BOTS FOR KIDS

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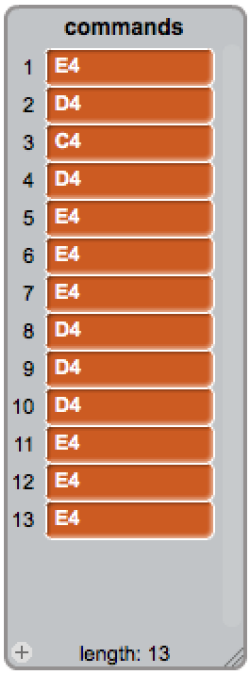
Programs as Data

This week we're going to learn how to use mBlock to store a set of commands and have the mBot run them. So far, we've been creating an entirely new program every time we want the robot to do something different. This time, the program will be the same every time, but we're going to create a way to store the bot's actions as data. We'll use it to create a music box.

Storing the commands as data lets us make our bots programmable by other people who aren't as good as you at programming. We could even upload a similar program to the robot and allow someone to use buttons or other input devices to program the bot.

This way of doing things is also a very powerful tool we can use in future lessons.

There are basically three things to know to be able to do this. First we will introduce lists, which will hold our program. Second we'll examine how we're going to use the list to store commands for our bot. Finally, we'll write a program that goes through the list, takes each command, and runs it.

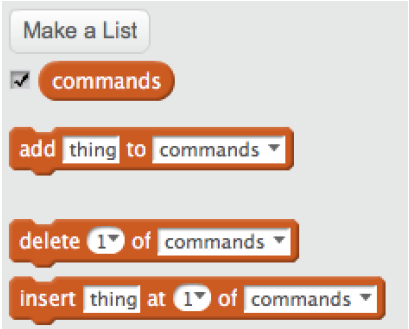


Lists

We have already learned how to use a variable, which stores a single item of information. What if we want to store a bunch of variables? Let's say we were writing down what we wanted to buy at the store; would we need a separate variable for each item? And if we wanted to add more, would we need to create more variables?

Lists are the answer. A list is something that can store many values and keep them in order. We can add items to the list, remove items from the list, find out how long our list currently is, and look at items on the list.

To create a list, go to the "Data&Blocks" panel, and click the "Make a List" button. We'll name our list "commands". Once the list is created, mBlock will create blocks to use it.



Once created, the list will show up in the stage under its name. (If it doesn't, you can click " show list [commands]" in the Data&Blocks panel.) You can scroll through the values. Right-click the list and you can export or import the values to a .txt file to save the values for later.

Storing

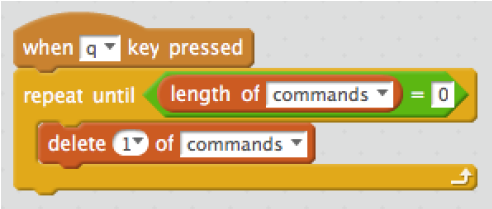
Now that we know what lists are, we have to decide what to put into them, and how to get it there.

For our music box, we're going to store the name of each note as our data. The mBot's "buzzer" can play notes, and the command to do it takes the letter of the note and the number of the octave. So "middle C" on a piano would be C4, and octaves in mBlock start with the note "C". (So D4 is higher, and A4 is higher still.)

To get values into the list, we're going to use the number keys on the keyboard as if they were a little piano. From the "Events" panel, drag out a "when [] key pressed" event and set it to "1". From "Data&Blocks" drag an "add [] to []" block underneath, and set it to "add [C4] to [commands]". Now when "1" is pressed, "C4" will be added to the "commands" list.

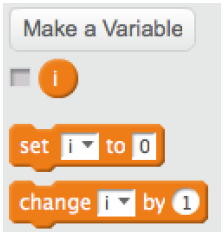
Do the same for 2, 3, 4, 5, 6, and 7. The number "6" should be adding "A4", and "7" should add "B4". Now when you play the numbers, the notes go into the list.

To clear the list, create an event that loops until the list is empty, deleting each item.



Running

Once you save the notes you want to play into the list, you'll want to play it on your bot. To do this, we're going to create a loop that gets each value out of the list one at a time and plays it.



First, we'll need a variable to know which list item we are currently on. In the "Data&Blocks" panel, "Make a Variable" called "i". The number of the list item we're on is called the "index", and this variable will store it. The first item in the list is item 1, the second is item 2, and so on.

Next, create a new Event for the letter "g" and as the first item under it, set "i" to 1. Now create a "repeat until", and use the "Operators" panel to put a greater-than into the slot. On the left, put "i", and on the right, from "Data&Blocks," put "length of [commands]". Finally, drag in a "change [i] by (1)" block into the loop.

We now have a loop that will go through each item in the list, but it doesn't actually do anything! To fix that, from the "Robots" panel drag in a "play tone on note () beat ()", and set the note to "item (i) of [commands]" from the "Data&Blocks" panel. For the beat, set it to "Quater". Now connect and run the program, and the bot should play your song when you press "g"!

Congratulations on your new music box.