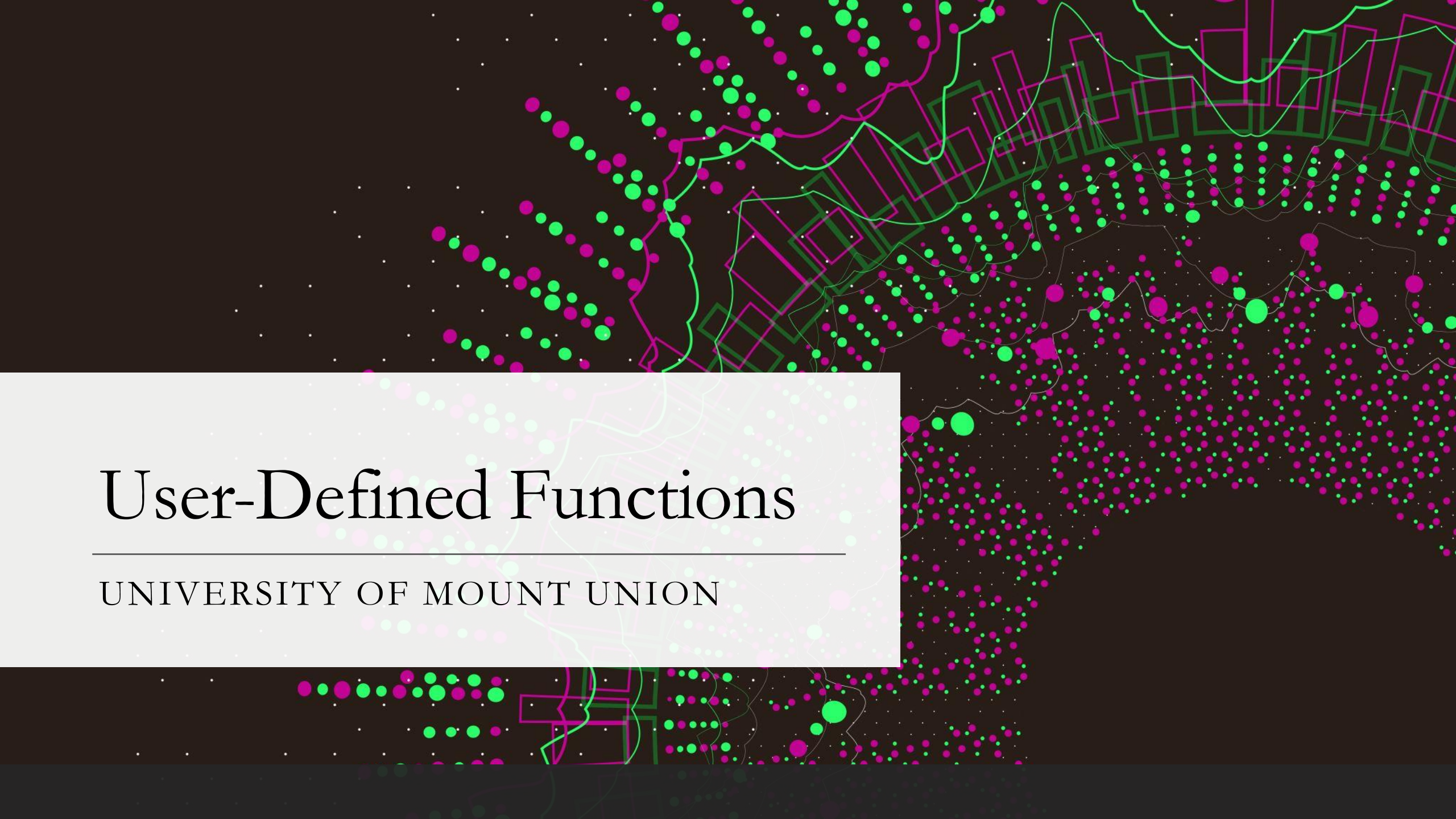

User-Defined Functions

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Functions in Processing

There are many built-in functions, and we've used quite a few already!

`setup()` and `draw()` run automatically

Other functions we've used include(but are not limited to) `size()`, `line()`, `ellipse()`, `rect()`, and `random()`

Why bother with functions?

Modularity: functions are independent software units that are used to build more complex programs.

Reusability: functions allow you to reuse code without having to retype it.

