Putting it All Together

Friday Four Square!
Outside Gates, 4:15PM

Artistry Submissions

An Interesting Listen
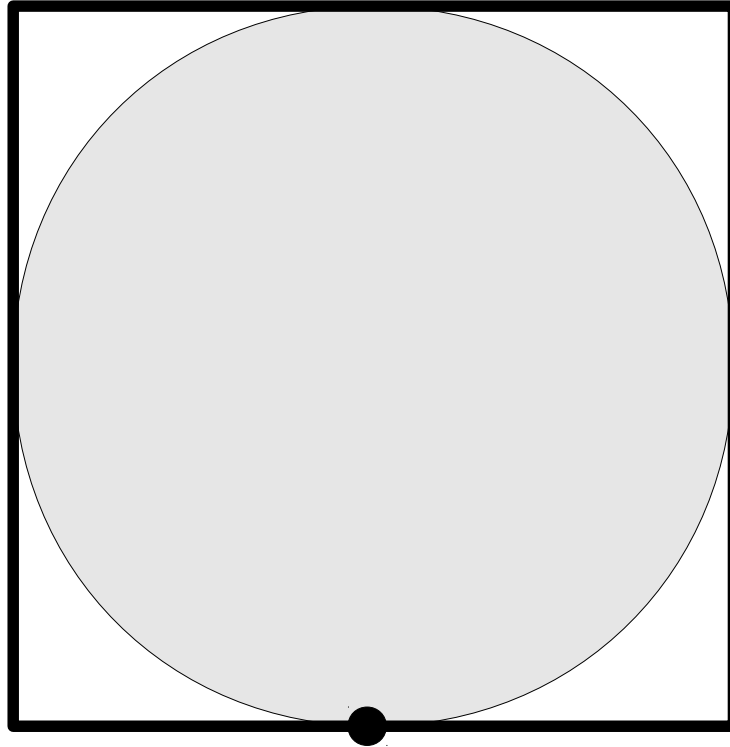
RadioLab: "Talking to Machines"
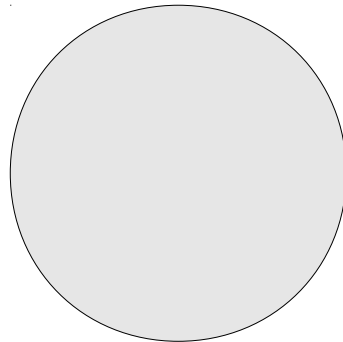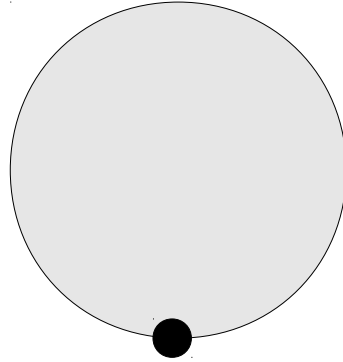http://www.radiolab.org/2011/may/31/
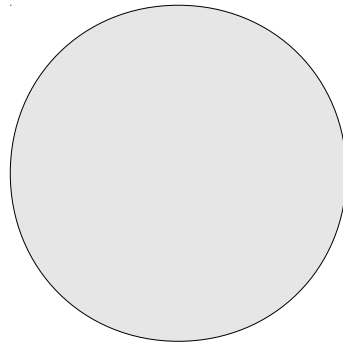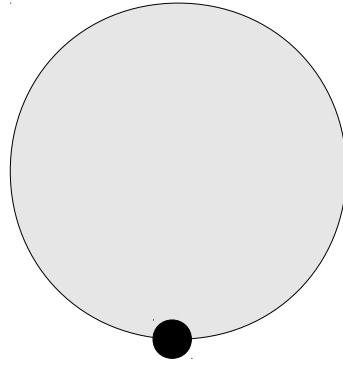
Snowfall Revisited

