

# **User's Manual**

SpeciesChecker 1.0  
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# I. INTRODUCTION

## 1.1 Overview

SpeciesChecker is a piece of software that enables users to enter in, save and modify simple compositions and have them automatically tested for technical errors. This is somewhat analogous to a word processor's spellchecker or a grammar checker. This software is able to analyze compositions for potential problems and generate output for the user that indicates what types of problems were detected and where.

## 1.2 Scope

The types of compositions that can be analyzed are cantus firmi and first through fifth species two-part tonal counterpoint.

## 1.3 Intended Users

This software is meant for use by students studying the rudiments of counterpoint. The software was developed specifically for users writing in the framework of species counterpoint, so it is of limited utility for people wishing to write in more sophisticated genres of music.

SpeciesChecker is intended to be used primarily in an educational context. Music students are able to enter their work into the software and have it detect potential problems for them. This gives them immediate feedback on their work so that they can learn from their mistakes, and it allows them to experiment with different ideas and see if they are acceptable. It also helps them by acting as a final proofreading tool to avoid handing in work that contains careless errors.

The software is also able to randomly generate cantus firmi which students can use as a base for writing counterpoint exercises.

## 1.4 Limitations of the Software

Although the music theory relating to species counterpoint is for the most part fairly standardized, there are still several differing perspectives on certain issues. Opinions on what is correct and what is not can vary from one ear to another, and some of the considerations involved depend on period and theoretical perspective. In order to compensate for this, this software implements certain controversial rules, but allows the user to disable them if desired. Despite this, however, there is a possibility that some of the more unusual rules may have been omitted.

A further problem is that many of the rules found in the literature are loose guidelines rather than absolute rules. Considerations of taste and context are often essential, and some rules are more important than others. Although this is certainly understandable and desirable for artistic reasons, it is necessary for all rules to be strictly defined in order for them to be implemented on a computer. The rules implemented by this software are therefore more rigorous in some cases than the literature requires. This helps to guard against problematic areas of compositions being missed because of ambiguities in the rules.

Despite efforts to take overall context into account where possible, some problems may still be detected in compositions even though the overall structure of the compositions may make them acceptable. The user should therefore regard problems that are detected as areas that may need improvement rather than fatal errors that must be corrected. In order to facilitate this, SpeciesChecker qualifies relatively minor problems as “warnings” and more serious problems as “errors.”

Finally, it should be understood that the random generation of cantus firmi is fairly rudimentary. Although a resultant cantus firmus will not violate the rules selected by the user in the preferences, this does not necessarily mean that it will be a good line. Also, it may take a few minutes to generate a cantus, depending on the speed of the user’s computer.

## II. FEATURES

### 2.1 Error Detection

The software detects technical errors in cantus firmi and tonal two-part species counterpoint compositions. A message is generated for each error detected, indicating the rule that was violated and, if appropriate, where the error occurred. The user can analyze the cantus or counterpoint individually, or can analyze both together, as desired.

### 2.2 Preferences

The software allows users to disable the application of certain rules. This is to accommodate users who wish to use different sets of rules. This is useful because there are several different theoretical perspectives on certain issues in the literature. The preferences are saved to disk so that they will persist when the program is closed.

### 2.3 Random Music Generation

The software can randomly generate a cantus firmus that conforms to the set of rules that are selected in the preferences. This enables users to generate cantus firmi for use in writing counterpoint exercises.

### 2.4 Graphical User Interface

The software has a menu and table-based interface that allows the user to enter and edit compositions using a mouse and/or keyboard shortcuts. The interface uses combo boxes to prevent the user from being able to enter inappropriate information. The user is able to add or delete a counterpoint from a given cantus firmi so that the same cantus can be used in multiple compositions without needing to be reentered.

### 2.5 Read From File / Save To File Functionality

A specially designed file format is used to allow users to save their work so that they can review or edit it later.

### 2.6 Online Help

There is an online help that the user can access to gain general information about the software, instructions on how to use the interface and explanations of the specific rules which are used in analyses.

## III. INSTALLATION GUIDE

### 3.1 Compatibility

The SpeciesChecker software is written in Java, which means that it can be run on any system that has the Java™ Runtime Environment (JRE) installed on it. It is recommended that it be used with Windows, as it was developed and tested under the Windows 98 operating system and the interface's appearance is optimized for Windows. However, the software will run under Linux, Solaris or any other operating system with the JRE installed on it. It is required that version 1.3 or higher of the JRE be installed.

### 3.2 Installing the Java™ Runtime Environment

If your system already has the JRE installed, you may skip this section. If not, you will need to install it in order to run SpeciesChecker. It can be downloaded for free from the [java.sun.com](http://java.sun.com) web site. At the time of release of this document, the precise URL is <http://java.sun.com/products/jdk/1.2/jre/download-windows.html>. Choose the language and operating system that is appropriate from this site, and then download the JRE.

When the download is complete, follow the given installation instructions. Make sure that you follow the necessary instructions to make it possible to run Java in arbitrary directories. Under Windows 98, this means adding an entry such as C:\JDK1.3\BIN; to your path variable in your AUTOEXEC.BAT file. The necessary instructions will be provided when you download the JRE.

If you are unsure if you have the JRE installed on your system, you may wish to follow the instructions in Sections 3.3 and 3.5. If you are able to run SpeciesChecker as outlined in Section 3.5, then you already have the JRE installed on your system. If not, then you will need to download and install it, as explained above.

### 3.3 Installing the SpeciesChecker Program

All of the SpeciesChecker files are contained in the spchk.zip file. The files contained in this file can be unpacked using WinZip, Stuffit Expander or any other free archiving utility. The files can be unpacked to any directory that you like on your system.

### 3.4 Guide to Bundled Files

You will find the following files and directories upon extracting the SpeciesChecker files from the spchk.zip file:

- **ClassFiles** - a directory that contains SpeciesChecker program files. You do not need to use this directory, as all of the necessary classes are also found in the sc.jar.
- **Documentation** - a directory that contains the SpeciesChecker User Manual, Final Project Report, Mid-Project Report and Project Outline
- **Help** - a directory that contains the SpeciesChecker on-line help files in HTML format
- **README.txt** - a basic guide to installing and running SpeciesChecker
- **SampleCompositions** - a directory that contains sample compositions that can be opened and analyzed with SpeciesChecker
- **sc.jar** - the SpeciesChecker program file
- **SourceCode** - a directory that contains the SpeciesChecker Java source code
- **SCPref.spr** - an encoded file that contains the SpeciesChecker preferences

### 3.5 Running the SpeciesChecker Program

One of the files that is extracted is called sc.jar. This is the file that should be run in order to use SpeciesChecker. You can run it either by double clicking on it or by typing the following line at a command prompt, such as the DOS prompt:

```
java -jar sc.jar
```

As an alternative, you may also move into the ClassFiles directory and type the following from a command prompt:

