Creation of a Japanese Typeface Designed for Readers with Dyslexia

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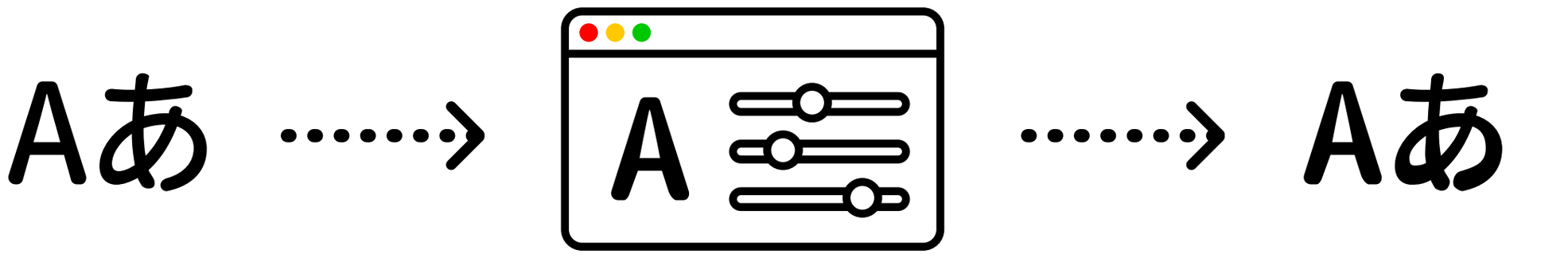
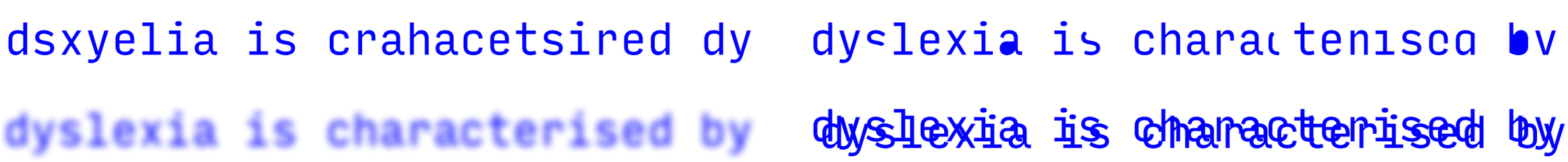
Aims

- To create a Japanese typeface (font) for readers with dyslexia
- To develop a Japanese typeface customisation system for readers with dyslexia



Dyslexia

- Developmental dyslexia is a specific learning disability that is characterised by difficulties with accurate and/or fluent reading (International Dyslexia Association, 2002)



- Visual symptoms of dyslexia include letter reversals, distortion, blurring and superimposition, etc… (Stein, 2008; Kato, 2010)

Dyslexia

- 5–17% of the population in English-speaking countries and 3–5% of the population in Japan have developmental dyslexia (Karita et al., 2010)

- In order to guarantee the right to equal access to books, knowledge and information for everyone, it is essential to provide assistive environments to readers with dyslexia

Typefaces

- Using suitable typefaces (fonts)
- Typefaces are design of letters
- Readability is a function of typefaces

Helvetica Neue

TRAJAN

Comic Sans

Futura

Times New Roman

Verdana

Latin Dyslexia Typefaces

- Latin typefaces designed for readers with dyslexia (Rello & Baeza-Yates, 2013; Zhu, 2016)

Dyslexie

Open Dyslexic

Lexie Readable

- Readers with dyslexia are able to read with less errors and/or feel more comfortable reading with dyslexia typefaces (Hillier, 2006; De Leeuw, 2010; Pijpker, 2013)

Japanese Dyslexia Typefaces?

- Typefaces do have impacts on readers with dyslexia in Japanese (Tani et al., 2016)
- The possible effectiveness of Japanese typefaces for readers with dyslexia is implied
- However, Japanese dyslexia typefaces have not been created so far

Problems

- Problem 1: Characteristics of dyslexia typefaces (both Latin and Japanese) are not clarified
- Problem 2: Japanese typefaces contain a large number of complicated characters which makes them difficult to create
- Problem 3: To create a typeface that fits everyone with dyslexia is not easy

Framework of Research

- Phase 1: Extracting visual characteristics of existing Latin dyslexia typefaces
- Phase 2: Defining requirements for Japanese dyslexia typefaces
- Phase 3: Creating Japanese dyslexia typefaces by manipulating existing font data by computer programming
- Phase 4 (Future Work): Developing a Japanese typeface customisation system

Phase 1:
Characteristics of Latin Dyslexia Typefaces

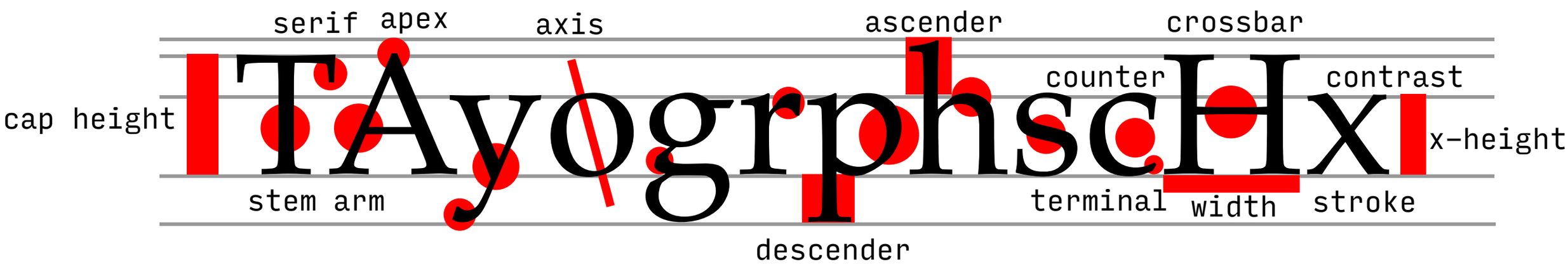
Methods

- Comparing characteristics of dyslexia typefaces and standard typefaces

dyslexia typefaces	standard typefaces
Dyslexie	Arial
Open Dyslexic	Calibri
Lexie Readable	Century Gothic
	Comic Sans
	Trebuchet
	Verdana

