Datatypes and Functions

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Plan For Today

- Two ideas – data types and functions – are already familiar to you, because you've been using them
- Today, we teach their details
  - Data types
  - Functions
- Also, today, we'll cover some handy "tricks" using those ideas

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Data Types

- Information has certain properties … we group information with similar properties into "types" --
  - integers, or whole numbers
  - floating point, usually called decimal numbers
  - colors, a triple of numbers for R, G and B
  - Etc.
- In order for computers to process data, they need to know its type
- So, we always specify the data's type

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Give Datatypes in Declarations

- Processing has a series of datatypes
- The most important datatypes for us are int, float, boolean and color
  - Find details in the references
- When declaring variables we list them after the type, as in
  - int x, y, z;
  - float half_step = 0.5, whole = 1.0;
  - color yellow = color(200,200,0);

Primitive

long
color
double
char
float
int
boolean
byte

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Examples: At Top of a Program

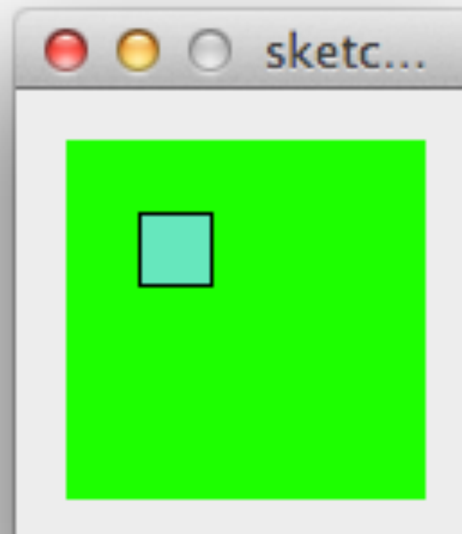
sketch_jan18b §

```
int i = 0;
int L, m, eN, Oh, pea;

float myTemp = 98.6;
float waterFreeze = 32;

color red = color(0,255,0), turquoise = color(100, 231, 192);

void setup( ) {
  size(100,100);
  background(red);
}
void draw( ) {
  fill(turquoise);
  rect(20, 20, 20, 20);
}
```



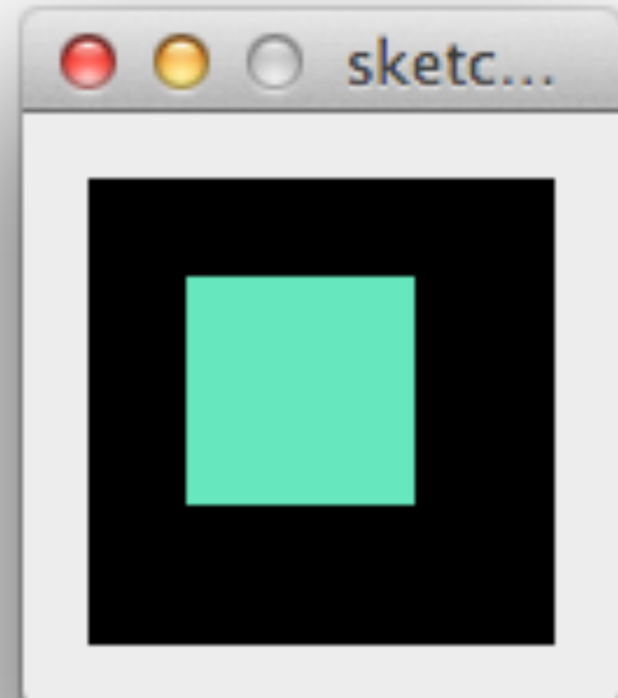
At The Top of Functions

sketch_jan18b §

```
int i = 30;

color turquoise = color(100, 231, 192);

void setup( ) {
  size(100,100);
  background(0);
}
void draw( ) {
  int inside = 30;
  fill(turquoise);
  rect(20, 20, 20+inside, 20+i);
}
```



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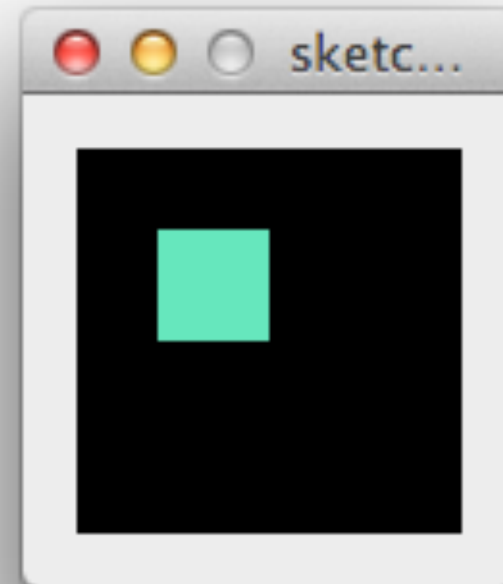
Global Variable Preserve Info

sketch_jan18b §

```
int i = 30;

color turquoise = color(100, 231, 192);

void setup( ) {
  size(100,100);
  background(0);
  i = i / 3;
}
void draw( ) {
  int inside=10;
  fill(turquoise);
  rect(20, 20, 20+i, 20+inside);
}
```



