CS Bridge, Lecture 10

Animation

CS BRIDGE

2021

KOÇ UNIVERSITY

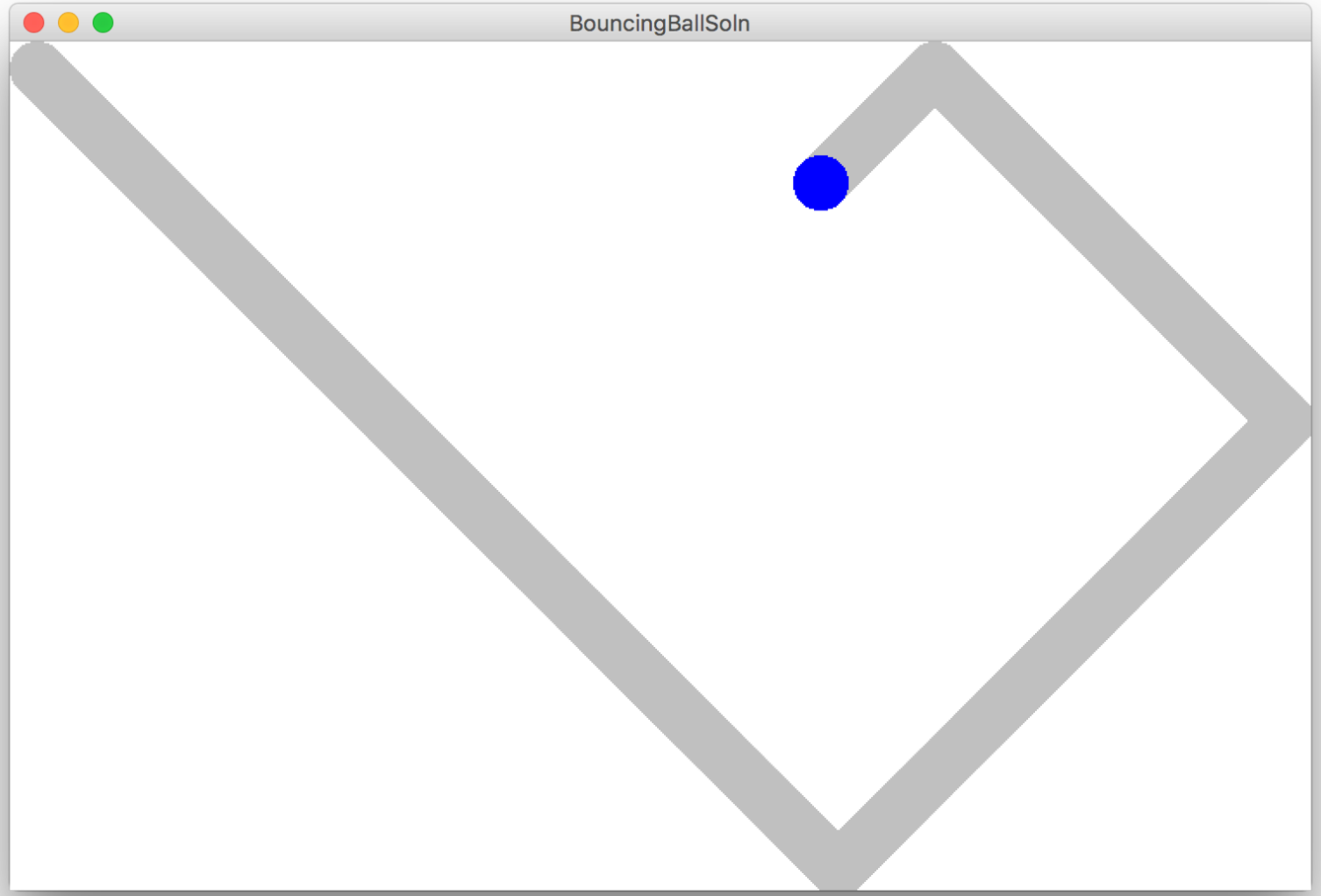
İZMİR DEMOKRASİ ÜNİVERSİTESİ 2016

LELAND STANFORD JUNIOR UNIVERSITY 1891

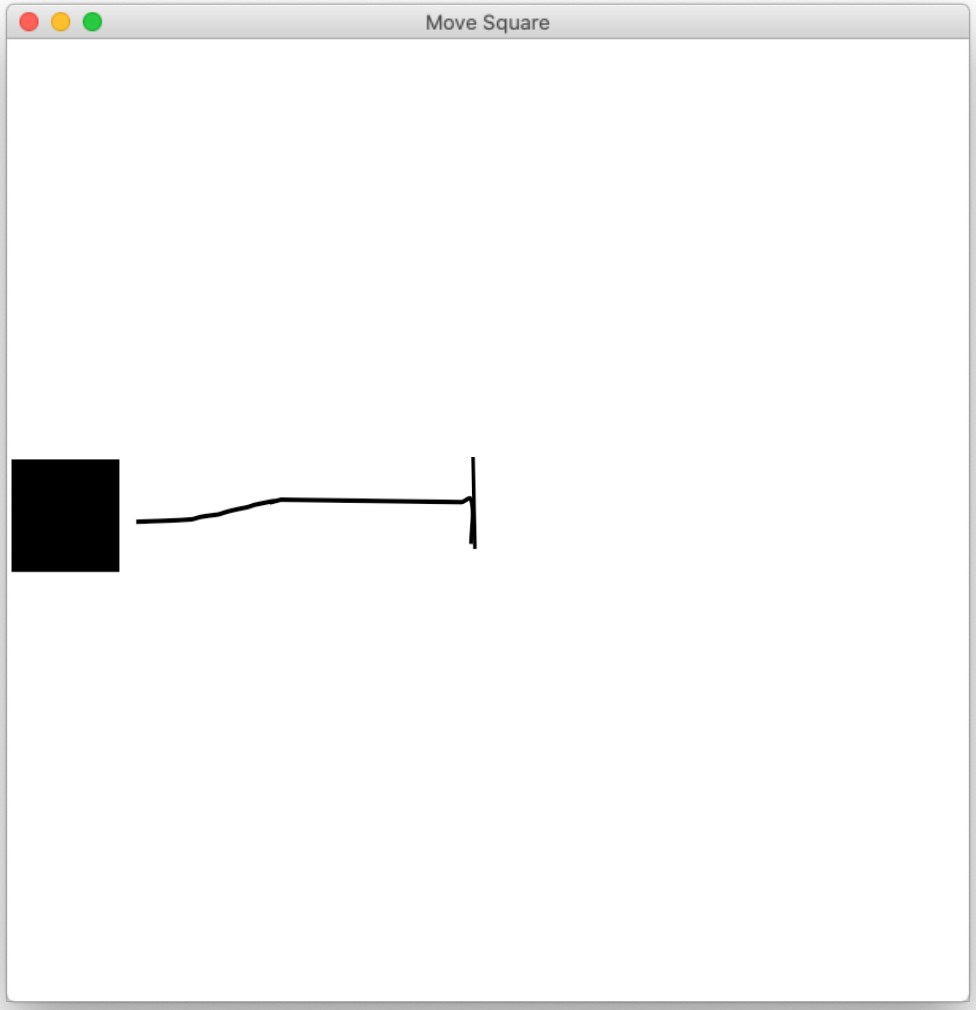
Learning Goals

1. Get more practice writing programs with graphics
2. Understand how parameters are passed between functions
3. Write graphics programs with animation

End Goal: Bouncing Ball!



Checkpoint: “Move To Center”



Lecture Plan

- **Review:** Graphics
- Animation Loop Structure
- **Example**: Move To Center
- **Practice**: Bouncing Ball
- Passing Parameters

Lecture Plan

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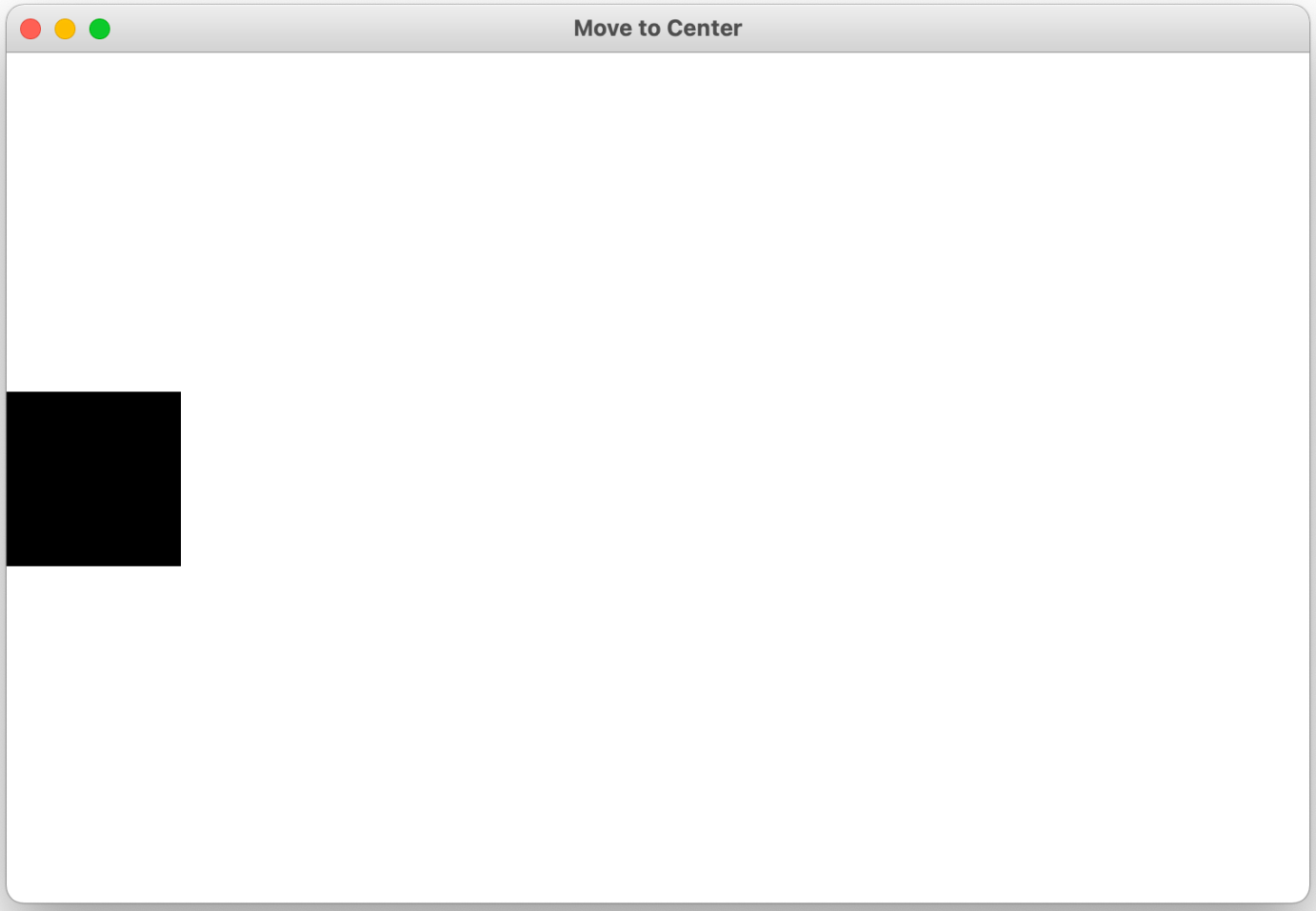
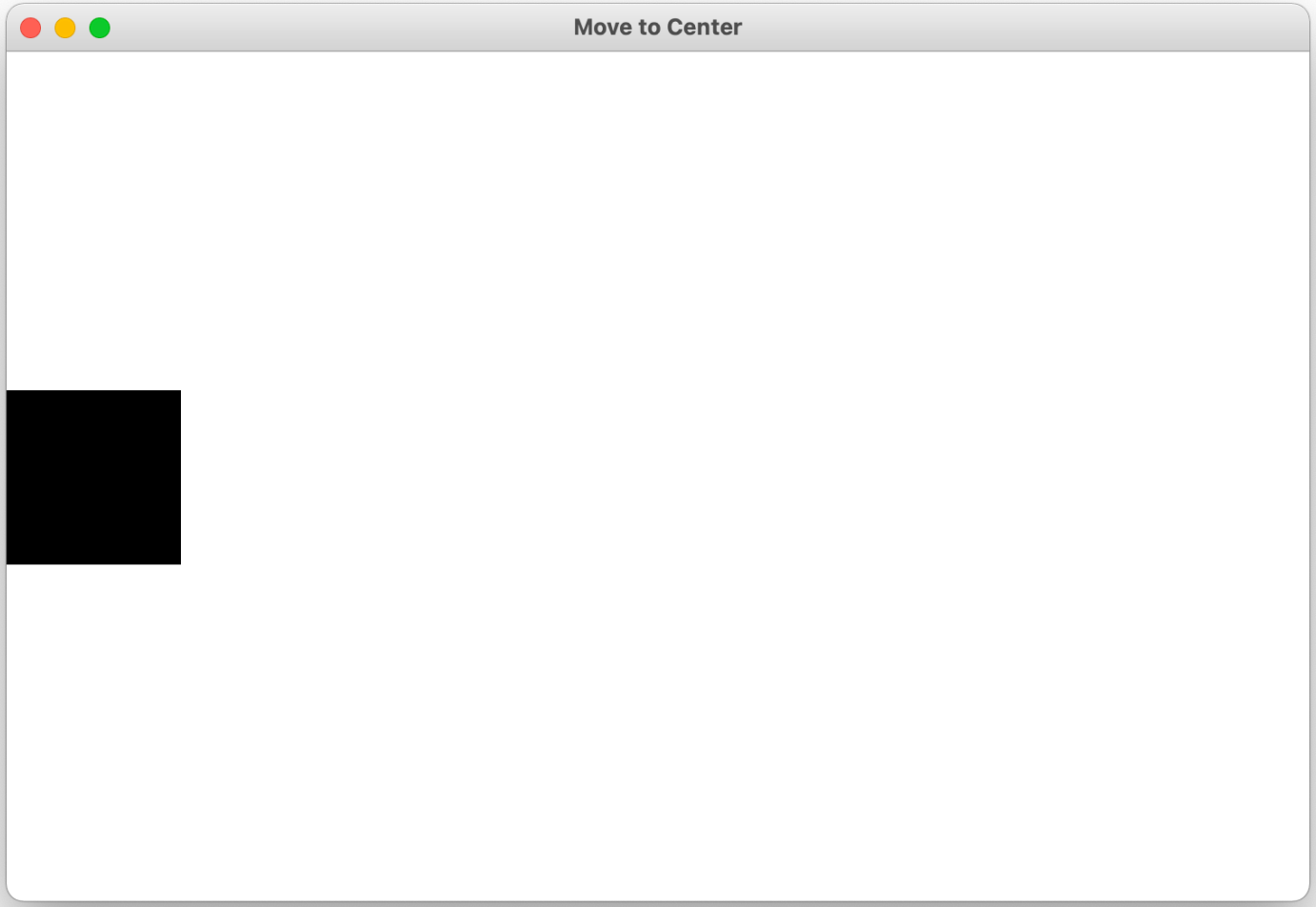
In our last episode…

Graphics From Tkinter

from graphics **import** Canvas



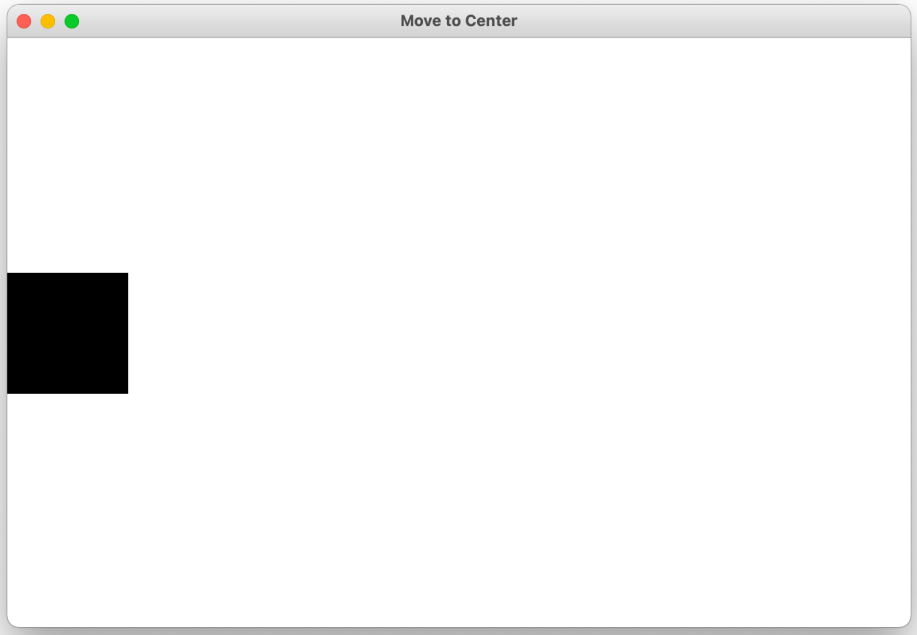
Add Square



Add Square

```
SQUARE_SIZE = 100

def main():
    canvas = Canvas()
    canvas.set_canvas_title("Move to Center")
    square_top_y = canvas.get_canvas_height() / 2 - SQUARE_SIZE / 2
    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")
    canvas.mainloop()
```