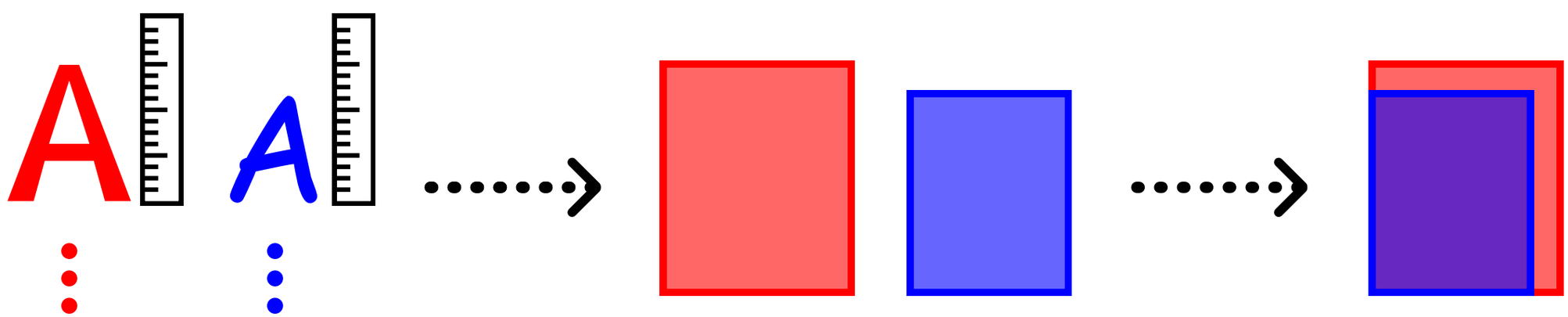
Methods

- Characteristics of a typeface appear in its elements



Methods

1. Measure elements of each typeface based on three measures of typeface classification
2. Take the average of each group
3. Compare the averages



Results

A. Larger letters

B. Extremely large uppercases

C. Larger gap between cap height and x-height

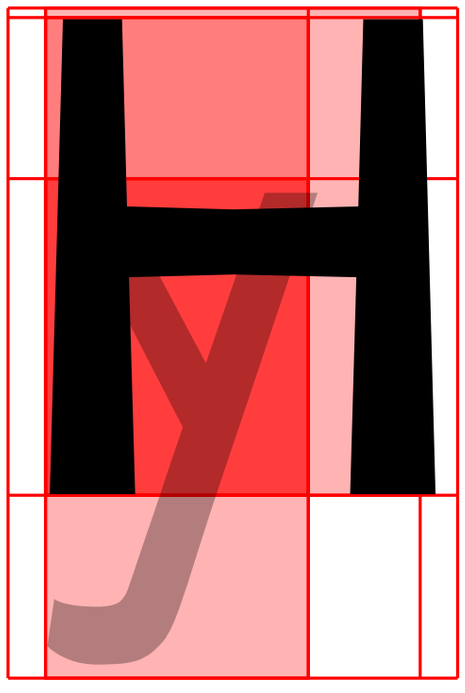
D. Rounded sans serif

E. Bolder strokes

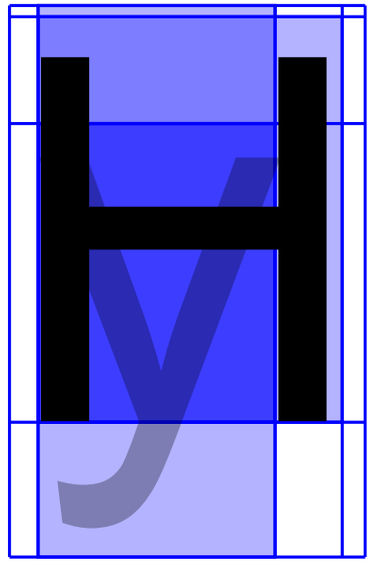
F. Larger height/width ratio

G. Contrast in stroke width

H. Similar letters made easy to identify



Dyslexia Typefaces



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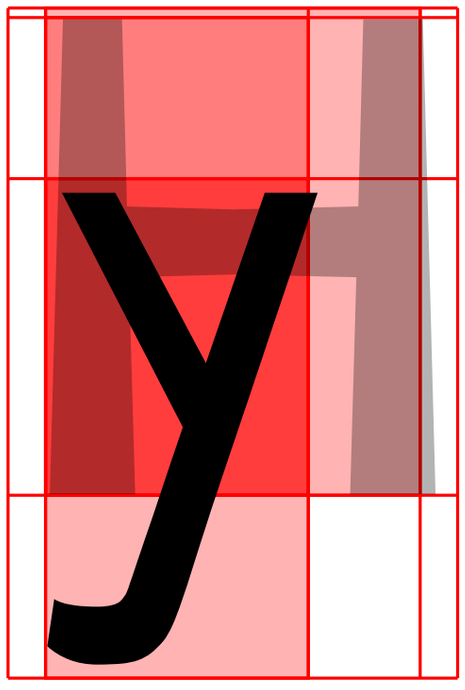

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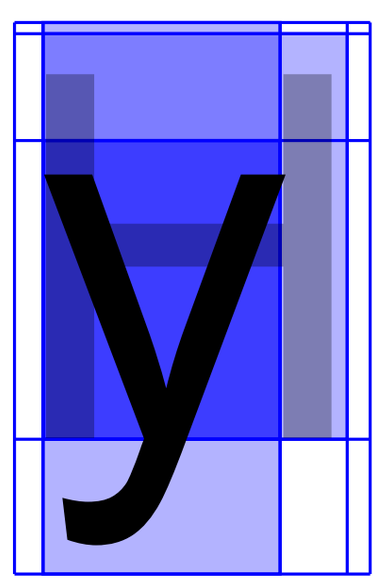

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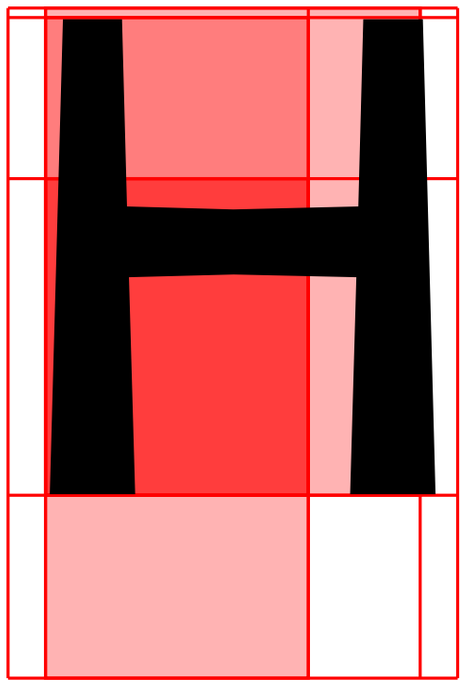

