Proposal to Encode Mediæval East-Slavic Musical Notation in Unicode

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PONOMAR PROJECT

Abstract

A proposal to encode eleven additional characters in the Musical Symbols block of Unicode required for support of mediæval East-Slavic (Kievan) Music Notation.

1 Introduction

East Slavic musical notation, also known as Kievan, Synodal, or "square" music notation is a form of linear musical notation found predominantly in religious chant books of the Russian Orthodox Church and the Carpatho-Russian jurisdictions of Orthodoxy and Eastern-Rite Catholicism. The notation originated in present-day Ukraine in the very late 1500's (in the monumental *Irmologion* published by the Supraśl Monastery), and is derived from Renaissance-era musical forms used in Poland. Following the political union of Ukraine and Muscovite Russia in the 1660's, this notational form became popular in Moscow and eventually replaced Znamenny neumatic notation in the chant books of the Russian Orthodox Church. The first published musical chant books using Kievan notation were issued in 1772, and, though Western musical notation (what is referred to as Common Music Notation [CMN]) was introduced in Russia in the 1700's, Kievan notation continued to be used. As late as the early 1900's, the publishing house of the Holy Synod released nearly the entire corpus of chant books in Kievan notation. The *Prazdniki* and *Obihod* chant books from this edition were reprinted in Russia in 2004; the compendium *Sputnik Psalomschika* (*The Precentor's Companion*) was reprinted by Holy Trinity Monastery in Jordanville, NY, in 2012. These books may be found in the choir lofts of many monasteries and parishes today. Therefore, the proper typesetting of Kievan notation is of interest not only to those in academic circles, but also to those who practice Russian Orthodox chant today.

2 Distinguishing Characteristics of the Notation

For a basic primer on sight reading Kievan Notation, the user may consult Simmons (2004). Kievan notation is characterized by the distinct, square shape of its noteheads. The graphical form of some symbols of Kievan notation is similar to shape notes used in the United States or to some elements of mensural notation or notation used for Gregorian chant, all of which have already been encoded in Unicode. However, these elements of Kievan notation are functionally different from their shape notes, mensural, or Gregorian analogs. In addition, they do not decompose into stems, heads and flags. This is a key difference between Kievan notation and CMN; in addition, unlike CMN, Kievan notation has a unique character for the eighth

note. In sum, the use of characters used to encode CMN or mensural notation to represent Kievan notation is not appropriate; Kievan notation characters should be encoded separately.

Several recensions of Kievan notation may be identified. Of these, by far the most widespread, and the only still in practical use, is the Synodal recension as used in the square notes chantbooks of the Russian Orthodox Church. Other recensions of Kievan notation may be considered only of interest to musicologists. All of these recensions share a common repertoire of characters and the same notational principles but have some differences in typography. This proposal uses the character forms of the Synodal recension and proposes that they be the default forms in Unicode; Figure 3 presents a typical score of Synodal Kievan notation from the chant books published by the Russian Holy Synod; Figure 4 presents an example of Kievan notation of a Western (Galician) provenance.

It is a goal of the Unicode standard to leave the rendering of pitch and other complexities associated with typesetting music to higher-level protocols. Musical layout, as well as the digital storage of musical compositions are therefore not addressed in this proposal. Rather, the encoding of Kievan notation in Unicode is required for two reasons. First, to allow the handling of Kievan notation symbols in line (that is, within a body of text, such as academic literature, instructional manuals and guides to computer software); second, to identify the repertoire and provide a standard encoding method for use by musical typesetting software. In a related project, the authors have developed a method for the handling of Kievan musical notation in the popular open-source music engraving package LilyPond. In the Appendix, we present typeset examples of Kievan notation using LilyPond to demonstrate certain technical points.

3 Proposed Characters

Kievan notation and CMN share some elements of encoding; others may be considered as simple graphical variants. Table 1 presents the additional symbols proposed for inclusion in Unicode and required for full support of Kievan notation. The subsequent subsections discuss the technical aspects of Kievan notation support. Figures 1 and 2 present examples of the use of Kievan musical symbols within a body of text. Figure 3 presents an example of a typical music score using Kievan notation; this proposal encodes all of the characters required to typeset the score, though the typesetting (engraving) process itself is left to musical software. For more examples of Kievan scores, please see the Appendix.

