

Bopomofo Ruby

implement and requirement

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What is Bopomofo?

- Bopomofo is a phonetic system with 100 years history used by Republic of China(Taiwan).
- Bopomofo is used in education from grade 1 to grade 4 .
- 90% people in Taiwan use Bopomofo as main input method. So that's very important.



figure 1) Bopomofo is simplified symbols from character with pronunciation.

Structure of Bopomofa

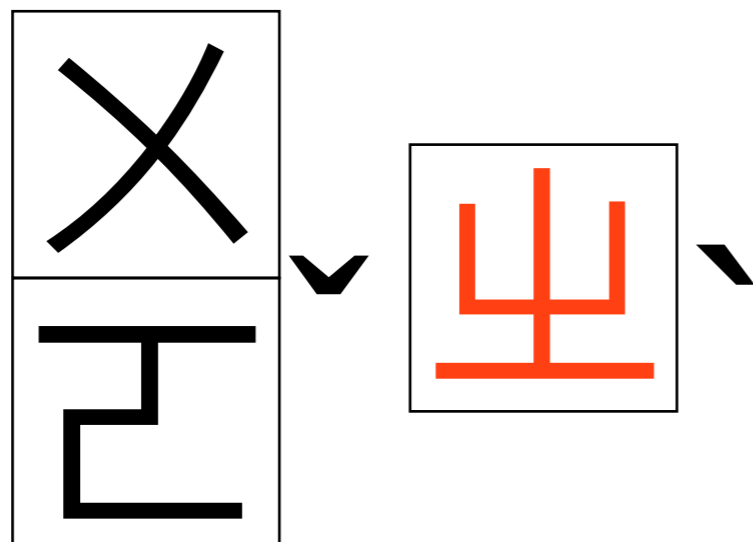
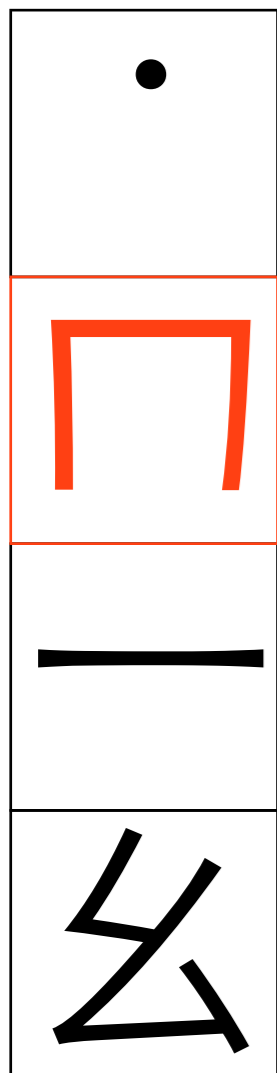
- Bopomofo system contains 37 symbols with 4 tone marks.

ㄅ	U+3105
ㄆ	U+3106
ㄇ	U+3107
ㄏ	U+3108
ㄏ	U+3109
ㄏ	U+310A
ㄏ	U+310B
ㄏ	U+310C
ㄏ	U+310D
ㄏ	U+310E
ㄏ	U+310F
ㄏ	U+3110
ㄏ	U+3111
ㄏ	U+3112
ㄏ	U+3113
ㄏ	U+3114
ㄏ	U+3115
ㄏ	U+3116
ㄏ	U+3117
ㄏ	U+3118
ㄏ	U+3119

ㄩ	U+311A
ㄩ	U+311B
ㄩ	U+311C
ㄩ	U+311D
ㄩ	U+311E
ㄩ	U+311F
ㄩ	U+3120
ㄩ	U+3121
ㄩ	U+3122
ㄩ	U+3123
ㄩ	U+3124
ㄩ	U+3125
ㄩ	U+3126
ㄩ	U+3127
ㄩ	U+3128
ㄩ	U+3129

