

# Section 1



# Humdrum General Introduction

## Introduction

Humdrum is a general-purpose software system intended to assist music researchers in posing and answering research questions. Humdrum's capabilities are quite abstract, and so it is difficult to characterize precisely what it can do. Humdrum can encode information in an unbounded variety of forms. It can transform, classify, coordinate, search, transfer, restructure, contextualize, compare, and otherwise manipulate both pre-defined and user-defined information.<sup>†</sup>

Humdrum will be of potential benefit to anyone wishing to pursue systematic investigations of musical information. This includes the posing of factual questions about music and the testing of hypotheses about musical organization. Humdrum may thus prove to be of use to music theorists, music analysts, ethnomusicologists, historical musicologists, psychomusicologists, music librarians, dance scholars, linguists, and others.

Although Humdrum facilitates exploratory investigations, Humdrum is best used when the user has a clear problem or question in mind. For example, Humdrum allows users to pose and answer questions such as the following:

- In Bartók, are dissonances more common in strong metric positions than in weak metric positions?
- What passages of the original *Salve Regina* antiphon are preserved in the settings by Tomas Luis de Victoria?
- In Urdu folk songs, how common is the so-called “melodic arch” — where phrases tend to ascend and then descend in pitch?
- Which of the Brandenburg Concertos contains the B-A-C-H motif?
- What are the most common fret-board patterns in guitar riffs by Jimmy Hendrix?
- Which of two English translations of Schubert lyrics best preserves the vowel coloration of the original German?
- Is there evidence of greater metric syncopation in late Mozart than in early Mozart?
- How do chord voicings in barbershop quartets differ from chord voicings in other repertoires?
- After the V-I progression, which harmonic progression is most apt to employ a suspension?
- In what harmonic contexts does Handel double the leading-tone?

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<sup>†</sup> Transform (see **humshed**); classify (see **recode**); coordinate (see **assemble**); search (see **grep**, **awk**, **regexp**, **patt**, and **pattern**); transfer (see **rend** and **cleave**); restructure (see **extract**, **yank**, **strophe**, and **thru**); contextualize (see **context**); compare (see **correl** and **simil**).

- Are crescendos in Wagner more strongly associated with rising pitch than is the case for other composers?

Only a few of these questions are *easy* to answer using Humdrum. Although the Humdrum tools may take just minutes to compute an answer for any of the above problems, the primary impediment to a quick solution is the user's skill in interconnecting the right tools for the task at hand. In short, learning Humdrum is akin to learning a programming language.

The Humdrum software system consists of two distinct components: the *Humdrum Syntax* and the *Humdrum Toolkit*. The *Humdrum Syntax* is a grammar for representing sequential symbolic information. The Humdrum syntax is not a single representation scheme; rather, within the syntax, an endless number of representation schemes can be defined. Theoretically, any type of sequential symbolic data may be accommodated — such as square notation, Schenkerian graphs, piano fingerings, changes of emotional states, MIDI data, acoustic spectra, North Indian tabla bols, ballet steps, concurrent television schedules — or even industrial chemical processes.

Within Humdrum's syntactic framework users are free to concoct their own task-specific representations — such as a scheme to represent Telugu notation or Dagomba dance. Humdrum representations may be very highly crafted, or they may be invented in a matter of seconds. It is common to generate intermediate or “throw-away” representations that are used only for a single research task.

The *Humdrum Toolkit* is a set of more than 60 inter-related software tools. These tools manipulate ASCII data conforming to the Humdrum syntax. If the ASCII data represents music-related information, then we can say that the Humdrum tools manipulate music-related information.

The names of some of the Humdrum tools will be readily recognizable by musicians. Humdrum tools such as **degree**, **key**, **pitch**, **record**, **tacet**, **trans** and **reihe** may evoke fairly accurate ideas about what they do. Ironically, the most recognizable tools are typically the least useful tools in the toolkit — because they are so specialized. The most powerful Humdrum tools have names such as **cleave**, **humsed**, **simil**, **recode**, **context**, **patt** and **yank**.

By themselves, the individual tools of the Humdrum Toolkit are quite modest in their effects. However, the tools are not intended to be self-sufficient. They are designed to work in conjunction with each other, as well as in consort with existing standard UNIX commands. Like musical instruments, their potential usefulness is greatly increased when they are deployed together in various ensembles. Musical problems are typically addressed by linking together successive Humdrum (and UNIX) commands to form one or more command *pipelines*. Although each individual tool may have only a modest effect, the resulting capacity for solving complex problems is legion.

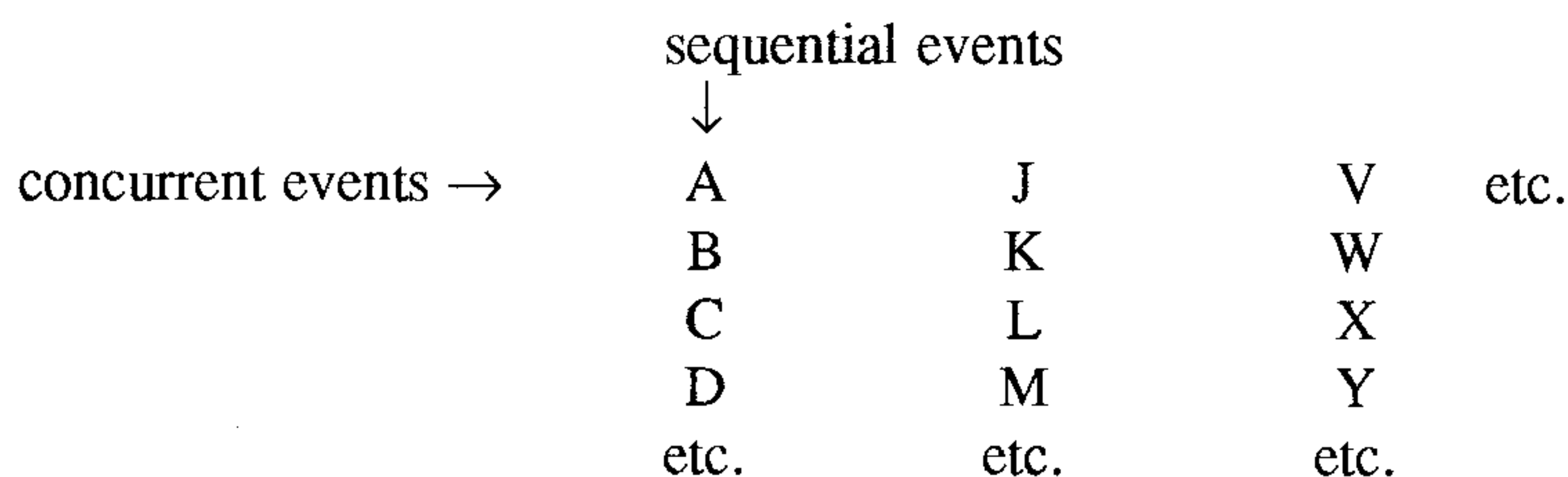
## The Humdrum Syntax

The Humdrum syntax provides a framework within which representation schemes can be defined. Each scheme consists of a mapping between the concepts we wish to represent (“signifieds”) and how we wish to represent them (“signifiers”). The signifieds are music-related concepts determined by the user, whereas the signifiers consist of the individual ASCII<sup>†</sup> characters



commonly available on computers.

