

Guide to Programming with Music Blocks

Music Blocks is a programming environment for children interested in music and graphics. It expands upon Turtle Blocks in that it has a collection of features relating to pitch and rhythm.

The Turtle Blocks guide is a good place to start learning about the basics. In this guide, we illustrate the music features walking the reader through numerous examples.

Getting Started

Music Blocks is designed to run in a browser. Most of the development has been done in Chrome, but it should also work in Firefox (although you may need to disable hardware acceleration). You can run it from [github.io](https://github.com) or by downloading a copy of the code and running directly from the file system of your computer.

For more details on how to use Music Blocks, see [Using Music Blocks](#) and for more details on how to use Turtle Blocks, see [Using Turtle Blocks JS](#).

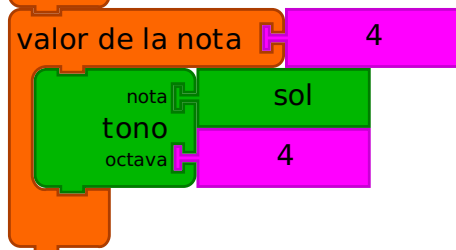
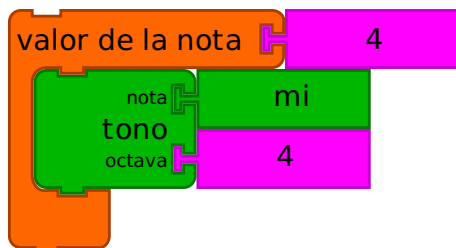
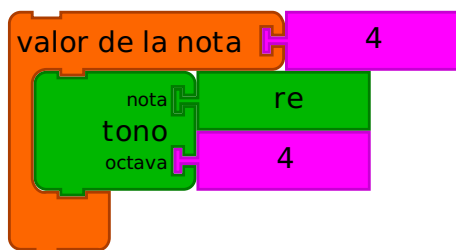
ABOUT THIS GUIDE

Many of the examples given in the guide have links to code you can run. Look for EJECUTAR EN VIVO links.

NOTES

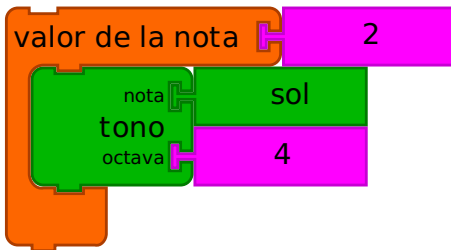
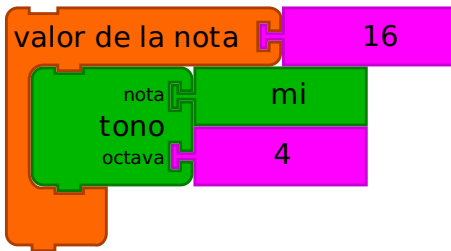
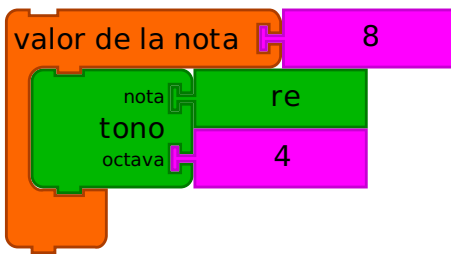
Music Blocks exposed the common elements of music: pitch, rhythm, and sonic quality, e.g., loudness and softness, and to some degree, timbre and texture.

At the heart of Music Blocks is the *Note value* block. The *Note value* block is a container for a pitch that specifies the duration (note value) of the pitch. (The *Pitch* block is detailed below.)

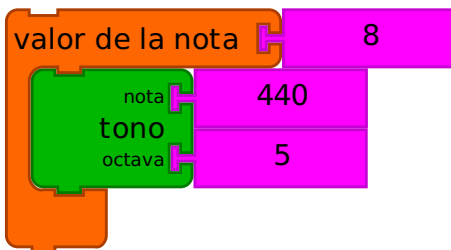
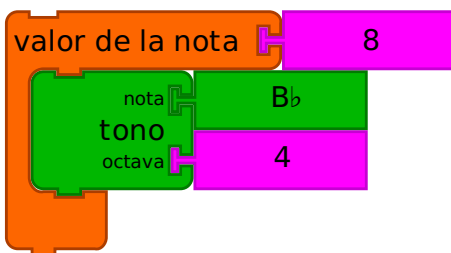
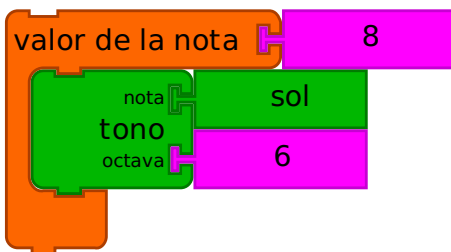


Se muestra un bloque *Valor de la Nota*. El 4 es el valor de la nota, en este caso, una quarter note. El tono, especificado por el bloque *Tono*, contiene un tono Re en la octava 4.

Un acorde (tonos múltiples y simultáneos) puede especificarse agregando múltiples bloques *Tono* a un bloque *Valor de Nota*.



In this example, different note values are shown. From top to bottom, 8 for an eighth note, 16 for a sixteenth note, and 2 for a half note.

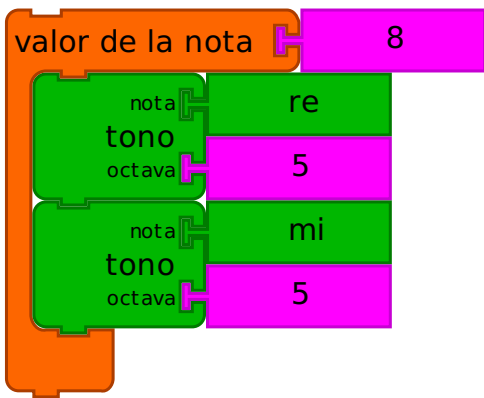


As we have seen, *Pitch* blocks are used inside the *Note value* blocks. The *Pitch* block specifies a pitch name and pitch octave that in combination determine the frequency at which a note is played.

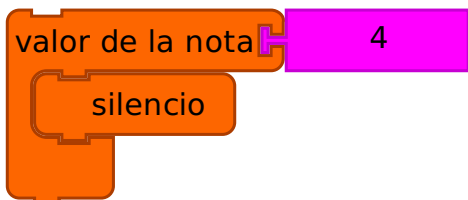
You can plug different values into the *Pitch* block name and octave slots. Some examples are shown above. Starting from the top, the pitch name block is specified using a *Solfège* block (Sol in Octave 6); the pitch name is specified using a *Pppppitch-name* block (B flat in Octave 4); the pitch name is specified using a *Number* block (440 Hertz).

The octave is specified using a number block and is restricted to whole numbers. In the case where the pitch name is specified by frequency, the octave is ignored.

Note that the pitch name can also be specified using a *Text* block.

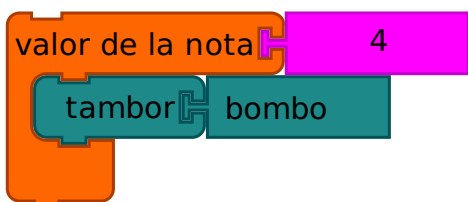


A chord (multiple, simultaneous pitches) can be specified by add multiple *Pitch* blocks to a *Note value* container.

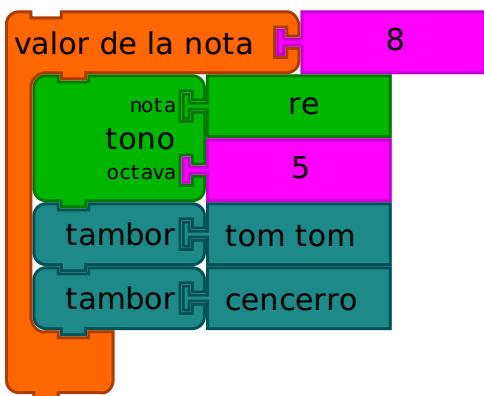


A rest of duration note value can be constructed using a *Silence* block.

Using drums

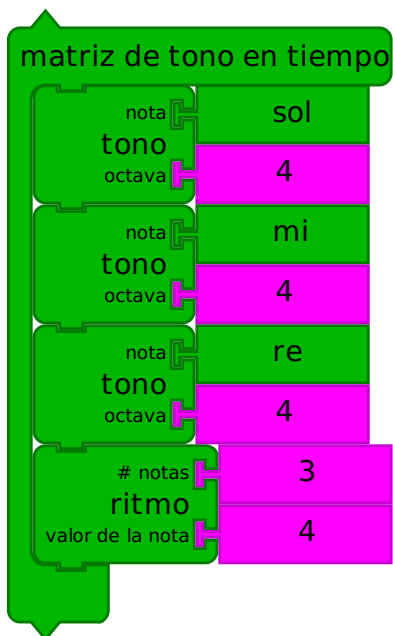


Anywhere you can use a *Pitch* block—e.g., inside of the matrix or a *Note value* block—you can also specify a drum sample. Currently there about two dozen different samples from which to choose. The default drum is a kick drum.



Al igual que en el ejemplo del acorde, se pueden usar múltiples bloques *Tambor* y combinarlos con bloques *Tono*.

THE PITCH-TIME MATRIX



Music Blocks provides a widget, the *Pitch-time Matrix*, as a scaffold for getting started.

Once you've launched Music Blocks in your browser, start by clicking on the *Pitch-time Matrix* stack that appears in the middle of the screen. (For the moment, ignore the *Start* block.) You'll see a grid organized vertically by pitch and horizontally by rhythm.

Solfa				
sol ₄				
mi ₄				
re ₄				
valor de las notas	1/4	1/4	1/4	

El bloque *Matriz de Tono en Tiempo* de la figura tiene tres bloques *Tono* y un bloque *Ritmo*, a partir de los cuales se crea una grilla 3 x 3 de tono y tiempo.

Note that the default matrix has five *Pitch* blocks, hence, you will see five rows, one for each pitch. (A sixth row at the bottom is used for specifying the rhythms associated with each note.) Also by default, there are two *Rhythm* blocks, which specifies six quarter notes followed by one half note. Since the *Rhythm* blocks are inside of a *Repeat* block, there are fourteen (2 x 7) columns for selecting notes.

Solfa				
sol ₄				
mi ₄				
re ₄				
valor de las notas	1/4	1/4	1/4	

Al hacer clic en cada celda de la grilla se reproducen notas individuales o acordes si se hace clic en más de una celda por columna.

In the figure, three quarter notes are selected (black cells). First **Re 4**, followed by **Mi 4**, followed by **Sol 4**.



If you click on the *Play* button (found in the top row of the grid), you will hear a sequence of notes played (from left to right): **Re 4**, **Mi 4**, **Sol 4**.



Se puede guardar un grupo de notas (una "colección"). Esto creará una pila de bloques que pueden usarse para tocar las notas almacenadas.

You can rearrange the selected notes in the grid and save other chunks as well.



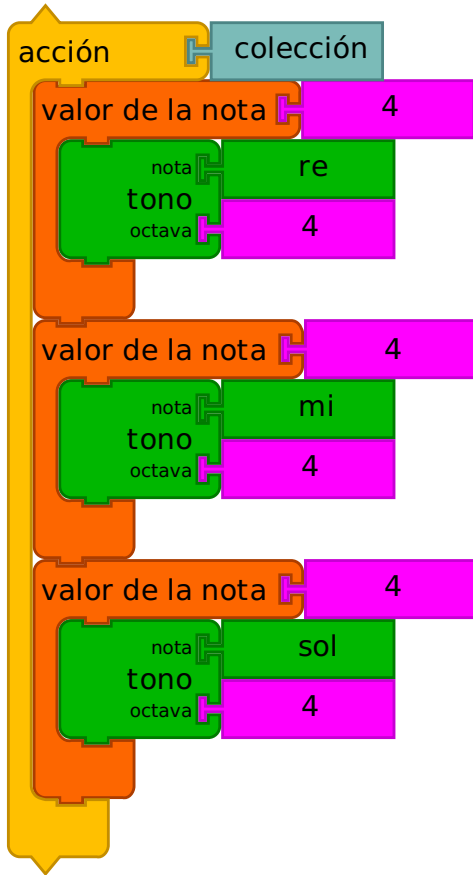
Or hide the matrix by clicking on the *Close* button (the right-most button in the top row of the grid.)



There is also an Erase button that will clear the grid.

Don't worry. You can reopen the matrix at anytime (it will remember its previous state) and since you can define as many chunks as you want, feel free to experiment.