1 Technical Notes on some Characters

The reader can note that two of these characters are similar in appearance to Gregorian ligatures; however, these characters are not ligatures but single characters. The character Musical Symbol Kievan Whole Note (, labeled 1 in Figure 1) consists of two attached diamonds; the nominal note is located between the two diamonds. The character Musical Symbol Kievan Eighth Note Stem Down (, labeled 5 in Figure 1) consists again of two attached diamonds and a stem; the nominal note is located on the top diamond. In addition, the character Musical Symbol Kievan Final Note (, labeled 1 in Figure 2) consists of two attached rectangles; the nominal note is located between the two rectangles. The character Musial Symbol Kievan Recitative Mark (, labeled 1 in Figure 3) also consists of two attached rectangles; the nominal note is again located between the two rectangles.

Kievan notation has two forms of the quarter note and eighth note characters – a form that appears with the stem up and a form that appears with the stem down. Thus, the quarter note may appear as or as and the eighth note may appear as or as . In CMN, notes may also appear in stem up and stem down forms. However, unlike CMN, where the direction of the stem is usually entirely predictable based either on the position of the note on the staff or, in polyphony, on the part being notated, the direction

Table 1: Proposed Characters

Representation	Codepoint	Name	Annotations
Clefs			
	U+1D1DE	MUSICAL SYMBOL KIEVAN C CLEF	Tsefaut (do or fa) clef.
Ornamentation			
	U+1D1DF	MUSICAL SYMBOL KIEVAN END OF PIECE	
Notes			
	U+1D1E0	MUSICAL SYMBOL KIEVAN FINAL NOTE	Nominal note located between the two rectangles
	U+1D1E1	MUSICAL SYMBOL KIEVAN RECITATIVE MARK	Nominal note located between the two rectangles
	U+1D1E2	MUSICAL SYMBOL KIEVAN WHOLE NOTE	Nominal note located between the two diamonds.
	U+1D1E3	MUSICAL SYMBOL KIEVAN HALF NOTE	
	U+1D1E4	MUSICAL SYMBOL KIEVAN QUARTER NOTE STEM DOWN	
	U+1D1E5	MUSICAL SYMBOL KIEVAN QUARTER NOTE STEM UP	
	U+1D1E6	MUSICAL SYMBOL KIEVAN EIGHTH NOTE STEM DOWN	Nominal note located on the top diamond.
	U+1D1E7	MUSICAL SYMBOL KIEVAN EIGHTH NOTE STEM UP	
Accidentals			
	U+1D1E8	MUSICAL SYMBOL KIEVAN FLAT SIGN	

of the Kievan notehead cannot be predicted algorithmically. First, Kievan notation is used to notate only monophonic music; second, the direction of the notehead usually does not depend on the position of the notehead on the staff. Rather, it is commonplace to have the directions of all noteheads within a single melisma to be the same, regardless of their staff position (compare Figure 6 and Figure 5 in the Appendix; this is also demonstrated in Figure 8 in the Appendix). In addition to this fact, note that the appearances of the Kievan noteheads (especially of the eighth note) in their stem up and stem down forms are sufficiently different that notational manuals usually list both forms in describing the notation. This is illustrated clearly in Figure 1. Since both forms of the noteheads are typeset in line, where no algorithmic prediction of the form can be made and thus contextual substitution or stylistic set features cannot be used, both forms need to be encoded at separate codepoints, as we have proposed. Alternatively, one of the forms may be encoded as a standardized Variation Sequence and accessed via the use of Variation Selectors.

The Synodal recension of Kievan notation is distinguished by the existence of two forms of the character Kievan Half Note, the form with the long stem up and short stem down, which occurs in a space, and the form with the short stem up and long stem down, which occurs on a line. The distinction between these two forms can be seen in Figure 3 and has been correctly implemented in Figure 5. Unlike the stem up and stem down forms of the quarter and eighth notes, the use of the two forms of the half note on the staff is

Figure 1: Kievan musical symbols used in-line. Note the characters used: 1. Musical Symbol Kievan Whole Note; 2. Musical Symbol Kievan Half Note; 3. Musical Symbol Kievan Quarter Note Stem Down; 4. Musical Symbol Kievan Quarter Note Stem Up; 5. Musical Symbol Kievan Eighth Note Stem Down; 6. Musical Symbol Kievan Eighth Note Stem Up. Source: Soloviev (1889).

