

Using textmidicgm

The MIDI-to-textmidi translator

Thomas E. Janzen

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1 Overview

The `textmidicgm` program generates works of music in `textmidi` language, which can be converted by `textmidi` into standard MIDI file formats. Using `textmidicgm`, it is possible to generate pieces of music in a text file using `textmidi` language, which can in turn be converted by `textmidi` into a standard MIDI file. The resulting text files can be edited in text editors, processed with text tools, and enriched using a macro processor such as `m4`. (The C preprocessor uses the pound sign (`#`), which is a sharp sign in `textmidi` language.)

`textmidicgm` chooses pitches as MIDI key numbers from an even distribution of a random variable, and similarly for MIDI velocities and rhythmic durations. In addition, the current ranges of key, velocity and duration are modulated as sinusoids of any period but typically 2 to 5 minutes, which control, roughly, the mean and range for each, and the number of voices playing. A MIDI-key-based scale is specified in the input file formats, along with a pulse, which can force a pseudo-metrical feel on the music. If pulse is zero, then the rhythm will be more fluid or conversational. It is also possible to force a random-walk melody rather than use white-random key numbers. The text file specification implements this original scheme. The text file specification is deprecated and may lose support.

The XML file format implements this scheme with a few added features, such as parallel-tracking voices, setting the probabilities of a random walk moving up, down or repeating the key number; amplitudes and offsets for the form sinusoids.

Aside from a few simple added features, the compositional engine of `textmidicgm` is described in *AlgoRhythms: Real-Time Algorithmic Composition for a Microcomputer*, by Thomas E. Janzen, pp. 109-210, *Readings in Computer-Generated Music*, Denis Baggi, ed. *AlgoRhythms* 1.0 and 2.0 were released as open-source software on the Commodore Amiga and distributed at least on "Fred Fish" disks starting in 1990. *AlgoRhythms* 3.0 was probably not released; it combined MIDI and Amiga Audio voices.

`textmidicgm` always generates one voice per track, in `textmidi` LAZY mode.

The `textmidi` language is described in the info page for `textmidi`.

1.1 What is `textmidicgm`?

The program `textmidicgm` generates a work of music basically using evenly-distributed ("white") random numbers to select of MIDI keynumbers, MIDI velocities, and durations. The output file is a text file in `textmidi` language.

Unlike the original *AlgoRhythms* program, which had a real-time GUI and permitted changes to a Form while playing, `textmidicgm` is a "batch" program and does not record or play over a MIDI interface.

The rationale for `textmidicgm` comprises several incentives:

- The use of simple statistical distributions as a source of musical choices has not been fully exploited. Iannis Xenakis's *Akrata* used a Gaussian density distribution, and LeJaren Hiller started with random notes before moving on to Markov chains, but further experimentation might be productive. `textmidicgm` provides a tool for continued exploration of evenly-distributed random notes etc.
- The use of sinusoids to modulate the ranges of key number, loudness (dynamics), duration and number of voices explores an approach to musical form as the modulation

of the character of the musical texture. This approach to musical form was used in Thomas E. Janzen's hand-composed piano works *Animations* (1977) and *Lucy's Dance* (1982). It is perfectly fine to experiment with very short periods, say 0.1 seconds, and very long ones, such as 1000000000.0 seconds (which produces a static performance).

- Just as human auditors in a Turing Test can be forgiving of computer and human entrants, those who listen to the music from `textmidicgm` can sometimes imbue the music with meaning that depends on their imaginations and not on how the music was generated.
- `textmidicgm` is not, by itself, intended to imitate any known style of music. The presumption is Bach wrote all the Bach music that is needed, and bad jazz players in the 1950's made all the bad jazz that is needed. `textmidicgm` makes its own music.
- `textmidicgm` is a medium. When an artist uses a graphite pencil, they do not expect to produce a full-color image with painterly marks. A musician using `textmidicgm` doesn't expect to produce a movement in sonata form, or a Country song.
- `textmidicgm` exploits the conveniences of the MIDI interface definitions of key number, velocity, and duration. This off-loads `textmidicgm` from concerns with DSP and instrument sound generation.

