# Designing Cham fonts for Windows and Macintosh

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The Cham people are originated from the Kingdom of Champa who is now the minority ethnic in Vietnam. They speak familiar with the language used as others Malay group but differ in their written language. Cham Script inscriptions appear on Dong Yen Chau stone stele (Tra Kieu) in the early 4th century and the Cham have used this writing system until today.

With the development of technology, the new font of Cham for writing was designed. However, these existing Cham fonts have not unified about the encoding value which cause difficulties in the exchange of information. The old Cham font is not been able for scientific and aesthetics value since the fonts are limited in the technical text. In the effort to preserve the language through the advancement of technology, this present study is conducted to create a new Cham font for both Windows and Macintosh keyboard. This system ensures the similarity of technical features and character size between Cham and Latin characters.

Three types of Cham font are created using, namely *Cham Thrah1*, *Cham Thrah2*, and *Cham Thrah3* which all of these are ensured to fulfill the technical requirement and the variety demands in research issues.

**Keywords:** Champa script, Cham font.

## 1. INTRODUCTION

Cham people are ethnic groups of the Champa kingdom was established in the second century in central Vietnam. Cham language is one of the languages in the family of multi-island "Austronesian". Therefore Cham language is close relationship with Malay language. As compared to the Malay language, researchers have found traces on stone stele in Java island in the 7th century [2], while Cham letters has also appeared on the first stone stele, namely of Dong Yen Chau (Tra Kieu) in the 4th century [1,3,5].

Using Cham Fonts to write Cham script on the computer has become necessary and useful for several fields, such as compilation of research, storage, communication, and teaching Cham language. Recently, there have been some Cham fonts created to meet the actual demands, however, these are not uniform in encoding value, hence, and it caused many difficulties in the information exchange. Furthermore, the Cham fonts are still limited in technique; therefore the text is not ensuring the high quality. With the computer science development, creating new Cham fonts with technical requirements is essential to adapt with user needs in diverse areas, such as academic, research, and information exchange. Since our main purpose is to study for construction of a new Cham font which is able to use for both Windows and Macintosh.

## 2. LITERATURE REVIEW

The Cham script was systems of signs derived from the Sanskrit alphabet in southern India, in the long term approach culture of Hindu civilization, the Cham people have used Indian Sanskrit and then they have improved this Sanskrit completely and become the Cham script [6].

Using information technology to preserve the endangered language is not new in the world today when digital technology has developed powerfully. Information technology has significantly contributed in the indigenous language education, restoring and preserving of ancient writing system is a very obvious fact in many countries [4]. In Vietnam, some organizations and individuals who have studies created a number of fonts as champa.ttf, camtanran.ttf, *bingudi tanran.ttf, cam thrah.ttf*, to support for compilation of Cham documents on the computer.

The Cham fonts are designed on Unicode standard; however assigning characters (code points) to represent a character or diacritics of Cham language is slightly different. This is disadvantages for using and storage of Cham documents. During of the using process, it shows that camtanran.ttf font created by EFEO for Macintosh has been high appreciated in typefaces. However, this font is also existed of some minor flaws in technique. Moreover, when converting of this font from Macintosh to Windows, the typing system for this font is no longer suitable. Hence, *bingudi tanran.ttf* and *camthrah.ttf* font were developed by camtanran.ttf rebuilt it for Windows, and redesigned of characters assigning on the keyboard. However, this font is still facing a number of obstacles and unstable during using process

## 3. CREATING NEW CHAM FONTS

In order to design new *Cham* fonts, we based on a number of valuable documents and dictionary which are using today. It is Cham-French dictionary of E. & A.

Cabaton Aymonier; Cham-Vietnamese-French dictionary of G. Moussay, and *Akhar Thrah Cham* materials used in Cambodia that is currently stored in the library in French. New *Cham* Fonts will bring many advantages in exchanging information, creating and storing *Cham* documents on a computer widespread in domestic and foreign.

## 3.1 CHAM SCRIPT ANALYSIS

*Akhar Thrah* Script is a script derived from the Sanskrit, difference Latin characters. To design the font for *Akhar Thrah*, firstly analyze the number of characters needed to create the font for *Akhar Thrah* script.