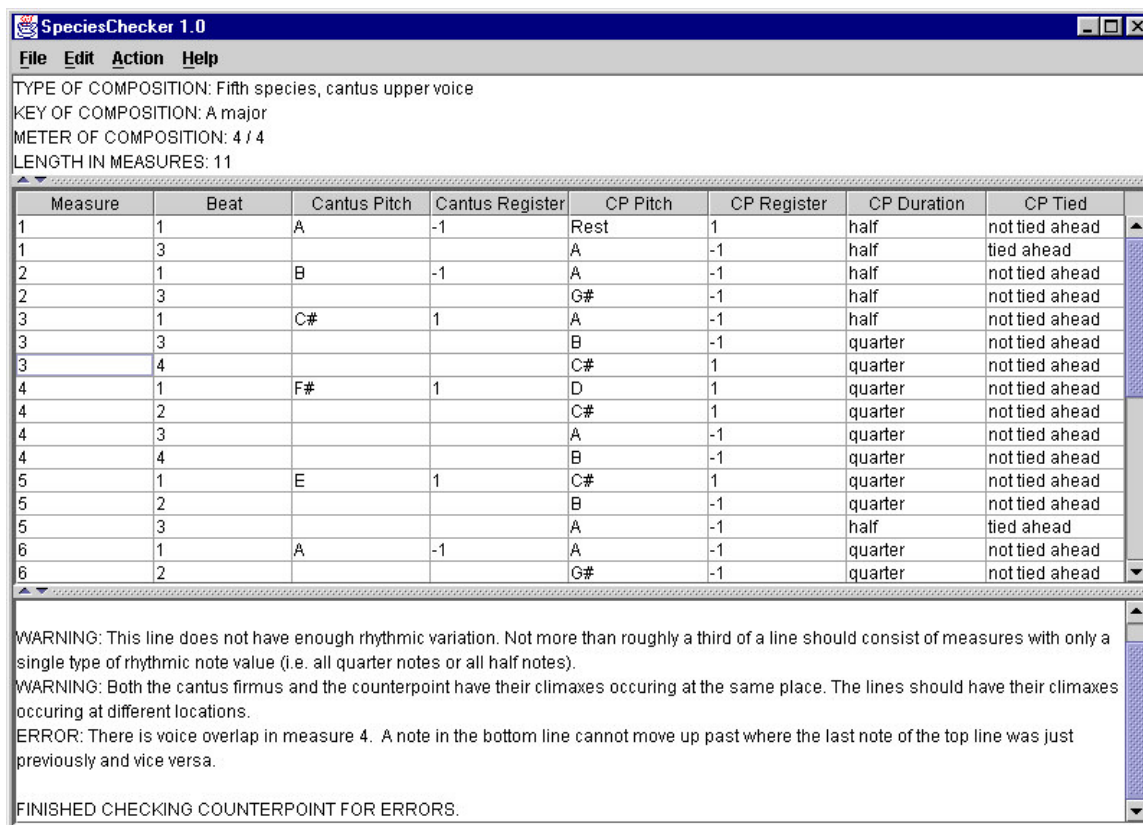
```
java SpeciesChecker
```



## IV. USING THE SOFTWARE

### 4.1 Overview of the Main Window

The main window of the SpeciesChecker interface can be seen in Figure 4.1:



**Figure 4.1:** The main window of the SpeciesChecker interface

From top to bottom, the components of the interface are as follows:

- **Menu Bar:** used to cause the software to perform actions
- **Composition Settings:** displays the overall settings of the current composition
- **Notes Table:** allows the user to view and modify the notes in a composition
- **Analysis Results:** displays the results of the analysis of a composition as well as miscellaneous error messages

### 4.2 Creating a New Composition

The user can start a new composition by selecting the *New Composition* command from the *File* menu. The user is then presented with the dialog box shown in Figure 4.2:



**Figure 4.2:** The Create New Composition dialog box

The user can use this dialog box to select what species the new composition will be in, whether the cantus firmus is the upper or lower voice, the key of the new composition and its length. When the *OK* button is pushed, the user will be returned to the main window of the SpeciesChecker interface, where he or she can specify the notes of the new composition. A new composition is automatically filled in with default notes, based on the species type, as seen in Figure 4.3:

SpeciesChecker 1.0

File Edit Action Help

TYPE OF COMPOSITION: Third species, cantus lower voice  
 KEY OF COMPOSITION: C major  
 METER OF COMPOSITION: 4 / 4  
 LENGTH IN MEASURES: 8

Measure	Beat	Cantus Pitch	Cantus Register	CP Pitch	CP Register	CP Duration	CP Tied
1	1	C	1	C	1	quarter	not tied ahead
1	2			C	1	quarter	not tied ahead
1	3			C	1	quarter	not tied ahead
1	4			C	1	quarter	not tied ahead
2	1	C	1	C	1	quarter	not tied ahead
2	2			C	1	quarter	not tied ahead
2	3			C	1	quarter	not tied ahead
2	4			C	1	quarter	not tied ahead
3	1	C	1	C	1	quarter	not tied ahead
3	2			C	1	quarter	not tied ahead
3	3			C	1	quarter	not tied ahead
3	4			C	1	quarter	not tied ahead
4	1	C	1	C	1	quarter	not tied ahead
4	2			C	1	quarter	not tied ahead
4	3			C	1	quarter	not tied ahead
4	4			C	1	quarter	not tied ahead

**Figure 4.3:** Sample new third species composition

### 4.3 Editing the Notes Table

Once a composition is created as just described or loaded from disk, the user can modify it using the notes table. This is done by clicking on the appropriate cell of the table. If the cell is modifiable (as are all non-empty cells not in the first two columns), a combo box will appear when the cell is clicked on, from which user can select the new value.

Each row of the table corresponds to a rhythmic location in a composition. The cells in the first row of the table in Figure 4.3, for example, correspond to information about notes struck in the first beat of the first measure of the composition. The columns are as follows:

- **Measure:** the measure where notes in the given row are struck
- **Beat:** the beat where notes in the given row are struck
- **Cantus Pitch:** the pitch of the note belonging to the cantus firmus that is struck on the given beat of the given measure. It is also possible to place a rest at this location by choosing “Rest” from the combo box rather than a pitch.
- **Cantus Register:** the register of the pitch specified in the corresponding Cantus Pitch cell. For example, a C in the Cantus Pitch cell and a 1 in the Cantus Register cell refers to middle C. A value of 2 in the Cantus Register cell would correspond to the C an octave above middle C, and a value of -1 in the Cantus Register cell would correspond to the C an octave below middle C. Values of B and -1 in the Cantus Pitch and Cantus Register cells would correspond to the B a semitone below middle C, and a D and a 1 in these cells would correspond to the D a whole tone above middle C.
- **CP Pitch:** the pitch of the note belonging to the counterpoint that is struck on the given beat of the given measure. It is also possible to place a rest at this location by choosing “Rest” from the combo box rather than a pitch.
- **CP Register:** the register of the pitch specified in the corresponding CP Pitch cell. This column functions similarly to the Cantus Register column.
- **CP Duration:** the rhythmic duration of the note belonging to the counterpoint that is struck on the given beat of the given measure
- **CP Tied:** specifies whether or not the note belonging to the counterpoint that is struck on the given beat of the given measure is tied ahead to the next note. It is not necessary to indicate whether or not a note is tied back, as this is determined automatically.

The table prevents the user from being able to make certain mistakes. No rhythmic duration is specified for notes belonging to the cantus firmus, for example, because the theory requires that these notes must always be whole notes. For similar reasons, it is not possible to tie notes belonging to the cantus firmus.

