Basic Latin brevigraphs listed in *Polonia Typographica Saeculi Sedecimi* (progress report)

1 Introduction

The fonts of the several 16th century printers active in Poland, namely Aleksander Augezdecki, Jan Haller, Kasper Hochfeder, Florian Ungler (the first and second printing house) and Maciej Wirzbięta, has been described in the series of 12 fascicules entitled *Polonia Typographica Saeculi Sedecimi* published in years 1959–1981[1]. Almost all of them are digitized but available only for "digital lending" in ACADEMICA[2] because, I guess, it's not clear who owns the copyright as this was a collaborative effort of several persons (only one contributor is still alive) and institutions.

In the fascicules every font is illustrated by an excerpt of a text and sometimes additionally by a table of character set, an example of such a table is presented on Fig. 1. Most of the tables has been prepared by Maria Błońska with some help of Anna Wolińska and Henryk Bułhak (the editor of several fascicules), some tables were prepared also by Anna Śliwa, Alodia Kawecka Gryczowa (the editor of several fascicules) and Paulina Buchwald-Pelcowa (the editor of the whole series). The number of font tables is 76 and the total number of glyphs in the tables is over 6 hundred. Unfortunately I missed the opportunity to get the first-hand information how the tables were prepared when talking by phone with Paulina Buchwald-Pelcowa in 2022 (she died two years later). Some rudimentary information I got from Henryk Bułhak, also in phone calls, but he was able to provide me only with a rather general information: the glyphs were cut out with a razor blade from photocopies and pasted together. This information seems relevant because it shows what kind of mistakes can be expected in the tables: if a character occurs in a table then it can be displaced or misassigned (cf. sec. 7), but definitely exists in a text, on the other hand some omissions are possible. For example, the glyph on Fig. 2 is not listed in the table on Fig. 1, but can be found in the texts printed reportedly with this font; according to Peter Baker the meaning is *cis*[3].

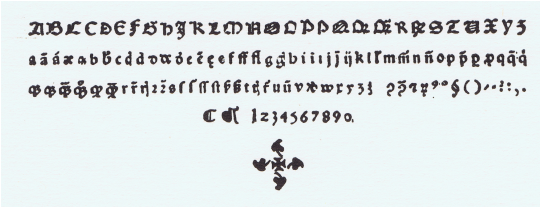

Figure 1: Ungler's second printing house font no 16 (a fragment of Plate 359)

Figure 2: The letter or the ligature *cis*? Cf. Fig. 40

Figure 3: A fragment of Plate 168. The fourth glyph is interpreted as *h*, not a *b*, because of its position in the font table.Cf. sec. 8

Figure 4: A fragment of Plate 357. The last glyph is interpreted as *e* with ogonek because of its position in the font table.

Figure 5: A fragment of Plate 411. The third glyph is interpreted as *h* because of its position in the font table.

No comments to the tables are provided, but the order of glyphs is sometimes relevant for their interpretation, cf. Fig 3, 4 and 5.

The quality of the glyph images is sometimes quite low, I understand no better samples were available.

Early prints used a lot of abbreviations which where the descendants of the abbreviations used in manuscripts; we discuss here a subset of them called brevigraphs. Quite often they consisted of a regular non-modified letter supplemented by a diacritical mark, usually a macron or a similar glyph, placed above. It is natural to call them composed brevigraphs. On the other hand there are abbreviations in a shape of a modified letter or a letter-like symbol; we call them basic brevigraphs even if they are accompanied by a diacritical mark.

The work described here consisted primarily in creating computer indexes allowing to compare similar characters from the same or different fonts, cf. Fig. 6. The indexes and other resources are available

[1] The first two fascicules were published in 1936 and 1937, but we are interested in their second revised editions because they were supplemented by the character set tables.

[2] *Interlibrary loan system of books and scientific publications*: `https://academica.edu.pl/`

[3] `github.com/psb1558/Junicode-font/discussions/255`

in a public repository[4]; the repository site contains *Issues* and *Discussions* tabs which allow to report mistakes and provide comments.

Figure 6: Comparing characters with djview4poliqarp

The paper is considered a progress report for two reasons. First, the character indexes should be supplemented by indexes showing their meaning and their use in texts, in a similar way as described in [5]. Secondly, I omitted some interesting glyphs because I was not sure how to interpret them. An example is presented on Fig. 7: is the last but one glyph a modification of the letter *h* or is this just the letter *h* with a diacritic mark which happens to touch the letter?

Figure 7: A fragment of Plate 21. Is the last but one glyph a basic brevigraph?

The obvious question for every basic brevigraph is whether it has been assigned a codepoint in the Unicode standard[5]. Checking the character charts is unfortunately not sufficient for two reasons. First, the character name is not intended to provide the full information about the character, it should be treated as a more or less arbitrary label. Secondly, in principle (the practise is sometimes questionable) the standard defines characters, not glyphs, and the glyph in a chart is only one of the possible representations of the character (an example is given in sections 9). In consequence it is useful to look up also the character proposals and related documents in the Unicode Technical Committee Document Registry [6] (a similar resource is the ISO/IEC JTC1/SC2/WG2 register[7]). It is also useful to look for alternative glyphs in specialized fonts, cf. sections 12.

Another interesting question is whether the brevigraph has been assigned a codepoint in the Unicode

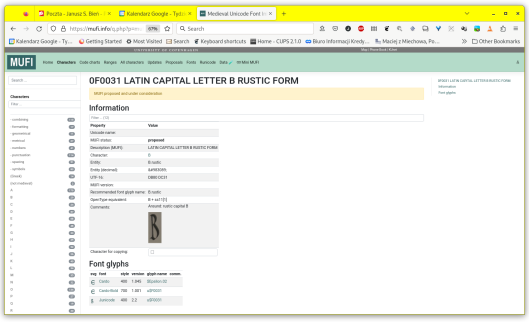

Figure 8: MUFI LATIN CAPITAL LETTER B RUSTIC FORM assignment proposal as of 2024-01-01

Private Use Area by Medieval Unicode Font Initiative[8]. The MUFI assignments at first, up to version 4.0, were published as the recommendations in the form of PDF documents, cf. [11], they list over 1500 pure Unicode and Private Use Area characters in the Latin alphabet of potential use for the encoding old text sources.

Now the recommendations have the form of a database which can be browsed online, cf. Fig. 8. Since some time a subset of the data content is available for download on the Creative Commons Attribution-ShareAlike 4.0 license in the form of a CSV or Jason file.

We will use here also the resources of *Projet d'Inventaire des Caractères Anciens*[9] created and maintained by Jacques André.