The basis for the Humdrum syntax is a file or group of files. Rather than viewing a file as a linear string of characters, Humdrum regards each file as a two-dimensional plane — much like a sheet of paper. The two dimensions represent *sequence* and *attribute*. *Sequences* of events proceed vertically down the page, whereas concurrent *attributes* extend horizontally across the page. Two signifiers that occupy the same horizontal line represent concurrent (or overlapping) events. The basic organization of Humdrum files may be schematically illustrated as follows:



Humdrum encodings consist of a set of one or more lines or *records*. There are three types of Humdrum records:

1. comment records,
2. interpretation records, and
3. data records.

These three record types are mutually exclusive, so it is not possible to mix comments, interpretations, or data records on the same line.

There are two kinds of *comments*: global comments and local comments. *Global comments* may pertain to an entire file (such as the title of a work), whereas *local comments* may pertain to some specific part of the file (such as a particular staff, instrument, note, finger, etc.). Comments are lines that contain an exclamation mark (!) at the beginning of the record (in the first column); subsequent characters up to and including the first occurrence of a carriage return or newline character constitute the comment record. Global comments are denoted by two exclamation marks (!! ) at the beginning of the record. Global comments may contain any sequence of printable ASCII characters — including ‘blank space’ such as tabs and spaces. Local comments may contain any sequence of printable ASCII characters, with the important exception of the tab character. (The reason for excluding tabs in local comments will become clear shortly.) Comments may be used to insert free-format commentaries in Humdrum encodings.

*Interpretations* are lines that begin with the asterisk character (\*). Interpretations are used to identify more precisely the state of the representation — for example, to indicate that an encoded part is for a transposing instrument in E-flat, or to indicate that the representation is for a given Balinese tuning, or that the representation encodes a conductor’s physical gestures. Humdrum requires that at least one interpretation must be specified before any data records are encountered. The difference between a comment and an interpretation is that interpretations are

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† ASCII is an initialism for American Standard Code for Information Interchange.

formal, potentially *executable* statements; interpretations pass information to programs that process the Humdrum encoding.

As in the case of comments, there are two types of interpretations: *exclusive interpretations* and *tandem interpretations*. Exclusive interpretations begin with a double asterisk (\*\*) whereas tandem interpretations begin with a single asterisk (\*). Exclusive interpretations are mutually exclusive — only one such interpretation can be active at a given time for a given string of data. No set of data is complete without the presence of an exclusive interpretation. Tandem interpretations, by contrast, provide supplementary information about how a set of data is to be interpreted. Several tandem interpretations may pertain to a given set of data; unlike exclusive interpretations, tandem interpretations are not necessarily mutually exclusive. Various pre-defined Humdrum interpretations are described in detail in Sections 2 and 3 of this document. Section 2 describes a number of exclusive interpretations, whereas Section 3 describes several tandem interpretations.

Lines that do not contain either an exclamation mark or an asterisk in the first column are *data records*. Blank lines (i.e. lines which are either empty, or contain only blank space — such as tabs and spaces) are forbidden in Humdrum. Thus data records may be formally defined as non-empty lines that do not begin with either an exclamation mark or an asterisk. Data records are the work-horses of Humdrum; data records hold the bulk of the encoded information.

In Humdrum, each data record encodes information pertaining to either a particular moment in time or to a particular time window or duration. (Whether a record represents a precise moment or whether it represents an expanse of time depends on the accompanying interpretation.) Each data record may contain one or more data *tokens*. When more than one token is present, tokens are separated from each other by tabs. When several data records are present, multiple tokens will align themselves in columns through the file. Columns have a special importance in Humdrum and are referred to as *spines*.

In a sense, Humdrum data records can be regarded as a two-dimensional table or grid consisting of one or more *spines* and one or more *records* (i.e. columns and rows respectively). By itself, a spine has no particular meaning; it is simply a way of linking together related tokens through time. Spines become meaningful only when they are labelled by adding an interpretation.

By itself, Humdrum recognizes only six ASCII characters. Two of these characters — the exclamation mark (!) and the asterisk (\*) — are recognized only when they appear in the first column of a record.<sup>†</sup> The remaining characters are the period (.), the space, the tab character, and the carriage return (=newline character). As we have seen, the exclamation mark and the asterisk are used to identify comments and interpretations, respectively. The tab and carriage return characters are used to format the data into *spines* and *records*, respectively.

As noted above, the data in the data records are conceptually divided into tokens. In Humdrum, there are two possible types of tokens:

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<sup>†</sup> Or preceded by a tab. See below.



1. *data* tokens, and
2. *null* tokens (.).

Consider, for example, the following file:

```

X      .      X
X      X      X
.      X      X
X      .      X

```

This file consists of three vertical spines and four horizontal records. The first and third spines begin with data tokens, while the second spine begins with a null token. Without the presence of interpretations, the meaning of this file is indeterminate. The file below contains two spines that have been labelled using Humdrum interpretations:

```

**left  **right
X      .
.      X
X      .
.      X
X      .
*-      *-

```

The user has defined two interpretations: “left” and “right.” The intention is to represent the footfalls of a person’s left and right feet. The above representation simply encodes that the left and right feet have alternating events — such as might be produced by walking or running. Notice that null tokens (.) indicate nothing at all — they merely act as place-holders to maintain the format of the two spines (i.e. the two columns). Notice also that interpretations must be defined for each spine, and that each interpretation consists of some keyword appended to the double asterisks (e.g. *\*\*left*). No intervening spaces are permitted between the interpretation *keyword* (*left*) and the asterisks, however spaces may appear as part of the keyword itself. In addition, when more than one spine is present, both the data tokens and the associated interpretations must be separated by a tab character; spaces cannot be used to separate spines. Finally, note that each spine is formally terminated by a *spine-path terminator* — the asterisk character followed by a minus sign.

Interpretations can be cascaded so that a single spine has more than one interpretation associated with it. This is done through the addition of tandem interpretations. Consider, the following example:

```

**left  **right  **left  **right
*foot   *foot    *arm    *arm
X      .      .      X
.      X      X      .
X      .      .      X
.      X      X      .
X      .      .      X
*-      *-      *-      *-

```

In this case the categories “foot” and “arm” have been added to our representation. The first spine is interpreted both as “left” and as “foot.” However, the exclusive interpretation (double

asterisks) takes conceptual precedence over the tandem interpretation (single asterisk). That is, tandem interpretations merely modify or supplement the exclusive interpretation. Hence, given the above representation, we would say that “foot” is an attribute of “left” or “right,” but we could not say that “left” is an attribute of “foot.”

Users are free to define as many different exclusive and tandem interpretations as they wish. For example, a user might define the interpretation `**bowing` that would be suitable for encoding detailed bowing information in works for strings. For each exclusive interpretation, the Humdrum user can re-define the meaning of all of the ASCII characters — with the exception of the tab and the carriage return which always retain their functions as ‘token/spine separator’ and ‘record separator’ respectively. The characters: `! . *` can also be re-defined — although there are some restrictions as to how they can be used.<sup>†</sup>

Since certain types of musical information are quite common, it is helpful to pre-define some general-purpose interpretations. Examples of pre-defined exclusive interpretations include: `**dynam` (dynamics), `**pitch` (pitch), `**harm` (functional harmony), `**pcset` (pitch-class sets), `**degree` (scale degree), `**freq` (frequency), `**mint` (melodic interval), and `**text` (lyrics). Dozens of pre-defined Humdrum representations are described in Section 2 of this manual. However, when browsing through the Humdrum manual, it is important to remember that users are entirely free to concoct their own representations. Humdrum users are not obliged to use any of the pre-defined representations described in this manual. For example, an ethnomusicologist may prefer to define an alternative to the `**text` representation in order to better handle the Inuit language. The most important Humdrum software tools will continue to work with any user-defined representations.