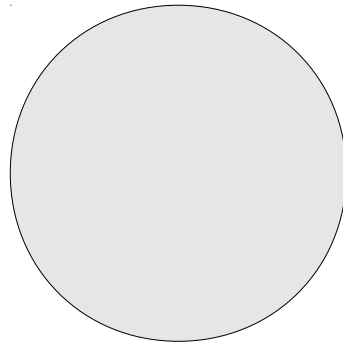# A Simple Collision Detector
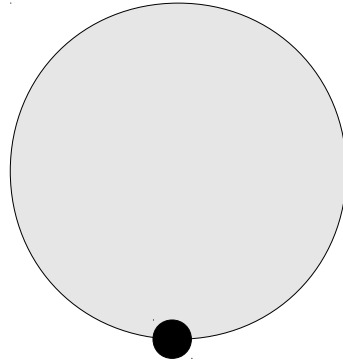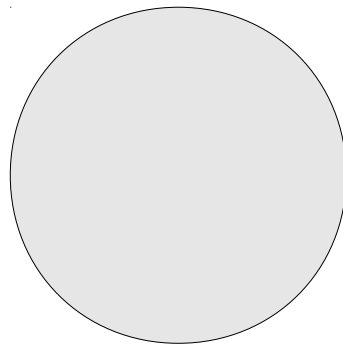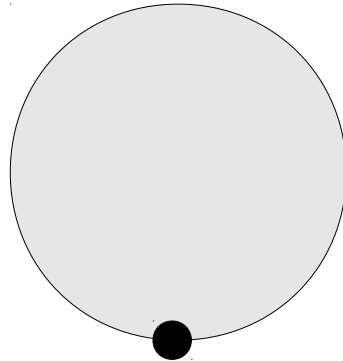
(x, y)

(x + r, y + 2r)

(x + 2r, y + 2r)

A Simple Collision Detector

A Simple Collision Detector

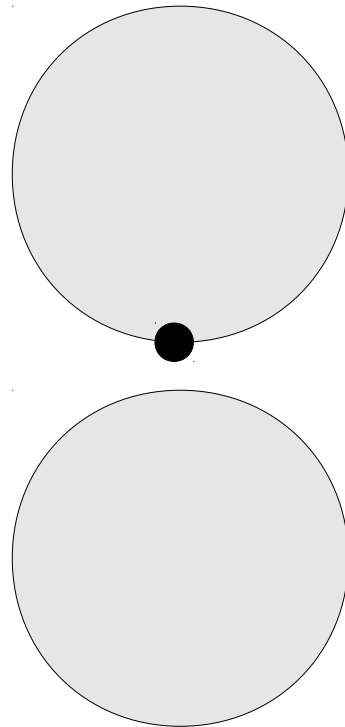# A Simple Collision Detector

A Simple Collision Detector

A Simple Collision Detector

A Simple Collision Detector

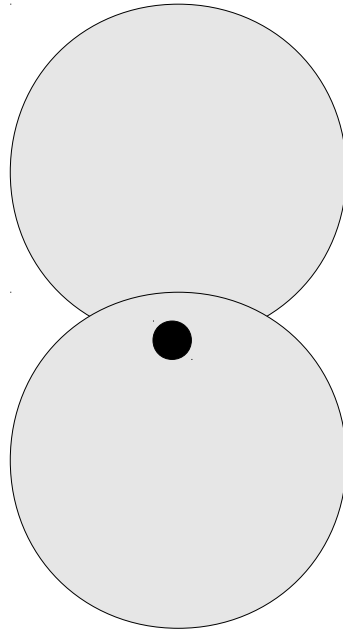# Combining Animation and Events

The Chaos Game

- Pick any three points.
- Starting at any of the points:
    - Choose one of the three points randomly.
    - Move halfway from your current location to the chosen point.
    - Draw a dot at your current location.
    - Repeat.