Last but not least, it is important whether a brevigraph can be rendered adequatly by a font. Our primary focus is on Peter Baker's Junicode Two font, as it is available on a free license[10] and contains some characters not available elsewhere, cf. [7]. However we use also George Douros' Symbola font[11] when we need a character not available in Junicode.

It is also worth mentioning that some of the brevigraphs discussed here has been already used in Gutenberg's bibles. The character set of these books has been the subject of several publication, they are referenced in [2] and [6]. I found also very useful the unpublished text [4] provided to me kindly by the author (it is attached by the Printing Museum in Lyon to digital copies of a folio of the Gutenberg Bible purchased by the visitors).

2 The workflow

It is an old idea of mine to use the fact that for the compression purpose the identical or similar shapes

[4] github.com/jsbien/early_fonts_inventory
[5] home.unicode.org/
[6] http://unicode.org/L2/
[7] www.unicode.org/wg2/
[8] mufi.info/
[9] jacques-andre.fr/PICA/
[10] github.com/psb1558/Junicode-font
[11] dn-works.com/ufas/

are collected into the shape dictionaries. It seems that this approach, named mixed raster content, is used now in JPEG2000, but the first format to use it succesfully was DjVu.

I designed two tools which are based on this approach. The first one was a quick and dirty modification of a standard DjVu viewer, cf. Fig. 9. It was originally implemented by Michał Rudolf twelve years ago, some important contributions were made later by Alexander Trufanov[12]. It is quite good for getting a quick overview of the shapes in a document, but it is not convenient enough for analysing them in detail[13].

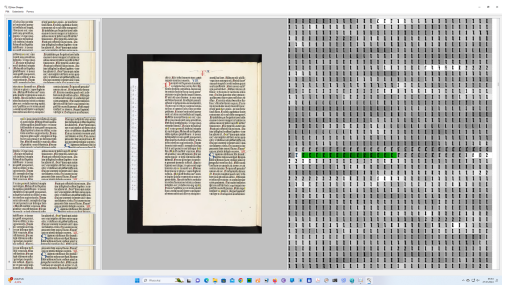

Figure 9: djview-shapes and Gutenberg's bible

The second tool was a sophisticated client-server system. The idea was that a data base will store shapes from different documents provided by different persons or institutions and accessed remotely by interested users. The shapes were exported to a MySQL database. Unfortunately the client[14] was a complete failure, as due to some wrong coding decisions it was prohibitively slow. There was neither opportunity nor sufficient motivation to reimplement it in a better way.

So when working on the present paper my main tool was Alexander Trufanov's `djvudict` program[15] which dump a DjVu shape dictionary in an almost human readable form, despite the fact that the program does not seem to be fully reliable (e.g. for some not yet known reasons some shapes are skipped).

The first step was of course accessing the scans of *Polonia Typographica* and preparing (with Gimp) the images of the relevant tables. Then the images has been converted to DjVu (with Friedric Foebel's Python 3 fork of didjvu[16]) and supplemented by appropriate metadata. Next they have been processed by djvudict. The primary DjVu file names has the form exemplified by `Augezdecki-01a_PT08_403.djvu` where `Augezdecki` in the printer name, `01a` is the font number sometimes suplemented by a letter, `PT08` is the identification of the *Polonia Typographica* fascicule and `403` is the plate number (they are numbered continuosly in the whole series, a lot of them contain woodcuts of no interest to us). The djvudict output is placed in the directories with shorter names, exemplified by `Augezdecki-01a`.

A quick and dirty Python program (written, or rather put together from pieces of code found on the Internet, by myself) convert the djvudict output to an index for the djview4poliqarp program (described already in [5] and [8]); the shape identifiers are preserved. The index contains also the results of OCR made with *Tesseract*, but at present, due to the lack of appropriate training, they are rather of no use. The files names are in the form `Augezdecki-01a.csv`

The indexes require unfortunately some hand editing with djview4poliqarp. The first stage is to create the index named in the form `Augezdecki-01a_tmp.csv` where the interesting elements are marked with '`+`' in the so called comment field; moreover some entries are marked with '`#`' which means that there is a need to adjust the bounding box; it is not yet clear why it is sometimes needed. Moreover some entries are marked with '`^`', they also require adjusting the bounding box, but for a different reason: the shapes recognized by the DjVu compression algorithm are just connecting components, so diacritics are usually separate objects.

The files `*_tmp.csv` are processed with grep to put the marked entries into the indexes named `*_work.csv`, where the bounding boxes are adjusted if needed. The files form the basis for the intermediate brevigraphs indexes named `*_workbr.csv` where the entries are supplemented by the brevigraphs names.

The brevigraph names serve purely a technical goal, they allow to group the similar brevigraphs together in the djview4poliqarp program. However the choice of the names is not obvious. The official Unicode names and the Unicode-like MUFI names are cumbersome because of their length, e.g. LATIN CAPITAL LETTER V WITH DIAGONAL STROKE. In consequence I was considering using names derived from the XML entity names provided by MUFI also for selected pure Unicode characters. Some are short and mnemotechnical, e.g. `&pbardes;` (U+A751 latin small letter P with stroke, here BAR, through DEScender). Some are short and not mnemotechnical, e.g. `&q3app;` (U+E8B4 LATIN SMALL LETTER Q LIGATED WITH FINAL ET; 3 may suggest the shape of the

[12] `github.com/jsbien/djview4shapes`
[13] When the present paper was almost finished, some changes has been made to the program which make it much more useful.
[14] `github.com/jsbien/ndt/wiki/z_shapes`
[15] `github.com/trufanov-nok/djvudict`
[16] `github.com/FriedrichFroebel/didjvu`

final *et*, but I have no association with app), some are mnemotechnical but rather long, e.g. `&lhighstrok;` (U+A749 latin small letter L with HIGH STROKe).

After some hesitation I decided to use those names (with '`&`' and '`;`' stripped) for my purposes. The crucial factor in making the decision was the fact that djview4poliqarp has a kind of macro facility, cf. Fig. 10. The configuration file[17] has the `[edit]` section which can contain appropriate settings.

For characters which are present neither in Unicode nor in MUFI I use some *ad hoc* names; the character which are difficult to identify I handle in an analogical way. Such names often don't identify the glyphs uniqually, they just point to similar glyphs.

For technical reasons the names are placed first in the comment field and then moved to the entry field with a program. The final indexes have the names in the form of `*_br.csv`. An aggregated index is also created which is named simply `brevigraphs.cvs`.