The following example illustrates a slightly more complex Humdrum representation. The representation shows one rendering of the opening of “Happy Birthday” — encoded using three interpretations. The `**pitch` interpretation provides a means for representing pitch information, the `**recip` interpretation is able to represent nominal durations, and the `**text` interpretation permits us to represent the lyrics.

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<sup>†</sup> Specifically, the exclamation mark (!) cannot occur in the first column of the record (unless it is used to indicate a comment). Similarly, the asterisk cannot occur in the first column of a record (unless it is used to indicate a Humdrum interpretation). The period (.) character can appear as a data signifier in any situation with the following exceptions: it cannot appear on a line by itself, it cannot appear in the first column of a record if it is followed by the tab character, and it cannot appear at the end of a record if it is preceded by a tab character (unless it is used to encode a null token).



```

!! Mildred and Patti Hill, composers.
!! 'Happy Birthday'
**pitch      **recip      **text
!re A4=440Hz  !            !(lyrics)
G4           8.          Hap-
G4           16          -py
A4           4           birth-
G4           4           -day
C5           4           to
B4           2           you ;
G4           8.          hap-
G4           16          -py
A4           4           birth-
G4           4           -day
D5           4           to
C5           2           you ;
*-           *-          *-

```

The following observations are pertinent. Time moves down the page. Each spine begins with an exclusive interpretation and ends with a spine-path terminator. Spines are separated by tabs. Data records appear only after an exclusive interpretation, but global comments can appear anywhere in the file. Each data record represents concurrent activities across all spines. Global comments ignore the column structure of the spines. However, local comments must conform fully to the spine structure, and can appear only after an exclusive interpretation. Local comments pertain only to their respective spines; the solitary exclamation mark in the second spine is a null comment, which simply acts as a place-holder for the concurrent comments in the other spines. In the case of the **\*\*recip** spine, durations are represented by numbers corresponding to the reciprocals of the American duration names (4=quarter, 2=half; 8.=dotted-eighth). The **\*\*text** representation requires that punctuation marks be isolated from the rest of the data token. When a data token is split in this way, Humdrum requires that the *subtokens* be distinguished by interposing a space character. Data tokens containing multiple subtokens are referred to in Humdrum as *multiple-stops*.

Another Humdrum representation is illustrated by the following excerpt from Fugue 20 from the Well-Tempered Clavier Vol. II. The first and last two measures are shown:

```

!! J.S. Bach, WTC Book II, Fugue 20; BWV 889b
**kern      **kern      **kern
*k[]        *k[]        *k[]
*a:         *a:         *a:
*M4/4       *M4/4       *M4/4
*MM72       *MM72       *MM72
=1          =1          =1
4r          1r          1r
4e          .           .
4c          .           .
4f          .           .
=2          =2          =2
4G#         1r          1r
4r          .           .
8r          .           .
8d          .           .
8B          .           .
8e          .           .
!! Continuing measure 27:
=27         =27         =27
8r          8E          8r
8Dn         8r          32r
.           .           32e
.           .           32f#
.           .           32g#
8BB         4r          8.g#T
8E          .           .
.           .           32f#
.           .           32g#
8C          8r          [2a
8AA         32r          .
.           32B          .
.           32c          .
.           32d          .
8EE         8.c#T        .
8GG         .           .
.           32B          .
.           32c#         .
=28         =28         =28
32FF        8d          8a]
32EE        .           .
8DD         .           .
.           8f          8b
32EE        .           .
32FF        .           .
8.EET       8G#         8e
.           8B          8g#

```



32DD	.	.
32EE	.	.
2AAA; 2AA;	2c; 2e;	2a; --
==	==	==
*_	*_	*_

In this example, all of the spines use the `**kern` exclusive interpretation; `**kern` is suitable for representing the core pitch and duration information for common-practice musical scores. Several tandem interpretations specify a key-signature having no sharps or flats (`*k[]`), a key of A minor (`*a:`), a meter signature (`*M4/4`), and a tempo (`*MM72`). (Detailed descriptions of these and other pre-defined tandem interpretations are given in Section 3 of this manual.) Barlines are indicated by an equals-sign. Rests are indicated by the lower-case letter 'r'. In this example, each spine represents a different musical part or voice. Parts are ordered from left-to right with the lowest voice in the left-hand spine. The file is structured like a score turned sideways. In the final chord, double-stops (two pitches) are evident in each of the lower two voices. Notice the use of null tokens (.) as place holders, so when only one voice is active, the other voices merely sustain their previous action. Trills are designated by the upper-case 'T'; tied notes are designated by square brackets; pauses are indicated by the semicolon.

In the `**kern` scheme, pitches are represented by letter names (a-g and A-G). Lower-case letters indicate pitches above (and including) middle C; upper-case letters indicate pitches below middle C. Letters are repeated (e.g. "cc" or "CC") for each successive octave distance from middle C. In the `**kern` representation, durations are encoded in the same manner as the previous `**recip` representation. Although not shown in the above example, `**kern` is also able to represent phrases, slurs, articulation marks, stem directions, beaming, ornaments, and other features. A complete description of `**kern` is given in Section 2 of this manual.

## Spine Paths

Humdrum representations frequently consist of a fixed number of spines that continue throughout the course of an encoded file. As illustrated above, a typical use of spines might be to encode different "voices" in a musical work. However, there is no reason to equate spines with voices; spines are used for many other purposes. In encoding Humdrum representations it is occasionally useful to be able to vary the number of spines. However, files with varying numbers of spines can pose significant questions of interpretation. Consider, for example, the following sequence of Humdrum-like data records:

1	2	3
1	2	3
1	2	3
A	B	
A	B	
A	B	

At the point where three spines is reduced to two spines the continuity is ambiguous: Has spine '3' been discontinued? Or is spine 'B' a continuation of spine '3' with spine 'A' a continuation of spine '1'? For some representations such questions will be of little concern; however in other circumstances the manner in which the spines continue will be of critical importance. For example, if all of the above spines encoded pitch information for various musical parts, a study of melodic intervals would need to resolve the specific melodic paths as the representation moves

from three to two spines. Failure to clarify the pitch-paths would make it difficult to determine or search for specific sequences of melodic intervals.

The Humdrum syntax provides special *spine path indicators* that make it possible to resolve such ambiguities and to ensure that the continuity (or lack of continuity) is made clear. Humdrum provides five special path indicators — one of which we have already encountered. Specifically:

- an existing spine may terminate (without continuing further)
- a new spine may be introduced
- a previous spine may be split into two spines
- two or more spines may be amalgamated into a single spine
- the positions of two spines may be exchanged

Spine path indicators use the following signifiers: the plus sign (add a spine), the minus sign (terminate a spine), the caret (split a spine), the small letter 'v' (join spines), and the small letter 'x' (exchange spines). In addition to these, a *null interpretation* exists — whose purpose is merely to act as a place-holder in interpretation records:

*-	terminate a current spine
*+	add a new spine
*^	split a spine (into two)
*v	join (two or more) spines into one
*x	exchange the position of two spines
*	null interpretation (place holder)

*Spine Path Interpretations*

Spine paths are types of interpretations, so the spine path indicators are encoded as Humdrum interpretations using the asterisk signifier (\*). The following examples illustrate a few possible path changes.