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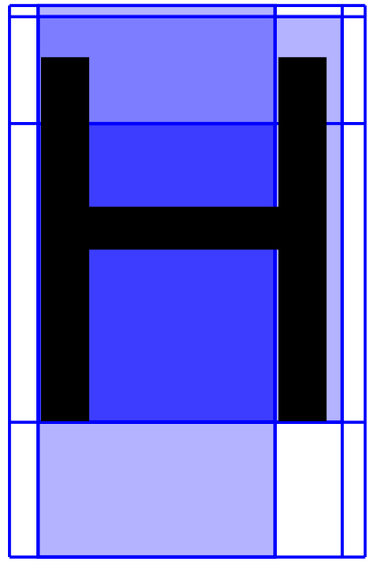

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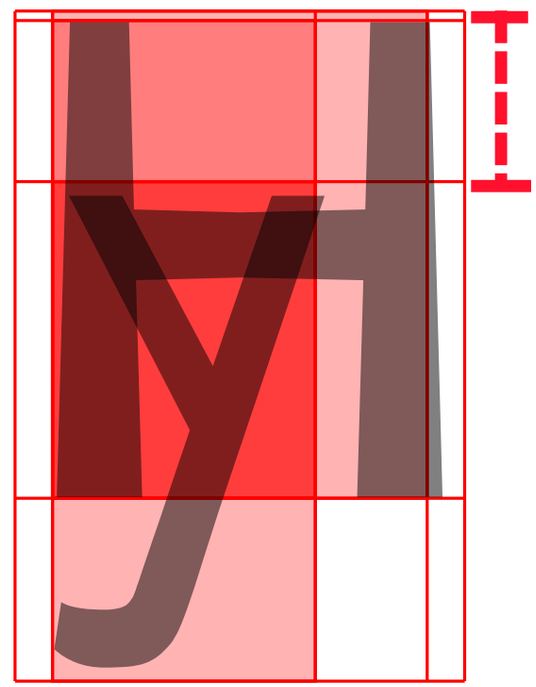

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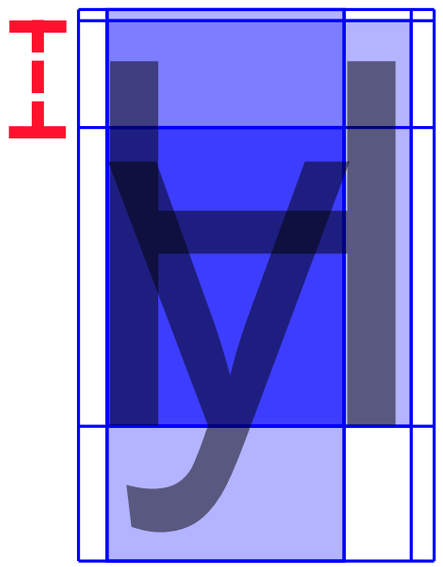

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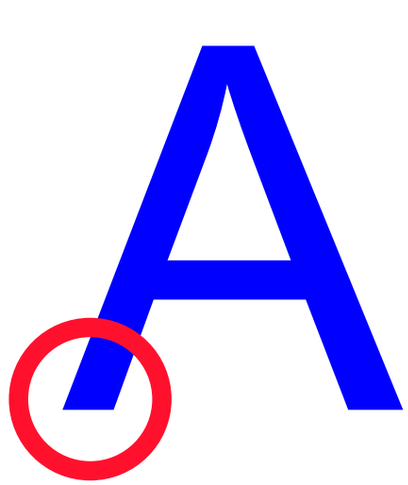

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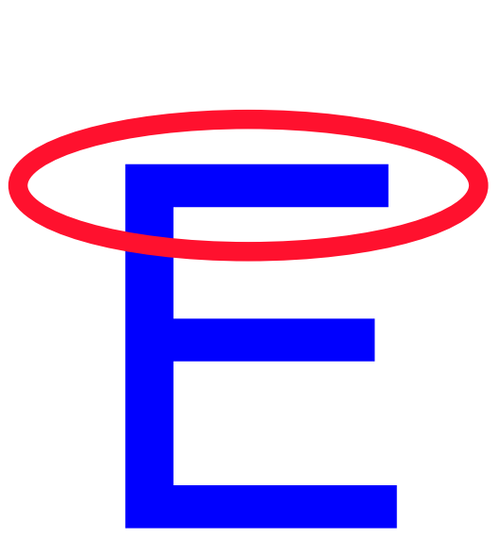

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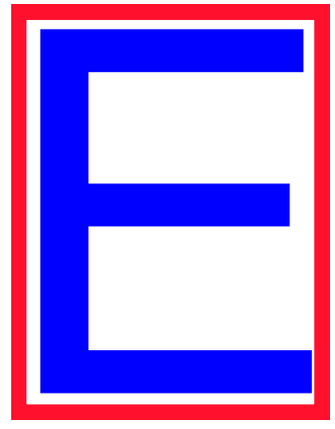

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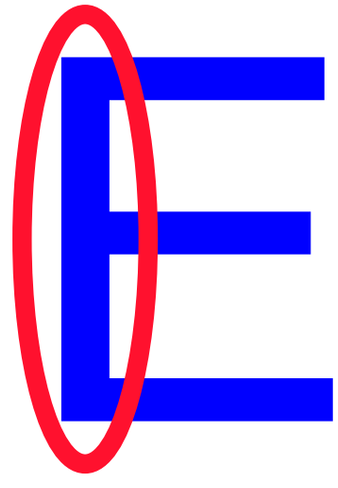