Sierpinski Triangle
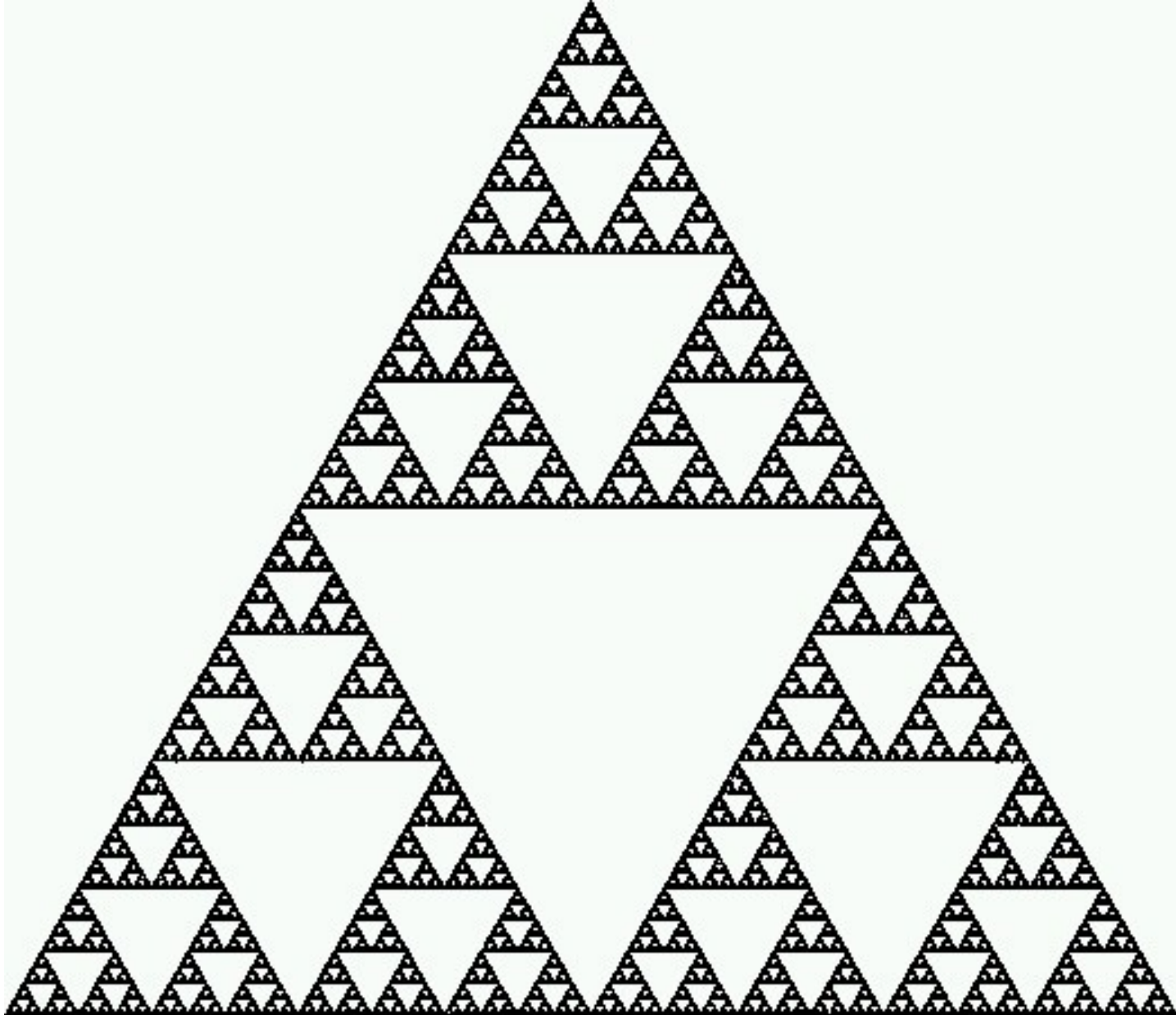
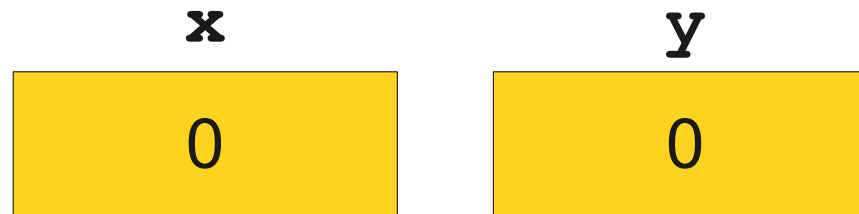# A Minor Change

What Just Happened?