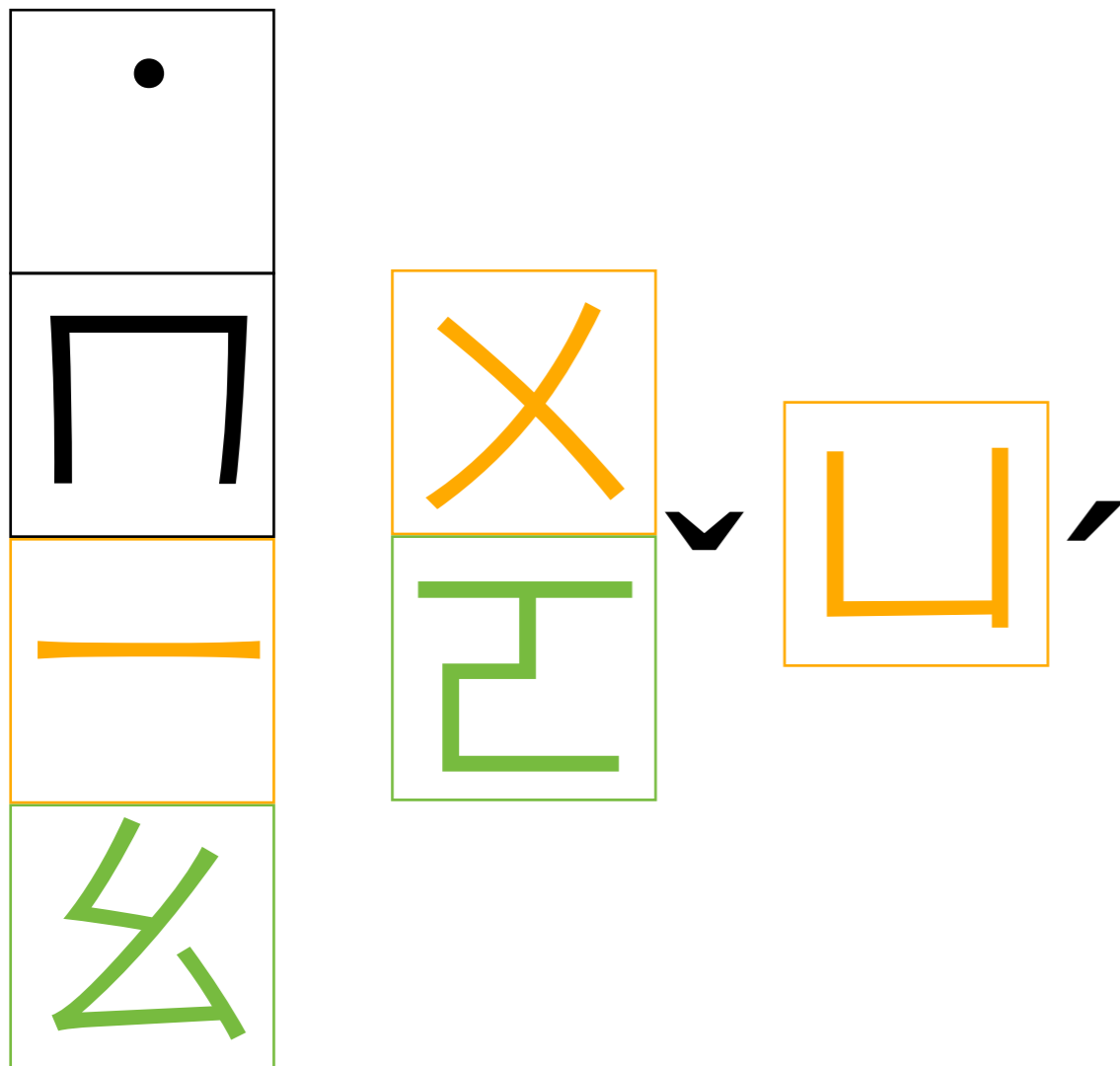
˙	U+02D9
˘	U+02CA
˘	U+02C7
˘	U+02CB

chart 1) Bopomofo symbols and tone marks in UNICODE chart



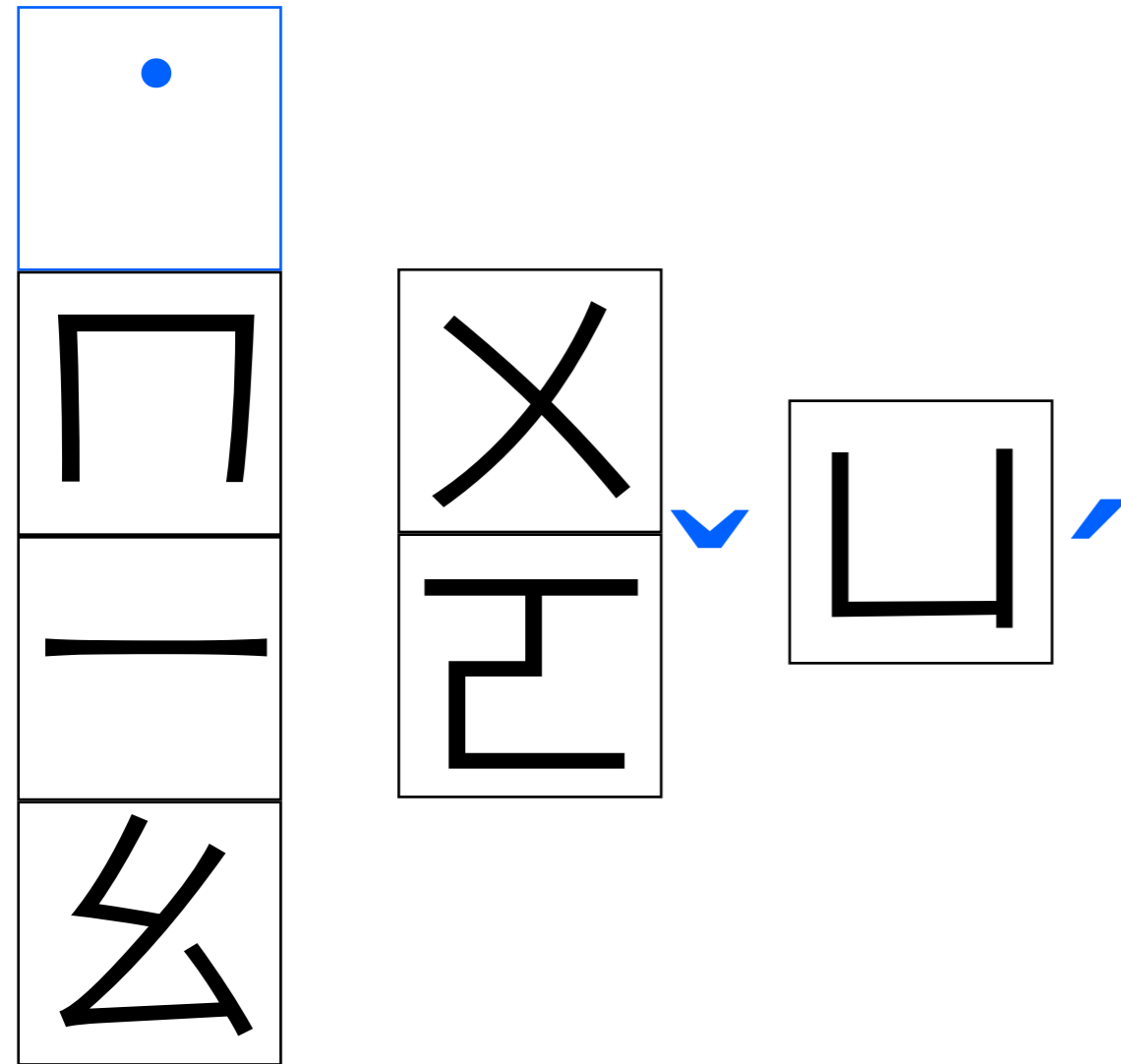
21 Consonants

- 14 cannot pronounce alone.
- 7 can pronounce alone.



16 Rhymes and Medials

- All can pronounce alone.
- 3 as medials can also pronounce with other Rhymes.



4 Tone Marks

- 3 (´ ˇ `) should be placed to the right, usually aligned middle. They affect whole character pronunciation, so are placed in parallel.
- 1 (˙) should be placed above symbols. It affects consonant and first rhyme as an avant determination for pronunciation.

Usage of Bopomofo

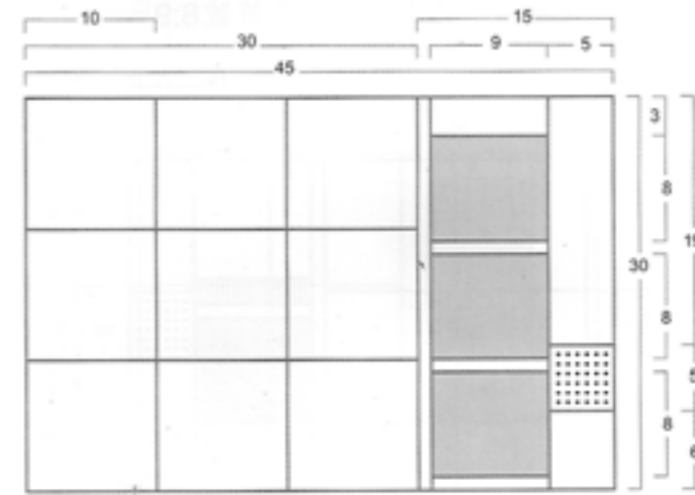
- Bopomofo placed to the **right** of the Chinese character **vertically** in **most all printed books**, whether horizontal or vertical writing.
- Bopomofo usually marked with **every character** in books for education purpose.
- Bopomofo of a character could be:
 1. a set of 1~4 full width symbol(s) and a tone mark.
 2. a set of 1~3 full width symbol(s) with a tone mark aside right.

From Printed Media

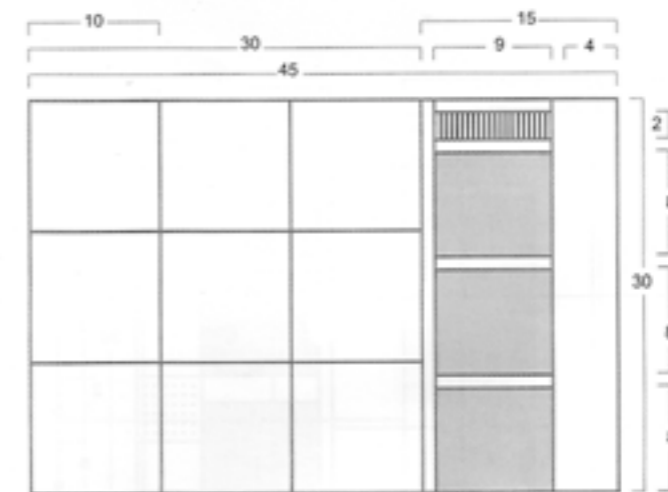
- Ministry of Education Taiwan had published its composition rule in 2000.
- Almost impossible to do as-is on web.
- Tone makers' glyphs are another issue.

