-keypad Chinese characters layouts mapping of mobile phone can be classified to the consonants and vowels in Chinese as “C” represents consonant and “V” represent vowels as shown in “Figure 3”.

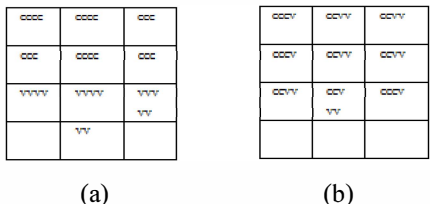


Figure 3. Classification of Consonants and Vowels in Chinese.

In order to improve usability in mobile text input usage, the existing of various keypad layouts shows that it might be challenging issues in find the standard of keypad layouts or a better input method that take advantage of the existing consistent English keypad for these languages. Therefore in this work, we purpose to concentrate on studying the input methods because we see the opportunity in using the existing standardized English keypad layout with Thai input method which is called Karaoke method. In our study, we adopt the Thai mapping on 12-key mobile phone keypad layout of Nokia phone which is shown in “Figure 1b”. This is because according to the marketing research [1], this brand is very popular and widely use in developing country like Thailand. The device model that is used in this study is Nokia N70. The experiment applies both Multi-press and T9 input methods to the mobile device which will be discussed in the next section.

III. SPELLING WORD IN THAI LANGUAGE

The Thai language includes 44 consonants, 15 vowels and 5 tones. Sentences are written left to right, without any spaces between the words. Vowels are written above, below, before, or after the consonant that they modify, although the consonant is still spoken first before any vowels. Vowels can sometimes occur together to make compound vowels. The tone of a spoken word affects its meaning, with some words having up to five tones and meanings. The tones include: low, high, mid-pitch, rising, and falling. Four tones are written on top of the consonant or vowels, and the fifth tone is represented by no written tone.

Most spoken words have an initial consonant sound, then a vowel sound, and then another consonant sound as shown in “Figure 4” [9]. The writing of the word however does not necessary have the order of consonant, vowel and consonant. For example, the word “ผ่าน” which mean pass. That has “ผ” as an initial consonant, “า” as a vowel, “น” as a final consonant and “่” is a tone, etc.

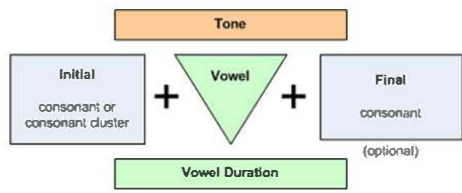


Figure 4. Structure of Thai words.

IV. TEXT INPUT METHODS

According to our questionnaire survey with users prior to this study, most of the users know of T9 but they have never used it before. However, they mentioned in the questionnaire that this method is hard to use. So they adopt the Multi-press method in their everyday mobile usage. As mentioned, Thai language has many characters and vowels which cause difficulty in finding each character on such a tiny 12 keypad buttons on mobile phone. Based on our literature review [10], it suggested the possibility of using Karaoke method as a Chinese language input method on mobile phone for ease of use in typing a message with English characters on 12-key mobile

keypad. Therefore in our study, we propose Karaoke method in our user experiment for Thai language input method on mobile phone. This is because in Chinese language there are many characters similar to Thai language. The 3 input methods on mobile phone are described further as follow:

A. Multi-press

For Multi-press method, users have to press button repeatedly or press the same key several times to get the desired character and similarly in order to get desired vowel and tone mark. As mentioned, the nature of keypad layout uses one key to hold all 24 vowels which causes even more difficulty in getting the desired vowel with the Multi-press method. Sometimes when users pressed a wrong character, in order to make correction, they have to re-type or delete it and then type a new one. For example, if user wants to get the character “ม”, they need to press keypad button “7” repeatedly 4 times. When mistype occurs, they have return to re-typing or delete it and start all-over again.

