Chapter 37

Electronic Editing

The preparation of encoded musical materials for processing is an essential part of computer-assisted musicology. Without electronic data to process, none of the manipulations described in this book would be possible. The encoding and editing of musical data has been an activity that has occupied various scholars since the earliest forays into computer-assisted musicology (e.g., Bronson, 1959).

In this chapter we identify and describe some of the tasks and issues involved in preparing electronic musical documents in the Humdrum format. In general, the following discussion pertains to the production of electronic documents representing musical score information. However, the basic procedures are applicable to any kind of data — from sound recordings to historical choreographies of ballets.

The Process of Electronic Editing

Electronic editing entails translating one representation into another representation. In many cases, an electronic edition is prepared from existing source documents — such as printed scores or manuscripts. In other cases, an electronic edition may be prepared from another electronic form — such as MIDI. When translating between two formats, it is important to be familiar with both representations. Descriptions of a number of popular electronic music formats may be found in Eleanor Selfridge-Field's encyclopedic *Handbook of Musical Codes* (1997).

The principal processes involved in electronic editing include identifying possible sources and alternative versions, selecting and encoding the material, proofing the material (using both automated and manual methods), adding reference and editorial information, writing appropriate research notes, generating possible analytic information, and resolving issues related to copyright, distribution, and data integrity.

Establishing the Goal

Encoding and editing music is a time-consuming and labor-intensive process. Before starting to work on a electronic edition, it is appropriate to ask: what is the goal? What purpose will be served by the edition? Is the objective to provide a performance copy? A historically accurate document? A document suitable for analysis? If so, what sort of analysis?

In general, it is wise to avoid trying to cater to all needs at once. There is nothing wrong with creating a narrowly-defined document that serves a modest goal. For example, if our intention is to pursue a study of rhythm, there is little need to encode data that is extraneous to this goal. Accordingly we might omit stem-direction, beaming, textual underlay, and even pitch information.

Note that it is always possible to incorporate additional information at a later date. Additional information can be inserted into a Humdrum encoding by using the **assemble** and **cleave** commands. In general, it is important that the encoding of electronic documents not consume all of a researcher's efforts and resources. The most common problem that beset early projects in computational musicology was that researchers rarely got past the stage of inputting data. Early researchers typically ran out of time, money or enthusiasm before they could turn to *using* the materials they had input.

Documenting Encoded Data

More important than generating a complete and accurate database is generating complete and accurate documentation so that future users of the information understand the limitations of the materials. Whether or not the electronic edition is "complete," the materials are almost useless without proper documentation about what information is present, what information has been omitted, what sources were used, and what interpretations have been made. As long as the electronic materials are well documented, users can make effective use of whatever you create.

An ethnomusicologist may have inaccurately transcribed pitches, but even approximate pitch information can be used for a study of pitch contour. Of course, it is better to have clean data than messay data, but even messy data can be highly useful if the nature of the mess is well understood by researchers. In fact, most historical information is a mess.

Concretely, Humdrum provides several reference records that allow electronic editors to identify what information has been encoded and what information has been omitted or interpreted.

Sources

In light of the editorial goal, you can procede to select source materials for encoding. In many cases, this will involve selecting printed musical scores. Begin by spending time with the materials. What special problems or challenges are raised? What sort of Humdrum representation would be suitable for the proposed edition? Are there special notational symbols that suggest a new representation should be designed? Can special representational problems be accommodated within an existing Humdrum representation? How would users be made aware of extensions or modifications to the representation?

In the case of musical scores, there is rarely a single source or *Urtext*. In most cases, multiple sources are available. How do you want to approach the problem of variant sources? One approach is to select a single source and remain true to it. A second approach is to identify the principal variant sources and encode each independently. A third approach is to encode several variants within a single document and provide Humdrum "versions" that allow users to select particular "readings" from a single file. A fourth approach is to create your own "critical" edition — based on a close re-examination of the original materials.

An important consideration will be the copyright status of the materials you examine. Some materials are old enough that their copyrights have expired. Encoding older materials raises two difficulties. First, older sources are typically not the best quality editions available. Second, access to printed versions of older sources may be difficult for other scholars using your data. Some publishers (such as Dover Publications) specialize in reprinting musical scores whose copyrights have lapsed. Although these sources may not be the best available, they are often convenient because other scholars can easily purchase the modern Dover reprints that correspond to your electronic edition.