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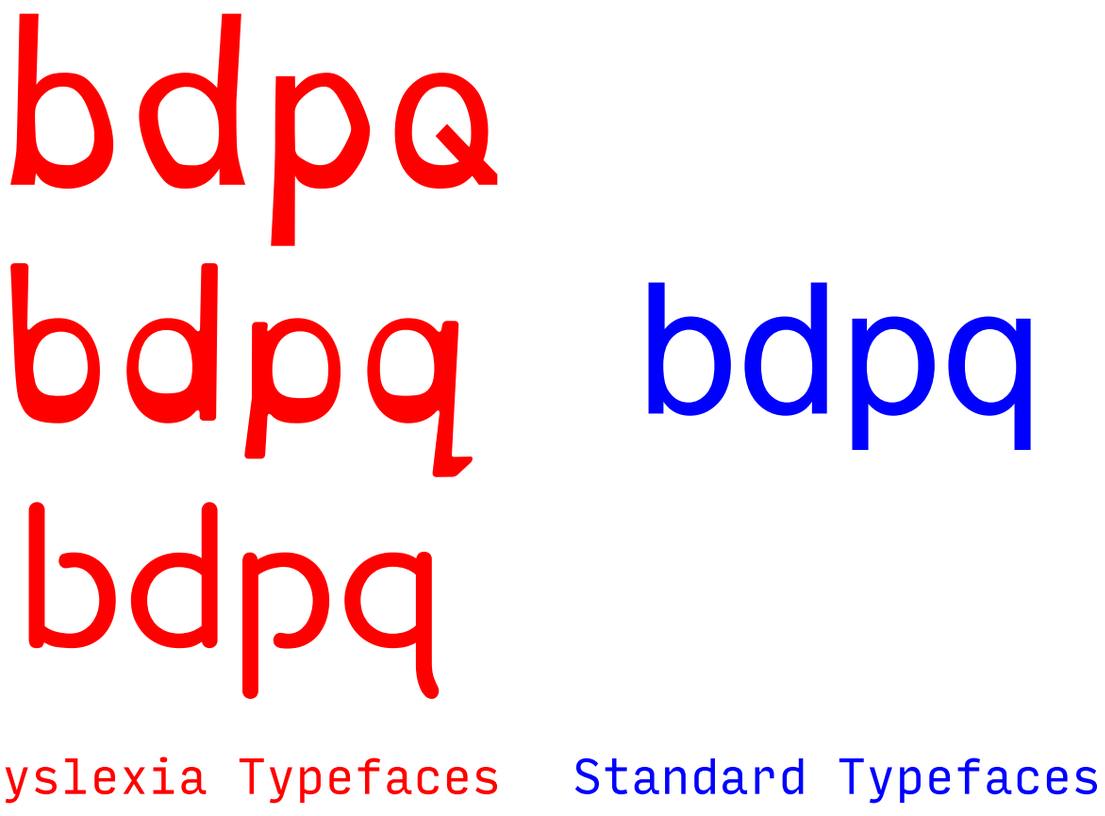


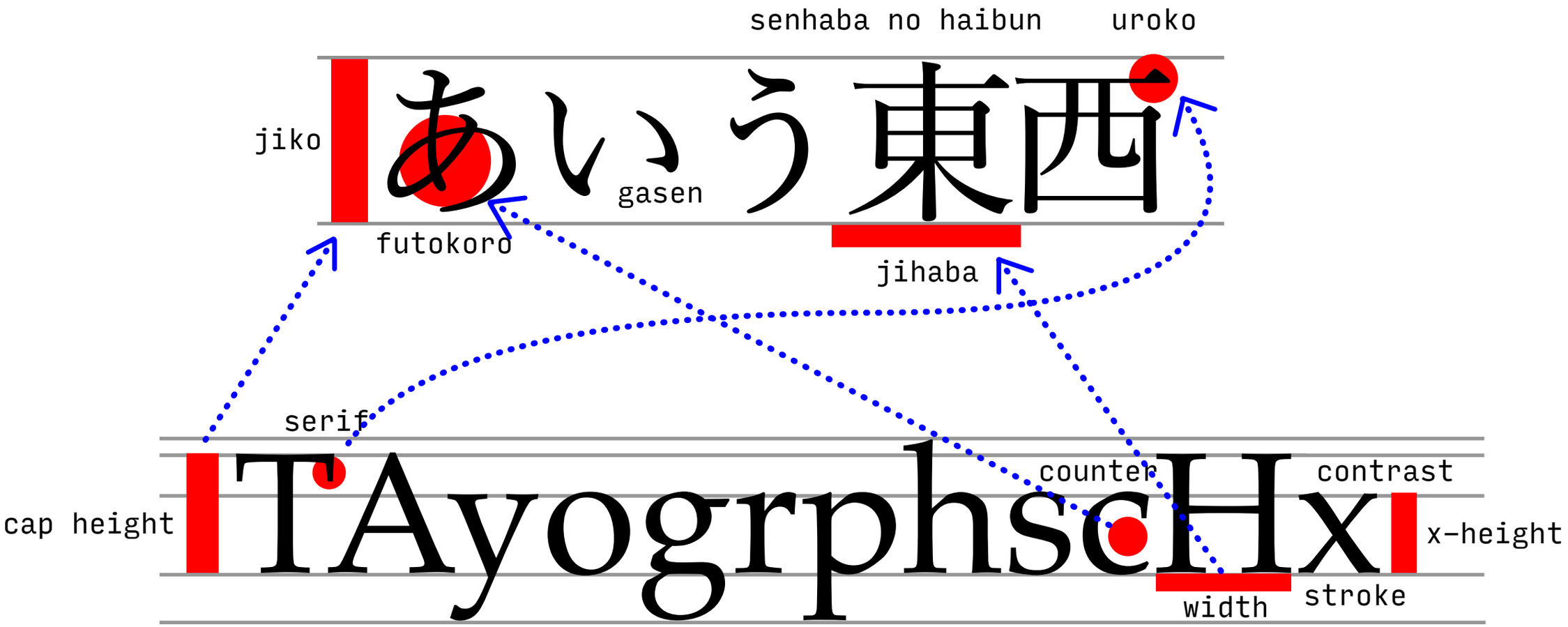
Phase 2:
Requirements for Japanese Dyslexia Typefaces

Methods

- Visual symptoms of dyslexia are similar in English and Japanese
- Correspondence between elements of Japanese typefaces and those of Latin typefaces

Methods

1. Make correspondence between elements of Japanese typefaces and Latin typefaces



Methods

2. Take into consideration three kinds of characters in Japanese writing system

Hiragana	Katakana	Kanji (Ideograph)
あいうえおかきくけこ さしすせそたちつてと なにぬねのはひふへほ まみむめもやゐゆゑよ らりるれろわをん……	アイウエオカキクケコ サシスセソタチツテト ナニヌネノハヒフヘホ マミムメモヤヰユヱヨ ラリルレロワヲン……	一右雨円王音下火花貝 学気九休玉金空月犬見 五口校左三山子四糸字 耳七車手十出女小上森 人水正生青夕石赤……

Results

A. Larger characters
B. Maru gothic (rounded sans serif) typefaces
C. Bolder strokes
D. Larger height/width ratio
E. Contrast in strokes
F. Kana characters made easy to identify
G. Kanji characters made easy to identify
H. Frame the structure of kanji characters to illustrate radicals