1.2 History

`textmidicgm` enlarges on the approach developed in 1989 as "AlgoRhythms" for the Commodore Amiga (running AmigaDOS) and improved a couple years later. The compositional engine was adapted in 2004 for linux and to produce text-based `textmidi` files. Improvements in 2020 and 2021 added minor features.

`textmidicgm` is a command-line batch program and not an interactive graphical program as `AlgoRhythms` was.

2 Invoking textmidicgm

2.1 Options

```
textmidicgm -f|--form
             text_form_file|
-x|--xmlform xml_form_file
[-r|--random]
[-a|--answer]
[-i|--instruments {piano chromaticpercussion organ guitar bass strings ensemble brass reed pipe synth-
lead synthpad syntheffects ethnic percussive soundeffects all melodic idiophone...}]
[-o|--textmidi output textmidi file] [-g|--gnuplot] [-h|--help] [-V|--version] [-v|--verbose]
```

-f, --form text_form_file

The input file: a text file in the format used in the original 1990 version, probably. Use of this file format is deprecated.

-x, --xmlform xml_form_file

The input file: an XML file supporting more features. If **--random** is specified, the form's output file.

-r, --random

Make a random form, write it to the filename given with **--xmlform** and exit.

- The duration is 30 minutes. The min and max note lengths are 0.0 to 2.0 seconds.
- The pulse is random 0.0 to to 16.0.
- The melodic probabilities are random including rests, but the up and down probabilities are set equal.
- The form sines are all set with no effective offsets or gains, that is sines that range from 0.0 to 1.0.
- The form sines period is random from 1 to 6 minutes and the phase is random from $-\pi$ to $+\pi$.
- The scale is randomly selected from diatonic, minor, whole, diminished, pentatonic (think Debussy), tritone (C, D, E, F, F#, G#, A#, B), chromatic, on any chromatic step. The scales themselves cover the full range of MIDI key numbers.
- The number of voices is random from 1 to 16.
- Each voice is set to use a random MIDI channel from 1 to 16.
- A voice is randomly selected to walk or skip.
- The General MIDI program is selected depending on the instruments selected with **--instruments**. The voices' ranges are limited by the characteristic range of the instruments selected, using <http://en.wikipedia.org> to look up the actual instruments.
- The pan is set to spread the voices across the audio field from left to right.
- No voice is set to follow another voice.

After the random form file has been written it may be edited, then used as an input to the `--xmlform` option.

```
-i, --instruments {piano chromaticpercussion organ guitar bass strings
ensemble brass reed pipe synthlead synthpad syntheffects ethnic percussive
soundeffects all melodic idiophone...}
```

Select the groups of General MIDI instruments (patches) to use. The selections may be repeated to affect their probability of being selected. For example, “strings strings piano” will create a complement in the form file that is twice as likely to have strings as pianos. Note that idiophones appear on channel 10, as per the MIDI 1.1 spec, and the range of scale used will be limited to the range given in the MIDI spec for idiophones, and will also be limited to the scale used. The default is all non-idiophones.

```
-o, --textmidi textmidi_output_file
```

The output file, in textmidi text language.

```
-g, --gnuplot
```

Output a file of gnuplot data.

```
-v, --verbose
```

Write some informative messages to the screen. Errors are printed regardless.

```
-V, --version
```

Print the version of `textmidicgm`.

```
-h, --help
```

Print the options summary.

Note that the XML file produced can be edited to reflect your interests; you will learn what XML and boost serialization can accept for edits.