An example of all of a fifth species composition is shown in Figure 4.4:

**SpeciesChecker 1.0**  
**File Edit Action Help**  
 TYPE OF COMPOSITION: Fifth species, cantus lower voice  
 KEY OF COMPOSITION: A major  
 METER OF COMPOSITION: 4 / 4  
 LENGTH IN MEASURES: 11

Measure	Beat	Cantus Pitch	Cantus Register	CP Pitch	CP Register	CP Duration	CP Tied
1	1	A	-1	Rest	1	half	not tied ahead
1	3			A	1	half	tied ahead
2	1	B	-1	A	1	half	not tied ahead
2	3			G#	1	quarter	not tied ahead
2	4			F#	1	quarter	not tied ahead
3	1	C#	1	E	1	half	not tied ahead
3	3			E	2	half	tied ahead
4	1	F#	1	E	2	quarter	not tied ahead
4	2			A	1	quarter	not tied ahead
4	3			D	2	half	tied ahead
5	1	E	1	D	2	quarter	not tied ahead
5	2			E	2	eighth	not tied ahead
5	2.5			D	2	eighth	not tied ahead
5	3			C#	2	half	tied ahead
6	1	A	-1	C#	2	half	not tied ahead
6	3			D	1	quarter	not tied ahead

**Figure 4.4:** Sample fifth species composition

The first row of the table shows that the first beat of the piece has an A (the one below middle C) struck in the cantus firmus, while there is a half rest in the counterpoint on this beat. The third beat of the first measure has an A (the one above middle C) struck as a half note that is tied over to another A on the first beat of the second measure. It can be seen that the user is in the process of altering the pitch of the note in the counterpoint on the third beat of the fifth bar from a C# to a D. Also, note that notes falling between beats are given a .5 designation, as is the case with the second eighth note in measure 5 in Figure 4.4.

As a final example, Figure 4.5 and Figure 4.6 show a sample second species composition, first in standard musical notation and then as displayed by the software:



**Figure 4.5:** Sample second species composition

SpeciesChecker 1.0								
File Edit Action Help								
TYPE OF COMPOSITION: Second species, cantus lower voice								
KEY OF COMPOSITION: D minor								
METER OF COMPOSITION: 4 / 4								
LENGTH IN MEASURES: 9								
Measure	Beat	Cantus Pitch	Cantus Register	CP Pitch	CP Register	CP Duration	CP Tied	
1	1	D	1	Rest	1	half	not tied ahead	
1	3			D	2	half	not tied ahead	
2	1	A	1	C	2	half	not tied ahead	
2	3			A	1	half	not tied ahead	
3	1	G	1	Bb	1	half	not tied ahead	
3	3			C	2	half	not tied ahead	
4	1	F	1	D	2	half	not tied ahead	
4	3			F	2	half	not tied ahead	
5	1	E	1	G	2	half	not tied ahead	
5	3			E	2	half	not tied ahead	
6	1	D	1	F	2	half	not tied ahead	
6	3			D	2	half	not tied ahead	
7	1	F	1	A	1	half	not tied ahead	
7	3			B	1	half	not tied ahead	
8	1	E	1	C#	2	whole	not tied ahead	
9	1	D	1	D	2	whole	not tied ahead	

**Figure 4.6:** Sample second species composition

#### 4.4 Inserting or Deleting Rows

It is sometimes necessary to insert or delete rows in the table, in cases where a note needs to be added to a beat that is not present on the table or where there is no note struck in either voice on a given beat. This is only necessary in second and fifth species, since they are the only species that allow choices as to rhythmic values.<sup>1</sup>

<sup>1</sup> Second species compositions allow either a whole note or two half notes in the penultimate bar, and fifth species compositions allow many different rhythmic combinations. All other species require a whole note in the final measure, and fixed durations everywhere else. The SpeciesChecker interface automatically configures the table to meet the requirements of compositions belonging to these species, so the option of adding or deleting rows is disabled in all but second and fifth species.

The user can insert or delete rows by choosing the *Insert Row* or *Delete Row* commands from the *Edit* menu. The *Insert Row* command gives the user a dialog box to select the rhythmic location of the new row, and the *Delete Row* command simply deletes the row that is currently selected on the table.

#### 4.5 Opening or Saving Files

The user can open or save compositions using the *Open*, *Save* and *Save As* commands from the *File* menu. Only one composition can be open at a time, so the user will be asked if he or she wishes to save the currently open file if he or she attempts to open or create a composition if one is already loaded.

#### 4.6 Adding or Removing a Counterpoint

If a cantus firmus is open and the user wishes to add a counterpoint to it, he or she may choose the *Add Counterpoint* command from the *Edit* menu. The user can then choose the type of counterpoint from a dialog box. The user can also remove the counterpoint from a given composition, so that a composition containing only a cantus firmus is left. This can be done by selecting the *Remove Counterpoint* command from the *Edit* menu. This is useful if the user wishes to reuse a given cantus firmus in another composition without having to reenter it.

#### 4.7 Checking a Composition for Errors

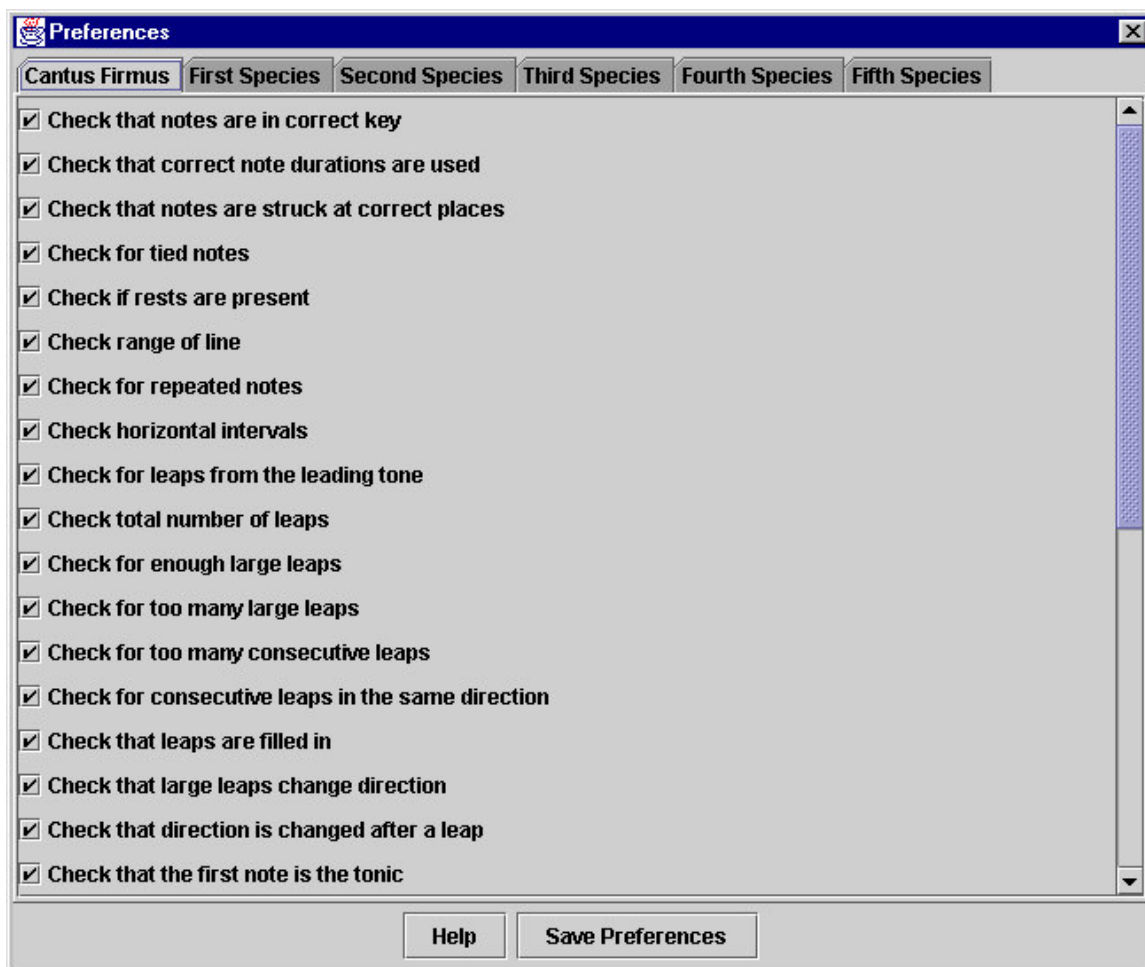
The user can check a composition for errors by selecting the *Analyze Composition* command from the *Action* menu. This generates a list of problems detected in the Analysis Results area of the main window. This list is composed of two sections: The first section holds the results of an analysis of the cantus firmus itself, independently of the counterpoint. The second list consists of errors detected in the counterpoint line itself and in how the cantus firmus and the counterpoint interrelate.