The best materials are usually under copyright. If you encode this material without permission, you will never be able to distribute the encodings — even on a non-profit basis. Most modern publishers profess an interest in electronic publishing, but (at the time of this writing) few publishers have any pertinent expertise, and fewer yet are willing to encourage or allow the preparation of electronic documents from their publication catalogue by third parties. It is likely to take decades before the financial and legal issues are satisfactorily addressed.

In some cases, you will be translating from one electronic format to another — such as from MIDI to `**kern`. Once again, be conscious of any copyright issues that are raised. Few experiences are more discouraging than discovering that your work cannot be distributed because you failed to consider seriously the copyright issues involved.

Selecting a Sample from Some Repertory

Quite often, there are insufficient resources to encode an entire corpus. Many repertories are simply too large to consider creating an exhaustive electronic edition. Nevertheless, you might choose to encode a subset or selection of works from the given corpus.

A common expectation is that studying a sample subset of works will inform us about the corpus as a whole. That is, it is commonly expected that studying a number of works by, say, Offenbach, the scholar may be able to identify general characteristics of Offenbach's writing. In order for this assumption to be valid, statisticians tell us that the sample of works must be a *representative* sample — free of all sorts of possible selection biases.

From a research perspective, the best sample is a *random sample.* Suppose, for example, that there are 2,000 items in a particular repertory, but you are able to encode just 100 items. You might be tempted to select the first 100 items, or to select a subset of items that share some common feature that makes the collection seem "coherent."

However, picking and choosing what to encode will prevent researchers from being able to draw general conclusions about the repertory as a whole. For example, selecting the first 100 items will typically bias the sample to early works in a composer's career. Selecting 100 random items provides a very good statistical sample of a population of 2,000 items.

Unfortunately, since random sampling has little precedence in traditional humanities research, many scholars are resistent to the idea. The value of random sampling has been established beyond a doubt by statisticians. This is not the place to rehearse the detailed arguments. Simply take my word for it: if you can't encode a complete corpus, the very best solution is to select a random sample.

In making such a random sample, it is essential to resist the temptation to select a "random" sample "by eye." Establish a truly random procedure (such as flipping coins or using a random number table) and methodically follow the procedure.

Incidentally, it is common to run out of resources before completely encoding the selected materials. As a result, you may end up encoding only half or two-thirds of the projected materials. If you began encoding the materials in (say) chronological order, then the resulting database will be biased toward the early works of the repertory. In order to avoid introducing an unwanted bias, it is also prudent to encode the selected materials in a random order.

Encoding

Once you have established your materials and have decided on the type of encoding, you can go ahead and begin encoding the documents in random order. Use whatever resources are available to you. These might include scanning software, MIDI performance capture, or the Humdrum **encode** command. Begin by encoding a sample section or sections. Spend some time determining ways to increase your productivity.

As you encode the selected materials, editorial problems or questions will inevitably arise. As you gain experience, you may realize that earlier encoding practices were not the best. You may want to return to these problems and encode them in a different manner. Be sure to keep notes — either pencil marks on a page, or local comments in a file — so that you can easily revisit these problem sites later. Again, it is valuable to encode works in random order in order to avoid possible confounds arising from editorial experience. That is, you don't want a scholar's conclusions about differences between early works and late works to be merely an artifact of the electronic editor's increasing experience.

Typically, it is more efficient to encode individual parts and then assemble all parts into a single full score.

Transposing Instruments

In the case of the `**kern` representation, all parts are represented at concert pitch. It is typically easier to encode the parts as written and then transpose the result using the Humdrum **trans** command. For example, material for B-flat trumpet or B-flat clarinet can be transposed using the following command:

```
trans -d -1 -c -2
```

In the case of clarinet in A, a suitable transposition would be:

```
trans -d -2 -c -3
```

The **trans** command adds a transposition interpretation to the output in order to identify that the material has been shifted. In the `**kern` representation, transposed instruments must be explicitly identified using a special "transposing-instrument interpretation" (see *Humdrum Reference Manual* — Section 3 for details). A suitable interpretation can be created by adding the upper-

case letter 'I' prior to the 'T' in the appropriate tandem interpretation. In the case of a horn in F for example, the transpostion interpretation would be modified from

```
*Trd-4c-7
```

to:

```
*ITrd-4c-7
```

Instrument Identification

Humdrum provides standardized instrumentation indicators. Three different types of indication are appropriate: (1) the instrument name as indicated in the source, (2) standardized instrument name, and (3) instrument class. Standardized instrument names can be found in Appendix II. For example, the standard indicator for "harpsichord" is `*Icemba`.