2.2 Invocation Examples

The following command will read the XML form file `graduallyitsmorning.xml` and generate the textmidi text file `graduallyitsmorning.txt`:

```
textmidicgm --xmlform graduallyitsmorning.mid --textmidi graduallyitsmorning.txt
```

The following generates a randomized form file for generation in another step, and then converted into a MIDI file:

```
textmidicgm --random --xmlform newpiece.xml
textmidicgm --xmlform newpiece.xml --textmidi newpiece.txt
textmidi --textmidi newpiece.txt --midi newpiece.mid
```

The following example generates a data file that can be plotted as a statistical plot with error bars:

```
textmidicgm --xmlform newpiece.xml --textmidi newpiece.txt --gnuplot
```

The gnuplot data file will be named from the name inside the XML form file, with “.plot” appended.

3 The Model of Musical Form

The `textmidicgm` program models musical form as a musical character that is modulated by sinusoids. This was explored in a traditionally-composed work in 1976/1977, and again in 1982. It was automated by the `AlgoRhythms` program distributed as open-source software for the Commodore Amiga, which was described in a paper listed in the Bibliography.

`textmidicgm` does not model musical melody, meter, harmony, or traditional forms such as sonata form.

Musical character is described as the following instantaneous statistical quantities:

- Pitch
 - Mean: The mean, or average, pitch (actually the mean MIDI key number);
 - period: in seconds
 - phase: in radians (sorry). Note that one full circle is two pi radians (about 6.28). Ninety degrees is a half Pi, about 1.5707, and so on. Phase may be negative, so the full range could be represented from about -3.14159 to +3.14159.
 - Range: The range of key numbers from which one is selected. A narrow range will select a narrow range around the value of the mean.
 - period: in seconds
 - phase: in radians
- Dynamic
 - Mean: The mean MIDI key velocity, or loudness.
 - period: in seconds
 - phase: in radians
 - Range: The range of velocity from which one is selected for the note event.
 - period: in seconds
 - phase: in radians
- Duration
 - Mean: The mean duration of individual notes from the overall range given separately. Note that the pulse setting in the form file specifies a minimum duration that supersedes the minimum duration given in the form file. A pulse of, for example, a fifth of a second or so tends to make the music bounce a bit, as though it had a time signature, although `textmidicgm` does not specify a time signature or other way to group rhythmic values.
 - period: in seconds
 - phase: in radians
 - Range: The range of duration from which one is selected; this range is a subset of the overall range, which is given separately.
 - period: in seconds
 - phase: in radians

- Texture (number of voices)
 - Range: The number of voices playing polyphonically.
 - period: in seconds
 - phase: in radians

These quantities can be modulated over time so that the character of the music varies. Edgard Varese explored using statistical functions to modulate musical character. `textmidicgm` uses sinusoids, typically with periods of one to a few minutes. Periods that are very long relative to the length of the piece produce static pieces that in which the musical character does not change, which has its own fascination. Because the seven sinusoids can each have a unique phase and period, the exact character of the music might not repeat at all for long pieces.

In addition to this approach to musical form, `textmidicgm` specifies a musical work as having:

- a length in seconds;
- a scale, defined as the full scale in MIDI key numbers;
- a pulse, which forces notes to start together on a number of pulses per second;
- in the XML form file, probabilities of a walking voice rising, falling, or repeating the last key number;
- a number of voices, each of which has the following attributes:
 - a range of key numbers from minimum to maximum. If the form requires pitches out of range for a voice, it remains quiet;
 - a MIDI channel;
 - in the XML form file, a MIDI program, mapped by General MIDI to an instrument sound;
 - In the XML file the voices also have a pan value;
 - in the XML file each voice can be defined as a follower by scale interval or chromatic interval;

The XML form file add amplitude and offset for all sinusoids that specify the musical form.

4 The Original Text Form File

The original text form file was developed for the Amiga version of this music generator. It may now be slightly different from that for the Amiga, but probably it is identical to the form file for AlgoRhythms 2.0. The original text form file is now deprecated in favor of the XML form file.

