

Chapter 4. Color, Music, and Pizazz

Drawing thin white lines on a dull white screen gets real boring real fast. So before we go any further, let's add some pizazz to Logo procedures.

Add color to your procedures! Add music. Animate the turtle. Change its shape. Make flashing signs. There's all sorts of things you can do...too many to describe here. Let's get started. You can discover the rest on your own.

Adding Some Color

You can change the color of the background, the color used to fill shapes, and the color of the turtle's pen. You can even change the size of the turtle's pen.



Setting Colors

MSW Logo gives you far more than just the few colors Logo is using. MSW Logo color commands use three numbers to measure the mix of red, green, and blue.

SETPENCOLOR [255 255 255]...SETPC, for short...tells Ernestine what color to use to draw a line.

SETFLOODCOLOR [000 000 000]...SETFC, for short...lets you fill a closed shape with a color. You must go inside the shape to use this command.

SETSCREENCOLOR [255 000 000]...SETSC, for short...sets the background color to whatever you want it to be.

Look at the numbers inside the brackets. You can use any number from 0 to 255 for shades of red, green, and blue. With all those choices, you can make just about any color...more than 16 million if you want.

And, of course, setting all those numbers for all those colors can be a real hassle. So Morf went off and wrote some procedures to make life a bit easier. For example...

```
TO PINK  
OP [255 200 255]  
END
```

OP is the shortcut for OUTPUT. This is a command that must be used with another procedure. It does just what the name says, it outputs something to another command. You'll hear lots more about this in Part 2 of *The Turtle's Discovery Book*. For now, we'll keep it simple.

Before we get started with adding colors, here's a whole bunch of pen color procedures. They're in the COLORS.LGO procedure that was installed with MSW Logo.

TO BLACK
OP [000 000 000]
END

TO BLUE
OP [000 000 255]
END

TO BROWN
OP [128 64 0]
END

TO CYAN
OP [0 255 255]
END

TO DKGREEN
OP [0 128 128]
END

TO GREEN
OP [000 255 000]
END

TO GREY
OP [128 128 128]
END

TO MAGENTA
OP [255 0 255]
END

**TO OLIVE
OP [128 128 0]
END**

**TO ORANGE
OP [255 128 255]
END**

**TO PURPLE
OP [128 0 128]
END**

**TO RED
OP [255 0 0]
END**

**TO WHITE
OP [255 255 255]
END**

**TO YELLOW
OP [255 255 0]
END**

Now make some of your own color procedures...

**TO _____
OP [_____ _____ _____]
END**

**TO _____
OP [_____ _____ _____]
END**

```
TO _____  
OP [ _____ ]  
END
```

```
TO _____  
OP [ _____ ]  
END
```

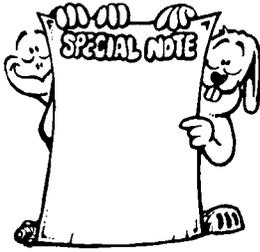
Now Morf doesn't need to remember all the different codes for colors. He simply adds the color name to his procedures.

SETPC BLACK sets the pen color to [000 000 000] or black.

SETFC BLUE sets the fill color to [000 000 255] or blue. Use it with the **FILL** command to fill closed shapes with color.

```
TO FILL.IT  
SETPC BLACK  
REPEAT 4 [FD 100 RT 90]  
PU RT 45 FD 40 PD  
SETFC RED FILL  
PU HOME PD  
END
```

The first thing this procedure does is draw a square using a black pen color. Then the turtle picks the pen up, moves inside the square, and puts the pen down. The flood color is set to red, and then the square is filled.



SPECIAL NOTE: If FILL didn't work just right on your computer, don't be too surprised. It works differently on different computers. The same goes for setting the screen color.

One way to fix the screen is to left-click on the Zoom menu and then select "In." The picture gets twice as big as it was. And the square should look filled. If not, another way to fix it is to "minimize" your screen and then restore it again. You can also move the Commander window over the drawing and then put it back where it belongs. (We talked about moving the Commander window back in chapter 2.)

Cyan is a light blue color. Let's set the screen to cyan, set the pen to red, and fill the square with yellow.

```
TO FILL.IT
SETSC CYAN
SETPC RED
REPEAT 4 [FD 100 RT 90]
PU RT 45 FD 40 PD
SETFC YELLOW FILL
PU HOME PD
END
```

That's not bad. But the red line is sorta thin.