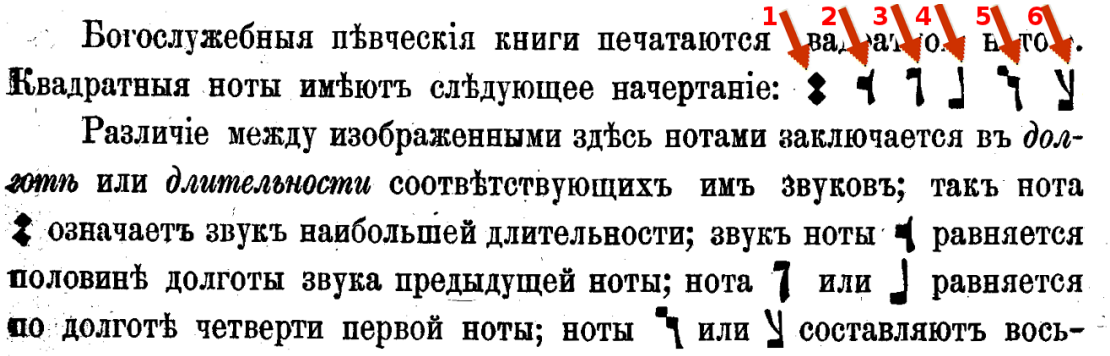
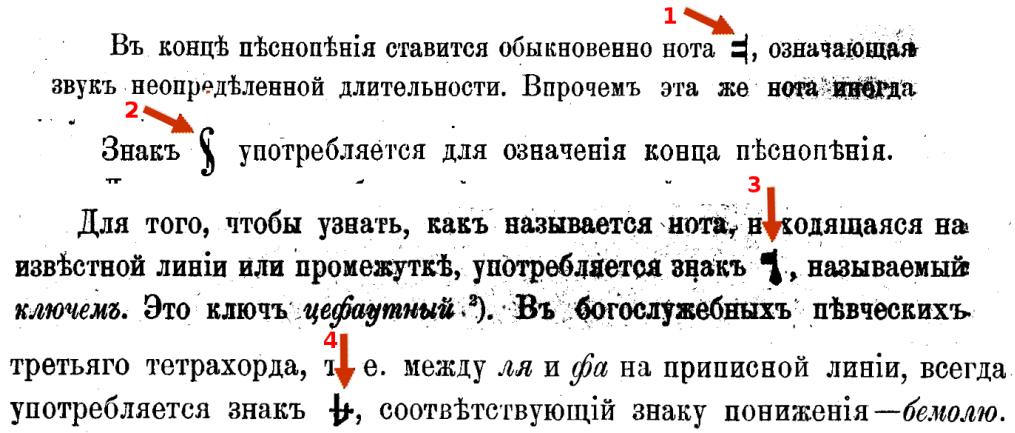


Figure 2: Additional Kievan musical symbols used in-line: 1. Musical Symbol Kievan Final Note; 2. Musical Symbol Kievan End of Piece; 3. Musical Symbol Kievan C Clef; 4. Musical Symbol Kievan Flat Sign. Source: Soloviev (1889).



entirely predictable. Because we do not foresee a need to use both of these characters in text documents, we do not propose encoding both variant forms. In fonts, the variant character could be made available via the use of stylistic sets. Alternatively, one of the forms may be encoded as a Variation Sequence, and accessed via a Variation Selector.

2 Technical Comments

We have proposed for encoding the additional characters required for Kievan musical notation. In some cases, symbols used in Kievan notation have a sufficiently close graphical representation and an identical function as CMN analogs; in these cases, the existing CMN symbol's codepoint should be used. Thus, for example, we have not proposed the encoding of a Kievan Combining Augmentation Dot (•) or a Kievan Sharp Sign (𝄯); rather, the existing codepoints U+1D16D and U+266F, respectively, should be used. The Sharp Sign, which does not appear in the Synodal chant books, is used in some Kievan notation scores of a Galician provenance. It may also be used to transcribe the F-sharp that is used in certain schools of

Figure 3: A typical music score in Kievan notation of the Synodal recension. Note also the use of 1. Musical Symbol Kievan Recitative Mark and two variants of Musical Symbol Kievan Half Note, short stem up (on Line) (2) and long stem up (in space) (3). Source: Moscow Patriarchate (2004).