Tip: You can put a chunk inside a *Pitch-time Matrix* block to generate the matrix to corresponds to that chunk.

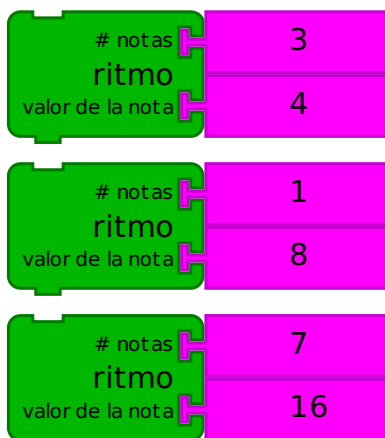


La colección creada cuando se hace clic en la matriz es una pila de bloques. Estos están anidados: un bloque de *Acción* contiene tres bloques de *Valor de la Nota*, cada uno de los cuales tiene un bloque de *Tono*.

The *Action* block has a name automatically generated by the matrix, in this case, chunk. (You can rename the action by clicking on the name.). Each note has a duration (in this case 4, which represents a quarter note). Try putting different numbers in and see (hear) what happens. Each note block also has a pitch block (if it were a chord, there would be multiple *Pitch* blocks nested inside the Note block's clamp). Each pitch block has a pitch name (*Re* , *Mi* , and *Sol*), and a pitch octave; in this example, the octave is 4 for each pitch. (Try changing the pitch names and the pitch octaves.)

To play the chunk, simply click on the action block (on the word action). You should hear the notes play, ordered from top to bottom.

About the Rhythm Block








Rhythm blocks are used to generate rhythm patterns in the *Pitch-time Matrix* block. The top argument to the *Rhythm* block is the number of notes. The bottom argument is the duration of the note. In the top example above, three columns for quarter notes would be generated in the matrix. In the middle example, one

column for an eighth note would be generated. In the bottom example, seven *columns for 16th notes would be generated.

matriz de tono en tiempo

nota	sol
tono	
octava	4
nota	mi
tono	
octava	4
nota	re
tono	
octava	4
# notas	3
ritmo	
valor de la nota	4
# notas	6
ritmo	
valor de la nota	8

Solfa     

sol ₄										
mi ₄										
re ₄										
valor de las notas	1/4	1/4	1/4	1/8	1/8	1/8	1/8	1/8	1/8	1/8

Puedes usar tantos bloques *Ritmo* como quieras dentro del bloque *Matriz de Tono en Tiempo*. En el ejemplo se usan dos bloques *Ritmo*, lo que da como resultado tres quarter notes and six eighth notes.

Creating Tuplets

matriz de tono en tiempo

nota
tono
octava

sol
4

nota
tono
octava

mi
4

nota
tono
octava

re
4

notas
triplet
valor de la nota

3
4

notas
ritmo
valor de la nota

3
4

Solfa					
sol ₄					
mi ₄					
re ₄					
triplet valor de las notas	1/12	1/12	1/12		
valor del triplet	3				
valor de las notas	1/4				

Tuplets son una colección de notas que son ajustadas a una duración específica. El uso de tuplets facilitan la creación de grupos de notas que no están basadas en potencias de 2.

En el ejemplo, tres quarter notes, definidas en el bloque *Ritmo*, suenan en el tiempo de una sola quarter note. El resultado es tres twelfth notes.

Se pueden mezclas y combinar los bloques de *Ritmo* y *Tuplet* al definir la matriz.

Using individual notes in the matrix

1/2 nota ♪

# notas	1
ritmo	2
valor de la nota	2

1/4 note ♪

# notas	1
ritmo	4
valor de la nota	4

1/8 note ♪

# notas	1
ritmo	8
valor de la nota	8

You can also use individual notes when defining the grid. These blocks will expand into *Rhythm* blocks with corresponding values.

PROGRAMMING WITH MUSIC

The remainder of this guide discusses how to use the chunks created by the *Pitch-time Matrix* when programming (You can also program with chunks you create and/or modify by hand).

1. A chunk of notes

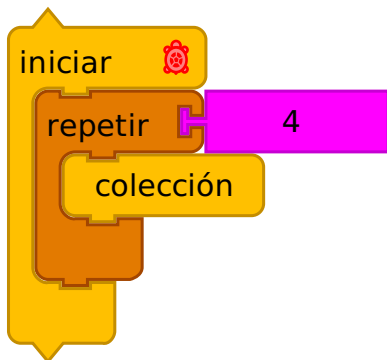
```
acción
└─ colección
  └─ valor de la nota: 4
    └─ nota: re
      └─ tono: re
      └─ octava: 4
  └─ valor de la nota: 4
    └─ nota: mi
      └─ tono: mi
      └─ octava: 4
  └─ valor de la nota: 4
    └─ nota: sol
      └─ tono: sol
      └─ octava: 4
```



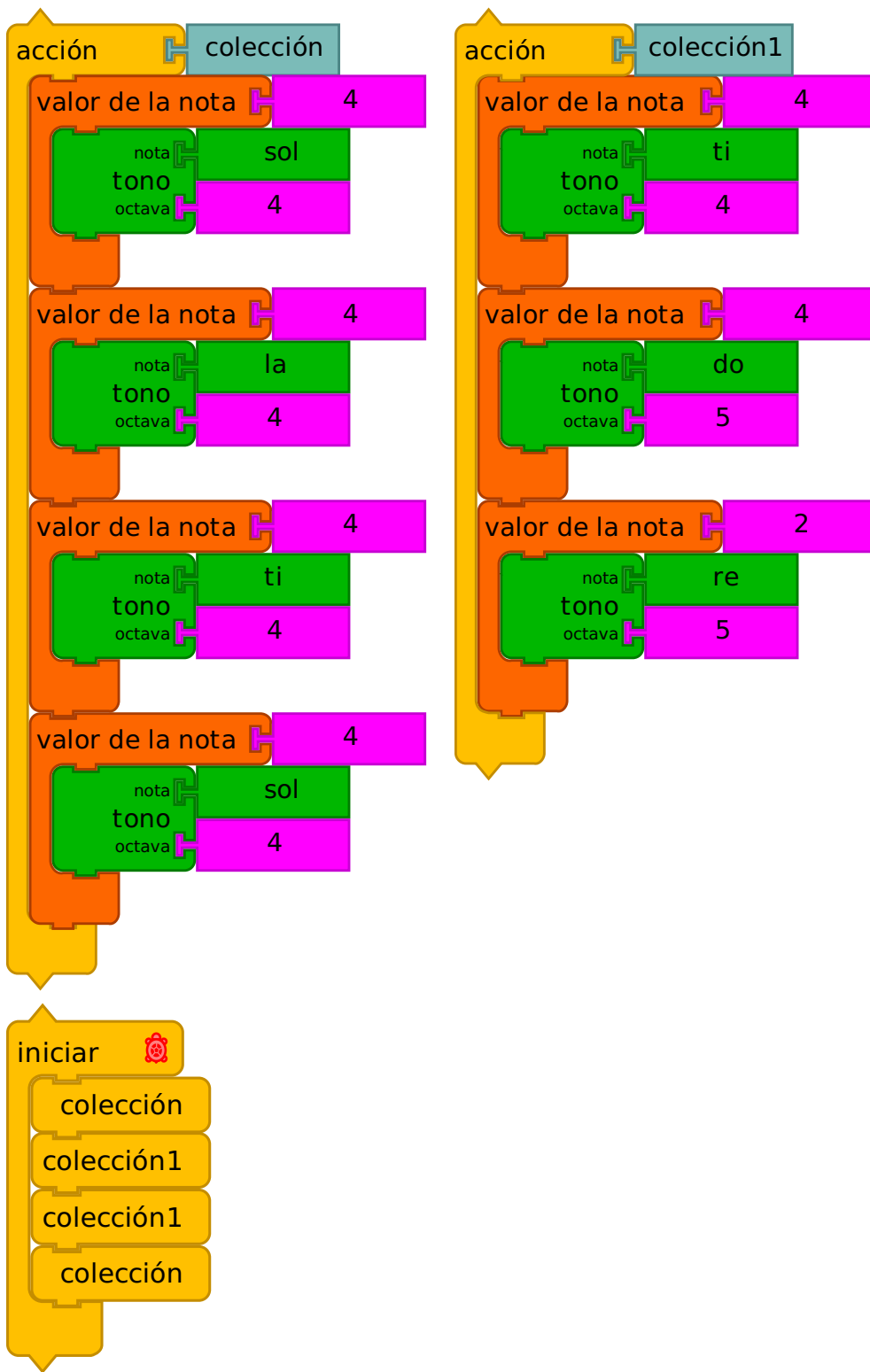

Every time you create a new *Action* stack, Music Blocks creates a new block specific to that stack. (The new block is found at the top of the *Block* palette, found on the left edge of the screen.) Clicking on this block is the same as clicking on your stack. By default, the new blocks are named `chunk`, `chunk1`, `chunk2` ... but you can rename them by editing the labels on the *Action* blocks.

En el ejemplo el bloque *Colección* está dentro de un bloque *Iniciar*, lo que vincula su ejecución al botón *Ejecutar* (ícono de conejo). Haz clic en el botón *Ejecutar*. Prueba también los botones *Ejecutar Lento* (ícono de tortuga) y *Ejecutar paso a paso* (ícono de caracol).

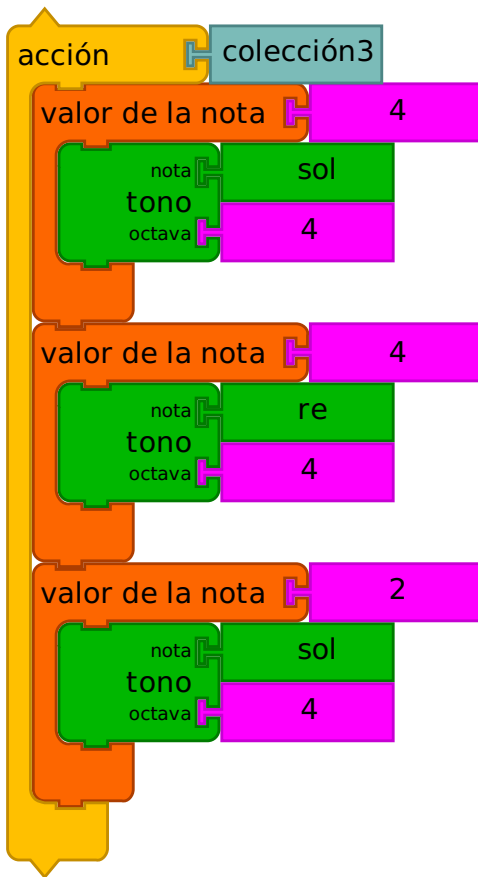
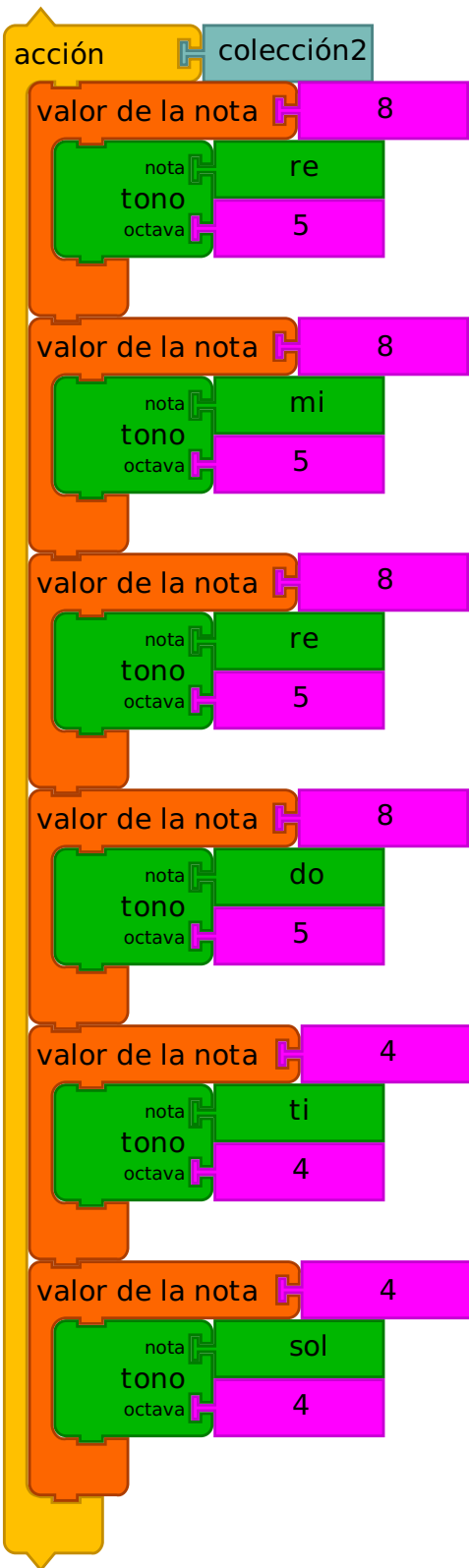
También hay botones para reproducir lentamente la música y para avanzar una nota por clic.