Setting the Pen Size

Tired of skinny lines? Try colorful fat ones.

You can change the size of the lines that are drawn with the `SETPENSIZE` command. `SETPENSIZE` takes two inputs representing width and height.

There's a long technical reason why there are two numbers. The easy thing is to just remember that both numbers should be the same.

The standard or default values are `[1 1]`. You can make those values just about anything you want. Try this...

```
SETPENSIZE [500 500] FD 100
```

Now that just about fills the screen, doesn't it? So you need to be careful not to get too carried away.

Try this...

```
TO FILL.IT  
SETSC CYAN  
SETPC RED  
SETPENSIZE [5 5]  
REPEAT 4 [FD 100 RT 90]  
PU RT 45 FD 40 PD  
SETFC YELLOW FILL  
PU HOME PD  
END
```

There! Now you can see a bold red line.

Want to try something really new? How about this one! First, write a simple procedure to send the turtle forward and then back.

```
TO STAR  
LT 18 REPEAT 5 [FD 200 RT 144]  
END
```

Now let's add some pizazz!

```
TO PIZZAZ  
SETSC WHITE  
SETPENSIZ [120 120] SETPC PURPLE STAR  
SETPENSIZ [100 100] SETPC BLUE STAR  
SETPENSIZ [80 80] SETPC MAGENTA STAR  
SETPENSIZ [60 60] SETPC RED STAR  
SETPENSIZ [40 40] SETPC ORANGE STAR  
SETPENSIZ [20 20] SETPC YELLOW STAR  
SETPENSIZ [5 5] SETPC GREEN STAR  
END
```

Now that you have the pizazz, let's add some flash!

```
TO FLASH  
REPEAT 20 [CS SETSC BLACK PIZZAZ]  
END
```

Wow! Not bad, huh? Of course, what this looks like depends somewhat on the type of computer you are using. A 120 MHz Pentium is a lot faster than a 25 MHz 386 system.

Try something like this, maybe...

```
TO TRI  
REPEAT 3 [FD 200 RT 120]  
END
```

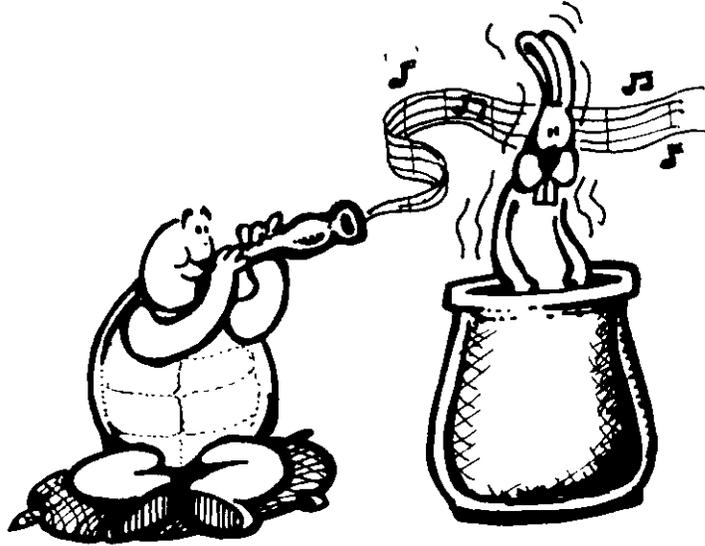
```
TO PIZZAZ
SETSC CYAN CS HT
PU LT 45 FD 100 RT 45 PD
SETPENSIZE [120 120] SETPC PURPLE RT 30 TRI
PU HOME LT 45 FD 80 RT 45 PD
SETPC BLUE RT 30 TRI
PU HOME LT 45 FD 60 RT 45 PD
SETPC MAGENTA RT 30 TRI
PU HOME LT 45 FD 40 RT 45 PD
SETPC RED RT 30 TRI
PU HOME LT 45 FD 20 RT 45 PD
SETPC ORANGE RT 30 TRI
PU HOME PD
SETPC YELLOW RT 30 TRI
PU HOME RT 135 FD 20 LT 135 PD
SETPC GREEN RT 30 TRI
END
```

This gives you another idea or two of what you can do with the basic color commands. We'll use these more as we go on. But for now, why not explore what you can do with color and the shapes that you know.