## Examples:

1	2	3	
*	*-	*	(elimination of spine #2)
1	3		

1	2	3	
*	*x	*x	(exchange spines #2 and #3)
1	3	2	

1	2	3	
*	*^	*	(splitting of spine #2)
1	2a	2b	3

1	2	3	
*	*v	*v	(amalgamation of spines #2 and #3)
1	2&3		

Notice that in cases where two or more spines are amalgamated, it is imperative that the spines be adjacent neighbors. For example, the arrangement below is forbidden by the Humdrum syntax since it is not clear whether the spines #1 and #3 amalgamate into spine 'A' or spine 'B'.

1	2	3	
*v	*	*v	(syntactically illegal)
A	B		

In such cases, amalgamating the two outer spines can be accomplished by first using the exchange path signifier. Here we exchange spines #2 and #3 before amalgamating the original first and third spines:

1	2	3	
*	*x	*x	
*v	*v	*	
1&3	2		

In cases where several amalgamations are necessary, more than one set of interpretation records may be necessary. In the following example, spines #1 and #2 are first joined together (momentarily defining three spines: 1&2, 3, 4). In the subsequent interpretation record, spine #2 (previous spine #3) and spine #3 (previous spine #4) are then joined:

1	2	3	4
*v	*v	*	*
*	*v	*v	
1&2	3&4		

In addition, it is possible to join more than two previous spines at the same time:

1	2	3	4
*v	*v	*v	*v
1&2&3&4			

In cases where a new spine is introduced, it is essential to indicate the exclusive interpretation that applies to the new data. Thus an 'add spine' indication must be followed by a second

interpretation record:

```

1      2      3
*      *+     *      (add a new spine.)
*      *      **inter * (define exclusive interpretation for the
1      2      new      3      new spine.)

```

Failing to follow the introduction of a new spine by a subsequent exclusive interpretation is illegal.

The following examples illustrate a variety of more complex path redefinitions:

```

1      2      3      4
*v      *v      *^      *^
1&2     3a     3b     4a     4b

```

```

1      2      3      4      5
*      *−      *      *−      *
*v      *v      *v
1&3&5

```

```

1      2      3      4      5
*      *−      *      *^      *+
*      *      *      *      *      **new
*v      *v      *      *      *      *
1&3     4a     4b     5      new

```

```

1      2      3      4
*x      *x      *      *
*      *x      *x      *
*      *      *x      *x
2      3      4      1

```

Note that with judicious planning, the user can completely reconfigure all spines within a Humdrum file.

Syntactically, some path constructions are illegal; here are some examples of illegal constructions:

```

1      2      3
*v      *      *v      (The join-spine indication in spine #1 does not
                        adjoin spine #3.)

```

```

1      2      3
*x      *x      *x      (No more than two exchange interpretations at a time.)

```



1	2	3	
*x	*	*	(Must have two exchange interpretations together.)
1	2	3	
*v	*	*	(Must have two or more join interpretations at a time.)
1	2	3	
*	*		(Spine eliminated without using a termination interpretation.)
1	2	3	
*	*	*+	(Adding a new spine should result in 4 interpretations.)
1	2		
*	*	*-	(Cannot eliminate non-existent spine.)
1	2		
*+	*		
1	new	2	(New spine started without specifying new interpretation.)
1	2		
*	*+		
*	**inter	*	(Interpretation labels the wrong spine.)
A	B	C	

## The Humdrum Syntax: A Formal Definition

With the preceding background it is now possible to define formally a Humdrum representation. First we can define a Humdrum file. A Humdrum file must conform to any one of the following:

1. A file containing *comments*, *data records* and *interpretations* with the restriction that no data record or local comment appears before the first *exclusive interpretation*.
2. A file containing *data records* preceded by at least one *exclusive interpretation*.
3. A file containing only *comments* and *interpretations* with the restriction that no local comments appear before the first interpretation.
4. A file containing only *interpretations* beginning with an exclusive interpretation.
5. A file containing only global *comments*.
6. A totally empty file (i.e. a file containing no records).

In addition, each spine in a Humdrum file must ultimately end with a path terminator (\*-). Only global comments (or new exclusive interpretations) may occur following the termination of all spines. A property of Humdrum files is that the concatenation of two or more Humdrum files will always result in a Humdrum file.

Additional interpretations may be added throughout the file. Global comments may appear anywhere in the file. However, local comments are much more restricted: (1) Local comments

may not appear until after the first interpretation record. (2) The number of sub-comments in a local comment record must be equivalent to the number of currently active spines.

Comment	Either a global or local comment.
Global comment	Any record beginning with two exclamation marks (!!).
Local comment	Any record beginning with one and only one exclamation mark (!). Each concurrent spine in the same record must also begin with an exclamation mark.
Null comment	A comment record containing no commentary; only the appropriate exclamation mark(s) present.
Interpretation	Either an exclusive or tandem interpretation.
Exclusive interpretation	Any record beginning with an asterisk (*).
Tandem interpretation	Any record beginning with one or more asterisks (*), where at least one spine begins with two asterisks.
Path indicator	Any record beginning with a single asterisk (*) where none of the spines begins with two asterisks.
Null interpretation	One of five special interpretations: *+ *- *v *^ *x found only in tandem interpretation records.
Data record	An interpretation for a given spine or spines consisting of just the interpretation signifier (i.e. a single asterisk — *).
Null token	Any record that is not a comment or interpretation. Must contain the same number of tokens as the number of current spines.
Null data record	The period (.) either alone on a single record or separated from other characters by a tab. Appears only in data records.
Spine	A data record consisting only of null tokens.
	A column-like “path” of information — including data records, local comments, and interpretations.

### *Humdrum Terminology*

As a supplement to the above “positive” definition of the Humdrum syntax, we can also describe various inputs that do *not* conform to the Humdrum syntax:



An empty record.  
 A record containing only tabs.  
 A record beginning with a tab.  
 A record ending with a tab.  
 Any record containing two successive tab characters.  
 Any data record having fewer or more spines than the immediately preceding data record.  
 Path indicator having only one join-spine indication  
 Path indicator having only one exchange-spine indication  
 Path indicator having more than two exchange-spine indications

*Some Illegal Humdrum Constructions*

One of the most important commands in the Humdrum Toolkit is the **humdrum** command itself. This command is used to identify whether a file or other input stream conforms to the above Humdrum syntax. Where appropriate, the **humdrum** command issues error messages identifying the type and location of any syntactical transgressions. If no infractions are found, **humdrum** produces no output (i.e. "silence is golden"). All of the remaining commands in the Humdrum toolkit assume that the inputs given to them conform to the Humdrum syntax. Where problems arise, the user should always test the input to assure that it is in the proper Humdrum format.

The examples given below provide further illustrations of Humdrum representations:

```

**form
Introduction
Exposition
Development
Recapitulation
Coda
*-

**American    **British
quarter       crotchet
eighth        quaver
dotted half   dotted minim
*-            *-

**Opus/No     **Year
23/1          1821
23/2          1821
23/3          1822?
24            1822
*-            *-

```

```

**recip    **diaton    **accidental    **stem-dir    **kern
4          c          #          /          4c#/
8          d          .          /          8d/
8          e          .          /          8e/
2          f          #          /          8f#/
*-         *-         *-         *-         *-

**heart-rate
74
73
74
77
78
*-

**foreground
flute
*^
flute          violin1
*-             *
violin1
*^
violin1        bassoon
*              *^
violin1        bassoon    'cello
*              *         *^
violin1        bassoon    'cello    trombone
*-             *-         *-         *
trombone
*^
trombone        trumpet
*-             *-

```

## Section Labels and Repetitions

Musical scores are often notated so as to take advantage of repetitions in the music. Through such devices as repeat marks, Da Capo, Dal Segno, Codas, and other mechanisms, it is possible to represent a musical work in an abbreviated format. Humdrum provides parallel mechanisms that allow works to be represented in succinct ways.