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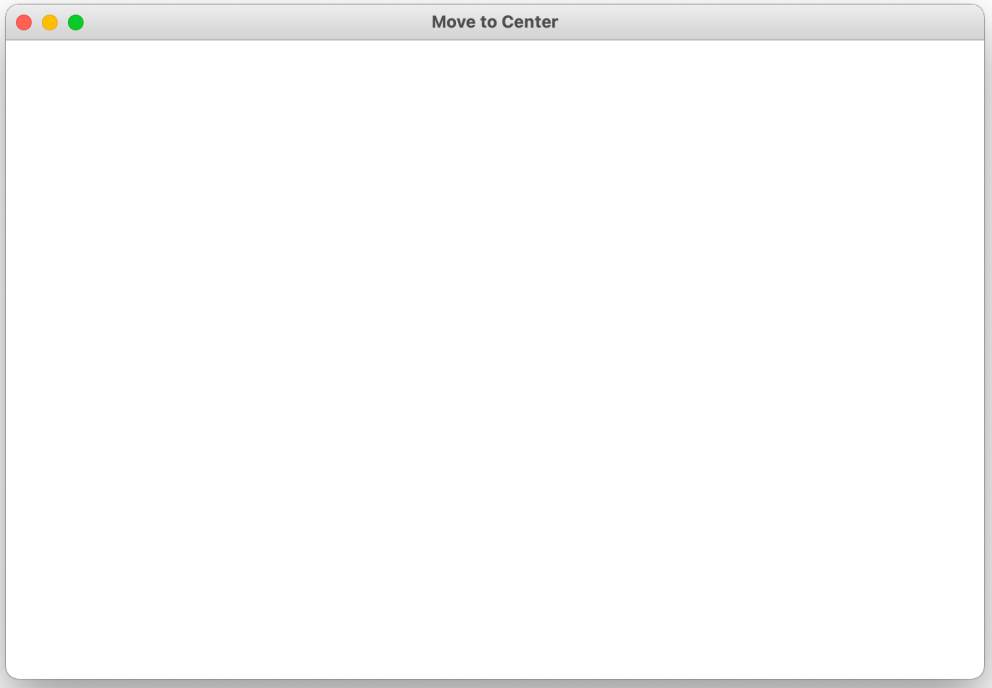

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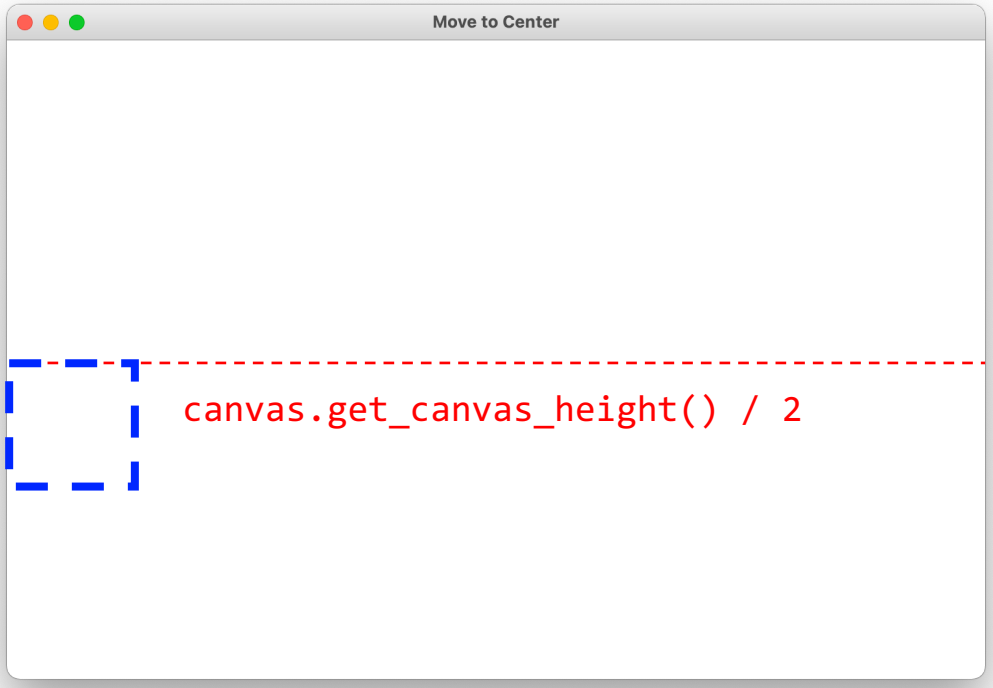

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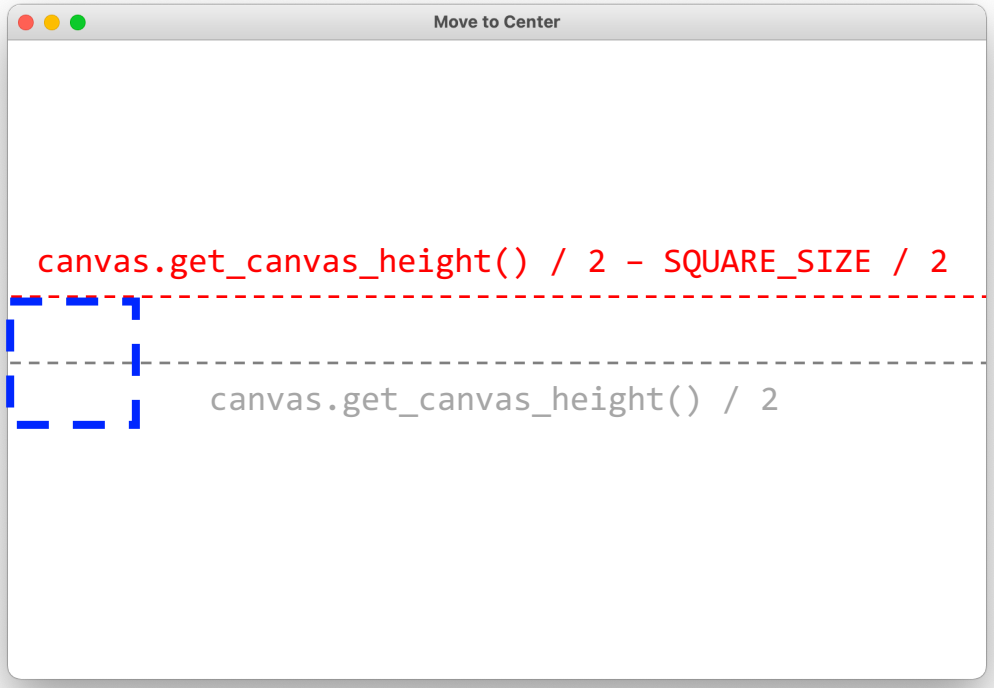

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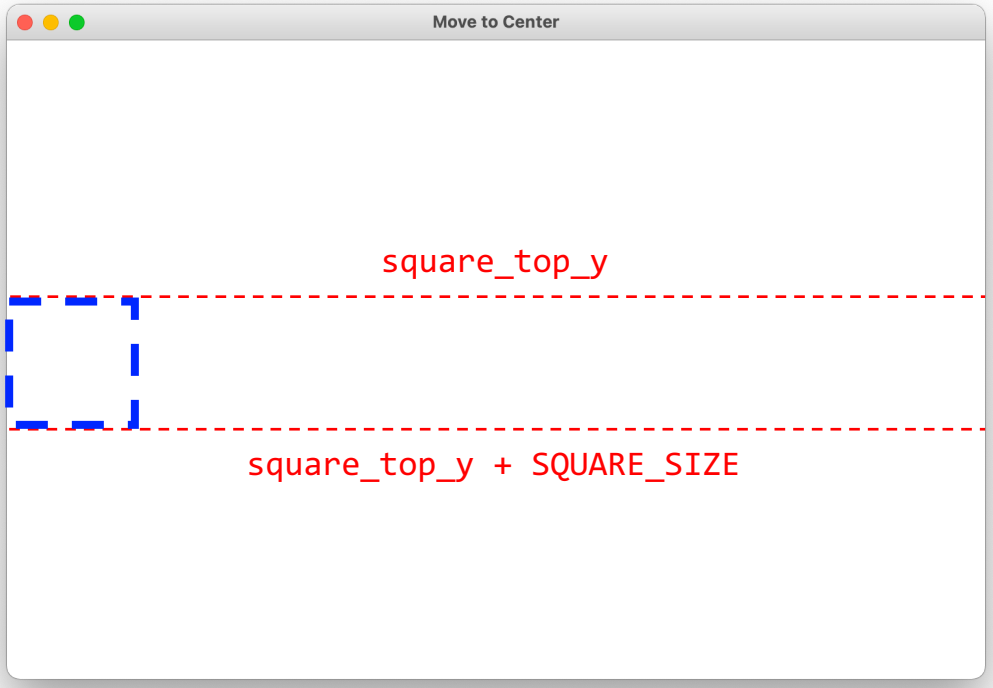

Some “heavy duty” variables allow you to call functions on them

Add Square

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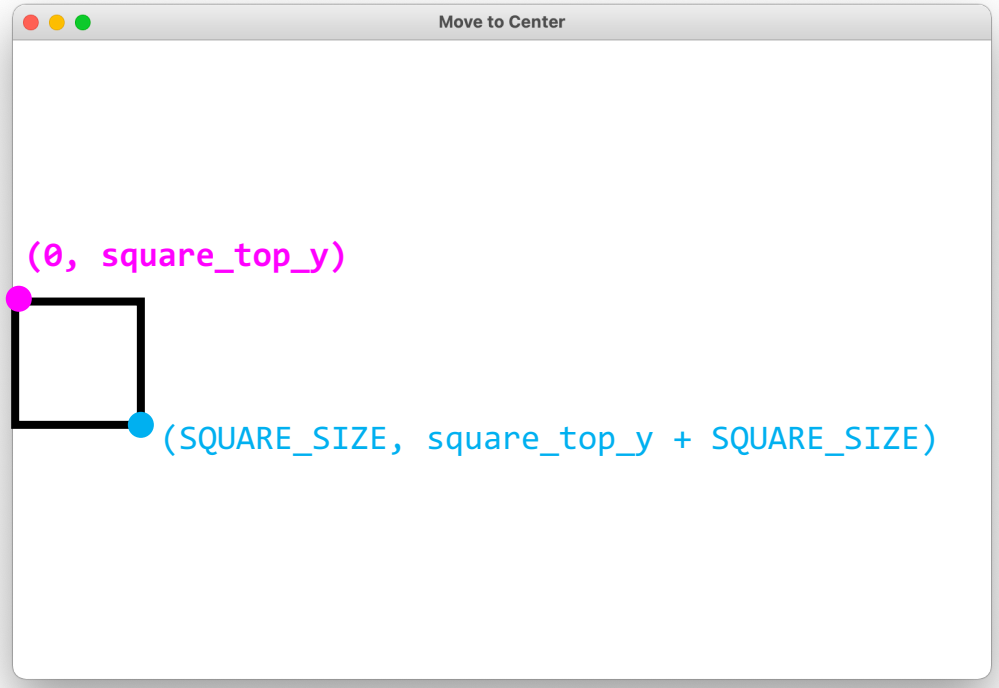

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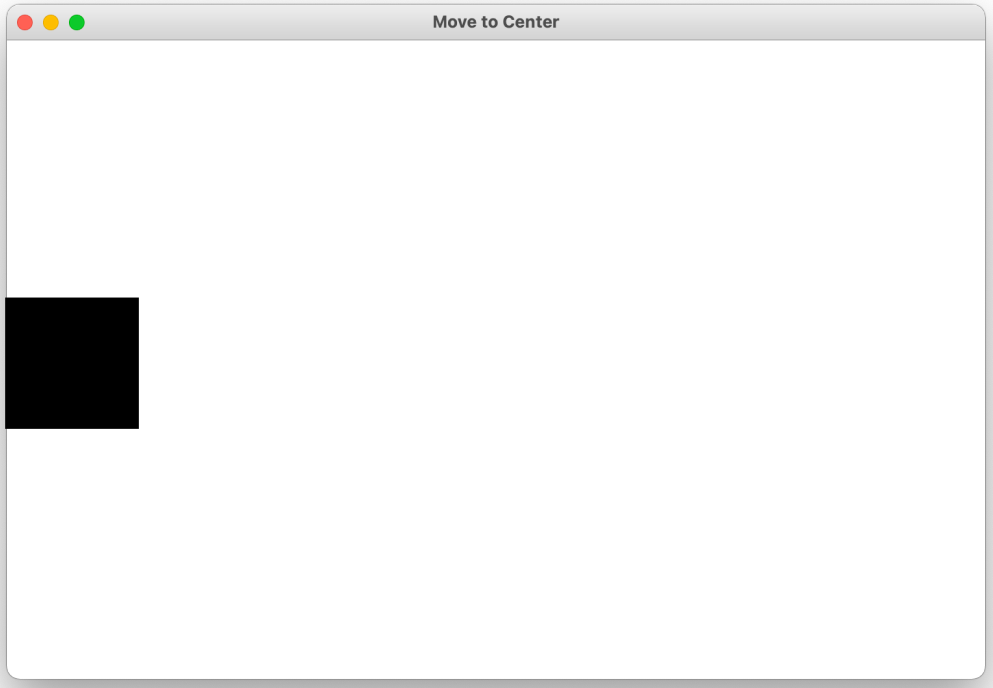

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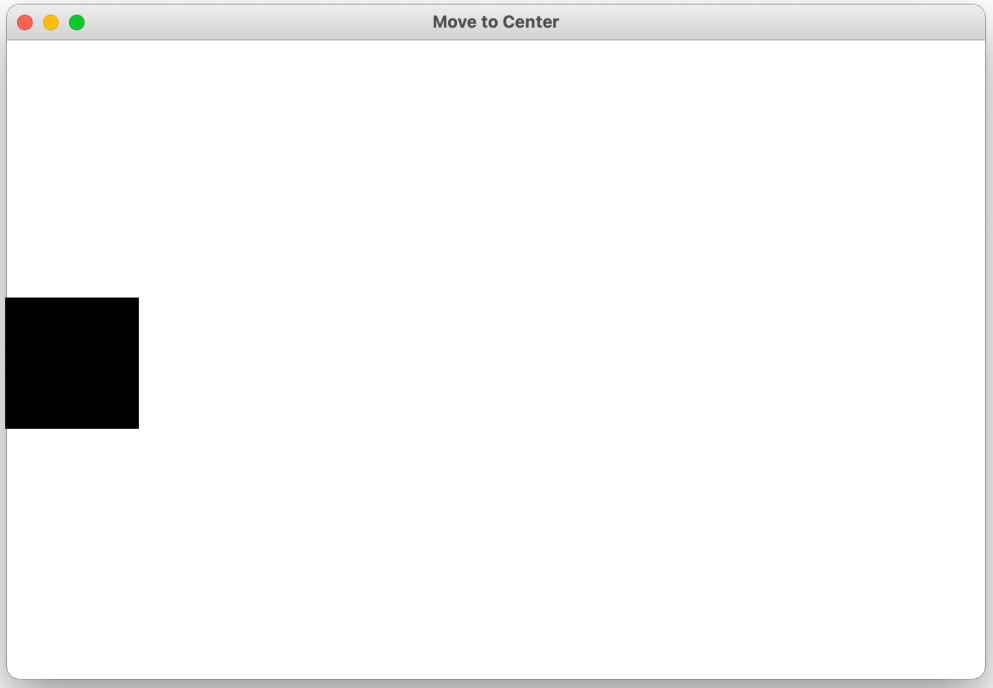

End of review!

Lecture Plan

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- **Example**: Move To Center
- **Practice**: Bouncing Ball
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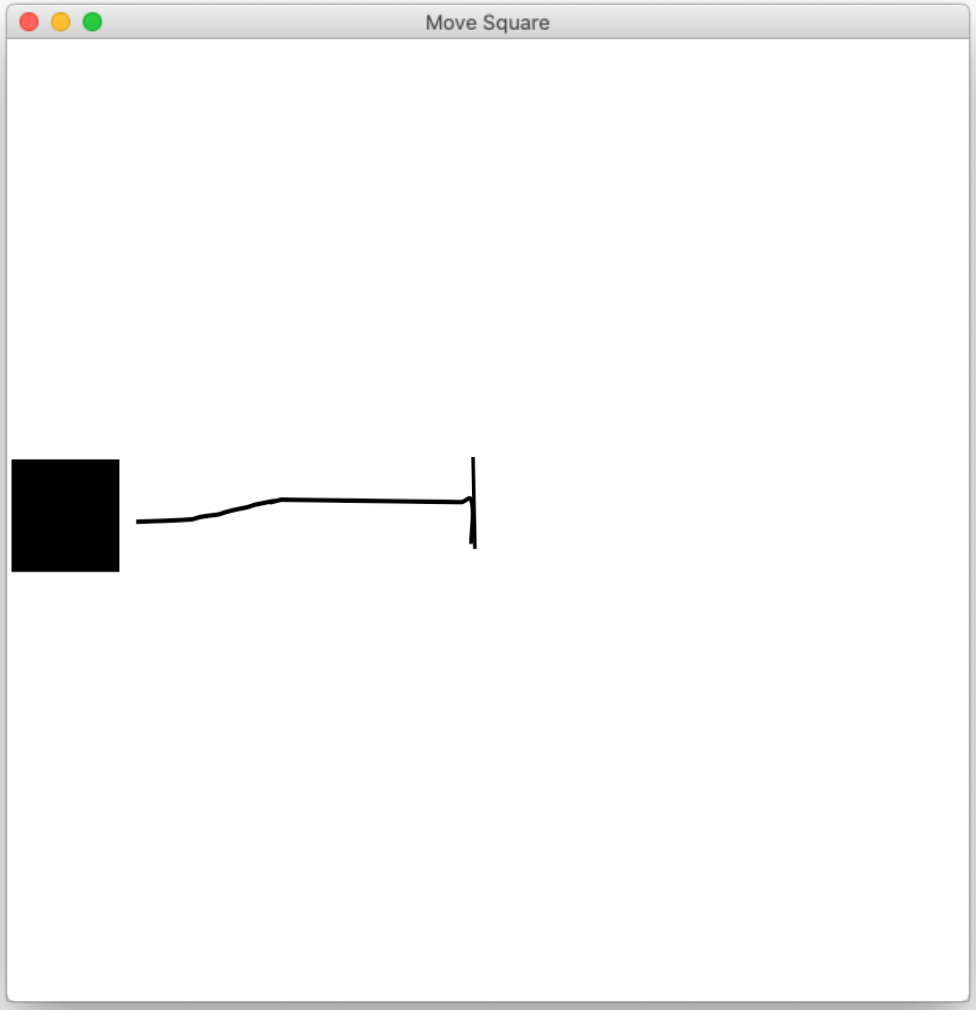
How do movies or games animate?