After that...how about some sound?

Add Some Sound Effects

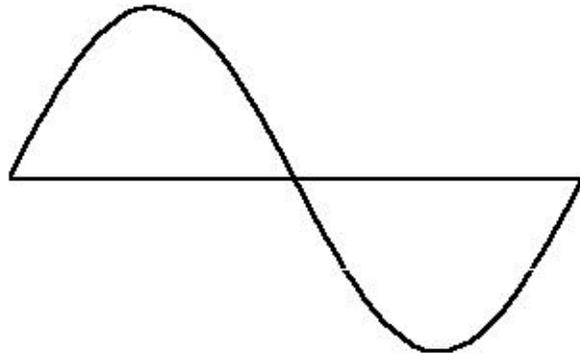
MSW Logo allows you to do lots of different things with sounds including music.



SOUND is the command for making music. It takes two inputs, the frequency of the sound and the length of time it is to play. The length of time, or duration, is based on the speed of your computer. So you'll have to do some experimenting to make it sound the way you want.

Frequency is the number of sound waves per second. So what's a sound wave you ask?

When you drop a pebble into a pool of water, you see the waves move out from where the pebble hit the water. Sound acts the same way. It travels in waves out in all directions from the source of the sound.



Think of that line through the middle as the pond when there are no waves. When you make a wave, part of it rises above the level of the pond. Part of it sinks below the level of the pond.

When you make lots of sound waves in each second, the sound is higher...fewer waves per second gives a lower sound. For example, when a piano wire vibrates 262 times each second, you get the note Middle C. When it vibrates 440 times each second, you get the note A above middle C...at 220 vibrations per second, you get the note A below middle C.

Here are two octaves of sounds you can use to play music.

FREQUENCY	NOTE
220	A (below Middle C)
223	A#
247	B
262	C (Middle C)
277	C#
294	D
311	D#
330	E
349	F
370	F#
392	G
415	G#
440	A
466	A#
494	B
523	C
554	C#
587	D
622	D#
659	E

698	F
740	F#
784	G
831	G#

Making Music

Time to put all this good sound stuff to use. First let's write procedures for the basic scale. Those are for the notes, C D E F G A B CC (that's high C).

```
TO C  
SOUND [262 100]  
END
```

```
TO D  
SOUND [294 100]  
END
```

```
TO E  
SOUND [330 100]  
END
```

```
TO F  
SOUND [349 100]  
END
```

```
TO G  
SOUND [392 100]  
END
```

```
TO A  
SOUND [440 100]  
END
```

**TO B
SOUND [494 100]
END**

**TO CC
SOUND [523 100]
END**

**Now you can start playing music from the keyboard.
Just press the letter for the note you want to hear and press
ENTER.**

**There's another way also...that's to write a song
procedure.**

**TO SAINTS
SOUND [262 100]
SOUND [330 100]
SOUND [349 100]
SOUND [392 300]
WAIT 50
SOUND [262 100]
SOUND [330 100]
SOUND [349 100]
SOUND [392 300]
WAIT 50
SOUND [262 100]
SOUND [330 100]
SOUND [349 100]
SOUND [392 200]
SOUND [330 200]
SOUND [262 200]
SOUND [300 200]
SOUND [294 200]
END**

Saints is a song popular in New Orleans...part of “When the Saints Go Marching In.”

We threw in another command you’ll find useful...the WAIT command. You’ll have to experiment with the numbers you use with WAIT to find what works best on your computer...just like duration. You need to find out what duration numbers work best for you.

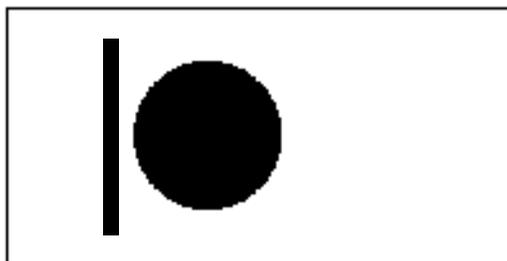
Rabbit Trail 12. Morf’s Shoebox Guitar



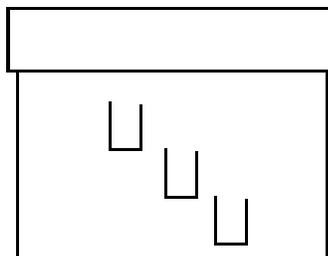
Here’s a real simple experiment you can do with sound and sound waves...make a shoebox guitar. No...it’s not Logo. But it’s fun anyway. If you want to learn how Logo and the computer can make music, try it out.

