UNIX Tools for Musical Research

The Humdrum Toolkit

REFERENCE MANUAL

David Huron

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Preface

As a music scholar, I have long appreciated the gains in personal productivity that are possible through the judicious use of computer technology. At the same time I’ve come to recognize that computers are inherently interesting objects, and that there is always the danger of finding the technology more interesting than the musical problems. While musicological problems are often elusive and enigmatic, software programming can offer the quick rewards of linear thinking and the illusion of boundless power. For this reason, I am wary of computer expertise per se. My hope is that this manual testifies, not to a compelling interest in computers, but to a more abiding interest in understanding music.

The mindless tasks that often dominate scholarly projects can be powerful deterrents for those contemplating research. Seeing other scholars discouraged by such mindlessness has encouraged me to share my own research tools with the wider scholarly community. The distribution of this software is accompanied, however, by some trepidation. Any set of tools requires the development of a concomitant expertise, and the Humdrum Toolkit is no exception. It is my hope that the investment of time required to learn how to use Humdrum will be more than offset by the subsequent scholarly gains. Regrettably, not all Humdrum users may have this experience.

The Humdrum Toolkit remains a work in progress. As will become evident, the very structure of Humdrum invites users to intervene, augment, re-define, throw-away, and otherwise tinker. Users are encouraged to formulate their own representation schemes and to create their own task-specific software tools — as appropriate. In the case of predefined Humdrum representations, comments, criticisms, and suggests for improvement are most welcome.

A number of individuals have contributed directly or indirectly to the creation of the Humdrum Toolkit. I am deeply indebted to my supporters and collaborators, and take pleasure in voicing my public thanks.

Research assistants Tim Racinsky and Kyle Dawkins have been indispensable in bringing Release 1.0 to completion. Tim Racinsky revised nearly all of my original code and programmed innumerable new tools as well. I have especially valued Tim’s cautious skepticism and his relentless pursuit of design inconsistencies and bugs. Kyle Dawkins wrote all of the MIDI-related code and also handled system administration. Through his musical savvy and high energy, Kyle contributed significantly to the excitement of the project.

In addition, several other individuals have contributed by volunteer efforts to this project. Dr. Gregory Sandell kindly agreed to include his library of spectral analyses of instrument tones in this release. Keith Orpen implemented the Damerau-Levenshtein metric used in the program for measuring non-parametric similarity. Keith Mashinter contributed the Kameoka and Kuriyagawa dissonance tool. Jasha Simpson co-authored the implementation of the modified Johnson-Laird syncopation algorithm. Andreas Kornstaedt helped with portability problems. Simon Clift programmed some exploratory routines that helped clarify the feasibility (and infeasibility) of certain tools.

Timothy Prime and Maki Ishizaki voluntereed their time to test several of the tools and critique parts of the accompanying documentation. Sandra Serafini put the toolkit through its paces while pursuing her undergraduate thesis on Haydn string quartets. Stephen Bondy
suggested useful modifications to the representation for fretted instruments.

Randall Howard, President of Mortice Kern Systems, provided valuable professional advice on software testing and project organization. In addition, Mortice Kern Systems donated critical development and documentation software that saved a great deal of time. I am also indebted to Dr. Walter Hewlett and Dr. Eleanor Selfridge-Field of the Center for Computer Assisted Research in the Humanities for their professional support and encouragement.

Finally, I would like to thank the Social Sciences and Humanities Research Council of Canada for providing funding to assist in the release of this software to the scholarly community.

David Huron
1994 August
Waterloo, Ontario
CONTENTS

Preface 1

Introduction 3
Organization of Reference Information 3
Commands and Representations 4
Documentation Style 4

1. Humdrum General Introduction 7

Introduction 7
The Humdrum Syntax 8
Spine Paths 15
The Humdrum Syntax: A Formal Definition 19
Section Labels and Repetitions 22
Versions 23
Strophic Representations 24
The Humdrum Syntax: Conclusion 26
Reference Records 26
  Authorship Information 28
  Performance Information 30
  Work Identification Information 30
  Imprint Information 32
  Copyright Information 32
  Analytic Information 34
  Representation Information 34
  Electronic Citation 35
  Further Reference Record Codes 35

2. Humdrum Representation Reference 41

Documentation Style 41
barlines 43
**cents 46
**correl 49
**date 51
**dB 56
**deg 58
CONTENTS

