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A Comparison of Thai Mobile Phone Keypad Mappings

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1. Introduction

Unlike English and other Roman Character based languages; Thai language with 72 characters (Consonant, Vowel, Tone-mark and Special symbol) is challenge for designing the easy-to-use and user-friendly keypad mapping method. Currently, there are many methods of mobile keypad mapping which depend on brand and model of mobile handset. These keypad mapping methods also apply with Multi-tap and predictive method (T9, iTap). In the past there were other methods such as Thai SMS2 of TAOrange and Thai Matrix of Hutchison which are developed by local mobile operator, but those 2 methods are already obsolete from the market. In this study we will focus on 4 methods of well-known mobile phone manufacturers; Nokia, Sony Ericsson (SE), Samsung and Motorola which cover around 80% of mobile in Thai market. Though there are many methods of keypad mapping, Thai text input method is unable to gain good feedback from users because of its difficulty.

2. Thai Keypad Mapping and Text Input Method

In order to understand the nature of Thai keypad mapping and text input method, an introduction of Thai language will be discussed in this section.

Present Thai alphabets consist of 44 consonants, 15 vowel marks, 4 tone marks, 4 consonant-vowel, 5 special symbols and 10 numerals as shown in Table 1. There are two obsolete consonants, [ฃ] and [ฅ].

Table 1. Thai Alphabets

Consonant	ก ข ฃ ค ฅ ฆ ง จ ฉ ช ซ ฌ ญ ฏ ฏ ฐ ฑ ฒ ณ ด ต ถ ท ธ น บ ป ผ ฝ พ ฟ ภ ม ย ร ล ว ศ ษ ส ห ฬ อ ฮ
Vowel	Upper position ◌ิ ◌ี ◌ึ ◌ื ◌ั Lower position ◌ุ ◌ู Right position เ แ โ ใ ไ Left position ะ า ๅๅ
Tone Mark	◌่ ◌้ ◌๊ ◌๋
Consonant-Vowel	ฤ ฤๅ ฦ ฦๅ
Special Symbol	◌็ ◌์ ๆ ฯ ◌ํ
Number	๑ ๒ ๓ ๔ ๕ ๖ ๗ ๘ ๙ ๐

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Phrase and word are the combination of consonants, vowel and tone mark. By adding another consonant, left, right, upper and lower vowel to main consonant and tone mark will be added to the combination to assign 5 various tones. Thai language is a tonal and analytic language, and the meaning of the words depend on the combinations of characters including tones. For example, combination of ข, า, ว is ขาว which means "white", when added ่ this word will be ข่าว which means "news", when added ้ this word will be ข้าว which means "rice".

2.1 Keypad Mapping

Each leading mobile handset manufacturers (Nokia, SE, Samsung, Motorola, etc) has their own keypad mapping methods while most of China-made and local mobile handset duplicated the keypad mapping and input method from leading global brand. Therefore, in this study, we will consider only 4 main brands which cover around 80% of market share.

Nokia, around 40% market share [1], the dominant brand in Thai mobile market, introduces their own keypad mapping by mapped consonants into "1"-"9", upper and lower position vowel, special symbol and tone mark are assigned to "*", "0" is for left and right position vowels, "#" is for changing input method (English multi-tap, English multi-tap capital letter, English T9, Thai multi-tap, Thai T9, number) as shown in Figure 1a.

The second ranking with 20% market share [1], Samsung has exactly the same keypad mapping method as Nokia but "#" is for space and using other buttons (not a 12-key keypad) for changing input method as shown in Figure 1b.

SE, around 10% market share uses "1" for space and mapped consonants to "2" to "9". "*" is for left and right position vowel, "0" is for upper and lower position vowel and "#" is for tone mark and special symbol and using other buttons for changing input method as shown in Figure 1c.