Standardized instrument class designators include `*ICklav` for keyboard instruments and `*ICidio` for percussion instruments, etc., and instrument grouping designators — such as `*IGripn` for *ripieno* instruments and `*IGacmp` for accompaniment instruments. These instrument class designators can also be found in Appendix II.

In addition, the original instrument name (as found in the score) should also be encoded as a Humdrum local comment.

Leading Barlines

Humdrum tools prefer to have explicit information indicating the beginning of the first measure. If a file does not begin with an anacrusis ("pickup") then it is appropriate to encode an "invisible" first barline. For a hypothetical file containing five spines, we would need to insert the following line just before the first note(s) in the work:

```
=1-   =1-   =1-   =1-   =1-
```

Recall that the common system for representing barlines makes a distinction between the logical *function* of a barline and it's visual or *orthographic* appearance. For example, the common system for barlines distinguishes between double barlines whose function is to indicate the end of a work or movement, and double barlines that simply delineate sections within the course of a work or movement. It is possible for a barline at the end of the work to be "functionally" a double barline, yet appear visually as a single barline.

Functional double barlines are encoded with a double equals sign (==) whether or not they are visually rendered as double barlines. *Functional single barlines* are encoded with a single equals sign (=) whether or not they are visually rendered as single barlines.

The specific visual appearance may be encoded following the equals sign(s). The vertical line (|) represents a 'thin' line and the exclamation mark (!) represents a 'thick' line. A typical final double bar would be encoded:

```
==|!
```

Most mid-movement double bars are encoded with two thin lines and so would be encoded:

```
=||
```

A common encoding error is to render mid-movement double barlines as *functional* rather than *orthographic* double-bars.

Ornamentation

The `**kern` representation makes a distinction between whole-tone and semitone trills and mordents. Typically, each ornament must be examined manually and the correct code selected.

In some cases, the size of the trill or mordent will be ambiguous and so some sort of editorial decision will be necessary. One possibility is to add the kern 'x' signifier immediately following the 'T' or 't'. This indicates that the trill size is an "editorial interpretation."

The `**kern` representation treats appoggiaturas in a special way. In general, `**kern` is oriented to representing things in a manner closer to how they sound. Consequently, appoggiaturas are encoded as they would be logically performed. For example, a quarter-note preceded by an appoggiatura (small note) would be performed as two eighth-notes. Similarly, a dotted quarter-note preceded by an appoggiatura would be performed as a quarter-note followed by an eighth-note.

All appoggiaturas must be re-encoded in a way that reflects their likely performance. At the same time, the two notes forming the appoggiatura must be marked in the kern representation: the initial note of the appoggiatura is marked by the upper-case letter '`P`' and the final (second) note of the appoggiatura is marked by a lower-case letter '`p`'.

Editing Sections

It is helpful to break-up large works/movements into smaller sections that can be labelled. In a binary work, for example, it may be useful to label the 'A' and 'B' sections. In a sonata-allegro work, it may be useful to label the introduction, exposition, development, recapitulation, etc. Some works include explicitly notated labels. These labels may be traditional, e.g. "Coda," or they may reflect programatic descriptions, such as the section entitled *Il canto degl'uccelli* [The song of the birds] in Vivaldi's *The Four Seasons.*

Where appropriate, suitable section labels should be created and encoded using the Humdrum Section Label designator. Remember that section labels can include the space character:

```
*>1st Theme
```

If you include section labels, you must also include a Humdrum "Expansion List" to indicate how the sections are connected. The Humdrum **thru** command causes a through-composed version of a file to be generated according to the expansion list. For example, an expansion list for a simple binary work may be encoded as:

```
*>[A,B]
```

Remember that expansion lists ought to be encoded prior to the first section label.