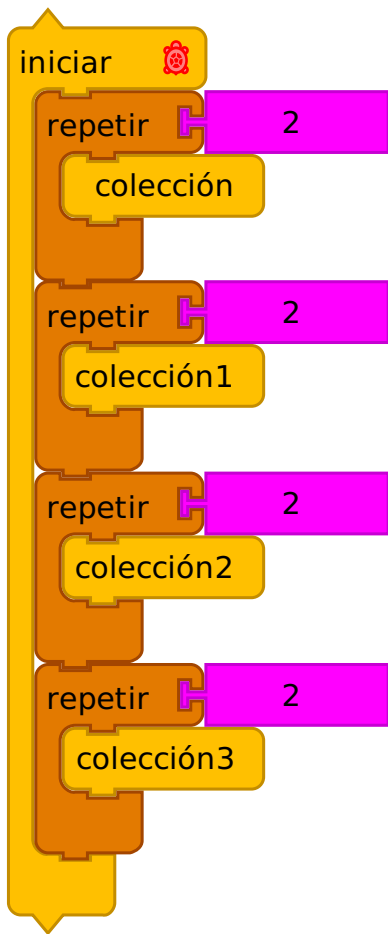


You can repeat chunks either by using multiple *Chunk* blocks or using a *Repeat* block.



You can also mix and match chunks. Here we play chunk, followed by chunk1 twice, and then chunk again.

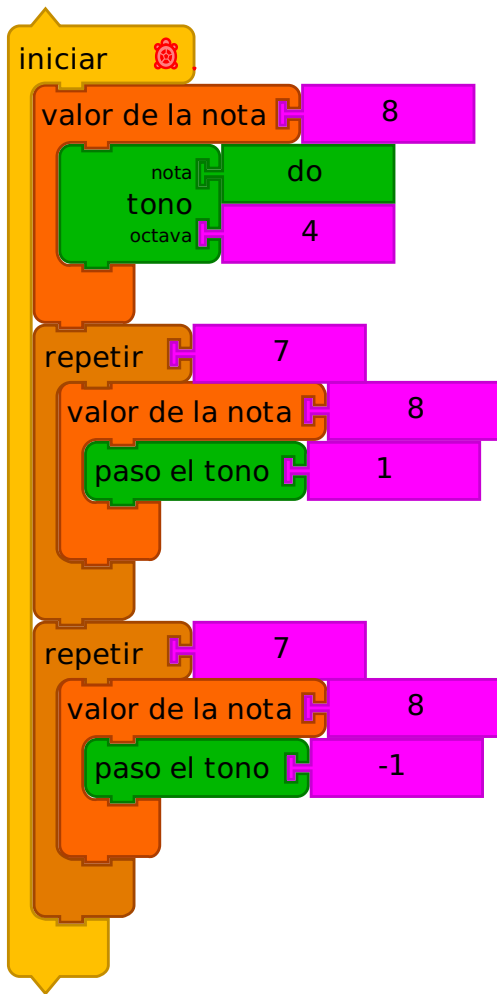




Agregando algunas colecciones podemos crear una canción. ¿Puedes leer la notación de bloques y adivinar la canción que hemos programado?

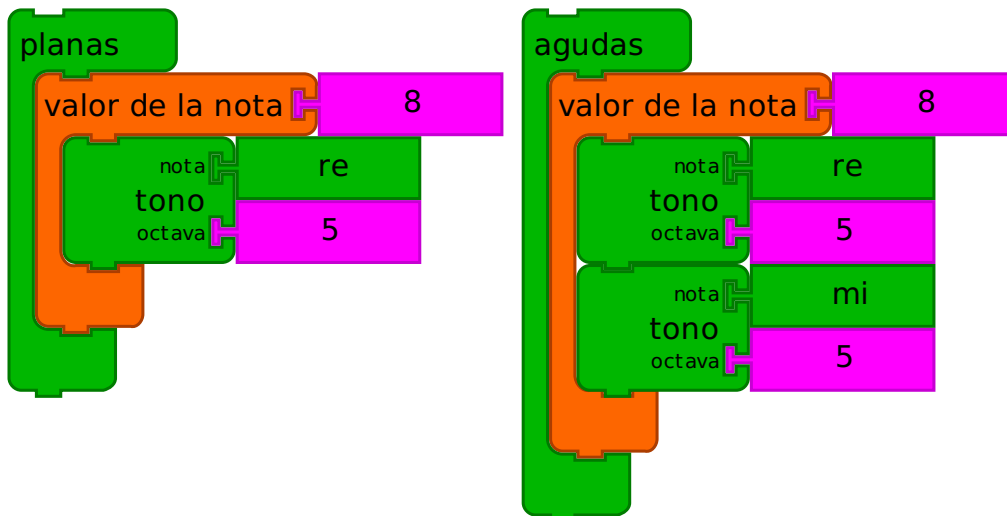
2. Transformations

There are many ways to transform pitch, rhythm, and other qualities of the sound.



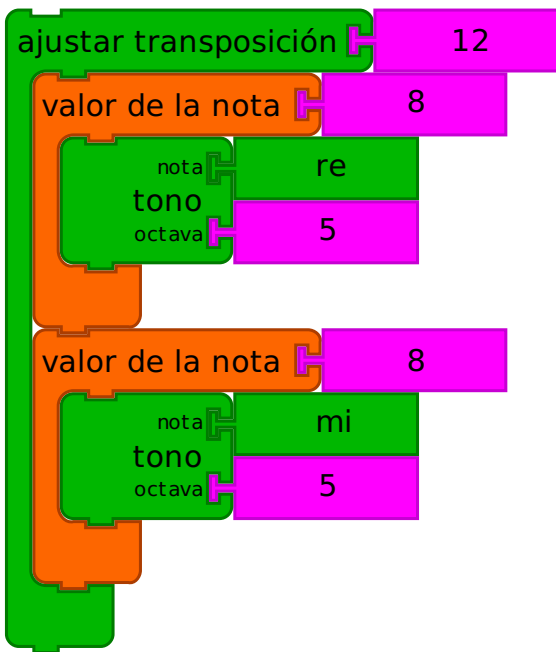
El bloque Paso el Tono moverá las notas hacia arriba o hacia abajo en una escala a partir de la nota actual En el ejemplo, bloques Paso el Tono se usan dentro de bloques Repetir para tocar una escala hacia arriba y hacia abajo.

[EJECUTAR EN VIVO](#)

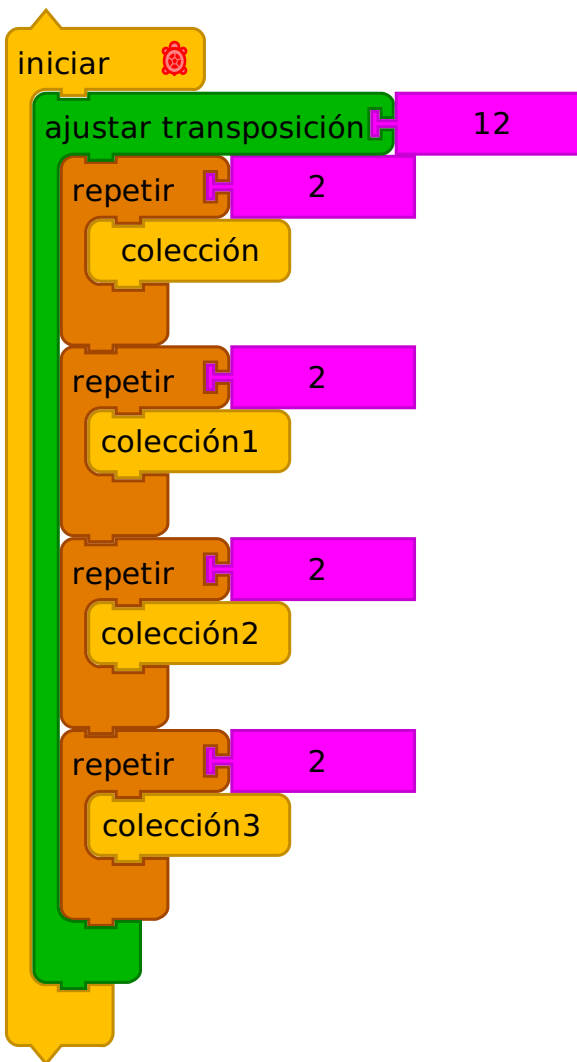


Los bloques Agudas y Planas pueden contener bloques Tono, Valor de la Nota o colecciones.

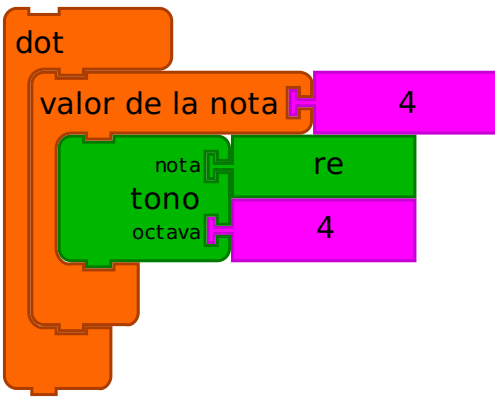
Un bloque Agudas va a aumentar el tono en medio paso. Un bloque Planas lo disminuye en medio paso.



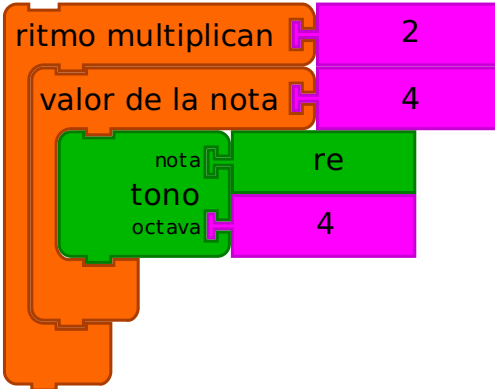
El bloque Ajustar Transposición puede usarse para hacer desplazamientos más largos de tono. Para desplazar una octava completa, se debe trasponer 12 medios pasos. -12 desplazará una octava hacia abajo.



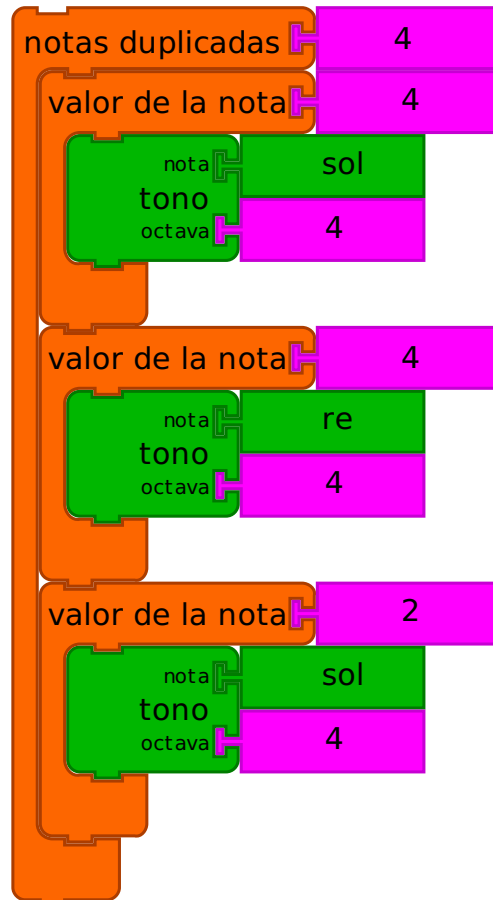
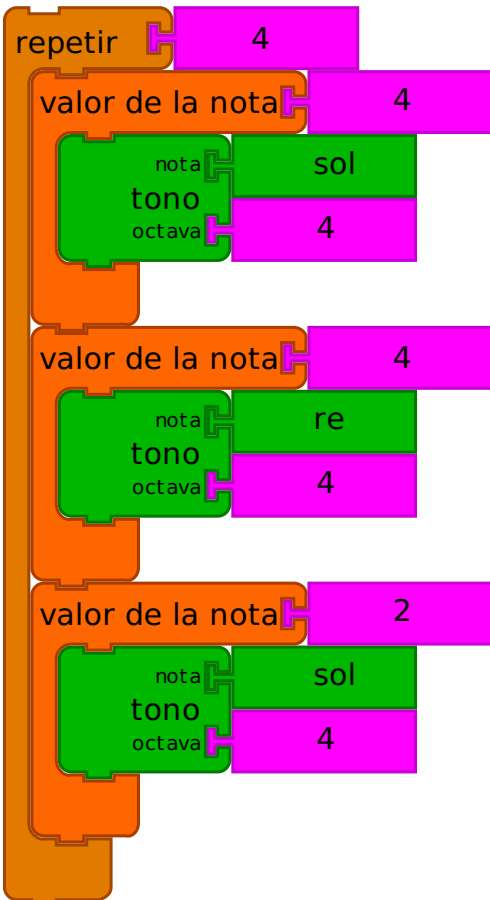
In the example above, we take the song we programmed previously and raise it by one octave.