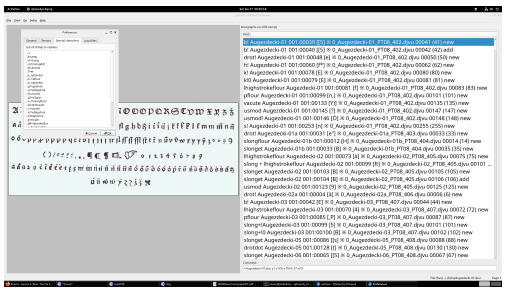

Figure 10: Keyboard shorcuts in djview4poliqarp

The figures in the present paper were prepared in a way similar to that used for [8]: a program converts the index of the selected glyphs into the expex[18] code and creates a set of graphic snippets from the DjVu documents.

The glyphs in the figures are numbered for reference purposes and accompanied by the self-explanatory abbreviations of printing house names and font numbers.

3 Non-alphabetic brevigraphs

The Fig. 11 shows ampersand, the brevigraph which in one of its form survived to present time; it is a very old abbreviation of the word *et*. It has two forms, both of them are available in the Junicode family of fonts: '&' (Junicode-Regular) and '*&*' (Junicode-Italic). In computer code the first form is available at least since ASCII (*American Standard Code for*

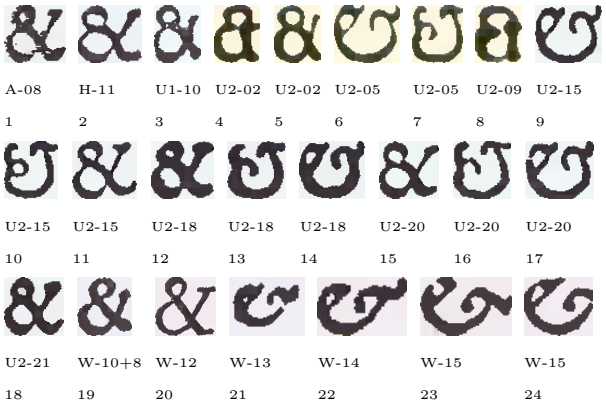

Figure 11: Ampersand

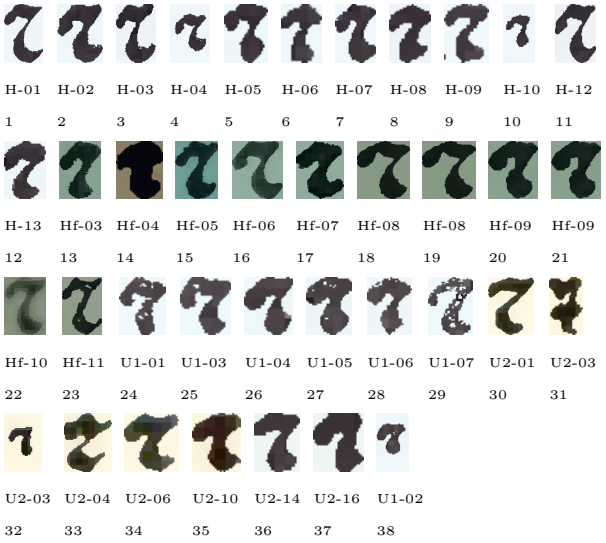

Figure 12: Tironian note *et*

Intermation Interchage), which was created in 1963. The Unicode charts also show only the first form.

The brevigraph presented on Fig. 12 is without any doubt the Tironian note *et* (Tironian notes are named after Tiro, the secretary of Cicero, who is credited to invent them), used always as a separate word. The brevigraph is present in Unicode since verion 3.0 (published in 1999) as U+204A `TIRONIAN SIGN ET` with the canonical glyph '⁊'. The Junicode font has also another variant of the glyph, namely '⁊' (accessed with OpenType character variant feature or just with the code U+F001D), which is quite close to the shape of most glyphs on Fig. 12. Item 31 on the figure is yet another variant, called in the font manual *Tironian et sign later form with bar*; it is available in Junicode only with OpenType feature *ss10* and the tags 'a.tag'i.tag': '⁊'.

[17] `~/.config/djview-poliqarp/djview-poliqarp.conf`
[18] `www.ctan.org/pkg/expex`

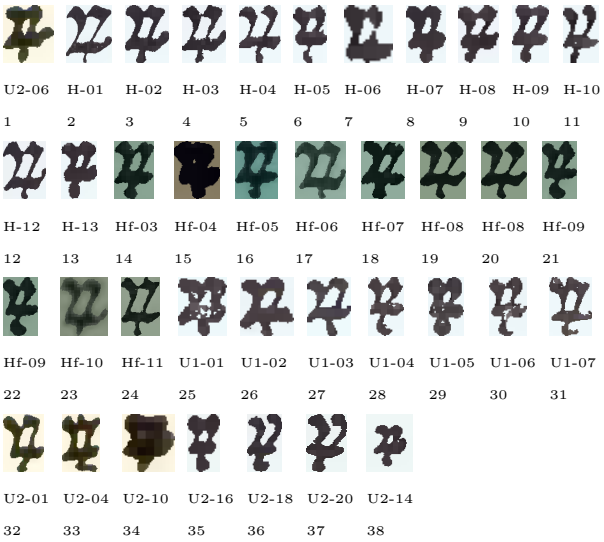

Figure 13: The letter *rum* rotunda

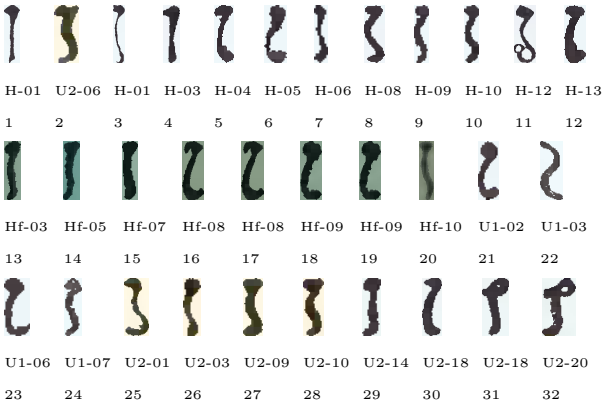

Figure 14: The letter *is*

The brevigraph presented on Fig. 13 is present in Unicode since version 5.1.0 (published in 2000) as U+A75D LATIN SMALL LETTER RUM ROTUNDA with the canonical glyph 'ꝛ', which is quite close to the glyphs on the figure. It can mean *-rum* or *-rom*.

Although the name may suggest that this is a variant of the letter *rum*, their shapes have little in common, cf. sec. 12.

As noted in [1, p. 130], Unicode has additionally two similar symbols: U+0264 JUPITER, U+1F729 ALCHEMICAL SYMBOL FOR TIN ORE. In the Symbola font all the tree characters look respectively as: ♃, ♃ and ♃. They look differently, but this is the decision of the contemporary font designer. The glyphs listed on Fig. 13 probably could represent any of those three characters, this is to be checked in the original texts.