Checkpoint: “Move To Center”



Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Make all the variables you need.

Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

The animation loop is a repetition of heartbeats, either forever (while True) or until some condition is no longer true.

Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Each heart-beat, update the world forward one frame

Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

If you don't pause, humans won't be able to see it!

Animation Loop

```
def main():
    # setup done once

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Make sure to call mainloop() to make your program run correctly.

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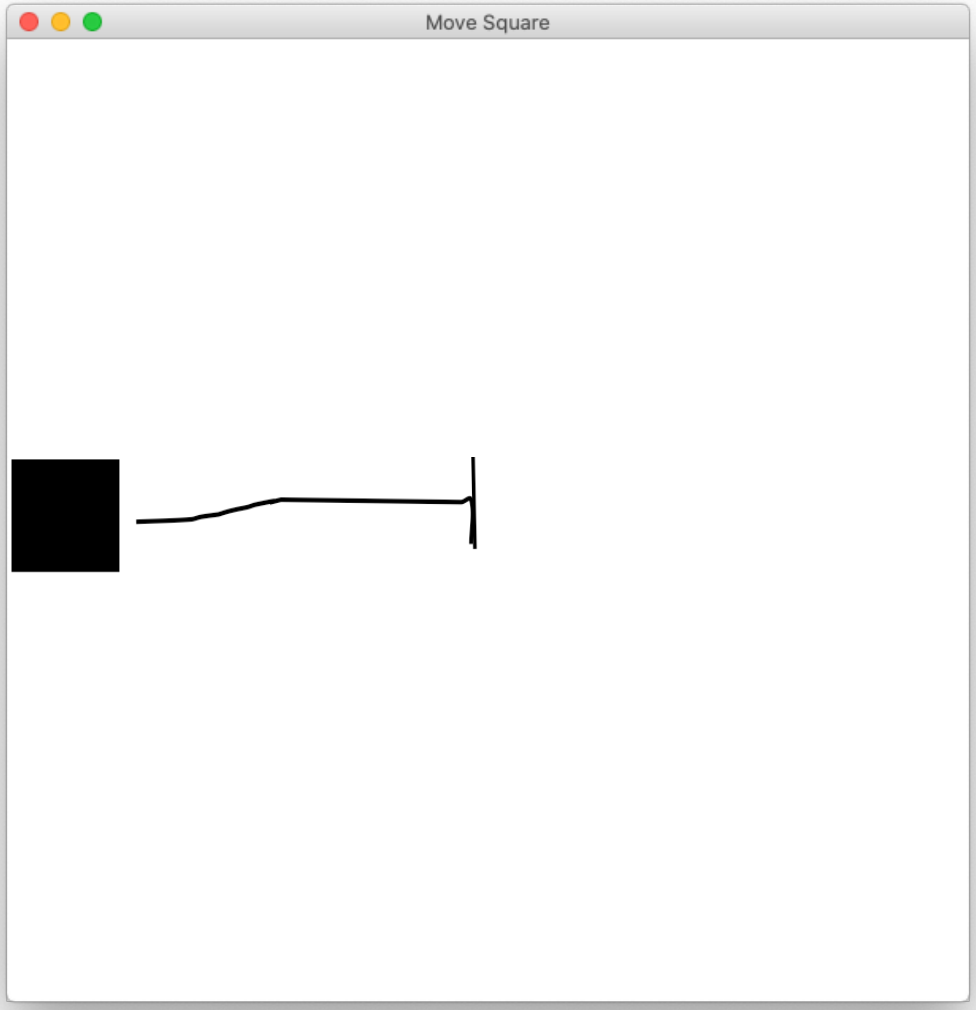
Checkpoint: “Move To Center”



Animation Loop

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Animation Loop

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def main():
    # setup done once
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    canvas.set_canvas_title("Move to Center")
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    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while ???:
        # update world

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Animation Loop

```
def main():
    # setup done once
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    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while ???:
        # update world
        canvas.move(rect, 1, 0)
        canvas.update()

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Animation Loop

```
def main():
    # setup done once
    canvas = Canvas()
    canvas.set_canvas_title("Move to Center")
    square_top_y = canvas.get_canvas_height() / 2 - SQUARE_SIZE / 2
    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while ???:
        # update world
        canvas.move(rect, 1, 0)
        canvas.update()

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Move the rectangle 1 pixel to the right.

Animation Loop

```
def main():
    # setup done once
    canvas = Canvas()
    canvas.set_canvas_title("Move to Center")
    square_top_y = canvas.get_canvas_height() / 2 - SQUARE_SIZE / 2
    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while ???:
        # update world
        canvas.move(rect, 1, 0)
        canvas.update()

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

Tells the canvas to update the screen. Don't forget this!
Call it once you are finished making all canvas changes for now.

Animation Loop

```
def main():
    # setup done once
    canvas = Canvas()
    canvas.set_canvas_title("Move to Center")
    square_top_y = canvas.get_canvas_height() / 2 - SQUARE_SIZE / 2
    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while ???:
        # update world
        canvas.move(rect, 1, 0)
        canvas.update()

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

When do we want to stop the animation loop?

Let’s live code!

Move to Center

```
def main():
    # setup done once
    canvas = Canvas()
    canvas.set_canvas_title("Move to Center")
    square_top_y = canvas.get_canvas_height() / 2 - SQUARE_SIZE / 2
    rect = canvas.create_rectangle(0, square_top_y, SQUARE_SIZE, square_top_y + SQUARE_SIZE)
    canvas.set_color(rect, "black")

    while is_not_past_center(canvas, rect):
        # update world
        canvas.move(rect, 1, 0)
        canvas.update()

        # pause
        time.sleep(DELAY)

    canvas.mainloop()
```

More Helpful Graphics Functions

canvas.move(obj, dx, dy)	Moves obj using the displacements dx and dy.
canvas.moveto(obj, x, y)	Sets the location of obj to the specified coordinates.

```
# move shape to some new coordinates
canvas.moveto(shape, new_x, new_y)