·	U+02D9	DOT ABOVE
´	U+02CA	MODIFIER LETTER ACUTE ACCENT
˘	U+02C7	CARON
̀	U+02CB	MODIFIER LETTER GRAVE ACCENT

chart 2) Bopomofo tone makers' glyphs are hard to fulfill MoE's requirement.

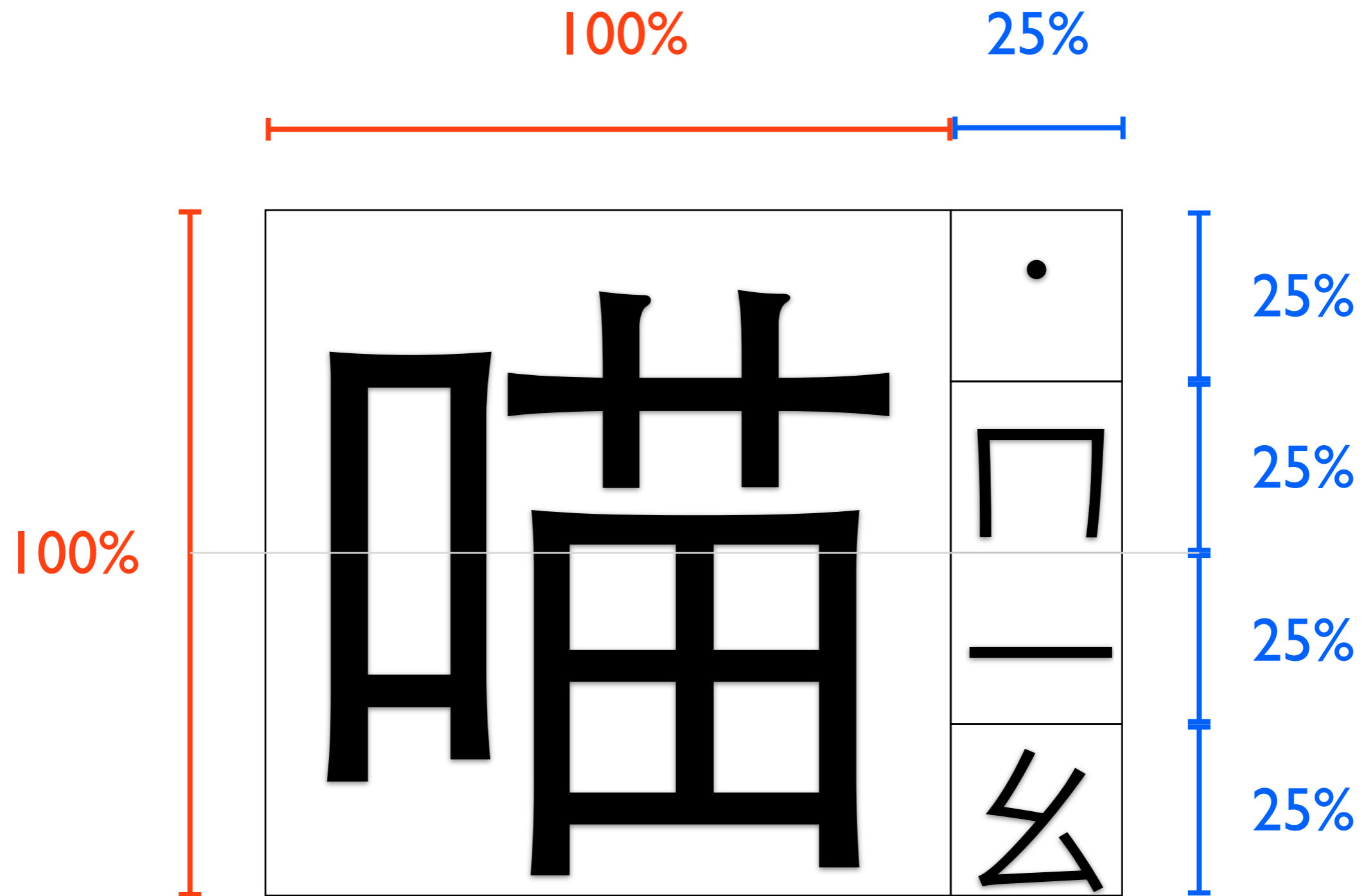


三個注音符號加四聲聲調