Individual notes have key numbers, velocities (dynamics), and durations that are selected using evenly-distributed (“white”). At a given moment these values are selected from ranges of key number, velocity, and duration that are determined by sinusoidal curves defined in the form file. There are seven curves:

- Pitch
 - Mean Sinusoid: The peak of the sinusoid selects high pitches (MIDI key numbers); the low part selects low pitches.
 - Range Sinusoid: A narrow range will select a narrow range around the value of the mean sinusoid.
- Dynamic
 - Mean Sinusoid: The peak of the sinusoid selects high (loud) velocities; The low part selects softer dynamics.
 - Range Sinusoid
- Duration
 - Mean Sinusoid: The peak of the sinusoid selects long durations from the full duration range specified in the form file. The low part selects shorter durations. Note that the pulse setting in the form file specifies a minimum duration that supersedes the minimum duration given in the form file. A pulse of, for example, a fifth of a second or so tends to make the music bounce a bit, as though it had a time signature, although `textmidicgm` does not specify a time signature or other way to group rhythmic values.
 - Range Sinusoid
- Texture (number of voices)
 - Range Sinusoid The range sinusoid merely specifies how many voices will play, in the order of the voice list. At the peak of the texture sinusoid, all of the voices will play. At the low point, only one voice will play.

The range sinusoid is used to spread out the mean. The mean sinusoid:

```

      **
    *   *
  *     *
    *   *   *
      *     *
        *   *
          **

```

The range sinusoid: The lowest values of the range wave indicates a narrow range.

```

*****
*****          **
*****          ***

```

```

*****
*****      ***
*****      **
*****

```

The range sinusoid, by halves, added to and subtracted from the mean sinusoid:

```

****
*****
*****
*****      *
*****      **
*****      ***
*****      ****
**      *****
          * * ***** *

```

Note that the range and mean sinusoids can have different periods and different phases so that they do not align like the example above. In addition, note that when the range goes beyond the actual limits of key number or dynamic, it is clipped, or truncated to the practical limit. Because the range sinusoid, which varies from -1 to 1, is defined as covering the full range, this happens any time that the added range exceeds the peak of the mean sinusoid, or below its minimum. Originally the form sinusoids had periods of about 1 to 4 minutes. To make a static, unchanging, form, use very long periods, such as millions of seconds.