The total numbers of *Akhar Thrah* characters required design are 86 characters. After analyzing and removing some of the same characters as (H), (3), (o), (r), respectively (H) 1, (i) 3, (o) 5, (6)  6. Thus, the total number of characters needed to be designed for *Akhar Thrah* fonts are 82 characters as shown in Table 1:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ꨀ | ꨁ | ꨂ | ꨄ | ꨅ | ꨆ | ꨈ | ꨈꨪ | ꨉ | ꨊ | ꨋ |
| ꨌ | ꨍꨮ | ꨍꨮ | ꨎ | ꨏ | ꨐ | ꨑ | ꨒ | ꨓ | ꨔ | ꨕ |
| ꨖ | ꨗ | ꨗ | ꨘ | ꨙ | ꨚ | ꨛ | ꨜ | ꨝ | ꨞ | ꨟ |
| ꨠ | ꨡ | ꨢ | ꨣ | ꨤ | ꨥ | ꨦ | ꨧ | ꨨ | ꨩ | ꨪ |
| ꨫ | ꨬ | ꨭ | ꨮ | ꨯ | ꨰ | ꨱ | ꨲ | ꨳ | · | ๐ |
| ๏ | ꨴ | ꨵ | ꨶ | ꨷ | ꨸ | ꨹ | ꨺ | ꩀ | ꩁ | , |
| ꨽ | ꨾ | ꨿ | ꩂ | ꩃ | ꩄ | ꩅ | ꩆ | | ๘ | ꩏ |
| ꩐ | ꩑ | ꩒ | , | ꩜ | | | | | | |

Table 1. Total number of characters to design Cham fonts

## 3.2. CHAM FONTS DESIGN

Cham script has a total of 82 characters. However, for convenience of typing Cham script, we design and add seven new punctuation characters for using in Latin system, which is ', ", :, •, ?, (, ).

In traditional Cham script systems, there are two character (�xꨯ) and (ꨎꨯ) very similar in a style of drawing. In 1963, a group of Cham intellectuals has edited the character kha (ꨎꨯ) to be distinguishable with the character (ꨎꨯ). Therefore, in order for users or researchers who using Cham script to easily compare of these two different characters, we design and add more a traditional characters (ꨎꨯ) into new font. Then, numbers of character need to design are 90 characters. See Table 4.

To type the letters of Cham script on computer, usually typing directly on the keyboard with lowercase letters as (q, w, e, r,...) and uppercase letters as (Q, W, E, R, ...). In addition, font Cham we design also have a particular characteristic, which is four characters (Takai Kuk, Takai Kâk, Takai Klak, Takai Kuak) can be used simultaneously, but do not overlap and very stable position.

For using Cham font easier, we divide Cham characters into 3 areas different on the keyboard:

## 3.2.1 FINAL CONSONANT LOCATION

For using convenience, we assign all *Akhar Matai* characters (final consonant group) as ꩀ, ꩁ, ꩂ, ꩃ, ꩄ, … on the row key numbers, from the first key (~), 1, 2, 3.... to key number 9.

## 3.2.2 VOWELS AND CONSONANTS LOCATION

All of the *Ina Akhar* of Cham script such as ꨆ, ꨆꨯ, ꨈ, ꨈꨯ, ꨉ... located on the regional location of vowels and consonants in English keyboard, including Q, W, E, R, ... B , N, M. Also in this area, we assign an extra 6 characters of Takai Akhar, that is:

| Semi-vowels | diacritic | Key |
|---|---|---|
| Takai kuak | ꨩ | W |
| Dar tha dar dua | ꨵ | E |
| Takai krak | ꨴ | R |
| Takai kiak | ꨰ | Y |
| Takai kâk | ꨮ | I |
| Takai klak | ꨭ | L |

## 3.2.3 DIPHTHONG AND SEMI-VOWELS

Except 6 characters of *takai akhar* has presented in the previous section, all of *takai akhar* (diphthong and semi-vowels) mostly remaining on the right side of the keyboard (see Table 3).

| Diphthong and Semi-vowels | diacritic | Key |
|---|---|---|
| Paoh ngâk | ꨲ | ) |
| Paoh thek | ꨱ | - |
| Craoh aw | ꨯ | – |
| Craoh aw paoh ngâk | ꨰ | = |
| Craoh aw tut takai mâk | ꨳ | + |

Table 3. Diphthong and Semi-vowels Location

Particularly the traditional *Kha* consonant (ꨎꨯ) is designed in the last position with value "002F", that key (/) under the question mark.

Another noteworthy point is Cham Akhar Thrah in Vietnam using 82 characters while Cham Akhar Thrah in Cambodia only using 81 characters, because the Cham in Cambodia does not use character Takai Kak (,). In addition, there is a difference in the number of characters such as character for start a paragraph and comma as follows:

Cham in Việt Nam using ( ꩜ ) but Cham in Cambodia using (ꩌ)

Cham in Việt Nam using ( , ) but Cham in Cambodia using ( „ )

Cham in Việt Nam using ( „ ) but Cham in Cambodia using ( ꩍ )

All the characters of the Akhar Thrah Cham alphabet in Vietnam and Cambodia are designed to have the same value (position) on the same keyboard.