Whenever a work/movement includes repeats or Da Capos, section labels and expansion lists must be encoded. In some cases, there is more than one way of interpreting how to realize the repeats. The most "conventional" realization should be encoded with the *unnamed expansion list.* This will specify the default expansion using the Humdrum **thru** command. Suppose for example, that you are encoding a typical minuet and trio. The conventional performance practice involves repeating all sections of both the minuet and trio, but then avoiding the repeats in the minuet following the Da Capo. A suitable expansion list might be:

```
*>[Minuet,Minuet,Trio,Trio,,Minuet]
```

An alternative expansion list might be encoded as follows (notice the expansion-list-label *ossia*):

```
*>ossia[Minuet,Minuet,Trio,Trio,,Minuet,Minuet]
```

Editorialisms in the ***kern* Representation

Humdrum provides several ways of encoding editorialisms. These include editorial footnotes, local comments, global comments, interpretation data, *sic* and *ossia* designations, version labels, sectional labels, and expansion lists.

The `**kern` representation provides several special-purpose signifiers to help make explicit various classes of editorial amendments, interpretations, or commentaries. Five types of editorial signifiers are available: (1) *sic* (information is encoded literally, but is questionable) signified by the `Y` character; (2) *invisible symbol* (Unprinted note, rest or barline, but logically implied) signified by the `y` character; (3) *editorial interpretation*, (a "modest" editorial act of interpretation — such as the interpretation of accidentals in *musica ficta*) signified by the `x` character; (4) *editorial intervention* (a "significant" editorial intervention) signified by the `X` character; (5) *footnote* (accompanying local or global comment provides a text commentary pertaining to specified data token) signified by `?`.

One of the most onerous impositions of the `**kern` representation is the requirement that the music be interpreted into a coherent spine organization. Why not avoid interpreting the voicings?

The answer to this question is that editorial interventions are often essential clarifications that make a document useable. Without voicing information, users would be unable to calculate melodic intervals, for example. Without melodic intervals, it may be impossible to search for themes, motives, and other patterns. Editorial interpretations are not simply unwarranted obfuscations. This does not mean that interpretations are "correct" and so it may be necessary to provide several alternative or plausible interpretations of an artifact.

One of the advantages of computers is that it is possible for documents to undergo continuous revision. In research, it is common for documents to be reinterpreted, annotated, or recast in light of newly found documents.

The kern 'x' signifies an "editorial interpretation" — that the immediately preceding signifier is interpreted. The kern 'xx' also signifies an editorial interpretation where the immediately preceding data token is interpreted. The kern 'X' signifies an "editorial intervention" — that the immediately preceding signifier is an editorial addition. The kern 'XX' also signifies an editorial intervention where the immediately preceding data token is an editorial addition. The kern 'y' designates a invisible symbol — such as an unprinted note or rest that is logically implied. The kern 'Y' signifies an editorial *sic* marking — that the information is encoded literally, but is questionable. The kern '?' signifies an editorial footnote where the immediately preceding signifier has an accompanying editorial footnote (located in a comment record). The kern '??' signifies an editorial footnote where the immediately preceding data token has an accompanying editorial footnote (located in a comment record).

Adding Reference Information

Reference information must be added to each file. This information provides "library-type" information about the composer, date of composition, place of composition, copyright notice, etc.

As many reference records should be added as possible since these are immensely useful to Humdrum users. Essential reference records include the following:

!!!COM:	composer's name
!!!CDT:	composer's dates
!!!OTL:	title (in original language)
!!!OMV:	movement number (if appropriate)
!!!OPS:	opus number (if appropriate)
!!!ODT:	date of composition
!!!OPC:	place of composition
!!!YEP:	publisher of electronic edition
!!!YEC:	date & owner of electronic copyright
!!!YER:	date electronic edition released
!!!YEM:	copyright message
!!!YEN:	country of copyright
!!!EED:	electronic editor
!!!ENC:	encoder of document
!!!EEV:	electronic edition version
!!!ELF:	file number, e.g. 1 or 4 (1/4)
!!!VTS:	checksum validation number (see below)
!!!AMT:	metric classification
!!!AIN:	instrumentation

Where appropriate, the following reference records should also be included:

!!!CNT:	composer's nationality
!!!XEN:	title (English translation)
!!!OPR:	title of larger (or parent) work
!!!ODE:	dedication
!!!OCY:	country of composition

`!!!PPR:`	first publisher
`!!!PDT:`	date first published
`!!!PPP:`	place first published
`!!!SCT:`	scholarly catalogue name & number
`!!!SMA:`	manuscript acknowledgement
`!!!AFR:`	form of work
`!!!AGN:`	genre of work
`!!!AST:`	style of period

In general, place essential reference records at the beginning of a document. These will include the composer, title of the work, etc. Less important reference records should be placed at the end of the file. Minimizing the number of reference records at the beginning of a file makes it more convenient for users looking at the contents of a Humdrum file.

