

CS1013 - Programming Project

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Program structure

- Get the structure of your program right and putting it together will be a lot easier.
- Classes are good for providing a clear structure, and help to keep your code clean, so that the code is easier to maintain and improve.
- Why write hideously complex, unmaintainable code to avoid using classes?

The alien example

Main program:

setup()

- create a new Alien object

draw()

- ask alien object to move itself
- ask alien object to draw itself

```
class Alien
  move()
  draw()
```

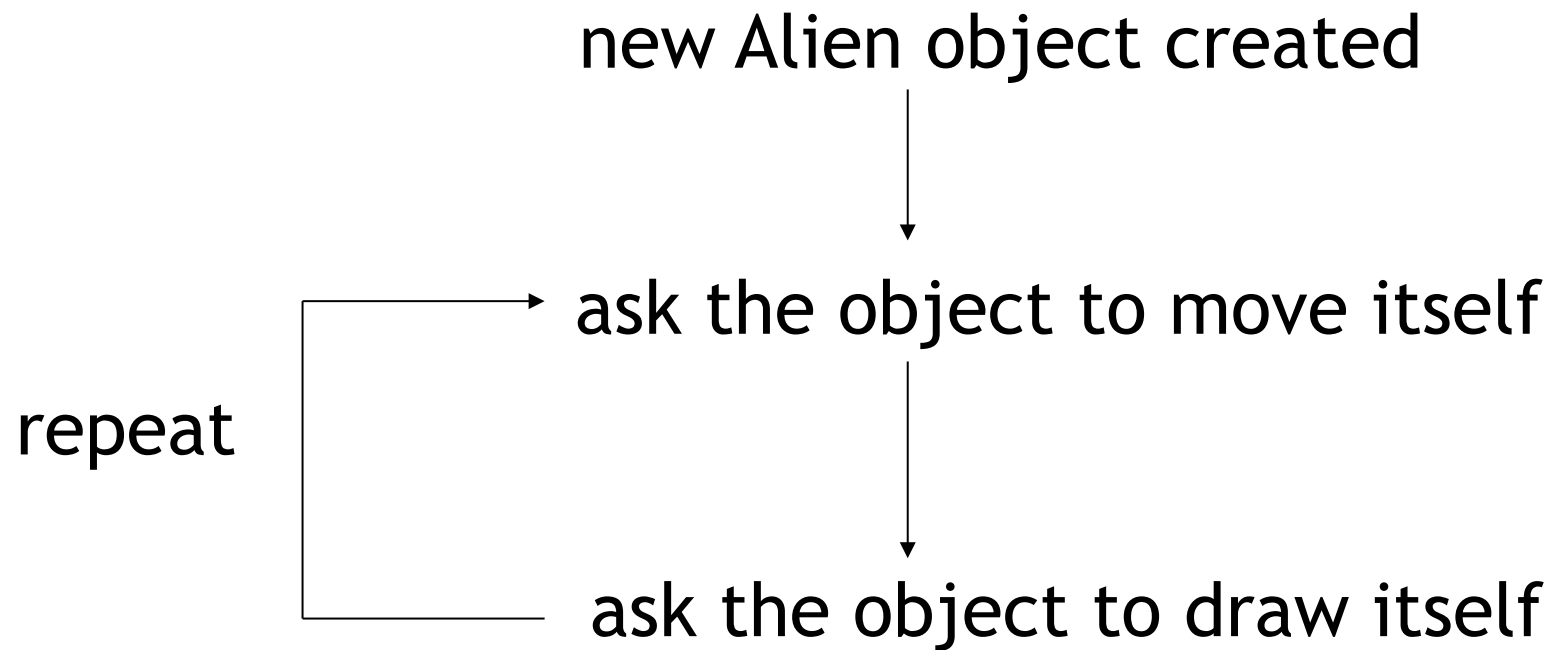
myAlien:
x: 100; y: 100;

move

draw

One Alien

- Start out with one alien object.