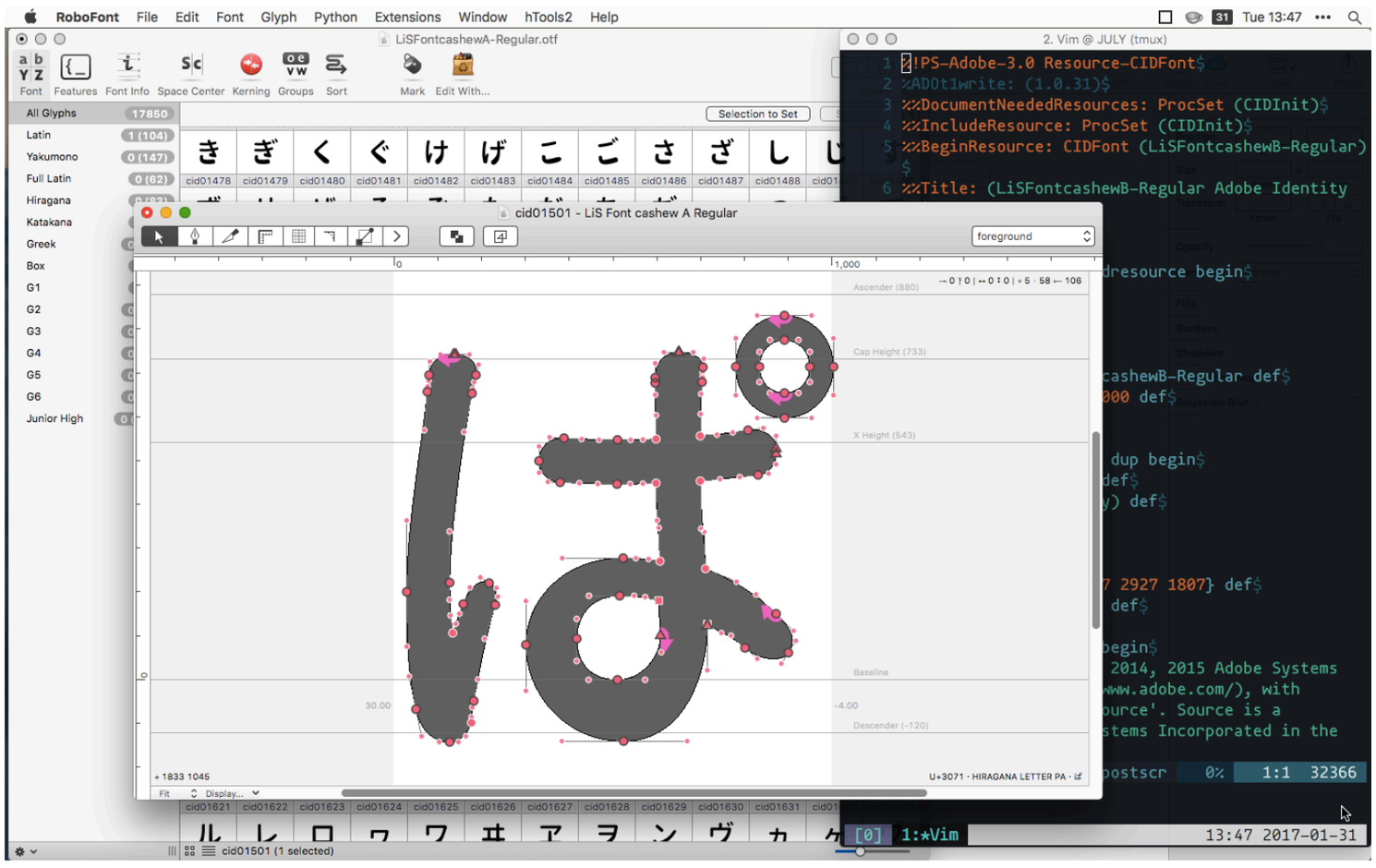
Phase 3:
Creation of a Japanese Dyslexia Typeface

Methods

- Problem 2: Japanese typefaces contain a large number of complicated characters, which makes them difficult to create
- Phase 3: Creating Japanese dyslexia typefaces by manipulating existing font data by computer programming