Se puede usar la notación punto con el bloque Dot. Una nota con punto se extiende en un 50%. Por ejemplo, una quarter note con punto tocará durante $3/8$ ($1/4 + 1/8$) de un pulso. Una eighth note con punto tocará por $3/16$ ($1/8 + 1/16$) de un pulso.

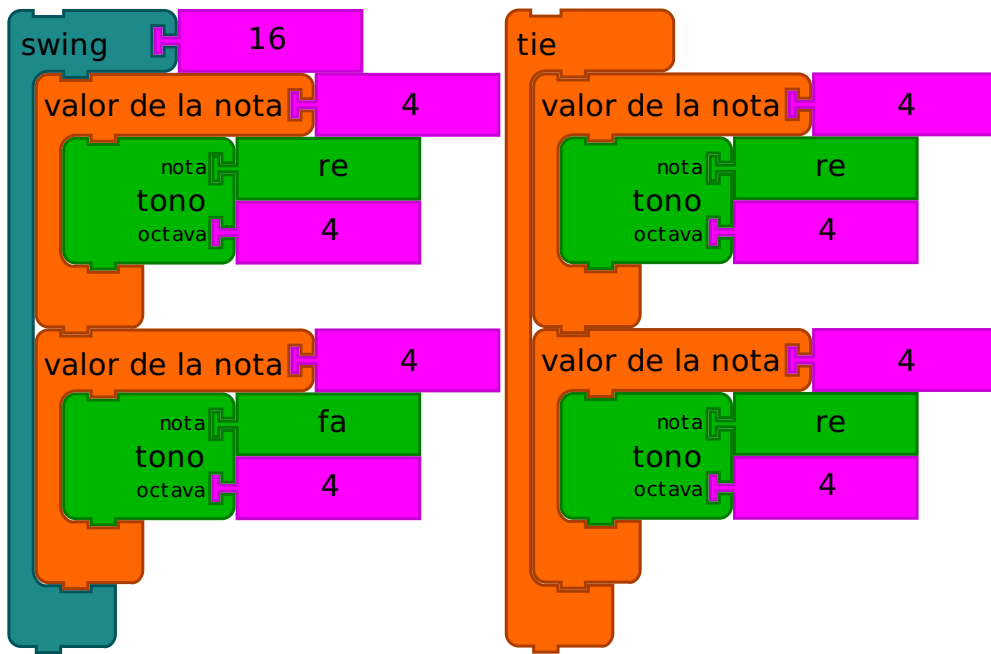


También se puede multiplicar o dividir el valor del pulso, lo cual acelerará o disminuirá las notas.



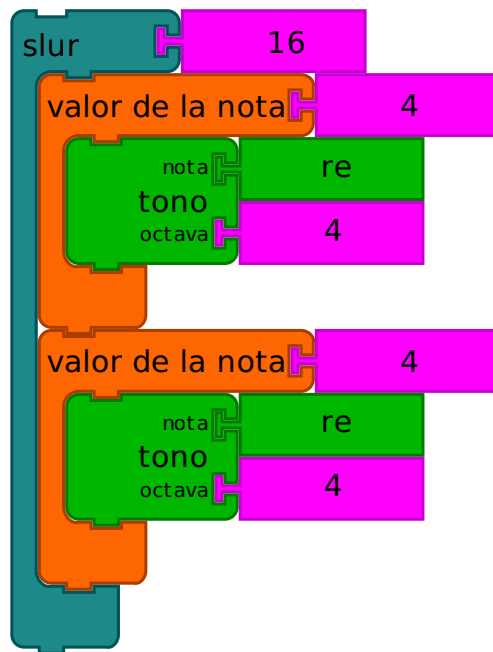
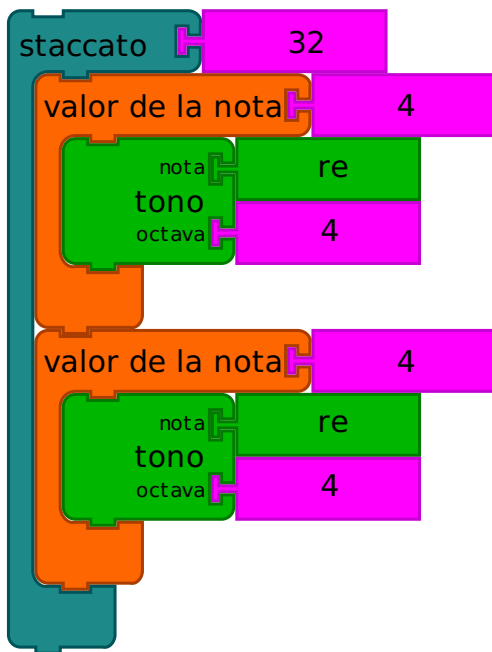
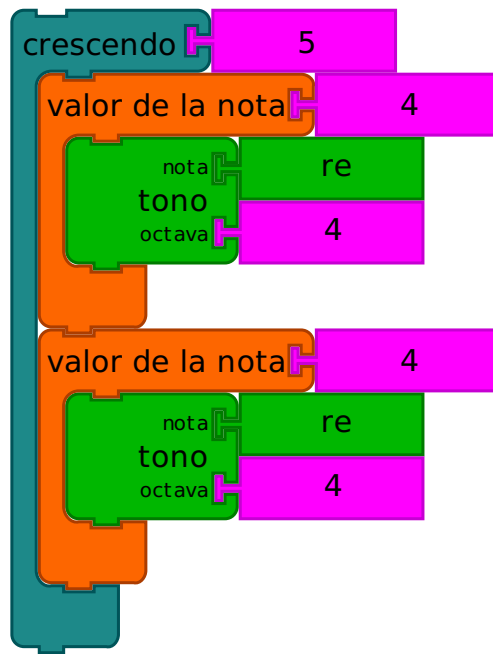
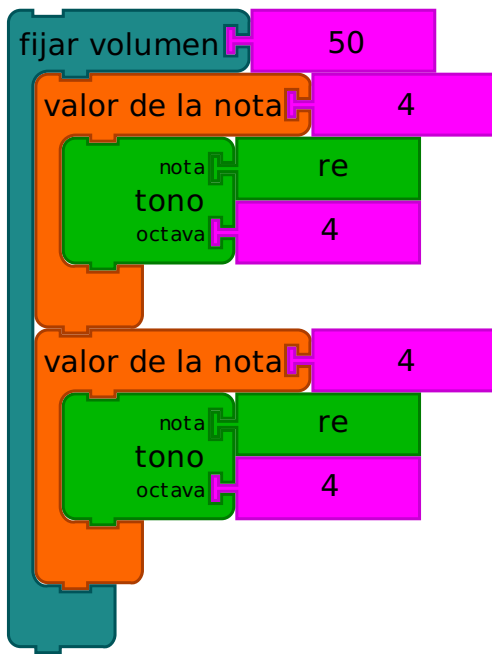
There are several ways to repeat notes. The Repeat block will play a sequence of notes multiple times; the Duplicate block will repeat each note in a sequence.

In the example, on the left, the result would be *Sol, Re, Sol, Sol, Re, Sol, Sol, Re, Sol, Sol, Re, Sol*; on the right the result would be *Sol, Sol, Sol, Sol, Re, Re, Re, Re, Sol, Sol, Sol, Sol*.



El bloque Swing actúa sobre pares de notas, extendiendo la duración de la primera y restándole la misma cantidad de tiempo a la segunda

El bloque Tie también actúa sobre pares de notas, combinándolas en una sola. Las notas tienen que tener tono idéntico, pero pueden variar en ritmo.

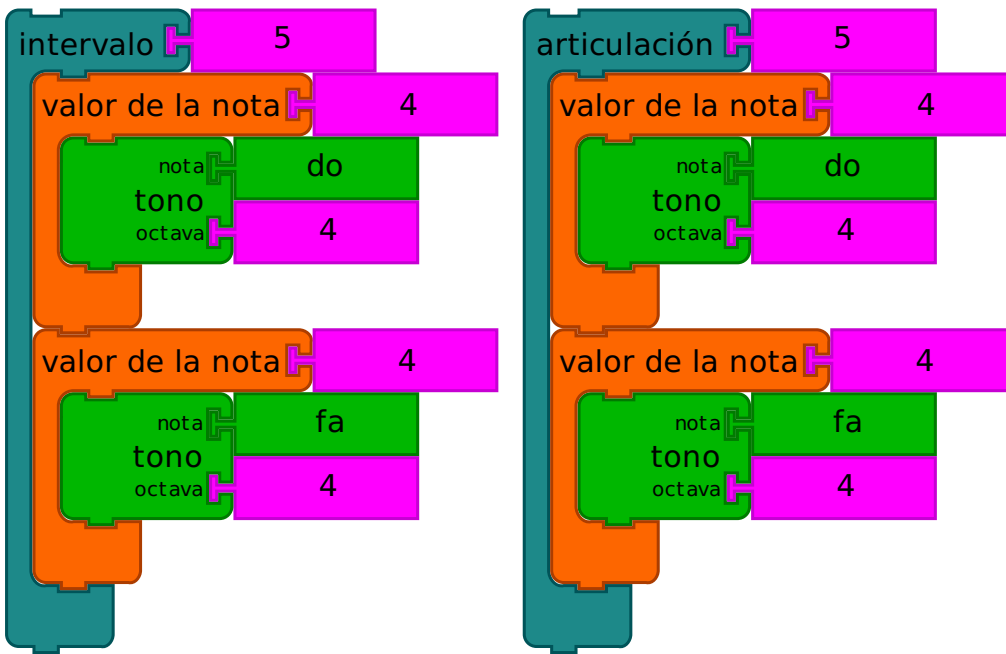


El bloque Fijar Volumen cambia el bolumen de las notas. El valor por defecto es 50, y puede variar desde 0 (silencio) hasta 100 (volumen máximo).

El bloque Crescendo aumenta o disminuye el volumen de las notas que contiene según el valor especificado.

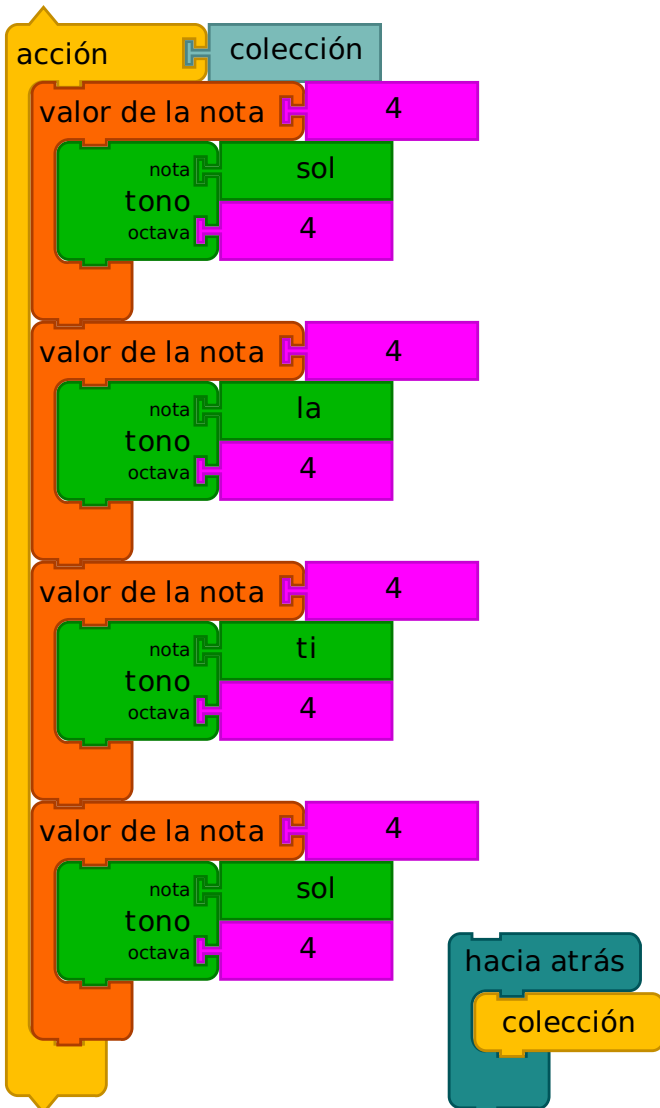
El bloque Staccato toca las notas en ráfagas rápidas, manteniendo su ritmo.

El bloque Slur toca una nota más allá de su duración, mezclándola con la nota siguiente.

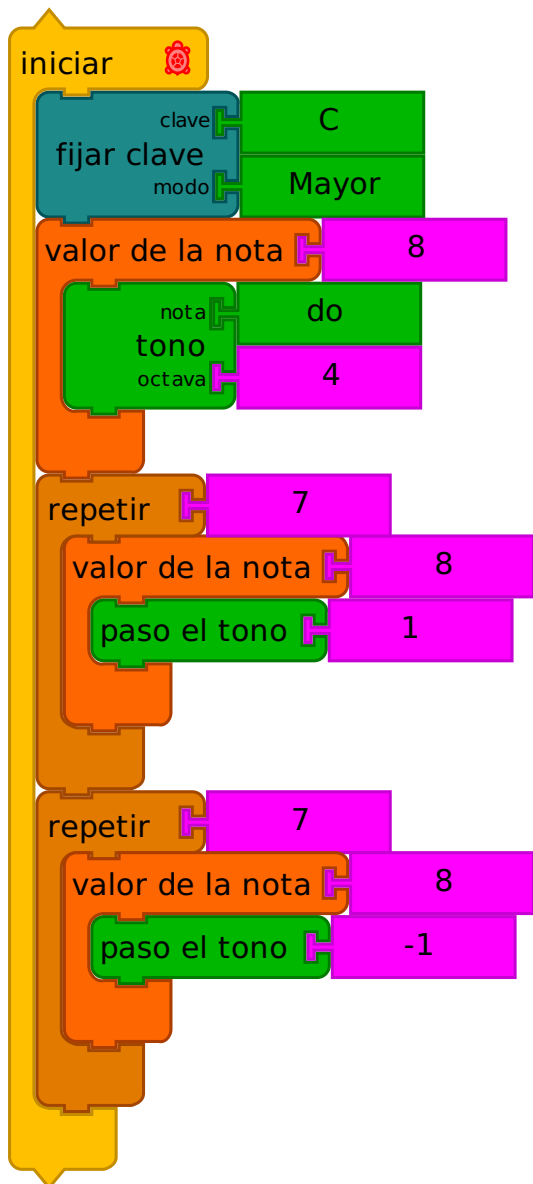


El bloque Intervalo calcula un intervalo (por ejemplo, un quinto) y agrega los tonos adicionales a una nota. En la figura, se agrega Sol a Do y Do a Fa.

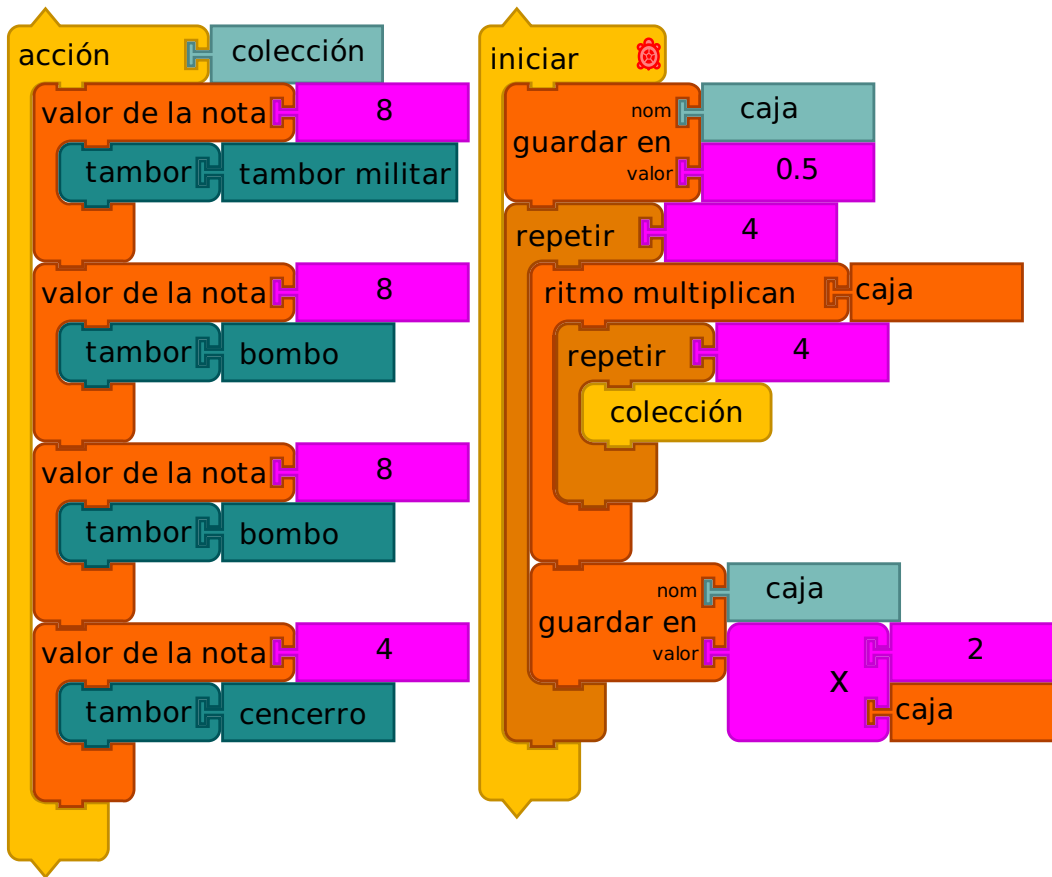
El bloque Articulación cambia el volumen de un grupo de notas.



El bloque Hacia atrás juega las notas contenidas en reversa orden. En el ejemplo anterior, las notas en la colección se reproducen como Sol, Ti, La, Sol, es decir, desde el fondo hasta la parte superior de la pila.



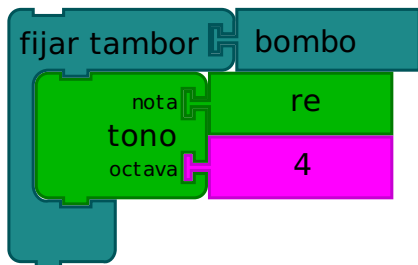
El bloque Fijar Clave cambia la clave y el modo de relación entre solfege, por ejemplo, Do, Re, Mi, a nombres de notas como C, D, E, en C Mayor. Los modos incluyen Mayor y Menor, Cromático y otros modos exóticos como Bebop, Geez y Maqam.



In the above example, the sequence of drum beats is increased over time.

EJECUTAR EN VIVO

The Pitch Drum Matrix

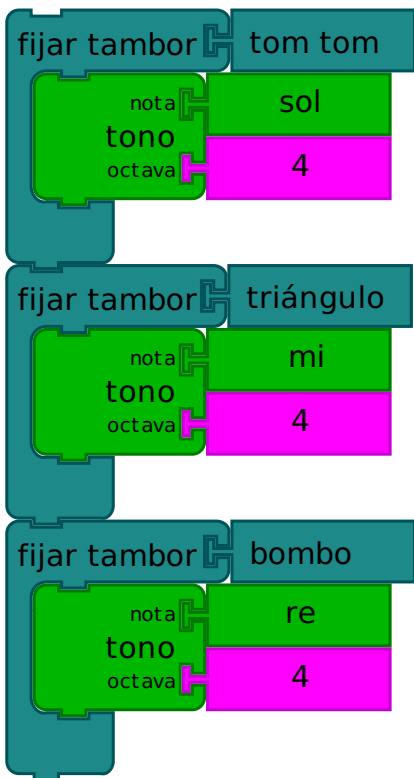


The Set Drum block is used to map the enclosed pitches into drum sounds. Drum sounds are played in a monopitch using the specified drum sample. In the example above, a **kick drum** will be substituted for each occurrence of a **Re 4**.

matriz de tono en tambor

nota	sol
tono	
octava	4
nota	mi
tono	
octava	4
nota	re
tono	
octava	4
tambor	bombo
tambor	tom tom
tambor	cencerro
tambor	triángulo

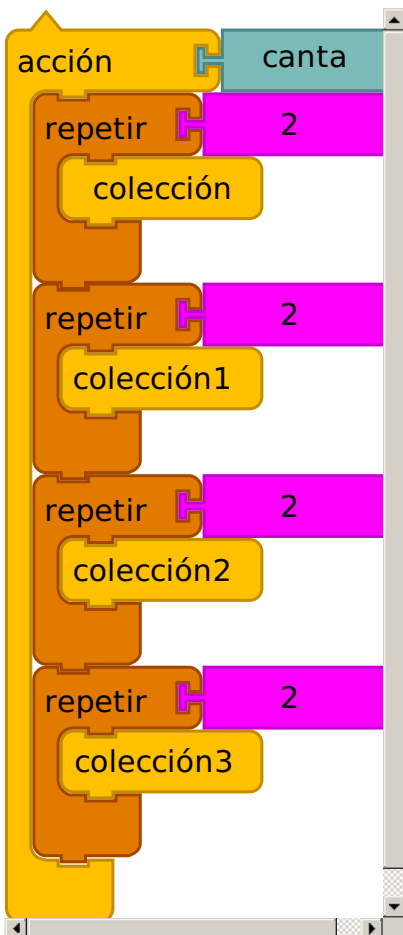
Solfa					
sol ₄					
mi ₄					
re ₄					
Solfa					
sol ₄					
mi ₄					
re ₄					



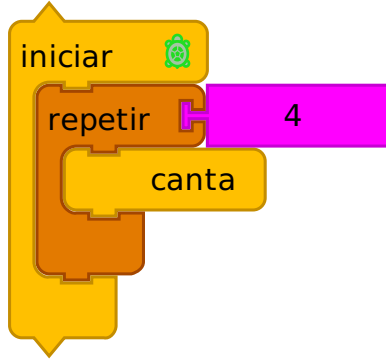
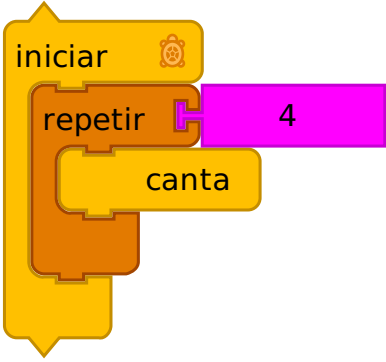
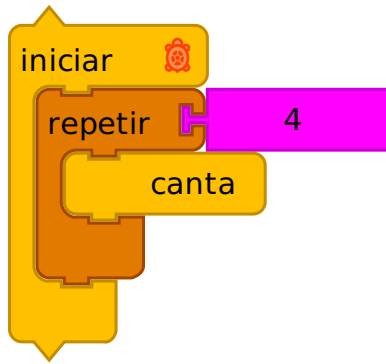
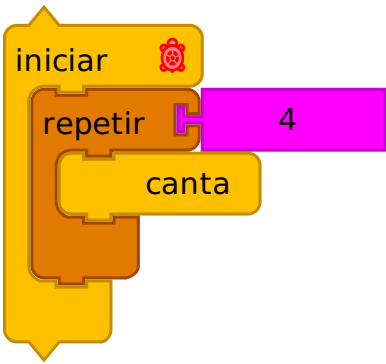
As an expedience for creating mapping with the Set Drum block, we provide the Drum-Pitch Matrix. You use it to map between pitches and drums. The output is a stack of Set Dum blocks.

3. Voices

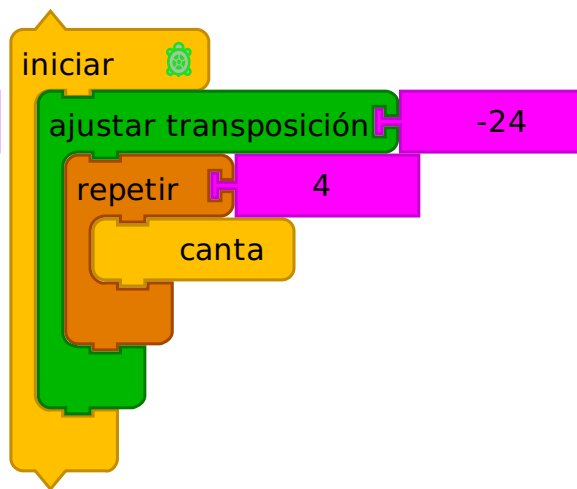
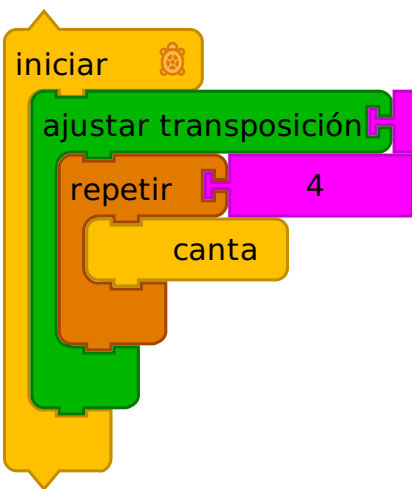
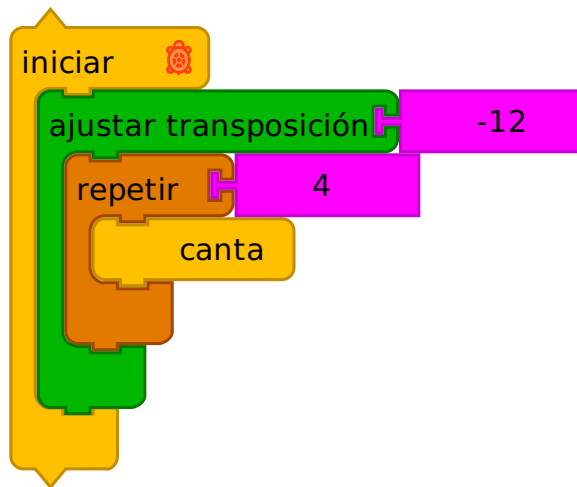
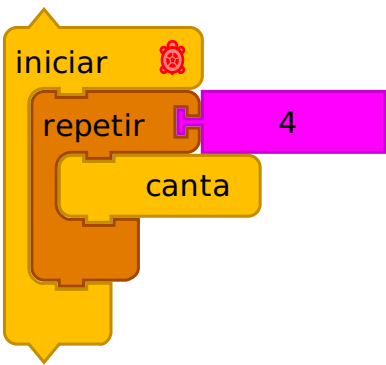
Each Start block runs as a separate voice in Music Blocks. (When you click on the Run button, all of the Start blocks are run concurrently.)



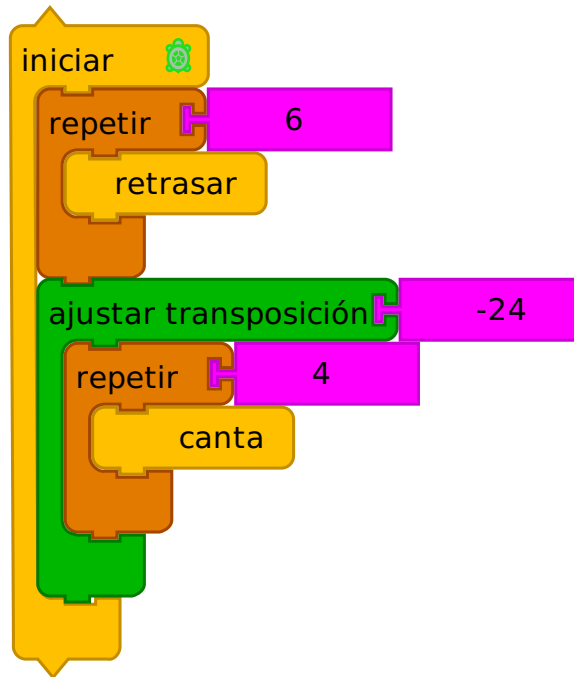
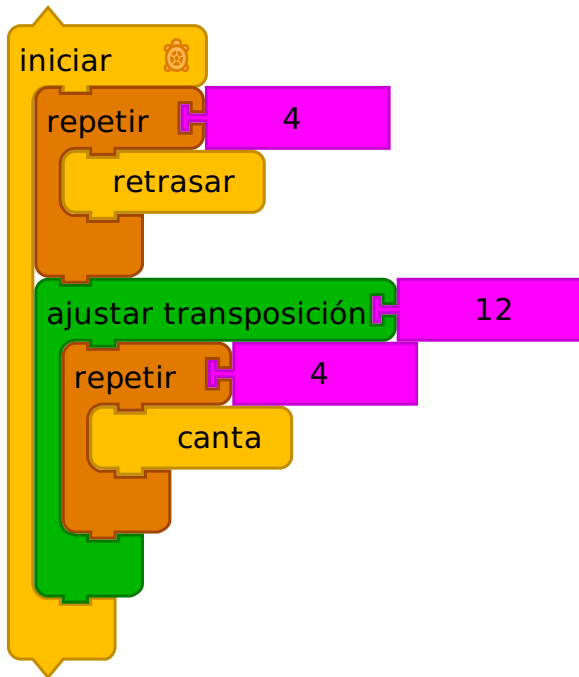
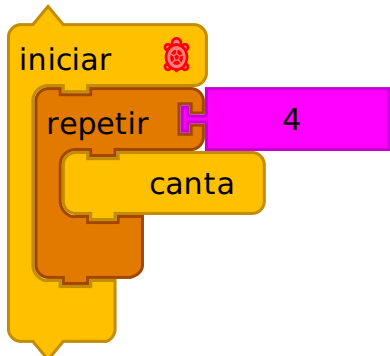
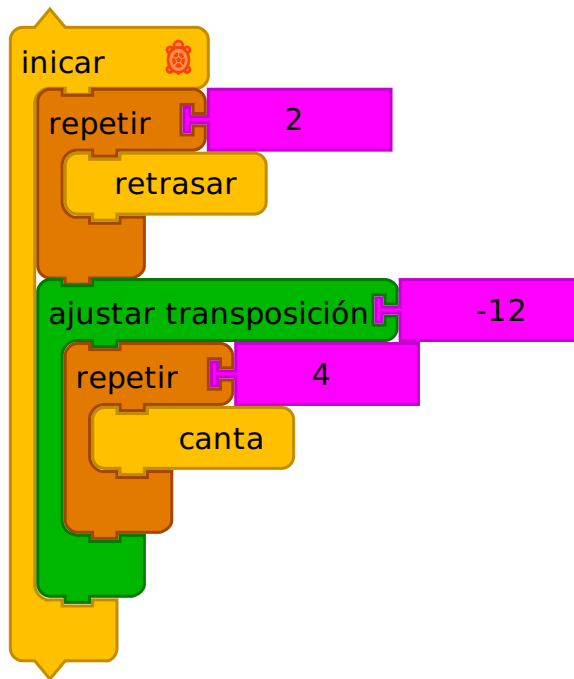
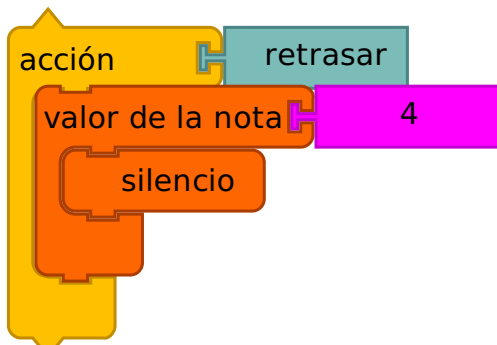
If we put our song into an action...



...we can run it from multiple Start blocks.



It gets more interesting if we shift up and down octaves.



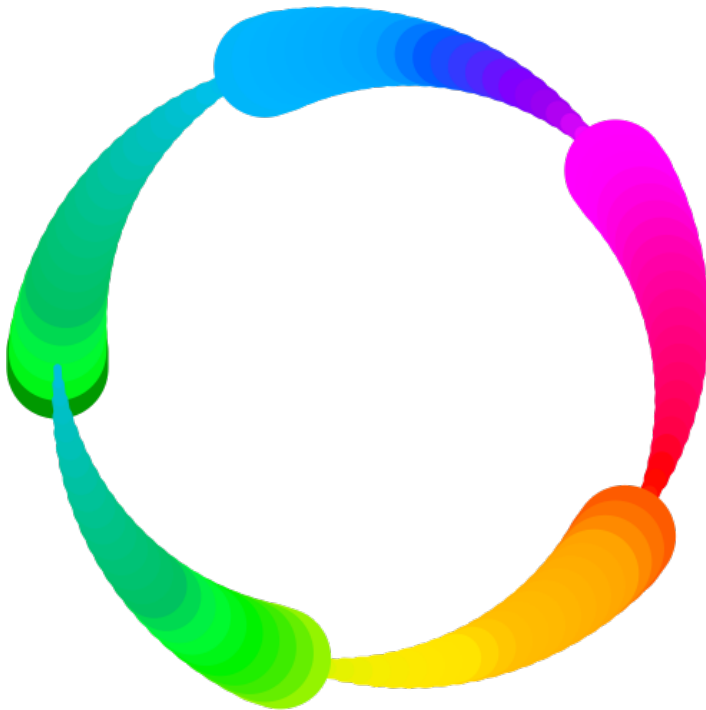
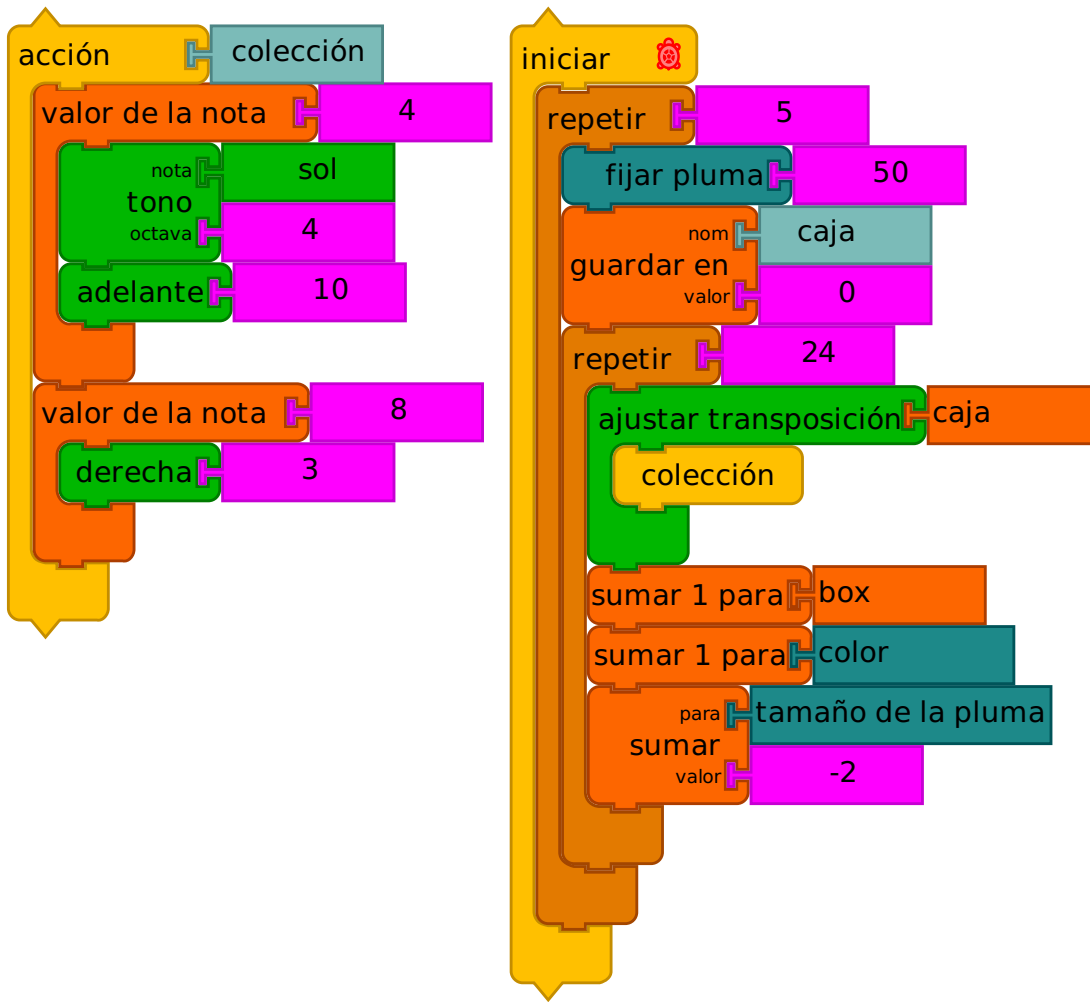
And even more interesting if we bring the various voices offset in time.