Two Aliens

- Using a class already starts to pay off when we have more than one alien:

```
firstAlien = new Alien(100, 100);  
secondAlien = new Alien(100+ALIENWIDTH, 100);  
.  
.  
.  
.  
firstAlien.move(); secondAlien.move();  
firstAlien.draw(); secondAlien.draw();
```

Many Aliens

- Pretty tedious and inflexible to code all the aliens by hand. Just use an array.

```
/* This creates something we can  
   point to an array of Aliens with */  
Alien theBaddies[];
```

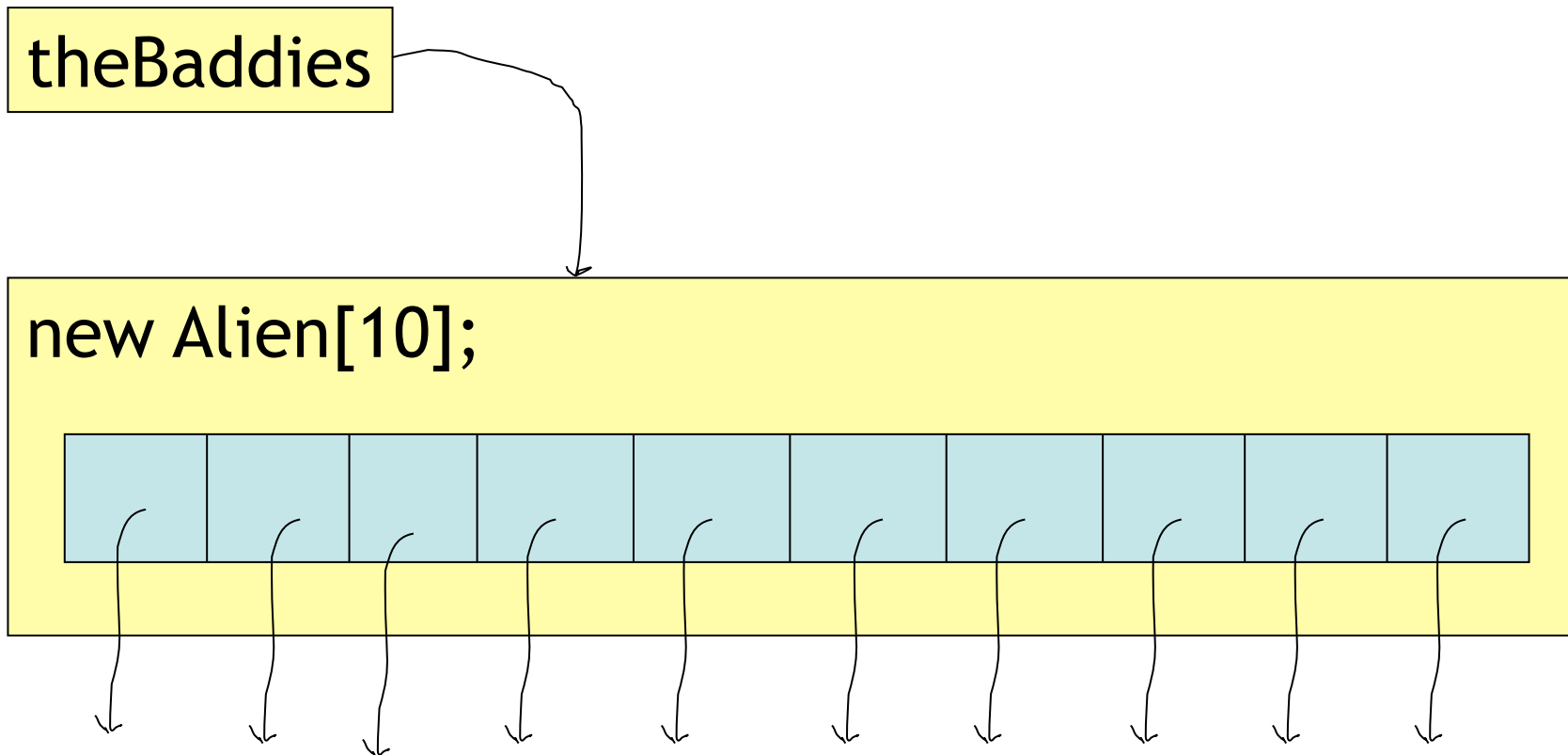
```
void setup(){  
  // Now it points at an empty array  
    theBaddies = new Alien[10];  
}
```


What is happening?