If the user only wishes to analyze the cantus firmus, or if the composition is made up solely of a cantus firmus, then the user can select the *Analyze Cantus* command from the *Action* menu. The user can also concentrate the analysis on the counterpoint by choosing the *Analyze Counterpoint* command from the *Action* menu. This will cause the software to look for errors in the counterpoint line and how it relates to the cantus firmus, and will omit the independent analysis of the cantus.

The problems that are detected are given one of two labels: “errors” or “warnings.” Warnings indicate problems that may be relatively minor, and errors indicate problems that are more likely to be significant.

## 4.8 Setting the Preferences

The user may wish to disable some of the rules that the software applies while looking for problems. This can be done by selecting the *Preferences* command from the *Edit* menu. The user is then presented with the dialog box shown in Figure 4.7.



**Figure 4.7:** Preferences dialog box

The user may then choose to enable or disable any of the rules by clicking on the check box corresponding to the rule. The tabs at the top of the dialog box allow the user to view the rules for each of the different types of compositions. Explanations of these rules are found in Section V of this document. The user may also click on the *Help* button to check the definitions of the rules in the on-line help.

The software comes pre-loaded with the preferences configured to apply the rules most commonly found in the literature. Pressing on the *Save Preferences* button will save the currently selected preferences to disk, so that the user will not have to reset the preferences the next time that the software is run.

## 4.9 Automatically Generating a Cantus Firmus

The user can randomly generate a cantus firmus by selecting the *Generate Cantus* command from the *Action* menu. The generated cantus will appear on the table when it is complete. This may take a few minutes, depending on the speed of the computer that the software is run on. This cantus firmus will not violate any of the rules selected in the Preferences Dialog Box, but the user should still be aware that this does not necessarily mean that it will be a particularly good cantus. A counterpoint can be added to a generated cantus by selecting the *Add Counterpoint* command from the *Edit* menu

## 4.10 Using the On-Line Help

Selecting the *Help Topics* command from the *Help* menu will bring up the Help Dialog Box. This contains an HTML version of this manual. The user can navigate it by clicking on any of the links in the text, and can return to the topics page by clicking on the *Index* button. This dialog box remembers the user's location in the manual as long as the SpeciesChecker software is not closed, so choosing the *Help Topics* command again or clicking on the *Help* button in the Preferences Dialog Box will return the user to his or her last location. Clicking on the *OK* button in the Help Dialog box will hide the dialog box.

## 4.11 Quitting the Program

The software can be closed by selecting the *Exit* command from the *File* menu or by clicking on the x button at the top right corner of the main window.

## 4.12 Sample Compositions

A number of sample compositions for each species are bundled with the software in SpeciesChecker format. These are available in the SampleCompositions directory. These are primarily from examples found in the literature. Depending on what rules are enabled in the preferences, some problems will be found in most of these pieces. The user can use these files to gain familiarity with using the SpeciesChecker interface.



## V. GUIDE TO DIAGNOSTIC RULES

### 5.1 Overview

The rules specified in this section correspond to the rules in the Preferences Dialog box, where the user may either enable them or disable them. The rules are organized by species, and the rules for each species are only applied to compositions belonging to that species.<sup>2</sup>

Certain rules are present in more than one species. Users are able to disable an instance of one of these rules in one species, but leave it enabled in another, if they wish. Also, although the titles of certain rules may appear similar in different species, their descriptions should still be read, since there are sometimes subtle differences between species.

Some of the rules listed in the following sections are redundant, in the sense that a single error may be detected by multiple rules. This is to allow users to select between slightly different rules based on differing theoretical perspectives. The default preferences are set up to minimize this double counting.

### 5.2 Rules Imposed by the Interface

The interface does not allow the user to make certain mistakes, in order to prevent him or her from inadvertently violating the integrity of the software. The user is still, however, allowed to make many kinds of errors, in order that he or she may learn from mistakes. Those limitations imposed by the interface are as follows:

- Only pitches between C-2 and B3 are permitted.
- Only whole notes are allowed in cantus firmi, and they must be struck on the first beat only.
- Notes belonging to a cantus firmus may not be tied.
- The only time a note may be struck on the last measure of a bar is on its first beat.
- Notes may only be struck on the first beats of all measures in first species compositions.
- Notes may not be struck between beats in third species compositions.
- Notes may only be struck on the first and third beats of all measures in fourth species compositions.
- Notes may only be struck on beats and directly between beats in second and fifth species compositions.
- The only rhythmic durations allowed in the counterpoint are eighth notes, quarter notes, half notes and whole notes.

---

<sup>2</sup> Note that the rules relating to cantus firmi are applied whenever the *Analyze Composition* or *Analyze Cantus* commands are selected, irregardless of the species.

- Only one note may be struck at a time in a given voice.
- A composition may only have a length of four to twenty measures.
- Both voices in a composition must have the same key, and it cannot change during the piece.
- The only permitted time signature is 4/4.

### 5.3 Diagnostic Rules for Cantus Firmi

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.
- **Check that correct note durations are used:** Only whole notes can be used.
- **Check that notes are struck at correct places:** A note must be struck on the first beat of each measure, and notes may only be struck then.
- **Check for tied notes:** Notes may not be tied.
- **Check if rests are present:** Rests are not permitted.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row.
- **Check horizontal intervals:** The only permitted horizontal intervals are minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves.
- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check total number of leaps:** There should be between two to four leaps in the line.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** More than two consecutive leaps are not permitted.
- **Check for consecutive leaps in the same direction:** Two or more consecutive leaps in the same direction are not permitted.
- **Check that leaps are filled in:** All leaps larger than a third must be filled in by the next note.
- **Check that large leaps change direction:** Leaps larger than a fourth should move in the direction opposite to the direction of the motion preceding them.
- **Check that direction is changed after a leap:** All leaps larger than a third must be followed by a change of direction.
- **Check that the first note is the tonic:** The first note of the line must be the tonic and it must be on the first beat of the piece.
- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.

- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that second to last note is approached properly:** The second to last note of the line may not be approached by a leap larger than a third.
- **Check that the last note is approached stepwise:** The last note of the line must be approached stepwise.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.
- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line. The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check that a note does not reoccur too often:** No note should appear more than four times in the same register.
- **Check rigorously that a note does not reoccur too often:** A note should not appear more than three times in the same register if it is ever used to change direction or is involved in a skip. A note should not appear more than twice in the same register if it is used to change direction or is involved in a skip more than once.
- **Check interval outlined by a series of notes:** The interval between the first and last notes of a series of notes moving in the same direction should not be dissonant (i.e. tritone, minor 7th or major 7th).
- **Check for too many consecutive stepwise notes:** There should not be more than five consecutive notes without a leap.
- **Check number of consecutive notes moving in the same direction:** There should not be more than five consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for repetitions of groups of tones:** Lines should not contain more than one occurrence of the same three pitches occurring consecutively in the same order.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).
- **Check length of piece:** The piece should be between eight and sixteen measures long.

#### 5.4 Diagnostic Rules for First Species – Counterpoint Line Only

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.

- **Check that correct note durations are used:** Only whole notes can be used.
- **Check that notes are struck at correct places:** A note must be struck on the first beat of each measure, and notes may only be struck then.
- **Check that tied notes are used correctly:** Notes may only be tied if they have the same pitch, the duration of a note that is tied ahead must be such that it ends when the note that it is tied to starts, rests may not be tied and a note that is tied ahead must have a note ahead of it to receive the tie.
- **Check for too many consecutive tied notes:** Consecutive ties are not permitted.
- **Check for too many tied notes in total:** A line should not contain more than two ties in total.
- **Check if rests are present:** Rests are not permitted.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row unless it is tied.
- **Check horizontal intervals:** The only permitted horizontal intervals are unisons, minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves. Tied notes are also permitted.
- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check total number of leaps:** There should be between two to four leaps in the line.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** More than two consecutive leaps are not permitted.
- **Check for consecutive leaps in the same direction:** Two or more consecutive leaps in the same direction are not permitted.
- **Check that leaps are filled in:** All leaps larger than a third must be filled in by the next note.
- **Check that large leaps change direction:** Leaps larger than a fourth should move in the direction opposite to the direction of the motion preceding them.
- **Check that direction is changed after a leap:** All leaps larger than a third must be followed by a change of direction.
- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.
- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that second to last note is approached properly:** The second to last note of the line may not be approached by a leap larger than a third.
- **Check that the last note is approached stepwise:** The last note of the line must be approached stepwise.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be

raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.

- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line. The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check that a note does not reoccur too often:** No note should appear more than four times in the same register.
- **Check rigorously that a note does not reoccur too often:** A note should not appear more than three times in the same register if it is ever used to change direction or is involved in a skip. A note should not appear more than twice in the same register if it is used to change direction or is involved in a skip more than once.
- **Check interval outlined by a series of notes:** The interval between the first and last notes of a series of notes moving in the same direction should not be dissonant (i.e. tritone, minor 7th or major 7th).
- **Check for too many consecutive stepwise notes:** There should not be more than five consecutive notes without a leap.
- **Check number of consecutive notes moving in the same direction:** There should not be more than five consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for repetitions of groups of tones:** Lines should not contain more than one occurrence of the same three pitches occurring consecutively in the same order.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).

### 5.5 Diagnostic Rules for First Species – Both Lines

- **Check vertical intervals:** The only permitted vertical intervals are unisons, minor and major thirds, perfect fifths, minor and major sixths, octaves, minor and major tenths and perfect twelfths.
- **Check unisons:** Vertical unisons may only be present in the first and last measures of the piece.
- **Check that vertical twelfths are treated properly:** Vertical perfect twelfths are only permitted in the climax of the counterpoint, and they may not leap to or be leapt from a perfect fifth..
- **Check that perfect intervals are approached properly:** Perfect intervals must be approached with contrary or oblique motion. This rules out the possibility of parallel fifths or octaves.
- **Check successive unisons and octaves:** Vertical octaves may not be followed by unisons and vertical unisons may not be followed by octaves.
- **Check for too many consecutive identical intervals:** More than three consecutive identical vertical intervals (e.g. four thirds in a row) should not be present.

- **Check for too much consecutive parallel motion:** A piece should not have more than three pairs of notes in a row that move using parallel motion.
- **Check leaps from perfect intervals:** Notes in the counterpoint that are part of vertical perfect intervals should not be leapt to or from.
- **Check lines for improper simultaneous leaps:** If there is a horizontal leap in one line, then the other line should move stepwise if the leap is greater than a fourth or if the lines move with similar motion.
- **Check for simultaneous climaxes:** The counterpoint and the cantus firmus should not have their climaxes occur simultaneously.
- **Check for voice crossing:** A note in the bottom line may never be above the corresponding note in the top line and a note in the top line may never be below the corresponding note in the bottom line.
- **Check for voice overlap:** A note in the bottom line may not move up past where the last note of the top line was just previously and a note in the top line may not move down below where the last note of the bottom line was just previously.
- **Check the beginning interval:** The first vertical interval of the piece must be a unison, a perfect fifth or an octave. A perfect fifth is only permitted when the counterpoint is above the cantus.
- **Check the last interval:** The last vertical interval of the piece must be a unison or an octave.
- **Check the approach to the last interval:** The last interval of the piece must be approached with contrary motion.

## 5.6 Diagnostic Rules for Second Species – Counterpoint Line Only

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.
- **Check that correct note durations are used:** Only whole notes and half notes are permitted. Whole notes are only permitted in the last two measures of the line and half notes are not permitted in the last measure of the line.
- **Check that notes are struck at correct places:** All parts of the line must have a note sounding or be covered by a rest at all times. Multiple notes and/or rests may not overlap in a single line.
- **Check for tied notes:** Notes may not be tied.
- **Check if rests are present:** The only rest permitted is a half rest on the first beat of the line.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row.
- **Check horizontal intervals:** The only permitted horizontal intervals are minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves.

- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** There should not be more than two consecutive leaps.
- **Check for consecutive leaps in the same direction:** Two or more consecutive leaps in the same direction are only permitted if the following conditions are met: a) the first leap starts on the first beat of a measure and the second leap ends on the first beat of a measure and b) the combined interval of the two leaps is consonant (i.e. perfect fifth, minor sixth, major sixth or octave).
- **Check for leaps across measure lines:** Leaps across measure lines are only permitted if the leap is a fourth or smaller and the direction of motion is changed immediately after the leap.
- **Check that leaps are filled in:** All leaps larger than a fourth must be filled in by the next note.
- **Check that leaps of a fourth are treated properly:** Leaps of a fourth must be filled in unless the following conditions are met: 1) the note after the leap is approached stepwise, 2) there is a change of direction following the note following the leap and 3) the leap is in the direction opposite to the direction of motion preceding the leap.
- **Check that large leaps change direction:** Leaps larger than a fourth should move in the direction opposite to the direction of the motion preceding them.
- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.
- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that second to last note is approached properly:** The second to last note of the line may not be approached by a leap larger than a third.
- **Check that the last note is approached stepwise:** The last note of the line must be approached stepwise.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.
- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line. The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check interval outlined by a series of notes:** The interval between the first and last notes of a series of notes moving in the same direction should not be dissonant (i.e. tritone, minor 7th or major 7th).