Humdrum files may be logically divided into segments or passages by encoding Humdrum *section labels*. A section label is a type of tandem interpretation that consists of a single asterisk, followed by a greater-than sign, followed by a keyword that labels the section. The following are examples of section labels.

```

*>Coda
*>1st Ending
*>Refrain

```

Notice that spaces can appear in section labels as in *1st Ending*. Sections begin with a section label and end when either another section label is encountered, all spines are assigned new exclusive interpretations, or all spines terminate. If there is more than one spine present in a passage, identical section labels must appear concurrently in all spines.

Rather than encode multiple copies of a passage, a single instance may be encoded and labelled as a section. The complete version of the work can be reconstructed by referring to an *expansion list*. An expansion list is another tandem interpretation that contains an ordered list of section labels. In effect, the expansion list indicates how the abbreviated file should be expanded to a full-length encoding. Consider the following expansion list:

```
*>[verse1,refrain,verse2,refrain]
```

This list indicates that the abbreviated file contains (at least) three sections, labelled “verse1,” “verse2” and “refrain.” When the file is expanded, the “refrain” section should be repeated following each verse.

The Humdrum **thru** command expands *abbreviated format* representations to a so-called *through-composed format* in which repeated passages are expanded according to an expansion list. When the **thru** command is invoked, it eliminates any expansion lists present in the input; in addition, **thru** places a *\*thru* tandem interpretation in all spines immediately following each instance of an exclusive interpretation in the input. This marks the file as being in a through-composed format. Any other *\*thru* tandem interpretations encountered in the input are subsequently discarded. As a result, running a file through **thru** twice will not change the file in any way.

## Versions

For works encoded in an abbreviated format, it is not always useful to expand it according to a single fixed recipe. Depending on the performance practice, individual performer, or edition, certain repeats may be avoided, passages may be added, or material eliminated altogether. In short, several different versions or interpretations of the overall organization of a work may exist.

Humdrum provides a mechanism by which several alternative versions of the overall organization of a work may co-exist in the same file. This is achieved simply by encoding more than one expansion list. In order to distinguish different versions, each expansion list is given a unique version label. Consider the following expansion lists:

```
*>Gould82 [A, A, B]
*>Landowska [A, A, B, B]
```

Here we see two expansion lists, one labelled *Gould82* and the other labelled *Landowska*. These expansion lists might encode different interpretations of the repeats in a rounded binary form. When the **thru** command is invoked, the user can specify which *version* is intended, and the appropriate through-composed expansion will be output.



## Strophic Representations

Section labels and versions allow Humdrum users to select alternative groups of (horizontal) records within a Humdrum file or document. In other circumstances it is useful to be able to select alternative (vertical) paths within a file. Strophic representations may be conceived as “alternative concurrent paths” through a Humdrum document. Examples of alternative concurrent representation paths might include (1) the texts for different verses of a song, (2) alternative renditions of the same passage (such as *ossia* passages), or (3) differing editorial interpretations of a given note or sequence of notes.

Structurally, strophic data must begin from a single common spine, split apart into two or more alternative spines, and then rejoin to form a single spine. Since the strophes split from a common spine, they all necessarily begin by sharing the same data type. Different exclusive interpretations may be introduced in the strophic passage — provided all strophic spines end up sharing the same data type just prior to being rejoined.

The beginning of a strophic passage is signalled by the presence of a *strophic passage initiator* — a single asterisk followed by the keyword “strophe” (\*strophe). The end of a strophic passage is signalled by the *strophic passage terminator* — a single asterisk followed by the upper-case letter ‘S’ followed by a minus sign (\*S-). Each spine within the strophic passage begins with a *strophe label* and ends with a *strophe end indicator* (\*S/fin). Strophe labels may consist of either alphanumeric names, or numbers. Numerical labels should be used when the strophic data imply some sort of order, such as verses in a song. Alphanumeric labels are convenient for distinguishing different editions or *ossia*

passages. The following example encodes a melodic phrase containing four numbered verses from “Das Wandern” from *Die Schoene Muellerin* by Schubert:

```

!! Franz Schubert, 'Das Wandern' from "Die Schoene Muellerin"
**kern          **text          --
*>[1,1,1,1]    *>[1,1,1,1]
*>1            *>1
*k[b-e-]       *Deutsch
*              *solo
*              *strophe
*              *^
*              *^          *^
*              *S/1        *S/2        *S/3        *S/4
8f             Das        Vom        Das        Die
=5             =5         =5         =5         =5
8f             Wan-       Was-       sehn       Stei-
8b-            -dern      -ser       wir       -ne
8a             ist        ha-        auch      selbst ,
8ee-           des        -ben       den       so
=6             =6         =6         =6         =6
(16dd          Mül-       wir's     Rä-
16ff)          |          |          |          |
(16dd          -lers      ge-       -dern     sie
16b-)          |          |          |          |
8f             Lust ,     lernt ,   ab ,      sind ,
8dd            das        vom        den       die
=7             =7         =7         =7         =7
(8.cc          Wan-       Was-       Rä-       Stei-
16a)           |          |          |          |
8b-            dern !     ser !     dern !    ne !
8r             %          %          %          %
*              *S/fin     *S/fin     *S/fin     *S/fin
*              *v         *v         *v         *v
*              *S-
*_             *_

```

Notice that this file contains a single section labelled '1' and that an expansion list occurs near the beginning of the file that indicates the section is to be repeated 4 times in total.

The strophic passage pertains only to the spine marked `**text`. Following the strophic passage indicator (`*strophe`), the spine is split apart until the required number of verses are generated. Then each spine is labelled with its own strophe label. Since the verses have an order, it is appropriate to label them with numbers: `*S/1`, `*S/2`, and so on. The individual verses are terminated with strophe end indicators (`*S/fin`), the spines rejoin, and then a strophic passage terminator (`*S-`) marks the end of the strophic passage.

The Humdrum **strophe** command can be used to isolate or extract selective strophic data. For example, the user might select certain verses, or extract an *ossia* passage. But before using the **strophe** command, the file must be transformed to a through-composed format via the **thru** command.



## The Humdrum Syntax: Conclusion

This introduction to Humdrum has identified the major structural and organizational features of the Humdrum syntax. This syntax provides a framework within which sequential symbolic data can be represented. Individual representation schemes map the ASCII character set (signifiers) to various music-related concepts (signifieds).

Each mapping is designated by an exclusive interpretation. The corresponding data are organized in spines that may meander throughout the file. New spines may be added, spines joined together, exchanged, split, or terminated. Data are organized as tokens — however, the tokens themselves can consist of multiple subtokens separated by spaces. Null tokens can appear as place-holders where no specific data exists.

Free-form comments may be interspersed throughout the file. Global comments pertain to all spines whereas local comments pertain to individual spines. Additional interpretive information may be encoded using tandem interpretations. Both local comments and tandem interpretations may occur anywhere, but must be preceded in the spine by some exclusive interpretation.

Entire passages or sections may be labelled and repetitive material can be eliminated to produce abbreviated formats. Expansion lists indicate the manner by which abbreviated encodings can be restored to through-composed formats. Several alternative versions of the expansion can exist concurrently in a document, and any given named version can be selected for expansion. Alternative concurrent paths of information can be selected in the case of strophically-organized material.

In the ensuing sections of the manual, further details are given concerning specific pre-defined representations. In addition, the operation of the individual Humdrum tools is chronicled in Section 4. In the immediately following discussion, further general information is presented concerning broader reference issues.