Motorola with more than 5% market share has a different mapping method; consonants are mapped into "1" to "6". And "7" is for left position vowel, "8" is for upper and lower position vowel, "9" is for right vowel and right position special symbol, "0" is for tone mark and upper position special symbol , "*" is for space and "#" is for changing input method as shown in Figure 1d.
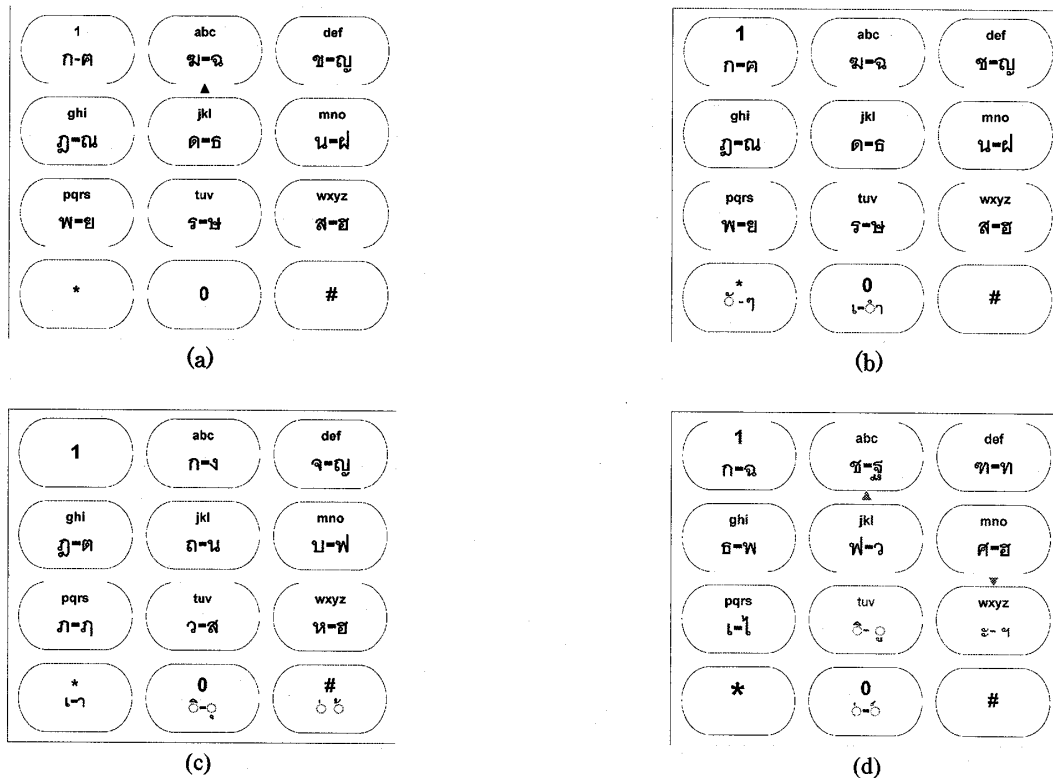
Figure 1. Thai Mobile Phone Keypad Layouts
(a) Nokia (b) Samsung (c) Sony Ericsson (d) Motorola

Nokia and SE show the list of characters (vowel, tone mark and special symbol) on screen when pressing "*" and "0" buttons. For Nokia, after users press "*" and "0", a list of characters will be shown on the screen and users will be able to select the desired character from the list by using arrow keys. While Sony Ericsson just shows the list of characters on screen, users have to use normal multi-tap way to get the desired character, unable to select desired character by arrow keys. Moreover, Nokia shows only possible vowel and mark which help reducing the total keystroke while SE shows the entire list. For example, Nokia, when pressing "*" after main consonant all of the vowel, tone mark and special symbol will be shown but if there is no main consonant only special symbol will be shown. Samsung and Motorola do not show the list of characters on the screen.

2.2 Text Input Method

All of these keypad mapping methods are applied for both multi-tap and predictive input method. For multi-tap, users have to press the same key several times to get the desired character and it will be more difficult to get vowel and tone mark. For some characters, users have to press the button for more than 10 times and it will be much more annoying if they fail to press the correct keystroke which tends to occur with vowel and tone mark. For example, if users want to get the tone mark $\check{}$, they need to press # button 10 times, but if they mistype, they have to delete the mistyped character and start all-over again.