# move shape by a given change_x and change_y
canvas.move(shape, change_x, change_y)
```

We are ready...

Lecture Plan

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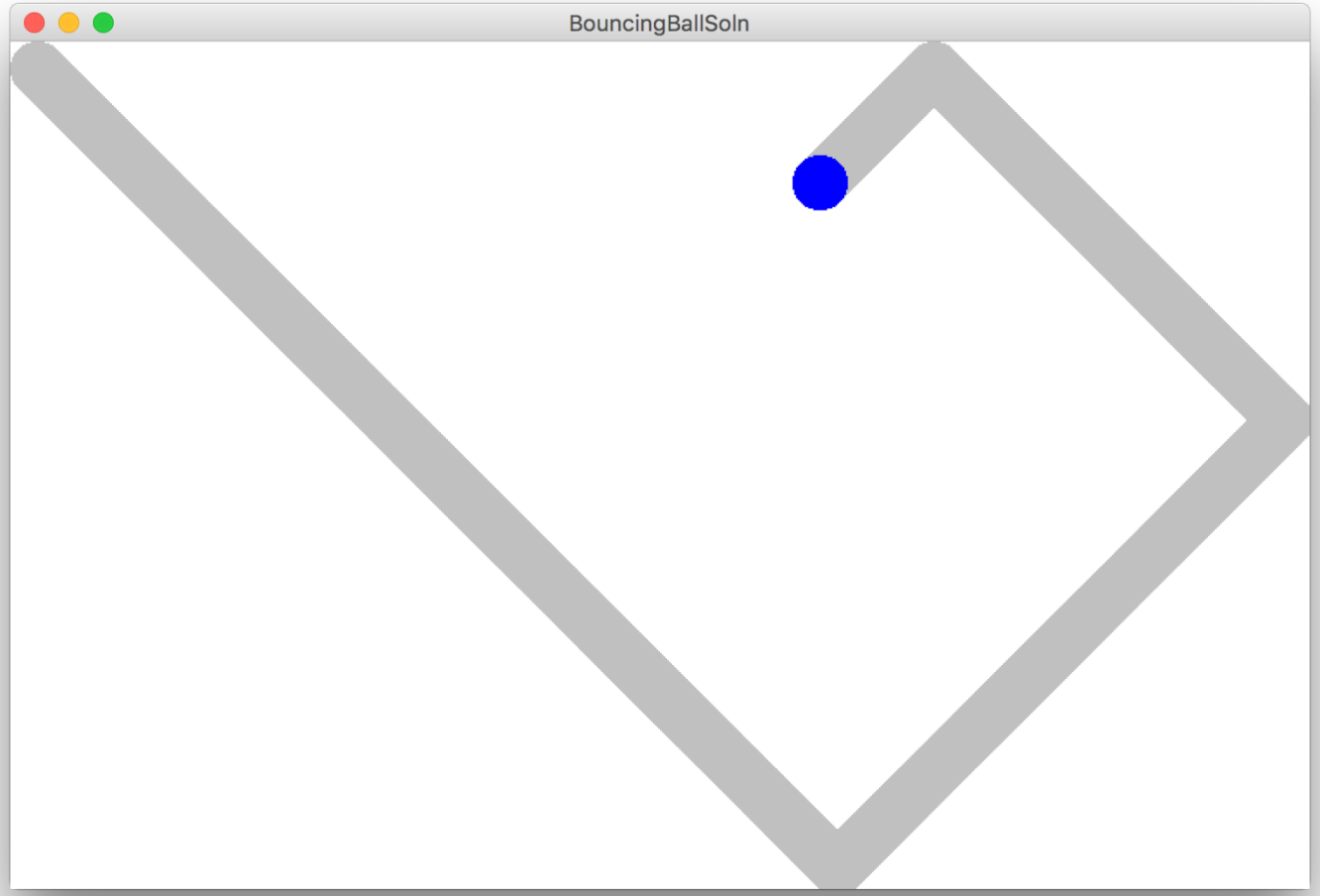
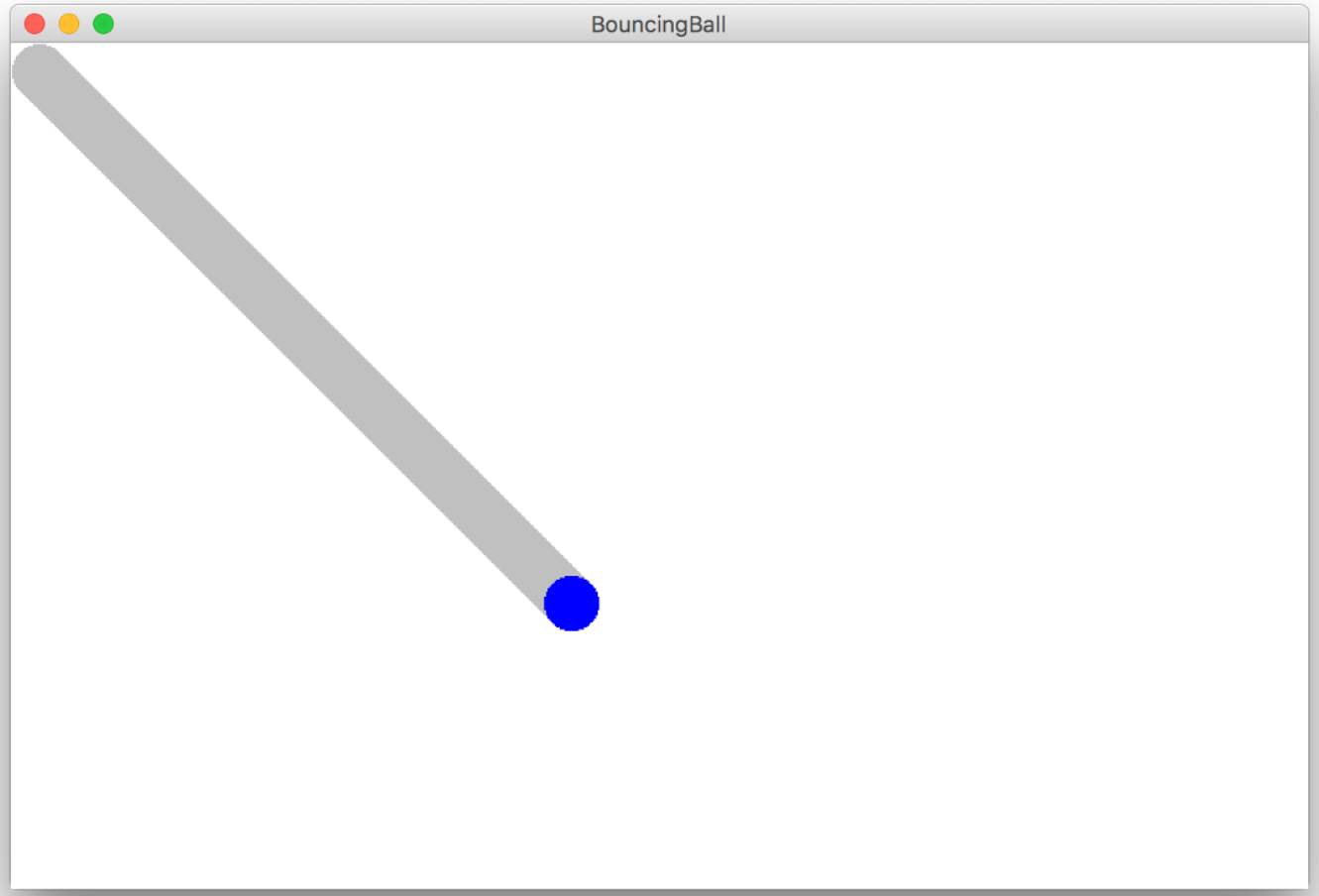
Bouncing Ball



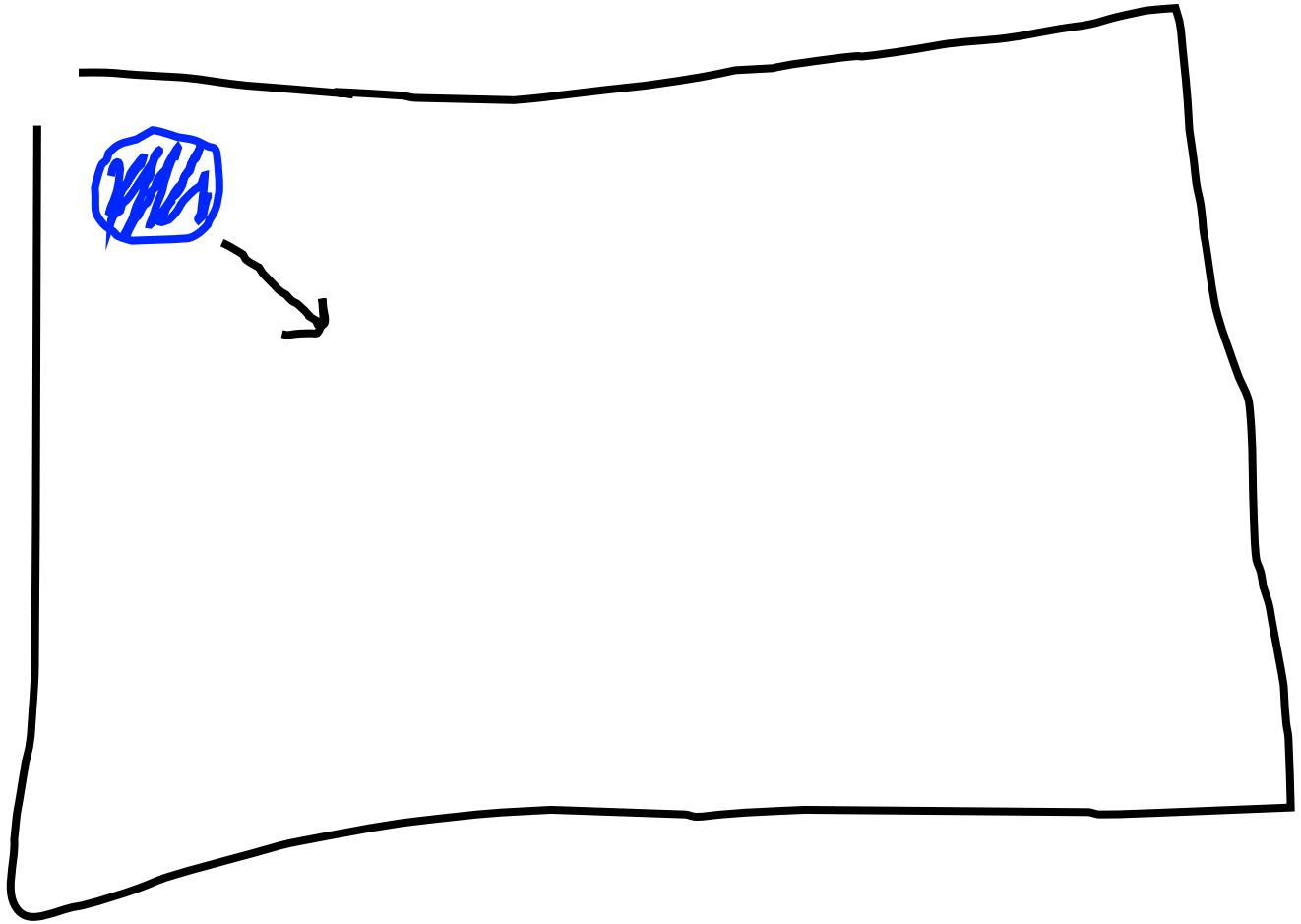
Bouncing Ball: Milestone 1 - Movement



Let’s try it!

Bouncing Ball

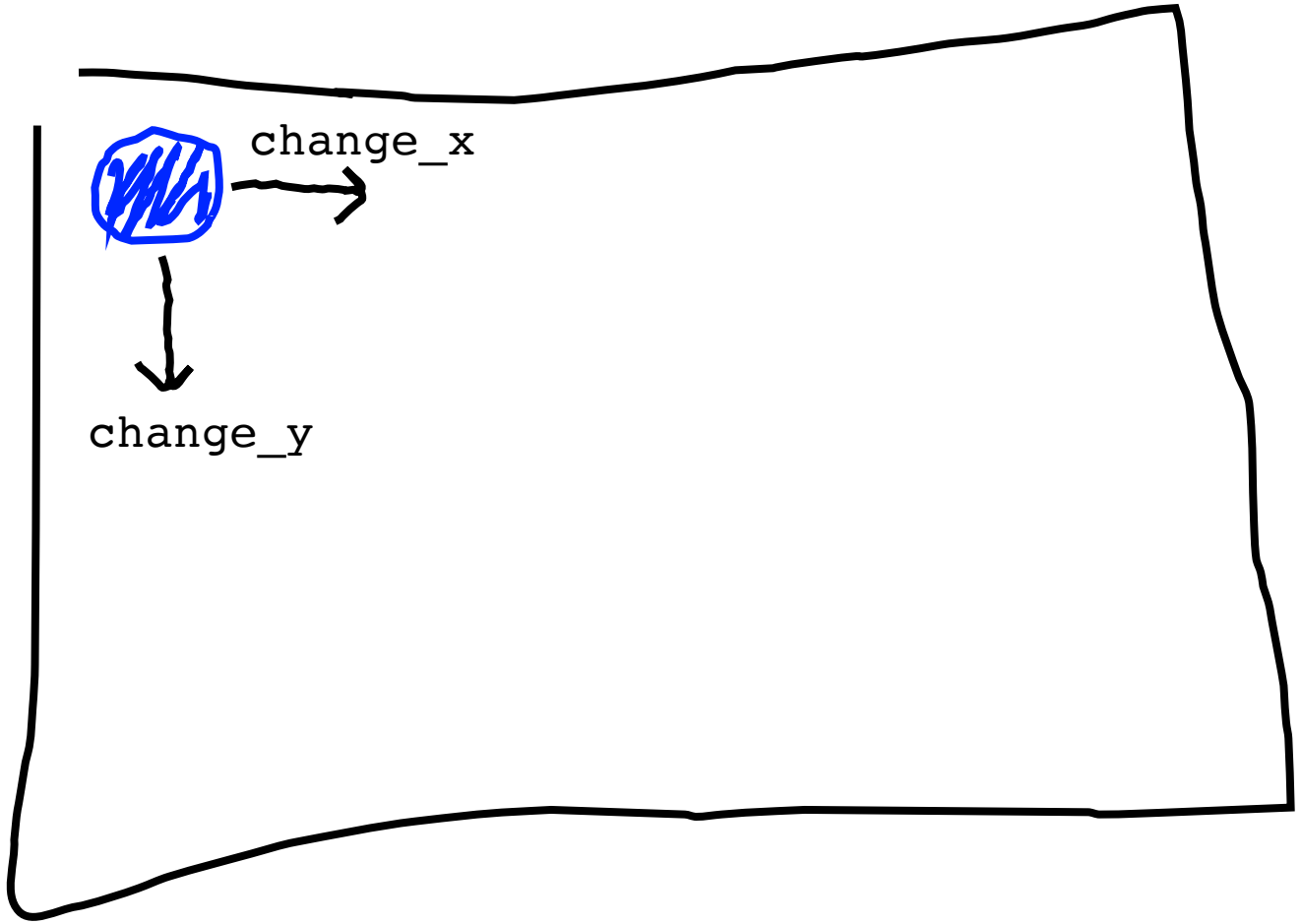
First heartbeat



Key variable: how much the ball position change each heartbeat?

Bouncing Ball

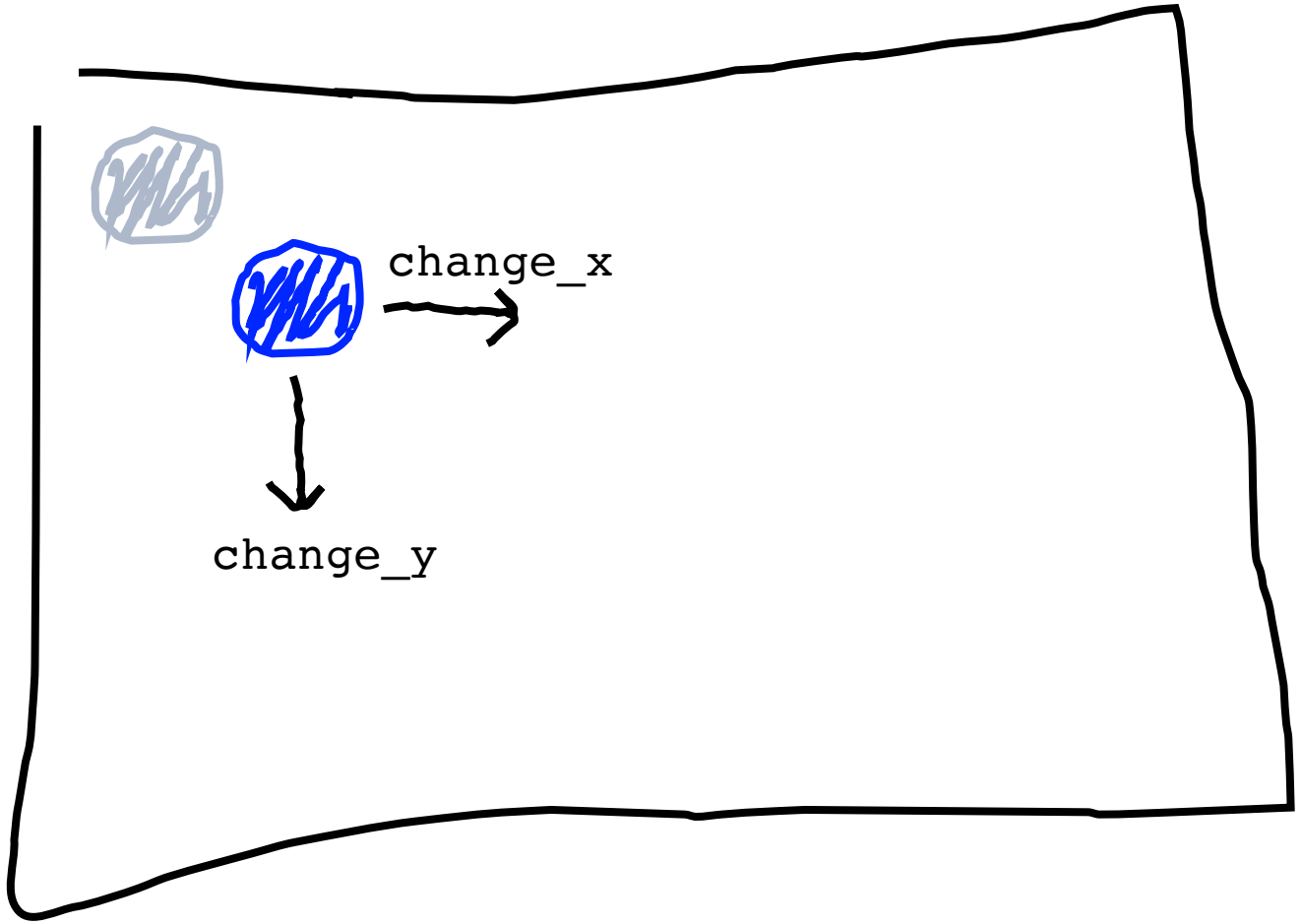
First heartbeat



The **`move`** function takes in
a change in x and a change in y

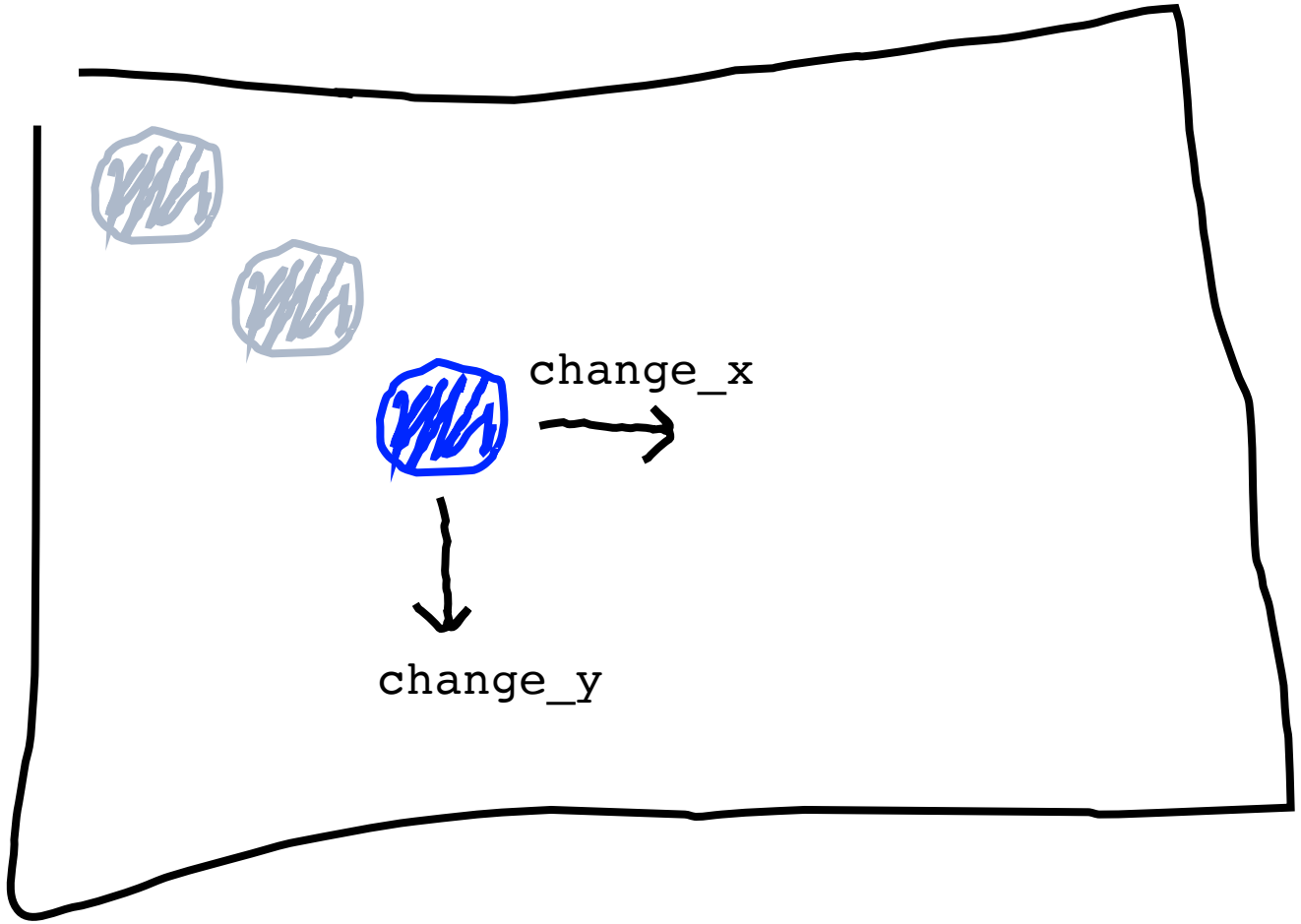
Bouncing Ball

Second heartbeat



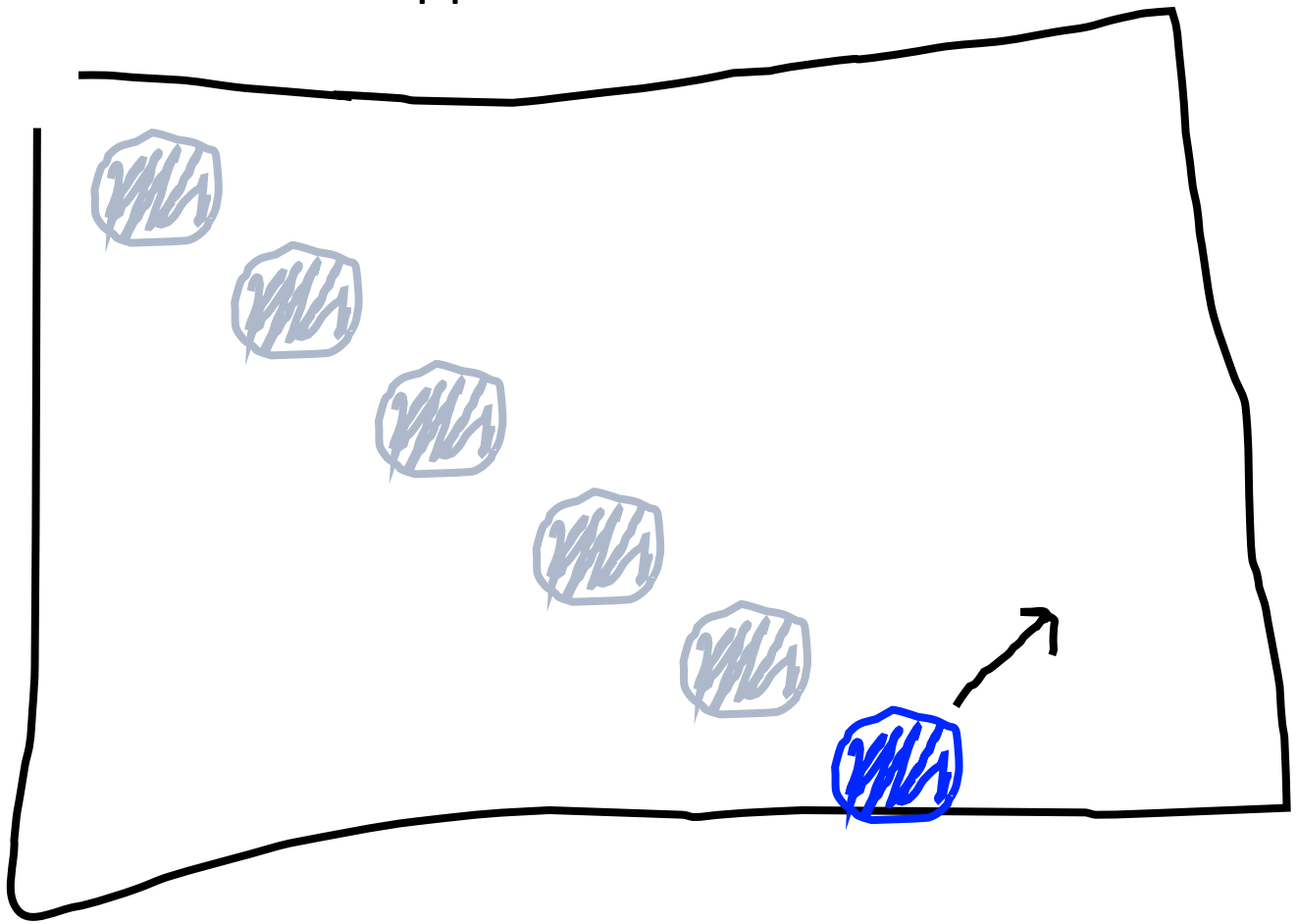
Bouncing Ball

Third heartbeat



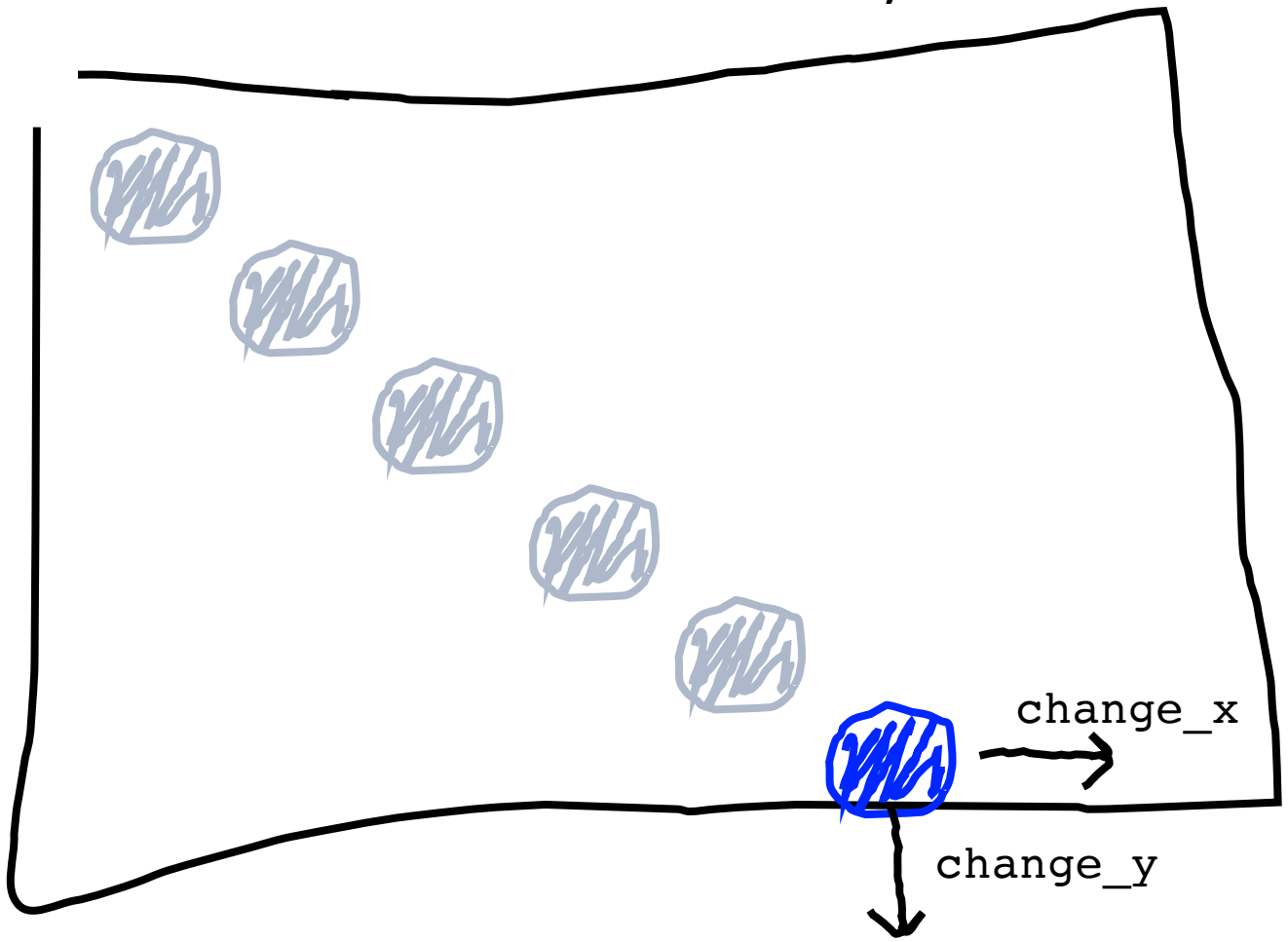
