

The Development of Adobe-Japan1-4 & Mac OS X OpenType Fonts: Adobe Systems' Perspectives

Ken Lunde, Adobe Systems Incorporated

lunde@adobe.com
<http://www.oreilly.com/~lunde/>

1. Introduction

The purpose of this paper is to describe the development of the Adobe-Japan1-4 character collection, the development of OpenType fonts based on it, and the experiences gained from both of these processes. The goal of the Adobe-Japan1-4 character collection is to provide significantly more glyphs in order to satisfy most professional and commercial printing needs in Japan. The goal of OpenType is to provide a truly cross-platform font format that also solves problems in legacy font formats. Experience demonstrates that cross-platform environments are increasingly more important. And, thanks to Unicode, language barriers in software development are coming down. All of these are valid reasons for developing Adobe-Japan1-4-based OpenType fonts.

Adobe Systems will soon release Kozuka Mincho and Kozuka Gothic designs in OpenType format, supporting the complete Adobe-Japan1-4 character collection.

2. Advantages of Adobe-Japan1-4 & OpenType

Adobe Systems considers Adobe-Japan1-4 and OpenType to be somewhat dependent on one another in order for either to be successful. Building Adobe-Japan1-4-based OpenType has three distinct advantages:

- Larger glyph complement (advantage of Adobe-Japan1-4)
- Advanced typographic features (advantage of OpenType)
- Font tables and overrides (advantage of OpenType)

Let's explore each of these advantages in greater detail.

2.1 Larger Glyph Complement

Mainstream PostScript fonts have been based on the Adobe-Japan1-2 character collection, which enumerates 8,720 glyphs. The Adobe-Japan1-4 character collection, which adds significantly more glyphs, became final in early 2000, and adds 6,090 glyphs (CIDs 9354 through 15443).¹

1. What about Adobe-Japan1-3? Because pre-rotated forms of all non-full-width glyphs are necessary to support the 'vrt2' GSUB feature, Adobe-Japan1-3 was defined as pre-rotated forms of all non-full-width glyphs in Adobe-Japan1-2, which amounted to 634 glyphs (CIDs 8720 through 9353). Adobe-Japan1-3 can be thought of as a way to enable Adobe-Japan1-2 for OpenType.

In order to ensure glyph consistency across fonts of different manufacturers, the JIS X 0208:1997 kanji (CIDs 1125–7477 and 8284–8285) should be JIS90-compliant. Some of the JIS X 0208:1997 kanji variants in the Adobe-Japan1-4 supplement are sometimes subtle in their difference with their JIS90 forms.

- There are 90 additional proportional Latin glyphs, and 294 true italic forms for proportional Latin. The “Euro” currency symbol (in full-width, proportional, and proportional italic forms) is also included. The additional proportional Latin characters (and corresponding italic forms) included macroned vowels, which are important for correct Japanese transliteration.
- “Horizontal in vertical” typesetting is made easier by 41 third- and quarter-width forms.
- Two styles of fractions (with a horizontal bar and diagonal line as the numerator/denominator separator), ranging from 0/3 to 1/100, are included.
- Nearly 2,000 additional annotated forms of the following character classes are included:
 - Numerals 0 through 100 (00 through 09 are also supported)
 - Upper and lowercase Latin alphabet
 - Hiragana and katakana
 - Some kanji

Annotation styles include parentheses, circles, black circles, boxes, black boxes, rounded boxes, and black rounded boxes.

- Additional Latin ligatures (25), kana ligatures with vertical forms (170), and kanji ligatures with vertical forms (22) are included.
- Additional half-width (25) and full-width (185) punctuation and symbols are provided. This includes the small hiragana and katakana “ko” (including vertical forms).
- Horizontally- and vertically-optimized kana glyphs (183 glyphs in each set) are included.
- 231 ruby glyphs are provided for typesetting ruby. Applications are still expected to shrink the glyphs down to 50 percent size, but the results are now typographically correct.
- 450 pre-rotated forms of all proportional-, half-, third-, and quarter-width glyphs.
- 2,124 kanji and kanji variants are included, and are ordered and categorized as follows:
 - 83 official traditional kanji forms (from the “Joyo Kanji” document)
 - 5 additional JIS78 (JIS C 6226-1978) kanji variants
 - 229 JIS83 (JIS X 0208-1983) kanji variants
 - 646 other JIS X 0208:1997 kanji variants
 - 13 IBM Selected Kanji variants
 - 1,090 JIS X 0212-1990 kanji
 - 21 JIS X 0212-1990 kanji variants
 - 15 Unicode kanji
 - 20 K-JIS kanji
 - 2 “Dai Kanwa Jiten” kanji

The above list could be misleading, because some glyphs in earlier character classes are included in later character classes. For example, all JIS X 0212-1990 kanji are in Unicode, and some JIS X 0212-1990 kanji are K-JIS kanji. These 2,124 kanji and kanji variants include support for the following sets of kanji or kanji variants (some were already included in Adobe-Japan1-2):

- The remaining official traditional forms as specified in the “Joyo Kanji” document
- The remaining JIS78 (JIS C 6226-1978) kanji variants
- JIS83 (JIS X 0208-1983) kanji variants
- Common JIS X 0208:1997 kanji variants
- IBM Selected Kanji variants

- JIS X 0221-1995 Ideographic Supplement 1 (918 kanji from JIS X 0212-1990)
- All “Kosei Hikkei” kanji variants
- All K-JIS kanji
- Other requests