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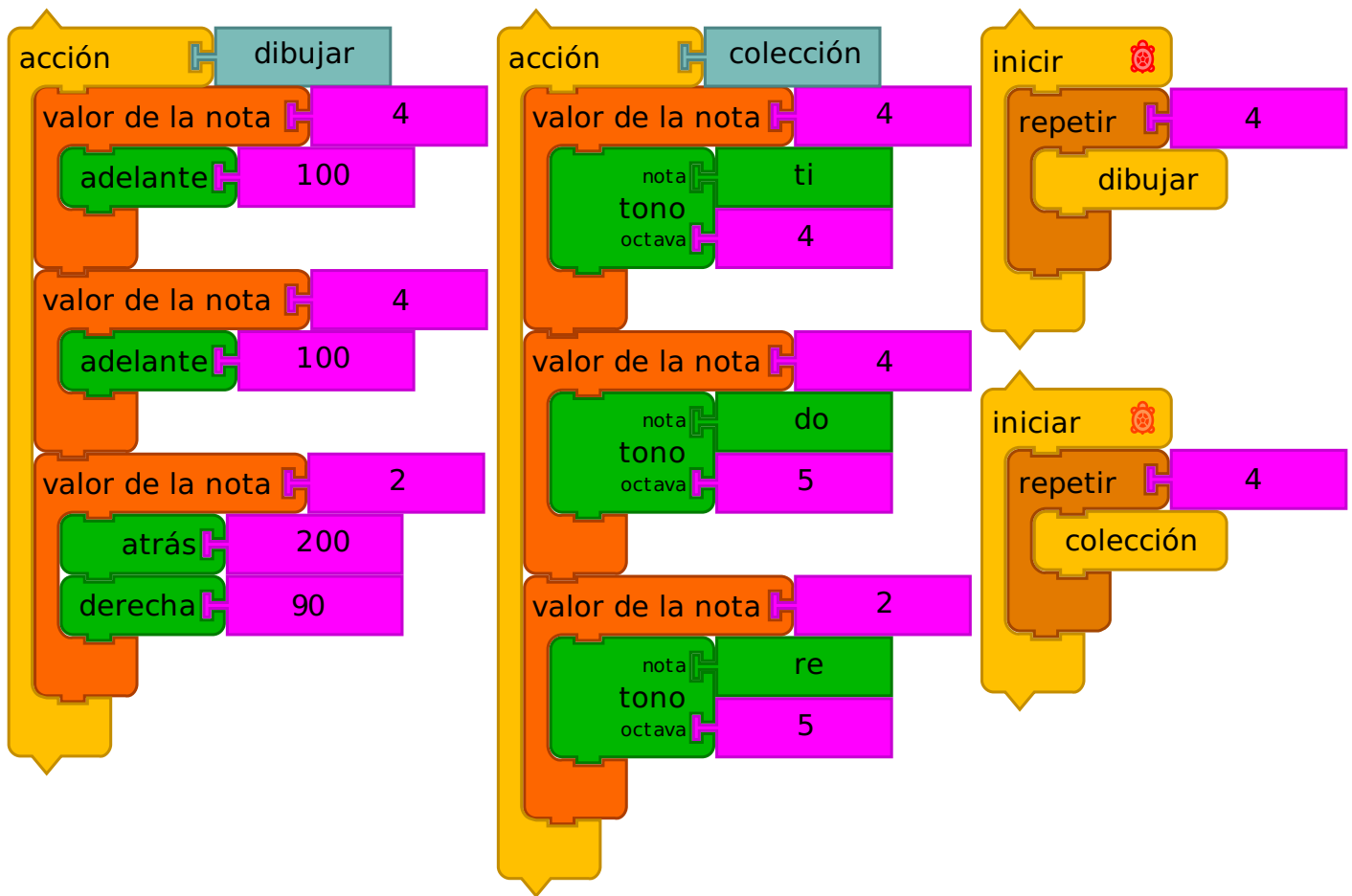
A special "drum" version of the Start block is available for laying down a drum track. Any pitch blocks encountered while starting from a drum will be played as **C2** with the default drum sample. In the example above, all of the notes in **chunk** will be played with a kick drum.

4. Adding graphics



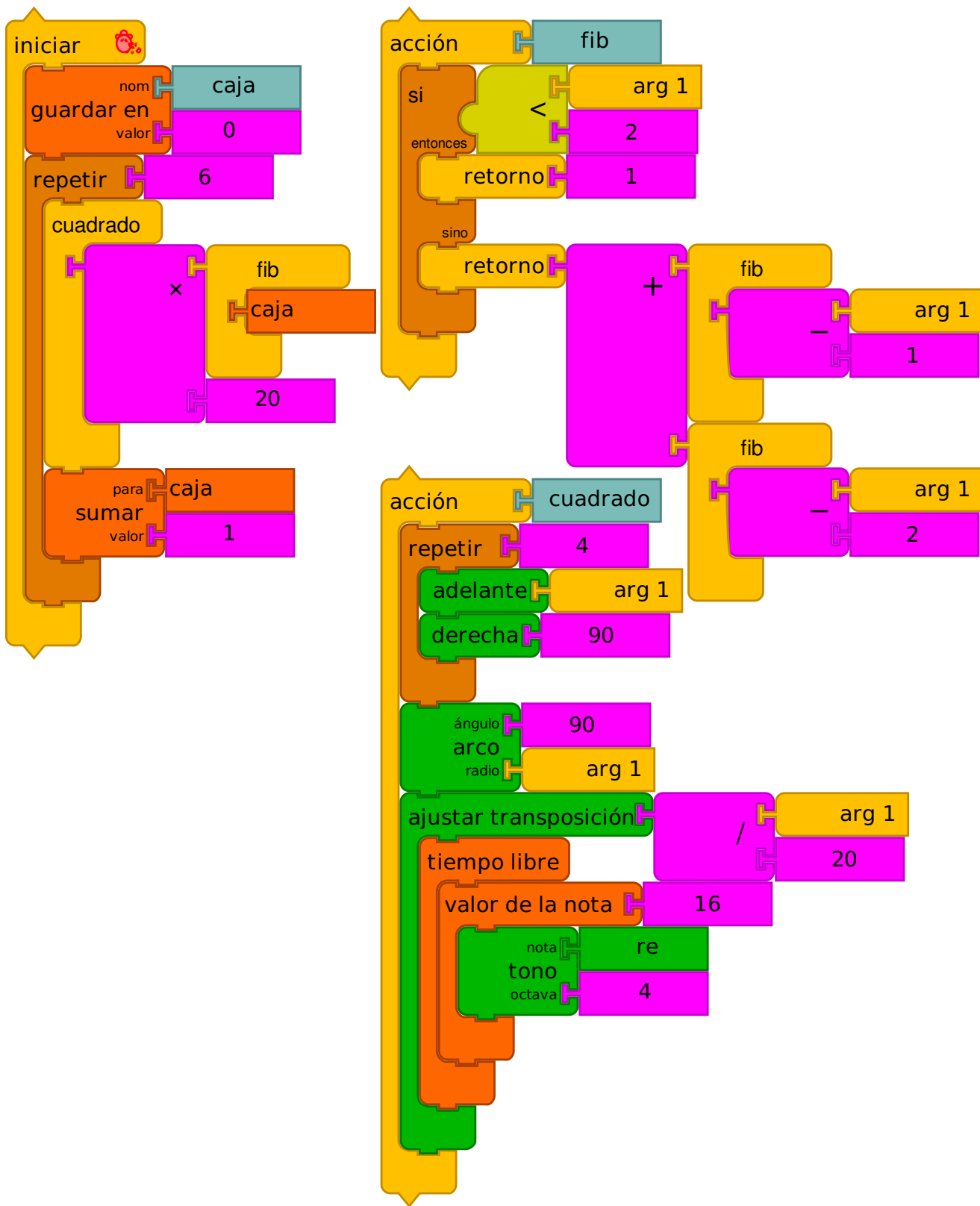
Es posible combinar dibujos con bloques musicales. Al colocar bloques de funciones gráficas (como Adelante o Derecha) dentro de bloques Valor de la Nota, los dibujos se sincronizan con la música.

En el ejemplo, la tortuga avanza cada vez que se toca una quarter note y gira a la derecha durante la octava nota. En cada paso del bloque Repetir más interno el tono sube un paso y medio, el tamaño de lápiz disminuye y el color aumenta.

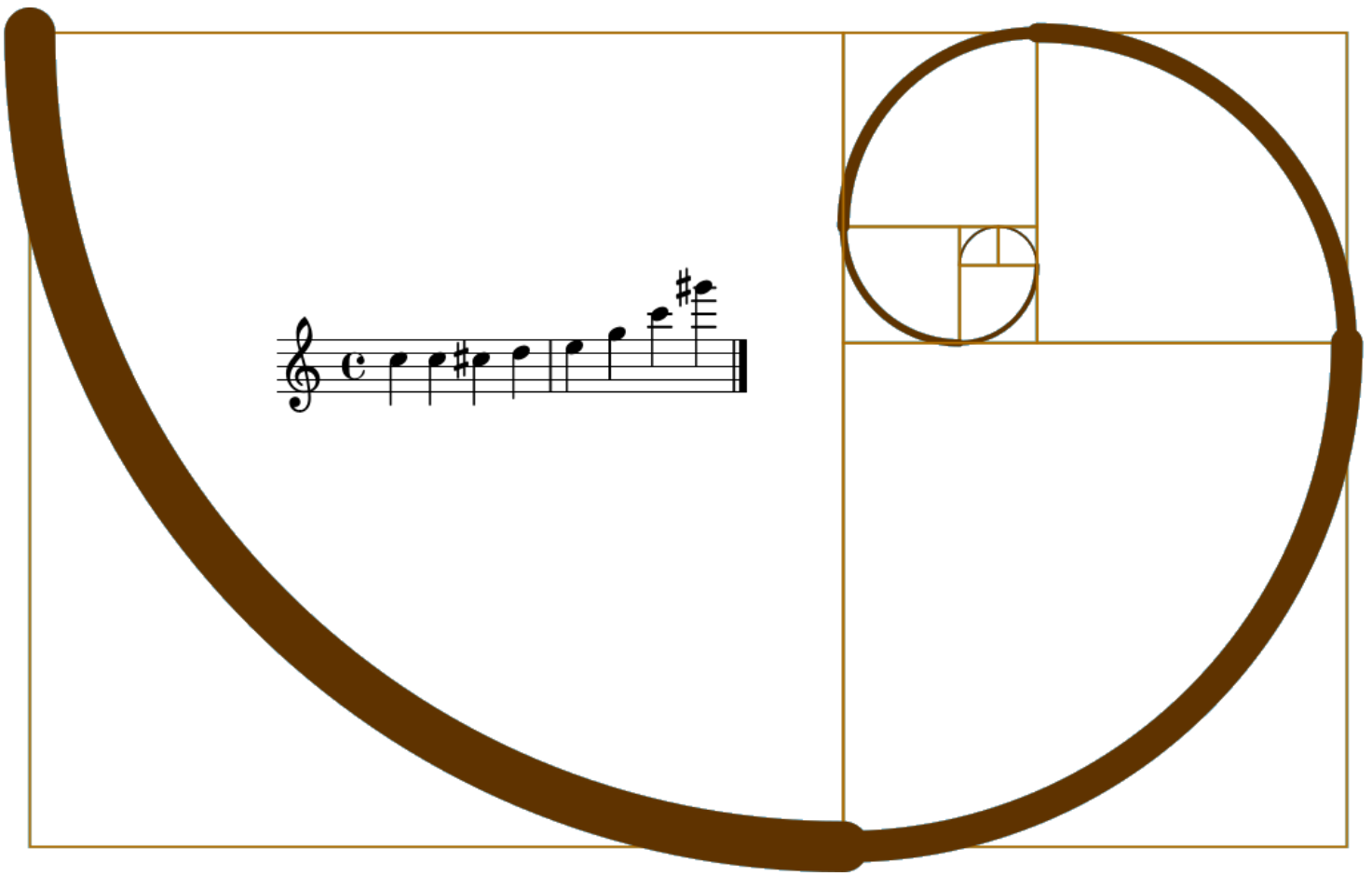


In this example, the graphics are synchronized to the music by placing the graphics commands inside of Note value blocks.