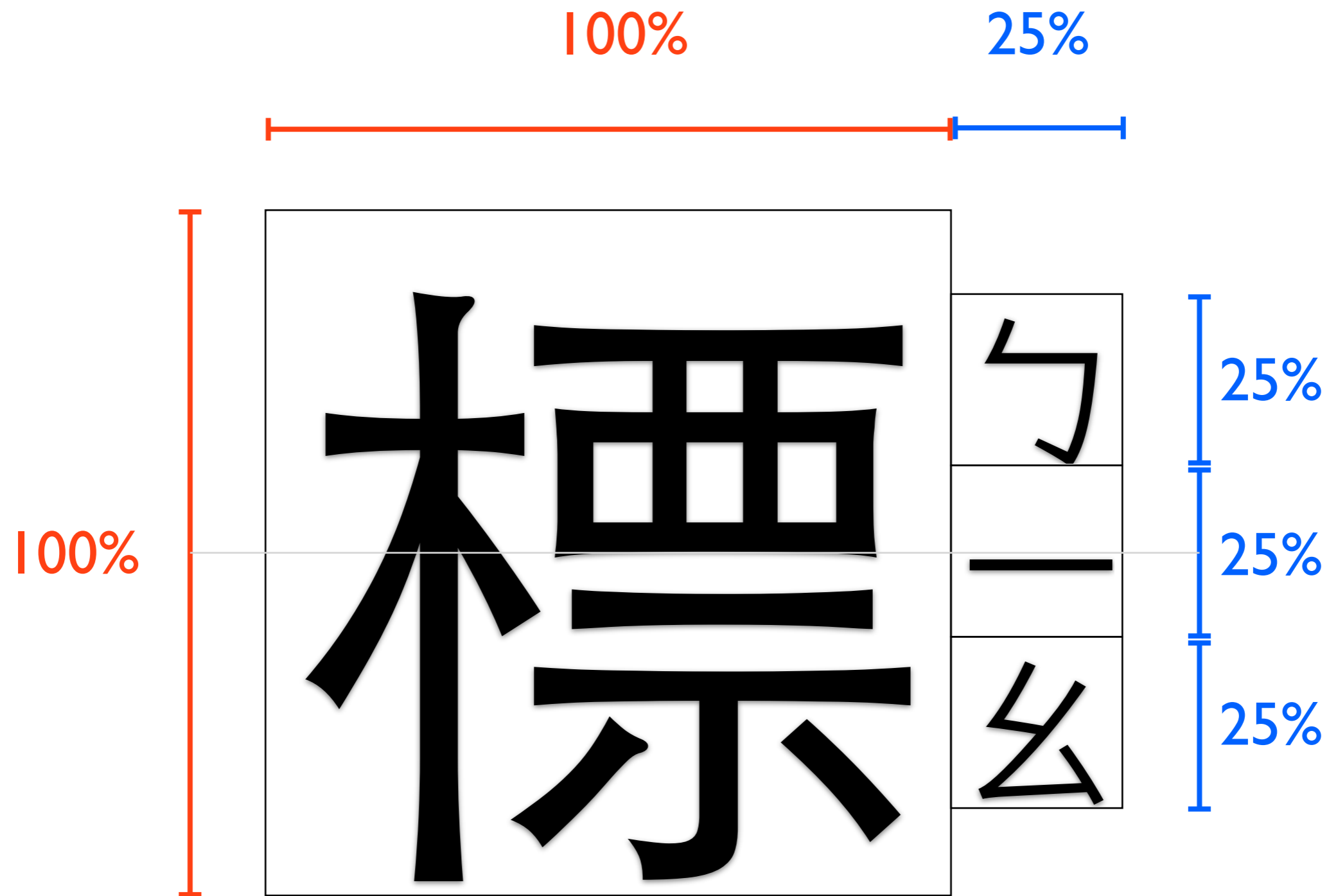


三個注音符號加輕聲調號

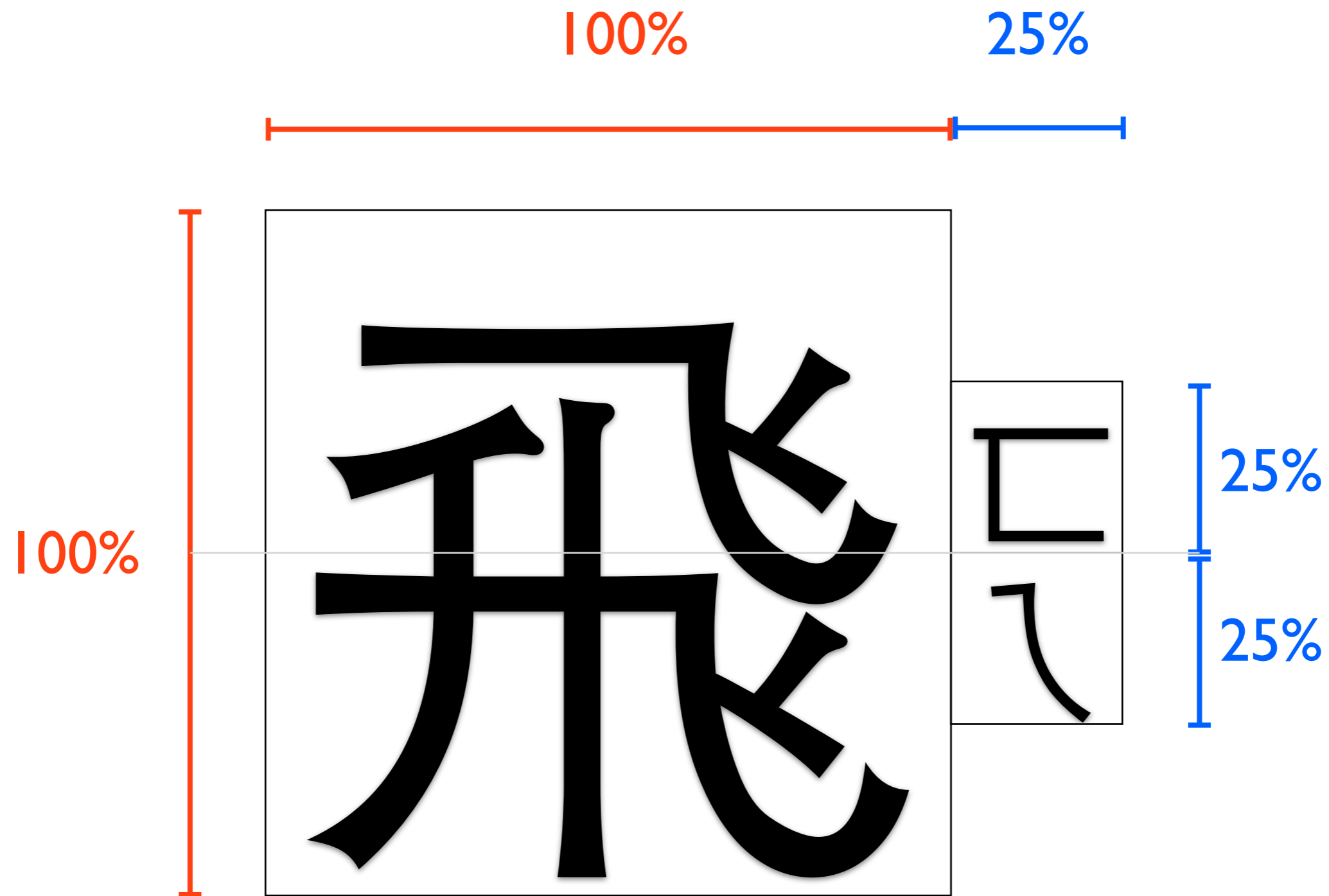
figure 2) Bopomofo composition rule in printed media by Ministry of Education.



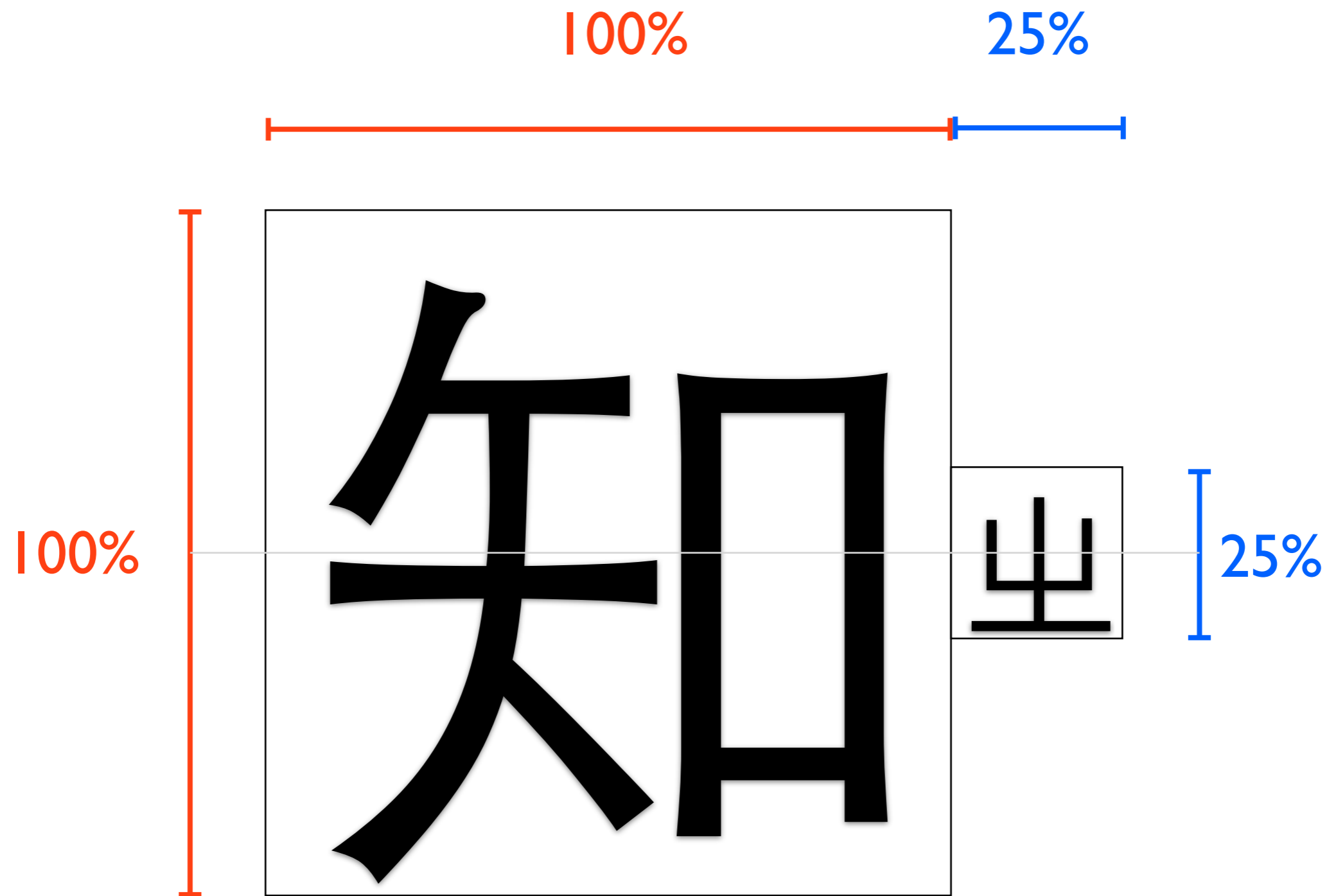
Case 1) a set of 4 full width symbols and tone mark.



