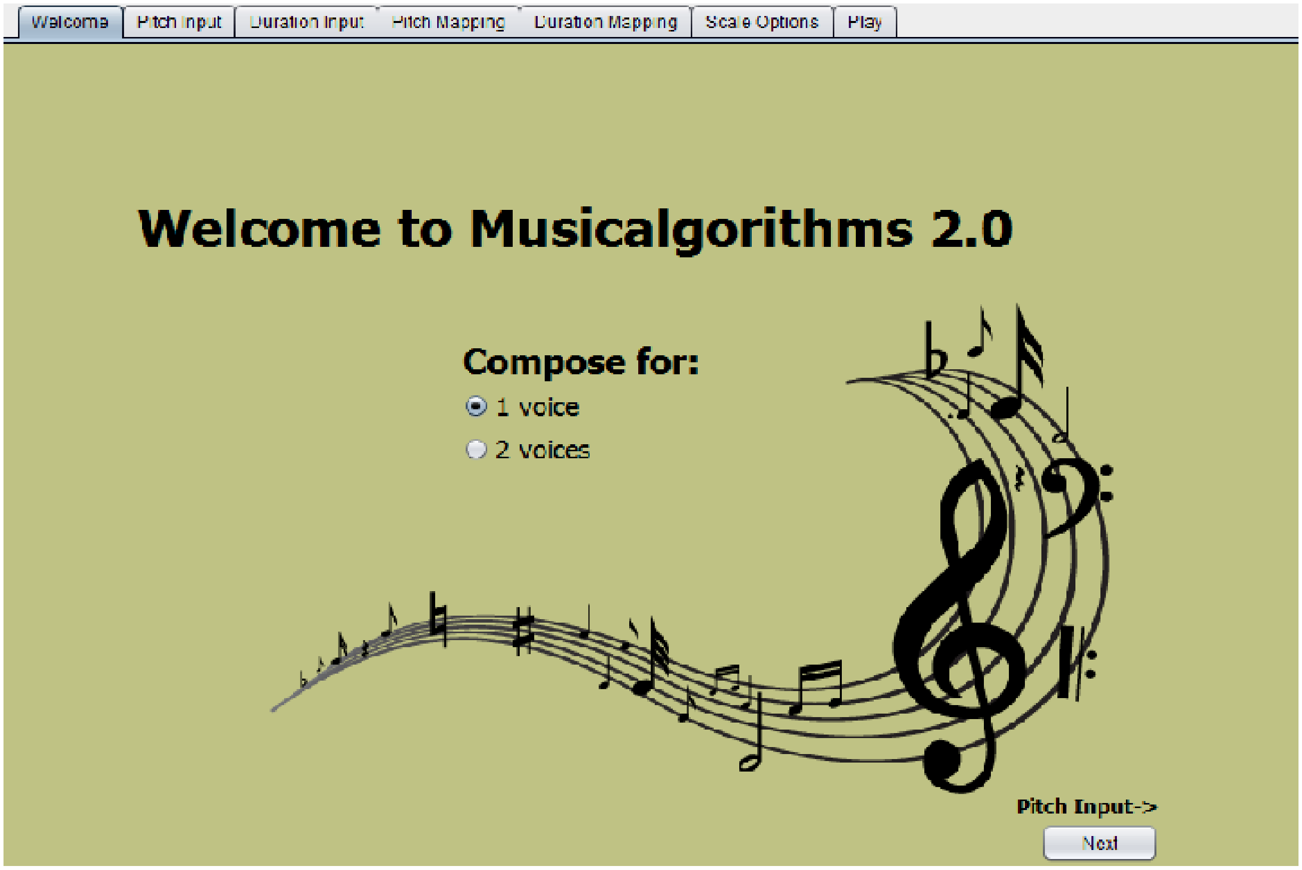
Musicalgorithms 2.0

User Interface Manual

Welcome screen

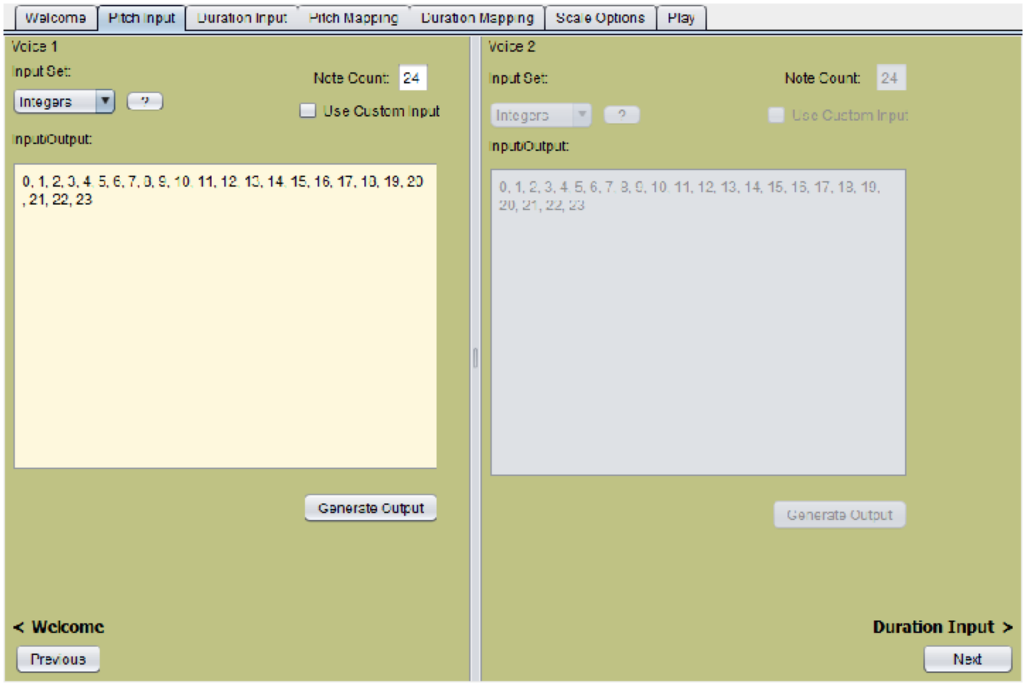


A voice can be compared to an instrument, or one hand playing on the piano.

Musicalgorithms 2.0 gives users the option to explore algorithmic composition with one, or two voices layered over each other at the same time!

Once you make your selection you can either select “Next” at the bottom of the screen, or jump directly to any step with the tabs at the top of the program.

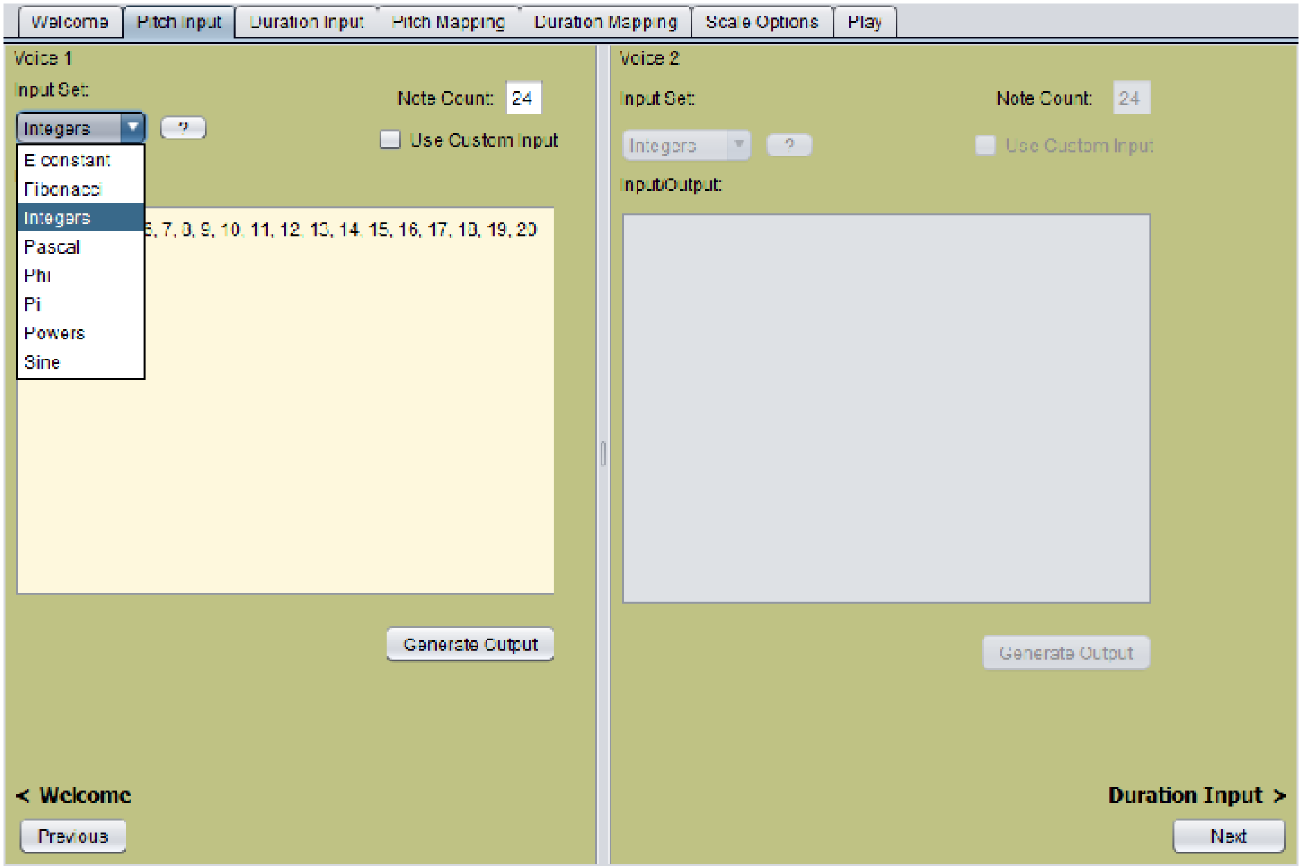
1 or 2 Voices



Notice that with 1 voice selected the second panel is grayed out.

The same panel with 2 voices selected. The second panel is now enabled.

Pitch Input



The Pitch Input panel is where the fun begins. You can choose from one of the pre-defined data sets from the drop down list on the top left of each panel. The number of notes generated defaults to 24, but you can choose to map up to 1000.

Checking the “Use Custom Input” box allows you to paste your own set of numbers to map to the keyboard! Numbers can be separated by commas or spaces.

The pre-defined data sets:

ESequence:

(e), known as Euler's number, is a mathematical constant which represents the base of the natural logarithm function, or 2.718…. This selection will display a decimal expansion of e.

