# 4.4 Musical Modes

Musical modes are used to specify the relationship between intervals (or steps) in a scale. Since Western music is based on 12 half-steps per octave, modes specify how many half steps there are between each note in a scale.

By default, Music Blocks uses the *Major* mode, which, in the Key of C, maps to the white keys on a piano. The intervals in the *Major* mode are `2, 2, 1, 2, 2, 2, 1`. Many other common modes are built into Music Blocks, including, of course, *Minor* mode, which uses `2, 1, 2, 2, 1, 2, 2` as its intervals.

Note that not every mode uses 7 intervals per octave. For example, the *Chromatic* mode uses 11 intervals: `1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1`. The *Japanese* mode uses only 5 intervals: `1, 4, 2, 3, 2],`. What is important is that the sum of the intervals in an octave is 12 half-steps.

The *Mode length* block will return the number of intervals (scalar steps) in the current mode.
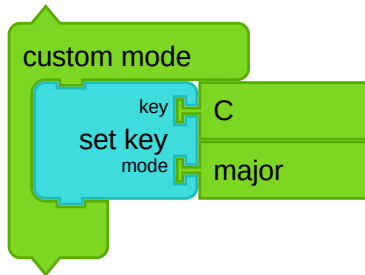
The *Mode* widget lets you explore modes and generate custom modes. You invoke the widget with the *Custom mode* block. The mode specified in the *Set key* block will be the default mode when the widget launches.
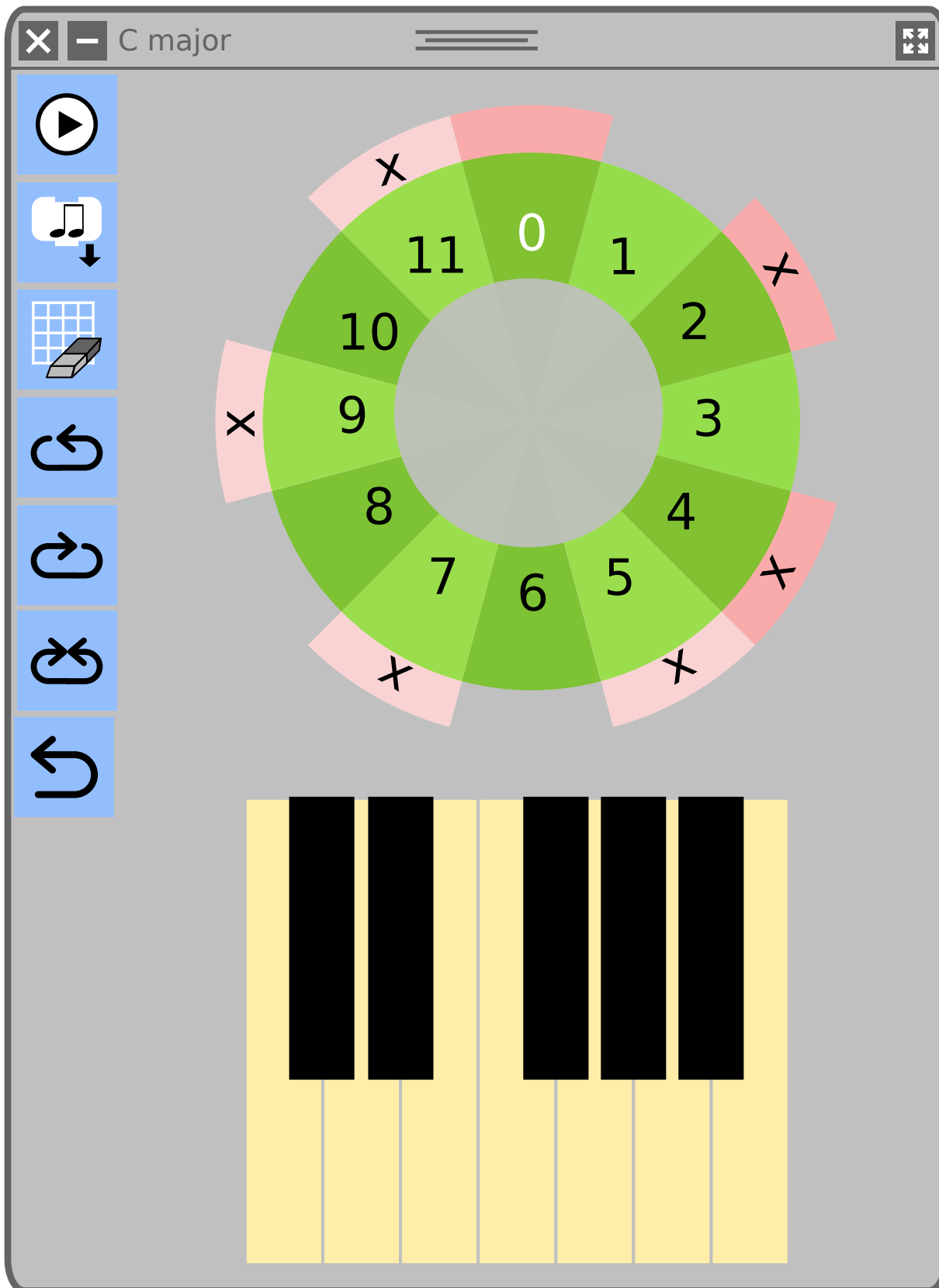
In the above example, the widget has been launched with *Major* mode (the default). Note that the notes included in the mode are indicated by the protruding sectors with 'X's, which are arrayed in a circular pattern of twelve half-steps to complete the octave.