Predictive input method seems to be easier to use than multi-tap, but practically users always face a difficulty at the very first time of using T9 or iTap and don't even try using it again. The first reason is that it's difficult to know exactly which button is for which character. It's not like English that there are only 3 characters in one button and all of those characters were printed on the button. Thai has only the first and last character printed on the button such as ค-ธ printed on 5-button while there are 5 characters in this button. Users have to memorize the position of characters (layout). Another reason is that users do not always get the desired word even if they press the right sequence and combination of buttons. It is because of the predictive algorithm that shows the frequently used word on the screen which is sometimes not the one that users want, and most of them do not know how to get the desired word. For these 2 reasons, users are not comfortable with predictive method and prefer multi-tap method. Comparing the text input method of Thai and English, Thai users who have English capability prefer English text input method because of its easiness.

3. Test Word/Phrase and Sentence

In this study, we use Nokia 5220, Samsung J700, SE K330 and Motorola RAZR V6 to conduct a Keystroke per character (KSPC) test. KSPC is the number of keystrokes required, on average, to generate a character of text for a given text entry technique in a given language [2]. We chose frequently used words/phrases in Thai texting and composed 5 sentences to be used in evaluating the (KSPC). For words/phrases, we grouped those words and phrases into 4 categories; "sentence ending and greeting", "normal place name", "daily verb" and "person and pronoun" as shown in Table 2. For sentences, we composed 5 sentences that cover consonant, vowel, tone mark, special symbol and number as shown in Table 3.

Table 2. Thai Words/Phrases for KSPC Evaluating

Category	Words/Phrases
Ending and Greeting	ครับ คะ จ๊ะ มั้ย นะ ล่ะ ก็ อยู่ กับ ไม่ ป่าว อยาก อะไร ใคร ที่ ไหน เมื่อไหร่ ยังไง สวัสดี ฝันดี คิดถึง
Place	สยาม สีลม ลาดพร้าว มหาลัย เซ็นทรัล พารากอน มาบุญครอง โลตัส บิ๊กซี โรงเรียน บ้าน ออฟฟิศ ที่ทำงาน โรงงาน ตลาด
Daily Verb	ไป มา กลับ กินข้าว นอน เที่ยว ทำงาน เดิน เล่น กำลัง โทร รับสาย ขึ้น ลง ดูหนัง
Person and Pronoun	แฟน พ่อ แม่ พี่ น้อง เพื่อน กิ๊ก ฉัน แก เธอ เรา มึง กู ที่รัก ไอ้

Table 3. Thai Sentence for KSPC Evaluating

Sentence
สวัสดีครับ สบายดีรีป่าว
(Hi, How are you doing?)
ทำอะไรอยู่ คิดถึงมากๆ
(What are you doing? I miss you so much.)
เย็นนี้ 6 โมงครึ่งเจอกันที่พารากอนชั้น 4 นะ
(See you at 6:30 p.m. at the 4th floor of Paragon.)
เราจะเปลี่ยนเบอร์ใหม่เป็น 0890304200
(I will change my phone number to 0890304200.)
หลับฝันดีนะ
(Good night.)

Both Thai text input methods; multi-tap and predictive methods will be tested for KSPC. We calculated KSPC by counting the total keystroke required to get the specified word/phrase or sentence and divide by total character of the word/phrase or sentence. In case of sentence we also count the keystroke of spacing and text input mode changing. Contradictory, word/phrase case is regardless of spacing and text input mode changing.

4. Analysis on Result

For word/phrase test with 287 total characters, in multi-tap mode SE has the least KSPC of 3.39 then Motorola, Samsung and Nokia with 3.51, 3.58 and 3.63 KSPC respectively. In predictive mode, Nokia and Samsung have same KSPC of 1.51 the least among these 4 methods then SE and Motorola with 1.55 and 1.66 KSPC as shown in Figure 2.