- **Check for too many consecutive stepwise notes:** There should not be more than six consecutive notes without a leap.
- **Check number of consecutive notes moving in the same direction:** There should not be more than six consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for repetitions of groups of tones:** Lines should not contain more than one occurrence of the same three pitches occurring consecutively in the same order.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).

### 5.7 Diagnostic Rules for Second Species – Both Lines

- **Check vertical intervals:** Vertical intervals other than unisons, minor and major thirds, perfect fifths, minor and major sixths, octaves and the multiples of these intervals are only permitted on weak beats, and must be approached and left with stepwise motion. Intervals greater than perfect twelfths should generally be avoided.
- **Check unisons:** Vertical unisons are only permitted on weak beats, except for on the first beats of the first and last measures, where they may be present. If they occur on weak beats, they must be left by stepwise motion in the opposite direction to that by which they were approached.
- **Check that vertical twelfths are treated properly:** Vertical perfect twelfths are only permitted in the climax of the counterpoint.
- **Check that perfect intervals are approached properly:** Perfect intervals must be approached with contrary or oblique motion. This rules out the possibility of parallel fifths or octaves, which are absolutely forbidden.
- **Check for parallel perfect intervals on successive strong beats:** Parallel fifths or octaves that occur on successive first beats should be avoided, regardless of the half note separating them. Although these are permissible occasionally, they should not be emphasized or used frequently.
- **Check for too many consecutive identical intervals:** Should not have the same vertical interval occurring on the first beats of more than three consecutive measures.
- **Check leaps from perfect intervals:** If there is a perfect vertical interval on the first beat of a measure, then the counterpoint note should not be leaped to or from. This is sometimes permissible if the leap is small and the direction of motion is changed, but it should generally be avoided.
- **Check for simultaneous climaxes:** The counterpoint and the cantus firmus should not have their climaxes occur simultaneously.
- **Check for voice crossing:** A note in the bottom line may never be above the corresponding note in the top line and a note in the top line may never be below the corresponding note in the bottom line.
- **Check for voice overlap:** A note in the bottom line may not move up past where the last note of the top line was just previously and a note in the top line may not move down below where the last note of the bottom line was just previously.



- **Check the beginning interval:** The first vertical interval of the piece must be a unison, a perfect fifth or an octave. A perfect fifth is only permitted when the counterpoint is above the cantus.
- **Check the last interval:** The interval of the notes struck on the first beat of the last measure of the piece must be a unison or an octave.
- **Check the approach to the last interval:** The notes on the first beat of the last measure must be approached with contrary motion.

### 5.8 Diagnostic Rules for Third Species – Counterpoint Line Only

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.
- **Check that correct note durations are used:** Only whole notes and quarter notes are permitted. A whole note may only be used in the last measure of the line and quarter notes are not permitted in the last measure of the line.
- **Check that notes are struck at correct places:** All parts of the line must have a note sounding or be covered by a rest at all times. Multiple notes and/or rests may not overlap in a single line.
- **Check for tied notes:** Notes may not be tied.
- **Check if rests are present:** The only rest permitted is a quarter rest on the first beat of the line.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row.
- **Check horizontal intervals:** The only permitted horizontal intervals are minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves.
- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** There should not be more than two consecutive leaps.
- **Check for consecutive leaps in the same direction:** Two consecutive leaps in the same direction are not permitted.
- **Check for leaps across bar lines:** Leaps across bar lines are only permitted if the leap is a fourth or smaller and is in the direction of motion opposite to the direction of motion preceding it..
- **Check that leaps are filled in:** Leaps larger than a third should be filled in by the next note.

- **Check that leaps change direction:** Leaps should generally move in the direction opposite to the direction of motion preceding them. This is occasionally acceptable, however, if it is not preceded by more than two or three notes moving stepwise in the same direction.
- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.
- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that second to last note is approached properly:** The second to last note of the line may not be approached by a leap larger than a third.
- **Check that the last note is approached stepwise:** The last note of the line must be approached stepwise.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.
- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line (decoration with a neighbour note is not considered repetition). The climax must be on a metrically strong beat (the first or third beat). The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check interval outlined by a series of notes:** The interval between the first and last notes of a series of notes moving in the same direction should not be dissonant (i.e. tritone, minor 7th or major 7th).
- **Check number of consecutive notes moving in the same direction:** There should not be more than six consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).

### 5.9 Diagnostic Rules for Third Species – Both Lines

- **Check vertical intervals:** Vertical intervals other than unisons, minor and major thirds, perfect fifths, minor and major sixths, octaves and the multiples of these intervals are only permitted on weak beats and must be approached and left with stepwise motion, unless they are part of a double neighbour or a nota cambiata.
- **Check unisons:** Vertical unisons are not permitted on the first beat of measures, except in the case of the first and last measures, where they may be used on the first beats.
- **Check nota cambiata:** The first and third tones of a nota cambiata must always be consonant. The first tone of a nota cambiata must fall on the first beat of a measure.

- **Check double neighbour:** The first tone of a double neighbour must fall on the first beat of a measure, the tone being decorated must be consonant and the motion immediately after a double neighbour must be stepwise and must continue the direction of motion. It is also preferable for the upper neighbour to precede the lower neighbour and for one of the neighbours to be a semitone from the note being decorated.
- **Check dissonant neighbour notes:** Dissonant neighbour notes on the third beat of measures should generally be avoided.
- **Check distance between lines:** Vertical intervals greater than perfect twelfths should generally be avoided
- **Check that perfect intervals are approached properly:** Perfect intervals should be approached with contrary or oblique motion.
- **Check for parallel perfect intervals:** Consecutive unisons, fifths and octaves are forbidden.
- **Check separation between perfect intervals:** Two vertical unisons, fifths or octaves separated by only one tone should be avoided.
- **Check for parallel perfect intervals on successive strong beats:** Parallel fifths or octaves that occur on successive first beats should be avoided, regardless of the notes separating them. Although these are permissible occasionally, they should not be emphasized nor used frequently.
- **Check for too many consecutive perfect intervals:** The same vertical perfect interval should not occur on the first beats of more than two consecutive measures.
- **Check leaps from perfect intervals:** If there is a perfect vertical interval on the first beat of a measure, then the counterpoint note should not be leaped to or from. This is sometimes permissible if the leap is small and the direction of motion is changed, but it should generally be avoided.
- **Check for simultaneous climaxes:** The counterpoint and the cantus firmus should not have their climaxes occur simultaneously.
- **Check for voice crossing:** A note in the bottom line may never be above the corresponding note in the top line and a note in the top line may never be below the corresponding note in the bottom line.
- **Check for voice overlap:** A note in the bottom line may not move up past where the last note of the top line was just previously and a note in the top line may not move down below where the last note of the bottom line was just previously.
- **Check the beginning interval:** The first vertical interval of the piece must be a unison, a perfect fifth, an octave or a perfect twelfth. A perfect fifth or twelfth is only permitted when the counterpoint is above the cantus.
- **Check the last interval:** The interval of the notes struck on the first beat of the last measure of the piece must be a unison or an octave.
- **Check the approach to the last interval:** The notes on the first beat of the last measure must be approached with contrary motion.