All the glyphs on Fig. 14 are in my opinion the variants of the character U+A76D LATIN SMALL LETTER IS, which is present in Unicode since version 5.1.0 (published in 2000) with the canonical glyph 'ꝭ'. Of course their usage should be verified in the original texts.

The glyphs on Fig. 15 looking like the digit *9* are the instances of the well known brevigraph present in Unicode as U+A770 MODIFIER LETTER US with the representative glyph 'ꝰ'; it was introduced in version 5.1.0 (published in 2008), *modifier* means it is not on the baseline. It is used always at the end of words. The meaning of the glyphs similar to a circle, like item 43, is to be checked in the texts, as it can be just a raised small letter *o*, in Unicode U+1D52 MODIFIER LETTER SMALL O.

Figure 15: The letter *us*

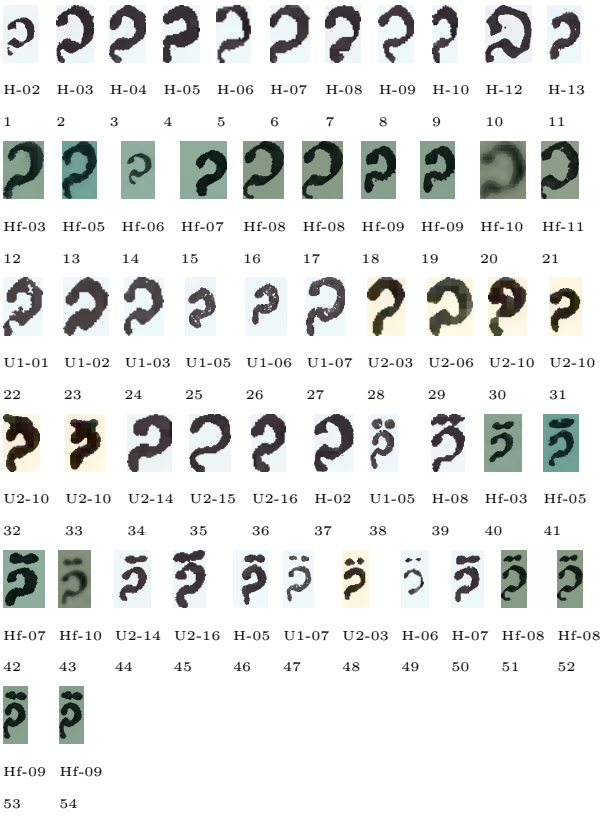

Figure 16: The letter small *con*

The base glyphs on Fig. 16, despite a slightly different shape, can be identified with the character called by MUFI LATIN ABBREVIATION SIGN SMALL CON [11, s. 29] and in Unicode unified with U+2184 LATIN SMALL LETTER REVERSED C with the representative glyph 'ↄ'. As the name suggests, it meaning is just *con* (perhaps with some exceptions).

As for the letter with diacritics, the situation is much more complicated. I have not found yet their occurrences in the texts, so I don't know their meaning. Another problem is the form of the diacritics. Besides a diaresis, we have the diacritic which seem to be the same as the one described in [10] as *jagged horizontal line* which is encoded in Unicode as U+1DD3 COMBINING LATIN SMALL LETTER FLATTENED OPEN A ABOVE but rendered differently: in Junicode is it '◌ᷓ' and in Symbola it is ◌ᷓ. Moreover there is an open question what kind of diacritics, if any, is used in Ungler's font 10 (items 32 and 33).

4 Modifications of the letter *b*

Old texts used many variations of the letter *b*, many of them are assigned code points by MUFI. Many variants of the letter *b* are also listed in *Polonia Typographica*, Fig. 17 presents those of them which are directly relevant to our purpose.

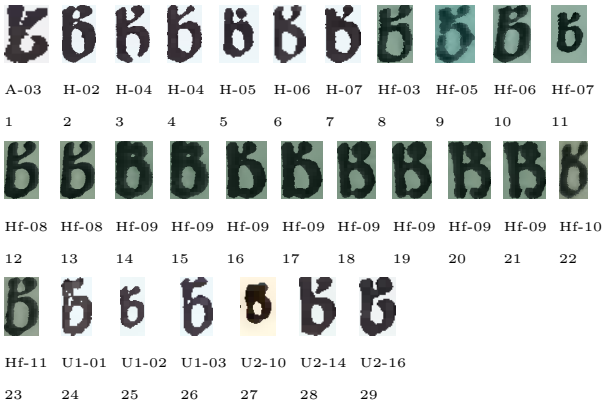

Figure 17: The variants of the letter *b*

We will focus on item 3 (Haller's font no 4) and those from Hochfeder's fonts like item 8-17, as their shapes seem to be carefully designed while other items seem to be just more or less crude versions of it.

Figure 18: Modified letter *b* in Gutenberg's bible: *sublime* and *substantia* (Bodleian Library copy, page 21 and 64 of volume II)

The character with the almost identical shape appeared already in Gutenberg's 42-line Bible. Despite of this it seems it still has no name and even no generally accepted description. In [2, p. 12] Jacques André proposes the name *latin small letter b with flourish* (he considers also an alternative one *latin small letter b ligated with arm of latin small r*, but cf. sec. 8).

According to Gerald Bettridge [4] it means *bis* and, after the long *s*, *ub*, cf. Fig. 18; cf. also [2, p. 12] and [3, p. 12]; it can be ligated with long *s*, cf. sec. 13.

Looks like it not always is a brevigraph, sometimes it is just equivalent to a normal *b*, cf. [6, p. 8] (or perhaps it was just a printer's mistake?).

5 Modifications of the letter *d*

The similarity of item 6 and e.g. 19 to the item 3 from the Fig. 17 and the item 5 and e.g. 8 from the Fig. 22, all from respectively the same fonts, seems to be a design decision.