Bouncing Ball

What happens when we hit a wall?



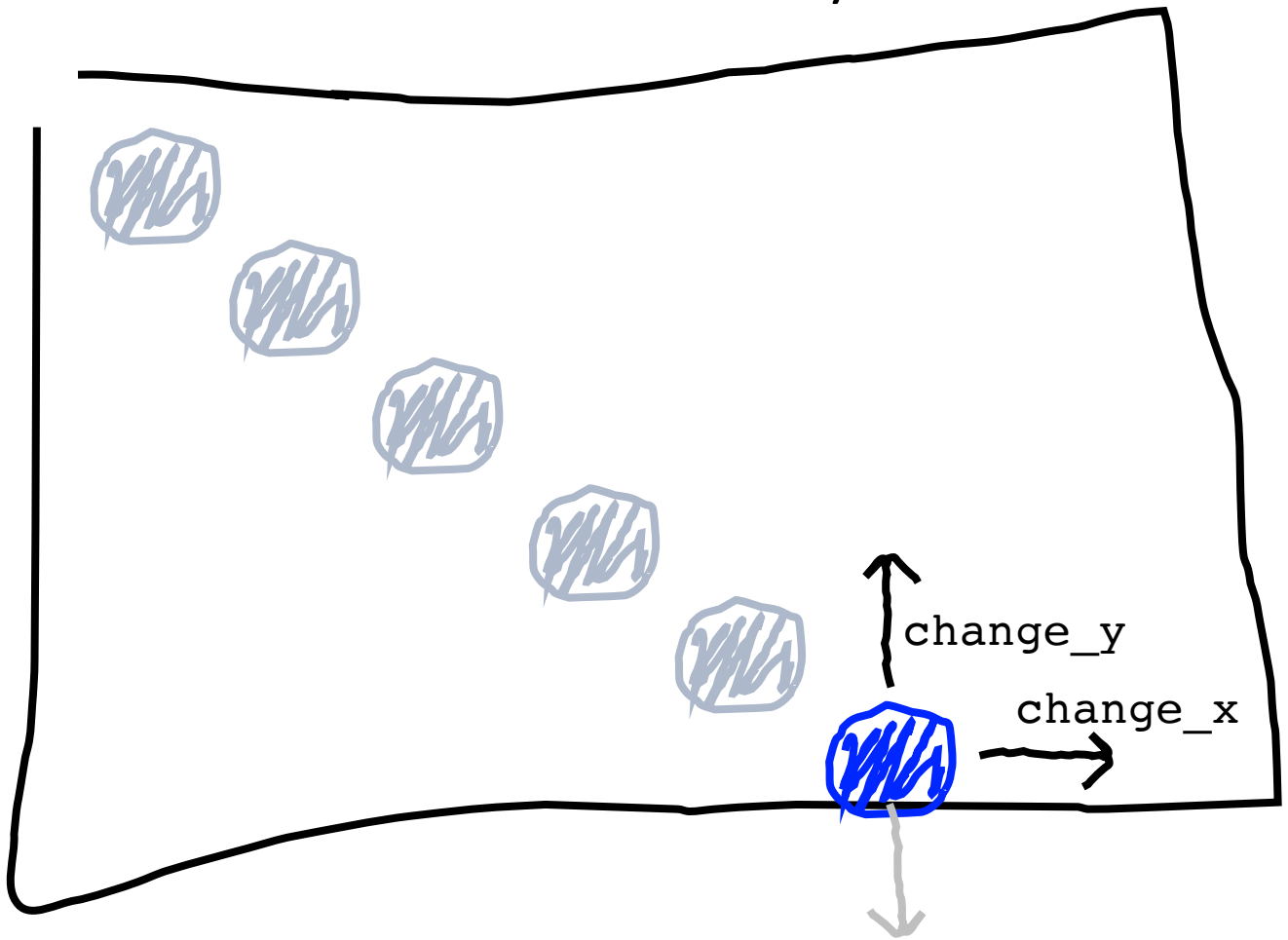
Bouncing Ball

We have this velocity



Bouncing Ball

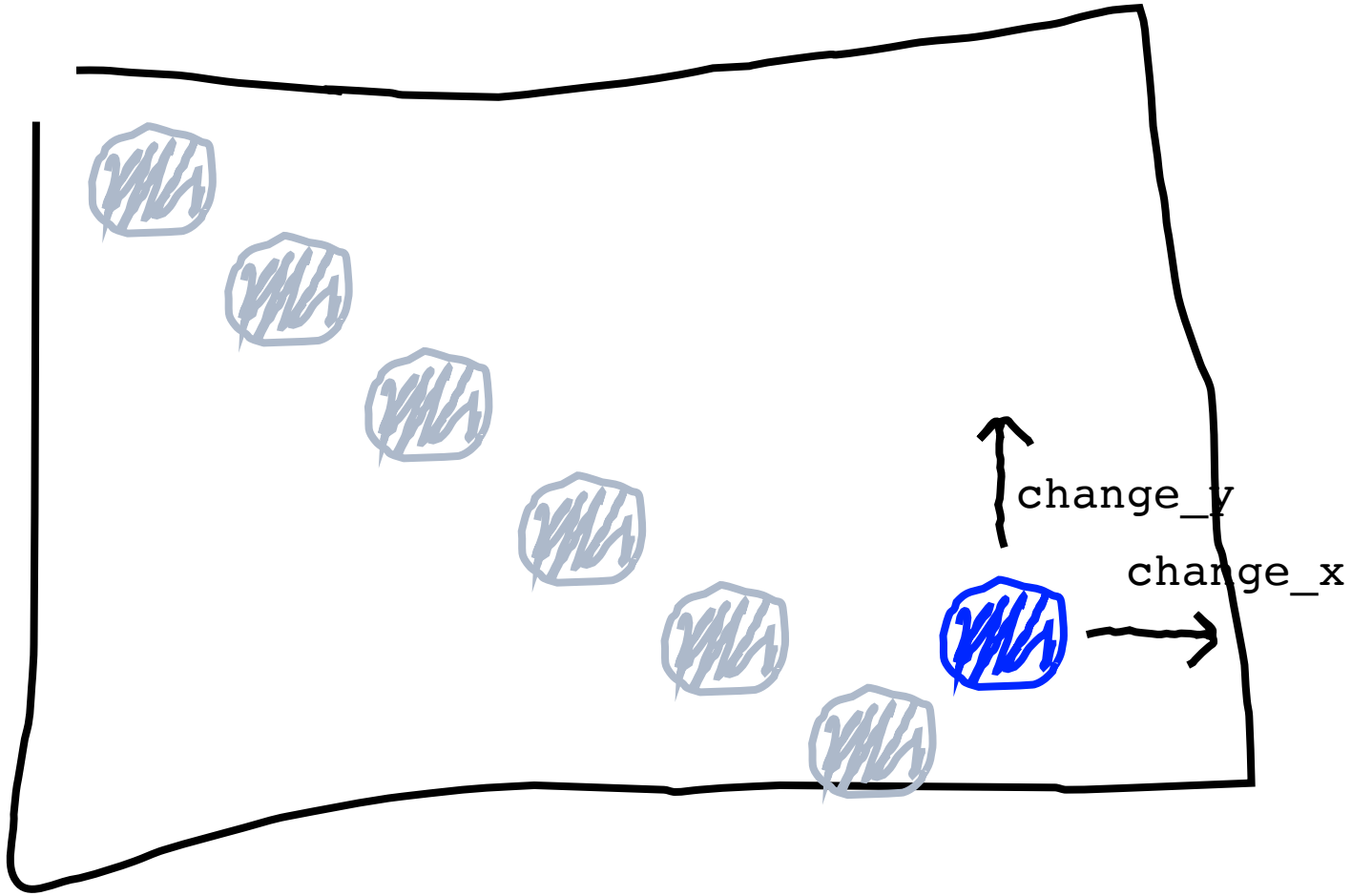
Our new velocity



When reflecting vertically: `change_y = -change_y`

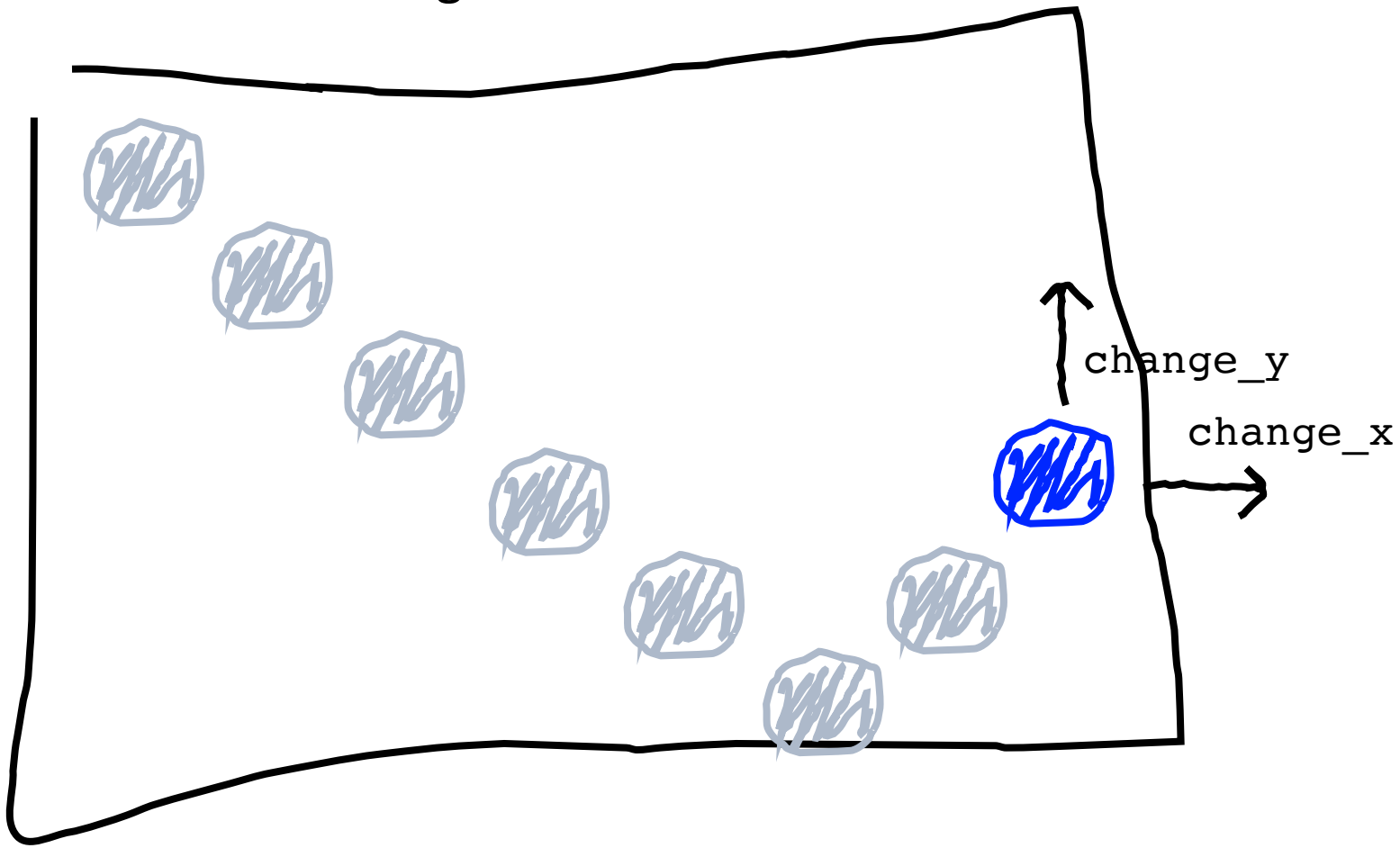
Bouncing Ball

Seventh heartbeat



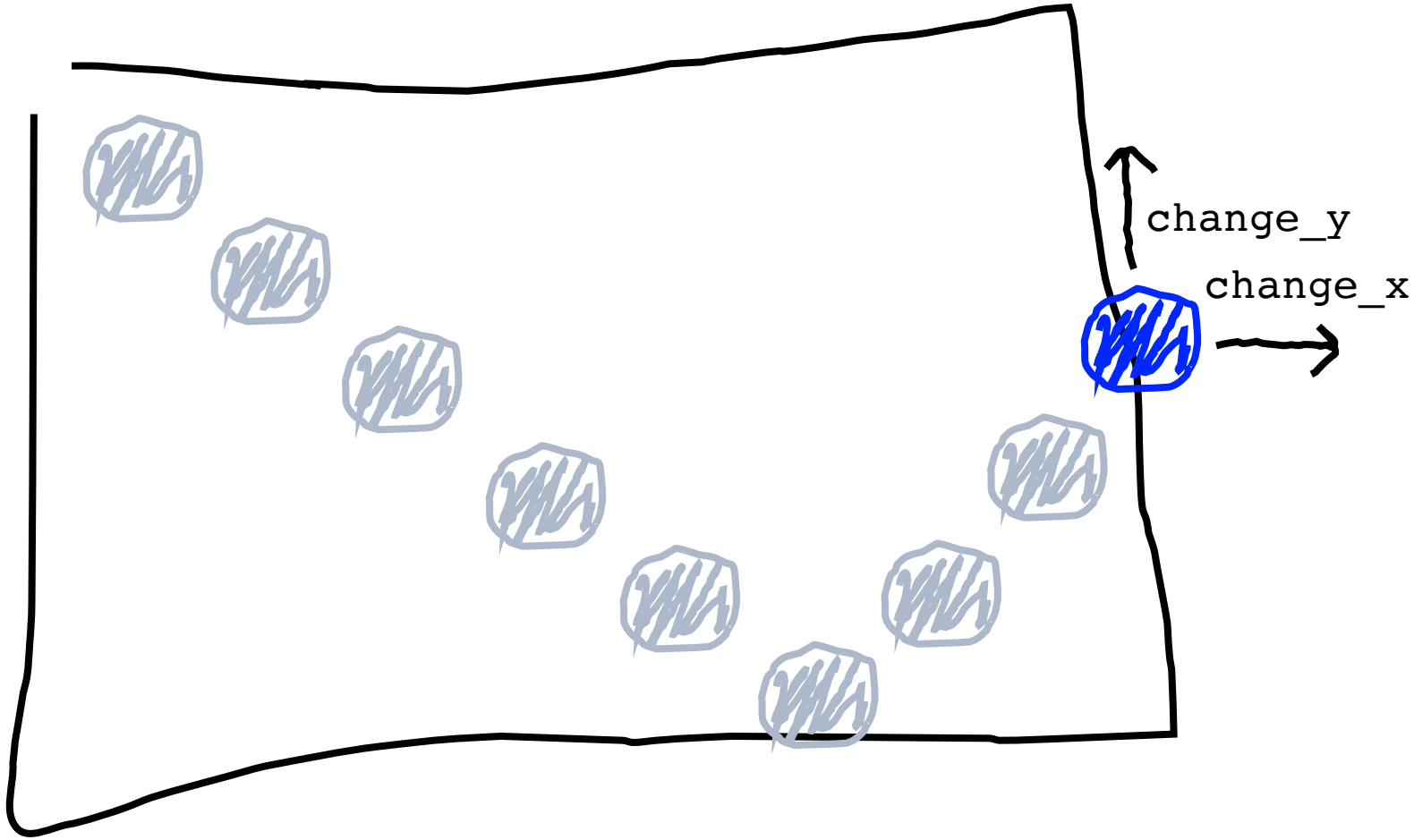
Bouncing Ball

Eighth heartbeat



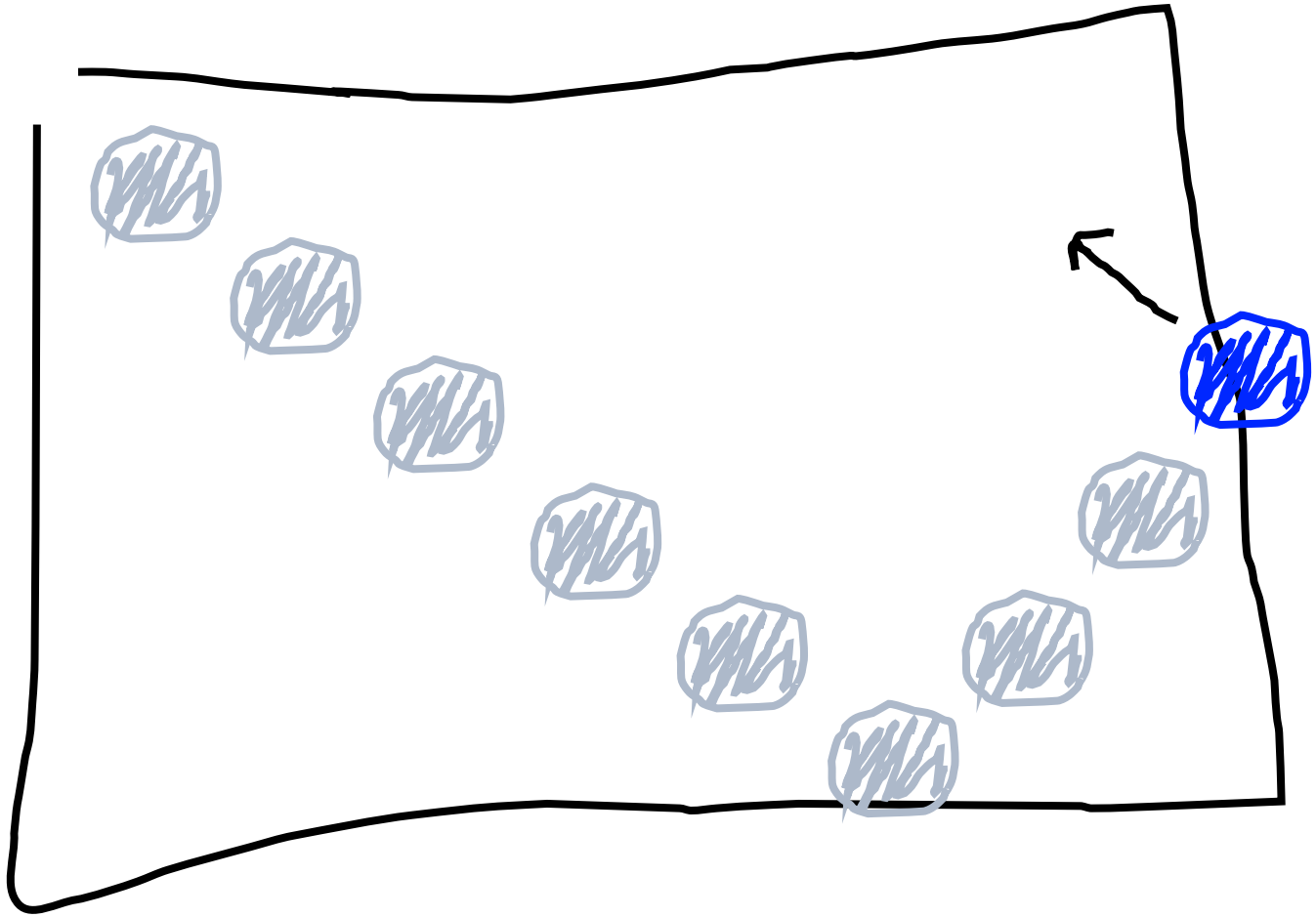
Bouncing Ball

Ninth heartbeat



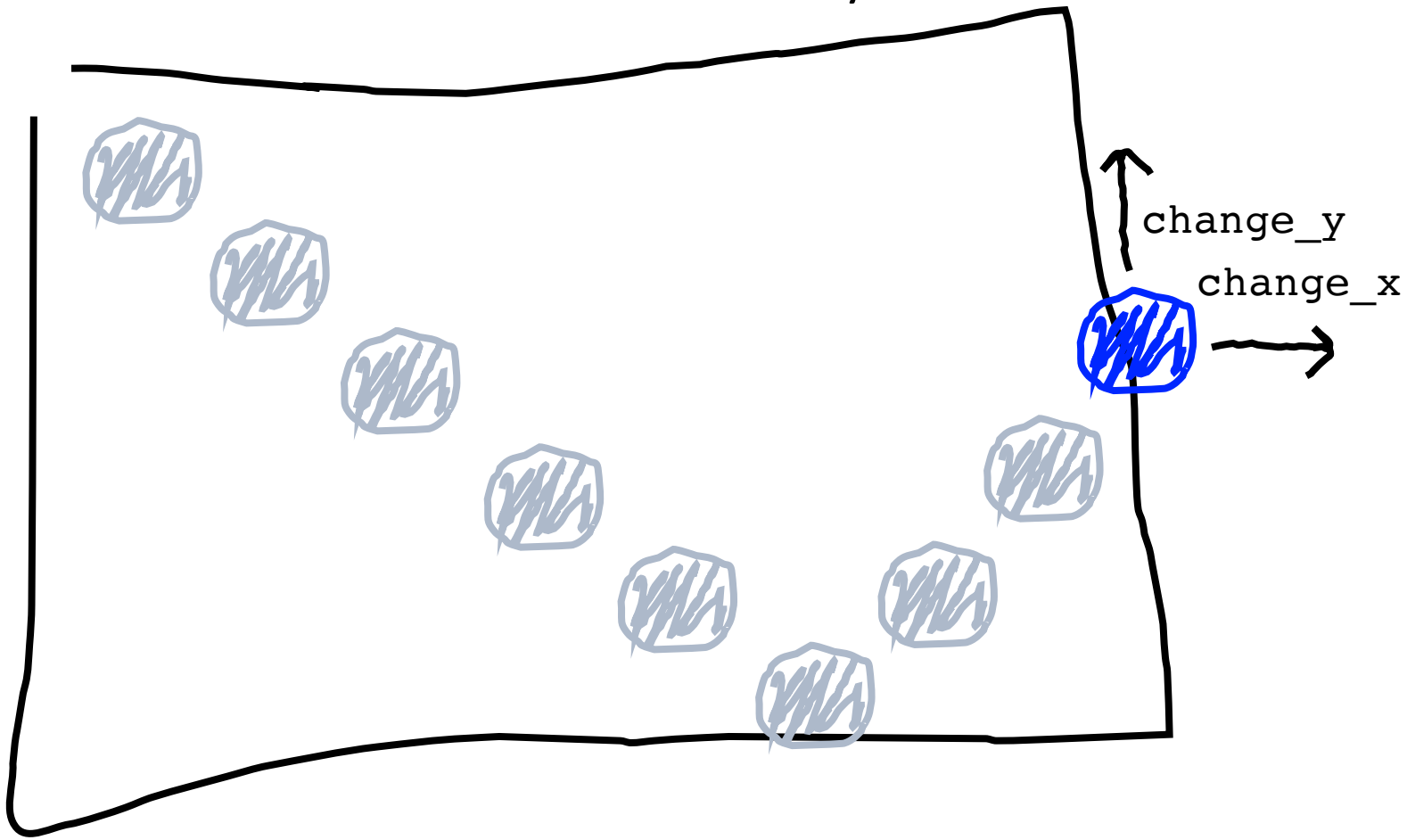
Bouncing Ball

We want this!



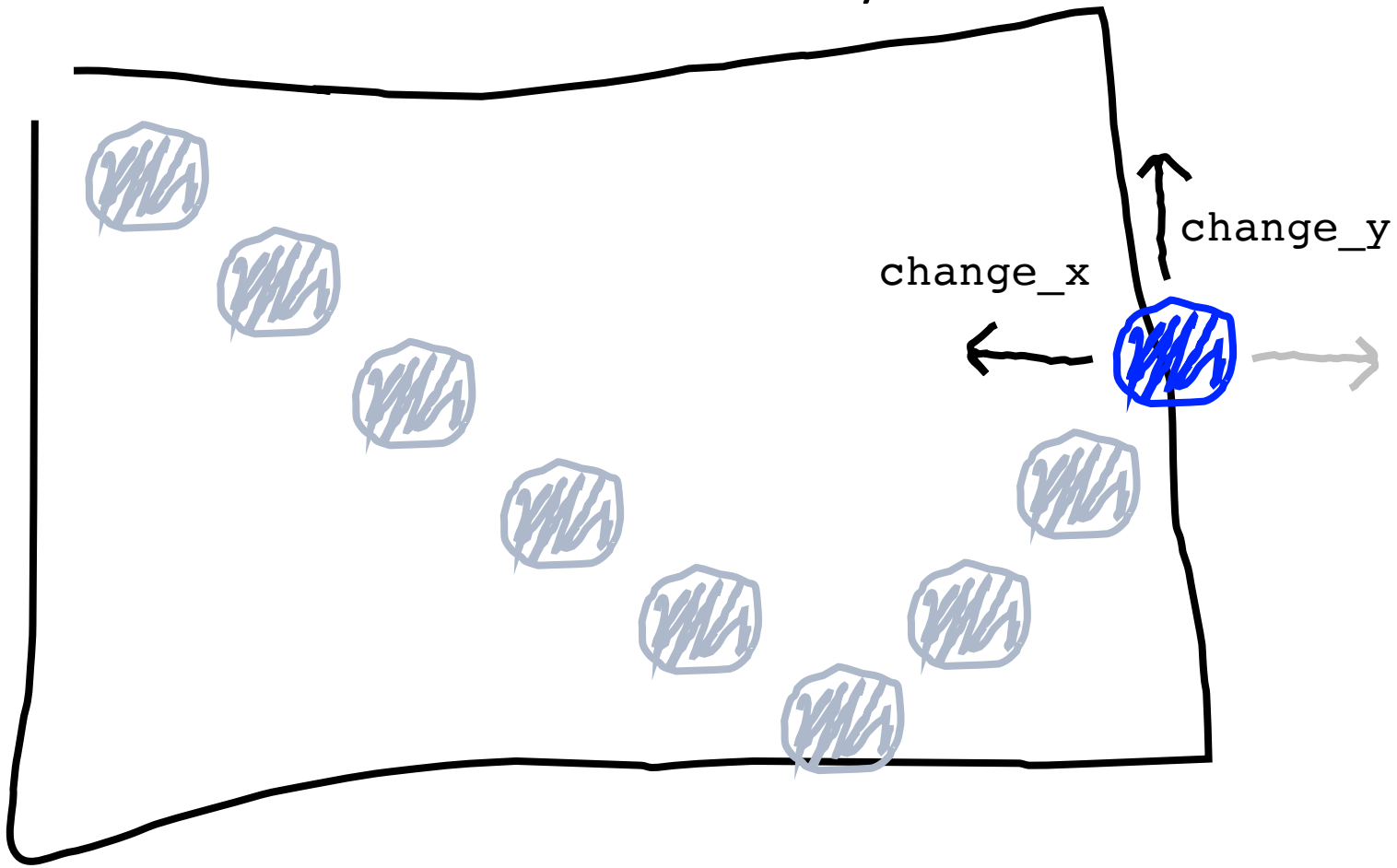
Bouncing Ball

This was our old velocity



Bouncing Ball

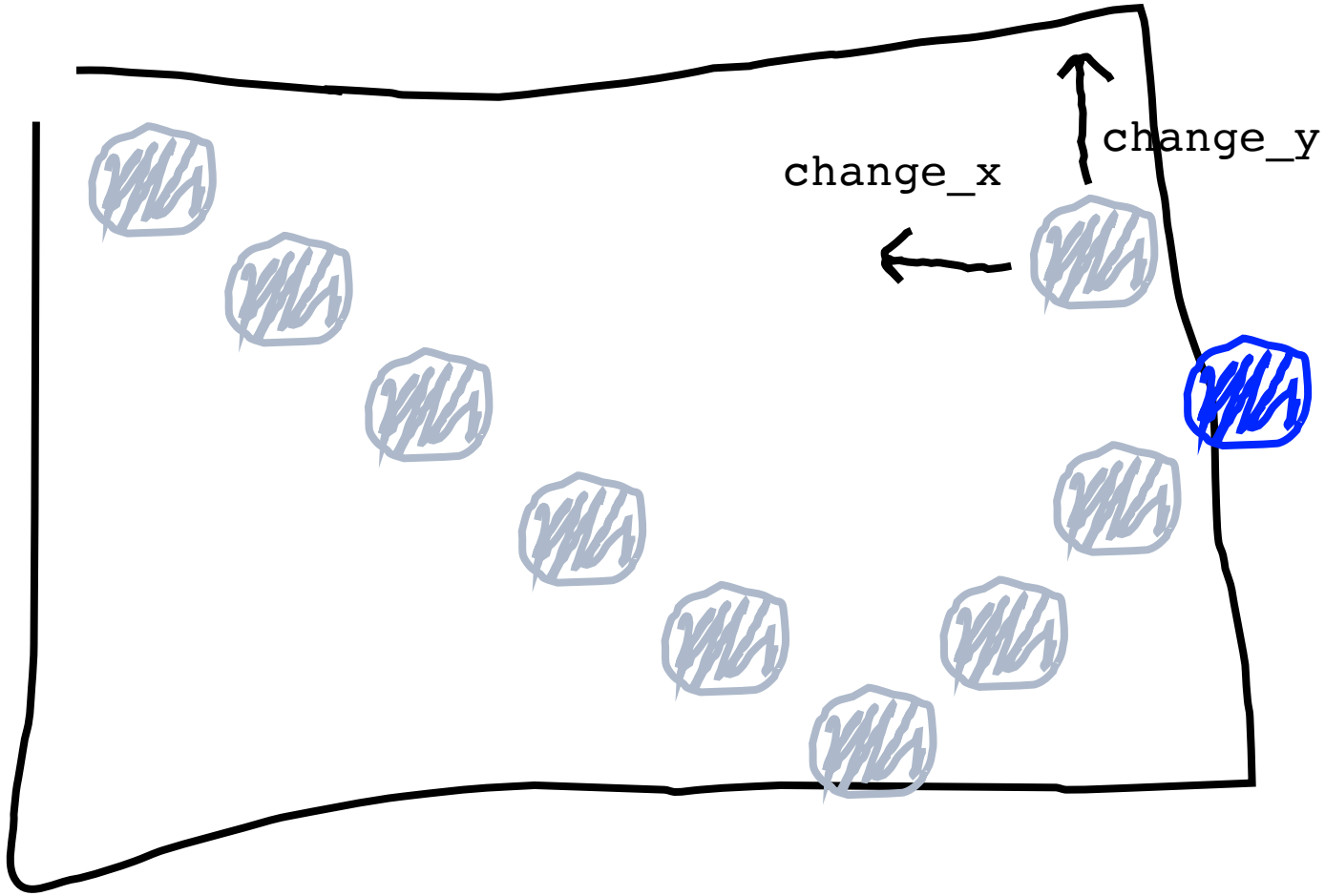
This is our new velocity



When reflecting horizontally: `change_x = -change_x`

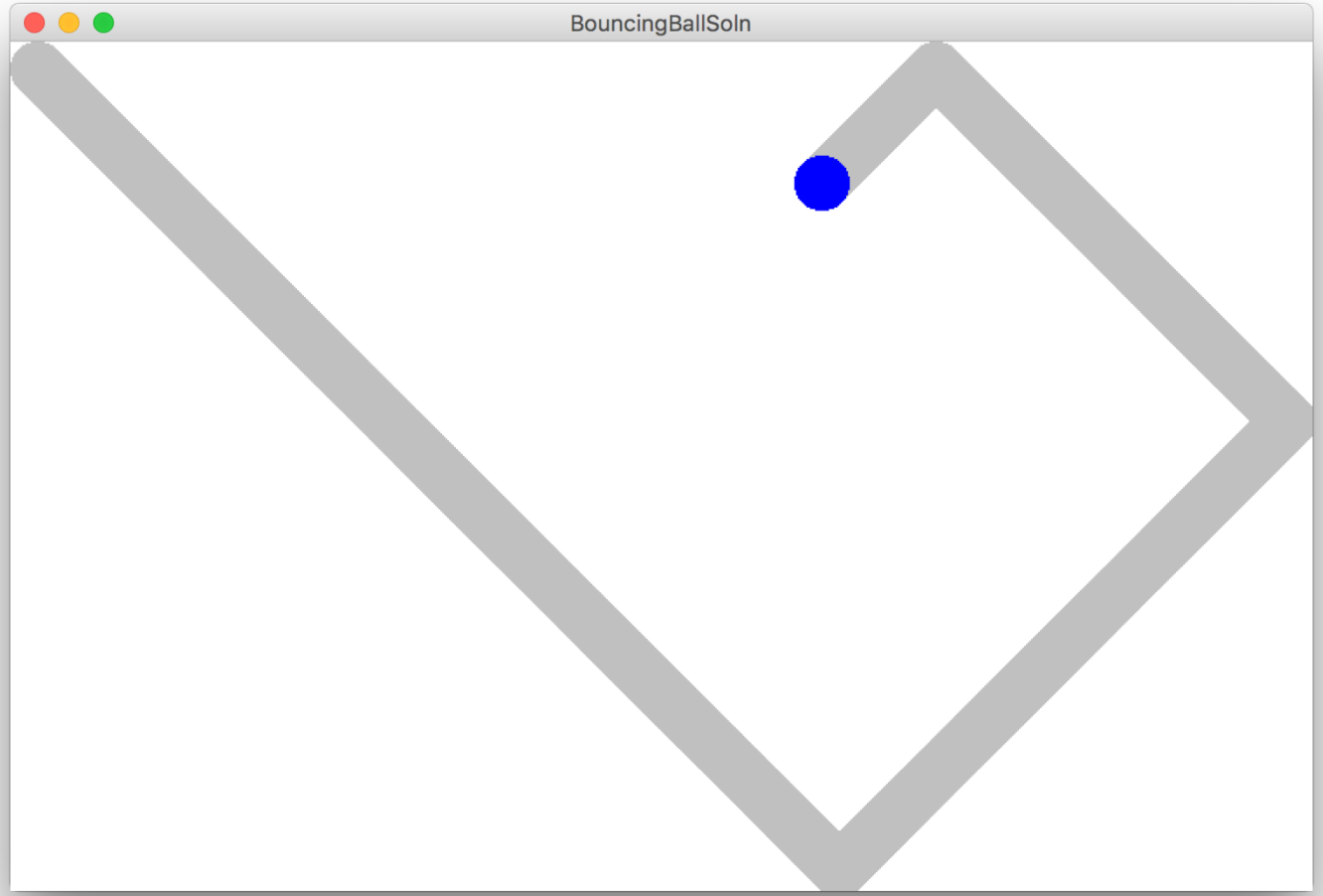
Bouncing Ball

Tenth heartbeat