Pass by Value

```
double x = 0;
double y = 0;

while (true) {
    moveRandomly(x, y);
    plotPixel(x, y);
}
```

x
0

y
0

Pass by Value

```
GPoint d = getRandomPoint();

x = (x + d.getX()) / 2.0;
y = (y + d.getY()) / 2.0;
```

x

y

0

0

Pass by Value

```
GPoint d = getRandomPoint();

x = (x + d.getX()) / 2.0;
y = (y + d.getY()) / 2.0;
```
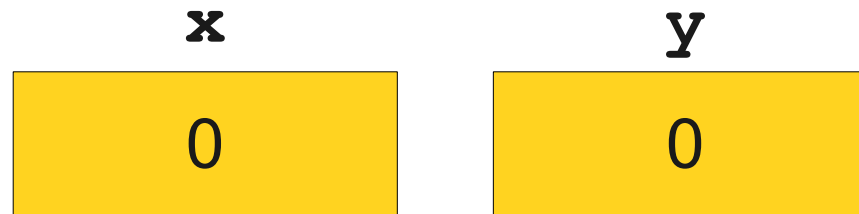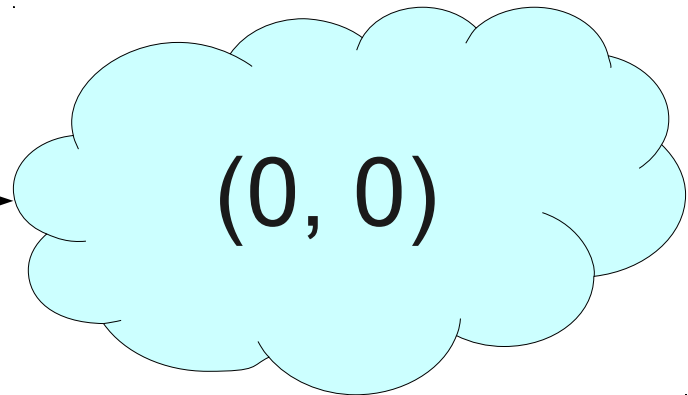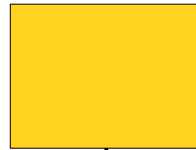
x

137

y

42

Pass by Value

```
double x = 0;
double y = 0;

while (true) {
    moveRandomly(x, y);
    plotPixel(x, y);
}
```

x
0

y
0

Pass by Reference

```
GPoint pt = new GPoint(0, 0);

while (true) {
    moveRandomly(pt);
    plotPixel(pt);
}
```

pt

(0, 0)

Pass by Reference

```
GPoint d = chooseRandomPoint();

pt.setLocation((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);
```

pt

(0, 0)