## 4. EXPERIMENTS

In order to create favorable conditions for design Cham font we use Fontographer 6.0. With a number of important functions such as viewing all the character designs in the window, test or modify the font encoding and kerning in Metrics Window,...and supported on many different operating systems such as Macintosh, Linus, or Windows. We have designed 90 characters Cham Thrah corresponding Unicode values as shown in table 4.

| Key | Unicode | Cam | Key | Unicode | Cam | Key | Unicode | Cam |
|-----|---------|-----|-----|---------|-----|-----|---------|-----|
| 0 | 0030 |  | R | 0052 |  | p | 0070 |  |
| 2 | 0032 |  | S | 0053 |  | q | 0071 |  |
| 4 | 0034 |  | T | 0054 |  | r | 0072 |  |
| 7 | 0037 |  | U | 0055 |  | s | 0073 |  |
| 8 | 0038 |  | V | 0056 |  | t | 0074 |  |
| 9 | 0039 |  | W | 0057 |  | u | 0075 |  |
| : | 003A |  | X | 0058 |  | v | 0076 |  |
| ; | 003B |  | Y | 0059 |  | w | 0077 |  |
| < | 003C |  | Z | 005A |  | x | 0078 |  |
| = | 003D |  | [ | 005B |  | y | 0079 |  |
| > | 003E |  | \ | 005C |  | z | 007A |  |
| ? | 003F |  | ] | 005D |  | { | 007B |  |
| @ | 0040 |  | ^ | 005E |  | \| | 007C |  |
| A | 0041 |  | _ | 005F |  | } | 007D |  |
| B | 0042 |  | ` | 0060 |  | ~ | 007E |  |
| C | 0043 |  | a | 0061 |  | ! | 0021 |  |
| D | 0044 |  | b | 0062 |  | " | 0022 |  |
| E | 0045 |  | c | 0063 |  | # | 0023 |  |
| F | 0046 |  | d | 0064 |  | $ | 0024 |  |
| G | 0047 |  | e | 0065 |  | % | 0025 |  |
| H | 0048 |  | f | 0066 |  | & | 0026 |  |
| I | 0049 |  | g | 0067 |  | ' | 0027 |  |
| J | 004A |  | h | 0068 |  | ( | 0028 |  |
| K | 004B |  | i | 0069 |  | ) | 0029 |  |
| L | 004C |  | j | 006A |  | * | 002A |  |
| M | 004D |  | k | 006B |  | + | 002B |  |
| N | 004E |  | l | 006C |  |  | 002C |  |
| O | 004F |  | m | 006D |  | - | 002D |  |
| P | 0050 |  | n | 006E |  | . | 002E |  |
| Q | 0051 |  | o | 006F |  | / | 002F |  |

Table 4. Code point values corresponding to Cham Thrah character

Results character s ('ꦩ') has designed on the Outline Window interface as in Figure1. and testing interface on Preview Metrics as Figure2.

These fonts have been built based on Cham dictionary and design on Unicode. The results we have design 3 types of font as *Cham Thrah1, Cham Thrah2, and Cham Thrah3*.
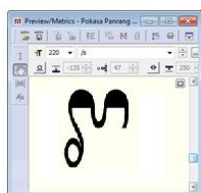


Figure 1.          Figure 2.

- *Cham Thrah1* typeface is based on drawings presented in Cham-Vietnamese-French dictionary of G. Moussay, published in 1971. See figure 3.
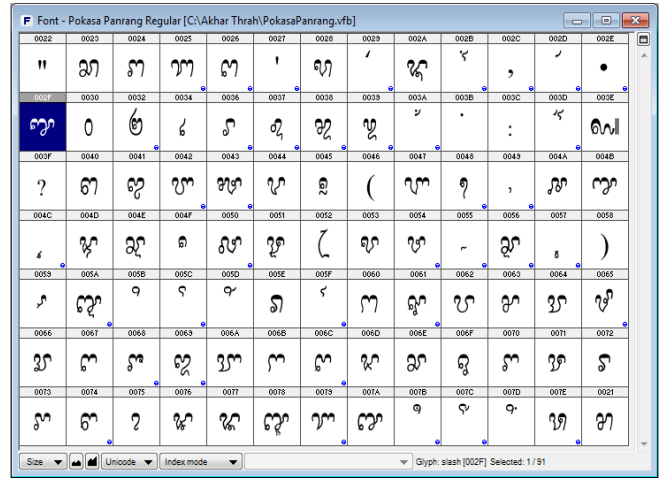


Figure 3. Code point location of font Cham Thrah1

- *Cham Thrah2* typeface is based on drawings presented in Cham-French dictionary of E. Aymonier & A. Cabaton published in 1906. See figure 4.