### 5.10 Diagnostic Rules for Fourth Species – Counterpoint Line Only

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.
- **Check that correct note durations are used:** All notes must be half notes, except for the last note, which must be a whole note and must be struck on the first beat of the last measure.
- **Check that notes are struck at correct places:** All parts of the line must have a note sounding or be covered by a rest at all times. Multiple notes and/or rests may not overlap in a single line.
- **Check that tied notes are used correctly:** Notes may only be tied if they have the same pitch, the duration of a note that is tied ahead must be such that it ends when the note that it is tied to starts, rests may not be tied and a note that is tied ahead must have a note ahead of it to receive the tie.
- **Check for consecutive tied notes:** A note may not be tied twice consecutively.
- **Check that ties are properly placed:** Notes on strong beats may not be tied ahead to notes on weak beats.
- **Check that species is not broken too frequently:** A line should not contain more than eight notes that are not involved in a suspension.
- **Check consecutive notes involved in broken species:** There may not be more than two consecutive notes that are not involved in a suspension.
- **Check if rests are present:** There must be a half rest on the first beat of the line and this is the only place where a rest may be present.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row unless it is tied.
- **Check horizontal intervals:** The only permitted horizontal intervals are minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves. Tied notes are also permitted.
- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** There should not be more than two consecutive leaps.
- **Check for consecutive leaps in the same direction:** More than two consecutive leaps in the same direction should be avoided.
- **Check for leaps across measure lines:** Leaps across measure lines are only permitted if the leap is a fourth or smaller and the direction of motion is changed immediately after the leap.

- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.
- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that the last note is approached properly:** The last note of the line may not be approached by leap and may not be involved in a suspension.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.
- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line. The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check for too many consecutive stepwise notes:** There should not be more than six consecutive notes without a leap.
- **Check number of consecutive notes moving in the same direction:** There should not be more than six consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).

### 5.11 Diagnostic Rules for Fourth Species – Both Lines

- **Check vertical intervals:** Vertical intervals other than unisons, minor and major thirds, perfect fifths, minor and major sixths, octaves and the multiples of these intervals are only permitted on strong beats when they are involved in a dissonant suspension, and they are only permitted on weak beats when they are not part of a suspension (i.e. species has been broken) and are approached and left with stepwise motion.
- **Check distance between lines:** Vertical intervals greater than perfect twelfths should generally be avoided
- **Check that perfect intervals are approached properly:** If species is broken, perfect intervals must be approached with contrary or oblique motion. This rules out the possibility of parallel fifths or octaves, which are absolutely forbidden.
- **Check for voice crossing:** A note in the bottom line may never be above the corresponding note in the top line and a note in the top line may never be below the corresponding note in the bottom line.
- **Check for voice overlap:** A note in the bottom line may not move up past where the last note of the top line was just previously and a note in the top line may not move down below where the last note of the bottom line was just previously.

- **Check the beginning interval:** The first vertical interval of the piece must be a unison, a perfect fifth or an octave. A perfect fifth is only permitted when the counterpoint is above the cantus.
- **Check the last interval:** The interval of the notes struck on the first beat of the last measure of the piece must be a unison or an octave.
- **Check the approach to the last interval:** The notes on the first beat of the last measure must be approached with contrary motion.
- **Check that dissonant suspensions resolve properly:** Dissonant suspensions must resolve downwards by step.
- **Check series of suspensions:** More than three suspensions of the same type occurring consecutively should generally be avoided.
- **Check consecutive 9-8 suspensions:** Consecutive 9-8 suspensions are not permitted.
- **Check consecutive 2-1 suspensions:** Consecutive 2-1 suspensions are not permitted.
- **Check consecutive 4-5 suspensions:** Consecutive 4-5 suspensions are not permitted.
- **Check for 7-8 suspensions:** 7-8 suspensions are forbidden.
- **Check for 2-1 suspensions:** 2-1 suspensions should be avoided if possible.
- **Check for enough consonant suspensions:** There should be at least one consonant suspension in the piece.
- **Check for enough dissonant suspensions:** There should be more dissonant suspensions than consonant suspensions in the piece.

### 5.12 Diagnostic Rules for Fifth Species – Counterpoint Line Only

- **Check that notes are in correct key:** All notes must belong to the given key, with two exceptions: 1) if the composition is in a minor key, then the second to last measure may contain the raised 7th scale degree and 2) if the composition is in a minor key, then the third to last measure may contain the raised 6th scale degree.
- **Check for whole notes:** A whole note is the only duration permitted in the last measure of a line and this is the only place where a whole note may be used.
- **Check that notes are struck at correct places:** All parts of the line must have a note sounding or be covered by a rest at all times. Multiple notes and/or rests may not overlap in a single line.
- **Check rhythmic configuration of first measure:** The first measure of the line must contain one of the following rhythmic configurations: two half notes, a half rest followed by a half note, a quarter rest followed by three quarter notes or four quarter notes. If the measure is ended with a half note, it may be tied ahead or not tied ahead.
- **Check rhythmic configuration of other measures:** Only the following rhythmic configurations are permitted in measures other than the first: Measures with four quarter notes, measures with two half notes with the second not tied, measures with a half note followed by two quarter notes, measures with a half note followed by a quarter note followed by two eighth notes, measures with a quarter note followed by two eighth notes followed by two quarter notes, measures with three quarter notes followed by two eighth notes, measures with two quarter notes followed by a tied half note, measures with a half note followed by a tied half note, measures with a quarter

note followed by two eighth notes followed by a tied half note, measures with a quarter note followed by two eighth notes followed by an untied half note and measures with just a half note.