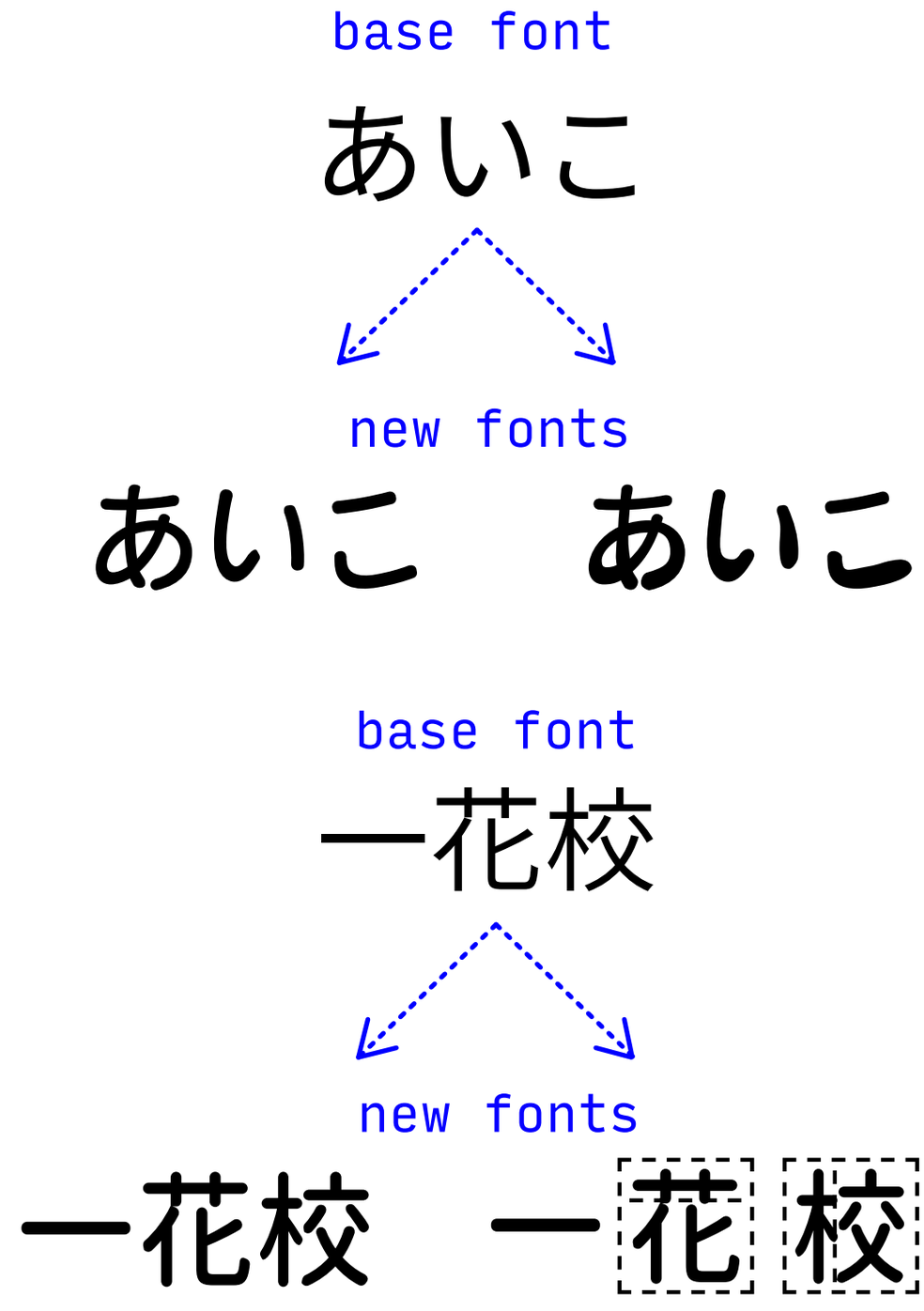
Methods

- Base font: Source Han Sans (https://github.com/adobe-fonts/source-han-sans/)
- Tools: Font editors, Python, AFDKO
  (Adobe Font Development Kit for OpenType)



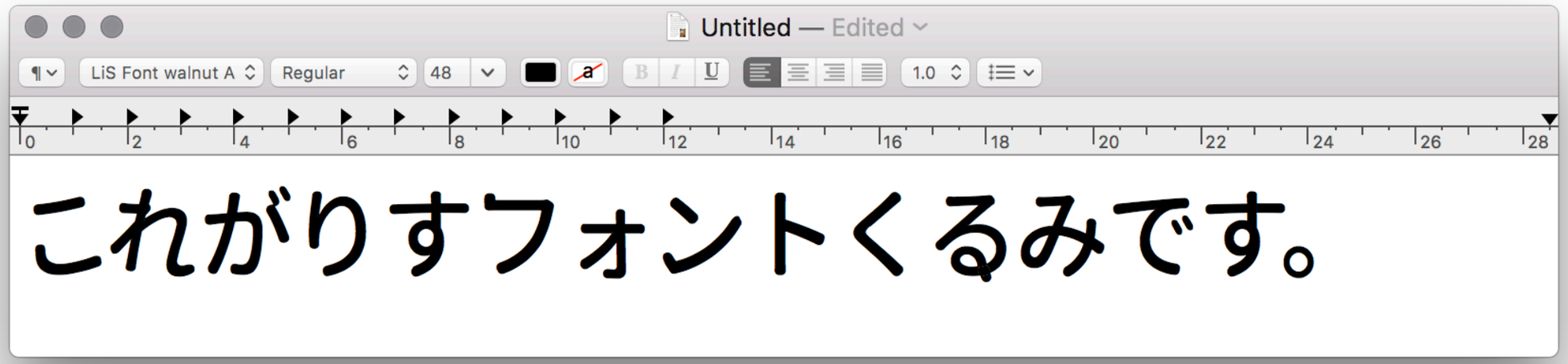
Methods

A. Larger characters
B. Maru gothic (rounded sans serif) typefaces
C. Bolder strokes
D. Larger height/width ratio
E. Contrast in strokes (manually)
F. Kana characters made easy to identify (manually)
G. Kanji characters made easy to identify (not applied yet)
H. Frame the structure of kanji characters to illustrate radicals (manually)

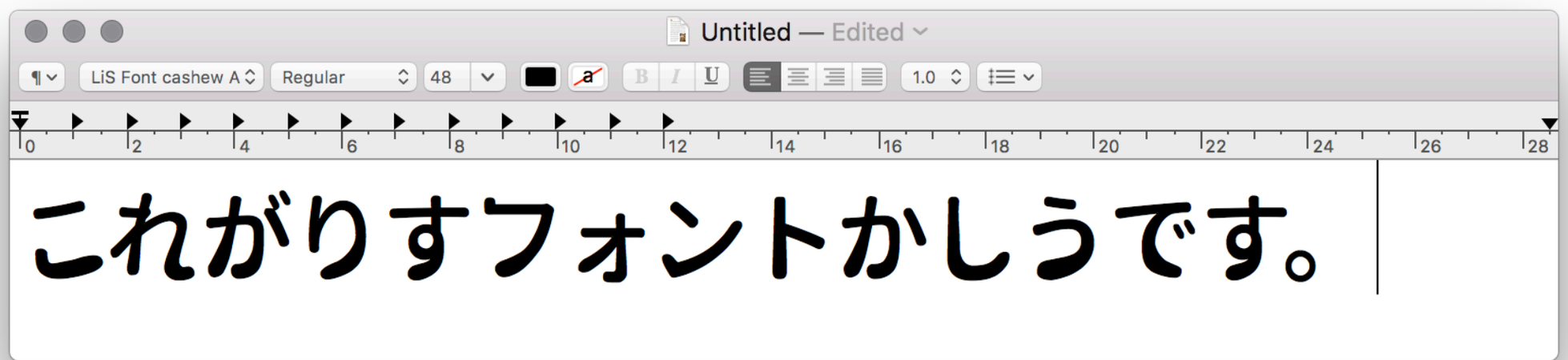


Results

- LiS Font walnut (2776 characters)



- LiS Font cashew (2776 characters)