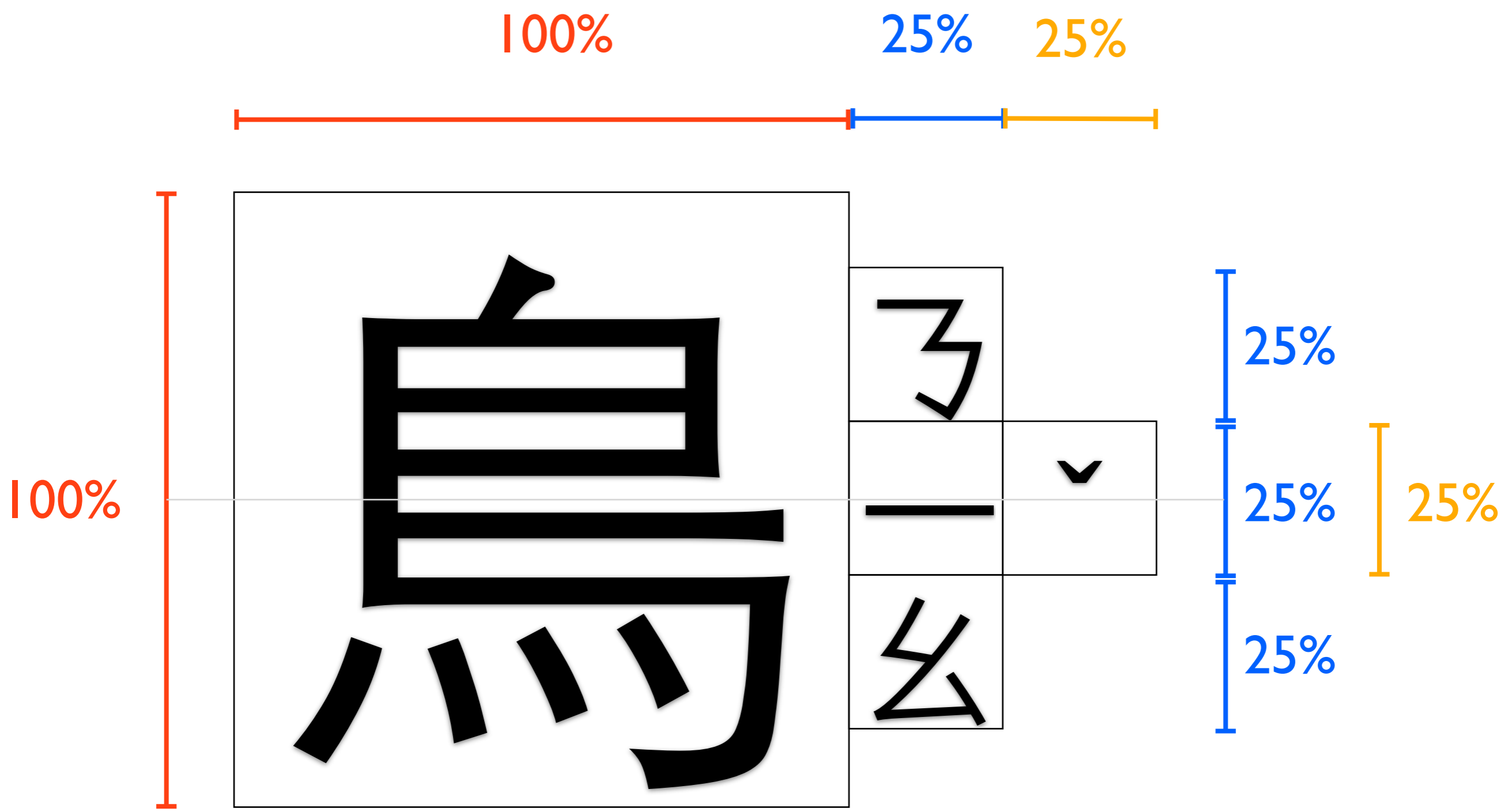
Case 2) a set of 3 full width symbols.



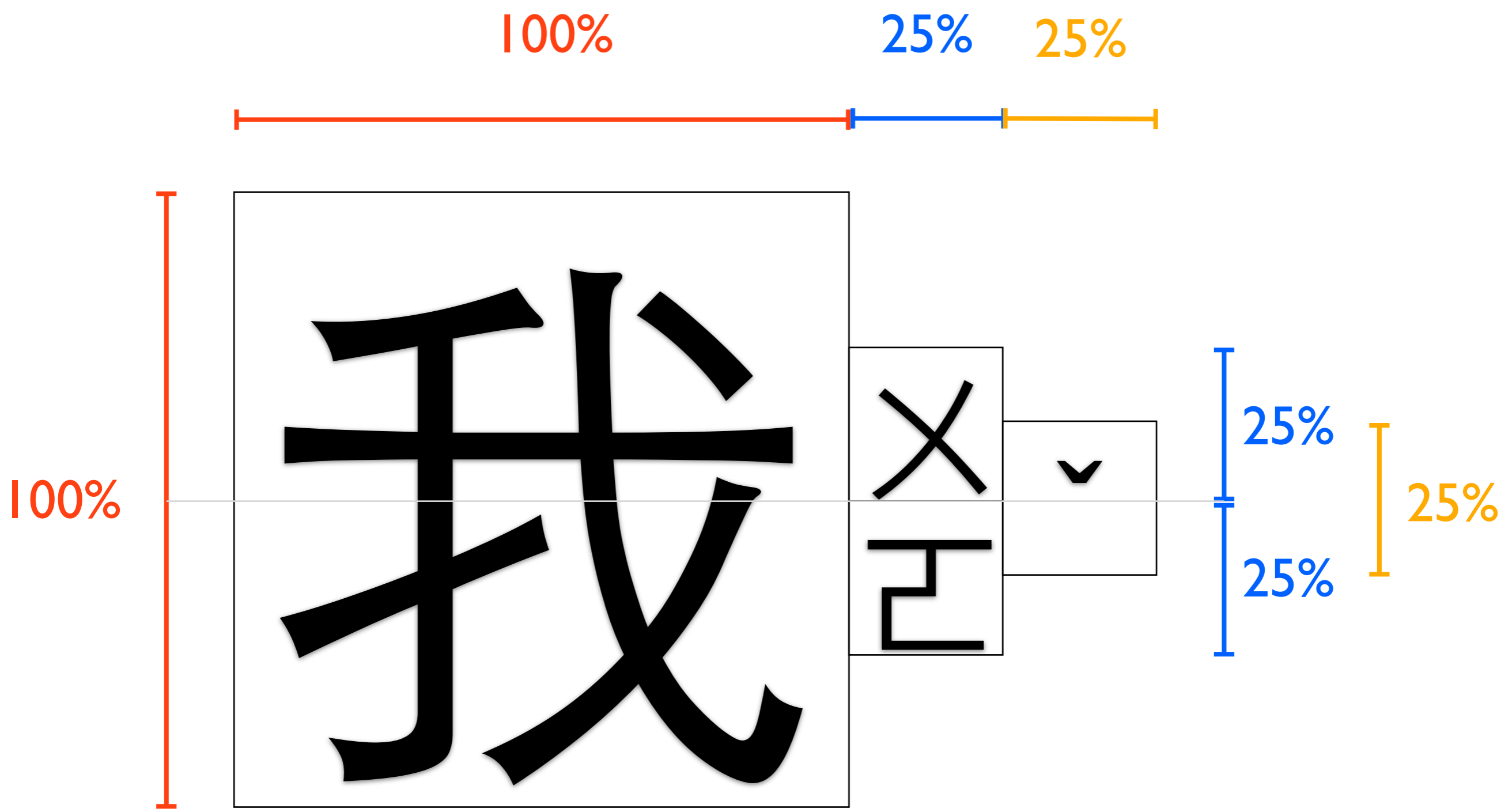
Case 3) a set of 2 full width symbols.