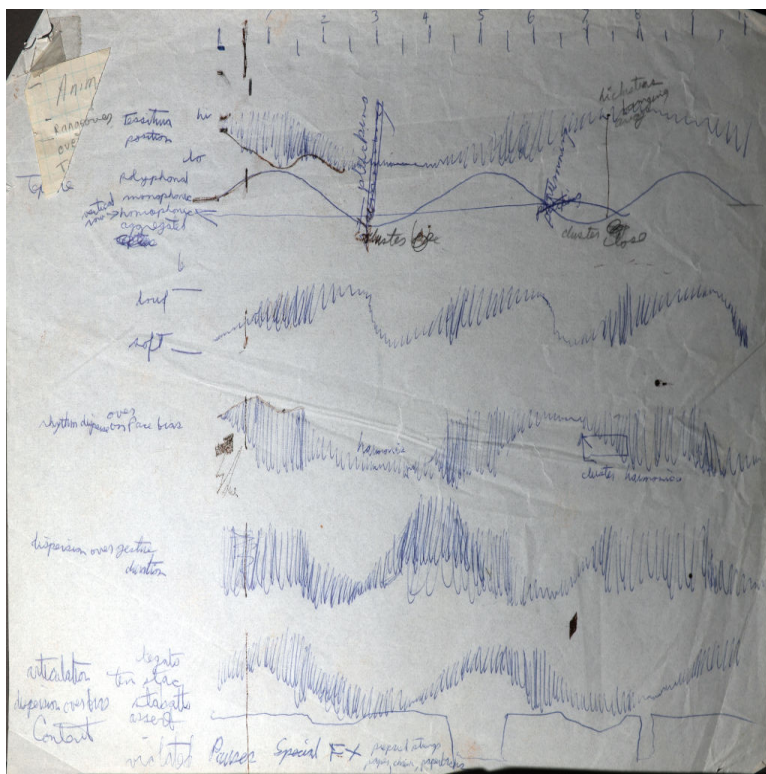


Figure 4.1: Animations (1976, conventionally composed) drawn plot

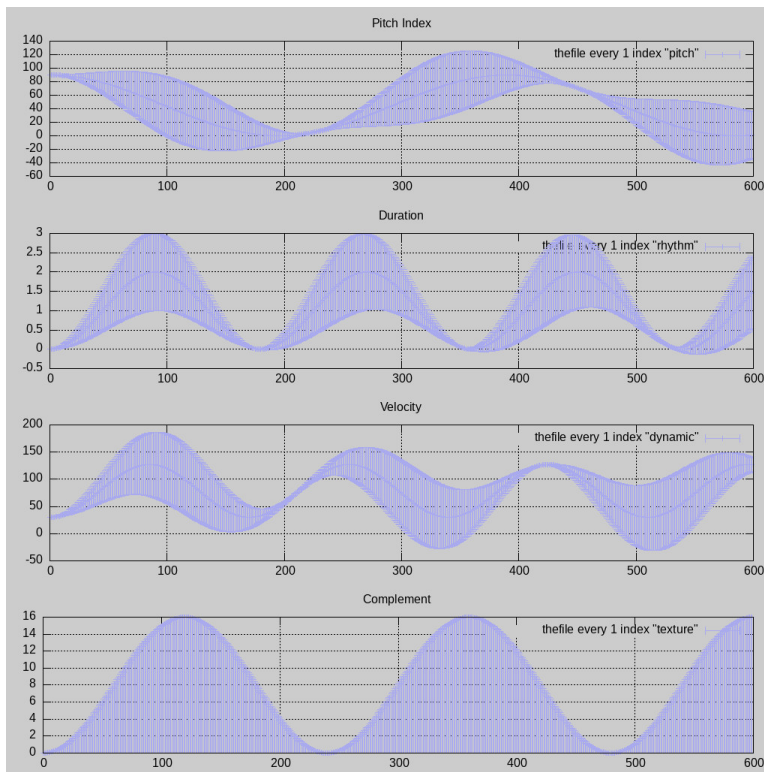


Figure 4.2: Animations (1977, conventionally composed) plot using textmidicgm.gnuplot.

```
[seconds duration of entire musical piece]
[minimum individual note length in seconds]
[maximum individual note length in seconds]
[number of scale tones]
[scale MIDI key numbers (Middle C = 60)]
...
[number of voices]
[pulses per second]
[pitch period of mean]
[pitch phase of mean]
[pitch period of range]
[pitch phase of range]
[duration period of mean]
[duration phase of mean]
[duration period of range]
[duration phase of range]
[velocity period of mean]
[velocity phase of mean]
[velocity period of range]
[velocity phase of range]
[texture period of range]
[texture phase of range]
[voice 0 low pitch] [high pitch] [channel 0-15] [walking flag]
...
```

For example:

```
600.00
0.00
2.00
13
48
50
53
55
58
60
62
65
67
70
72
74
77
4
6
200.00
-1.57
200.00
-1.57
200.00
1.57
200.00
-1.57
200.00
-1.57
200.00
-1.57
200.00
-1.57
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 96 14 1
24 120 14 0
24 120 14 0
24 120 14 0
24 120 14 0
```

5 The XML Form File

The XML version of the form file is a boost serialization XML archive format. (Cf. <https://boost.org>). The format must be exactly as expected by boost serialization; for example, comments may not be added. On the other hand, the floating point values need not have all the trailing fractional zeroes that are written by boost serialization. Note that the <count> tag must have the correct length of the following data, for example for the scale length. If <count> is corrected afterward, then you may add or delete members of a container. The new format of XML Form file adds a number of items for specifying the form to the original text format:

- **Melodic Probabilities** When using a random walk, the probability of walking up or down, or repeating the previous key number, or by implication, resting, can be specified. These probabilities should not add up to more than 1.0. If they add to less than 1.0, then the voice can be quiet the remaining proportion of time. The probability of moving up and down should be equal, or the voice will tend to drift in one direction and hover near either the bottom or top of the scale. The original program, AlgoRhythms, did not provide for voices randomly resting; voices only rested because the current musical character's texture did not specify sufficient voices for a voice to play; the first voice always played and had no rests.
- **sinusoid amplitude and offset** The sinusoids can have specified amplitudes for a narrower range of change, and offsets that raise and lower the sinusoid. These features have not been thoroughly tested. Their defaults are both 0.5; this is how AlgoRhythms set them.
- **MIDI Program** Each voice has a program, which is a 1-based MIDI program. Refer to General MIDI for the instrument assignments to program numbers.
- **Voice Pan:** The pan value for a voice can be specified for the entire piece of music. A pan of -64 is all the way left, 63 is all the way right, and zero (0) is centered.
- **Voice following:** A voice may be specified as a follower of another voice. If <follow_> is 0, then the voice will be independent. If <follow_> is 1, then the voice will follow the voice given in the <leader> tag (voices count from zero (0)). The interval_type tag determines whether the voice follows in the scale (1) or chromatically (2). The tag <interval_> specifies how many scale steps or half-steps above (positive values) or below (negative values) the follower should be. If there is a following circle, the voices in the circle will not have any notes. A following circle is created by any of the following:
 - A voice follows itself.
 - A voice follows another voice, which in turn follows the first voice.
 - A chain of follows ultimately follow a member in the chain.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes" ?>
<!DOCTYPE boost_serialization>
<boost_serialization signature="serialization::archive" version="14">
<xml_form class_id="0" tracking_level="0" version="0">
  <name_>lucy.form</name_>
  <len_>6.0000000000000000e+02</len_>
  <min_note_len_>0.0000000000000000e+00</min_note_len_>
  <max_note_len_>2.0000000000000000e+00</max_note_len_>
  <scale_ class_id="1" tracking_level="0" version="0">
```

```

    <count>13</count>
    <item_version>0</item_version>
    <item>C3</item>
    <item>D3</item>
    <item>F3</item>
    <item>G3</item>
    <item>A#3</item>
    <item>C4</item>
    <item>D4</item>
    <item>F4</item>
    <item>G4</item>
    <item>A#4</item>
    <item>C5</item>
    <item>D5</item>
    <item>F5</item>
  </scale_>
  <pulse_>6.0000000000000000e+00</pulse_>
  <melody_probabilities_ class_id="2" tracking_level="0" version="0">
    <down_>0.3300000000000000e+00</down_>
    <same_>3.3000000000000000e-01</same_>
    <up_>3.4000000000000000e-01</up_>
  </melody_probabilities_>
  <pitch_form_ class_id="3" tracking_level="0" version="0">
    <mean_sine_ class_id="4" tracking_level="0" version="0">
      <period_>2.0000000000000000e+02</period_>
      <phase_>-1.5700000000000000e+00</phase_>
      <amplitude_>5.0000000000000000e-01</amplitude_>
      <offset_>5.0000000000000000e-01</offset_>
    </mean_sine_>
    <range_sine_>
      <period_>2.0000000000000000e+02</period_>
      <phase_>-1.5700000000000000e+00</phase_>
      <amplitude_>5.0000000000000000e-01</amplitude_>
      <offset_>5.0000000000000000e-01</offset_>
    </range_sine_>
  </pitch_form_>
  <rhythm_form_>
    <mean_sine_>
      <period_>2.0000000000000000e+02</period_>
      <phase_>1.5700000000000000e+00</phase_>
      <amplitude_>5.0000000000000000e-01</amplitude_>
      <offset_>5.0000000000000000e-01</offset_>
    </mean_sine_>
    <range_sine_>
      <period_>2.0000000000000000e+02</period_>
      <phase_>-1.5700000000000000e+00</phase_>
      <amplitude_>5.0000000000000000e-01</amplitude_>

```