When reflecting horizontally: `change_x = -change_x`

Bouncing Ball



Lecture Plan

- **Review:** Graphics
- Animation Loop Structure
- **Example**: Move To Center
- **Practice**: Bouncing Ball
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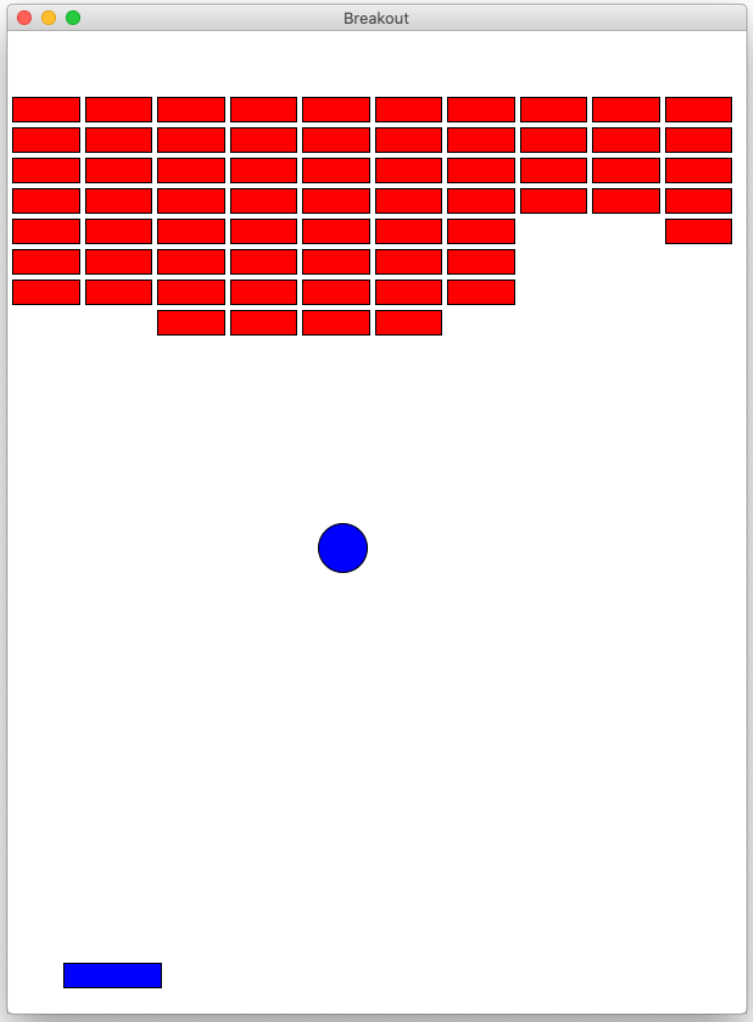
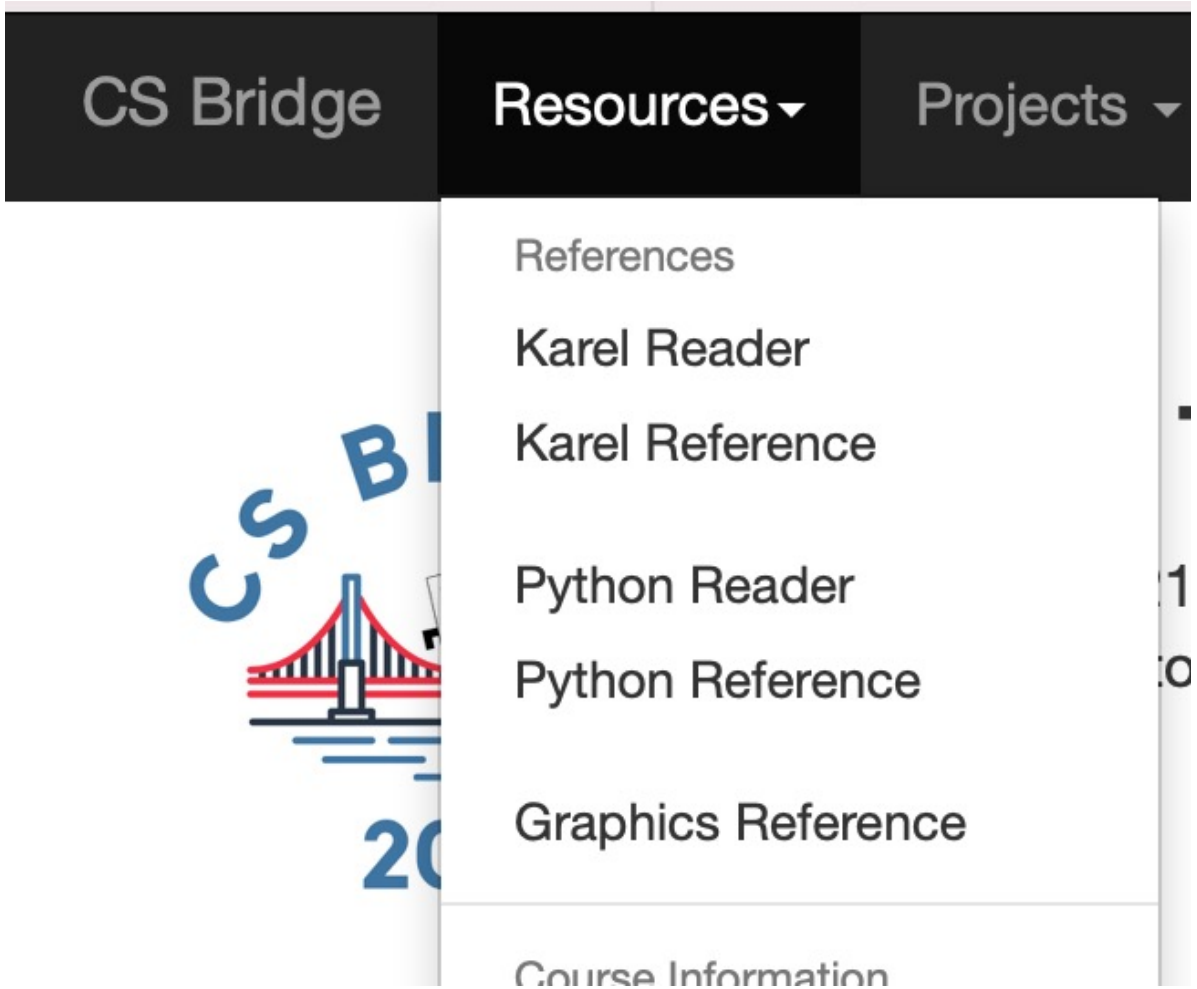
Coming soon…

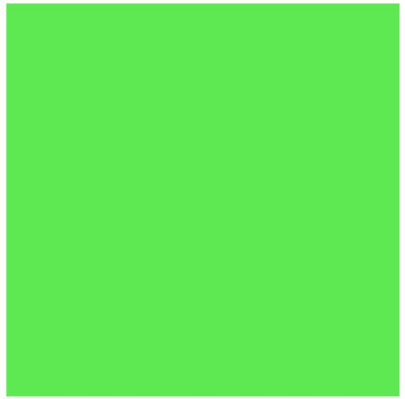


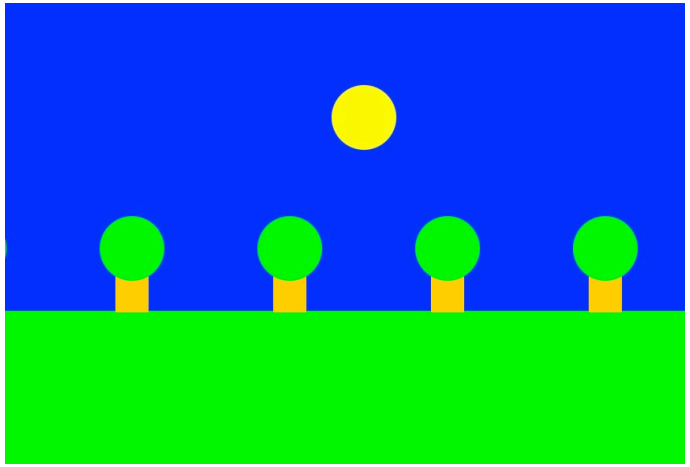
Graphics Resources

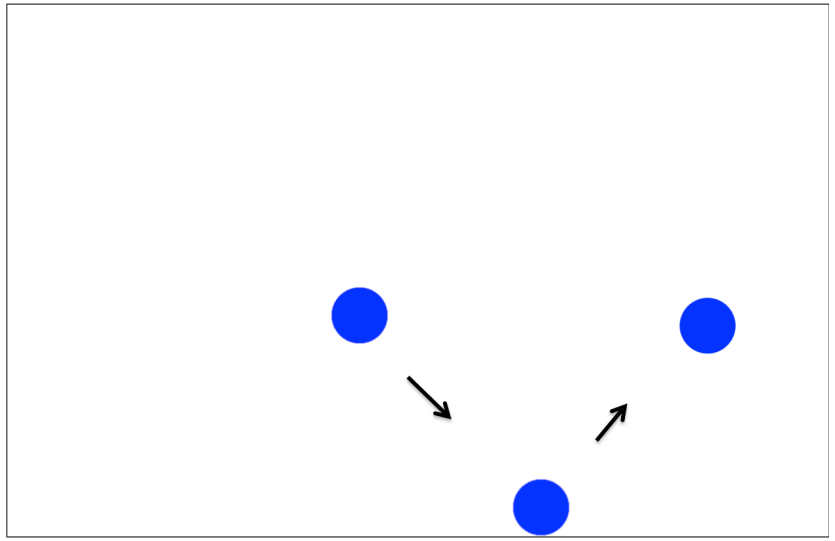


Rest Of Today

- **Quickstart:** Program a mystery square… (???)
- **Section:** Complete the implementation of the bouncing ball program
- **Project:** Use animation to create your own short film!







What’s Next?

- Time for your section’s quickstart time!
- Check your section’s Ed group for more information

Extra Slides

Wait a minute….

```
def make_ball(canvas):
```

Does this copy the canvas??!!

*Variables are stored using a reference. Which is like a **URL**. The URL gets copied when you pass the variable*

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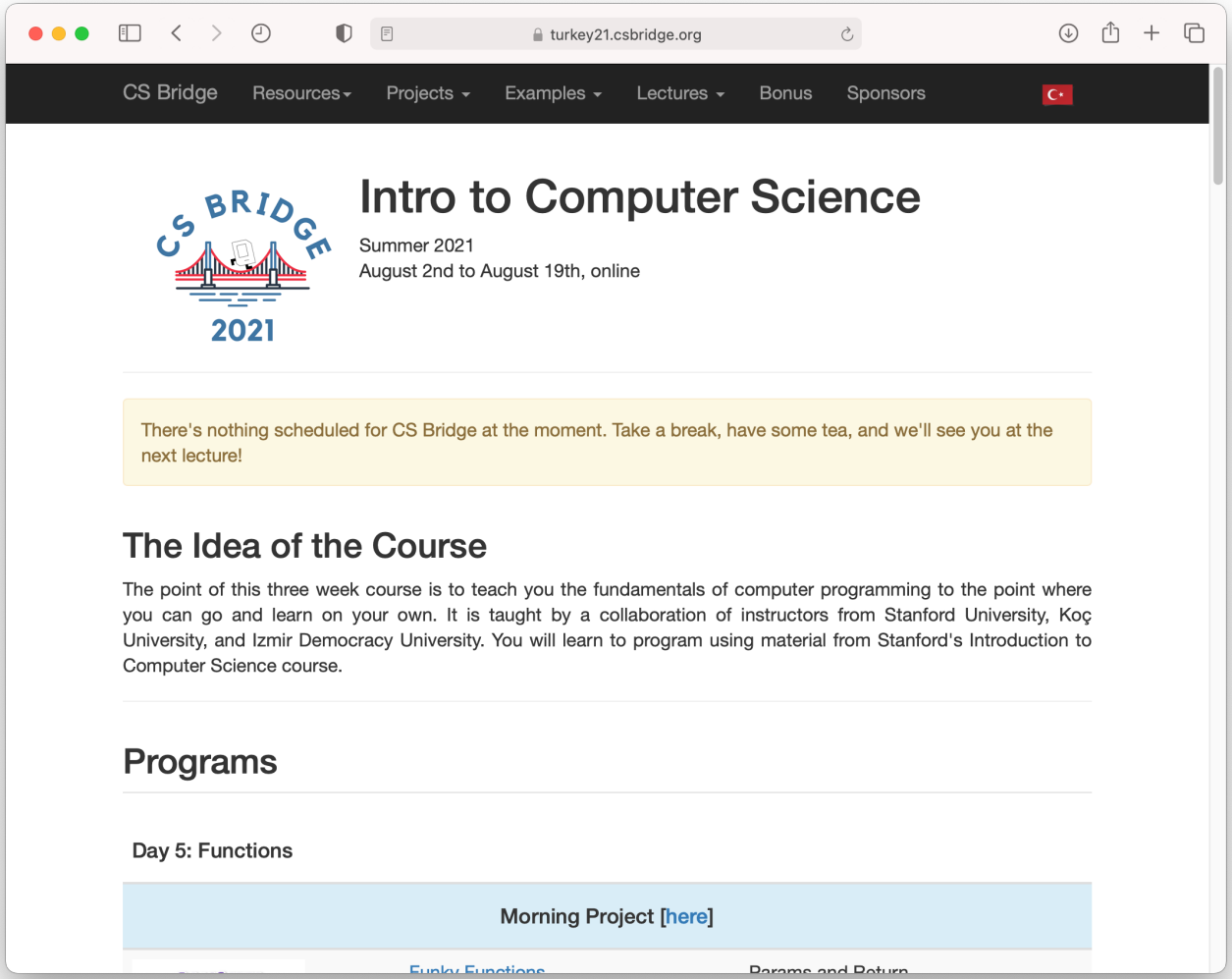
- Animation Loop Structure
- **Example**: Move To Center
- **Practice**: Bouncing Ball
- Passing Parameters

How do we share websites?



turkey21.csbridge.org

Passing Parameters

