

Design and Positioning of Diacritical Marks in Latin Typefaces

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Abstract:

This paper presents relevant information concerning the types, shape and positioning of diacritical marks in Latin typefaces. The aim is to increase the awareness of the importance of diacritics, their design and use. The design of the lowercase d-croat letter presents a particular problem, because it is present only in the Croatian and Vietnamese script and is therefore often incorrectly designed or it is missing the respective font. Data on the most common methods of shaping and positioning of this diacritical sign was collected by measuring the geometry of the d-croat letter in various fonts. Most common designers' mistakes were shown and evaluated. Suggestions for the design of diacritical marks are proposed taking into account asymmetry, width, uppercase, vertical and horizontal positioning and cultural preferences.

Keywords:

Diacritical Mark, Typography, Character Design

1. Introduction

Despite a large number of fonts, available technology (both software and hardware), and technical capabilities in the form of coding systems, there are many fonts that lack certain characters, thus disturbing proper written communication of non-Western Latin script users. Lack of information on the design of diacritical marks, as well as the fact that this issue is not given enough importance present a problem to native readers, typographers and font designers who would like to create or use all needed

characters in a particular language. Diacritics are signs that change the meaning or the pronunciation of certain letters, and without them, correct grammar and written communication come into question.

When designing diacritics one should be aware of their thickness (contrast), size, vertical and horizontal positioning with respect to the base letter, cultural preferences and the advance width. Diacritics can be positioned above, below, beside, or go through the letter. A particular problem arises in designing the Croatian

dcroat letter [ḍ] due to the lack of information and frequent errors in the design of existing fonts. The main determinants for re/designing this delicate letter were established by measuring various fonts.

2. The importance of diacritics

Printing text implies printing letters as well. The editing of these letters is an essential factor in the graphic and typographic design quality. When they come on to the market, fonts are mostly not ready for use; most of them are raw. Most of the characters and their widths are correct, but the need for corrections is inevitable. Only in the so-called „expert set“ we can find old style figures, ligatures etc. and still some characters will be lacking. Even when they exist, rarely used characters are well hidden in special tables which are hardly accessible to an average user. Letters with diacritics are not only required by native speakers but also the editors of international texts or texts that contain Polish, Czech or Croatian names. Although they sometimes are in inaccessible places and are often even missing, these characters should not be hard to make. The manner in which these changes will be made depends on a designer's knowledge of certain cultures/scripts. The kerning tables included into typographic software are usually not adjustable to languages other than English, Spanish, French or German. Letters with diacritics are in most cases not included in these tables and have to be adjusted manually. If letters with diacritics are required often, it is necessary to create these characters in the font itself. (Bringhurst, 2000)

Many typographers and designers whose native languages do not include letters with diacritics underestimate their importance. These scripts are generally less known because of their seldom use in Western countries. They include African, South American and Asian scripts, but also scripts characteristic for Central Europe. (Březina, 2009)

Most languages use Latin alphabet, and the English language is the only one that does not include diacritical marks. Latin script represents the phonological system of the Latin language well, but problems arise if the Latin script is used for languages whose phonetics use sounds that do not exist in Latin. For example, Croatian letter š that sounds like [ʃ], is often spelled *sh* in English, *ch* in French, *sc* in Italian, *sch* in German...and unlike Croatian, other languages use a digraph and not a diacritic. Croatian digraphs are: dž, lj and nj. Adding a diacritical mark is just one of the ways we can overcome the shortcomings of the Latin script. (Wells, 2000)

Digital technology now provides the ability to create and use all scripts; we can buy complete fonts that include all characters required for all European and most world scripts. Nevertheless, the illiteracy of typographers, designers and journalists can be noticed often and it emerges from the fear of characters with diacritics. Purchased and received fonts (with purchased software) contain many characters, but often lack small caps, old style figures, ligatures and diacritics. Each letter is the reflection of a culture accumulated through history and tradition. Typographers working with different scripts are forced to become acquainted with minor cultures due to typographical characteristics of individual scripts that they contain. In addition to all letters, uppercase and lowercase, Latin script contains around 1000 glyphs, which include diacritics, Arabic figures, punctuation, technical symbols, ligatures and letters borrowed from other scripts like Greek, Hebrew and Cyrillic. The components needed to produce rare characters (i.e. from Eastern Europe) are usually present in a font and a good typographer with adequate software and cultural knowledge should not have problems with their formation; but if these letters are present and poorly designed, they need to be corrected with certain skills and confidence. (Bringhurst, 2005)