```

        <offset_>5.0000000000000000e-01</offset_>
    </range_sine_>
</rhythm_form_>
<dynamic_form_>
    <mean_sine_>
        <period_>2.0000000000000000e+02</period_>
        <phase_>-1.5700000000000000e+00</phase_>
        <amplitude_>5.0000000000000000e-01</amplitude_>
        <offset_>5.0000000000000000e-01</offset_>
    </mean_sine_>
    <range_sine_>
        <period_>2.0000000000000000e+02</period_>
        <phase_>-1.5700000000000000e+00</phase_>
        <amplitude_>5.0000000000000000e-01</amplitude_>
        <offset_>5.0000000000000000e-01</offset_>
    </range_sine_>
</dynamic_form_>
<texture_form_>
    <period_>2.0000000000000000e+02</period_>
    <phase_>-1.5700000000000000e+00</phase_>
    <amplitude_>5.0000000000000000e-01</amplitude_>
    <offset_>5.0000000000000000e-01</offset_>
</texture_form_>
<voices_ class_id="5" tracking_level="0" version="0">
    <count>4</count>
    <item_version>0</item_version>
    <item class_id="6" tracking_level="0" version="0">
        <low_pitch_>C1</low_pitch_>
        <high_pitch_>C7</high_pitch_>
        <channel_>15</channel_>
        <walking_>1</walking_>
        <program_>1</program_>
        <pan_>0</pan_>
        <follower_ class_id="7" tracking_level="0" version="0">
            <follow_>0</follow_>
            <leader_>18446744073709551615</leader_>
            <interval_type_>0</interval_type_>
            <interval_>0</interval_>
        </follower_>
    </item>
    <item>
        <low_pitch_>C1</low_pitch_>
        <high_pitch_>C7</high_pitch_>
        <channel_>15</channel_>
        <walking_>1</walking_>
        <program_>1</program_>
        <pan_>0</pan_>

```

```

        <follower_>
            <follow_>0</follow_>
            <leader_>18446744073709551615</leader_>
            <interval_type_>0</interval_type_>
            <interval_>0</interval_>
        </follower_>
    </item>
    <item>
        <low_pitch_>C1</low_pitch_>
        <high_pitch_>C7</high_pitch_>
        <channel_>15</channel_>
        <walking_>1</walking_>
        <program_>1</program_>
        <pan_>0</pan_>
        <follower_>
            <follow_>0</follow_>
            <leader_>18446744073709551615</leader_>
            <interval_type_>0</interval_type_>
            <interval_>0</interval_>
        </follower_>
    </item>
    <item>
        <low_pitch_>C1</low_pitch_>
        <high_pitch_>C7</high_pitch_>
        <channel_>15</channel_>
        <walking_>1</walking_>
        <program_>1</program_>
        <pan_>0</pan_>
        <follower_>
            <follow_>0</follow_>
            <leader_>18446744073709551615</leader_>
            <interval_type_>0</interval_type_>
            <interval_>0</interval_>
        </follower_>
    </item>
</voices_>
</xml_form>
</boost_serialization>

```

6 The textmidi File

The output of `textmidicgm` is a `textmidi` text file with tracks in LAZY mode. It can be converted into a standard MIDI file by using the `textmidi` program. While a text file, the `textmidi` output can be edited in text editors and processed by other text tools. For example, assignments of MIDI channels and instrument programs can be changed.

7 The Gnuplot File

The `--gnuplot` option will cause a gnuplot data file to be written with the name in the xml form file with “.plot” appended. A gnuplot file that can read the file is shown below.

