# Marty Scratch Examples

This document shows a selection of things you can do with Marty through the Scratch interface, from the very basic to the fairly complicated. Everything here is in prototype stage, but hopefully it's a good start!

I've made some quick videos showing the scripts being run on a Marty. They're very much not a finished article (and apologies for the christmas music playing in the background), but you can see what each script looks like when it runs:

<u>https://www.youtube.com/playlist?list=PLiBgsWjIRfInizbzagjLnoQjoeb0psS33</u> And the individual videos are linked below

We'll be making starter projects for many of the examples, to get people started. Those should be appearing at <u>www.robotical.io/scratch</u> shortly

# **Basic commands**

Get used to controlling Marty from scratch by playing around with the built in functions

### **Controlling Marty**

The "Get Ready" block will return Marty to a normal standing position and do a little eyebrow wiggle. The "Turn off motors" block will... turn off the motors. It's good to call it at the end of a script.



### Longer chains of command (Video)

when	/ clicked
Lean	left -
Lean	right -
Get F	Ready
Walk	2) steps forwar
Eyes	angry 🚽
Kick	left leg
Eyes	excited -
Wigg	le
Turn	off motors

Have a play around with making Marty do more complicated things. Make a little dance routine or a play.

### Looping (Video)

w	hen 🔎 clicked
G	et Ready
re	peat 4
	Eyes normal
	Walk 😰 steps forward
	Eyes angry
	Kick right leg
E	yes excited
W	liggle
τι	irn off motors

Sometimes you want to do the same thing a few times, but copying and pasting code looks messy and is time consuming. Have a play with the "repeat" blocks to get the hang of looping

#### Define a function (<u>Video</u>)



Another way to avoid repeating code is to make a "function"

# Make Marty walk!

There is a built in walk function, but that's no fun. In this challenge you have to teach Marty to walk! You'll have to think about balance and how individual joints need to move to create a complex movement.

#### Take a step (Video)



The basic movements for taking a step - in this case with the right leg

# Take two (<u>Video</u>)

-	STREET, SOL	in the second		
	Ready			
Lean	left -			
Lift	right –	leg		
Move	left 🔹	leg	backward	
Move	right	leg	forward	
Lowe	r leg	2	1.1	
Lean	right 👻			
Lift	left -	leg		
Move	left 💌	leg	forward	-
Move	right -	leg	backwar	rd
Lowe	r lea			

And then add a step with the other leg

# Step functions (Video)

			_		 A		
G	et	Read	у				Lean left
st	tep	left					Lift right leg
		righ	-				Move left v leg backward v
Tu	urn	off	mo	tors			Move right   leg forward
							Lower leg
							Lonier reg
							define step right
							define step right
							define step right Lean inght
							define step right Lean light Lift left leg
							define step right Lean inght

Move the individual steps into their own functions

# Put the best foot forward (Video)

when clicked	define step left
Get Ready repeat (4)	
	Lean right -
step	Lift left leg
	Move left leg forward
Turn off motors	Move right   leg backward
define step	Lower leg
	set lastStep v to left
if (lastStep) = left then	a second seco
step right	
else	define step right
step left	define step fight
	Lean left
	Lift right leg
	Move left leg backward
	Move right leg forward
	Lower leg
	set lastStep v to right

It would be nicer to just be able to say "step" rather than specifically stating which leg to step with. This can be done by creating a variable to keep track of which foot the last step used

#### Make your own movement (Video)



Have a play with the "Move Joint" block to create a more complicated custom movement function

# A turning point (<u>Video</u>)

when 🖊 clicked	define step	Lean right	
Get Ready	step right	Lift left leg Move left leg forward	
step right and turn 15	else	Move right leg backwar	
Get Ready	step left	Lower leg	
showoff		set lastStep to left	
Get Ready			
Turn off motors			
			define step right
			Lean left
		define step right and turn amount	Lean left Lift right leg
afine showoff		define step right and turn amount	
			Lift right leg
love <sup>eyes</sup> to -10 degrees in		Lean left -	Lift right leg Move left leg backwa
love eyes to -10 degrees in love left arm to 30 degrees	in 0.5 secs	Lean lieft w	Lift right leg Move left leg backwa Move right leg forwa
ove eyes to -10 degrees in ove left arm to 30 degrees ove left knee to 30 degrees	in 0.5 secs in 0.5 secs	Lean left - Lift right leg Move left leg backward -	Lift right leg Move left leg backwi Move right leg forwa Lower leg set lastStep to right
love eyes to -10 degrees in love left arm to 30 degrees love left knee to 30 degrees love right knee to 20 degree	in 0.5 secs s in 0.5 secs s in 1.0 secs	Lean left Lift right leg Move left leg backward Move right leg forward Move left twist to amount degrees in 0.5 set	Lift right leg Move left leg backwi Move right leg forwa Lower leg set lastStep to right
love eyes to -10 degrees in love left arm to 30 degrees love left knee to 30 degrees love right knee to 20 degrees love left hip to -40 degrees	in 0.5 secs s in 0.5 secs in 0.5 secs in 0.5 secs	Lean left Lift right leg Move left leg backward Move right leg forward Move left twist to amount degrees in 0.5 set Lower leg	Lift right leg Move left leg backwi Move right leg forwa Lower leg set lastStep to right
love eyes to -10 degrees in love left arm to 30 degrees love left knee to 30 degrees love right knee to 20 degrees love left hip to -40 degrees love left twist to 40 degrees	in 0.5 secs s in 0.5 secs s in 1.0 secs in 0.5 secs in 0.5 secs	Lean left Lift right leg Move left leg backward Move right leg forward Move left twist to amount degrees in 0.5 set	Lift right leg Move left leg backwi Move right leg forwa Lower leg set lastStep to right
Iove left arm to 30 degrees   Iove left knee to 30 degrees   Iove right knee to 20 degrees   Iove left hip to 40 degrees   Iove left twist to 40 degrees   Iove left twist to 40 degrees	in 0.5 secs s in 0.5 secs in 0.5 secs in 0.5 secs	Lean left Lift right leg Move left leg backward Move right leg forward Move left twist to amount degrees in 0.5 set Lower leg	Lift right leg Move left leg backwi Move right leg forwa Lower leg set lastStep to right