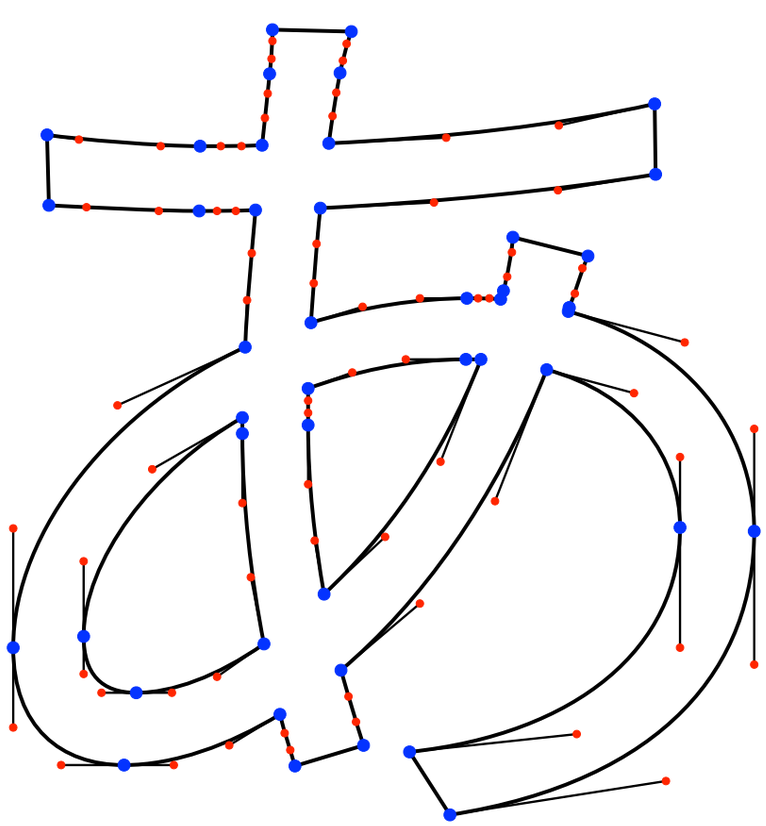
Evaluation

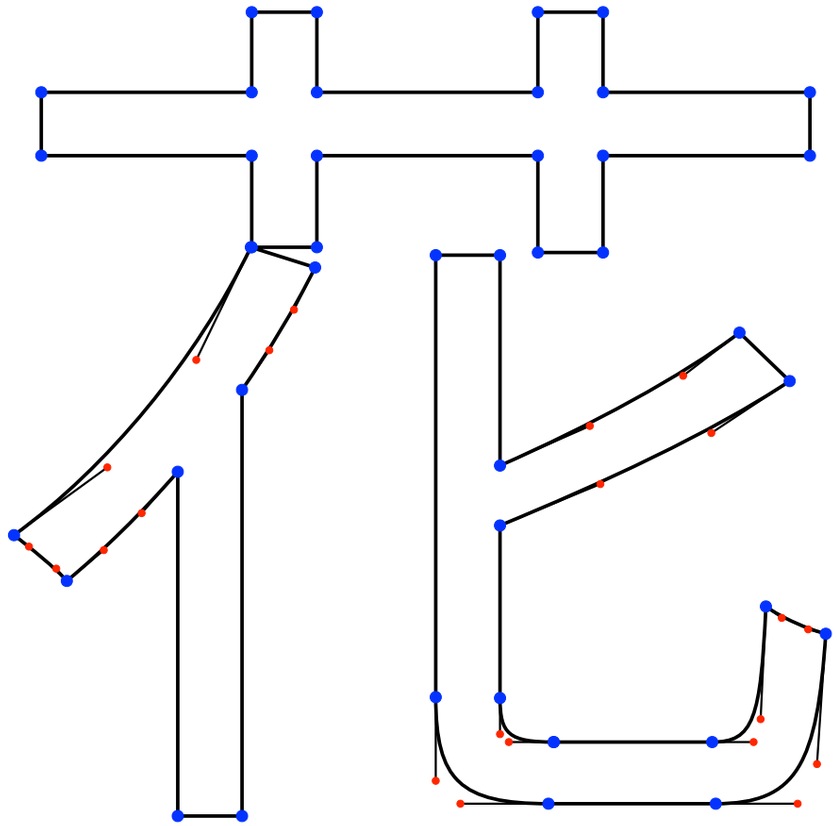
- Readability of LiS Font compared to other typefaces
- A preliminary evaluation involving 6 elementary students has been done
- A larger experiment involving 40 children and adults is being conducted
- Seem to be promising…so far