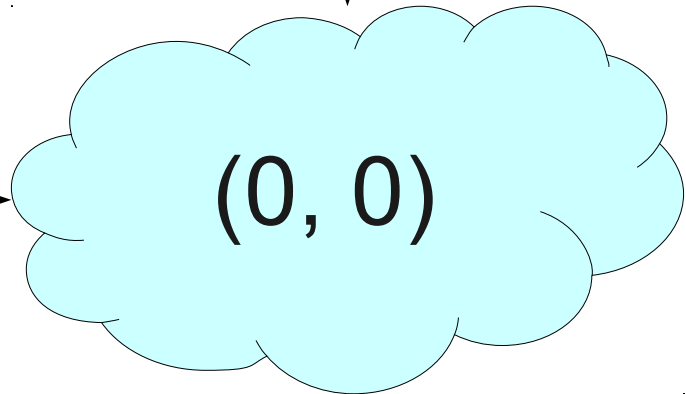# Pass by Reference

```
GPoint d = chooseRandomPoint();

pt.setLocation((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);
```
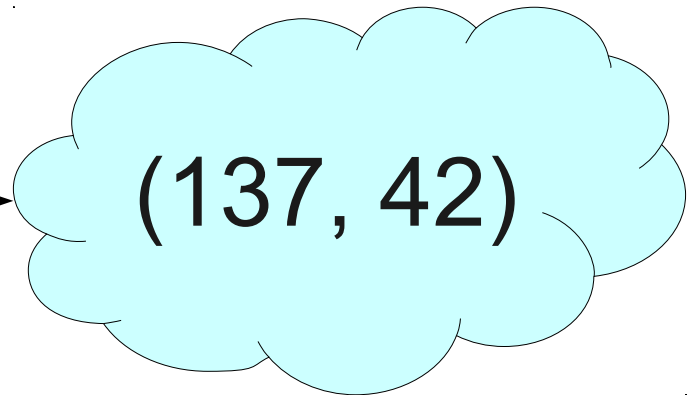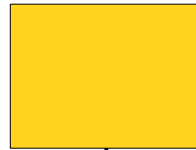
pt

(137, 42)

Pass by Reference

```
GPoint pt = new GPoint(0, 0);

while (true) {
    moveRandomly(pt);
    plotPixel(pt);
}
```

pt

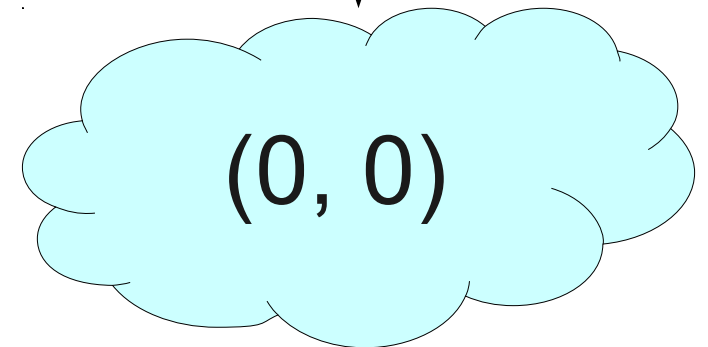(137, 42)

Parameter Passing

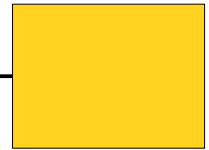- Primitive types (`int`, `double`, `boolean`, etc.) are passed by **value**.

  - Changes made to them do not reflect in the caller.

- Objects (`GRect`, `GOval`, `GPoint`, etc.) are passed by **reference**.

  - Changes made to the referenced objects do reflect in the caller.

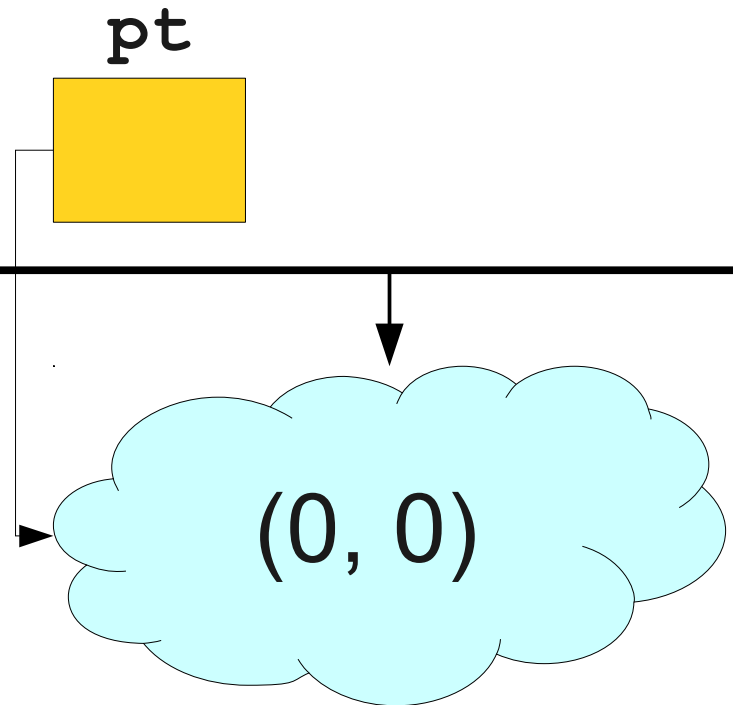# One More Change...