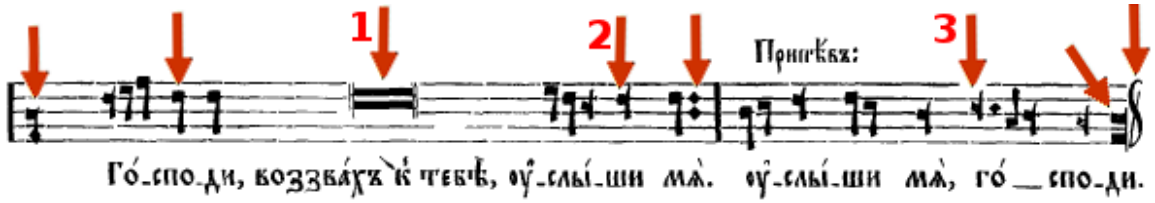
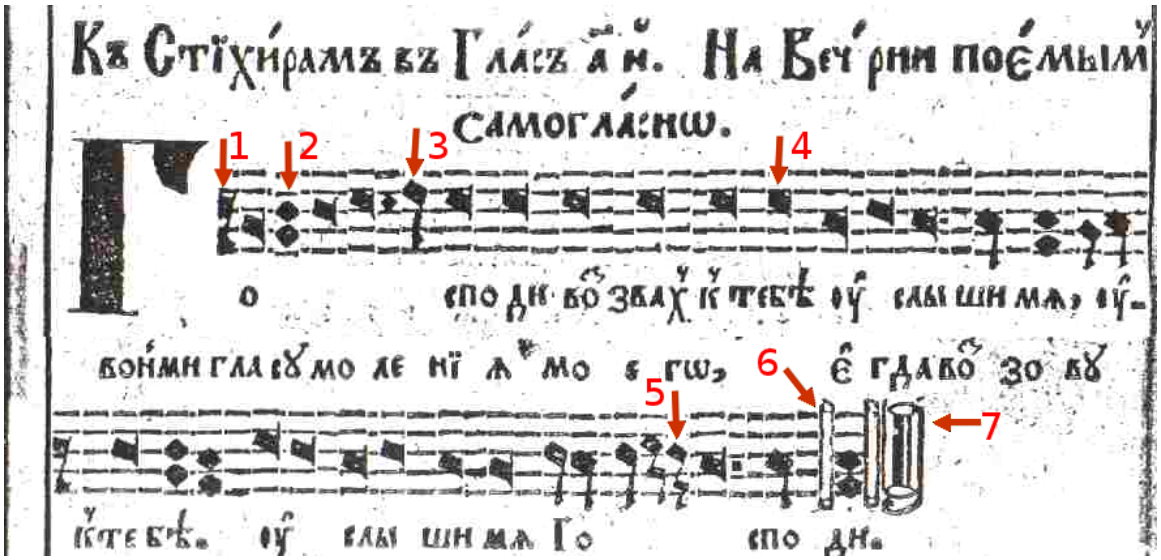


Figure 4: A typical score in Kievan notation of the Western recension. Source: *Irmologion*, Lvov, present-day Ukraine, 1846. Note the distinct forms of: 1. Kievan C Clef; 2. Kievan Whole Note; 3. Kievan Quarter Note Stem Down; 4. Kievan Half Note; 5. Kievan Eighth Note; 6. Kievan Final Note; 7. Kievan End of Piece.



Znamenny chant. The Flat Sign, which has a unique appearance, is used only with the high B, as can be seen from Figure 7.

In general, the following principles can be followed in typesetting Kievan notation in line. Kievan notes occur on a five-line staff; the existing five-line staff, U+1D11A, should be used. Musical phrases are separated by bar lines, and the existing codepoint, U+1D100 should be used for the bar line. We have proposed for encoding the C clef, more properly called Tsefaut clef,[1] the only clef used in Kievan notation. We have proposed for inclusion all required notes for the full repertoire of music. Graphical variations in the shape of the notes between the Synodal version, other recensions, and the manuscript tradition should be handled at the font level.