Microsoft's Character Design Standards is the only available source of diacritical marks design. It generally does not provide the description of characters themselves, but their positioning. Due to the lack of available informa-

tion, the largest source are the characters from existing fonts. However, this information can be misleading because it is easy to assume that every detail has its purpose and every difference is meaningful, but mostly these are mistakes or results of ignorance, especially if the subsequently added characters were not made by the original designer. (*Gaultney, 2002*)

WHAT ARE DIACRITICS?

Diacritics are characters that can either be added to the existing letter, or merged with it, and have various functions. They create new compound glyphs (graphemes) that represent new phonemes characteristic for a particular language. Although these characters are usually separated from the base letter, this does not diminish their importance, nor characterizes them as punctuation. (*Březina, 2009*)

Diacritics are marks added to letters to change their original meaning or pronunciation. They can be positioned above, below, through the letter or anywhere around the letter. The word originates from Greek and means “different”. They can be found in old medieval manuscripts from the 13th century. In most digital fonts, most common diacritics are: acute, grave, circumflex, dieresis and tilde. Due to the growing need for understanding and use of letters with diacritics, it is necessary to explain their visual features, such as design and placement, and not linguistic features. In Unicode all diacritics have their own positions specifically intended for three modes of use: above, below or through the letter (usually Latin letters). They can be classified according to their horizontal features: symmetrical and asymmetrical – centred and offset; and vertical placement: above, top right, through and below. (*Gaultney, 2002*)

3. Coding

When personal computers became available to the general public, it was not possible to use

glyphs with diacritic marks due to the 7-bit American Standard Code for Information (ASCII); ASCII has 128 (94 visible) available coding places that include 26 uppercase and 26 lowercase letters, punctuation, space and DEL. A significant improvement was made with the 8-bit coding system based on ASCII and another 128 places (256 all together). Different sets of characters were made depending on the area of usage. Latin 1 was intended for Germans, Spanish people, French, Italians, Portuguese and Scandinavians. Latin 2 included Eastern Europe (Poland, Czech, Hungary, Croatia etc.); Latin 3 Southern Europe, and Latin 4 the Baltic countries. There were also sets for Cyrillic, Greek, Arabic, and Hebrew. Problems occurred when someone wanted to use more than one language and was forced to change sets when needed. The 16-bit Unicode system was introduced because these solutions were inadequate. Unicode became standard, probably due to the Internet and the need for globalization of communication. Every Unicode symbol is a hexadecimal code of 4 figures: U+xxxx. In Unicode, diacritical marks are presented with their own separate coding places, but also as all combinations. (*Wells, 2000*)

4. Design and positioning

In the time of lead type, the creation and design of letters was solely dependent on type foundries. These foundries, such as Monotype and Linotype, had all the copyrights of these fonts. Given that there were no type foundries in Croatia at that time, Croatian printing houses ordered their sets of fonts from the Czech Republic or Germany. This means that the design of Croatian letters with diacritics was not dependant on Croatian typographers, designers or printing houses, but foreign type foundries where these fonts were made. In the time of phototypesetting, the computerization process was taken over by the big type foundries with the respected copyrights. However, when the digitalization of fonts to PostScript format was required, Professor Vilko Žiljak and Professor

Klaudio Pap of the Faculty of Graphic Arts took on the task. In 1990 they digitalized over 3000 fonts that worked on all major popular systems at the time and determined coding places for all Croatian letters. These fonts were used in newspaper publishing all over Yugoslavia. (*Žiljak & Pap, 1990*) These Croatian letters were the first attempt to design diacritics by the Croatian authors and remained in use until large corporations like Microsoft and Adobe concerted to Unicode standard, beginning to include letters with diacritics in some of the fonts that they produced.