Since the intervals in the *Major* mode are `2, 2, 1, 2, 2, 2, 1`, the notes are `0`, `2`, `4`, `5`, `7`, `9`, `11`, and `12` (one octave above `0`).

The widget controls run along the toolbar at the top. From left to right are:

Play all, which will play a scale using the current mode;

Save, which will save the current mode as the *Custom* mode and save a stack of *Pitch* blocks that can be used with the *Phrase Maker* block;

Rotate counter-clockwise, which will rotate the mode counter-clockwise (See the example below);

Rotate clockwise, which will rotate the mode clockwise (See the example below);
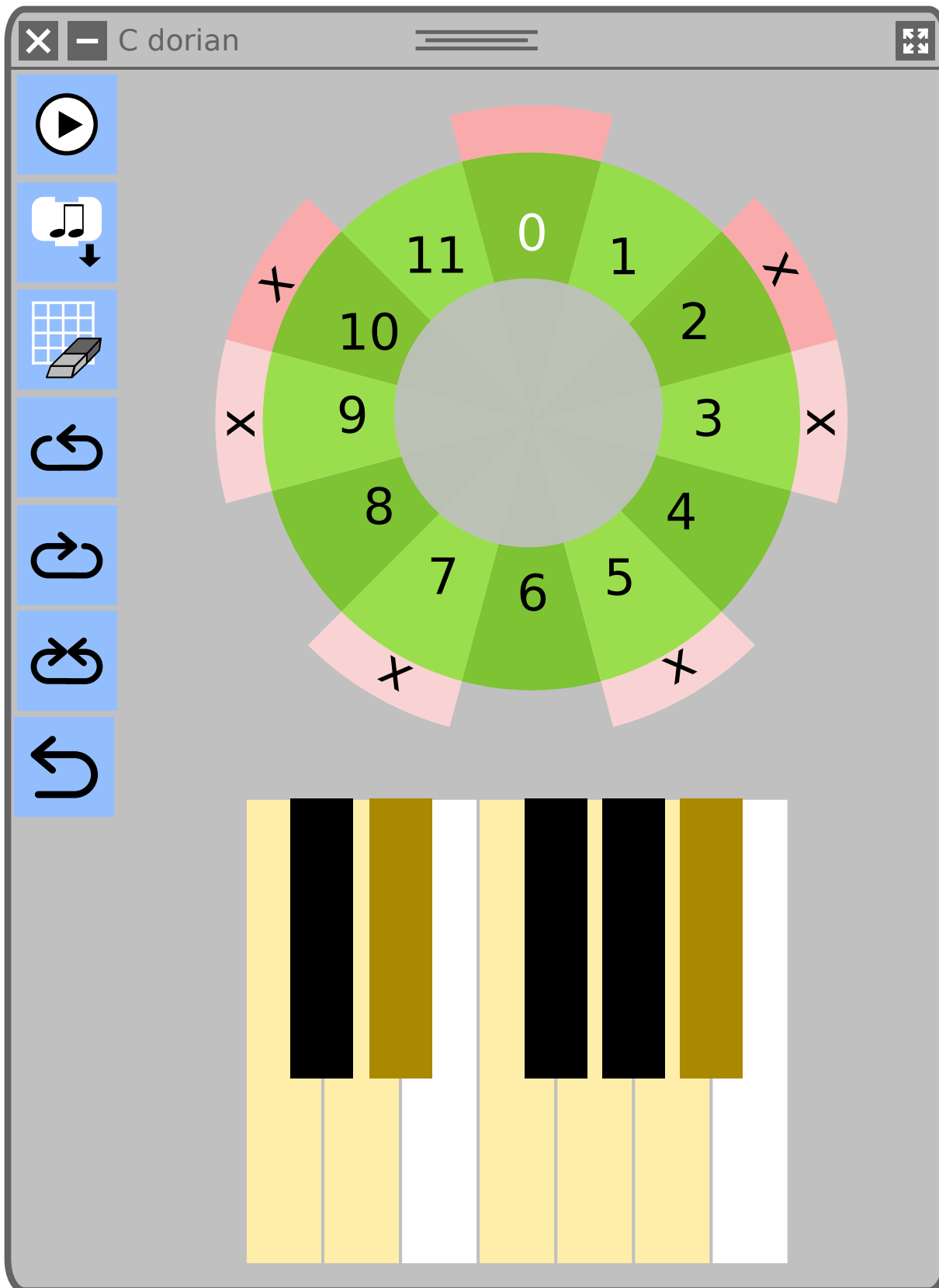
Invert, which will invert the mode (See the example below);