## Reference Records

An important aspect of any document is the manner by which it is identified and accessed. In the case of printed materials, the author, title, and date of publication provide important pieces of information by which the document can be uniquely identified, retrieved, or cited. In the Humdrum representation syntax, bibliographic or reference information is encoded using specially-formatted global comments called *reference records*. Reference records provide standardized ways of encoding bibliographic information — suitable for computer-based access.

In conjunction with the **grep** and **awk** commands, Humdrum reference records allow users to retrieve electronic documents according to sophisticated search strategies. For example, users can access all works attributed to more than one composer, those works composed in a particular country that exhibit irregular meters, or all works commissioned by a certain individual where the instrumentation includes a specified instrument.

Humdrum reference records are designated by three exclamation marks at the beginning of a record, followed by a three letter code, followed by an optional number, followed by a colon, followed by some text. For example, the following record indicates that the composer of the encoded work is Robert Schumann.



!!!COM: Schumann, Robert

In most cases, more than one reference code is permitted on the same record; successive codes are then delimited by interposing a tab. For example, the following record indicates both the composer and title of the work.

!!!COM: Stevenson, Ronald

!!!OTL: Passacaglia on DSCH

A large number of such three-letter codes are pre-defined in Humdrum, and are listed in the ensuing pages. Before identifying specific types of information, we can first identify some general principles for encoding reference information.

Humdrum reference records are intended to serve the international music scholarly community — not just those scholars who speak English. As a general principle, Humdrum reference information is encoded in the original or source language. This typically means that names, titles and other information are encoded in the language of the producer of the work. An exception to this principle arises where the original language does not make use of the Roman alphabet. In these cases, the most scholarly Roman transliteration scheme is used — such as *Pinyin* in the case of Mandarin Chinese.

Note that encoding reference information in the source language does not preclude translations of the reference data. Humdrum reference records also provide simple mechanisms for encoding and accessing information in translated forms. Translated reference information may be made to any language for which a Roman transliteration scheme exists. Thus titles for works by Mendelssohn may be rendered in Arabic or Japanese.

Many reference items pertain to the names of people. These include the names of composers, lyricists, librettists, and arrangers, as well as editors, copyright owners, and others. Since Humdrum representations are not limited to the representation of “musical scores,” names might include the names of performers, conductors, or even (in the case of perceptual data) listeners. Reference codes that encode people’s names follow a common syntax. Most names are in the form of a family-name, followed by a comma, followed by given names, followed by an optional colon, followed by any honorific (such as Dr., von, Sir, etc.). If given names are not known, one or more initials may be encoded where each initial is followed by a period with a single space interposed between successive initials. In the case of Asian names, a comma is placed following the family name. Hence, the Chinese name, Deng Xiao Tie, is represented as Deng, Xiao Tie. Where no family name exists, the name is represented as spoken, as in Guido d’Arezzo, Josquin des Prez, or Chief Falcon Feather. Note that many Javanese-Indonesian names consist of a single name.

In some cases, the most commonly known name is an abbreviation, alias, or stage name — such as Madonna or Liberace. In other cases, the most commonly known names will be corporate names — such as the names of popular groups. Special reference records are provided for these types of reference information and so corporate names should not appear in records intended for proper names. For anonymous individuals, the five-character text string “Anon.” should be encoded. Where a specific anonymous individual is understood to be the author, a conventional designation such as “Anonymous 3” may be used. Note that Humdrum provides separate reference codes for identifying “attributed composer” and “suspected composer.”



Computer-based documents may have complex networks of copyright-related information. Some documents will be encoded from other documents (often printed) that may or may not be in the public domain. The electronic version of the document may have been produced, owned, or licensed by the owner of the original document. In other cases, the original work may be in the public domain, but the edition or arrangement of the transcribed document may be under copyright. Once again, the electronic version of the document may have been produced or licensed by the owner of the original edition or by an arranger.

Unless the electronic document itself was illegally encoded, the document is protected by copyright — normally held by the producer of the electronic edition. In some cases, the producer may elect to assign the ownership to another, to license the ownership to others, to make the document available on a *shareware* basis, or to explicitly place the document in the public domain. Users of electronic media should be aware of the importance of intellectual property, and of the statutory rights of their producers to benefit financially from their labors. Humdrum provides detailed reference capabilities for specifying copyright information. Note that tampering with statements of copyright in an electronic document is a prosecutable offense in most countries.

Over 80 reference codes are pre-defined in Humdrum. Each of these reference records is described below under seven categories: (1) authorship information, (2) performance information, (3) work identification information, (4) imprint information, (5) copyright information, (6) analytic information, and (7) representation information. A final section discusses how to cite electronic documents.

## Authorship Information

**!!!COM:** Composer's name. In some cases, opinions differ regarding the best spelling of a composer's name. If so, all common spellings should be given — each alternative separated from the previous by a semicolon. E.g.

!!!COM: Chopin, Fryderyk; Chopin, Frederick

With respect to accents, refer to the discussion concerning the **!!!RLN:** reference record (see below). If a work was composed by more than one composer, then each composer's name should appear on a separate **!!!COM:** record with a number designation prior to the colon. For example,

!!!COM1: Composer, A.

!!!COM2: Composer, B.

**!!!COA:** Attributed composer. This may include attributions known to be false. Several attributions may be combined on a single record by separating each name by a semicolon. Note that if a document contains both **!!!COA:** and **!!!COM:** records, then the attributed composer is explicitly assumed to be false.

**!!!COS:** Suspected composer. This reference code indicates the belief of the editor or producer of the document as to the true identity of the composer(s). If more than one composer is suspected, each name should appear on a separate **!!!COS:** record.

**!!!COL:** Composer's abbreviated, alias, or stage name. e.g. Madonna.

**!!!COC:** Composer(s) corporate name. Corporate names may include the names of popular groups (especially when the actual composer is not known). Corporate names may also include business names, e.g. Muzak.

**!!!CDT:** Composer's dates. The birth and death dates should be encoded using the **\*\*Zeit** format described in the *Representation Reference* section of this manual. The **\*\*Zeit** format provides a highly refined representation, including methods for representing uncertainty, approximation, and boundary dates (e.g. prior to ..., after ...).

**!!!CNT:** Nationality of the composer. This reference information is encoded using the language of the nationality. Thus a German composer is encoded as `Deutscher` rather than "German", and a French composer is encoded as `Francais` rather than "French." Where the composer changed nationality, successive nationalities should be listed (in chronological order) separated by semicolons.

**!!!LYR:** Lyricist. The name of the lyricist. If more than one lyricist was involved in the work, then each lyricist's name should appear on a separate **!!!LYR:** record with a number designation prior to the colon. If the composer was also the lyricist, this should be explicitly encoding using the independent **!!!LYR:** record — rather than implicitly assumed.

**!!!LIB:** Librettist. The name of the librettist. If more than one librettist was involved in the work, then each librettist's name should appear on a separate **!!!LIB:** record with a number designation prior to the colon. If the composer was also the librettist, this should be explicitly encoding using the independent **!!!LIB:** record — rather than implicitly assumed.

**!!!LAR:** Arranger. The name of the arranger. If more than one arranger was involved in the work, then each arranger's name should appear on a separate **!!!LAR:** record with a number designation prior to the colon.

**!!!LOR:** Orchestrator. The name of the orchestrator. If more than one orchestrator was involved in the work, then each orchestrator's name should appear on a separate **!!!LOR:** record with a number designation prior to the colon.

**!!!TXO:** Original language of vocal/choral text. The name of the language should be encoded in that language. For example, `rusски` rather than `Russian`.