The existing CMN support in Unicode offers a set of control characters that may be used for the repertoire of Kievan notation, if necessary. For example, on some occasions, notes may be beamed. For the purposes of beaming, the existing control characters U+1D173 (Musical Symbol Begin Beam) and U+1D174

[1]This clef is called Tsefaut because the note on the line where it appears would, in solfège nomenclature, be called *fa* or *ut* (*do*), which in the alternative terminology, is called C (Slavic pronunciation: *tse*). While functionally similar to the alto clef, there is this subtle difference, *viz.* that in the Obihod scale used in Znamenny chant, transposition by a fourth (from *do* to *fa*) is musically invariant.

(Musical Symbol End Beam) should be used. The correct beaming behavior may be implemented at the font level, *e.g.*, via a ligature substitution to produce the beamed sequences  or  .

While slurs and ties do not exist in Kievan music notation, notes in single-syllabic melismatic structures are frequently grouped together; in the chantbooks, melismatic groups are separated from each other by whitespace. Existing control characters U+1D179 (Musical Symbol Begin Phrase) and U+1D17A (Musical Symbol End Phrase) should be used for the purposes of grouping.

We do not comment here on the correct methodology for implementing Kievan notation in music engraving software. The exact approach depends on the notational package. The interested reader may consult the LilyPond manual for one possible implementation. To our knowledge, commercial software packages (*e.g.*, Finale) do not currently support Kievan notation "out of the box", but may be made to support the notation through the installation of custom fonts. The authors have developed the Metasuprasl font for such purposes, which may be downloaded from `http://www.ponomar.net/cu_support.html` either in METAFONT source format or as a TrueType or OpenType font. The METAFONT source file may be modified to fit the metrics of the notational software and then compiled using standard methods.

Appendix A Character Properties

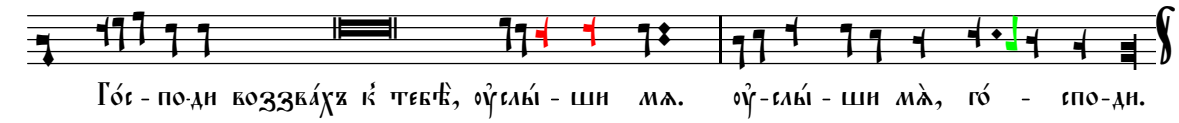
The following entries are proposed for addition to UnicodeData.txt:

```
1D1DE;MUSICAL SYMBOL KIEVAN C CLEF;So;0;L;;;;;N;;Tsefaut (do or fa)
   clef;;;
1D1DF;MUSICAL SYMBOL KIEVAN END OF PIECE;So;0;L;;;;;N;;;;;
1D1E0;MUSICAL SYMBOL KIEVAN FINAL NOTE;So;0;L;;;;;N;;Nominal note
   located between the two rectangles;;;
1D1E1;MUSICAL SYMBOL KIEVAN RECITATIVE MARK;So;0;L;;;;;N;;Nominal note
   located between the two rectangles;;;
1D1E2;MUSICAL SYMBOL KIEVAN WHOLE NOTE;So;0;L;;;;;N;;Nominal note
   located between the two diamonds;;;
1D1E3;MUSICAL SYMBOL KIEVAN HALF NOTE;So;0;L;;;;;N;;;;;
1D1E4;MUSICAL SYMBOL KIEVAN QUARTER NOTE STEM DOWN;So;0;L;;;;;N;;;;;
1D1E5;MUSICAL SYMBOL KIEVAN QUARTER NOTE STEM UP;So;0;L;;;;;N;;;;;
1D1E6;MUSICAL SYMBOL KIEVAN EIGHTH NOTE STEM DOWN;So;0;L;;;;;N;;Nominal
    note located on the top diamond;;;
1D1E7;MUSICAL SYMBOL KIEVAN EIGHTH NOTE STEM UP;So;0;L;;;;;N;;;;;
1D1E8;MUSICAL SYMBOL KIEVAN FLAT SIGN;So;0;L;;;;;N;;;;;
```

Appendix B Typeset Examples

In this Appendix, we have presented several examples, typeset using the package LilyPond. Below each typeset example, we include a scan of the original. The typeset examples serve to demonstrate that the proposed repertoire is complete as well as illustrating several features of the notation.