Defining a function

A function definition includes these parts:

- Return type
- Function name
- Parameters
- Code body

```
returnType functionName(parameters){
//code body of function
}
```

Calling a function

Any user-defined function must be called for it to run!

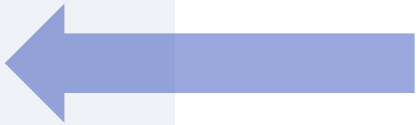
We call the function using its name and any necessary parameters inside parentheses, followed by a semicolon:

```
functionName(parameter1, parameter2, etc.);
```

Example 9-1

```
void setup() {
  println("Ready to roll!");
  rollDice(20);
  rollDice(20);
  rollDice(6);
  println("Finished.");
}

void rollDice(int numSides) {
  int d = 1 + int(random(numSides));
  println("Rolling... " + d);
}
```



Inside `setup()`, the user-defined function `rollDice()` is called three times. The first two times, the parameter 20 is passed into the function, and the last time, the parameter 6 is passed into the function.

Example 9-1

```
void setup() {
  println("Ready to roll!");
  rollDice(20);
  rollDice(20);
  rollDice(6);
  println("Finished.");
}

void rollDice(int numSides) {
  int d = 1 + int(random(numSides));
  println("Rolling... " + d);
}
```

Here is where the user-defined function `rollDice()` is defined. The word `void` means that no value is returned to the program (more on this later). The word `rollDice` gives us the name of the function. The parameter `int numSides` indicates that the function requires one parameter, an integer.

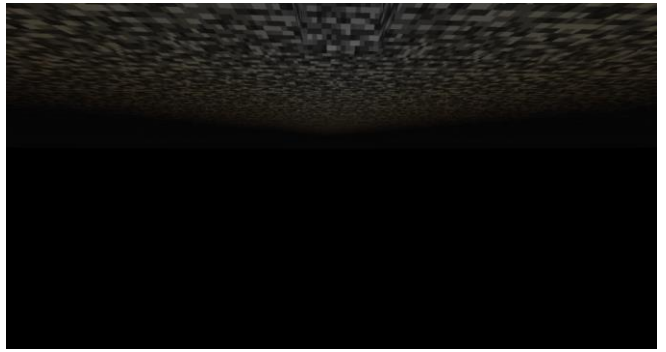
Example 9-1

```
void setup() {
  println("Ready to roll!");
  rollDice(20);
  rollDice(20);
  rollDice(6);
  println("Finished.");
}

void rollDice(int numSides) {
  int d = 1 + int(random(numSides));
  println("Rolling... " + d);
}
```

Here is the code body of `rollDice()`:
An integer variable `d` is assigned the value of `1+int(random(numSides)).`
With just one parameter, the `random()` function returns a random floating-point value between 0 and up to (but not including) that parameter value.
The function `int()` will convert that value to an integer using rounding.
Adding 1 to that integer will assign a value to `d` that is greater than 0 and less than or equal to the number of sides on the dice.
Then the function prints "Rolling…" and the value of `d` to the console using the `println()` function.

Return values



Remember when I said that'd we'd revisit "`void`"?

And remember that the Processing-defined function `random()` *returns* a floating-point number?

Functions can perform a calculation and then return a value to the main program. (Most of the functions we've used have not returned values, which is why their return type is "void").

Return values are frequently assigned to a variable or used as parameters in other functions.

```
float r = random(1, 10);

line(300, 300, random(0, 600), random(0, 600));
```

Returning a value with a user-defined function: Example 9-8

```
void setup() {
  float yourWeight = 132;
  float marsWeight = calculateMars(yourWeight);
  println(marsWeight);
}

float calculateMars(float w) {
  float newWeight = w * 0.38;
  return newWeight;
}
```

Inside `setup()`, the user-defined function `calculateMars` is called, and its return value is assigned to the floating-point variable `marsWeight`.

Returning a value with a user-defined function: Example 9-8

```
void setup() {
  float yourWeight = 132;
  float marsWeight = calculateMars(yourWeight);
  println(marsWeight);
}

float calculateMars(float w) {
  float newWeight = w * 0.38;
  return newWeight;
}
```

Here is the definition of `calculateMars()`. Hey, it's a function that *doesn't start with the word* `void`! This function returns a floating-point value, `newWeight`, to the program.