**degree 61
**diss 64
**dur 66
**embel 69
**freq 73
**fret 76
**harm 85
**IPA 91
**kern 96
**melac 107
**metpos 110
**MIDI 113
**mint 116
**ordo 119
**pc 121
**pitch 130
**recip 134
**semits 137
**simil 140
**solfa 142
**solfg 145
**specC 149
**spect 152
**synco 154
**takt 157
**text 160
**time 165
**Tonh 167
**URrhythm 171
**vox# 174
**Zeit 176

3. Tandem Interpretation Reference 183

Documentation Style 183
all harmonic intervals 184
clef 185
ensemble 187
expansion lists 188
fret tuning 190
harmonic number 192
instrument 193
instrument class 199
key 200
key signatures 202
language 204
meter signatures 206
MIDI channel 208
overlay 209
underlay 209
section labels 210
spine path indicators 212
staff 213
staff lining 214
strophe 215
tempo 217
thru 219
timebase 220
transposition 221

4. Humdrum Command Reference 225

Command Documentation Style 225
Inputs and Outputs 228
Tee 229
Quotation Marks in the Command Line 230
Help 230
On-line Manual 231
assemble 232
census 235
cents 237
cleave 240
context 245
correl 254
deg 261
degree 265
encode 269
extract 280
fields 286
fill 290
freq 294
hint 297
humdrum 303
humsed 310
humver 314
iv 321
kern 323
key 328
<table>
<thead>
<tr>
<th>Command</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>melac</td>
<td>332</td>
</tr>
<tr>
<td>metpos</td>
<td>334</td>
</tr>
<tr>
<td>midi</td>
<td>339</td>
</tr>
<tr>
<td>midreset</td>
<td>344</td>
</tr>
<tr>
<td>mint</td>
<td>345</td>
</tr>
<tr>
<td>nf</td>
<td>352</td>
</tr>
<tr>
<td>num</td>
<td>354</td>
</tr>
<tr>
<td>patt</td>
<td>359</td>
</tr>
<tr>
<td>pattern</td>
<td>365</td>
</tr>
<tr>
<td>pc</td>
<td>369</td>
</tr>
<tr>
<td>pcsel</td>
<td>373</td>
</tr>
<tr>
<td>perform</td>
<td>376</td>
</tr>
<tr>
<td>pf</td>
<td>381</td>
</tr>
<tr>
<td>pitch</td>
<td>383</td>
</tr>
<tr>
<td>proof</td>
<td>387</td>
</tr>
<tr>
<td>recode</td>
<td>389</td>
</tr>
<tr>
<td>record</td>
<td>394</td>
</tr>
<tr>
<td>reexp</td>
<td>397</td>
</tr>
<tr>
<td>reihe</td>
<td>399</td>
</tr>
<tr>
<td>rend</td>
<td>404</td>
</tr>
<tr>
<td>rid</td>
<td>408</td>
</tr>
<tr>
<td>scramble</td>
<td>411</td>
</tr>
<tr>
<td>semits</td>
<td>415</td>
</tr>
<tr>
<td>simil</td>
<td>418</td>
</tr>
<tr>
<td>smf</td>
<td>425</td>
</tr>
<tr>
<td>solfa</td>
<td>427</td>
</tr>
<tr>
<td>solfg</td>
<td>431</td>
</tr>
<tr>
<td>strophe</td>
<td>434</td>
</tr>
<tr>
<td>synco</td>
<td>441</td>
</tr>
<tr>
<td>tacet</td>
<td>445</td>
</tr>
<tr>
<td>timebase</td>
<td>451</td>
</tr>
<tr>
<td>tonh</td>
<td>453</td>
</tr>
<tr>
<td>trans</td>
<td>457</td>
</tr>
<tr>
<td>urrrhythm</td>
<td>462</td>
</tr>
<tr>
<td>veritas</td>
<td>465</td>
</tr>
<tr>
<td>vox</td>
<td>467</td>
</tr>
<tr>
<td>xdelta</td>
<td>469</td>
</tr>
<tr>
<td>yank</td>
<td>476</td>
</tr>
<tr>
<td>ydelta</td>
<td>481</td>
</tr>
</tbody>
</table>