- *Cham Thrah3*, refer to Cham Cambodia script, a typeface of *Akhar Thrah* fonts presented in the Cham language documents comes from Cambodia and currently stored in the France library. figure 5
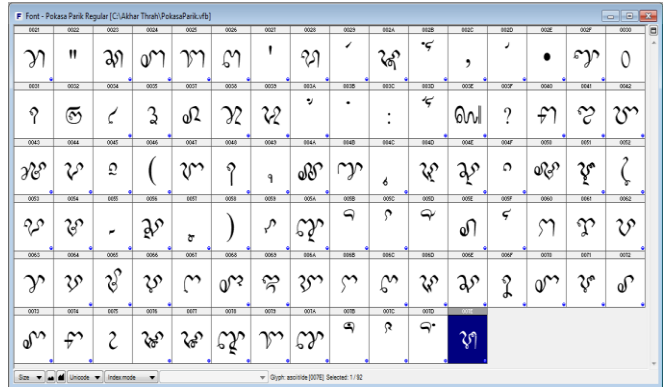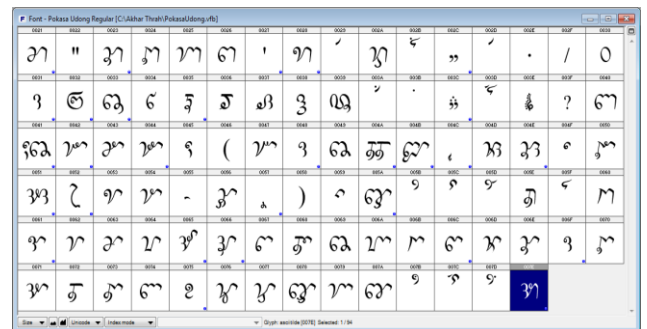


Figure 4. Code point location of font Cham Thrah2



Figure 5. Code point location of font Cham Thrah3

# 5. RESULTS

*Cham Thrah* fonts new create has significant in compilation, research, storage, communication and teaching Cham language. Compared with the font *champa.ttf, camtanran.ttf, bingudi tanran.ttf, cam thrah.ttf,* it is so that the *cham Thrah* fonts has outperformed with high accurate and easy to use. Furthermore, with three font *cham thrah1, cham thrah2*, and *cham thrah3* have the same value on both windows and Macintosh operating systems, then it is very convenient for the users. As the result, the Cham fonts using these methods are shown in section 3 and in Figure 3, 4 and 5.

In Initial survey of 50 users and result shows that *cham thrah* font's new design has surpassed in accuracy and ease of use as shown in Figure 6. Specifically, has achieved 60% of usability and 65% of high accuracy. Similarly, *champa* font only achieve (12%, 8%), *camtanran* (5%, 14%) and *bingu tanran* (23%, 13%).

Currently *Cham Thrah* font is used to enter the Champa Royal materials, documents relating to the seal of Champa, the literature, literary arts, documents relating to religion, and support for teaching and learning Cham language.
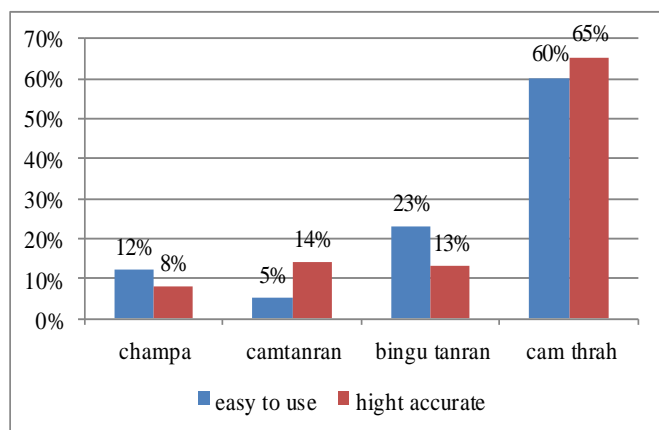


Figure 6. Chart of survey and assessment Cham font

# 6. CONCLUSIONS

We have presented a new approach in analyze and design all code point value of Cham fonts reasonable on the keyboard, ensuring the scientific of each character on Cham script and convenient in use.

Cham fonts have design based on Unicode and using for both Macintosh and Windows operating systems. Furthermore, Cham character and Times New Roman characters have the same size in the same text. Therefore the conversion or storage information on both operating systems is steady results.

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