Future Work

Original Base Font

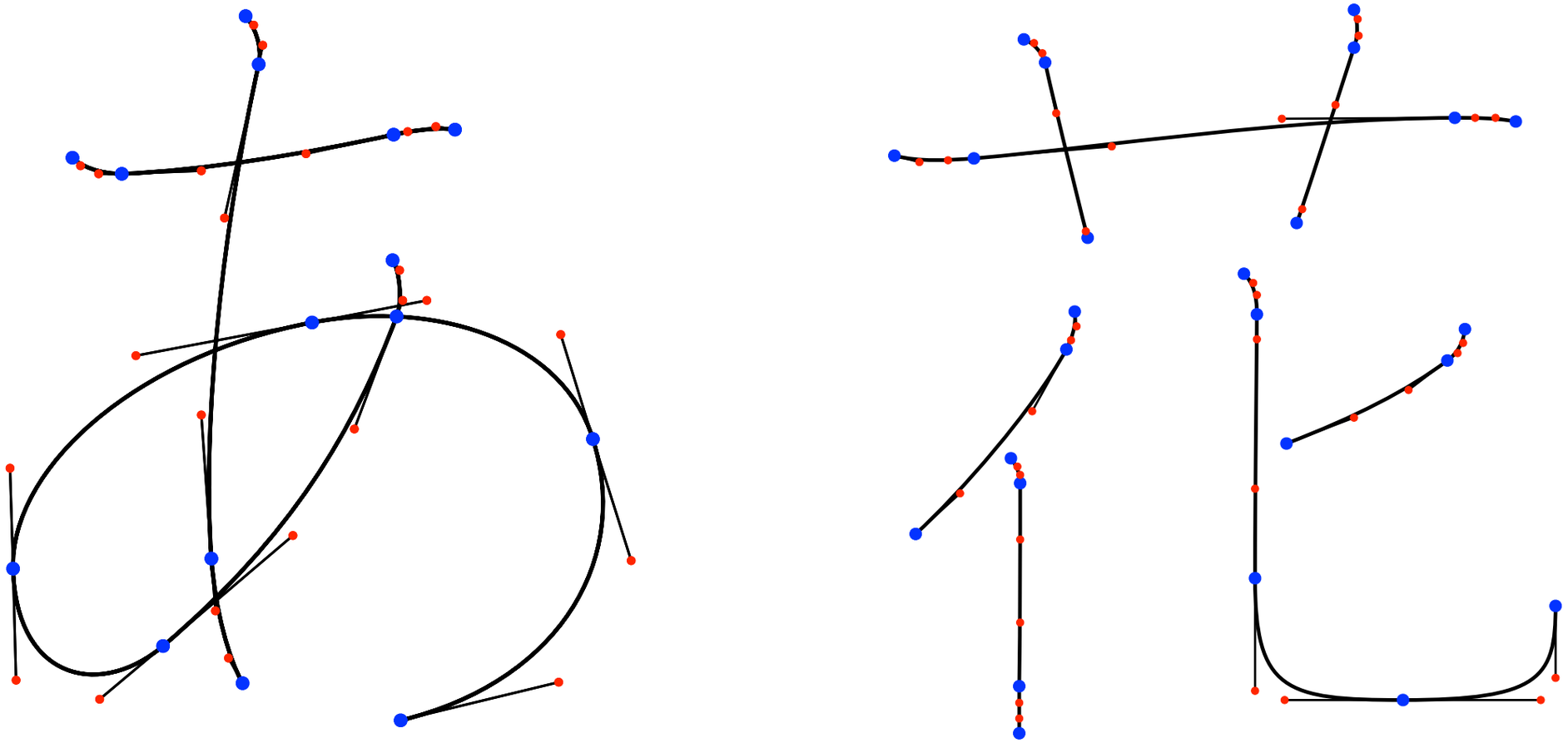
- Outline data of Source Han Sans





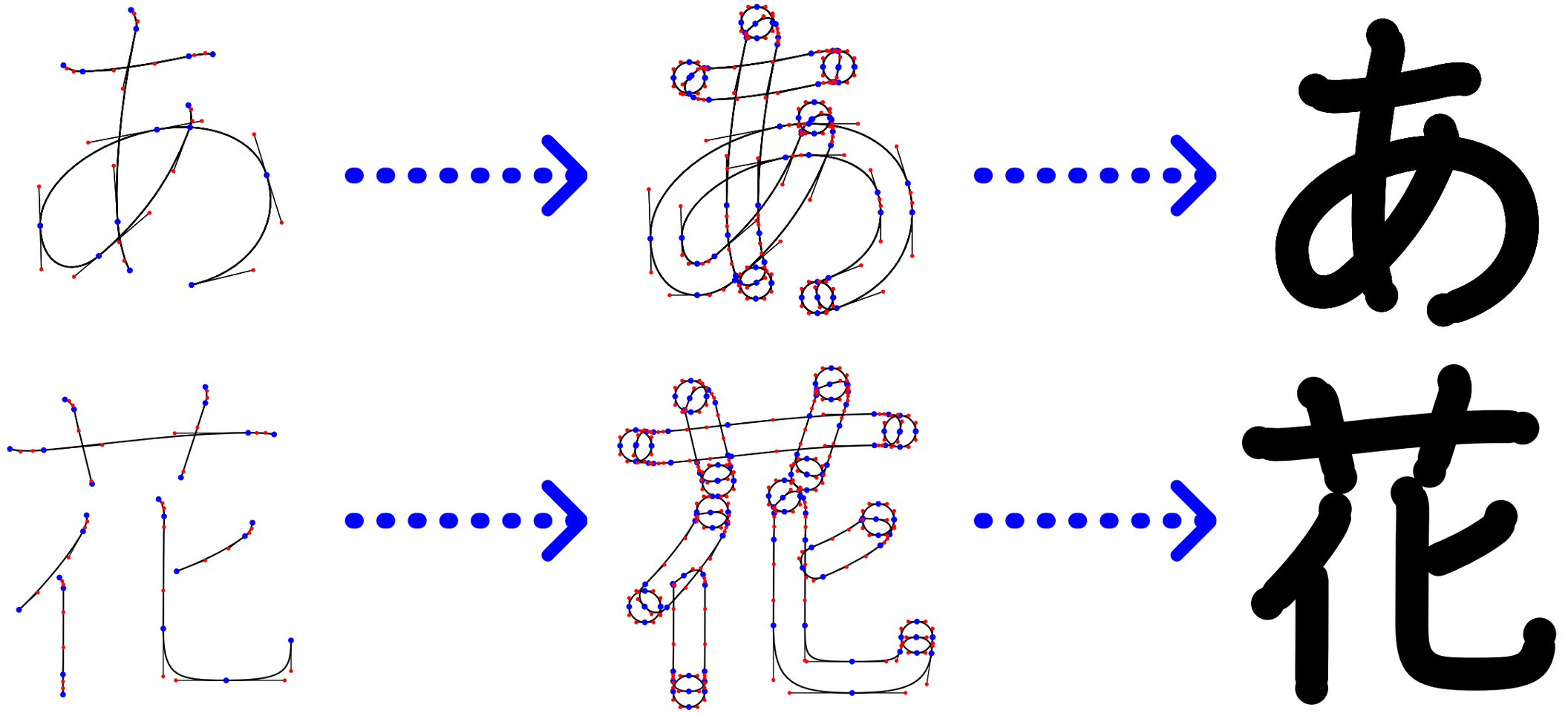
New Base Font

- Skeleton data of KanjiVG (https://github.com/KanjiVG/kanjivg)



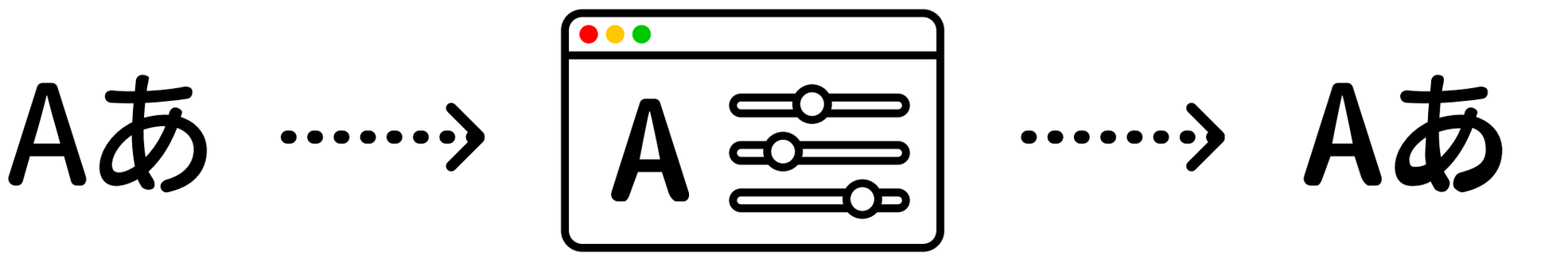
First Attempt

- Convert skeletons to outlines automatically



Outlooks

- Create typefaces based on KanjiVG more effectively and flexibly
- Expand to the development of a typeface customisation system for readers with dyslexia
- Multilingual implementation in Asia



Thank you for your attention

We are looking for advice and collaboration on multilingual implementation of LiS Font.
If you have any information on dyslexia in Asia, please let me know!

http://www.p.u-tokyo.ac.jp/~shushinjo/