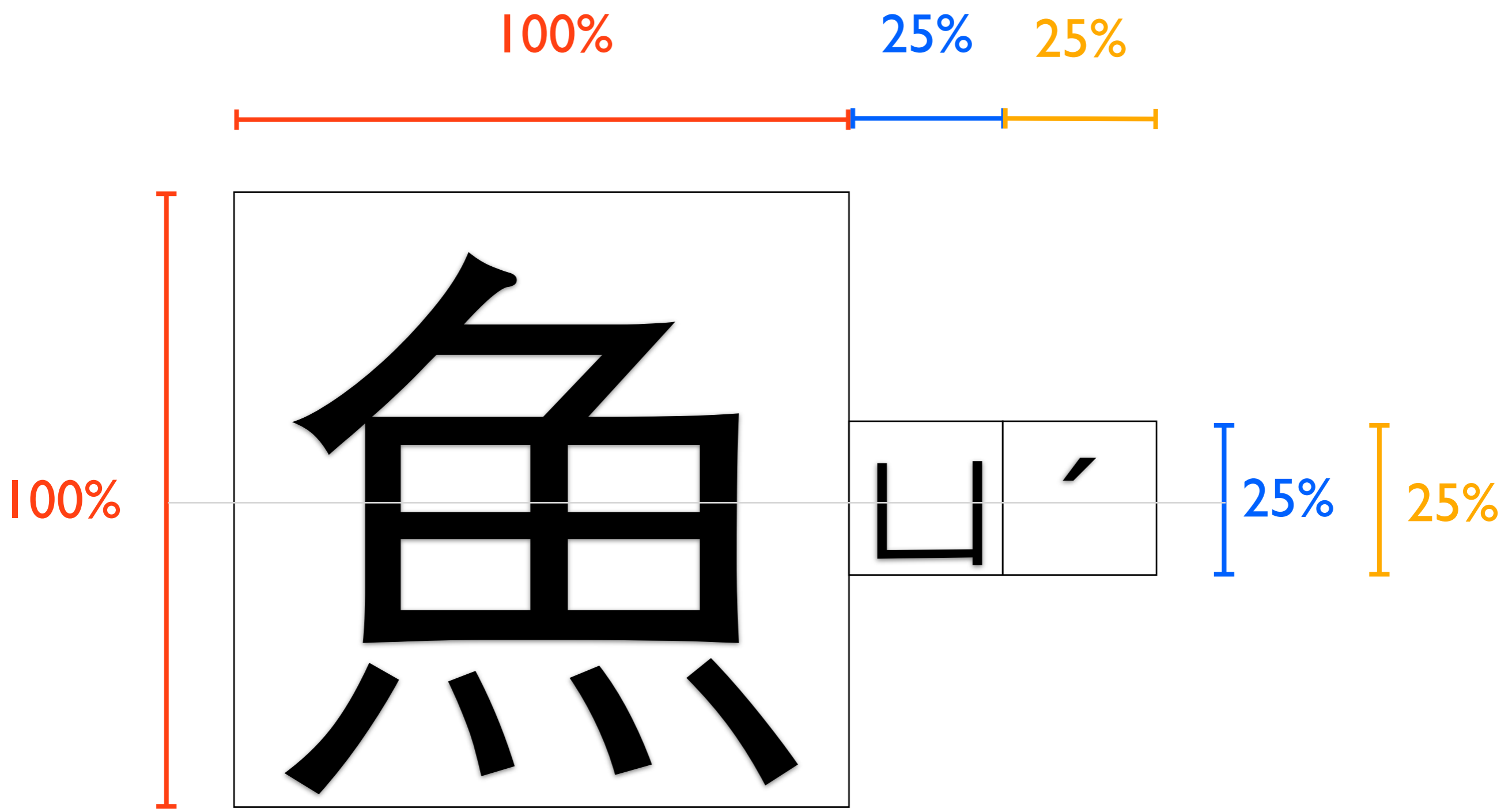
Case 4) | full width symbol.



Case 5) a set of 3 full width symbols with a tone mark aside right.



Case 6) a set of 2 full width symbols with a tone mark aside right.



Case 7) a set of 1 full width symbols with a tone mark aside right.

Implementation of Bopomomofo

HTML markup

- Marked as mono-ruby (モノルビ) .
- Hovered ruby structure for side tone mark.
- Add class for relative font-size setting.

```
<ruby>左<rt><ruby>ㄗㄨㄛˊ<rt class="tone">ˇ</rt></ruby></rt></ruby>  
<ruby>邊<rt>ㄅㄧㄢ</rt></ruby>  
<ruby>一<rt>ㄟ</rt></ruby>  
<ruby>隻<rt>ㄓㄜˊ</rt></ruby>  
<ruby>貓<rt>ㄇㄠ</rt></ruby>  
<ruby>喵<rt>ㄇㄠˊ</rt></ruby>  
<ruby>喵<rt>ㄇㄠˊ</rt></ruby>  
<ruby>叫<rt><ruby>ㄐㄠˋ<rt class="tone">ˋ</rt></ruby></rt></ruby>
```

figure 3) HTML markup for Bopomofo implementation

* <rp> is omitted for editing easily

Stylesheet design

- <rt>'s font-size by proportion.
- <p>'s font-size must be absolute value.

```
h1{  
font-family: "Heiti-TC", Sans-serif;  
margin-right: 0.5em;  
}  
  
p{  
font-family: "Heiti-TC", Sans-serif;  
font-size: 12pt;  
line-height: 1.7em;  
}  
  
rt{  
font-size: 25%;  
line-height: normal;  
text-align: center;  
}  
  
rt.tone{  
font-size: 100%;  
}
```