Some of the biggest type foundries still use the same sets of accents in their fonts, which results in a bad design and confuses young designers. Good design guarantees legibility to the native reader. It is important that the accents are consistent with the design of the whole font: it should not be thinner or thicker than the base letter (adequate contrast); their size should be adequate (especially in smaller sizes because it can cause the mark to be unrecognizable.); its position depends on the base letter (it is usually placed centrally above or below the letter, but there are some diacritics that are placed in the upper right corner like ogonek, next to the letter or through the letter).

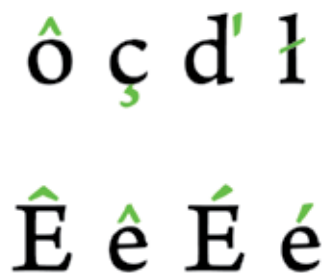


Fig. 1 Positioning of diacritical marks, the difference between uppercase and lowercase letters (Arno)

The design depends on the font variant (display/text) and font-weight (bold/light). It is important not to change the balance of the base letter or disturb the stylistic harmony of the glyph. The contrast of the diacritical mark

should not usually be identical with the contrast of the base letter. It is advisable to reduce the contrast, because the diacritics themselves are smaller; however it is necessary to beware of the thinner parts so they would not disappear at smaller font sizes. The style of character endings should be identical with the endings of the base letter, but more elaborate terminals like serifs or bulbous terminals should be avoided in diacritical design. The differences in the thickness of strokes should be as similar as possible. Diacritics on uppercase letters are mostly different in design due to the lack of space. It is particularly important that these marks do not collide with the next letter, thus creating illegible shapes. It is therefore important to carefully determine character widths, advance widths and kerning. (*Březina, 2009*)

According to J. Victor Gaultney there are five basic problems in the design of diacritical marks: asymmetry, width harmony, vertical spacing, capitals and cultural preferences.

5. Assimetry

Balance is important in typography – if the alignment of terminals is unbalanced, it can appear that the character is leaning to a certain side and this creates tension in the reader. Horizontal alignment of diacritics and the base letter have to be in balance. This is not a problem in symmetrical letters and symmetrical diacritics. A character can have many centres, mostly mathematical, but the optical middle is crucial for correct diacritical positioning.



Fig. 2 Positioning in regards to the base character (Arno)

The unwritten rule of finding optical centre of asymmetrical characters (like p,b,d,h) relies on the width of the counter, and not the whole character. After determining the mathematical middle, it is necessary to visually adjust the position based on previous experience. Problems occur particularly in asymmetrical serif characters where determining mathematical or optical centres do not ensure proper positioning, but individual adjustments have to be carried out. Accents like acute and grave are the most common examples of aligning asymmetrical letters with asymmetrical accents. (i.e. Croatian character ć – c acute)



Fig. 3 Positioning and designing of the diacritic acute

These marks are deliberately mathematically or optically misaligned with the base because of historical and aesthetic reasons. There are many ways in which diacritical marks can be placed above the letter depending on the base (if it is symmetrical) and the angle at which the accent is placed (usually 45° or less), but it usually depends on the visual balance that should be achieved. There are some programming solutions that include the creation of subroutines and determine optical centres of certain letters or characters.

6. Width

After positioning, the problem is also the defining of advance width to avoid overlapping.

One of the solutions is the creation of ligatures like fi. With diacritics, the most common problem is when the mark is wider than the base letter, particularly in bold font-faces. In sans-serif fonts there is even less space for the diacritics normally created by the serifs. There are various solutions: one of them is that with narrower letters (e.g. i) diacritics like acute are placed under steeper angle than with wider letters such as m. This strategy of changing diacritical marks depending on the base letter is the most common one. The easiest solution would be kerning. Kerning depends on the language so that it is hard to predict all the kerning pairs for all the languages and all the characters. With this method it is also possible to disrupt the harmony of the negative areas between the characters.