Figure 5: A typical score in Kievan notation. Note the use of two variants of the half note, indicated in red.



Source: *Obihod Notnago Penia*, Moscow, 2004, f. 7.

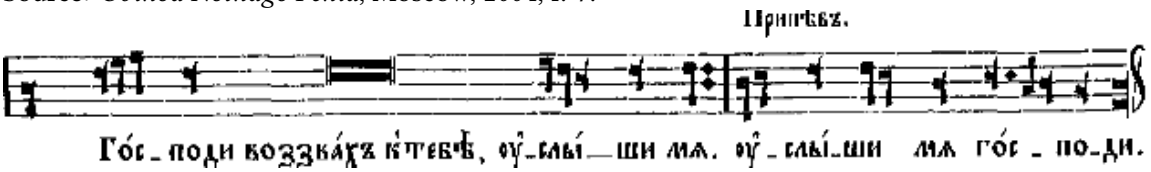
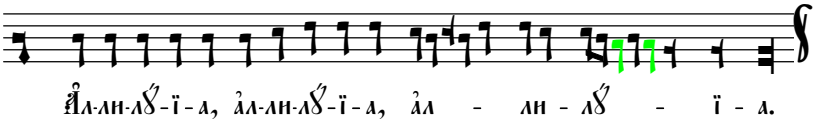


Figure 6: Another typical score. Compare the stem directions of the notes labeled in green in this score and the score in Figure 5. Note also the use of beamed eighth notes.



Source: *Sputnik Psalomschika*, Jordanville, NY, 2012, p. 149.

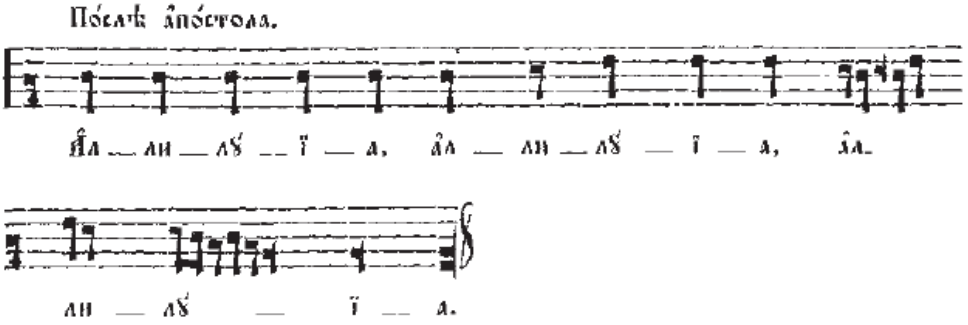
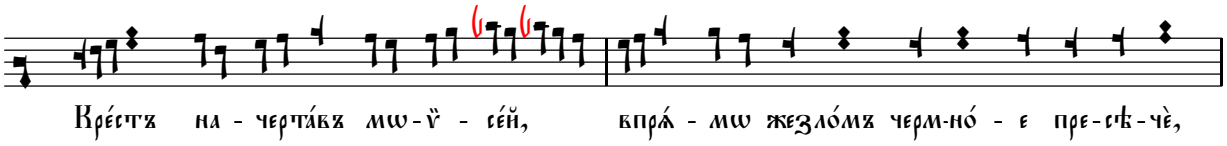


Figure 7: Another score. Note the use of the Flat (which only appears with the high B) labeled in red.



Source: *Prazdniki Notnago Penia*, Moscow, 2004, f. 15 rev.