*Undo*, which will restore the mode to the previous version; and

Close, which will close the widget.

You can also click on individual notes to activate or deactivate them.

Note that the mode inside the *Custom mode* block is updated whenever the mode is changed inside the widget.

In the above example, the *Major* mode has been rotated counter-clockwise, transforming it into *Dorian*.
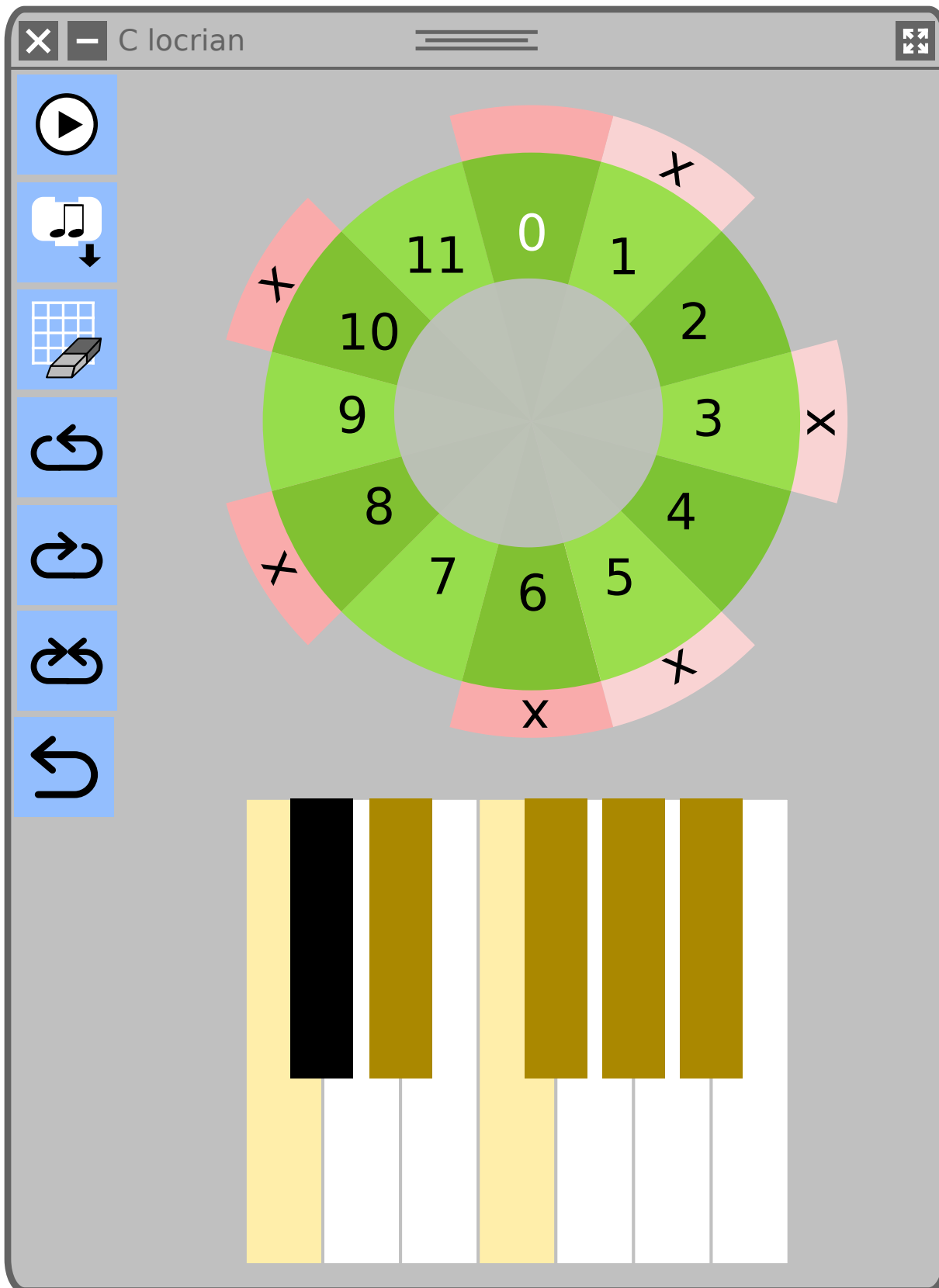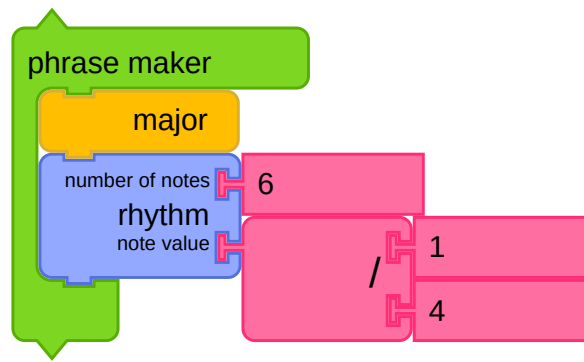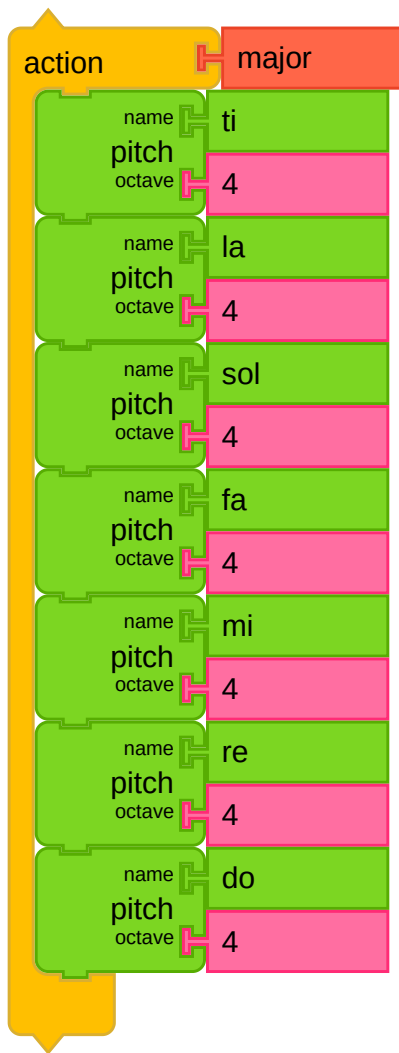
In the above example, the *Major* mode has been rotated clockwise, transforming it into *Locrian*.
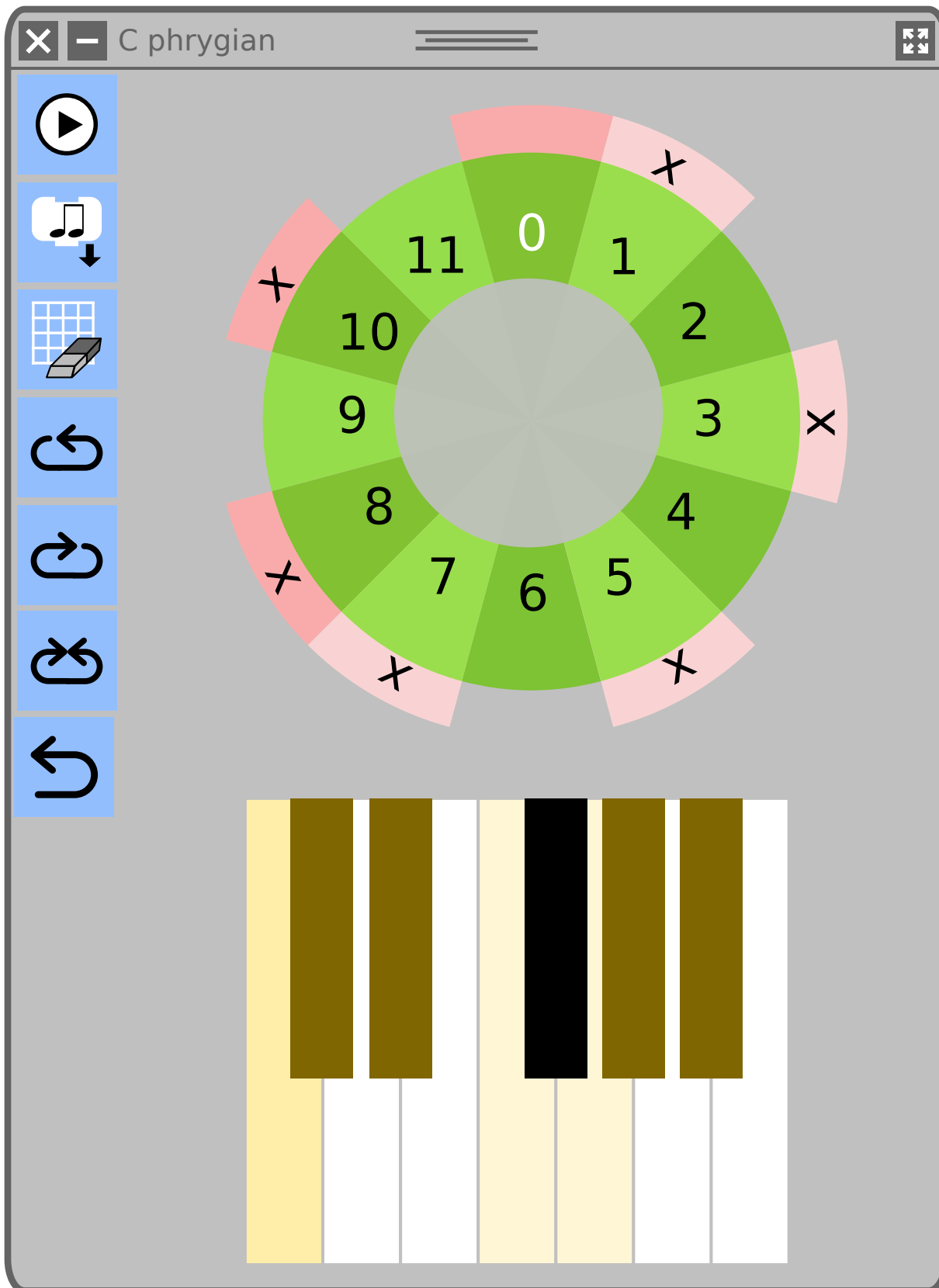
In the above example, the *Major* mode has been inverted, transforming it into *Phrygian*.

Note: The build-in modes in Music Blocks can be found in musicutils.js (https://github.com/sugarlabs/musicblocks/blob/master/js/musicutils.js#L68).

The *Save* button exports a stack of blocks representing the mode that can be used inside the *Phrase maker* block.