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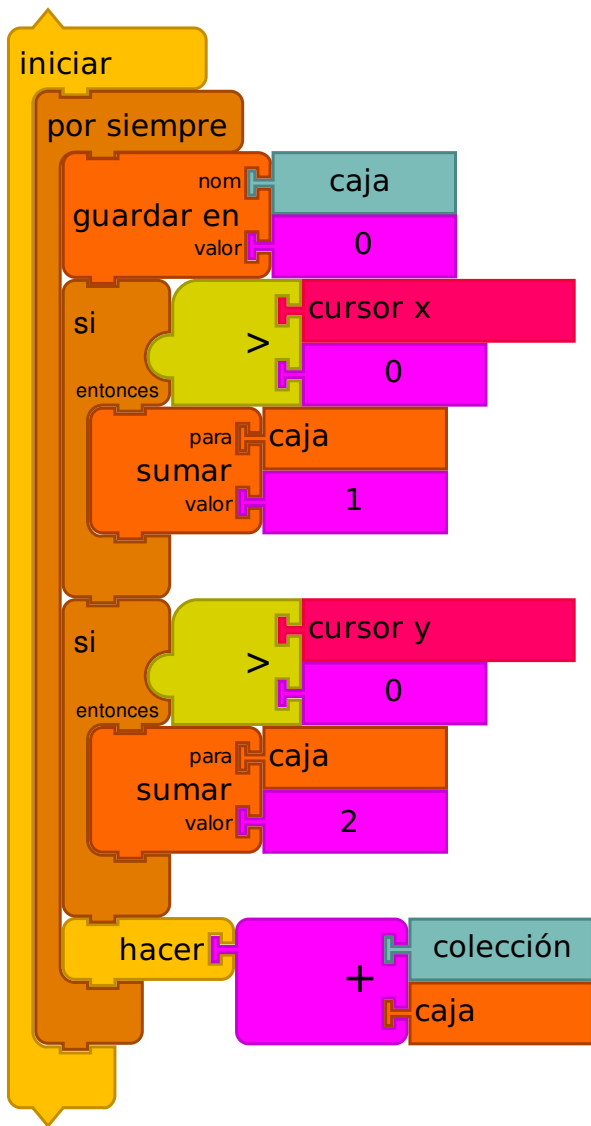


In this example, because the computation and graphics are more complex, a Free-time block is used to decouple the graphics from the master clock.



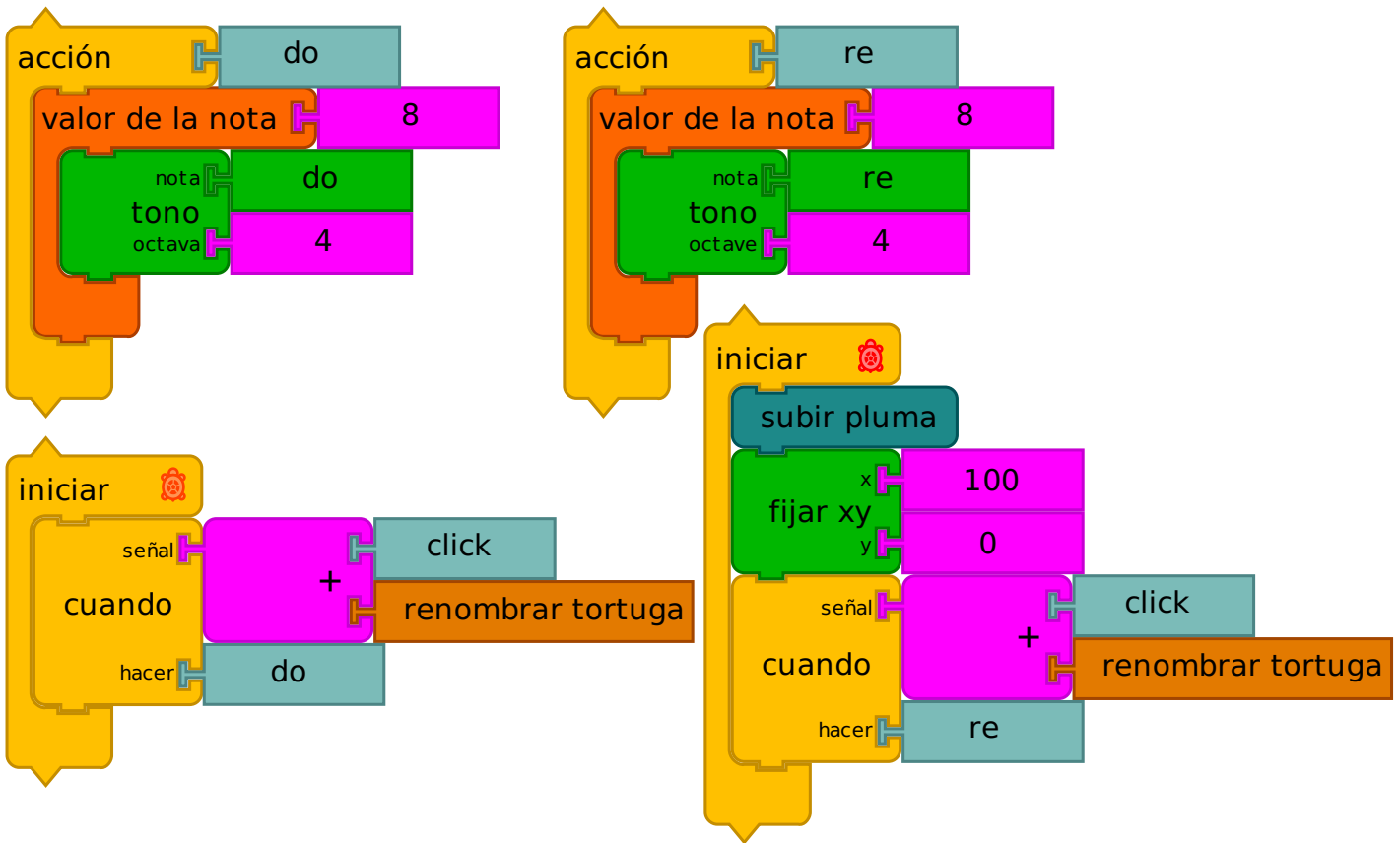
5. Interaction

There are many ways to interactive with Music Blocks, including tracking the mouse position to impact some aspect of the music.



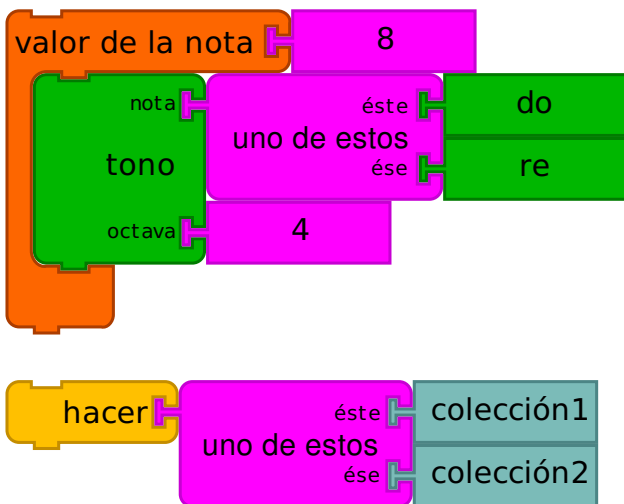
For example, we can launch the phrases (chunks) interactively. When the mouse is in the lower-left quadrant, `chunk` is played; lower-right quadrant, `chunk1`; upper-left quadrant, `chunk2`; and upper-right quadrant, `chunk3`.

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In the example above, a simple two-key piano is created by associating click events on two different turtles with individual notes. Can you make an 8-key piano?

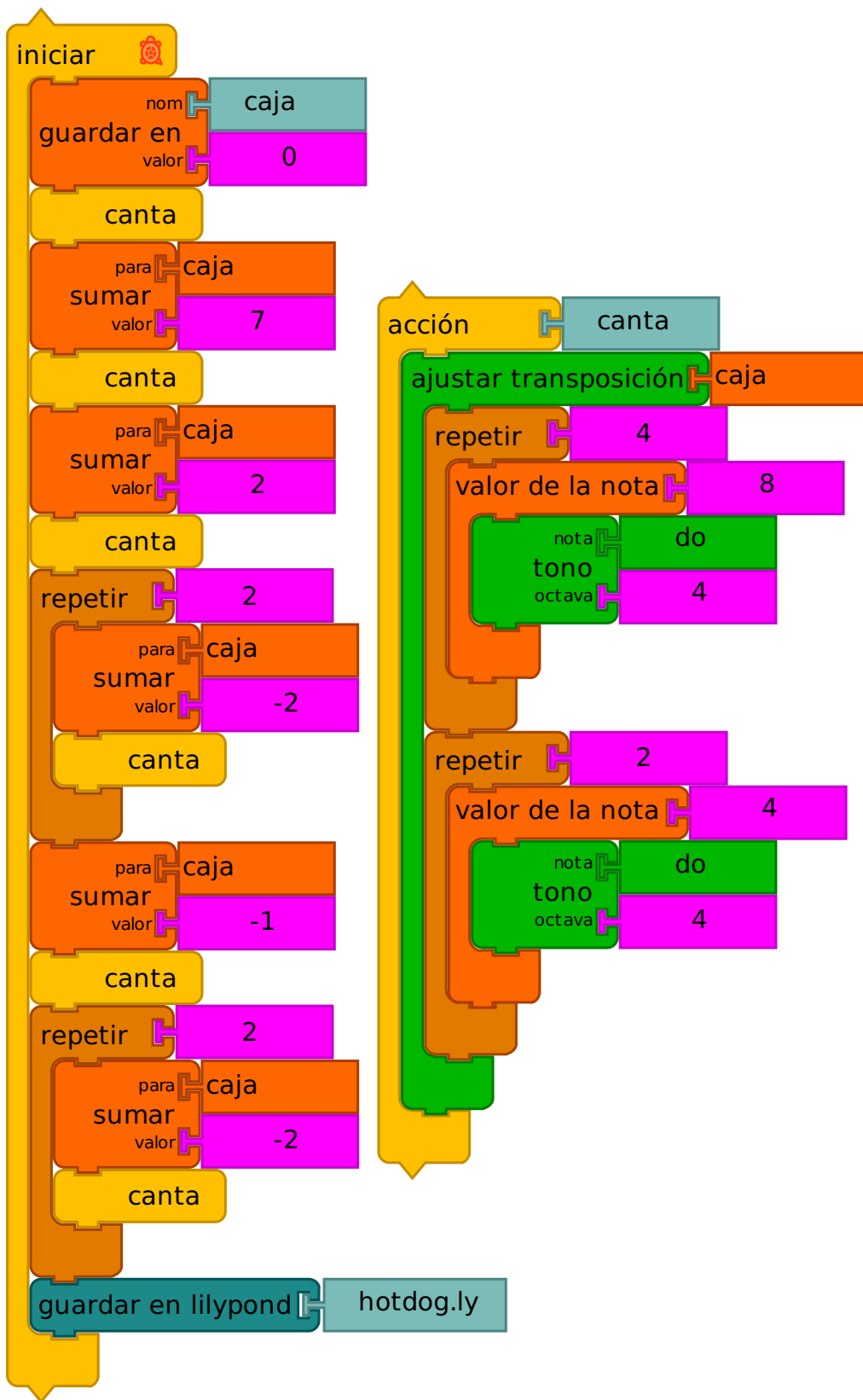
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You can also add a bit of randomness to your music. In the top example above, the One-of block is used to randomly assign either *Do* or *Re* each time the Note value block is played. In the bottom example above, the One-of block is used to randomly select between *chunk1* and *chunk2*.

6. Beyond Music Blocks

Music Blocks is a waypoint, not a destination. One of the goals is to point the learner towards other powerful tools. One such tool is [Lilypond](#), a music engraving program.



The Save as Lilypond block will transcribe your composition. The output of the program above is saved to <Downloads/hotdog.ly>. There is also a Save as Lilypond button on the secondary toolbar.



|version "2.18.2"

```
mouse = {  
c'8 c'8 c'8 c'4 c'4 g'8 g'8 g'8 g'4 g'4 a'8 a'8 a'8 a'4  
a'4 g'8 g'8 g'8 g'4 g'4 f'8 f'8 f'8 f'4 f'4 e'8 e'8 e'8  
e'4 e'4 d'8 d'8 d'8 d'4 d'4 c'8 c'8 c'8 c'4 c'4  
}
```

```
lscore {  
<<  
\new Staff = "treble" {  
\clef "treble"  
\set Staff.instrumentName = #"mouse" \mouse  
}  
>>  
\layout {}  
}
```



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