**!!!TXL:** Language of the *encoded* vocal/choral text. The name of the language should be encoded in the language used for encoding. For example, `Italiano` rather than `Italian`.

**!!!TRN:** Translator of text. The name of the translator of any vocal, choral, or dramatic text. If more than one translator was involved in the work, then each translator's name should appear on a separate **!!!TRN:** record with a number designation prior to the colon.



## Performance Information

Humdrum representations may encode performance-activity information rather than (or in addition to) score-related information. If the representation encodes a given performance (such as a MIDI performance), then the following reference records may be pertinent.

**!!!MPN:** Performer's name. If more than one performer was involved in the work, then each performer's name should appear on a separate **!!!MPN:** record with a number designation prior to the colon.

**!!!MPS:** Suspected performer. If more than one performer is suspected, each name should appear on a separate **!!!MPS:** record.

**!!!MRD:** Date of performance. The performance date should be encoded using the **\*\*date** format described in the *Representation Reference* section of this manual.

**!!!MLC:** Place of performance. (Local language should be used.)

**!!!MCN:** Name of the conductor of the performance.

**!!!MPD:** Date of first performance. The date of first performance should be encoded using the **\*\*date** format described in the *Representation Reference* section of this manual.

## Work Identification Information

**!!!OTL:** Title. The title of the specific section or segment encoded in the current file. Titles must be rendered in the original language, e.g. *Le sacre du printemps*. (Title translations are encoded using other reference records.)

**!!!XEN:** Translated title (in English). (Note that reference codes are also available for translations to languages other than English, French, German, or Japanese.)

**!!!XFR:** Translated title (in French). (Note that reference codes are also available for translations to languages other than English, French, German, or Japanese.)

**!!!XDE:** Translated title (in German). (Note that reference codes are also available for translations to languages other than English, French, German, or Japanese.)

**!!!XNI:** Translated title (in Japanese). (Note that reference codes are also available for translations to languages other than English, French, German, or Japanese.)

**!!!OTP:** Popular Title. This reference record encodes well-known or alias titles such as "Pathetique Sonata".

**!!!OTA:** Alternative title. This reference record encodes earlier or alternate titles.

**!!!OPR:** Larger (or parent) work from which the encoded piece is a part. For example, "Gute

Nacht" (OTL) from *Winterreise* (OPR).

**!!!OAC:** Act number. For operas and musicals, this reference record encodes the act number as an Arabic (rather than Roman) numeral. The number may be preceded by the word "Act" as in Act 3.

**!!!OSC:** Scene number. For operas and musicals, this reference record encodes the scene number as an Arabic (rather than Roman) numeral. The number may be preceded by the word "Scene" as in Scene 3.

**!!!OMV:** Movement number. For multi-movement works such as sonatas and symphonies, this reference record encodes the movement number as an Arabic (rather than Roman) numeral. The number may be preceded by the word "Movement" or "mov." etc., as in mov. 3.

**!!!OPS:** Opus number. The number may be preceded by the word "Opus" as in Opus 23. Once again, Arabic numerals are used.

**!!!ONM:** Number. The number may be preceded by the abbreviations "No." or "Nr." as in No. 4.

**!!!OVM:** Volume. The volume number may be preceded by the abbreviation "Vol." as in Vol. 2. Arabic numbers are used.

**!!!ODE:** Dedication. Name of person to whom the work is dedicated. If the work was dedicated to more than one person, then each dedicatee's name should appear on a separate **!!!ODE:** record with a number designation prior to the colon.

**!!!OCO:** Commission. Name of person or organization that commissioned the work. If the work was commissioned by more than one person, then each commissioner's name should appear on a separate **!!!OCO:** record with a number designation prior to the colon.

**!!!OCL:** Collector. Name of person who collected or transcribed the work. If the work was collected by more than one person, then each collector's name should appear on a separate **!!!OCL:** record with a number designation prior to the colon.

**!!!ONB:** Free format note related to the title or identity of the encoded work. If more than one such note is encoded, each should appear on a separate **!!!ONB:** record with a number designation prior to the colon.

**!!!ODT:** Date of composition. The date (or period) of composition should be encoded using the **\*\*date** or **\*\*Zeit** formats described in the *Representation Reference* section of this manual. The **\*\*date** and **\*\*Zeit** formats provides a highly refined representation, including methods for representing uncertainty, approximation, and boundary dates (e.g. prior to ..., after ...).

**!!!OCY:** Country of composition. Local names should be used, such as 'Espana'.

**!!!OPC:** City, town or village of composition. Local names should be used, such as 'Den Haag.'



## Imprint Information

**!!!PUB:** Publication status. This reference record identifies whether the document has ever been "published". One of the following English terms may appear: published or unpublished.

**!!!PPR:** First publisher. Name of the first publisher of the work.

**!!!PDT:** Date first published. The date of publication should be encoded using the `**date` format described in the *Representation Reference* section of this manual.

**!!!PPP:** Place first published. (Local language should be used.)

**!!!PC#:** Publisher's catalogue number. This should not be confused with better known scholarly catalogues, such as those of Köchel, Hoboken, etc.

**!!!SCT:** Scholarly catalogue abbreviation and number. E.g. BWV 551

**!!!SCA:** Scholarly catalogue (unabbreviated) name. E.g. Köchel 117.

**!!!SMS:** Manuscript source name. For unpublished sources, the manuscript source name.

**!!!SML:** Manuscript location. For unpublished sources, the location of the manuscript source.

**!!!SMA:** Acknowledgement of manuscript access. This reference information may be used to encode a free format acknowledgement or note of thanks to a given manuscript owner for scholarly or other access.

## Copyright Information

**!!!YEP:** Publisher of electronic edition. This reference identifies the publisher of the electronic document.

**!!!YEC:** Date and owner of electronic copyright. This reference identifies the year and owner of the copyright for the electronic document.

**!!!YED:** Date electronic edition released.

**!!!YEM:** Copyright message. This record conveys any special text related to copyright. It might convey a simple warning (e.g. "All rights reserved."), convey registration or licensing information, or indicate that the document is shareware.

**!!!YEN:** Country of copyright. This reference identifies the country in which the electronic document was created, or where the copyright was established. In effect, it identifies the country under whose laws the copyright declaration is to be interpreted.

**!!!YOR:** Original document. This reference identifies any original source or sources from which encoded document was prepared. Note that original documents may themselves be copyrighted,



and that permission may be required in order to create an electronic derivative document. Original documents may also have lapsed copyrights.

**!!!YOO:** Original document owner. If the electronic document was prepared from a copyrighted original document, this reference identifies the copyright owner of the original document. Note that unless the electronic and original documents have the same owner, some licensing agreement or other legal arrangement is necessary in order to create an electronic derivative document.

**!!!YOY:** Original copyright year. If the electronic document was prepared from a copyrighted original document, this reference identifies the year of copyright for the original document. Note that some licensing agreement or other legal arrangement is necessary in order to create an electronic derivative document.

**!!!EED:** Electronic Editor. Name of the editor of the electronic document. If more than one editor was involved in the work, then each editor's name should appear on a separate **!!!EED:** record with a number designation prior to the colon.

**!!!ENC:** Encoder of the electronic document. This reference identifies the name of the person or persons who encoded the electronic document. (Not to be confused with the electronic editor.) If more than one encoder was involved in the work, then each encoder's name should appear on a separate **!!!ENC:** record with a number designation prior to the colon.