Pass by Reference, Take II

```
GPoint pt = new GPoint(0, 0);

while (true) {
    moveRandomly(pt);
    plotPixel(pt);
}
```

pt

(0, 0)

Pass by Reference, Take II

```
GPoint d = chooseRandomPoint();
GPoint result =
    new GPoint((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);

pt = result;
```

pt
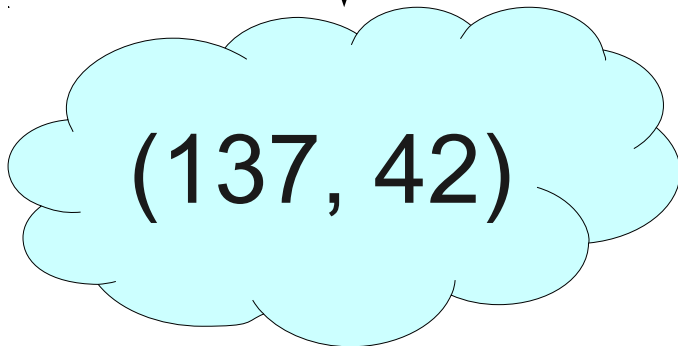
(0, 0)

Pass by Reference, Take II

```
GPoint d = chooseRandomPoint();
GPoint result =
    new GPoint((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);

pt = result;
```

result

pt

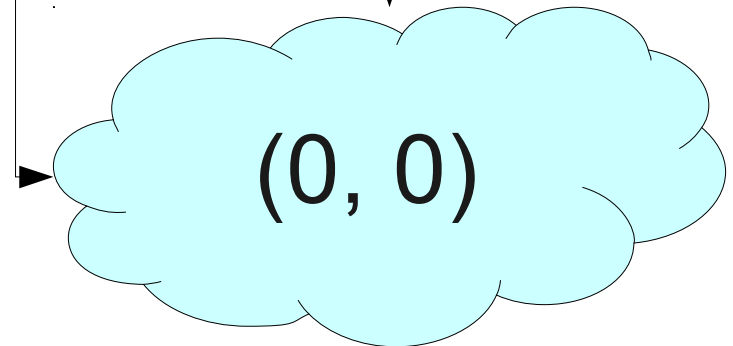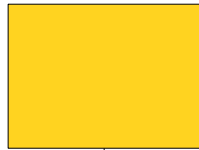(137, 42)

(0, 0)