B. T9

Predictive input method or T9 seems to be a more technical method comparing to the Multi-press method. The T9 method is implemented as an expert application. It uses a combination of characters sequence that the pressed buttons hold together with a predictive algorithm to suggest and show the word that it predicts according to the words in the built-in dictionary. In order to avoid the incorrect prediction, when the list of words are suggested and shown, users have to select a desired word by pressing “Arrow Key or Select Direction”. An important factor in using this method is that the users need to be able to recognize the characters, consonants, vowels and special symbols in each button and amount of time buttons have been pressed. This is because when the desired word is not pressed completely, it will show other possible words according to the existing characters sequence resulting from the previously pressed buttons. For example, if the desired word is “ม”, the user needs to press keypad button “7” 1 time and press keypad button “*” 1 time. The word that will be shown in the predictable input method is “ม”. When the users want to typing in another new word, users need to press a “Arrow Key or Select Direction” in the right position.

C. Karaoke

According to the study in [10], English alphabets were used to write a word in Chinese language. So the consistent English language keypad layout can be used without the problem of unstandardized layout and representing too many characters that can be represented on one button. This work demonstrates the possibility of applying the method to Thai language which has the same characteristic of containing many characters. This should reduce the problem of finding text and saving time in typing a word. As a result, we propose this method in our user experiment.

Method of using English character typing in order to make a Thai word takes on the same input method as Multi-press method but uses English characters in keypad button to spell the word in Karaoke pronunciation of the Thai word. It does

not interest in tone and special symbol. For example, if users want to typing a word “พริ้ว”, they need to spell as “phra” because according to [11] “ph” = “พ”, “r” = “ร” and “a” = “ะ”. When the users want to type a message “ฉันพร”, they need to type as “chan” because “ch” = “จ”, “a” = “ั”, “n” = “น” and it is not interested in special symbol.

V. OUR EXPERIMENT

In this study, we evaluate the usage of 12-small-key Thai text input methods on mobile phone, in order to compare and analyze user experience in inputting text (typing a message) on 12-key mobile phone. The main aim of the experiment is to measure and compare a usability of the 3 input methods according to the usability goal in term of its learnability (easy to learn) and effectiveness (easy to use) concepts. The input methods that are used in this study are the 3 methods mentioned in section IV (Text Input Methods), including existing Multi-press method, T9 method and Karaoke method that we propose to be a possible method of solving representing several characters on one button. In the experiment, we choose frequently used sentences in Thai texting and composing SMS from [12]. There are 15 sentences in total for this evaluation.

TABLE IV. THAI SENTENCES FOR EVALUATING

No.	Using Thai Keypad Button *	Using English Keypad Button **
S1	อยู่ที่ไหน	yu thinai
S2	คิดถึงจัง	khitthueng chang
S3	สุขสันต์วันเกิด	suk san wan koet
S4	เดี่ยวโทรกลับนะ	diao tho klap na
S5	ทำไม่มารับสาย	thammai mai rap sai

(*) for Multi-press and T9
(**) for Karaoke

A. Keystroke-Level Model

In order to pre-evaluate our proposed method of Karaoke, we perform Keystroke-Level Model (KLM) to ensure that the method has potential before doing an expensive and time consuming user experiment. From literature review [13], they introduced interaction times for 12-key mobile phone keypad based on the basic Keystroke-Level Model (KLM) and they have tested and concluded that the time constant of the activity is measured in seconds (such as; user press the button is 1 time is 0.33 seconds, 2 times is 0.66 seconds.). In [14], there also introduced new KLM that is suitable for using with some types of mobile phone such as iPhone, Greenphone and Neo1973, They have to rename some values in the model and call its KLM-Qt instead of the basic KLM. In [15] and [16], they present a model for predicting expert text entry rates for input methods on 12-key mobile phone keypad. They have tested and concluded the speed of typing value in term of a number of words per minute (wpm).

From above literatures, we have taken the model in [13] to calculate estimated time in our study because the model is studied and concluded the time of pressing button (Keystroke : K) in the 12-key mobile phone keypad and has seconds as a unit as shown in “Table V”. The time of pressing button, K in this study for quick users is 0.33 seconds per press and the

moving time of the fingers on keypad button (Finger Movement, F) is 0.23 seconds.