For sentence test with 134 total characters including keystroke of spacing and changing text input mode, in multi-tap mode the least KSPC is SE of 2.86 then Motorola, Nokia and Samsung with 3.22, 3.28 and 3.31 KSPC respectively. In predictive mode, Nokia is the least KSPC method of 1.38 then Samsung, SE and Motorola with 1.43, 1.51 and 1.60 KSPC as shown in Figure 3.
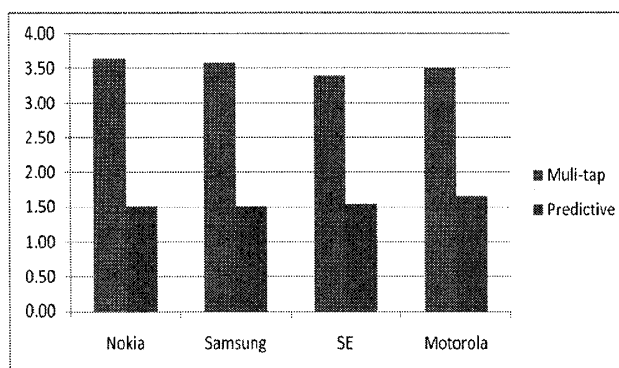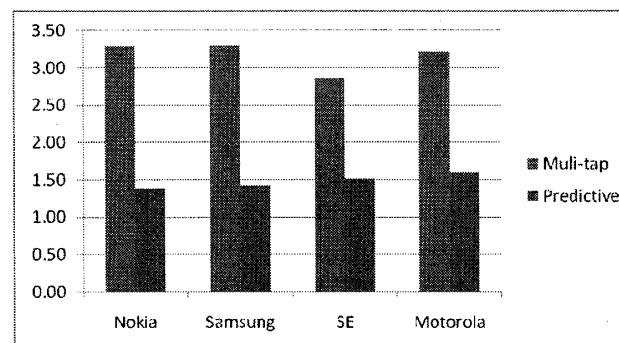

Figure 2. KSPC of Multi-tap Method

Figure 3. KSPC of Predictive Method

For multi-tap mode, in both word and sentence tests, SE and Motorola's keypad mapping which map vowel, tone mark and special symbol into 3 and 4 buttons have lower KSPC than Nokia and Samsung that use 2 buttons. Though Motorola uses 4 buttons for vowel and tone mark, Motorola's KSPC is higher than SE because Motorola maps all consonants into 6 buttons while SE uses 8 buttons. Therefore, Motorola needs more KSPC for consonant part.

Though Nokia and Samsung have the same keypad mapping, Samsung has lower KSPC than Nokia in multi-tap mode because

Nokia shows the list and users have to select by pressing "select" button that requires one more extra keystroke.

But as mentioned in the previous section that Nokia has a feature to show the list and users are able to select by arrow key, this feature helps reducing the KSPC of Nokia from 3.63 to 2.99 in the case of word and from 3.28 to 2.74 in the case of sentence. With this feature, Nokia turned to be the least KSPC text input method in multi-tap. In order to show the list, however, it takes around 2-3 seconds after pressing the button which is not concerned in terms of KSPC. But if we consider the typing speed, it will be affected by this time lag.

For predictive mode, in both word and sentence tests, methods of Nokia and Samsung have lower KSPC than the ones of SE and Motorola. In word test, Nokia and Samsung have the same KSCP because Nokia and Samsung have the same keypad mapping and predictive algorithm. But in sentence test including numbers, Nokia's KSPC is lower than the one of Samsung because users can press and hold the button to type numbers for Nokia, but for Samsung if they press and hold the button, numbers are shown in Thai language that are rarely used in daily writing. Therefore, input mode needs to be changed to number mode before typing, which requires 5 keystrokes while Nokia requires only 1 keystroke.

5. Conclusion and Future Work

In Thai text input method, all of the 4 methods divide characters into 2 groups; one is 44 consonants and the other is other characters including vowel, tone mark, consonant-vowel and special symbol. Normally, if the number of average characters mapped onto a key is small, KSPC is low, but this is not always true as we can see from Motorola's method. Motorola tried to spare more buttons for the second group in order to reduce average number of characters per key, but this caused more average number of characters per key in consonant group. Since consonant is a major composition of Thai word, many words are the composition of consonant only. Therefore, we should keep average number of characters per key of consonant group as low as possible. We agree that 8 or 9 buttons should be assigned for consonant as Nokia, Samsung and SE did, but we can omit some obsolete consonants and rarely use consonants to reduce the average number of characters per key.

As only 2 or 3 buttons are left for 23 characters of the second group, it is impossible to reduce the average number of characters per key for the second group, but there are still other keys available. We propose to use arrow keys to reduce KSPC of Thai text input method by using Positional Prediction [3, 4].

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