- **Check for prolonged use of a single rhythmic value:** A single rhythmic note value (i.e. all quarter notes or all half notes) should not continue without variation for more than two measures.
- **Check rhythmic variation:** Not more than roughly a third of a line should consist of measures with only a single type of rhythmic note value (i.e. all quarter notes or all half notes).
- **Check for changes of rhythmic configuration:** Two consecutive measures with the same rhythmic configuration are not permitted unless they are made up entirely of notes with only a single rhythmic value (i.e. all quarter notes or all half notes).
- **Check eighth notes:** Eighth notes must occur two at a time and they must move by step. A leap to the first eighth note is sometimes permitted, but a leap between the eighth notes or from the second eighth note is forbidden.
- **Check that tied notes are used correctly:** Notes may only be tied if they have the same pitch, the duration of a note that is tied ahead must be such that it ends when the note that it is tied to starts, rests may not be tied and a note that is tied ahead must have a note ahead of it to receive the tie.
- **Check for consecutive tied notes:** A note may not be tied twice consecutively.
- **Check that ties are rhythmically correct:** Only half notes struck on the third beat of a measure may be tied ahead.
- **Check if rests are present:** The only rest permitted is either a quarter rest or a half rest on the first beat of the line.
- **Check range of line:** The range of the line should be between a 5th and a 10th.
- **Check for repeated notes:** The same note may not be struck twice in a row unless it is tied.
- **Check horizontal intervals:** The only permitted horizontal intervals are minor seconds, major seconds, minor thirds, major thirds, perfect fourths, perfect fifths, minor sixths, major sixths and octaves.
- **Check for leaps from the leading tone:** It is not permitted to leap from the leading tone.
- **Check for enough large leaps:** There should be at least one leap larger than a third in the line.
- **Check for too many large leaps:** There should be no more than two leaps larger than a fourth in the line.
- **Check for too many consecutive leaps:** There should not be more than two consecutive leaps.
- **Check for consecutive leaps in the same direction:** Two consecutive leaps in the same direction are not permitted.
- **Check for leaps across bar lines:** Leaps across bar lines are only permitted if the leap is a fourth or smaller and is in the direction of motion opposite to the direction of motion preceding it.
- **Check that leaps are filled in:** Leaps larger than a third should be filled in by the next note.

- **Check that large leaps change direction:** Leaps larger than a fourth should move in the direction opposite to the direction of the motion preceding them.
- **Check that the last note is the tonic:** The last note of the line must be the tonic and it must be on the first beat of the last bar.
- **Compare first and last notes:** If there are no notes lower than the first note of the line, then the last note of the line must have the same pitch as the first note.
- **Check that second to last note is approached properly:** The second to last note of the line may not be approached by a leap larger than a third.
- **Check that the last note is approached stepwise:** The last note of the line must be approached stepwise.
- **Check that endings are properly treated in minor keys:** If the line is in a minor key, and the second to last note is the seventh scale degree, then this note should be raised a semitone. If the above condition is true and the third to last note is the sixth scale degree, then this note should also be raised a semitone.
- **Check for properly treated climax:** Every line must contain a climax. It is usually the highest note of the line, but may be the lowest point of the line if the first and last notes of the line are the highest points of the line. The climax note may not be exceeded or repeated anywhere in the line (decoration with a neighbour note is not considered repetition). The climax must be on a metrically strong beat (the first or third beat). The climax may not be on the first two or last two notes of the line. The climax may not be on the leading tone in a major key or the raised seventh scale degree in a minor key.
- **Check interval outlined by a series of notes:** The interval between the first and last notes of a series of notes moving in the same direction should not be dissonant (i.e. tritone, minor 7th or major 7th).
- **Check number of consecutive notes moving in the same direction:** There should not be more than six consecutive notes without a change of direction.
- **Check number of changes of direction:** The line should change direction at least twice.
- **Check for ornamentation:** Lines may not have ornamentation where two pitches are repeated immediately (e.g. ABAB or BABA).

### 5.13 Diagnostic Rules for Fifth Species – Both Lines

- **Check vertical intervals:** Vertical intervals other than unisons, minor and major thirds, perfect fifths, minor and major sixths, octaves and the multiples of these intervals are only permitted on the first beat of a measure when they are tied back. Dissonant intervals are only permitted on other beats when they are not tied forward and are approached and left with stepwise motion (unless they are part of a double neighbour or a nota cambiata, in which case there may be a leap between dissonances).
- **Check unisons:** Vertical unisons are not permitted on the first beat of measures unless they are part of suspensions or are in the first or last measures. Unisons are only permitted on other beats if they are tied over or are followed by stepwise motion.
- **Check nota cambiata:** The first and third tones of a nota cambiata must always be consonant. The first tone of a nota cambiata must fall on the first beat of a measure.



- **Check double neighbour:** The first tone of a double neighbour must fall on the first beat of a measure, the tone being decorated must be consonant and the motion immediately after a double neighbour must be stepwise and must continue the direction of motion. It is also preferable for the upper neighbour to precede the lower neighbour and for one of the neighbours to be a semitone from the note being decorated.
- **Check dissonant neighbour notes:** Dissonant neighbour notes on the third beat of measures should generally be avoided.
- **Check distance between lines:** Vertical intervals greater than perfect twelfths should generally be avoided
- **Check that perfect intervals are approached properly:** Perfect intervals not involved in suspensions should be approached with contrary or oblique motion.
- **Check for parallel perfect intervals:** Consecutive unisons, fifths and octaves are forbidden.
- **Check separation between perfect intervals:** Two vertical unisons, fifths or octaves separated by only one tone should be avoided.
- **Check for too many consecutive perfect intervals:** The same vertical perfect interval should not occur on the first beats of more than two consecutive measures.
- **Check leaps from perfect intervals:** If there is a perfect vertical interval on the first beat of a measure, then the counterpoint note should not be leaped to or from. This is sometimes permissible if the leap is small and the direction of motion is changed, but it should generally be avoided.
- **Check for simultaneous climaxes:** The counterpoint and the cantus firmus should not have their climaxes occur simultaneously.
- **Check for voice crossing:** A note in the bottom line may never be above the corresponding note in the top line and a note in the top line may never be below the corresponding note in the bottom line.
- **Check for voice overlap:** A note in the bottom line may not move up past where the last note of the top line was just previously and a note in the top line may not move down below where the last note of the bottom line was just previously.
- **Check the beginning interval:** The first vertical interval of the piece must be a unison, a perfect fifth, an octave or a perfect twelfth. A perfect fifth or twelfth is only permitted when the counterpoint is above the cantus.
- **Check the last interval:** The interval of the notes struck on the first beat of the last measure of the piece must be a unison or an octave.
- **Check the approach to the last interval:** The notes on the first beat of the last measure must be approached with contrary motion.
- **Check that dissonant suspensions resolve properly:** Dissonant suspensions must resolve downwards by step to the third beat of the measure, even if the suspension is decorated on the second beat.
- **Check series of suspensions:** More than three suspensions of the same type occurring consecutively should generally be avoided.
- **Check consecutive 9-8 suspensions:** Consecutive 9-8 suspensions are not permitted.
- **Check consecutive 2-1 suspensions:** Consecutive 2-1 suspensions are not permitted.
- **Check consecutive 4-5 suspensions:** Consecutive 4-5 suspensions are not permitted.

- **Check for 7-8 suspensions:** 7-8 suspensions are forbidden.
- **Check for 2-1 suspensions:** 2-1 suspensions should be avoided if possible.

## VI. ACQUIRING FURTHER INFORMATION

### 6.1 Other Documents

The following documents may also be consulted for further information relating to the SpeciesChecker software:

- **Project Outline:** contains the original plans and objectives of the SpeciesChecker project
- **Mid-Project Report:** contains an outline of the original design of the project, along with technical information relating to it
- **Final Project Report:** contains an overview of the project, what was accomplished, what problems were encountered, what was learned in the course of the project, an outline of potential improvements to the software and a bibliography.

The Project Outline and the Mid-Project Report are outdated in some respects, but still contain some useful information. There is some duplication between the material covered in the Final Project Report and this document, but it also contains a good deal of additional information.

### 6.2 Contact Information

Cory McKay can be contacted at [cory@uoguelph.ca](mailto:cory@uoguelph.ca) for any questions relating to this project or to report any bugs.