**!!!EMD:** Document modification description. This record type is used to chronicle all modifications made to the original electronic document. EMD records should indicate the date of modification, the name of the person making the modification, and a brief description of the type of modification made. For each successive modification, a separate **!!!EMD:** record should appear with a number designation prior to the colon.

**!!!EEV:** Electronic edition version. This reference identifies the specific editorial version of the work. e.g. Version 1.3g Only a single **!!!EEV:** record can appear in a given electronic document.

**!!!EFL:** File number. Some files are part of a series or group of related files. This record indicates that the current document is file  $x$  in a group of  $y$  files. The two numbers are separated by a slash as in:

**!!!EFL:** 1/4

**!!!EST:** Encoding status. This record indicates the current status of the document as it is being produced. Free-format text may indicate that the encoding is in-progress, list tasks remaining, or indicate that the encoding is complete. **!!!EST:** records are normally eliminated prior to distribution of the document.

**!!!VTS:** Checksum validation number. This reference encodes the checksum number for the file — excluding the **!!!VTS:** record itself. When this record is eliminated from the file, any POSIX.2 standard **cksum** command can be used to determine whether the file originates with the publisher, or whether it has been modified in some way. (See the Humdrum **veritas** command described in Section 4.) Note that this validation process is easily circumvented by malicious individuals. For true security, the checksum value should be compared with a printed list of checksums provided

by the electronic publisher.

## Analytic Information

**!!!AFR:** This is a free-form text record that can be used to identify the form (if appropriate) of the work. E.g. fuga, sonata-allegro, passacaglia, rounded binary, rondo.

**!!!AGN:** This is a free-form text record that can be used to identify the genre of the work. E.g. opera, string quartet, barbershop quartet.

**!!!AST:** Style, period, or type of work designation. This is a free-form text record that can be used to characterize the style, period, or type of work. This reference can include any term or terms deemed appropriate by the producer of the document. Designations might include keywords or keyphrases such as: Baroque, bebop, Ecole Notre Dame, minimalist, serial, reggae, slendro, heterophony, etc.

**!!!ASW:** Associated Work. Some works are associated with other works, such as plays, novels, paintings, films, or other musical works. E.g. Shakespeare's Othello. This reference allows associated works to be explicitly identified by author and title.

**!!!AMT:** Metric Classification. Meters may be classified using combinations of the following keywords: simple, compound, duple, triple, quadruple, quintuple, irregular.

**!!!AIN:** Instrumentation. This reference is used to list all of the instruments (including voice) used in the work. Instruments should be encoded using the abbreviations specified by the \*I tandem interpretation described in the *Tandem Interpretations* section of this manual. Instrument codes must appear in alphabetical order separated by spaces.<sup>†</sup> E.g.

`!!!AIN: clars corno fagot flt oboe`

## Representation Information

**!!!RLN:** ASCII language setting. This reference identifies the “language” code in which the file was encoded. This is applicable only to computer platforms which provide “extended ASCII” text capabilities (e.g. Danish or Spanish characters).

**!!!RDF:** User-defined signifiers. All Humdrum representations provide some signifiers (ASCII characters) that remain undefined. Users are free to use these undefined signifiers as they choose. When undefined signifiers appear in a give document, the **!!!RDF:** code should be used to specify what the signifiers denote. E.g.

---

<sup>†</sup> Note that alphabetical ordering is essential in order to facilitate searches for specific combinations or subsets of instruments using the **grep** command.



!!!RDF1: X=hands cross, left over right

!!!RDF2: x=hands cross, right over left

**!!!RDT:** Date encoded. This reference uses the Humdrum `**date` format to identify the date(s) when the document was encoded.

**!!!RNB:** Note. This reference provides a free-format text that conveys some document-specific note.

**!!!RWG:** Warning. This reference may be used to encode explicit warnings concerning the encoded material.

## 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 (e.g. **!!!OLe:**). The editor (**!!!EED:**), publisher (**!!!YEP:**), date of publication and copyright owner (**!!!YED:**), and electronic version (**!!!EEV:**). In addition, a full citation ought to include the validation checksum (**!!!VTS:**). This number will allow others to verify that a particular electronic document is precisely the one cited. A sample electronic citation might be:

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

In Humdrum files it does not matter where reference records appear. Since it is common for users to inspect the beginning of a file in order to check whether the file is being properly processed, the number of reference records at the beginning of the file should be kept to a minimum. A good habit is to place the composer, title of the work, and copyright records at the beginning of the file, and to relegate all other reference records to the end of the file.

## Further Reference Record Codes

The following table provides further pre-defined reference codes not identified in the preceding discussion.

Code	Language
<b>!!!XAL:</b>	translated title in Albanian
<b>!!!XAB:</b>	translated title in Arabic
<b>!!!XAM:</b>	translated title in Armenian
<b>!!!XAZ:</b>	translated title in Azeri



<b>!!!XBE:</b>	translated title in Bengali
<b>!!!XBU:</b>	translated title in Bulgarian
<b>!!!XCB:</b>	translated title in Cambodian
<b>!!!XCA:</b>	translated title in Cantonese
<b>!!!XHR:</b>	translated title in Croatian
<b>!!!XCE:</b>	translated title in Czech
<b>!!!XDA:</b>	translated title in Danish
<b>!!!XNE:</b>	translated title in Dutch
<b>!!!XEN:</b>	translated title in English
<b>!!!XET:</b>	translated title in Estonian
<b>!!!XSU:</b>	translated title in Finnish
<b>!!!XFL:</b>	translated title in Flemish
<b>!!!XFR:</b>	translated title in French
<b>!!!XGA:</b>	translated title in Gaelic
<b>!!!XDE:</b>	translated title in German
<b>!!!XGR:</b>	translated title in Greek
<b>!!!XHB:</b>	translated title in Hebrew
<b>!!!XHI:</b>	translated title in Hindi
<b>!!!XHU:</b>	translated title in Hungarian
<b>!!!XIC:</b>	translated title in Icelandic
<b>!!!XIT:</b>	translated title in Italian
<b>!!!XNI:</b>	translated title in Japanese
<b>!!!XJV:</b>	translated title in Javanese
<b>!!!XKO:</b>	translated title in Korean
<b>!!!XLI:</b>	translated title in Lithuanian
<b>!!!XLA:</b>	translated title in Latin
<b>!!!XLV:</b>	translated title in Latvian
<b>!!!XMG:</b>	translated title in Malayalam
<b>!!!XMA:</b>	translated title in Mandarin
<b>!!!XMO:</b>	translated title in Mongolian
<b>!!!XNO:</b>	translated title in Norwegian
<b>!!!XPL:</b>	translated title in Polish
<b>!!!XPR:</b>	translated title in Portugese
<b>!!!XRO:</b>	translated title in Romanian
<b>!!!XRU:</b>	translated title in Russian
<b>!!!XSR:</b>	translated title in Serbian
<b>!!!XSK:</b>	translated title in Slovak
<b>!!!XSN:</b>	translated title in Slovenian
<b>!!!XES:</b>	translated title in Spanish
<b>!!!XSW:</b>	translated title in Swahili
<b>!!!XSV:</b>	translated title in Swedish
<b>!!!XTA:</b>	translated title in Tamil
<b>!!!XTH:</b>	translated title in Thai
<b>!!!XTI:</b>	translated title in Tibetan

!!!XTU: translated title in Turkish  
!!!XUK: translated title in Ukrainian  
!!!XUR: translated title in Urdu  
!!!XVN: translated title in Vietnamese  
!!!XWE: translated title in Welsh  
!!!XHO: translated title in Xhosa  
!!!XZU: translated title in Zulu