Pass by Reference, Take II
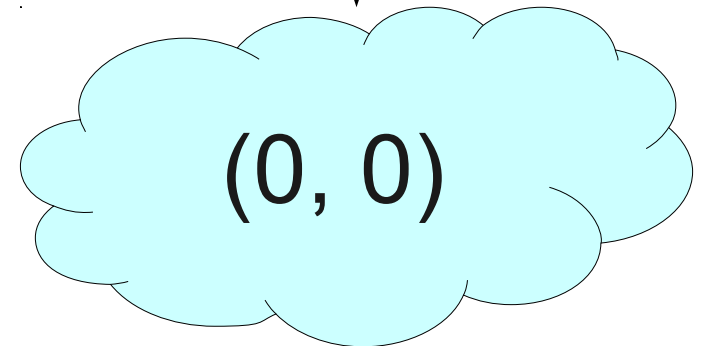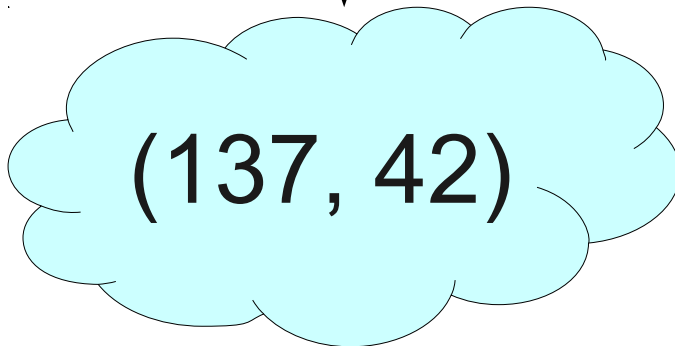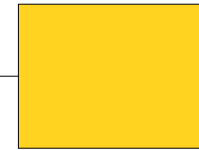
```
GPoint d = chooseRandomPoint();
GPoint result =
    new GPoint((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);

pt = result;
```
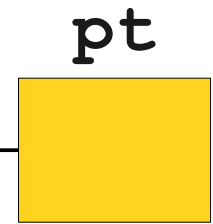
result

pt

(137, 42)

(0, 0)

Pass by Reference, Take II

```
GPoint pt = new GPoint(0, 0);

while (true) {
    moveRandomly(pt);
    plotPixel(pt);
}
```
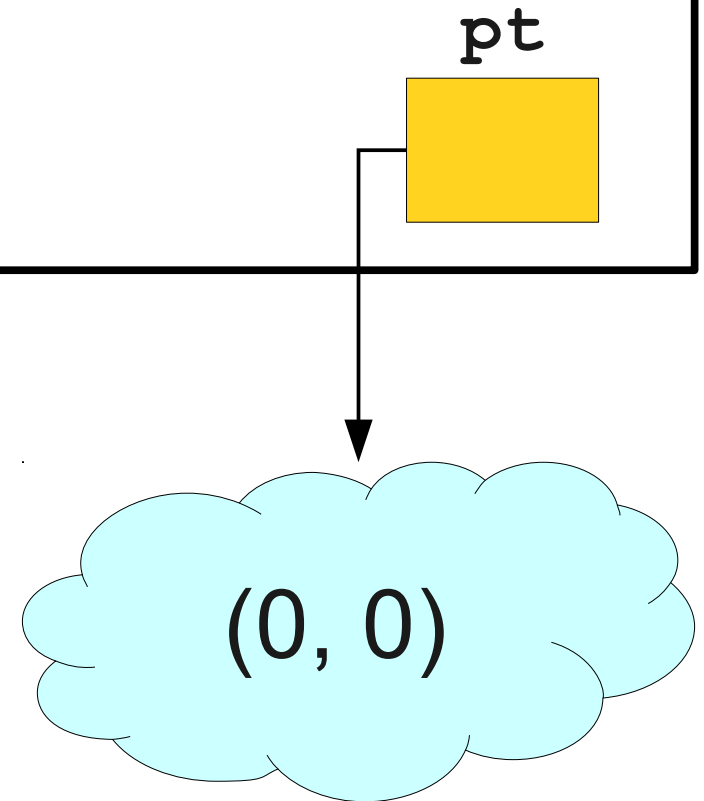
pt

(137, 42)

(0, 0)

Parameter Passing

- Primitive types (`int`, `double`, `boolean`, etc.) are passed by **value**.

  - Changes made to them do not reflect in the caller.

- Objects (`GRect`, `GOval`, `GPoint`, etc.) are passed by **reference**.

  - Changes made to the referenced objects do reflect in the caller.