PISequence:

Pi is known as Archimedes' constant. Pi represents the ratio of a circle's circumference with its diameter. Pi is an infinite constant that is often expressed in the shorter form 3.14 or 22/7. This selection will display a decimal expansion of Pi.

PhiSequence:

Phi is known as the golden ratio. Phi is the ratio of 2 line segments (one large and one small). When the ratio of the two segments is the same as the proportions of the entire line (two segments combined) with its largest segment one finds a perfect ratio expressed 1.618… This infinitely long number can be found by taking the square root of 5, adding 1, and then dividing the result by 2. This selection will display a decimal expansion of Phi.

Integers:

Integers are the set of numbers that include the natural numbers(0,1,2...), combined with the negatives of the natural numbers(0,-1,-2,...).

PascalTriSequence:

This algorithm uses Pascal's Triangle as a model for generating a series of integers derived from the sums of other integers.

FibonacciSequence:

The Fibonacci Sequence is a self generating series of numbers starting with 0 or 1. Each new number in the series is determined by the sum of the previous pair.

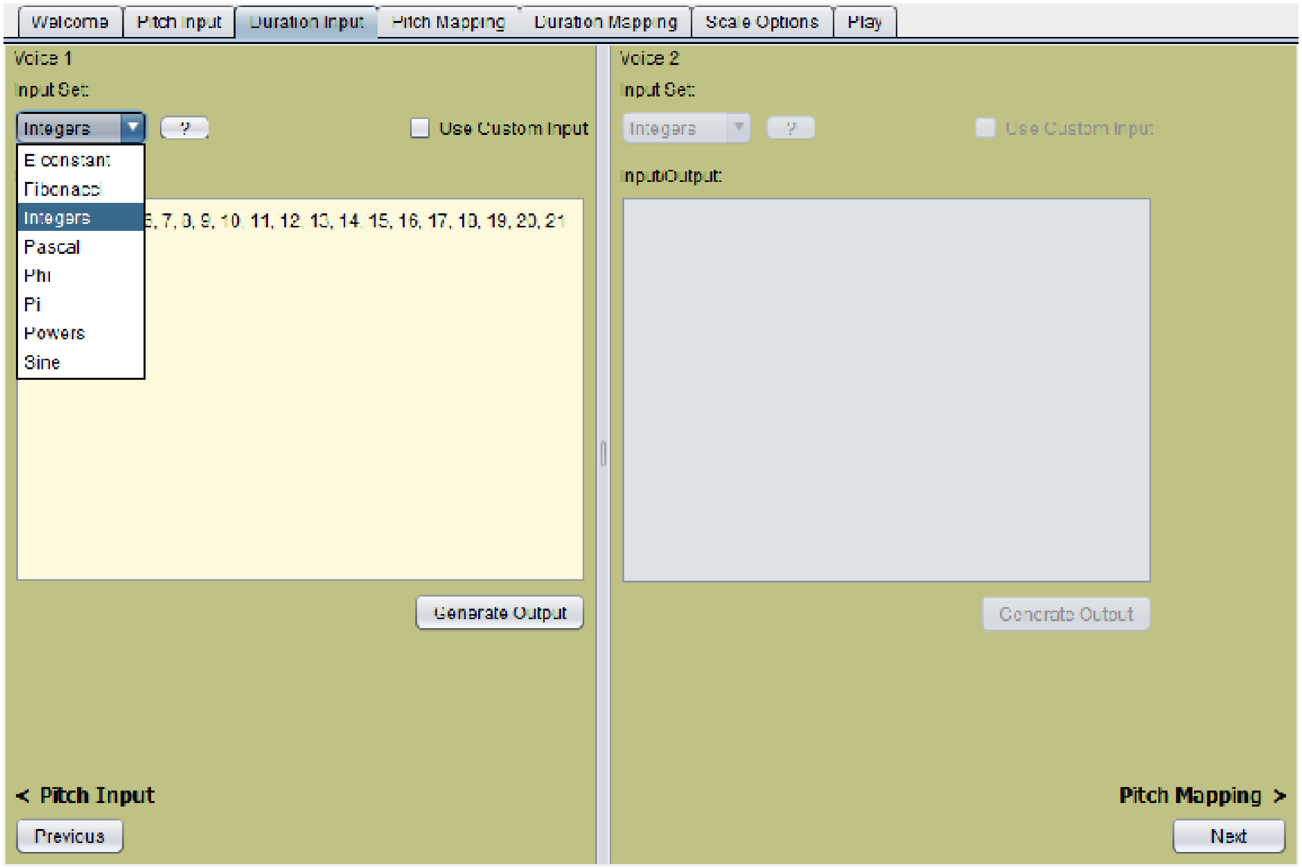
PowersSequence:

The Powers sequence takes each number in the set of integers and raises them to the second power (otherwise known as multiplying a number by itself. e.g. 2^2 = 2*2 = 4)

SineSequence:

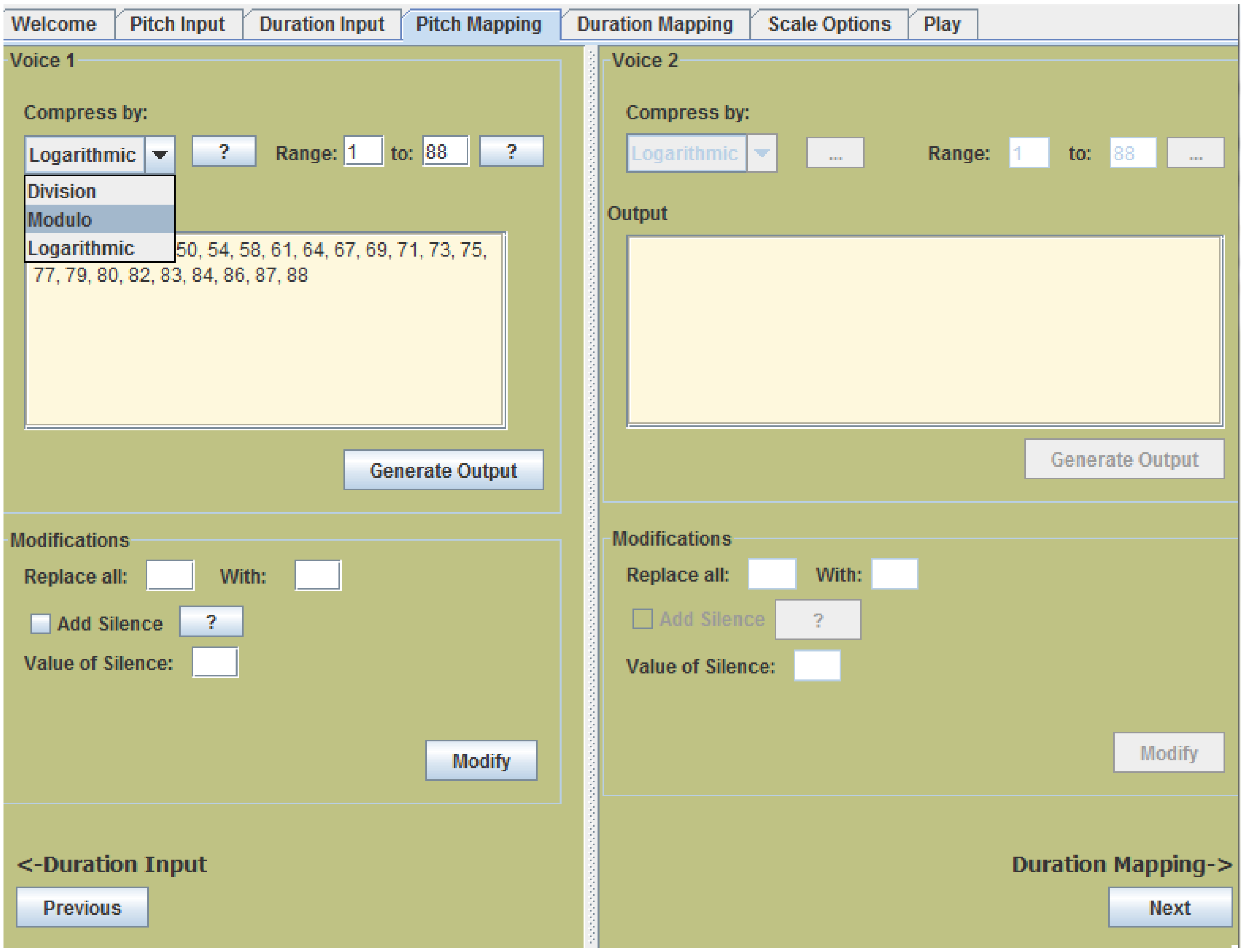
The sine function is a function of an angle, and is commonly used to model periodic phenomena such as sound and light waves, the position and velocity of harmonic oscillators, sunlight intensity and day length, and average temperature variations throughout the year.

Duration Input



The Duration Input panel has the same input options available as the Pitch Input panel. Duration will set the length of time each note will be played.

Pitch Mapping



The Pitch Mapping panel is where the number values from the original data sets are scaled to fit within the piano range. You can also specify a subset of this range, allowing output specific to a particular instrument, or even as a way to indicate separate ranges for each hand on the piano.

Clicking “Generate Output” displays the final note values in the Output box.

You are able to choose one of these note values to change into another value with the “Replace all” “With:” boxes.

You also have the option to choose one of the note values to represent silence.

Next we will take a look at the different compression algorithms.

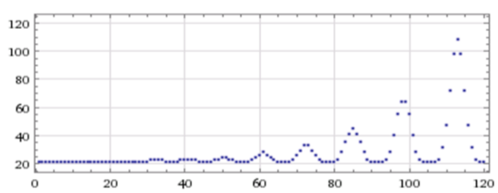
Compression algorithms

Algorithmic composition can be based on a wide variety of data sets. For this example we will use Pascal's Triangle. It is a popular data set with a simple pattern that can easily be followed throughout the process.
Pascal's triangle: A simple explanation. Every number in the triangle is the sum of the two numbers directly above it, to either side. Zero is assumed where there is no number. Thus 0+1= 1, 1+2= 3, 3+3= 6, 4+6= 10 etc.

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 10 5 1

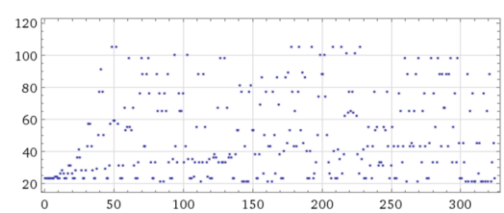
It is easy to see how these numbers grow quickly as the pattern progresses. By the time you reach the 10th row the greatest number is 126. By the time you reach the 20th row the greatest number is 92378.

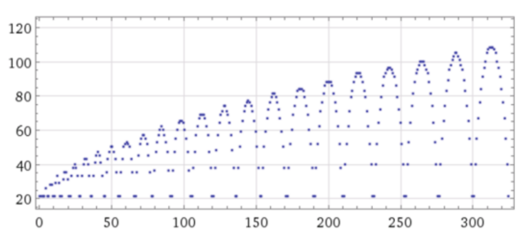
The compression algorithms enable these data sets to be scaled down to fit within the piano range, but they each have a profound impact on how the final output will sound. The Logarithmic Compression algorithm tends to reflect the original data set more accurately, while the Modulo compression algorithm results are much less accurate. The results from the Division compression algorithm tend to be somewhere in between the other two. The following graphs show the results of running Pascal's triangle through each compression algorithm.



The division operation scales the output values proportionally throughout the range provided by the user.

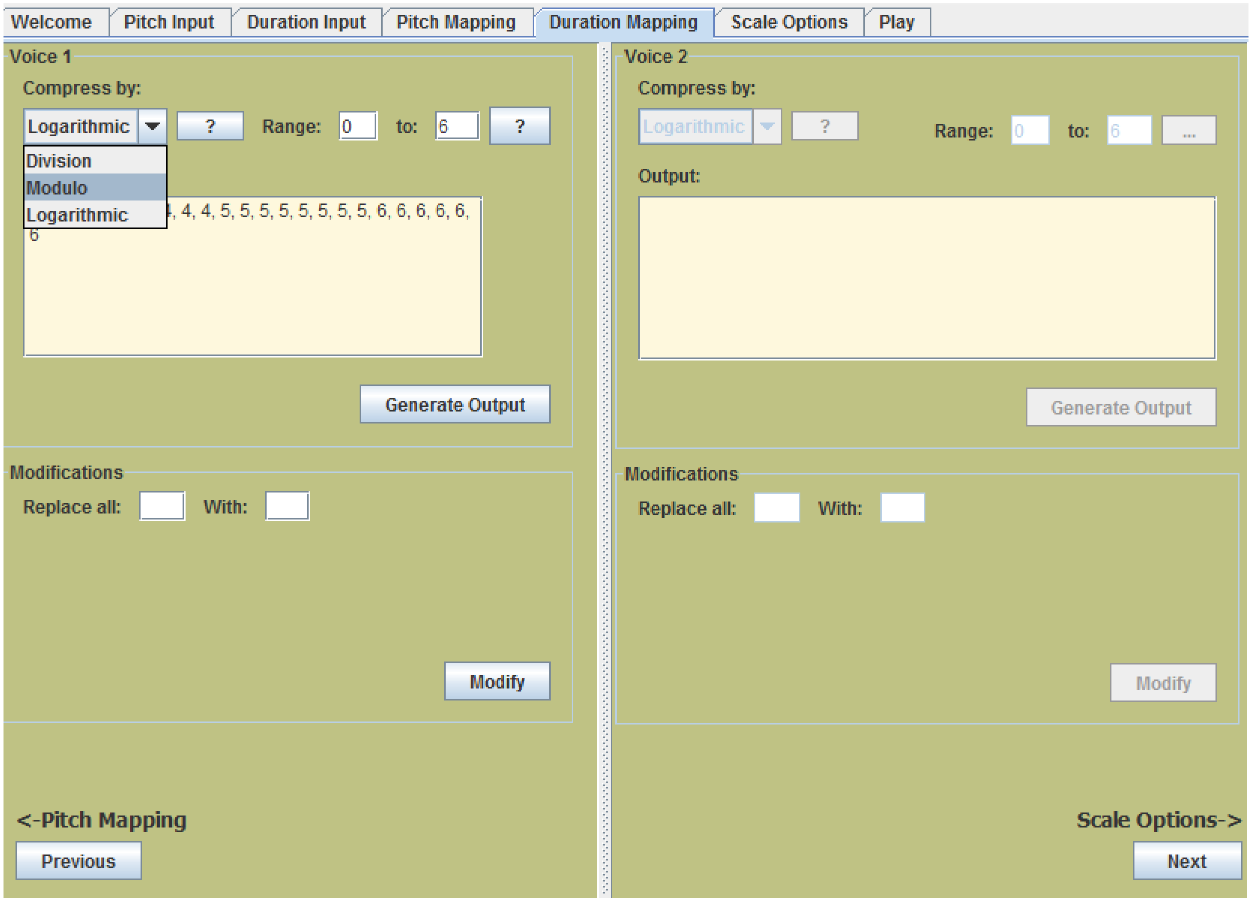
The modulo operation scales the output values into a cyclical pattern throughout the range provided by the user.





The Logarithmic Compression operation scales the output values into an inverse exponential curve.

Duration Mapping

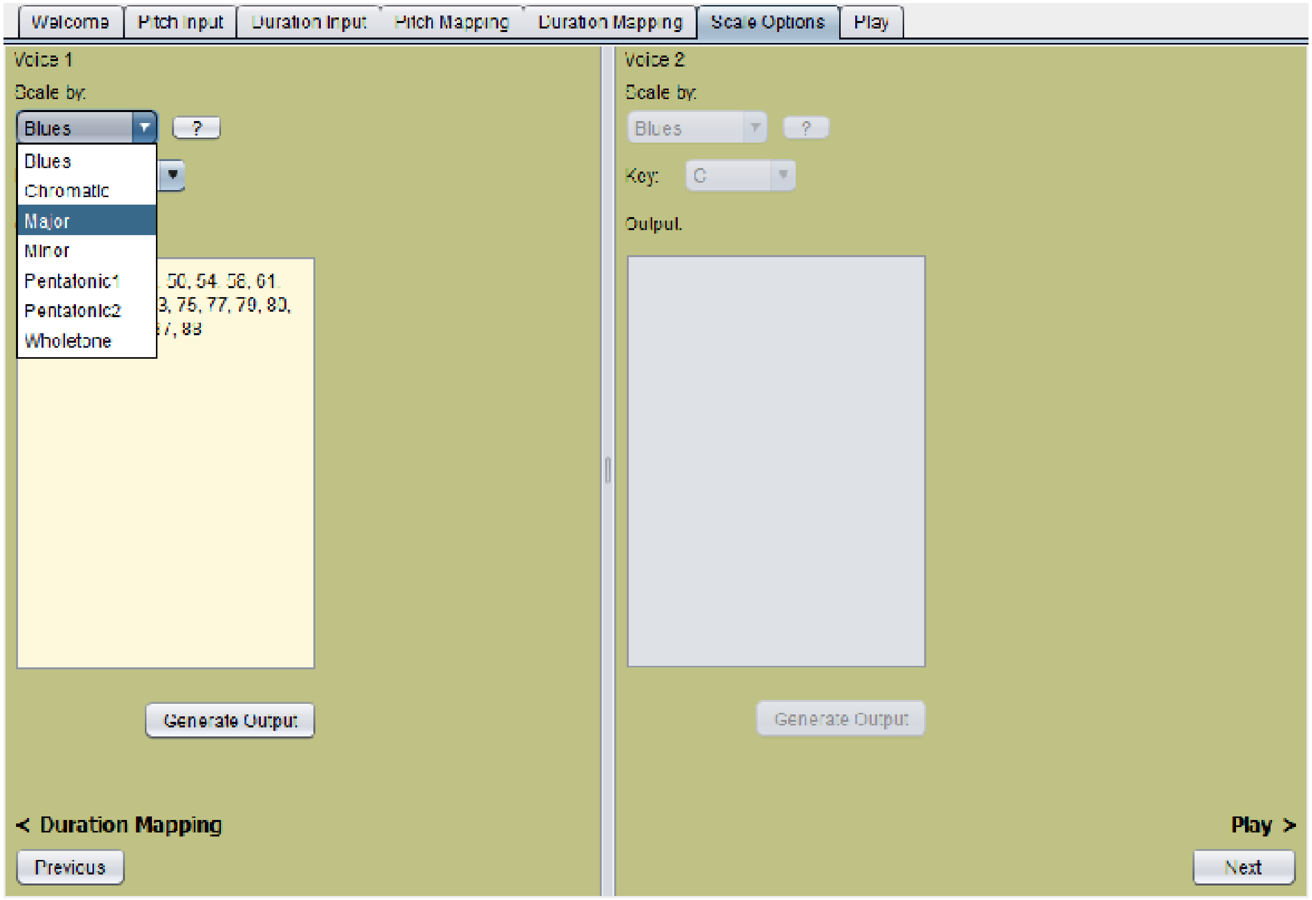


The Duration Mapping panel compresses the note duration values, or the length of time that each note will play, based on one of the compression algorithms. The duration results relate to the following note lengths:

0: 1/16
1: 3/32
2: 1/8
3: 3/16
4: 1/4
5: 3/8
6: 1/2
7: 3/4
8: 1/1
9: 3/2

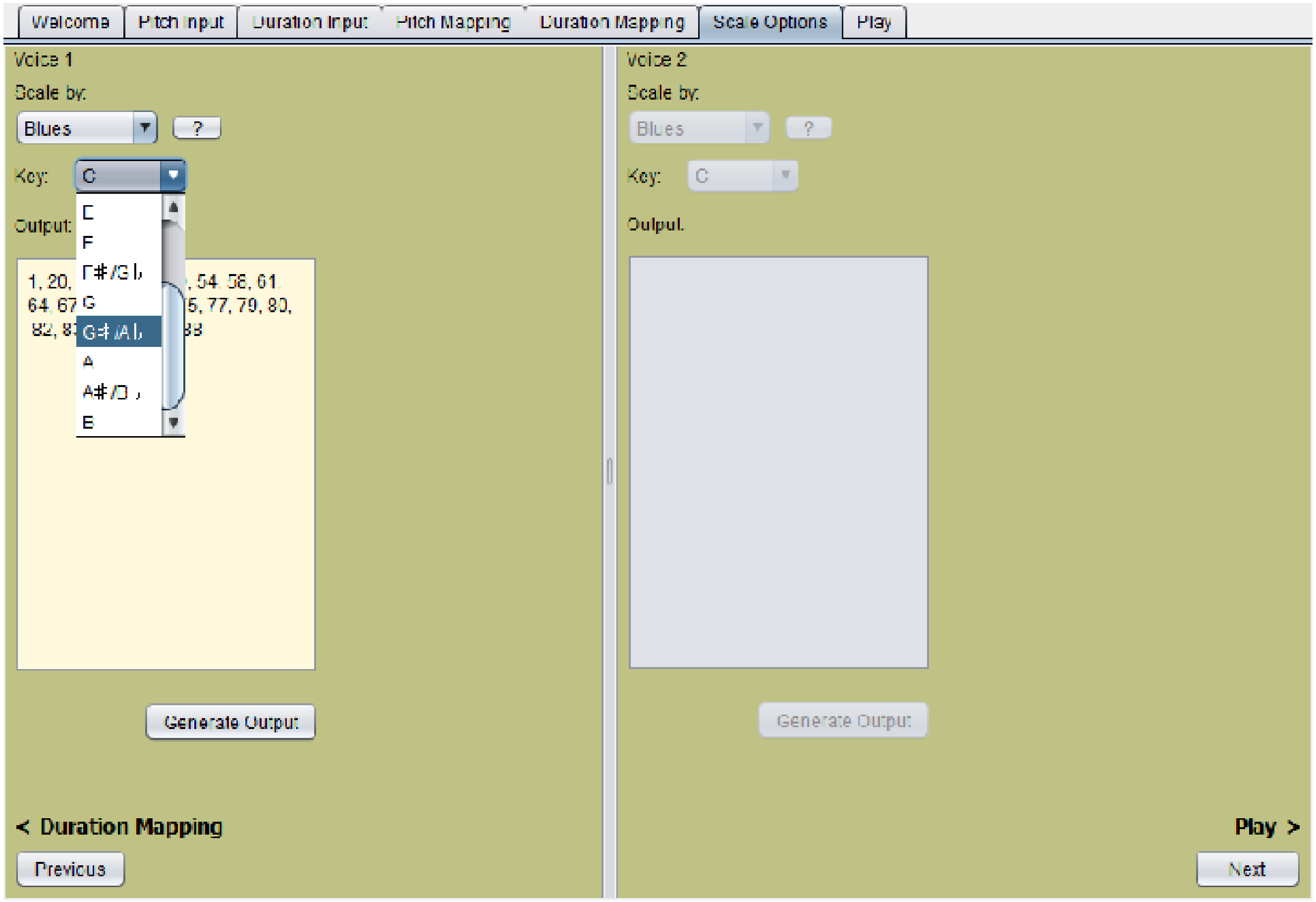
You can limit the range to a subset of these values.
You also have the option to choose one of the duration values to replace with another.

Scale Options: Scaling



Scaling is a new feature found in Musicalgorithms 2.0. This allows you to choose from one of seven pre-defined scaling options to further refine your musical output.