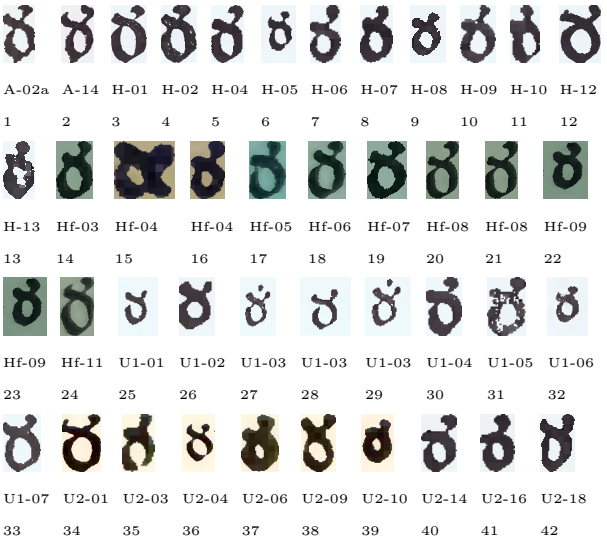

Figure 19: The variants of the letter *d*

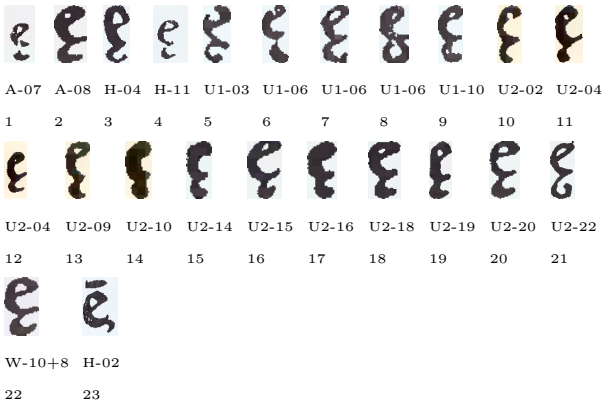

Figure 20: The variants of the letter *e*

Figure 21: The variants of the letter *g*

According to Gerald Bettridge [4] the character also appears in Gutenberg's bible with several meanings[19]. On the other hand the brevigraph is called *d with two ascenders* by Erin Blake in [10]; he states that the brevigraph stands for

> *de* and (depending on the language) also for *der*, *dis*, *dum* and other *d*-syllables

Peter Baker[20] suggest to treat the character as MUFI U+F159 LATIN ABBREVIATION SIGN SMALL DE ('ꝺ'), called also LATIN SMALL LETTER D ROTUNDA WITH BAR[21]. He also points to another similar MUFI character, namely U+EBB2 LATIN SMALL LETTER D ROTUNDA WITH ACUTE 'ꝺ́'.

The meaning of the brevigraph with a dot above is yet to checked in the texts.

6 Modifications of the letter *e*

Fig. 20 presents the well known *e caudata* meaning *ae*.

It is an open controversy whether *e caudata* and the contemporary U+0119 LATIN SMALL LETTER E WITH OGONEK should be considered the same character. Peter Baker wrote[22]

> Perhaps it is time to admit that the Latinate cauda and the ogonek used by Polish and other languages are different beasts.

[19] It is not confirmed by [2], perhaps the author was analizing a different edition.

[20] github.com/psb1558/Junicode-font/discussions/133

[21] mufi.info/q.php?p=mufi/chars/unichar/61785

[22] http://junicode.sourceforge.net/ecaudata.html

and provided an OpenType feature (*ss15*) to distinguish them in the Junicode font[23]. I have no opinion on this matter.

The meaning of the letter with a bar above is yet to be checked in the texts.

7 Modification of the letter *g*

I have very little to say about the glyphs on Fig. 21, as I haven't found any occurence of them in a text. On one hand it resemble the letters *rum*, cf. sec. 12, and *tum*, cf. sec. 14. On the other hand it resemble also the glyph from the Fig. 2. Moreover Blake [10] says that *weird vertical line at end of word* means a *s* preceded by a vowel (typically *es* in English and *is* in Latin); in other words in Latin it can be perhaps considered as the ligature of *g* and the letter *is* discussed already in sec. 3.

8 Modifications of the letter *h*

For some fonts there is an evident similarity of item on Fig. 22, Fig. 17 and Fig. 19. It seems to be a design decision.

The character with the almost identical shape appeared already in Gutenberg's 42-line Bible. In MUFI recommendation it is identified as U+E8C3 LATIN SMALL LETTER B LIGATED WITH ARM OF LATIN ('ꞵ'). Jacques André [2, p. 17] notes that the name is strange and I agree with him.

[23] github.com/psb1558/Junicode-font/issues/13

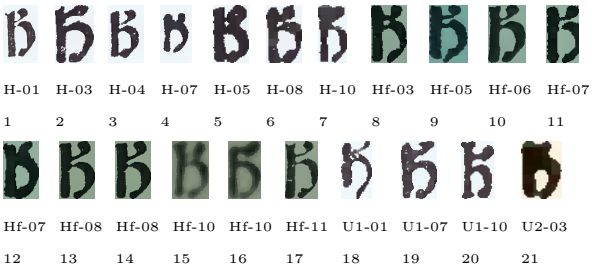

Figure 22: The variants of the letter *h*

The glyphs on Fig. 22 seem to be the same as those described as *h with a tick on top* by Blake, who states

> Stands for *h*-syllables like *han*, *het*, and *hic*

Another interpretation was presented by Lisa Howarth on the Facebook The Paleography Society group[24]:

> When attached to an 'h', it usually means 'er' or 'ab' depending on the word

She considers the glyph to be composed from the letter *h* and an diacritical sign, similarily as Peter Baker[25] who identifies the diacritics as U+0335 COMBINING SHORT STROKE OVERLAY ('◌̵').

9 The modification of the letter *l*

Reportedly the glyphs on Fig. 23 have the same meaning as U+A749 LATIN SMALL LETTER L WITH HIGH STROKE ('ꝉ') and therefore a separate code point has not been assigned[26]. However the Junicode font contains at the code point U+F000F the glyph *l with high stroke ending with flourish* ('ﰏ') accessible also as *l* with the OpenType feature ss10 and the tags '[s]'[f]'.

The character with the almost identical shape appeared already in Gutenberg's 42-line Bible, cf. Fig. 24.

10 Modifications of the letter *p*

Fig 25 contains the variants of a well known brevigraphs, which is available in Unicode since version 5.1.0 (published in 2008) as U+A751 LATIN LETTER P WITH STROKE THROUGH DESCENDER with the representative glyph 'ꝑ'. The brevigraph is ambiguius, the most popular meanings are *per*, *par* and *por*; it can be used as an individual word or as a prefix.

The base characters on Fig 26 are also the variants of a well known brevigraphs, which is available

Figure 23: The variants of the letter *l*

Figure 24: Modified letter *l* in Gutenberg's bible: according to [4] *iherusalem* (Bodleian Library copy, page 574 of volume II)

in Unicode since version 5.1.0 (published in 2008) as U+A753 LATIN LETTER P WITH WITH FLOURISH with the representative glyph 'ꝓ'. The brevigraph is also ambiguous, the most popular meanings are *pro* and *por*; it can be used as an individual word or as a prefix.

The last characters are included in the MUFI recommendation as U+EED7 LATIN SMALL LIGATURE PP WITH FLOURISH with the glyph 'Ꝕ', the meaning is *prop-*.

The meaning of the characters with diacritics is yet to be checked in the texts.