7. Vertical positioning

There are two ways of aligning diacritics vertically: the first is to align the bottom of all diacritics with the bottom end of acute and grave which is the most common way in sans-serif fonts; the other way is to align them according to their vertical middles.

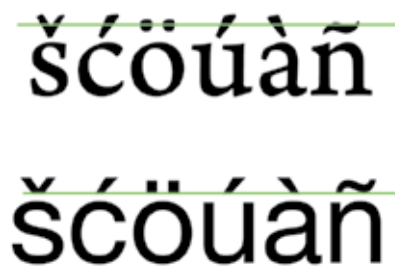


Fig. 4 Aligning diacritical marks: vertical middle (Arno) and bottom (Helvetica)

The situation gets complicated if there is a need to place two diacritical marks on the same character one on top of the other.

8. Capitals

Placing diacritical marks on capitals is challenging due to the lack of space. We can change the character itself, the accent or both. Usually, the diacritic is adapted by reducing its angle or shortening it.



Fig. 5 The differences of acute and grave in capitals and lowercase characters – Jenson, Helvetica, Arno

These adjustments were normal at the time of lead characters. With the transition to phototypesetting and the beginning of the digital age of type design, diacritical marks became identical in upper and lowercase letters. Even digitalized fonts that originally had different diacritics had their diacritics replaced so that the design would be equal. The other solution is to reduce the size of the capital character, which would make the diacritical mark “fit”, but usually the space between the letter and the diacritic would be reduced, thus preserving a more unified design.

9. Cultural preferences

All these visual problems have a linguistic or cultural background. Design and alignment of each diacritical mark depends on the language of origin. The width depends on the use of certain pairs of characters in that language. Under-

standing cultural preferences of a certain language helps designers in creating better fonts. However, it is harder to adjust type design for international users. Cultural background affects in particular the definition of size and width of diacritics. In French, diacritics affect the semantic meaning of words less than in Croatian, and may therefore be less noticeable. If you omit diacritics in French, basic communication will still be possible, so the diacritics may be smaller. Distinct ethnic design is rare in typography. Eastern Europeans will more likely buy fonts from Western type foundries and make the adjustments needed in their language. That way certain diacritics can be customized for a specific use.

It is difficult to obtain information on the design of diacritics without extensive study of type foundries documents. Little has been written, and problems arise in press and with linguists (insufficient legibility, smudges instead of diacritics etc.) The fact that production and design of fonts with extended number of characters increases the design price, but does not bring as much profit, should not be ignored. This allows us to conclude easily why so many fonts have inadequate diacritics or have no diacritics at all.

The need for extended sets of characters is obvious. The technology is available, but designers need to participate actively in their design. It is necessary to increase the amount of available information on special characters design from less popular scripts through relevant publications. The standards for the design of diacritics do not exist. There are many fonts without or with inadequate diacritics, and since they are the only sources of information about their design, they often mislead graphic designers into wrong conclusions.

For many years large font foundries concentrated only on the design of diacritics of Western typefaces, but owing to, among other things, the expansion of the European Union, this kind of behaviour is spreading towards the Central and Eastern Europe. However, smaller type foundries still lack the motivation for completing the Unicode table. Designers need more information on the design of diacritics, including cultural preferences, detailed information on each

and every diacritical mark with historical references and recommendations for best solutions. Microsoft offers little information on individual characters and many remain unmentioned. There is also a need for linguistic information on frequent combinations of letters and individual diacritics around the world. (Gaultney, 2002)

Diacritics are marks placed above, below or through the letter, and they change the pronunciation of the respective character.

ABOVE:

One of the most common diacritics is *acute*. It is used in Spanish, Czech, Irish, Slovak, French, Polish, Croatian, etc. More often it indicates stress in a word, rarely the pronunciation (e.g. palatalization in Polish or Croatian *ć* - *cacute*). The angle of this accent may vary depending on the language (in Polish the angle is steeper than in French, Croatian or Czech).