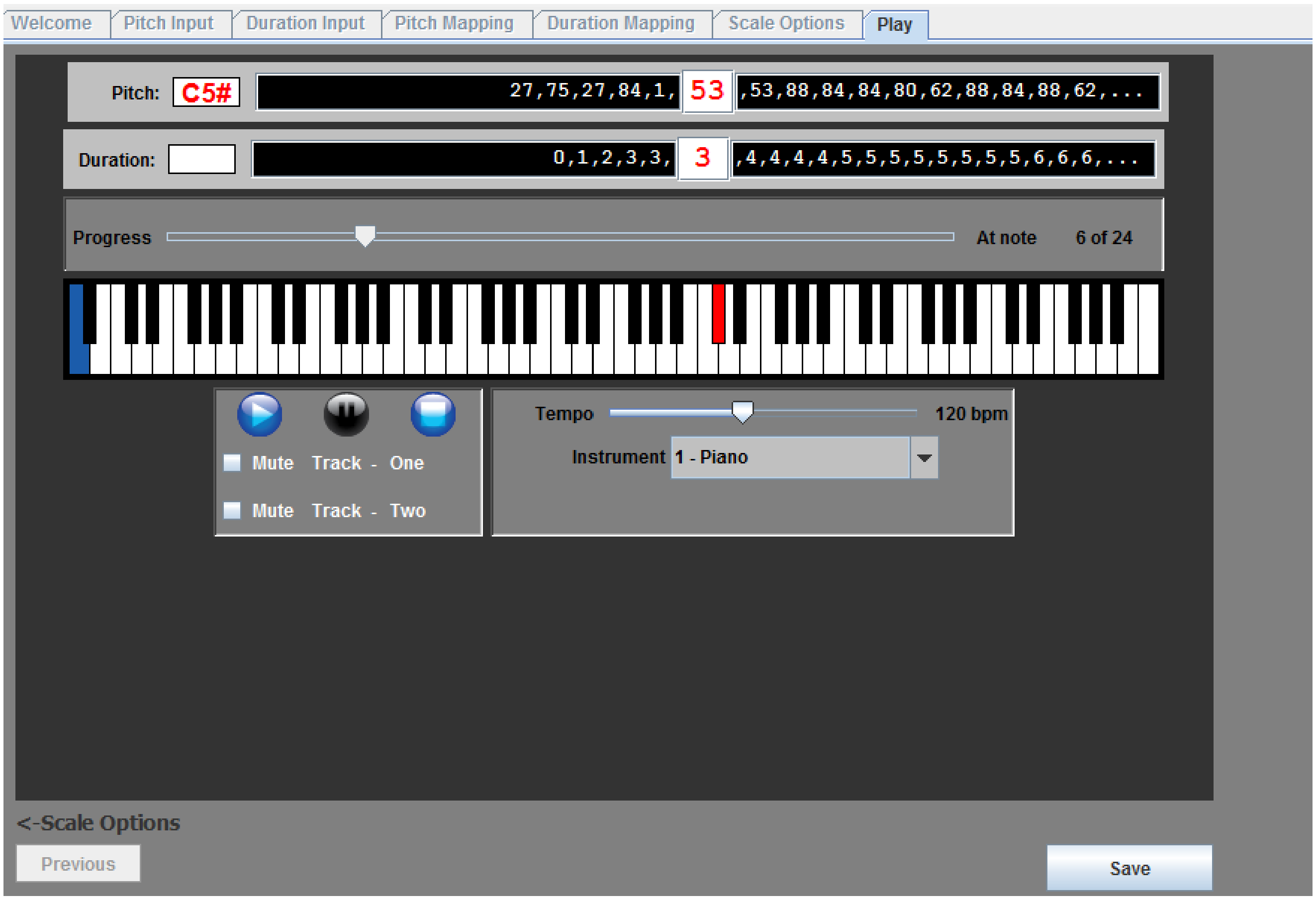
Scale Options: Key



In addition to choosing the scale of the final output, you also have the option to choose which key it will play in. The selected key will be the root of the scale.

Play Panel: 1 voice

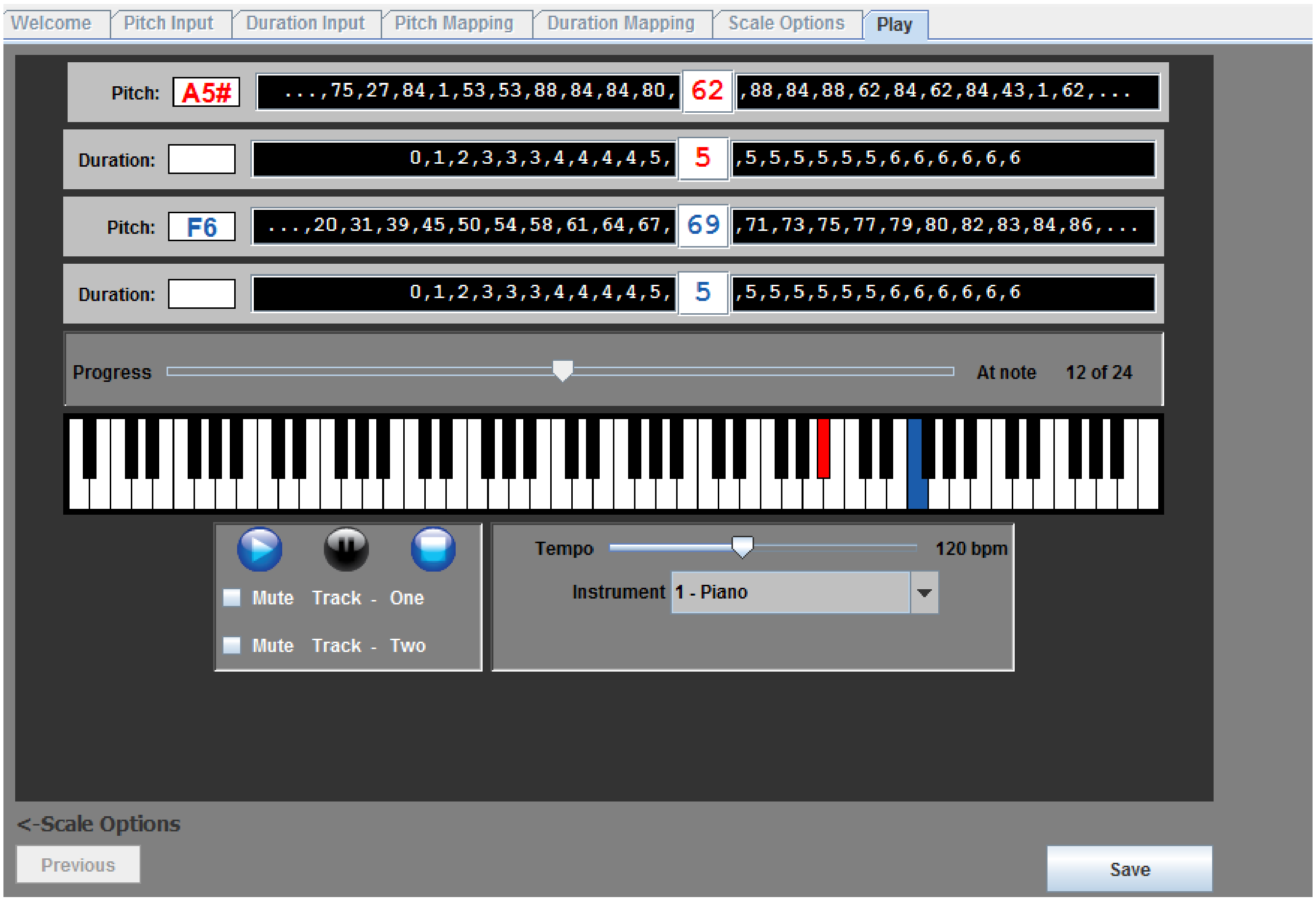
The Play panel displays the value of each note as it plays, along with its duration.



Notice that the tabs and the previous button are disabled during playback. Press “stop” to enable them again.

Play Panel: 2 voices

The Play Panel with both voices enabled. Each voice is color coded so you can easily see which note is being played on the keyboard as the number scrolls by on the play panel above.



The tabs and the previous button are disabled during playback. Press "stop" to enable them again.

- You have the option to mute either track during playback
- Tempo can be adjusted with the slider
- Different instruments can be chosen from the dropdown

And finally you have the option to save a MIDI file to your computer which can be used for playback, printing sheet music or for use with any number of standard MIDI applications or environments.