figure 4) CSS for Bopomofo implementation

E PUB 3 FXL

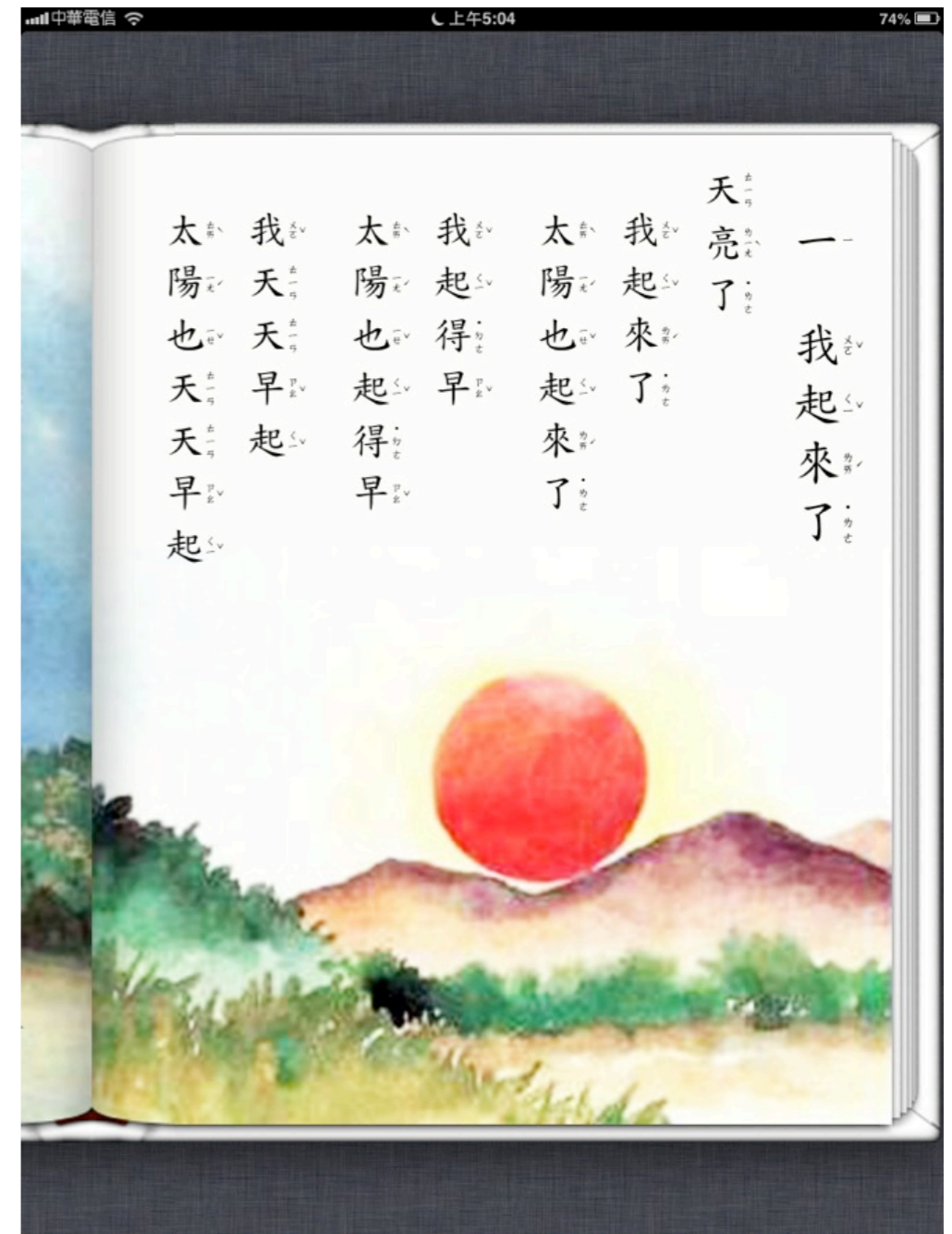
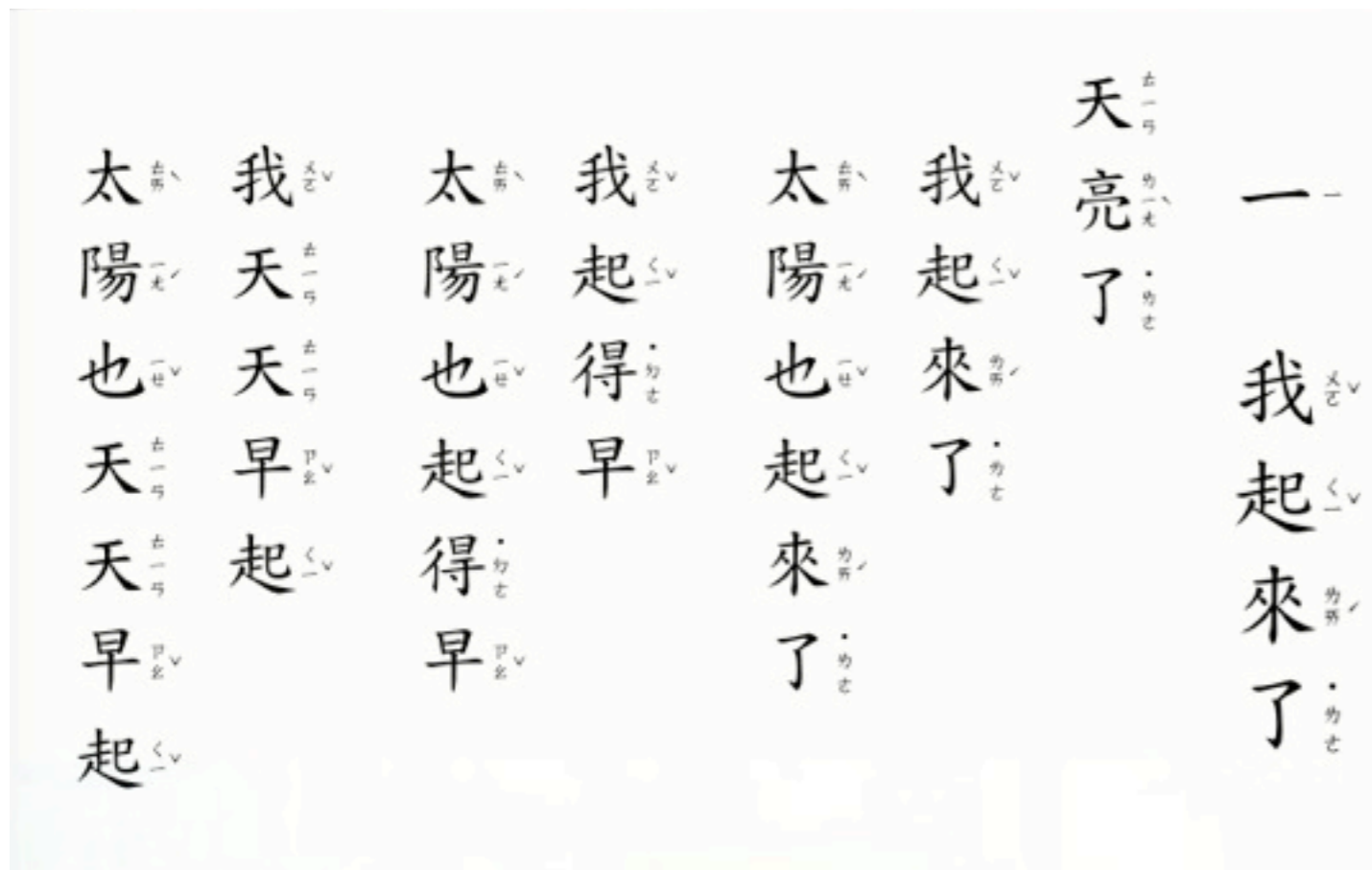


figure 6) Bopomofo Epub 3 FXL sample on iBooks

Epub reflow



figure 7) Bopomofo EPUB 3 sample on iBooks
no line length



figure 8) Bopomofo EPUB 3 sample on Kobo iOS App
no pagination

Horizontal Writing CSS

- imply writing-mode: vertical-lr.
- imply display: inline.