```
#
# RUN WITH by specifying the data file output by textmidicgm:
# /usr/bin/gnuplot -e "thefile='tjcgm.txt'" textmidicgm.gnuplot > name.jpg
#
# AlgoRhythms 3.0 colors
#wavecolor = "green"
#textcolor = "white"
#backgroundcolor = "0x9932CC"
## AlgoRhythms 1.0 colors
wavecolor = "0xAAAAEE"
textcolor = "black"
backgroundcolor = "0xCCCCCC"
set title "textmidicgm" textcolor rgb textcolor
set terminal jpeg background rgb backgroundcolor size 1024,1024
set grid xtics linetype rgb textcolor
set grid ytics linetype rgb textcolor
set border linetype rgb textcolor
set xtics textcolor rgb textcolor
set ytics textcolor rgb textcolor
set size 1.0,0.5
set multiplot layout 4,1
set size 1.0,0.25
set autoscale y
set title "Pitch Index" textcolor rgb textcolor
plot [] [] thefile every 1 index "pitch" with yerrorbars linecolor rgb wavecolor
set autoscale y
set title "Duration" textcolor rgb textcolor
plot [] [] thefile every 1 index "rhythm" with yerrorbars linecolor rgb wavecolor
set autoscale y
set title "Velocity" textcolor rgb textcolor
plot [] [] thefile every 1 index "dynamic" with yerrorbars linecolor rgb wavecolor
set autoscale y
set title "Complement" textcolor rgb textcolor
plot [] [] thefile every 1 index "texture" with yerrorbars linecolor rgb wavecolor

unset multiplot
```

8 Installation

This program was prepared for builds using GNU autoconf tools. Unpack the archive. Move to the directory created for the program. Run the configure script and run make.

```
./configure  
make
```

Make yourself superuser (root), or use sudo to run install targets:

```
make install  
make install-info
```

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11 Bibliography

- *The Complete MIDI 1.0 Detailed Specification*. Document version 96.1. Second edition. 1995. Los Angeles. The MIDI Manufacturers Association.
- “AlgoRhythms: Real-Time Algorithmic Composition for a Microcomputer.” (1992) Thomas E. Janzen. *Readings in Computer-Generated Music*. Denis Baggi, ed. p. 199. 11pp. IEEE Computer Society Press. Los Alamitos, CA.
- *AlgoRhythms Version 1.0*. 1990. Thomas E. Janzen. Fish disk 356. Fred Fish. Mentioned in *Amazing Computing/Amiga* Sep. 1990 p. 95.
- *AlgoRhythms Version 2.0*. 1992. Thomas E. Janzen. Fish disk 606. Fred Fish.
- *AlgoRhythms Version 3.1* 1996. Thomas E. Janzen. *AMINET 12*. (DVD). Schatztruhe. Stefan Ossowskis Schatztruhe. Gesellschaft fur Software mbH. eronikastr. 33 D-45131 Essen Germany. GTI GmbH. Zimmersmuhlenweg 73 D-61440 Oberursel Germany.
- *SMUS.H; Definitions for Simple MUSical score*. Jerry Morrison, Steve Hayes. 1986. Amiga header file for C and C++. Commodore.
- *Experimental music; composition with an electronic computer*. Hiller, Lejaren A., Jr. Isaacson, Leonard M. 1959. New York. McGraw-Hill.
- *Formalized Music. Thought and Mathematics in Composition*. Xenakis, Iannis. 1971. Bloomington. Indiana University Press.
- *The March Meeting*. Bits and Bytes. April 1991. WCAUG: Worcester County Amiga Users group. A review of Thomas Janzen’s presentation of AlgoRhythms for the Amiga Computer.
- *Be Bach in a Moment. Music Making for the Non-Musician*. Michael Hanish. AMIGA World. April, 1992. IDG Communications.
- *Boost serialization documentation*. Robert Ramey. 2004. https://www.boost.org/doc/libs/1_74_0/libs/serialization/doc/index.html.

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