```
def main():
    canvas = Canvas()
    make_ball(canvas)

def make_ball(canvas):
    canvas.create_oval( … )
```

stack

heap

main

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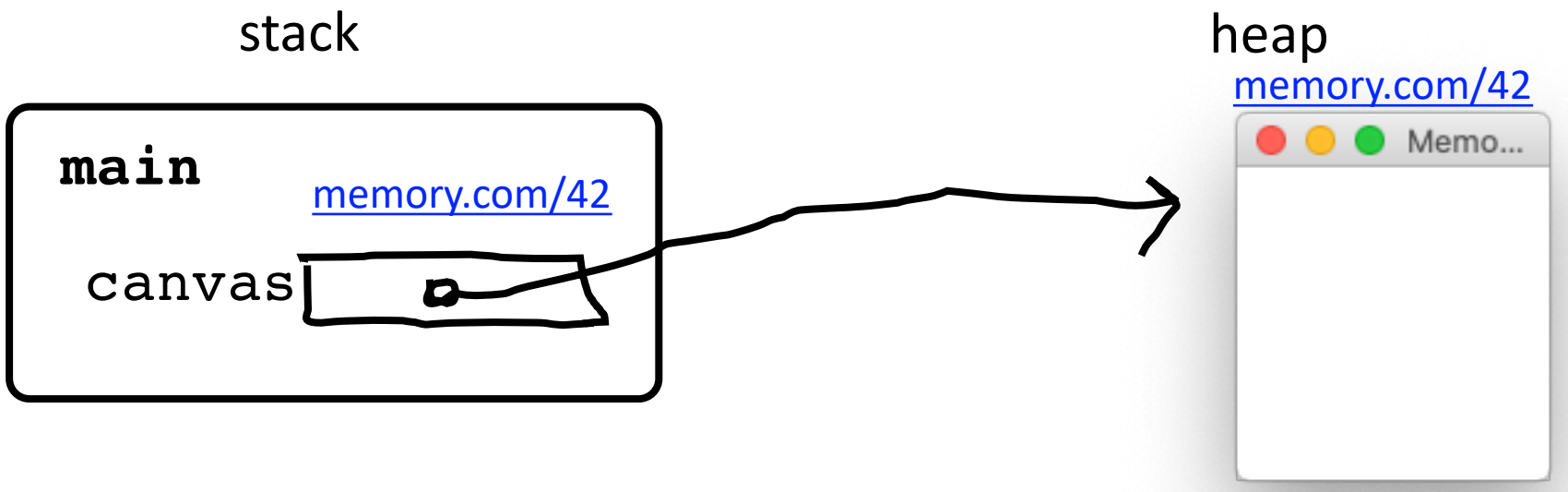

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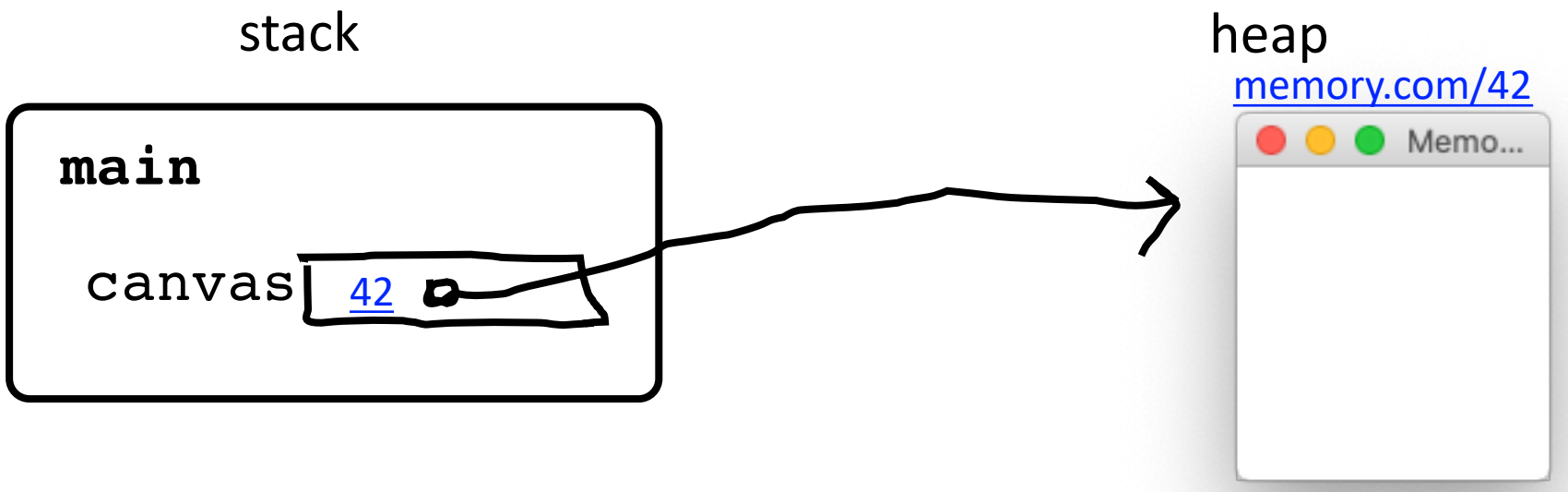

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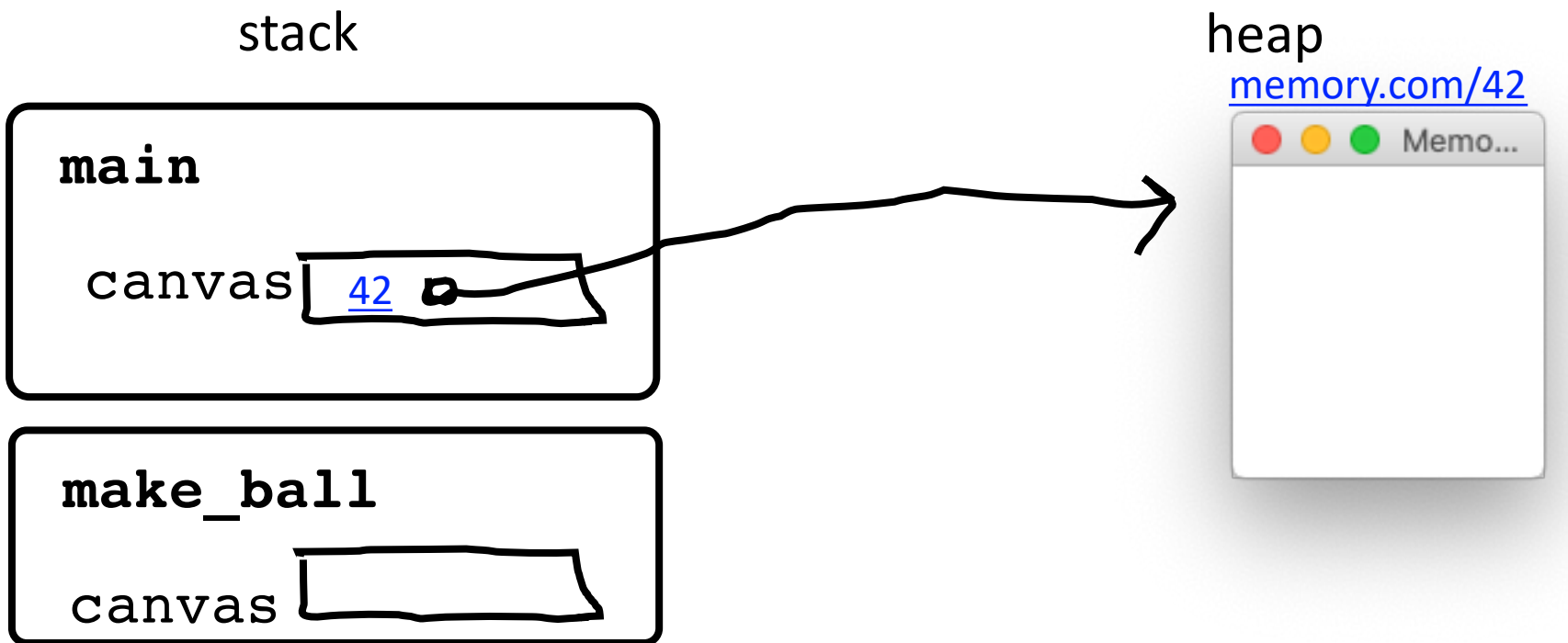

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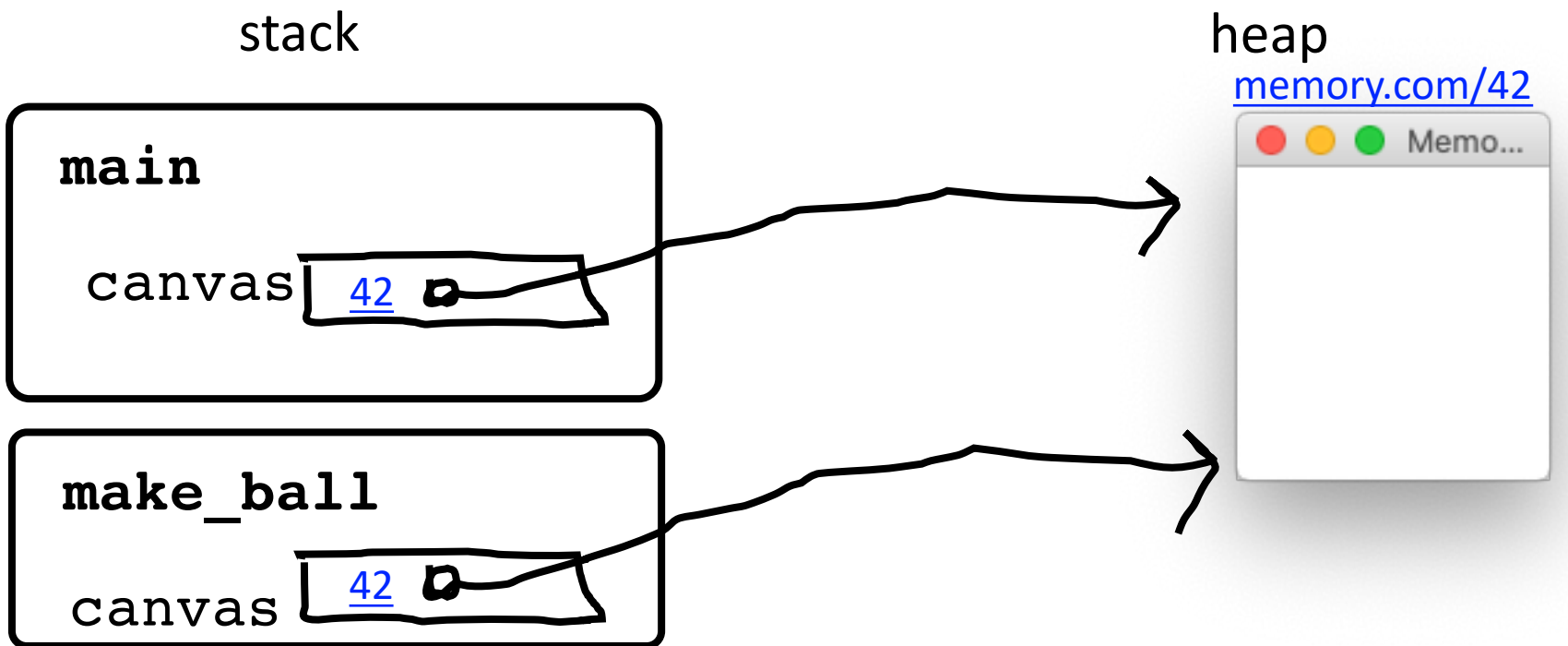

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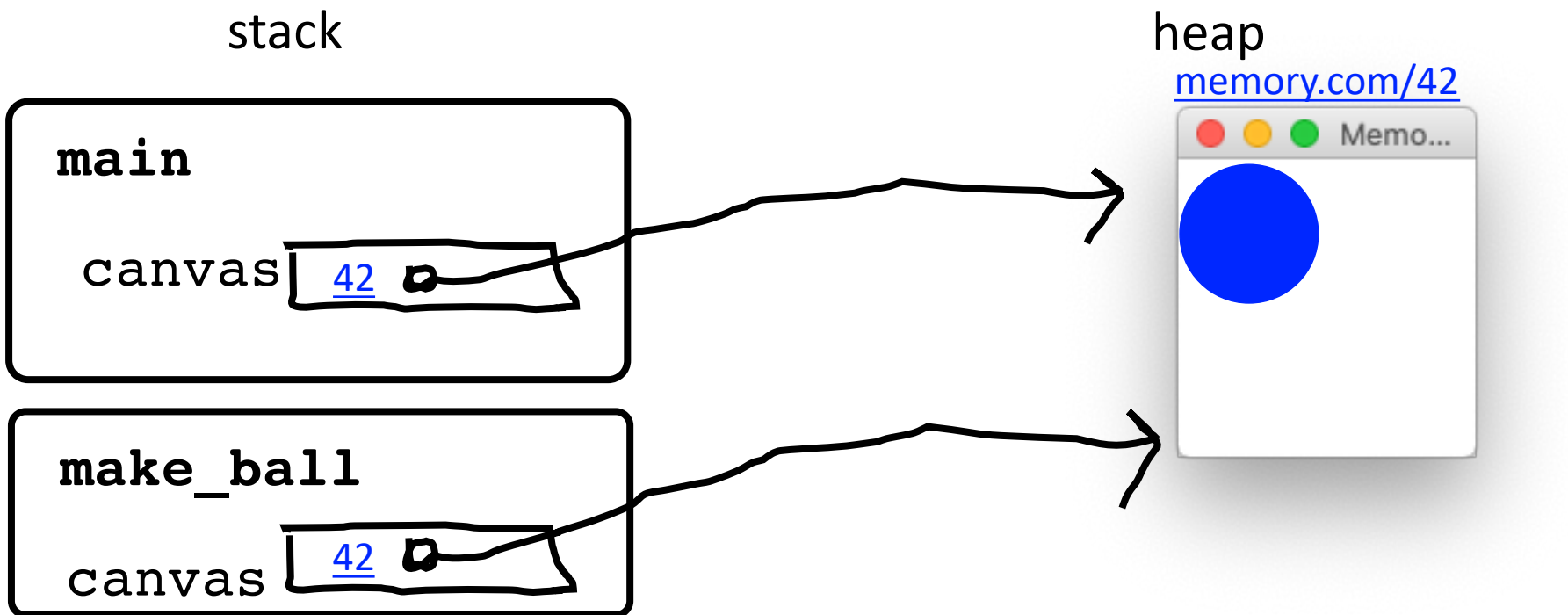

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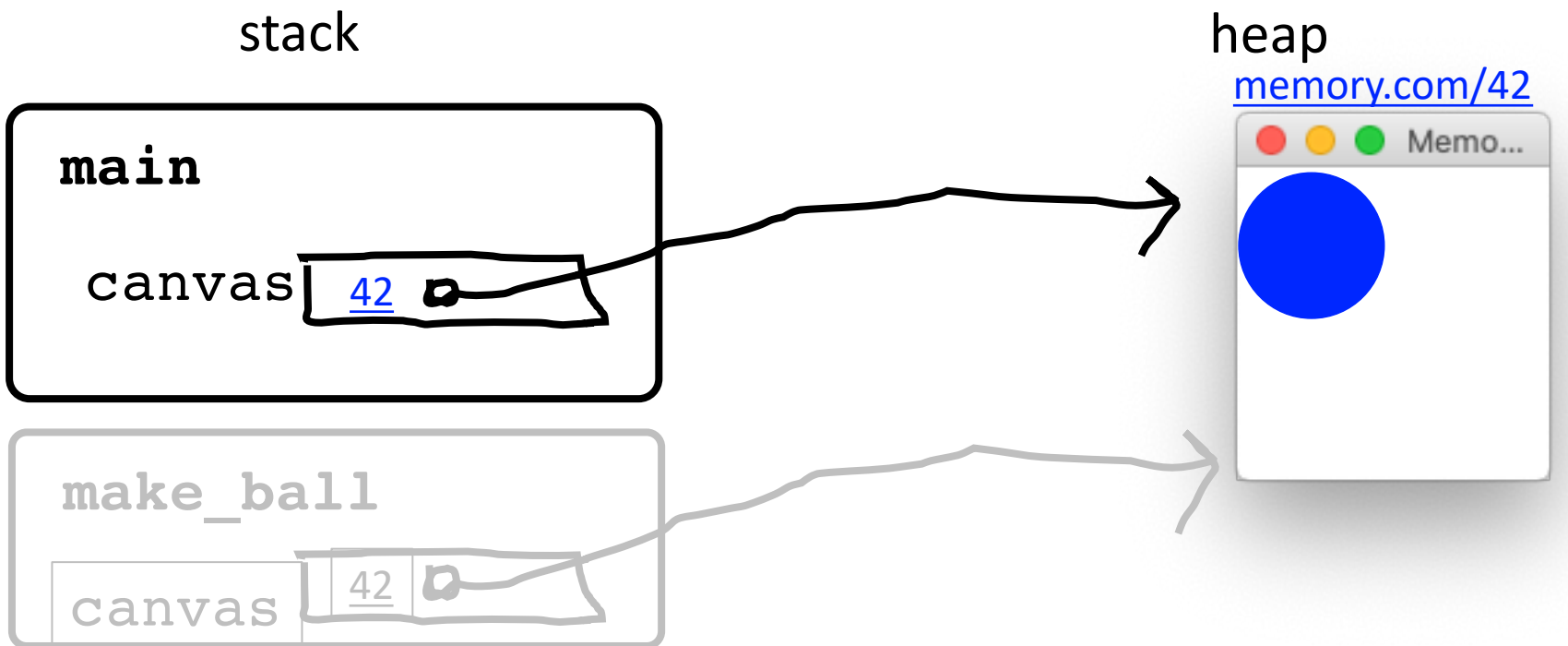

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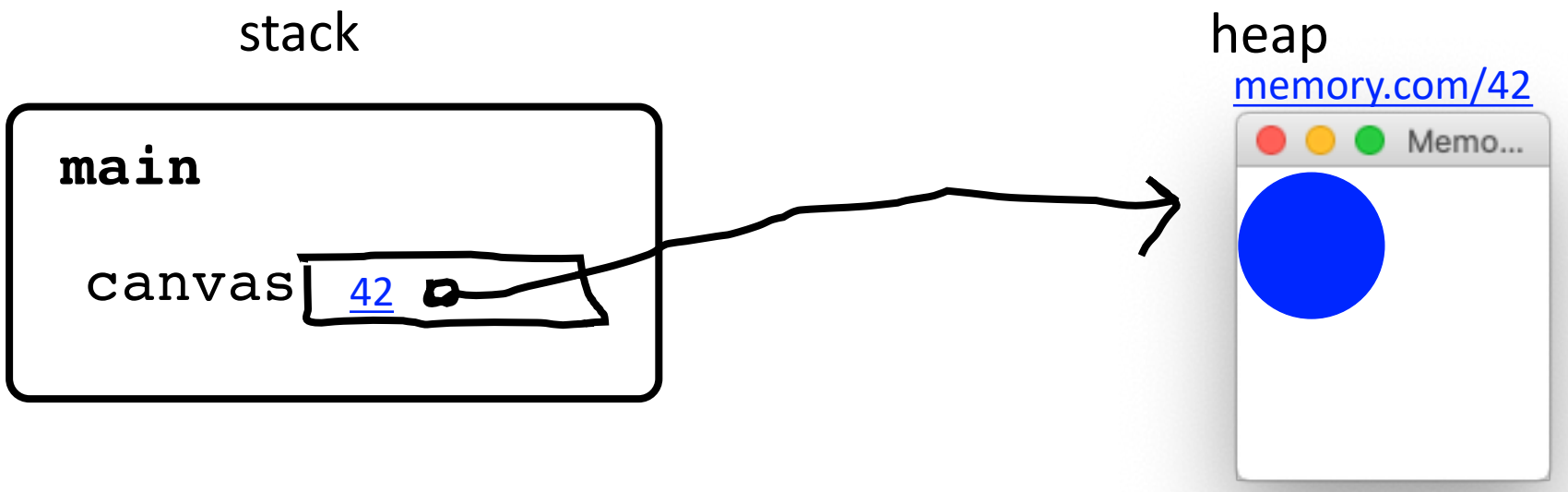

Key Idea: Passing Parameters

When passing variables, some act just like you are passing a URL.

That allows functions to modify the variable