11 Modifications of the letter *q*

The glyphs on Fig. 27 represent a well-known brevigraphs, which is included in Unicode since version 5.1.0 (published in 2008) as U+A757 LATIN SMALL LETTER Q WITH STROKE THROUGH DESCENDER with the representative glyph 'ꝗ'. It can be used as an

[24] facebook.com/groups/7687162686/permalink/10158299890607687

[25] github.com/psb1558/Junicode-font/discussions/133

[26] github.com/psb1558/Junicode-font/issues/4

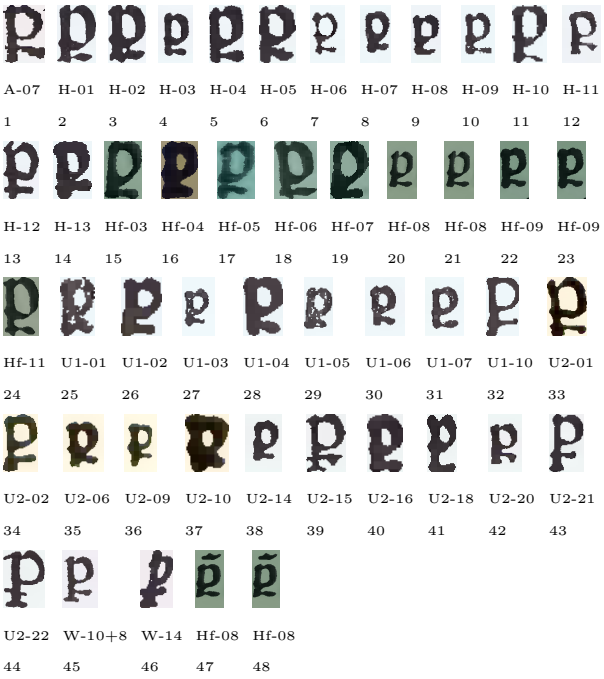

Figure 25: The letter *p* with stroke

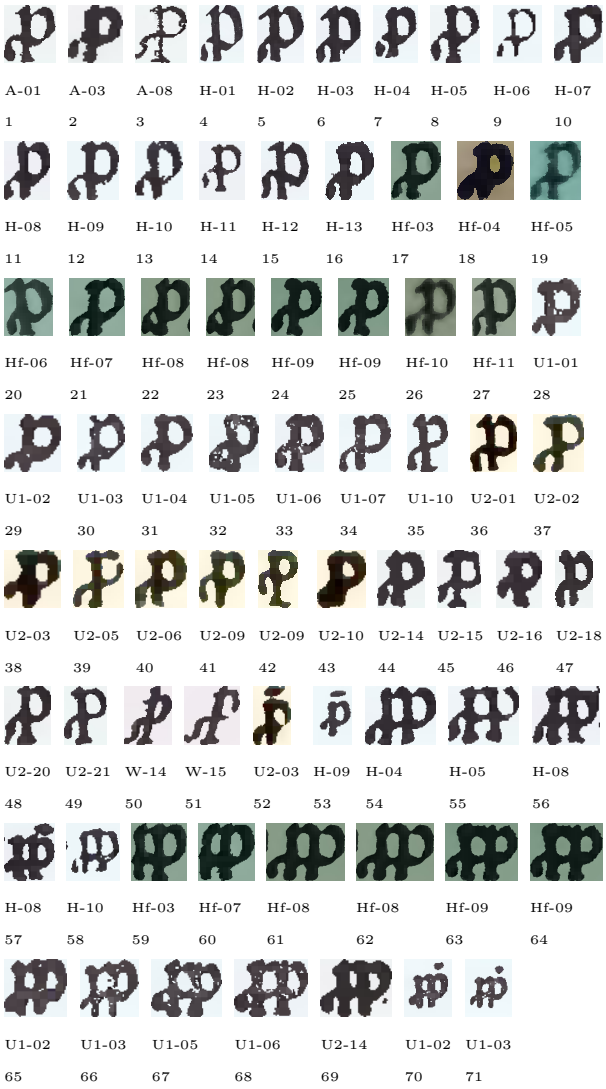

Figure 26: The letter *p* with flourish

individual word or as part of it and is quite ambiguous, the reported meanings are *quam*, *que*, *quan-* and *qui-*.

The Fig. 27 demonstrates also various kinds of diacritical marks which can be used with this brevigraph. The meanings of modified brevigraphs is not clear and requires some further research.

The characters on Fig. 28 are in my opinion the variants of the brevigraph introduced to Unicode in version 5.1.0 (published 2008) as U+A759 LATIN SMALL LETTER Q WITH DIAGONAL STROKE with the representative glyph 'ꝙ', although such a classification of some shapes is questionable. The Unicode name is not very adequate, in [3, p. 70] the name LATIN SMALL LETTER Q WITH SWASH is proposed. The brevigraph has three meaning: *quod*, *qui* and *que*; it can be used as an individual word or as a part of it.

The meanings of modified brevigraphs with diacritical marks is not clear. Here we will only mention that in [3, p. 71] a glyph similar to those from the Fig. 28 is classified as LATIN SMALL LETTER Q WITH SWASH AND LATIN SMALL LETTER FLATTENED OPEN A ABOVE (an alternative name LATIN SMALL LETTER Q WITH FLOURISH . . . is also considered), and an example is given where the brevigraph means *quan-*.

The glyphs presented on Fig. 29 represent the brevigraph assigned a Private Use Area code U+E8BF and the name LATIN SMALL LETTER Q LIGATED