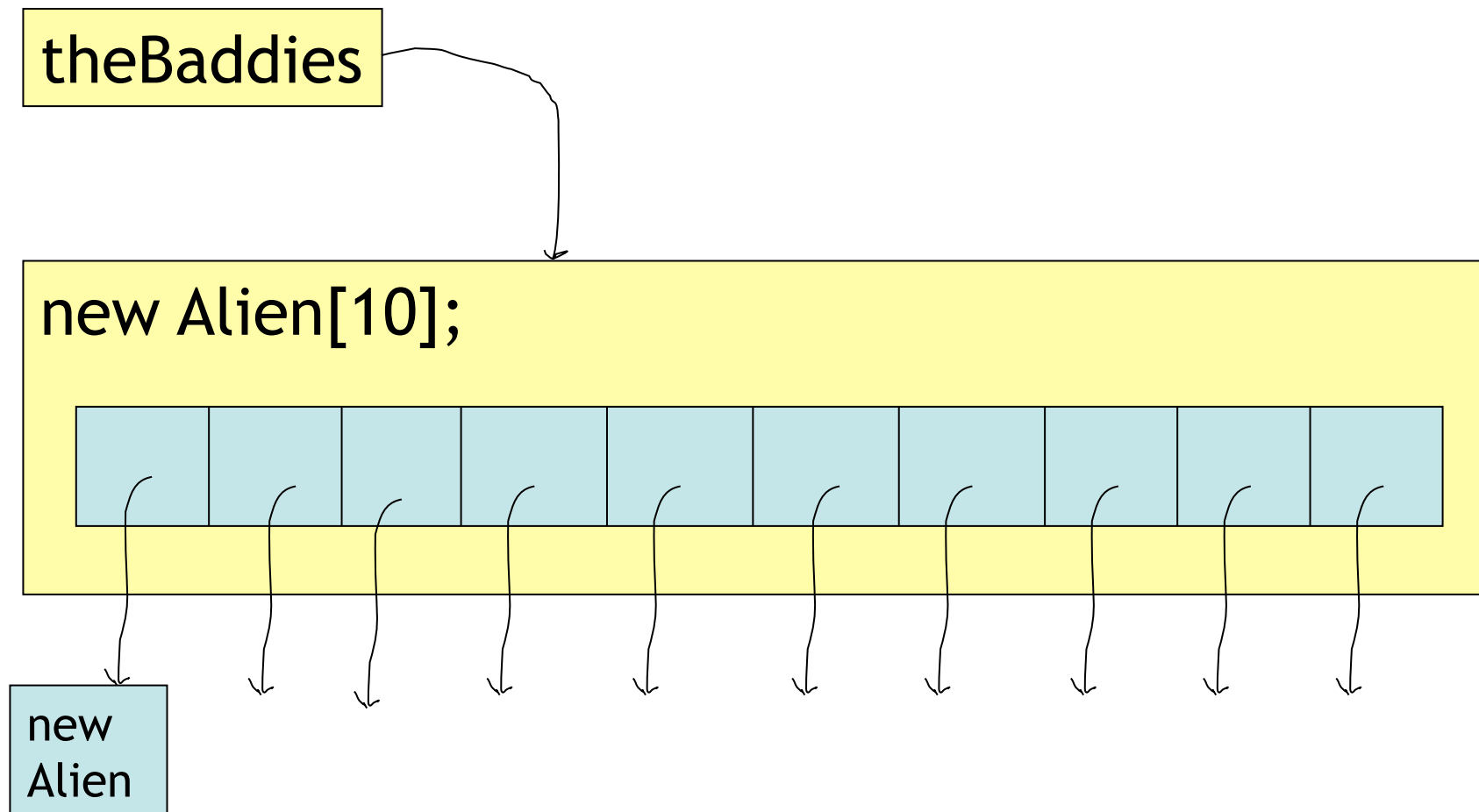
theBaddies