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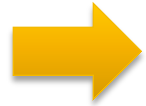
Hiding In Another Function …



```
int i = 30;

color turquoise = color(100, 231, 192);

void setup( ) {
  int inside = 30;
  size(100,100);
  background(0);
}
void draw( ) {
  fill(turquoise);
  rect(20, 20, 20+inside, 20+i);
}
```

Cannot find anything named “inside”

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Functions, A Review

- Functions have been used in Lightbot 2.0: F1
- Functions in HW 03: F.turn( ), HW 05: Cols …
- We've used functions, also known as
  - procedures, methods, subroutines

  in all of our Processing code: size(200, 200)
- Recall that functions have two parts:
  - function definition … declaration of its instructions
  - function call … a request to run the function
- Let's get the details down now …

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Functions In Processing

- The form of function definition in Processing

  <return type> *<name>* (*<param list>*) {

  <body>

  }

as in

```
void draw_a_box (int x_pos, int y_pos) {
        rect(x_pos, y_pos, 20, 20);
}
```

or

```
color pink ( ) {
        return color(255, 200, 200);
}
```


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Functions In Processing

- The form of function definition in Processing

<*return type*> <*name*> (<*param list*>) {

<*body*>

}

as in

```
void draw_a_box (int x_pos, int y_pos) {
        rect(x_pos, y_pos, 20, 20);
}
```

or

```
color pink ( ) {
        return color(255, 200, 200);
}
```


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Functions In Processing: Result

- Functions that do something, but do not return a value, have **void** as their <*return type*>
- Functions that return a value must say the datatype of the value returned

```
void draw_a_box (int x_pos, int y_pos) {
        rect(x_pos, y_pos, 20, 20);
}
color pink ( ) {
        return color(255, 200, 200);
}
```


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Functions In Processing: Params

- Parameters are the values used as input to the function; parameters are not required, but the parentheses are
- The type of each parameter must be given

```
void draw_a_box (int x_pos,  int y_pos) {
        rect(x_pos, y_pos, 20, 20);
}
color pink (  ) {
        return color(255, 200, 200);
}
```


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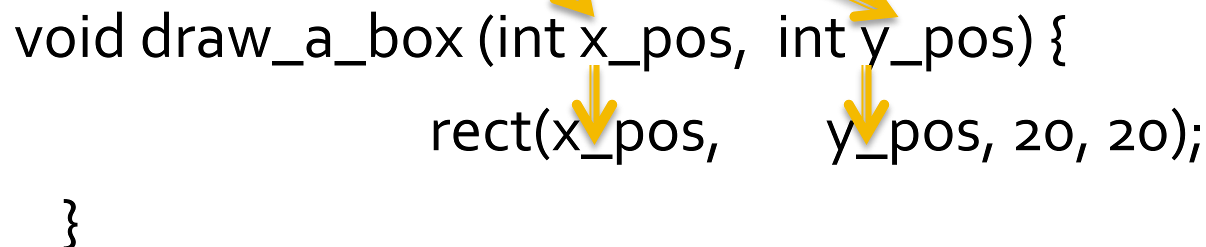
Functions In Processing: Args

- An argument is the input value given to a parameter when a function is called, as in draw_a_box(50, 200);
- The value of the argument becomes the value of the corresponding parameter:
  - draw_a_box(50, 200);



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Functions In Processing: Return

- A function returns its value with the **return** statement … the stuff following return is the result
- The function is done when it reaches return

```
void draw_a_box (int x_pos,  int y_pos) {
            rect(x_pos, y_pos, 20, 20);
}
color pink (  ) {
            return color(255, 200, 200);
}
```


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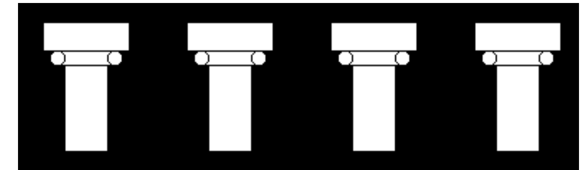
Plan The Function in Declaration

- The function has a name, parameters, def
  - Name: `drawColumn`
  - Parameters: `int offset;`
  - Definition:



```
rect(20+offset, 250, 60, 20);
rect(30+offset, 270, 40, 10);
ellipse(30+offset, 275, 10, 10);
ellipse(70+offset, 275, 10, 10);
rect(35+offset, 280, 30, 60);
```