Make a function which steps with a turn, this function can take an argument to define the amount of turning

### Parameter validation, and function-ception (Video)

define validate turn amount if turnAmount > 15 then	when clicked Get Ready repeat 3 step and turn 10 Get Ready Turn off motors	if amount = 0 then istep else if lastStep = left then ctop cicht and two property	ine step left n right left leg ve left leg backward ve right leg backward ver leg laststep to left laststep to left
set urnAmount to 15	if turnAmount > 15 then		set turnAmount to amount
if turnAmount 15 then set turnAmount Lean right   if turnAmount 15 to amount Lift left   set turnAmount to amount Lift left leg   set turnAmount to 15 validate turn amount Lift left leg		set turnAmount validate turn amount	Lean right - Lift left leg
define step   Move leg		Lift right leg Move left leg backward	Move right twist to turnAmount degrees in 0.5 set
step right else step left step v to left step left step v to left vist v to left step left step v to left vist v to left v to left vist v to left vist v to left	step right else	Lower leg	secs

There are a couple of things going on here:

- Parameter validation: If you tell Marty to turn too much, his feet will hit each other and bad things will happen. To avoid accidentally sending a bad command, we can "bound" the turn amount to within certain limits
- Making more general functions. Functions can call other functions in this case the "step and turn" function wraps the "step" function, as well as adding some functionality.

# Sensors

Marty has a few sensors built in - electrical current sensing on most of the motors, an accelerometer for measuring tilt and acceleration, and a set of ports to which sensors like bump switches can be attached.

The electronics wiring diagram below shows how sensors can be attached, but these examples assume there is a bump switch on port 0 which is at the front of a foot, and a bump switch on port 1 which is on the bottom of a foot.



Connecting sensors to Marty. Cables go in with the black wire at the top, and the numbers here correspond to the "Input *n*" block in Scratch.

#### Reading a sensor (Video)

The "Input" block will let you read the current state of a switch. By assigning the sensor reading to a variable you can observe it in Scratch.

The switch will read "1" when pressed, and "0" when not pressed



# Walking to the edge (Video 1) (Video 2)

This example assumes there is a bump switch on the bottom of a foot and attached to port 1. At the end of each step, the switch can be checked to see if it is pressed. If it is a "1", the foot is touching the ground, if it is a "0" then it's not! We can use this to check if Marty has come to a ledge



#### Walking back from the edge (Video)



It's useful to do something a bit better than just reacting. Add some more blocks to make Marty do something useful when he reaches an edge. In the example above he'll walk back from the edge and turn around before walking more

#### Responding to a button press (Video)



This is a simple example of reacting to a button being pushed. Marty will wait until something touches the bump switch and will then kick

### Reading motor current (Video)



Motor current sensing lets you see roughly how much torque a motor is producing. The sensor reads a small value so you'll need to multiply it up as shown above.

In this example we link the torque on the right arm to the eyebrow position - push Marty's arm or put something heavy on it and he'll get angry!

### Using motor current as an input (Video)

ns up it 1 secs	
ever	
set right arm current 👻 to right arm 👻 n	notor Current
	tor Current 1000
if right arm current > 5 then	
Eyes angry	
arms down	
Kick right leg	define arms up
arms up	Move right arm to 28 degrees in 0.2 se
wait 1.0 secs	Move left arm to 35 degrees in 0.2 set
Eyes excited -	
if left arm current > 5 then	define arms down
Eyes wide	
arms down	Move right arm to o degrees in o secs
Kick left leg	Move left arm to 0 degrees in 0 secs
arms up	
wait 10 secs	
Eyes excited	

In this example, we're letting somebody give Marty instructions by pushing down on one of his arms. Pushing the right arm will make him kick his right leg, and pushing the left arm will make him kick the left leg.

### AND behaviour (Video)



If you want to get really snazzy you can make Marty do something different when *both* arms are pushed at the same time

# Getting Graphic (Video)



Scratch is also cool for displaying sensor readings. In this example we're showing the output from one of the motor current sensors as a graph.

To do this we create a sprite which is a simple circle in the center, then animate it with a pen