5. Humdrum Special Files

Documentation Style 487
6. Regular Expression Reference

Regular Expression Documentation 491
Regular Expressions: A Tutorial Introduction 492
Literals 492
Wild-Card 493
Escape Character 493
Repetition Operators 493
Min-Max Character Repetition 495
Priority of the Longest String Match 496
Context Anchors 496
OR Logical Operator 497
Character Classes 497
Character Class Keywords 499
Examples of Regular Expressions 499
Examples of Regular Expressions in Humdrum 500
Basic, Extended, and Humdrum-Extended
Regular Expressions 501
Record-Repetition Operators 502
regexp 503

7. Development Reference

Command Documentation Style 509

Bibliography 520
Index 527
Reference Manual

Introduction

The Humdrum Toolkit provides a set of inter-related software tools intended to assist in music research. The toolkit is suitable for use in a wide variety of computer-based musical investigations. The toolkit is less well suited to creative (i.e. generative) musical tasks — such as electroacoustic composition.

Organization of Reference Information

This Reference Manual describes all of the individual components included in Release 1.0 of the Humdrum Toolkit. Technical descriptions are given of representation formats, file organizations, command invocations, options, and other information. The Reference Manual is divided into seven numbered sections:

Section 1 General Introduction
Section 2 Representation Reference
Section 3 Tandem Interpretation Reference
Section 4 Command Reference
Section 5 Special Files
Section 6 Regular Expressions
Section 7 Developer’s Reference

Note that numbers identifying each section are given in parentheses in the upper corner of each manual page.

Section 1 (General Introduction) provides an overview of Humdrum. This section describes the structural and syntactical elements of Humdrum representations. It also describes the means by which essential bibliographic and reference information is encoded in Humdrum electronic documents.

Section 2 (Representation Reference) describes many of the representation schemes currently defined within Humdrum. These schemes include ways of representing period-of-common practice Western music, ways of representing time, pitch, dynamics, tablatures, pitch intervals, functional harmony, embellishment tones, MIDI data, and innumerable other types of music-related information. Note that users are free to define additional or alternative representations that may be better suited to a given application (see Section 7).

Section 3 (Tandem Interpretation Reference) describes special-purpose methods for representing various global musical attributes — such as tuning, temperament, instrumentation, transpositions, languages, Da Capo structures, and other general types of information.

Section 4 (Command Reference) describes the individual commands contained in Release 1.0 of the Humdrum Toolkit. The majority of these commands accept some sort of musically-pertinent input, and transform this input representation into some other musically-pertinent output representation. Other commands manipulate or modify a given input without changing the form
or type of representation.

Section 5 (Special Files) describes special files that are created or required by various Humdrum commands.

Section 6 (Regular Expressions) describes a common syntax by which complex patterns may be defined. Many of the Humdrum commands rely on regular expressions as a means by which the user can specify some sought pattern. The greater the user's familiarity with regular expression syntax, the more powerful the potential effect of various Humdrum commands.

Section 7 (Development Reference) describes how to tailor and augment Humdrum in order to serve specialized research needs. Humdrum defines a format within which an unbounded number of musically-pertinent symbol systems can be defined. Users are thus free to design additional (or alternative) Humdrum representation schemes that are better suited to a given research goal. This section also describes how to write Humdrum compatible software.

Commands and Representations

Several of the entries in different sections of the Reference Manual have similar titles — and this can lead to some initial confusion. For example, one entry in Section 2 of the manual is entitled **semits, whereas a separate entry in Section 4 is entitled semits. The first entry describes a representation format for encoding data pertaining to semitone pitch information. By contrast, the entry in Section 4 (Command Reference) describes an executable command named semits. The semits command is able to translate many other types of data into semitone format.

By way of summary, Section 2 describes a set of "objects" or "nouns," whereas Section 4 of the manual describes a set of "actions" or "verbs." In practice, there should be little confusion. The names of Humdrum representations are always designated by two leading asterisks: hence **solfg is a data format, whereas solfg is the name of a command. In Humdrum, many commands are named according to the type of outputs they produce. So a command named freq has a good chance of producing **freq as output (although there are some exceptions to this convention).

Documentation Style

Each of the seven sections of the Reference Manual begins with a separate introduction describing how the entries within the section are organized. This introductory information outlines the conventions and abbreviations used in the corresponding section of the documentation. The manual entries themselves include a variety of examples that users may find helpful.

The power of the Humdrum Toolkit lies not in the individual commands, but in how these commands can be made to interact. In order to become a proficient user, frequent browsing through the Reference Manual is recommended. Even commands that are quite familiar to a user, will often provide options whose utility becomes evident only with experience.