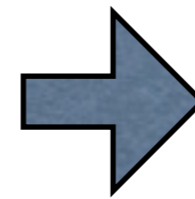
```
rt{  
font-size: 25%;  
line-height: normal;  
text-align: center;  
-epub-writing-mode: vertical-lr;  
-webkit-writing-mode: vertical-lr;  
vertical-align: middle;  
display: inline;  
}
```

figure 9) CSS for Bopomofo implementation in Horizontal Writing.

Horizontal Writing HTML

Mono
Ruby

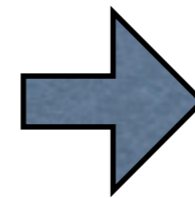
```
<ruby>左<rt><ruby> ㄩㄨㄥˊ<rt class="tone">ˇ</rt></ruby></rt></ruby>
<ruby>邊<rt>ㄅㄧㄢ</rt></ruby>
<ruby>一<rt>ㄟ</rt></ruby>
<ruby>隻<rt>ㄓ</rt></ruby>
<ruby>貓<rt>ㄇㄠ</rt></ruby>
<ruby>喵<rt>ㄇㄧㄠ</rt></ruby>
<ruby>喵<rt>ㄇㄧㄠ</rt></ruby>
<ruby>叫<rt><ruby> ㄐㄧㄠˋ<rt class="tone">`</rt></ruby></rt></ruby>
```



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貓喵
喵叫

Group
Ruby

```
<ruby>左<rt><ruby> ㄩㄨㄥˊ<rt class="tone">ˇ</rt></ruby></rt>
邊<rt>ㄅㄧㄢ</rt>
一<rt>ㄟ</rt>
隻<rt>ㄓ</rt>
貓<rt>ㄇㄠ</rt>
喵<rt>ㄇㄧㄠ</rt>
喵<rt>ㄇㄧㄠ</rt>
叫<rt><ruby> ㄐㄧㄠˋ<rt class="tone">`</rt></ruby></rt></ruby>
```



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喵叫

figure 10) In horizontal writing, Mono Ruby will cause layout break.

align issue

左邊一隻貓喵喵叫

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喵喵叫 左邊一隻貓喵喵叫 左邊一隻貓喵喵叫 左邊一隻貓
喵喵叫

inline issue

letter spacing issue
(investigating)

figure 11) In horizontal writing, Issues Bopomofo ruby confronted.

Requirement

ruby-position: inter-character

- keep Bopomofo ruby placed right of ruby base. especially in horizontal writing.
- With this property, ruby base and ruby text should not be separated with line-break. (as line-start prohibition rule?)

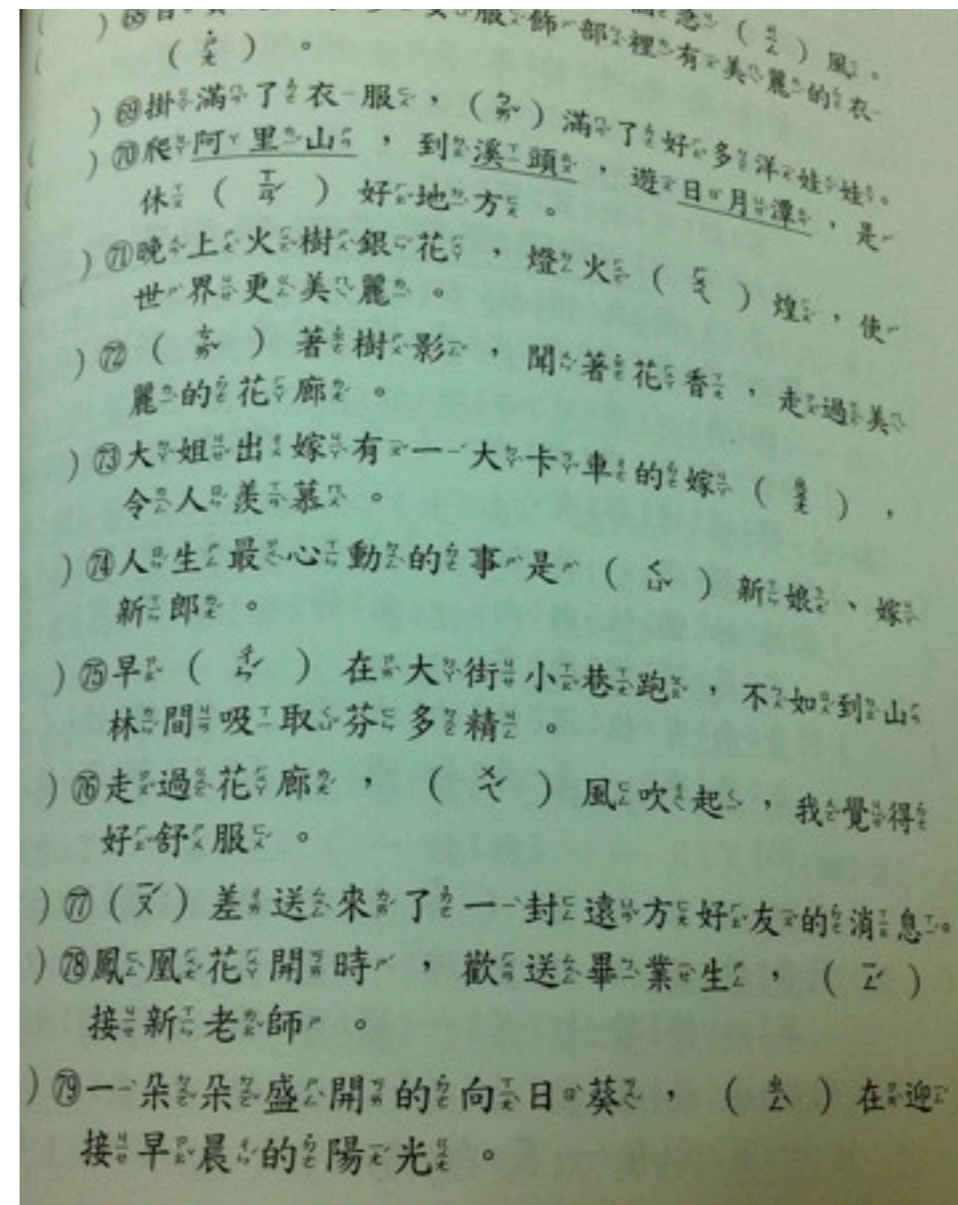


figure 13) Taiwan's Mandarin textbook, quiz section.
horizontal writing with Bopomofo.

Alternative Solution

Webfont

- It works, but not good enough.
- Lot of Chinese characters have alternative pronunciations, maximum to 6.
- 6 fonts with contents span class markup cannot be done easily. Even with subset to reduce size.
- It's proprietary, not open standard.

Tool

Why Tool?

- Bopomofo usually marked with **every character** in books for education purpose.
- Lot of Chinese characters have alternative pronunciations, **maximum to 6**.
 - = Tool to convert article into Bopomofo ruby markupted html with pronunciations choice for practice.

Thank you!

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