TABLE V. AVERAGE TIME OF KEYSTROKE-LEVEL MODEL (KLM)

Operator		Time	Quartile1	Quartile3
F, Finger Movement		0.23	0.20	0.29
K, Keystroke	Keypad average	0.39	0.37	0.48
	Keypad quick	0.33	0.32	0.37
	Hotkey	0.16	0.15	0.20

The result from the pre evaluation using KLM in [13] demonstrate that in theory the Karaoke method is more efficient than the Multi-press method as shown in “Table VI” that the time taken to complete the sentences in Karaoke method is less than using Multi-press method. However, “Table VI” and “Figure 5” shows that the most efficient method (use the least time to complete the sentences) is T9 method. But the result is sometimes debatable about the efficiency of Karaoke method and T9 method such as the sentence, S4 “เดี่ยวโทรกลับนะ”, where Karaoke method seems to be a more efficient method. Moreover, as mentioned, the questionnaire survey has shown that nearly 90% of users prefer Multi-press method and stated the reason for not using T9 method is because of its difficulty. But with our speculation, we think it might be that they have not been giving the guidance or introduction to the T9 method correctly. Therefore our aim is to study further in order to compare the usability of these 3 input methods. So we set up the user experiment.

TABLE VI. COMPUTATION TIME USING KLM-MODEL

No.	Sentence		Time (Second)		
	Using Thai Keypad Button *	Using English Keypad Button **	Multi-press	T9	Karaoke
S1	อยู่ที่ไหน	yu thinai	14.80	6.03	7.55
S2	คิดถึงจัง	khitthueng chang	10.78	6.49	12.23
S3	สุขสันต์วันเกิด	suk san wan koet	18.62	11.53	13.35
S4	เดี่ยวโทรกลับนะ	diao tho klap na	21.69	12.95	12.13
S5	ทำไมไม่รีบสาย	thammai mai rap sai	22.02	8.50	14.14

(*) for Multi-press and T9
(**) for Karaoke

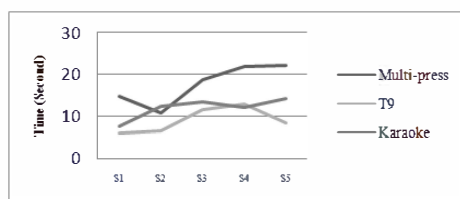


Figure 5. Comparison Time of Three Methods Using by KLM.

VI. USERS EXPERIMENT AND RESULTS

In this study, we focus on the evaluation of Thai input methods with limited 12-small-key mobile phone keypad. We are aiming on measure and compare the learnability (easy to learn) and efficiency (easy to use) of the user by using these 3 input methods: Multi-press, T9 and Karaoke methods.

Before the experiment starts, we teach the users how to use each method. Total sample users were 60 3rd year students in computer science who took Human Computer Interaction course in the academic year of 2010 at Maharakham university, Thailand. However, as the experiment took place over 2 weeks, only 46 students can commit to the whole experiment. Therefore, total valid experiment result comes from 46 students who came to all 6 tests over the 2 weeks period.

The users are set to attend the experiment for 6 sessions. The users attended the experiment session once every 2 days for 6 times over 2 weeks. The first 5 times, for each experiment session, each user typed selected 3 sentences from the total of 15 sentences. In these 5 sessions, we gave the users a piece of paper that shows the sentences in Karaoke spelling manner. Then the last experiment session, one of the sentences is picked from the 3 sentences that were used in each previous 5 experiment sessions, in this case the sentences are call S1-S5 as shown in “Table IV”. The final session was unlike other sessions because the users were not given a piece of paper that shows how to spell the sentences. The process and result of experimental as follows:

A. Evaluating Time to Input Text

“Figure 6” shows the estimated time of KLM compared with three methods (Multi-press and T9 and Karaoke). “Test1” represents the values obtained from testing a selected sentence in each day. “Test2” represents the same selected five sentences that were tested repeatedly on the last session of the experiment to observe the different between typing the same message for the first time and second time. Then, the two sets of values are compared with data obtained from applying KLM. In general, KLM seems to provide lower typing time than the real user experiment. Multi-press and T9 give the expected result of increasing in typing time in the second time the users were instructed to type the same sentences. However, Karaoke method gives the opposite result. This demonstrates that the karaoke method can be hard to learn. From the questionnaire after the experiment, it shows that users find it hard to remember how to spell the word in Karaoke pronunciation of the Thai word. Hence, the resulting in taking times to type. Whereas, users who mentioned in the pre experiment questionnaire about the difficulty of T9 method, have found that T9 is quick and easy to learn to use too.

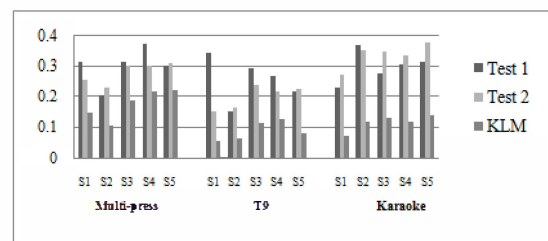


Figure 6. Comparing typing time with KLM Model.

B. Evaluating errors occurrence

“Figure 7” shows average times that users made errors during typing a message in the user experiment. For every

sentence, with Multi-press method, the users made fewer errors compare to the first time they had to input the sentence. T9 method gives a similar result. However, the errors values are decreasing more dramatically than in Multi-press method in 3 out of 5 sentences. Whereas, Karaoke method does not show dramatic changes in numbers of errors (the number of times all error divided by the number of users), that were made by users.

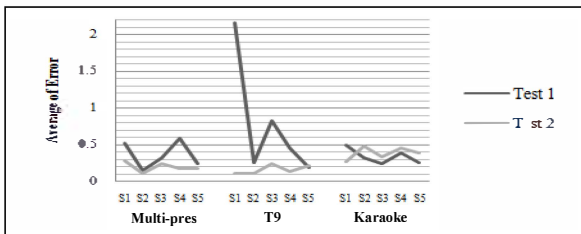


Figure 7. Number of errors.

VII. CONCLUSION AND FUTURE WORKS

We suggested the possibility of using Karaoke method as an input method for Thai language on mobile phone. The aim of this paper is to compare the usability in the field of learnability (easy to learn) and effectiveness (easy to use) of the existing Multi-press and T9 methods and our proposed Karaoke method. In our experiment, we chose the popular 12-small-key keypad layout that has been used by many people in developing country like Thailand.

In the first part of the experiment, Keystroke-Level Model (KLM) has a lower time in typing a message with limited 12-small-key mobile phone keypad than other three methods (Multi-press, T9 and Karaoke) because KLM is the model of expert user and does not count for the pressure that could occur in the real environment.

In the second part of the experiment, the user experiment is conducted over a short period of time in order to get user to automatically learn to get used to each method at the same time without their knowledge. Users were surprise to find that T9 method is the most effective to use and not as difficult as they thought. However, Karaoke method seems to be the most difficult to use because the users have to learn how to spell the word in a karaoke pronunciation.

In the last session of the experiment, the users do not have a guidelines word so they mistyped the words. As a result, users are taking more time to type with Karaoke method. Therefore, we conclude that when the users learned and known how to use T9 method, users will be able to use it efficiently and they would prefer the method gradually.

Moreover, from the pre and post questionnaire of the experiment shows that users found T9 method is easier than they thought. Users found themselves easily learn to user T9 within a few session during our experiment of 6 session.

The further study of this research will be focusing on allowing users to spell the words without following the rules [11]. As we see that the users find using English keypad is easy and efficient. From this study, we hope to store the messages with the spelling of each different user. In order to improve the

design and development of karaoke method for more convenient use, the final target of our study is to develop a system that transforms those karaoke sentences into Thai straight away when a user types a sentence in karaoke spelling manner.

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