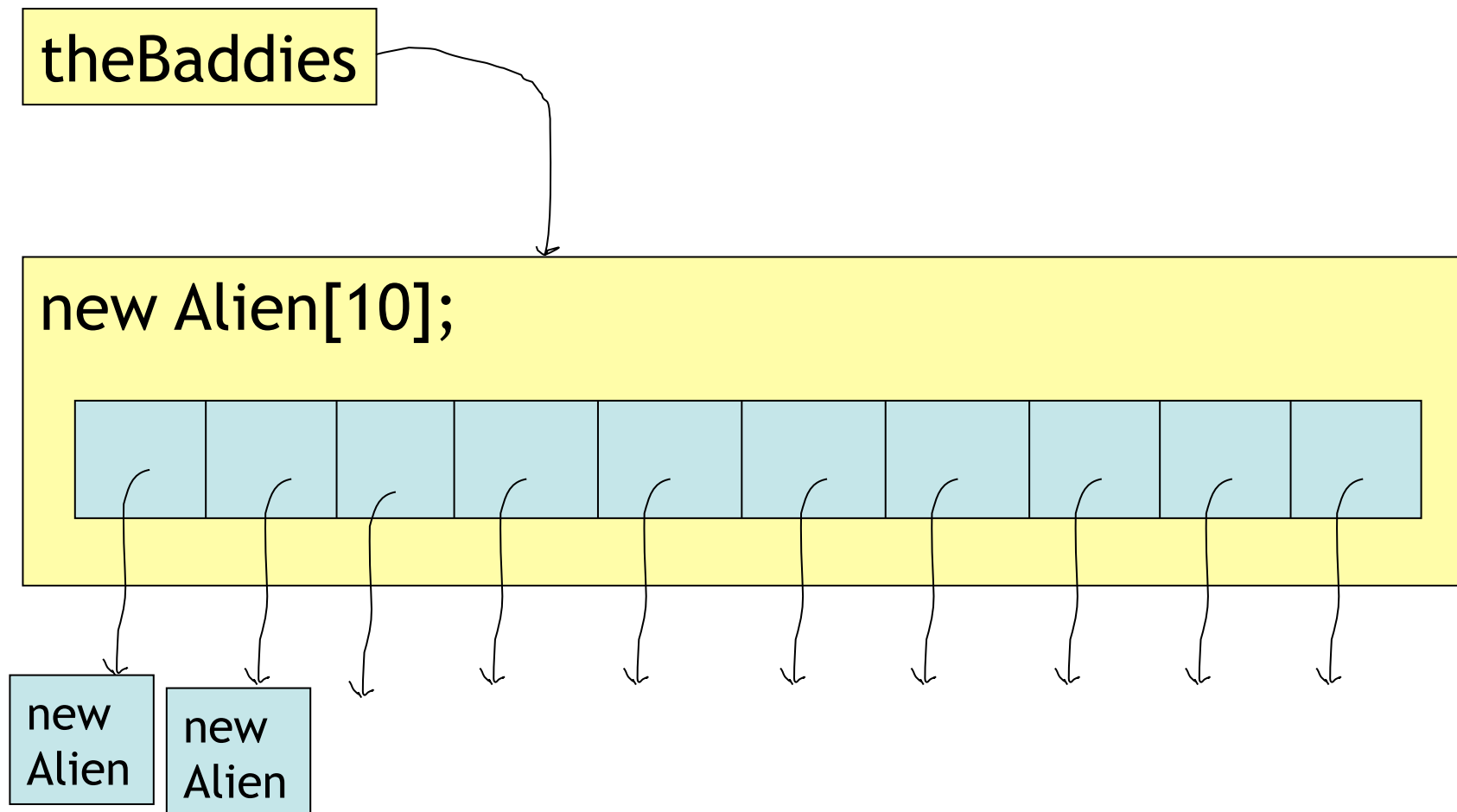
What is happening?



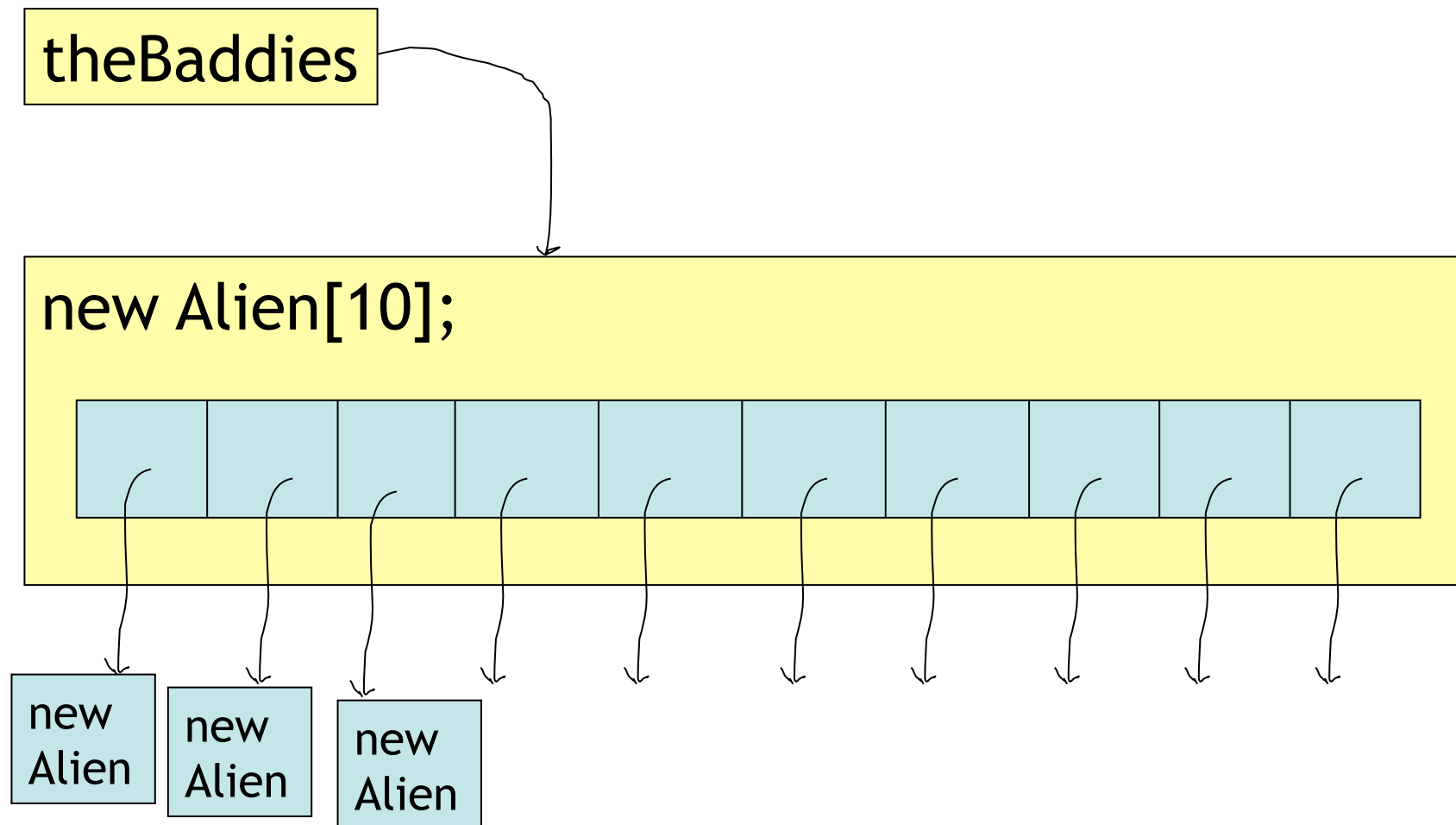
What is happening?



What is happening?



What is happening?



Many aliens

- When we run the program:
 - Create an empty array of Aliens with 10 positions in it.
 - Assign this new array to theBaddies so we can use it.
 - Go through the array and create a new Alien object to go in to each position in the array.

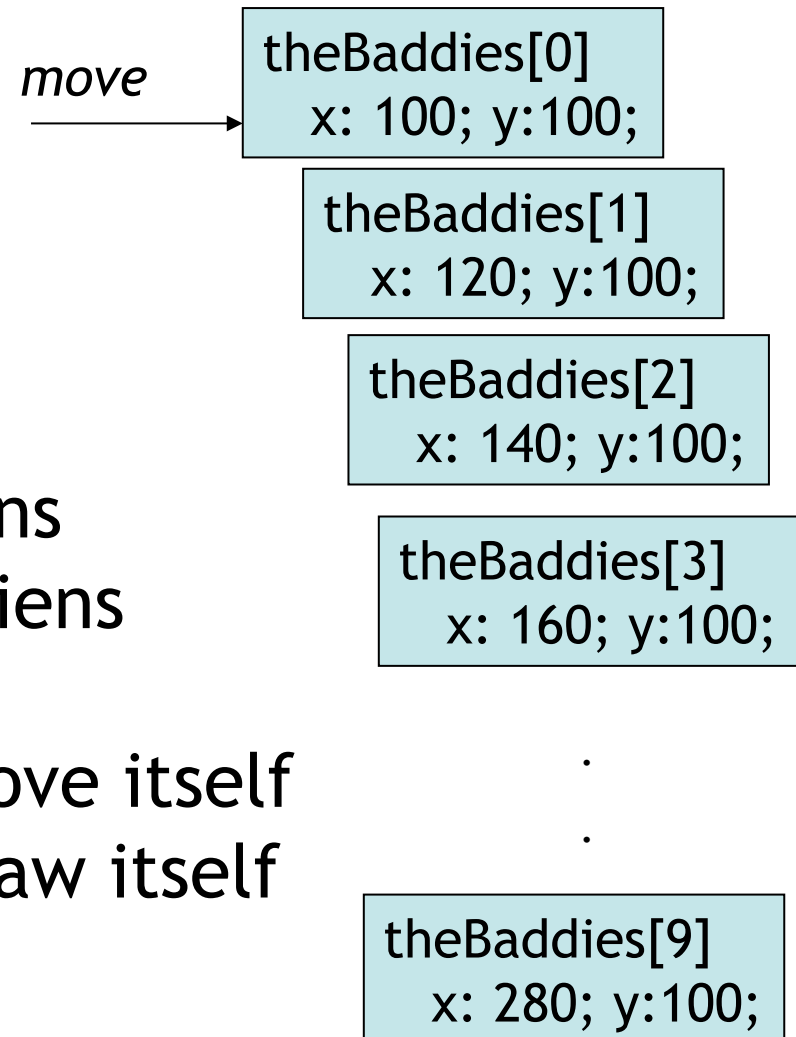
The alien example

Main program
setup()

- create an array to hold Aliens
- fill in the array with new Aliens

draw()

- ask each alien object to move itself
- ask each alien object to draw itself



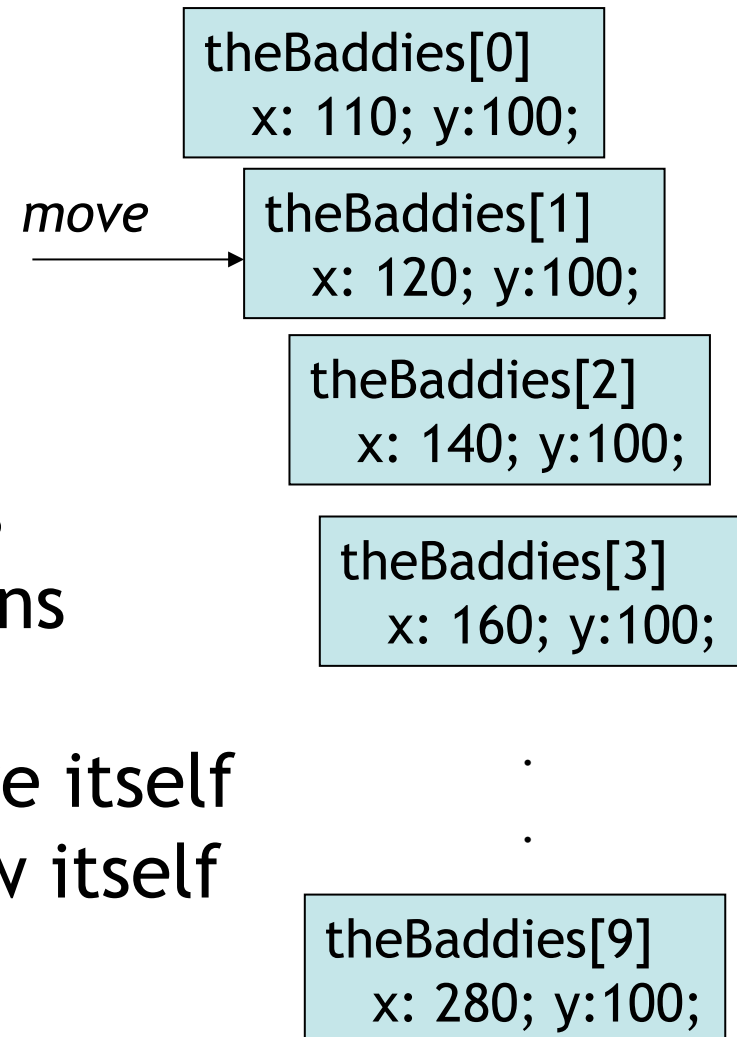
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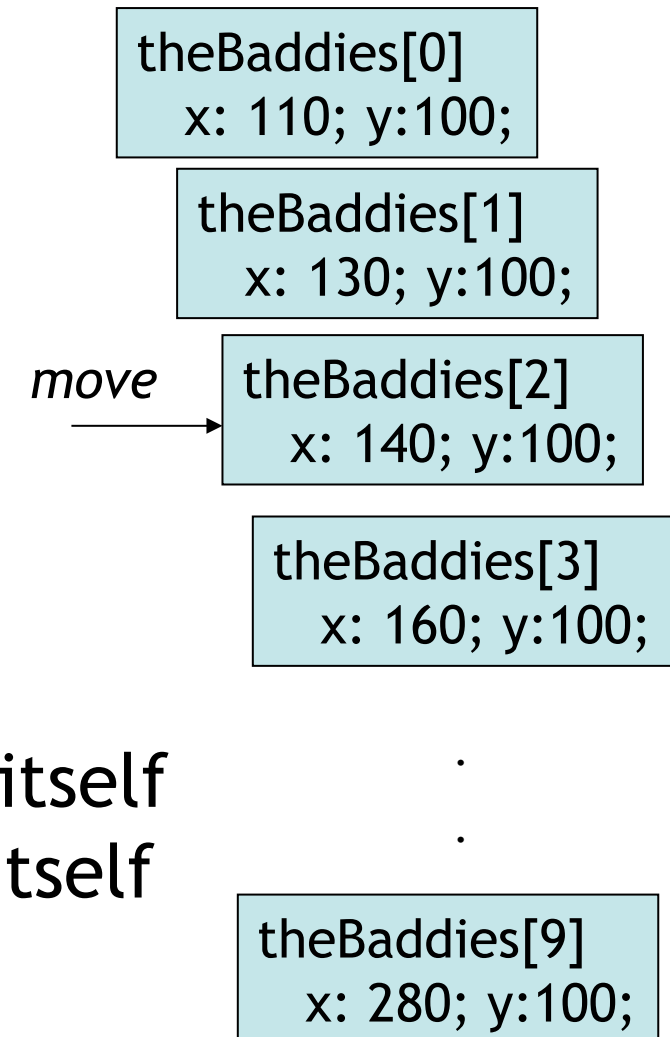
The alien example

Main program
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The alien example

Main program
setup()

- create an array to hold Aliens
- fill in the array with new Aliens

draw()

- ask each alien object to move itself
- ask each alien object to draw itself

theBaddies[0]
x: 110; y:100;

theBaddies[1]
x: 130; y:100;

theBaddies[2]
x: 150; y:100;

move → theBaddies[3]
x: 160; y:100;

·
·

theBaddies[9]
x: 280; y:100;

The alien example

Main program
setup()

- create an array to hold Aliens
- fill in the array with new Aliens

draw()

- ask each alien object to move itself
- ask each alien object to draw itself

theBaddies[0]
x: 110; y:100;

theBaddies[1]
x: 130; y:100;

theBaddies[2]
x: 150; y:100;

theBaddies[3]
x: 170; y:100;

·
·

move
→

theBaddies[9]
x: 280; y:100;

The alien example

Main program
setup()

- create an array to hold Aliens
- fill in the array with new Aliens

draw()

- ask each alien object to move itself
- ask each alien object to draw itself

theBaddies[0]
x: 110; y:100;

theBaddies[1]
x: 130; y:100;

theBaddies[2]
x: 150; y:100;

theBaddies[3]
x: 170; y:100;

·
·

move
→

theBaddies[9]
x: 290; y:100;

Arrays of objects

- We see a similar pattern to a lot of our code:

Pseudo-code:

```
for (each position in the array) {  
    tell the object at that position to do  
    something.  
}
```

Arrays of objects

- Overall pattern will be:
 - Declare the array - this creates a placeholder for it.
 - Create the empty array with a particular number of positions.
 - Fill in the array
 - For each position in the array, create a new object.
 - What happens if we don't do this?
- To draw the array
 - For each position in the array, call the draw method for the object in that position.

Initialisation

```
Alien theAliens[];
```

```
void setup(){
    PImage normalImg, explodeImg;

    size(SCREENX, SCREENY);
    normalImg= loadImage("invader.GIF");
    explodeImg = loadImage("exploding.GIF");
    theAliens = new Alien[10];
    init_aliens(theAliens,normalImg, explodeImg);
}

void init_aliens(Alien baddies[], PImage okImg, PImage
    exImg){
    for(int i=0; i<baddies.length; i++){
// This is buggy, what is the problem?
        baddies[i] = new Alien(i*(okImg.width+GAP), 0, okImg,
            exImg);
    }
}
```

class Alien

```
class Alien {  
    int x, y, direction;  
    int status;  
    PImage normalImg, explodeImg;  
  
    Alien (int xpos, int ypos, PImage okImg, PImage exImg){  
        x = xpos;  
        y = ypos;  
        status = ALIEN_ALIVE;  
        normalImg=okImg;  
        explodeImg=exImg;  
        direction=FORWARD;  
    }  
}
```

Alien.move

```
void move(){
    if(direction==FORWARD){
        if(x+normalImg.width<SCREENX-1)
            x++;
        else{
            direction=BACKWARD;
            y+=normalImg.height+GAP;
        }
    }
    else if(x>0) x--;
    else {
        direction=FORWARD;
        y+=normalImg.height+GAP;
    }
}
```


Alien.draw & Alien.die

```
void draw(){
    if(status==ALIEN_ALIVE)
        image(normalImg, x, y);
    else if(status!=ALIEN_DEAD){
        image(explodeImg, x, y);
        status++;
    }
    // otherwise dead, don't draw anything
}
```

```
void die(){
    if(status==ALIEN_ALIVE)
        status++;
}
```

Constants

```
final int SCREENX=400;  
final int SCREENY=400;  
final int GAP=10;  
final int ALIEN_ALIVE=0;  
final int ALIEN_DEAD=6;  
final int FORWARD=0;  
final int BACKWARD=1;
```

Main draw method

```
void draw(){
    background(0);
    for(int i=0; i<theAliens.length; i++){
        theAliens[i].move();
        theAliens[i].draw();
        if(random(0, 500)<1)theAliens[i].die();
    }
}
```

So far:

- A Player which follows the users movement across the screen.
- A Ball which moves about the screen which we can ask whether it has hit anything.
- Aliens which flow down the screen, randomly exploding.

Tomorrow's exercise

1. Building on the *Alien* class from last week (or the sample code given in the lecture), and the *Player* class from week 2, add a *Player* object to your program so that the *Player* can be moved around at the bottom of the screen while the *Aliens* move across and down the screen. (4 marks).

Tomorrow's exercise (2)

2. Add a ***Bullet*** class with a move method which moves the ***Bullet*** up the screen, and a draw method which draws the bullet. An instance of the ***Bullet*** class should be created at the ***Player's*** position when the mouse button is pressed. (3 marks)

Tomorrow's exercise (3)

3. Implement a collide method in the *Bullet* class to check whether the bullet has collided with an *Alien*. The array of *Aliens* should be passed as an argument to this method. Note - A single bullet can hit multiple aliens, these are futuristic bullets. (3 marks)