Refer to the *Humdrum Reference Manual* for further information about the types and format for different reference records.

Proof-reading Materials

Once you have encoded your document, you should create a error-checking strategy. The Humdrum **humdrum** command can be used to identify whether the final encoded output conforms to the Humdrum syntax:

```
humdrum full.krn
```

Use the Humdrum **proof -k** command to identify any syntactical errors in any encoded `**kern` data:

```
proof -k full.krn
```

One of the best ways to ensure that musical data makes sense is to listen to it. The Humdrum **midi** and **perform** commands can be used to listen to your data.

```
midi -c full.krn | perform
```

The **perform** command allows you to *pause* (press the space bar), to *move* to a particular measure (type a measure number followed by enter), to increase (type <) or decrease (type >) the *tempo,* and to *return* to the beginning of the score (type enter). There are many other functions within the **perform** command; refer to the *Humdrum Reference Manual* — section 4 for further details.

Data Integrity Using the VTS Checksum Record.

When using electronic documents, it is often useful to modify the document for some purpose. After a while, the user will become confused about the status of a document. Is this the original distribution file? Did I make some modification to this file that I've forgotten about? Has someone tampered with this data?

Humdrum provides a means for ensuring that a particular file is what it purports to be. The **veritas** command provides a formal means for verifying that a given Humdrum file is identical to the original distribution file and has not been modified in some way.

The **veritas** command works by looking for a VTS reference record in the file. It then calculates a "checksum" for the file (excluding the VTS record itself) and compares this value with the encoded VTS value. If these values differ, a warning is issued that the file has been modified in some way.

Once you are certain that an encoded Humdrum file is completely finished, you should calculate a "checksum" value to be encoded in a Humdrum "VTS" reference record.

In order to calculate the checksum value for a given file, use the following command:

```
cksum final.file > temp
```

Open the original file and move to the bottom of the document. Then read in the calculated checksum value. Finally, insert the '`!!!VTS: `' reference record designator.

You can check that everything is fine by invoking the **veritas** command:

```
veritas final.file
```

The command will complain only if the VTS checksum value does not correspond to the computed checksum for the file. Finally, be sure to include the checksum value in an index or README file for the distribution. This provides a public venue for users to determine whether the VTS record itself has not been modified.

Preparing a Distribution

Finally, you may want to prepare the material you have encoded for public distribution. Rename the score files and collect them into a coherent repertory. If your data is encoded in the `**kern` format, be sure to use the `.krn` file extension. Place all resulting Humdrum files in a single directory.

Create a `README` file similar to others in Humdrum data distributions. The file should contain a repertory title, a brief paragraph describing the historical background for the works, a paragraph describing the personnel involved in the production, a copyright and license notice, and a table of contents. Avoid tabs in this file, and ensure that no line is greater than 80-characters in length.

It is wise to also add a `LICENSE` file that reiterates whatever licensing agreement is entailed for the distributed data.

Electronic Citation

Electronic editions of music might be cited in printed or other documents by including the

following information. The "author" (e.g. **!!!COM:**), the "title" — either original title (**!!!OTL:**) or translated title (**!!!XEN:**). The editor (**!!!EED:**), published (**!!!YEP:**), date of publication and copyright owner (**!!!YED:**), and electronic version (**EEV:**). In addition, a full citation ought to include the validation checksum (**!!!VTS:**). The validation number will allow others to verify that a particular electronic document is precisely the one cited. A sample citation to an electronic document might be:

> Franz Liszt, Hungarian Rhapsody No. 8 in F-sharp minor (solo piano). Amsterdam: Rijkaard Software Publishers, 1994; H. Vorisek (Ed.), Electronic edition version 2.1, checksum 891678772.

Reprise

In this chapter we have reviewed the principal issues involved in preparing electronic music documents in Humdrum.