2.2 *Advanced Typographic Features*

The advanced typographic features of OpenType fonts are encapsulated in the features defined in its ‘GSUB’ (Glyph SUBstitution) and ‘GPOS’ (Glyph POSitioning) tables. Glyphs in OpenType fonts are represented by GIDs (Glyph IDentifiers) in the ‘CFF’ table. (Note that CIDs, Character IDentifiers, in the CIDFont world are analogous to GIDs.) ‘GSUB’ features operate by substituting GIDs with other GIDs. ‘GPOS’ features operate by altering the metrics for GIDs, or between two GIDs in the case of kerning. Complete descriptions of registered ‘GPOS’ and ‘GSUB’ features are available on the web.¹

The Kozuka Mincho Pro and Kozuka Gothic Pro OpenType fonts will include the following ‘GPOS’ features: halt, kern, palt, vhal, vkrn, and vpal. They will also contain the following ‘GSUB’ features: aalt, frac, numr, dnom, dlig, expt, fwid, hkna, hwid, jp78, jp83, nalt, pwid, ital, liga, qwid, ruby, subs, sups, trad, twid, zero, vert, vkna, and vrt2.

There is one special ‘GSUB’ feature, tagged as ‘aalt’ (All Alternate Forms). It is special in that it is possible to define it as a superset of all other non-ligature ‘GSUB’ features. Additional substitutions may be defined in ‘aalt’ above and beyond those that are inherited from other ‘GSUB’ features. These additional substitutions are typically substitutions that cannot otherwise be classified into other ‘GSUB’ features.

2.3 *Font Tables & Overrides*

OpenType fonts developed by Adobe Systems shall include the following 16 ‘sfnt’ tables: BASE, CFF, DSIG, GPOS, GSUB, OS/2, VORG, cmap, head, hhea, hmtx, maxp, name, post, vhea, and vmtx. The outlines are in the ‘CFF’ table, and the advanced typographic features are in the ‘GPOS’ and ‘GSUB’ tables.

The ‘BASE’ table contains ICF (Ideographic Character Face) values that can be used to significantly improve typographic quality in applications that recognize this information. InDesign 1.0J is the first that will recognize these ICF values. Simply put, the ICF values depict a box that represents the average imaging area of ideographic characters. This box is typically smaller than the design space (aka, em-box), and is used to better position characters along typographic edges, such as margins and the like.

The ‘name’ table contains entries for the various names associated with OpenType fonts. For our OpenType Japanese fonts, we include information in Unicode (for Windows, and for the future), Shift-JIS (for Mac OS), and ASCII (for non-Japanese OSes). Of particular interest is that Family and Subfamily names are included, which can be used to form hierarchical font menus in applications, much like what ATR (Adobe Type Reunion) provides on Mac OS.

Various tables and table overrides make significantly improved vertical behavior possible. Consider the following enhancements:

- The ‘vrt2’ GSUB feature includes not only the traditional vertical variants, but also substitutes pre-rotated forms for all non-full-width glyphs.

1. <http://partners.adobe.com/asn/developer/opentype/feattags.htm>

- It is possible to specify a different vertical origin for each glyph by appropriately setting its top side bearing in the 'vmtx' table. This makes it possible to better vertically-position characters that sit on a Latin baseline. The 'VORG' table contains similar information.
- The 'OS/2' table has two fields for specifying the top and bottom of a font's design space (aka, em-box): TypoAscender and TypoDescender. This in itself makes vertical writing much more predictable from an application's point of view.

The use of a Unicode 'cmap' table (equivalent to a CMap file in terms of purpose and functionality) ensures cross-platform use. The 'cmap' table maps character code (in this case, Unicode) to GIDs. This essentially means that OpenType fonts are Unicode (or, Unicode-compliant) fonts because their primary encoding is Unicode.

3. Application & OS Support of OpenType Fonts

Mac OS X and Windows 2000 include OpenType rendering support without the use of ATM (Adobe Type Manager). Earlier versions of these operating systems—such as Mac OS 9 and earlier, Windows NT Version 4.0, and Windows 98—require the use of ATM. Many Adobe applications—such as Adobe Acrobat (Version 5.0 and greater), Adobe Illustrator (Version 9.0 and greater), and Adobe InDesign—include a built-in font renderer that provides OpenType support.

Providing support for OpenType's advanced typographic features requires more than rendering support. Adobe applications' built-in font renderer also provides support for 'GSUB' and 'GPOS' features. Microsoft has developed the OTLS (OpenType Layout Services) library for supporting 'GSUB' and 'GPOS' features in Windows applications. Adobe is coordinating with Microsoft and Apple to determine the best way to provide the same level of support for Mac OS applications.

4. Developing OpenType Fonts

There are now tools available for developing OpenType fonts. Adobe is making an OpenType FDK (Font Developer Kit) available to font and font tools developers in order to enable OpenType font development. The OpenType FDK does not provide tools for building Type 1 fonts or CIDFonts, but does include an OpenType compiler, OpenType proofing tools, OpenType table editing tools, and other useful utilities. The OpenType compiler can even subroutinize the 'CFF' table, which can result in a significantly smaller font file. The Kozuka Mincho fonts have been reduced in size approximately 20–25 percent through the use of subroutinization.¹ Our testing has demonstrated that not all typeface designs benefit from subroutinization.

5. Future Prospects

Adobe-Japan1-4-based OpenType fonts will provide the glyphs necessary for professional and commercial printing in Japan. There are always opportunities to add glyphs through future Supplements. For example, many feel that fully supporting the new JIS X 0213:2000 character set is the next logical step in this character collection's evolution.

1. However, over 500MB of available RAM is required for subroutinization.