Acute occurs in Czech in the 14th century and in Hungarian in the 16th century. Its angle varies a lot: in Polish it is almost vertical. What is important is the harmony and the integration into the rest of the font. Horizontal positioning moves slightly to the right of the centre, but so as not to produce the effect that it is “falling” off the letter. The more gradual angle, the closer the bottom may be to the optical middle of the base; the steeper the angle, the mark must be optically centred above the base character. The

angle must be identical to the one of the grave accent. If there is a difference in the thickness of the strokes, the contrast should decrease towards the bottom. Unicode place: *Cacute* #0106 *cacute* #0107 (** 2010)

Caron (wedge) or *hacek* (in Czech) is known to the Slavists in the letters like *š*, *ž*, *č* and *dž*. Its first occurrence is noted in Czech in the 15/16th century. In Croatian it is called *kvačica*. It is similar to circumflex, but rotated by 180 degrees. Both caron and circumflex have the same contrast and thickness of lines. The contrast diminishes towards the top end. They can be symmetrical and asymmetrical. Unicode place: *Ccaron* #010C *ccaron* #010D *Scaron* #0160 *scaron* #0161 *Zcaron* #017D *zcaron* #017E. (** 2010)

If any, typographers often have only one type of diacritic available, which is intended to be merged with the required character, however it does not yield satisfactory results. The first difference is the height of characters (lowercase and uppercase), the second is the horizontal position (e.g. in I and W); it is therefore better to make each special character individually uniting it with the diacritical mark, otherwise the results are too unpredictable. Difficulties with finding enough space for diacritics in uppercase letters are known to have resulted in the omission of diacritics (especially in French).

Other diacritics placed above the letter are: Grave, Circumflex, Breve, Macron, Dot, Diacresis (Umlaut), Tilde, Double Acute, Ring, Hook.

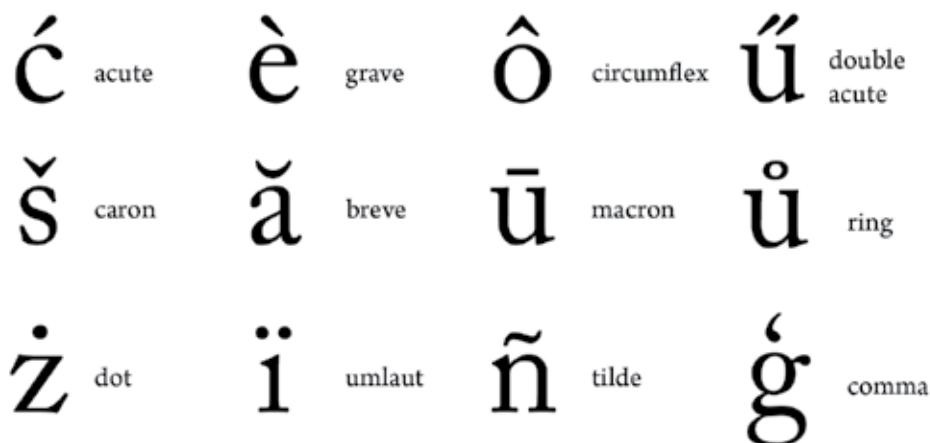


Fig. 6 Diacritics placed above the letter (Caslon)

THROUGH AND BELOW:

Unlike diacritics placed above the letter, the ones placed below or through the letter are often connected to the base character.

The Bar is placed through the letter. The difference between the Bar and the Slash is that the Bar is horizontal, and the Slash is diagonal. Character dcroat (Đ) is used in Croatian, Vietnamese and Sami language. The uppercase version can also be found in Icelandic, but the lowercase version is completely different. Unicode place: Dcroat #0110 dcroat #0111.

Other diacritics placed below or through the letter: Horn, Cedilla, Comma, Tail (ogonek), Dot, Slash.