Figure 27: The letter *q* with stroke through descender

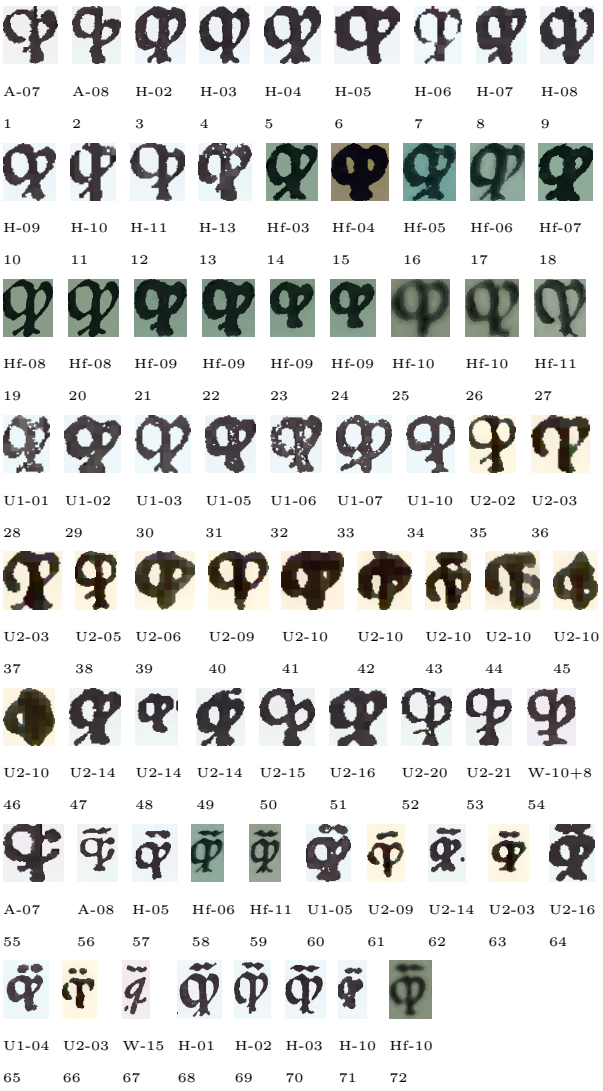

Figure 28: The letter *q* with diagonal stroke

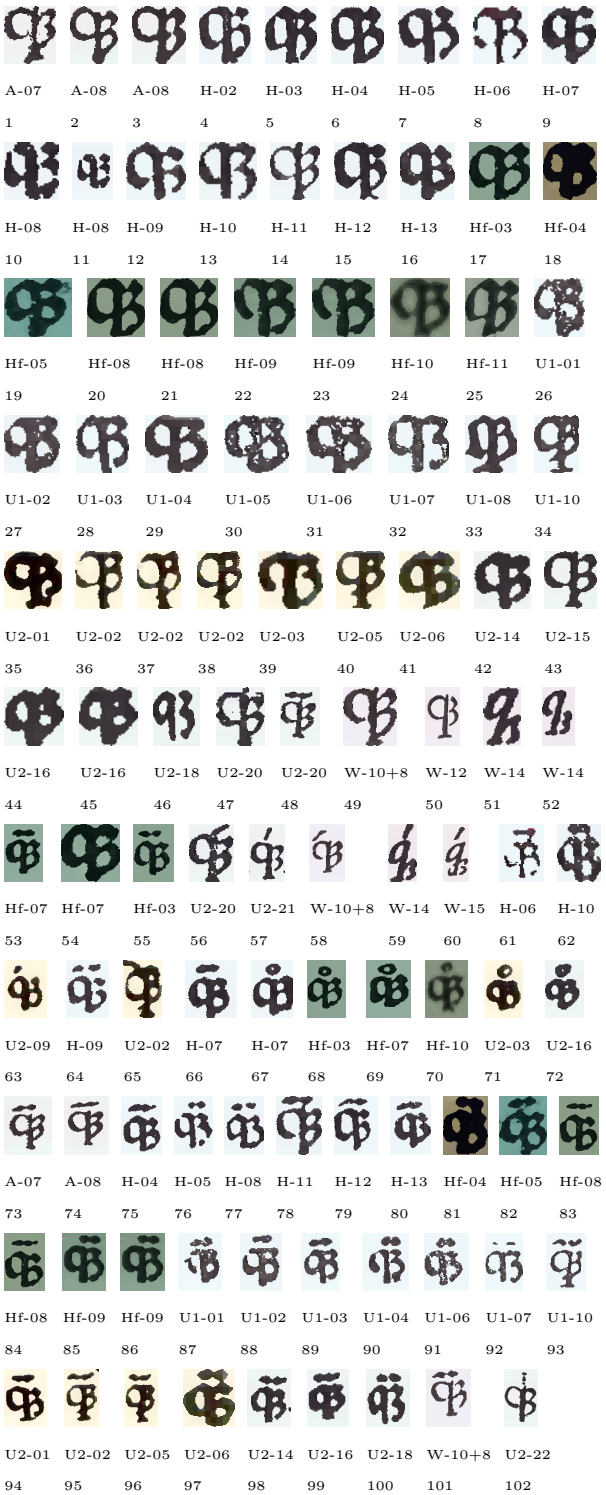

Figure 29: The letter *q* with with final *et*

Figure 30: The alternative glyphs of the letter *rum*

Figure 31: The alternative glyphs of the letter *response*

WITH FINAL ET by MUFI in the version 4 of the recommendation [11, p. 81], in the Junicode font rendered as '℔'.

Finding the meaning of the brevigraph with a diacritical mark requires some additional research. We will only note that according to [10] some of the glyph from Fig. 29 mean *quam* or *quan*.

12 Modifications of the letter *r*

The first glyph on Fig. 30 is an interesting and rather little known character. Although this is far from obvious, it is U+A775 LATIN SMALL LETTER RUM despite the fact that the Unicode representative glyph is 'ꝛ', as in Junicode we have 'ꝛ' — the glyph practically identical to that on the figure. The charactert was introduced to Unicode in version 5.1 (published in 2008), together with some other similar character, cf. sec. 14. I assume the second glyph on the figure is just a variant of the first one.

The glyphs on Fig. 31 are ambiguous. They can represent U+A776 LATIN LETTER SMALL CAPITAL RUM (ꝛ), but they can also be interpreted as U+211E PRESCRIPTION TAKE ('℞') and, last but not least, U+211F RESPONSE ('℟') which in prayer books can be paired with *versicle* character, cf. sec. 15.

13 Modifications of the letter long *s*

The glyphs on Fig. 32 are noted in the MUFI recommendations as M+E8B7 LATIN SMALL LETTER LONG S WITH FLOURISH ('ﬕ').

The glyphs on Fig. 33 are present neither in Unicode nor in the MUFI recommendation, but they are obviously the long *s* (U+017F) ligated with the final *et* (U+A76B). As far as I know, this ligature is available only in the Junicode font[27] with the Historic Ligature (*hlig*) feature: 'ﬖ'. Th meaning is *sed*, as exemplified in [9, example (68)].

[27] github.com/psb1558/Junicode-font/discussions/140

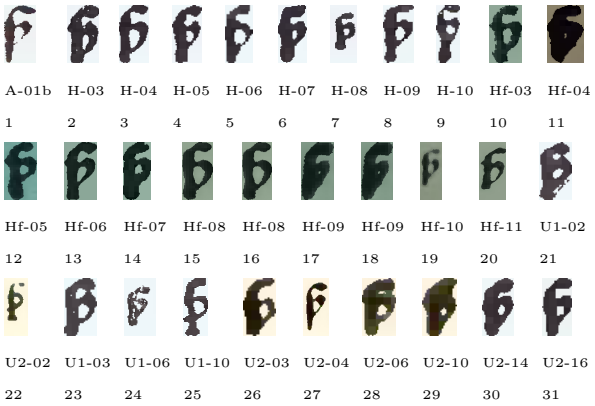

Figure 32: Long *s* with flourish

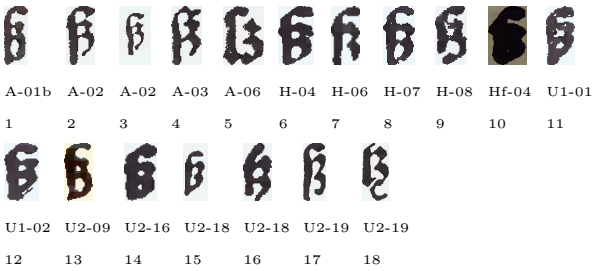

Figure 33: Long *s* with final *et*

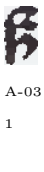

Figure 34: Long *s* with final *et*?