You’ll need a shoebox with a top, three small rubber bands...all the same size makes for the best demonstration, small scissors, and some tape.

1. Cut a round hole in your boxtop like this.



2. Tape the top of the box to the bottom.
3. Cut three small tabs on each end of the box as shown below.



4. Put the first rubber band under the first tab and stretch it over the top to the tab in the same position on the other end of the box.
5. Put the second rubber band under the middle tab and stretch over the top to the middle tab on the other end of the box.
6. Put the third rubber band under the third tab and stretch that over the top to the third tab on the other end of the box.
7. Slide a pencil under the rubber bands near the hole in the top...like the black line in the picture on the previous page.

If your rubber bands are not stretched pretty tight, find some smaller rubber bands. Now you're ready for some music.

When you strum your guitar, you're not going to sound like the newest country music star. But Morf doesn't sing very well either.

Back to business...when you strum the guitar, the rubber bands vibrate. This vibration is what makes sounds. Rubber bands that are stretched tighter vibrate faster, which makes them sound higher. Those that are not quite so tight don't vibrate quite so fast. These sound lower.

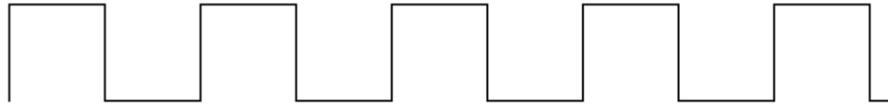
The box picks up the sound and makes it sound a bit louder. The sound goes through the hole and rattles around inside making it sound louder than if the hole wasn't there.

Tape a piece of paper over the hole in your box. When you strum your rubber bands, is the sound any different now?

OK, how does the computer make music?

The simple way is to have the computer turn the power up high and then down low for the frequency (number of times per second) and the duration you set. The sound

wave you get from this is more like a square wave than a nice rounded wave. That's why some simple sound effects played through the computer's speaker sound funny.

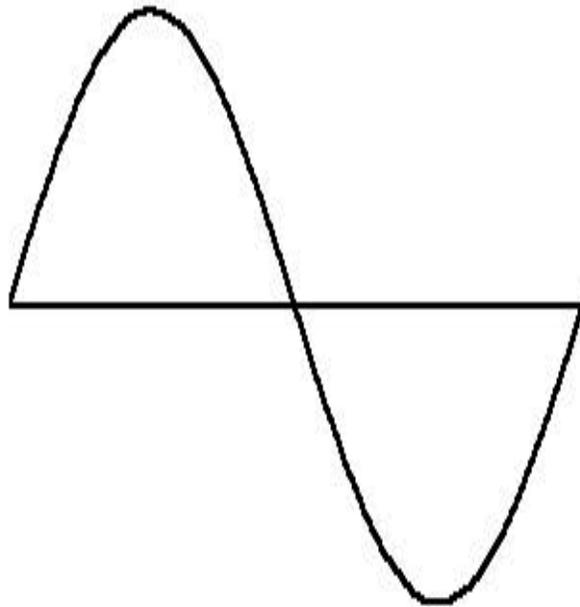


These electronic “square waves” make the computer’s speaker vibrate. And this vibration of the speaker is what lets you hear the sound you programmed.

Sounds lots better than a shoe box, doesn’t it?

There’s one more thing we need to talk about...and that’s loudness or volume. If you turn up the volume, does that change the frequency?

No...volume changes the height of the sound wave. But you still have the same number of waves per second.



What's the difference between this sound wave and the one a few pages back. The wave is as wide as the other one. That means it is the same frequency.

But it moves farther away from the center line. That means it is louder than the first sound wave.

Get it?

Good...now go have some fun with MSW Logo sounds.

Some More Ideas

You've added color and sound to your procedures. Before you go too far, why not see what you can do with these new commands.

What can you do with shapes now? Can you color them?

Why not draw a colorful birthday cake and then play Happy Birthday?

How about drawing colorful lines that streak across the screen...like a rock concert laser show? Remember the FLASH procedure? That gives you an idea on how to get started.

There's lots of things you can do to add pizazz to procedures right now. Give it a try. We've got lots more to do and see after this.