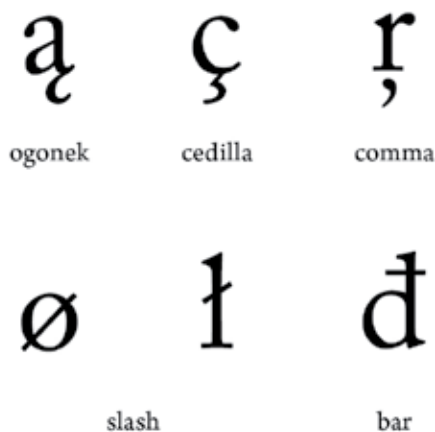


Fig. 7 Diacritics placed below or through the letter (Caslon) (Wells, 2000)

10. Diacritical design standards (for Latin typefaces)

Historically, the difference in uppercase and lowercase letters of diacritical design is common. In uppercase characters, the diacritics would usually be shorter to fit inside the glyph window. There are algorithms that create compound characters of certain characters and diacritical marks. These systems use programmed logic that merges these characters in one new letter.

There are also diacritical marks without any width value. They assume the width of the character which they are placed on. These characters should have the same proportional width as the base character.

There are two ways of vertical positioning of diacritical marks. Both ways are based on the model of *acute* and *grave*. The most common method is centre alignment on the height of the acute and grave. The other, less popular method, relates to the aligning in accordance with the bottom of acute/grave.

Diacritics are most commonly vertically placed so the space between the bottom of acute is offset 5 to 10% of the glyph window. Uppercase diacritics are closer to the base character. Horizontally, they are visually centred at the base glyph. The grave and the acute are the most difficult to place. One possibility is to place thinner part of the accent through an imaginary line that goes through the optical middle of the character. The other possibility is to place 1/3 of the diacritic on the left side of the optical centre and 2/3 on the right (with acute). Further visual adjustments are needed depending on the design. Polish acute is steeper than in most typefaces and so one should be aware of the cultural preferences. (** 1998)

11. Problems with dcroat character

A particular design problem is present in the lowercase dcroat letter (đ), because it is rarely used and asymmetrically shaped. It is used only in Croatian (Serbian, Macedonian, Bosnian), Vietnamese and Sami. Following the idea of Ljudevit Gaj, Đuro Daničić proposed its usage in the Croatian writing in 1878 in the academic dictionary of the Croatian Language. 'The appearance of the letter Đ/đ is based on the idea of the organizers of our graphics in 1836, who wanted each phoneme to be represented by one glyph, so they devised letters č, ć, š, ž, and the design details were determined by those who cut letters, so that the dash over D/d would be conveniently placed.' (Broz, 1892) The glyph was

created by combining groups of letters dj or gj into one phoneme.

According to Microsoft's Character Design Standards (that give us a detailed description and definition of the appearance of all graphemes), the dcroat character is called "d with a stroke" or "dyet" with the Unicode place U+0111. Design of the letter *đ* is based on the letter *d* with a horizontal bar. The bar should be of the same thickness as other lowercase characters with bars. Vertically the bar should be visually centred between the x-height and the ascender. It should horizontally extend to the right of the stem similarly to the serif in serif designs and enough to be visible at small size but not too long to cause spacing problems for sans serif designs. To the left, the bar should extend to approximately one half the width of the lower bowl of the *d*, and in italics designs it should visually extend to the one half of the bowl. The advance width should be the same as the lowercase *d*. In sans serif designs it may be necessary for the advance width of this character to be greater than the lowercase *d* to visually compensate for the bar.

The Croatian typographer Nikola Đurek adds that the thickness and position of the bar should be determined by the contrast of the letter and the x-height. In serif fonts with smaller x-height and thicker lines, the serif on dcroat is often moved because of the overlapping of the bar and the serif in smaller font sizes that reduces legibility. The bar should not be too short and the ideal length starts with the optical centre of the letter. (Đurek, 2009)

12. Measurements

Most common practices in designing were established by measuring geometry of the diacritical mark of the dcroat letter from different fonts and font faces. Fonts that were measured are the following: serif - Throhandik, Excelsior, Georgia, Sylfaen, Brioso, Warnock, Caslon, Jenson, Century, Constantia, Bookman Old Style, Palatino Linotype, Garamond Adobe, Chapar-

al, Times New Roman, Minion, Silentium I, Arno; sans-serif - Silentium II, Cronos, Myriad, Corbel, Gill Sans, Ellipse, Consolas, Lucida Sans, Calibri, Candara, Franklin Gothic, Neutra, Tahoma, Trebuchet, Sanvito, Tw Cen, Verdana, Haarlammer Sans. Different results were expected in serif and sans-serif fonts. Three values were measured:

1. Extension to the left (50% of counter was expected)
2. Vertical position (50% of ascender was expected)
3. Thickness (depending on the contrast of the base character); it is compared to the narrowest part of the letter



Fig. 8 (đ): X- extension to the left, h/H- height, D- thickness

Table 1 measurements: X- extension to the left, h - height (in serif typefaces excluding the height of the serif), H - height, D – thickness

Font	X %	h%	H%	D%
Serif-regular	61	50	38	136
Sans-serif-regular	55		44	119
Serif-bold	78	51	37	123
Sans-serif bold	67		45	117

The measurements show that the bar extends to the left more than 50 % of the counter, meaning that greater importance is given to the optical centre of the letter than the mathematical one. Due to the greater contrasts, serif fonts have different optical centres, found further to the left. The results found in sans-serif fonts were closer to the expected values, mostly because of smaller contrasts. It can be concluded which designs are not adequate (the bar is too long or too short): Excelsior (77%), Garamond (49%), Lucida Sans (71%) and Neutra (41%).

The vertical position of the bar in serif fonts is mostly around 50% of the ascender, excluding the height of serifs. The bar is expected to be placed in the middle between the bowl and the serif. In sans-serif fonts the bar is placed in the middle between the bowl and the overall height of the ascender (for the lack of serifs). The average is less than 50%, depending on the x-height and optical alignment. Vertical misplacements can be found in Garamond (56%), Corbel (52%) and Haarlamer sans (28%). The thickness of the bar is thicker than the thinnest part of the letter, even more in serif fonts due to bigger contrasts. When determining the thickness of the bar, the contrast and overall design of the base letter should be considered. Mistakes are more visible in bold faces, especially in serif fonts.

Different rules apply in the measurements of bold faces. The extension to the left is much larger than 50%, around 67% in sans-serif fonts, and 78% in serif ones, mostly because of bigger contrasts of letters. The numbers are obtained statistically and are therefore not realistic. It cannot be expected that the bar extends to the half of the counter because the bowl is wider and depends on the design of the letter *d* in the given font-face. Inappropriate lengths of the bar can be seen in Trebuchet and Neutra fonts, where the bar is too short and can cause recognition problems in small sizes.

Vertical positioning in bold faces remains in the optical middle of the ascender. Problems regarding the thickness of the bar, the serif and the x-height demand for different solutions in

order to avoid overlapping in smaller sizes. An alternative solution was proposed by the designer of Gill Sans Ultra bold font where the bar is positioned on top of the ascender, but the bar remains too thick and still unrecognizable in small sizes. Inadequate thickness can be found in Chaparral bold and Verdana bold fonts. Optimal solutions in length and thickness are offered by Constantia, Century and Candara. When comparing measurements with regular font faces we can conclude that the thickness of the bar in serif fonts is smaller, the height is similar and the length depends on the contrast. In sans-serif fonts the length is greater, and the height and thickness remain equal.

13. Conclusion

All glyphs required in “less popular” cultures and scripts are often not included in various fonts, and if they are present, they are rarely adequately designed. Information on the appearance of special characters is scarce and insufficient. Microsoft offers descriptions of diacritical positioning in Latin scripts, but does not explain the design. Most information can be gathered from the fonts themselves, although they are not necessarily designed in accordance with the cultural or graphical preferences of users. The importance of diacritical marks is usually marginalized although their absence causes problems in writing and legibility. It is therefore important to give designers enough information on the design of diacritics so they would be competent to adequately design or correct mistakes. The most common problems are the definition of width (the contrast of the accent), size, cultural preferences if there are any, and positioning, with regard to the base character. In designing the Croatian and Vietnamese lowercase letter *đ*, it is important to pay attention to the thickness of the bar, its length, vertical position and the design itself with regard to the font and font-face. Measurements demonstrate the most common practices and mistakes in designing this rare character.

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