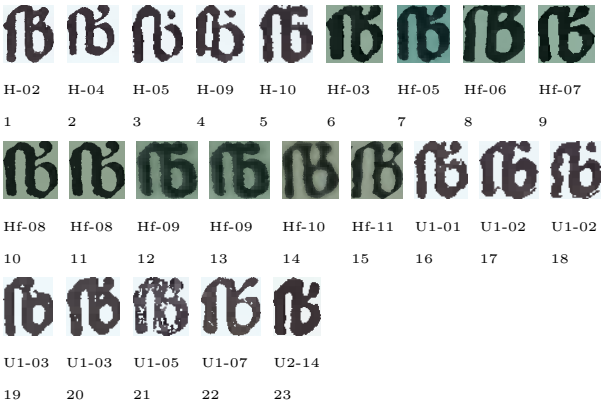

Figure 35: The ligature of long *s* with the letter *b* and its modifications

Figure 36: The ligature of long *s* with the letter *l* with flourish?

Figure 37: The letter *tum*

Fig. 34 shows a problematic glyph which I'm not sure how to interpret.

One of the component characters of the ligatures presented on Fig. 35 has been already mentioned in sec. 4. We see also the letter *b* with a dot above; the meaning of the letter, ligated or not, is yet to be investigated.

It is worth noting that in item 18 instead of a normal long *s* we have a LONG FUNNY S proposed to be included in the MUFI recommendation[28].

On Fig. 36 we have a ligature which can be perhaps treated as a variant of MUFI U+E8AF LATIN SMALL LIGATURE LONG S L WITH DIAGONAL STROKE ('ﬦ').

14 Modifications of the letter *t*

The Fig. 37 shows the rather rare brevigraph, namely U+A777 LATIN SMALL LETTER TUM with the representative glyph 'ꝧ'. It was introduced in version 5.1 (published in 2008), together with some related

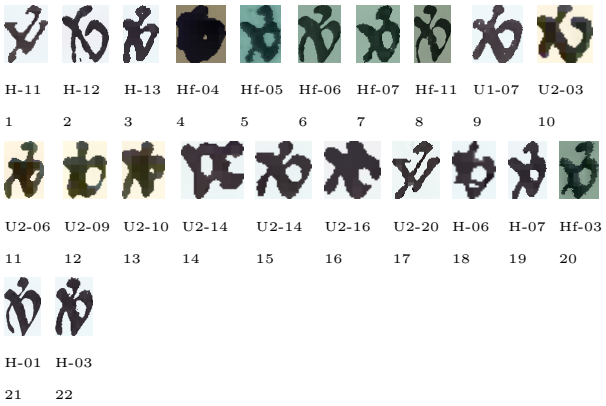

Figure 38: The letter *v* with diagonal stroke

letters such as U+A775 LATIN SMALL LETTER RUM, cf. sec. 12.

15 Modification of the letter v

The primary interpretation of the glyphs on Fig. 38 seems to be U+A75F LATIN SMALL LETTER V WITH DIAGONAL STROKE ('ꝟ') added to Unicode in version 5.1.0 (published in 2008); in item 14 it is the other arm which is crossed. It means *ver* or *vir*.

The glyphs can stand also for U+2123 VERSICLE ('℣'), used to mark in the prayer books the beginning of a versicle, i.e. a short sentence said or sung by the minister in a church service, to which the congregation gives a response[29].

16 Final remarks

As it was already mentioned, the next step should be to find the occurences of the discussed brevigraphs in the texts and in this way to find or verify their meaning. We don't need for this the full transcriptions of the texts. What is sufficient for our purposes is *glyph* or *character spotting*. These tasks are discussed in some publications, but there seems to be no tool available directly for use. With some limitation a variant of a workflow described earlier can be used for this purpose. The djvudict can be converted to a PDF document (created of course with TEX) with enlarged glyphs which make relatively easy to search for interesting items and to note their identifiers, cf. Fig. 39. Additionally an djview4poliqarp index can be created, which uses the shape identifier as the searchable entry fields, cf. Fig. 40. The identifiers are not unique, nevertheless it is possible with some effort to find the context of a shape in the document, as illustrated on the Figures 39 and 40 (please note the shape 01344).

[28] mufi.info/q.php?p=mufi/chars/unichar/1048876

[29] The definition provided by Google in a non-linkable form.

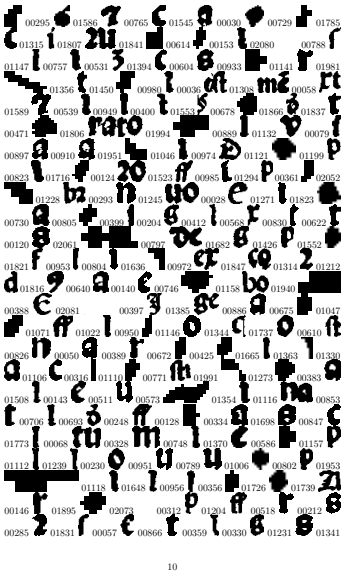

Figure 39: The djvudict output in the form of a PDF document

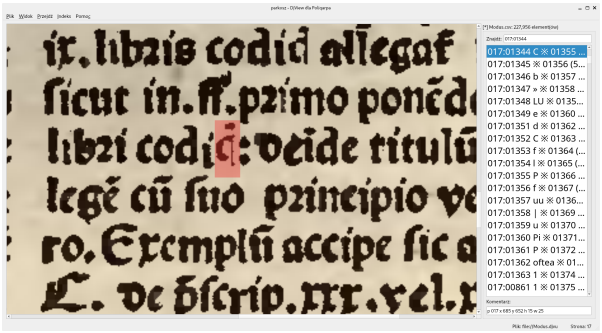

Figure 40: The djvudict output in the form of a djview4poliqarp index

At present my programs supporting this approach are too primitive to be used conveniently, but I will try to improve them. A help of Python and QT programmers (QT was used to implement djview4poliqarp and djview4shapes) would be welcomed and appreciated.

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