  - You cannot change **which object** is being referenced, though.
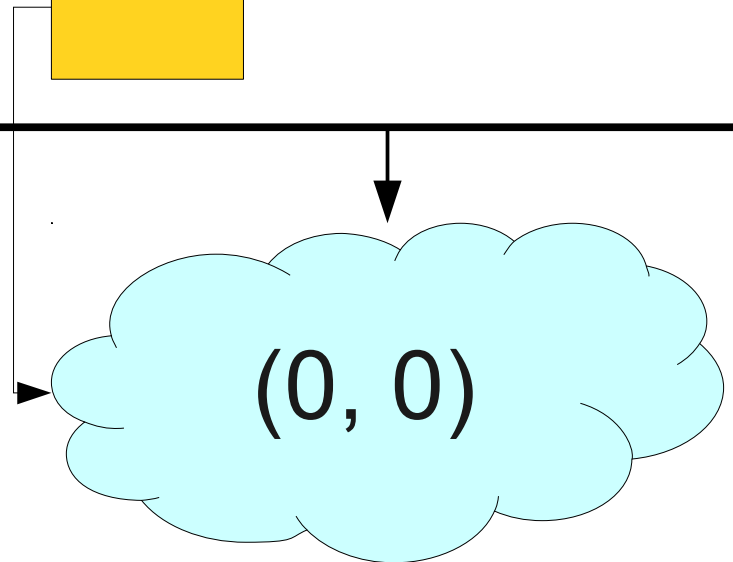
One Final Approach...

Returning Objects

```
GPoint pt = new GPoint(0, 0);

while (true) {
    pt = moveRandomly(pt);
    plotPixel(pt);
}
```

pt

(0, 0)

Returning Objects

```
GPoint d = chooseRandomPoint();
GPoint result =
    new GPoint((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);

return result;
```
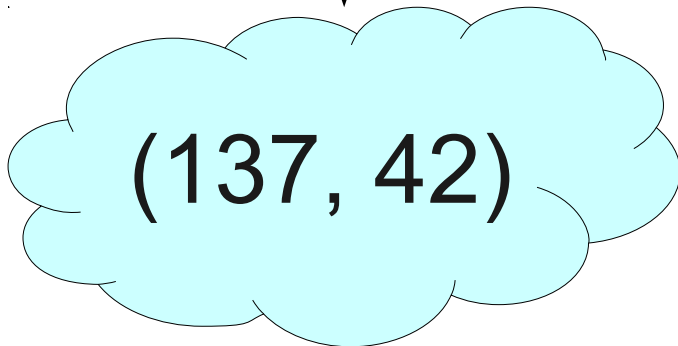
pt

(0, 0)

Returning Objects

```
GPoint d = chooseRandomPoint();
GPoint result =
    new GPoint((pt.getX() + d.getX()) / 2.0,
               (pt.getY() + d.getY()) / 2.0);

return result;
```
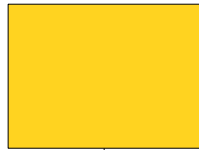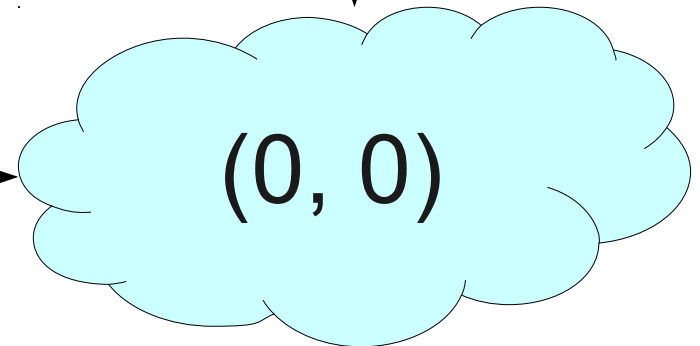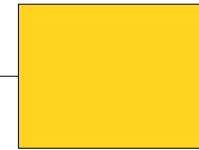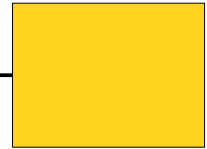
result

pt

(137, 42)

(0, 0)

Returning Objects

```
GPoint pt = new GPoint(0, 0);

while (true) {
    pt = moveRandomly(pt);
    plotPixel(pt);
}
```

pt

(137, 42)

(0, 0)