  - Nothing has to be returned

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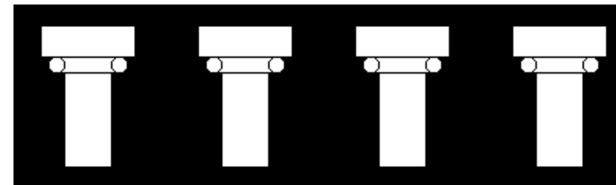
The Function Declaration & Calls

- The result:

```
void drawCol( int offset) {           // Draw a Column
  rect(20+offset, 250, 60, 20);       // Top stone
  rect(30+offset, 270, 40, 10);       // Stone below it
  ellipse(30+offset, 275, 10, 10);    // Left curl
  ellipse(70+offset, 275, 10, 10);    // Right curl
  rect(35+offset, 280, 30, 60);       // Actual column
}
```

- The calls

```
fill(255);
drawCol(0);
drawCol(100);
drawCol(200);
drawCol(300);
}
```



Parameters

- Parameters are automatically declared (and initialized) on a call, and remain in existence as long as the function remains unfinished
- When the function ends, the parameters vanish, only to be recreated on the next call
- It is wise to choose parameter names, e.g. o-f-f-s-e-t that are meaningful to you
  - I chose offset as the orientation point of the figure in the x direction
  - Notice that I used that name a lot, and the meaning to me remained the same

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Arguments Become Parameters

- Notice that if the DEFINITION has *n* parameters, the CALL needs *n* arguments
- The parameters and arguments correspond

```
void draw( ) {
  fill(255);
  hexa(20, 40);
  hexa(50, 40);
  hexa(80, 40);
}
```

Inside of the function, the parameter, e.g. xbase, is declared and initialized to the corresponding argument, e.g. 80. Then, the definition uses it, e.g.

`rect(80, 40+10, 20, 40)`

```
void hexa(float xbase, float ybase) {
  rect(xbase, ybase+10, 20, 40);
  triangle(xbase, ybase+10, xbase+20, ybase+10, xbase+10, ybase);
  triangle(xbase, ybase+50, xbase+20, ybase+50, xbase+10, ybase+60);
}
```


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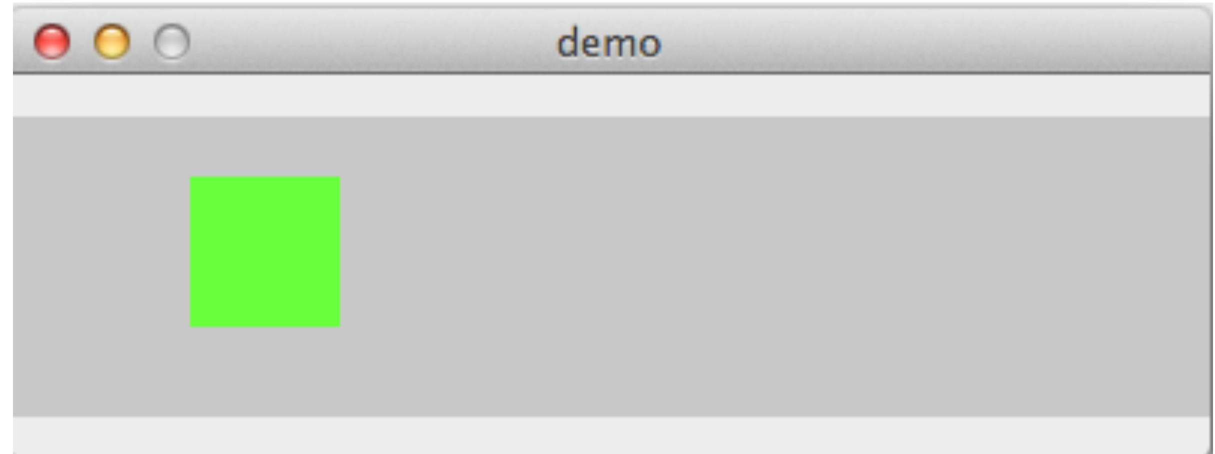
Using Functions + Global Variables

```
int x = 0;
int dir = 1;

void setup ( ) {
  size(400,100);
  noStroke( );
}
void draw( ) {
  background(200);
  fill(100, 255, 100);
  rect(20+x, 20, 50, 50);
  x = x+dir;
}

void mousePressed( ) {
  dir = 0 - dir;
}
```



Mouse clicks control the direction …
`dir` flips from 1 to -1 on each click

Summary on Functions

- When we have something we have to produce and perhaps use repeatedly, we need a function
- We need two things: a declaration, and calls
  - The declaration is the function “package”
  - The call is the use, where we ask to “run” it
- So we declared the function, and called it
  - Need to follow the rules on form: “void”, parens, give type of parameters, curly braces, indent, comment, ...
  - Use parameter values where changes are needed

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