

## Animation

## Active Sketches: Interaction vs Animation

In *interaction*, the changes over time are driven by user actions.

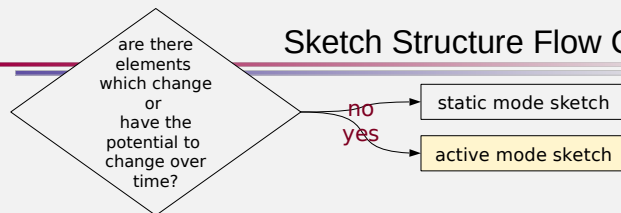
- mouse or keyboard actions

In *animation*, the changes over time are driven (only) by the passage of time.

A sketch can include both interaction and animation at the same time.

are there elements which change or have the potential to change over time?

## Sketch Structure Flow Chart

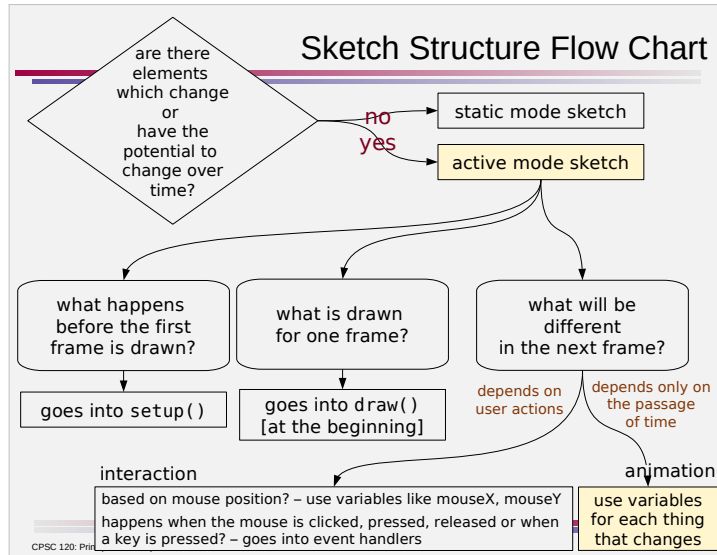


## Active Mode vs Static Mode

- active mode
  - two sets of instructions
  - things that happen once at the beginning – in `setup()`
  - things that happen to draw on frame – in `draw()`
- static mode
  - just one list of instructions

```
void setup () {  
  // open window  
  ...  
  // other things done only  
  // once at the beginning  
  ...  
}  
void draw () {  
  // draw one frame  
  ...  
  // update what changes for  
  // next frame  
  ...  
}
```

```
// open drawing window  
...  
// clear background  
// draw stuff  
...
```



## Variables

In a static sketch, the position, size, and color of each shape is hardcoded.

```
fill(255,0,0);
rect(100,100,100,100);
```

- changing the value means changing the code itself and running the program again

For values that change over time, we need variables.

## Variables

A *variable* is a name which has an associated value.

- when a statement containing the name of a variable is executed, the computer looks up and substitutes in the current value of the variable



```
// draw a rectangle whose upper left corner
// is at the mouse's current position
rectMode(CORNER);
rect(mouseX,mouseY,50,50);
```

- system variables are defined and maintained by the system
- ★ other variables must be defined and maintained by the programmer

## (Non-System) Variables

Four steps –

- declare** – “hey computer, this name is going to mean something!”
  - variable must be declared before initialization
- initialize** – give it a starting value
  - variable must be initialized before use or update
- use** – to draw (or whatever)
- update** – change its value

```
// rectangle moves to the right
int x; // x coordinate of the center

void setup () {
  // open window
  size(800, 400);

  // initialize variables
  x = 0;
}

void draw () {
  // draw one frame
  background(255);
  rectMode(CENTER);
  stroke(0);
  fill(255, 0, 0);
  rect(x, 200, 60, 20);

  // update variables
  x = x+1;
}
```

## (Non-System) Variables

Four steps –

1. **declare** – “hey computer, this name is going to mean something!”
  - variable must be declared before initialization
2. **initialize** – give it a starting value
  - variable must be initialized before use or update
3. **use** – to draw (or whatever)
4. **update** – change its value

```
type name; // description
```

- *type* specifies what kind of value the variable stores
  - `int` – whole numbers
  - `float` – numbers with decimal points
  - `boolean` – true or false
- *name* should be brief but descriptive
  - convention is to start with lowercase letter and separate words with capital or `_`
  - case-sensitive
- *description* provides info not apparent from the declaration itself

```
name = value;
```

- *value* can be a literal or an expression
  - as an expression, it can reference the variable *name*
- the value of *value* is computed and then stored in *name*, replacing any value already there

## Animation Questions

What changes (or has the potential to change) from one frame to the next?

→ one variable for each thing identified

For each variable –

- what kind of value is it? → type, for the declaration
  - whole numbers → `int`
  - numbers with decimal points → `float`
  - true or false → `boolean`
- where does it start? → initialization
- how does it change? → update

## Structural Pattern – Animation

Where does stuff go?

Animation variables are usually –

- declared at the very beginning of the sketch, before `setup()` and `draw()`
- initialized in `setup()`
- used and updated in `draw()`

## Animation Questions

What changes (or has the potential to change) from one frame to the next?

→ one variable for each thing identified

For each variable –

- what kind of value is it? → type, for the declaration
  - whole numbers → `int`
  - numbers with decimal points → `float`
  - true or false → `boolean`
- where does it start? → initialization
- how does it change? → update

for a rectangle moving to the right...  
x position of the rectangle

number – either whole number or number with decimal point

on the left side – 0

add – update by 1

```
// rectangle moves to the right...  
// right  
int x; // x coordinate of the center  
  
void setup () {  
  // open window  
  size(800, 400);  
  // initialize variables  
  x = 0;  
  
  void draw () {  
    // draw one frame  
    background(255);  
    rectMode(CENTER);  
    stroke(0);  
    fill(255, 0, 0);  
    rect(x, 200, 60, 20);  
    // update variables  
    x = x+1;  
  }  
}
```