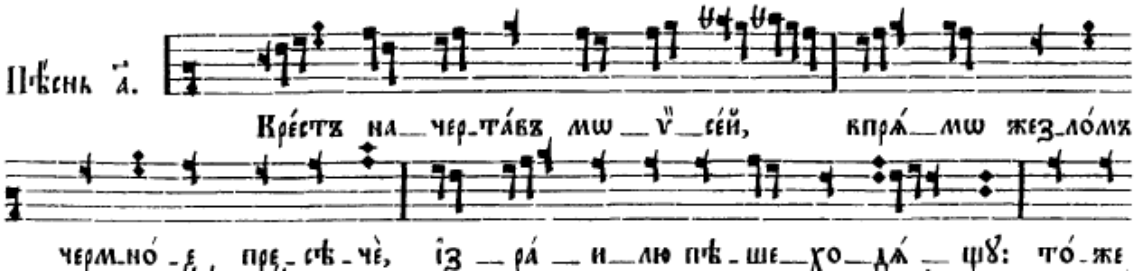
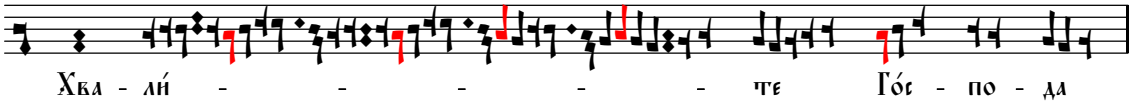
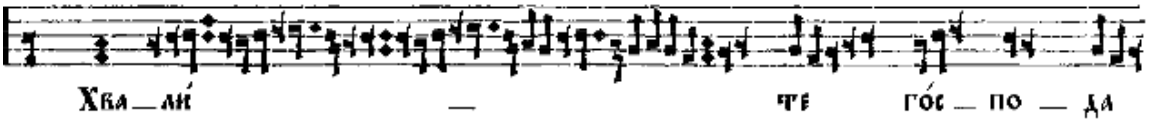


Figure 8: Note that noteheads may appear in stem up or stem down forms in the same staff position at the whim of the engraver.



Source: *Obihod Notnago Penia*, Moscow, 2004, f. 39 of Part 2.



Bibliography

Moscow Patriarchate (2004). *Обиход нотнаго пения употребительных церковных роспевов.* Moscow, Russia: Publishing Council of the Russian Orthodox Church. (Obihod of scored music in common church chants).

Simmons, N. (2004). A primer of Kievan square-note (Quadratic or Synodal) musical notation. Online resource: `http://www.synaxis.info/psalom/research/simmons/Kievan_notation.pdf`.

Soloviev, D. N. (1889). *Краткое руководство к первоначальному изучению церковного пения по квадратной ноте.* St Petersburg, Russia. (A brief handbook for the study of church music written in Square notation).

ISO/IEC JTC 1/SC 2/WG 2
PROPOSAL SUMMARY FORM TO ACCOMPANY SUBMISSIONS
FOR ADDITIONS TO THE REPERTOIRE OF ISO/IEC 10646[1]
Please fill all the sections A, B and C below.
Please read Principles and Procedures Document (P & P) from http://www.dkuug.dk/JTC1/SC2/WG2/docs/principles.html **for guidelines and details before filling this form.**
Please ensure you are using the latest Form from http://www.dkuug.dk/JTC1/SC2/WG2/docs/summaryform.html**.**
See also http://www.dkuug.dk/JTC1/SC2/WG2/docs/roadmaps.html **for latest *Roadmaps*.**

A. Administrative

1. **Title:** *Proposal to Encode Mediaeval East-Slavic Musical Notation*
2. Requester's name: *Aleksandr Andreev, Yuri Shardt and Nikita Simmons*
3. Requester type (Member body/Liaison/Individual contribution): *Individual contribution*
4. Submission date: *October 4, 2012*
5. Requester's reference (if applicable): *N/A*
6. Choose one of the following:
   This is a complete proposal: *YES*
   (or) More information will be provided later:

B. Technical – General

1. Choose one of the following:
   a. This proposal is for a new script (set of characters): *NO*
      Proposed name of script:
   b. The proposal is for addition of character(s) to an existing block: *YES*
      Name of the existing block: *Musical Symbols*
2. Number of characters in proposal: *11*
3. Proposed category (select one from below - see section 2.2 of P&P document):
   A-Contemporary B.1-Specialized (small collection) Yes B.2-Specialized (large collection)
   C-Major extinct D-Attested extinct E-Minor extinct
   F-Archaic Hieroglyphic or Ideographic G-Obscure or questionable usage symbols
4. Is a repertoire including character names provided? *YES*
   a. If YES, are the names in accordance with the "character naming guidelines" in Annex L of P&P document? *YES*
   b. Are the character shapes attached in a legible form suitable for review? *YES*
5. Fonts related:
   a. Who will provide the appropriate computerized font to the Project Editor of 10646 for publishing the standard?
   Aleksandr Andreev (aleksandr.andreev@gmail.com)
   b. Identify the party granting a license for use of the font by the editors (include address, e-mail, ftp-site, etc.):
   Metasuprasl Regular, available at http://www.ponomar.net/cu_support.html, licensed under GNU GPL or OFL
6. References:
   a. Are references (to other character sets, dictionaries, descriptive texts etc.) provided? *YES*
   b. Are published examples of use (such as samples from newspapers, magazines, or other sources) of proposed characters attached? *YES*
7. Special encoding issues:
   Does the proposal address other aspects of character data processing (if applicable) such as input, presentation, sorting, searching, indexing, transliteration etc. (if yes please enclose information)? *YES*
   Technical comments concerning input and presentation have been provided

8. Additional Information:

Submitters are invited to provide any additional information about Properties of the proposed Character(s) or Script that will assist in correct understanding of and correct linguistic processing of the proposed character(s) or script. Examples of such properties are: Casing information, Numeric information, Currency information, Display behaviour information such as line breaks, widths etc., Combining behaviour, Spacing behaviour, Directional behaviour, Default Collation behaviour, relevance in Mark Up contexts, Compatibility equivalence and other Unicode normalization related information. See the Unicode standard at http://www.unicode.org for such information on other scripts. Also see Unicode Character Database (http://www.unicode.org/reports/tr44/) and associated Unicode Technical Reports for information needed for consideration by the Unicode Technical Committee for inclusion in the Unicode Standard.

[1] Form number: N4102-F (Original 1994-10-14; Revised 1995-01, 1995-04, 1996-04, 1996-08, 1999-03, 2001-05, 2001-09, 2003-11, 2005-01, 2005-09, 2005-10, 2007-03, 2008-05, 2009-11, 2011-03, 2012-01)

C. Technical - Justification

1. Has this proposal for addition of character(s) been submitted before? YES
   If YES explain: Submitted on September 29, 2011; this version is revised based on UTC comments
2. Has contact been made to members of the user community (for example: National Body, user groups of the script or characters, other experts, etc.)? YES
   If YES, with whom? Academics, choir directors using Kievan notation
   If YES, available relevant documents: Personal correspondence and mailing lists
3. Information on the user community for the proposed characters (for example: size, demographics, information technology use, or publishing use) is included? YES
   Reference: See Section 1 of Proposal
4. The context of use for the proposed characters (type of use; common or rare) Common
   Reference: See Section 1 of Proposal
5. Are the proposed characters in current use by the user community? YES
   If YES, where? Reference: Chant books, manuals, LilyPond software and documentation
6. After giving due considerations to the principles in the P&P document must the proposed characters be entirely in the BMP? NO
   If YES, is a rationale provided?
   If YES, reference: N/A
7. Should the proposed characters be kept together in a contiguous range (rather than being scattered)? YES
8. Can any of the proposed characters be considered a presentation form of an existing character or character sequence? NO
   If YES, is a rationale for its inclusion provided?
   If YES, reference: N/A
9. Can any of the proposed characters be encoded using a composed character sequence of either existing characters or other proposed characters? NO
   If YES, is a rationale for its inclusion provided?
   If YES, reference: N/A
10. Can any of the proposed character(s) be considered to be similar (in appearance or function) to, or could be confused with, an existing character? YES
    If YES, is a rationale for its inclusion provided? YES
    If YES, reference: See Section 3 of Proposal.
11. Does the proposal include use of combining characters and/or use of composite sequences? NO
    If YES, is a rationale for such use provided?
    If YES, reference: N/A
    Is a list of composite sequences and their corresponding glyph images (graphic symbols) provided?
    If YES, reference:
12. Does the proposal contain characters with any special properties such as control function or similar semantics? NO
    If YES, describe in detail (include attachment if necessary)
    Existing control characters of Musical Symbols block should be used.
13. Does the proposal contain any Ideographic compatibility characters? NO
    If YES, are the equivalent corresponding unified ideographic characters identified?
    If YES, reference: