BREAKOUT

CS360 PROJECT
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WHAT IS BREAKOUT?

Breakout is an arcade game developed and published by **Atari, Inc.**

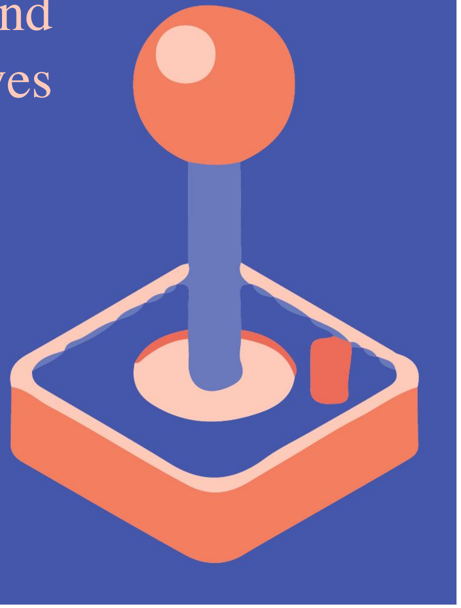
The game was ported to multiple platforms and upgraded to video games such as **Super Breakout.**

Atari, Inc. was an American video game development and home computer company founded in 1972 by Nolan **Bushnell** and Ted **Dabney [1]**.

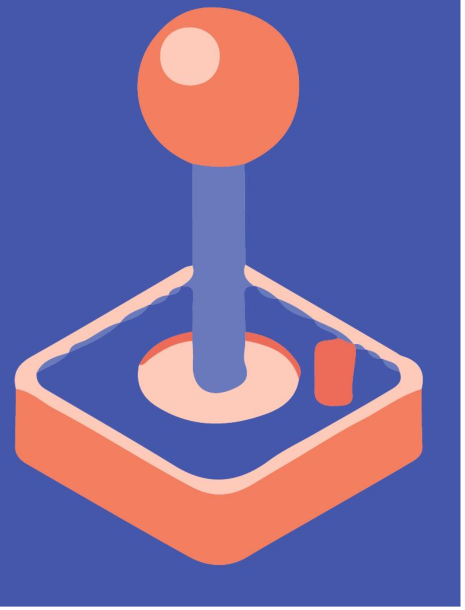
GAME PLAY

The game consists of **layers of blocks**, a **ball**, and a **movable controller block.**
The game start once the player presses **SPACE** bar.
It starts with the ball traveling across the screen, bouncing off the top and side walls of the screen as well as on the movable controller, which moves by pressing the **right** and **left** keys.

When a block is hit, the ball bounces away and the block is **destroyed.**
If the ball falls, the player **loses**.

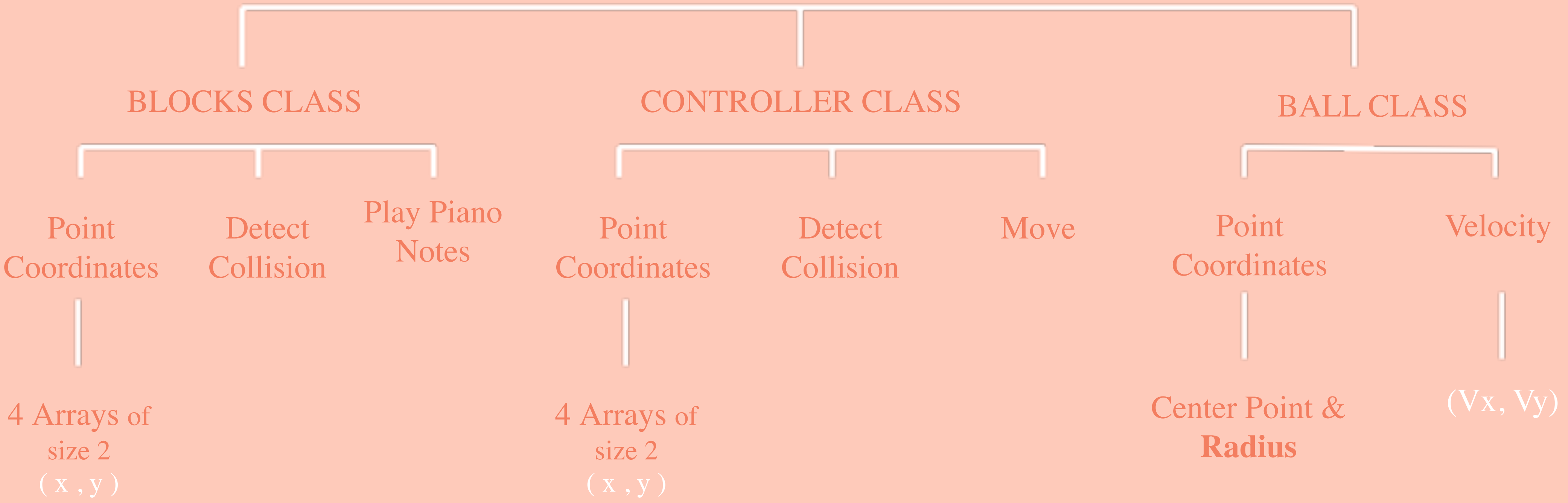


LET’S PLAY



IMPLEMENTATION

PROGRAM INFRASTRUCTURE



BLOCKS CLASS

Point Coordinates

4 Arrays of size 2 (x , y)

Detect Collision

Play Piano Notes

CONTROLLER CLASS

Point Coordinates

4 Arrays of size 2 (x , y)

Detect Collision

Move

BALL CLASS

Point Coordinates

Center Point & **Radius**

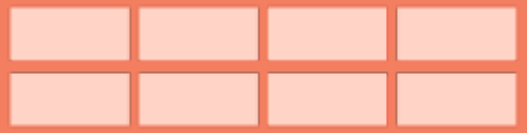
Velocity

(Vx, Vy)

CONSTRUCT & DRAW

```
Blocks[][] BLOCKS[i][j] = new Blocks[rows][cols]....;
```

→ GL_QUADS

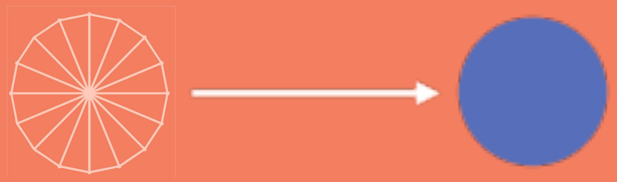


```
Controller player = new Controller....;
```

→ GL_QUADS

```
Ball ball = new Ball....;
```

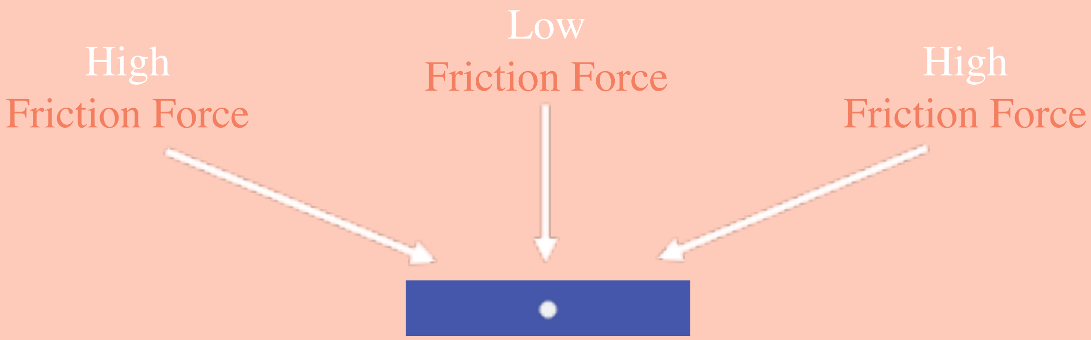
→ GL_TRIANGLE_FAN



CONTROLLER

It’s not just bouncing back

The **controller** applies friction force to the **BALL** that will alter the bouncing behavior.



High
Friction Force

Low
Friction Force

High
Friction Force

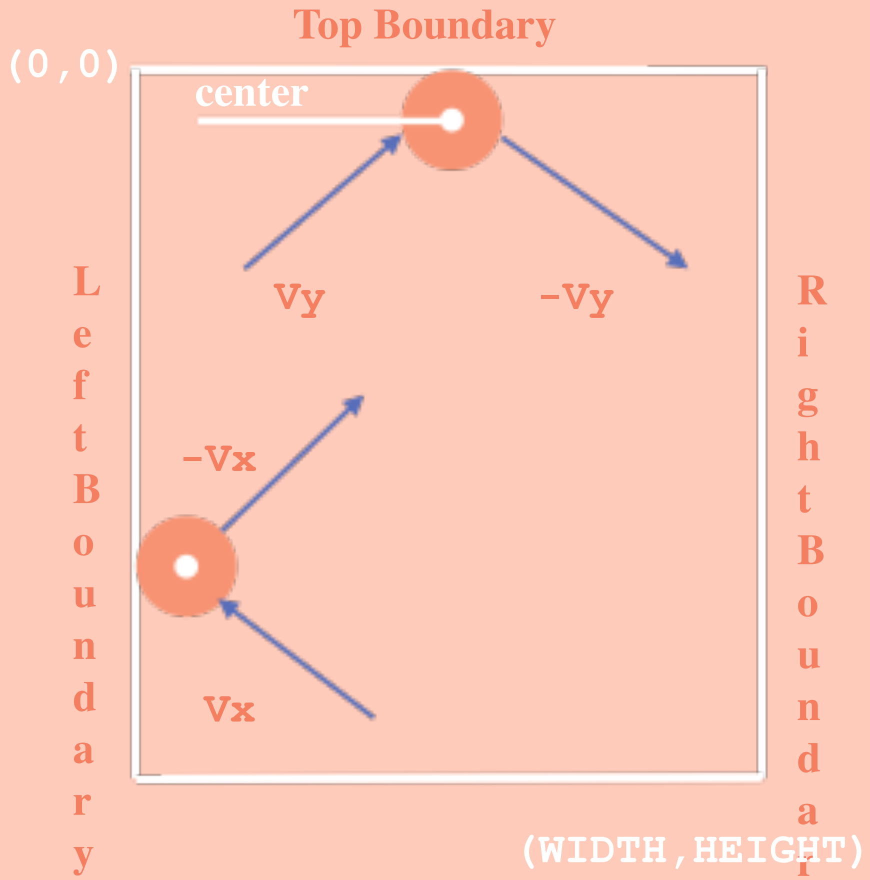
```
ratio= (collisionPoint - ControllerCenter) / WIDTH
Vx= ratio * V
Vy= (1-ratio)* V
```

BALL MOVEMENT

```
Ball.CenterX += Vx;
Ball.CenterY += Vy;
```

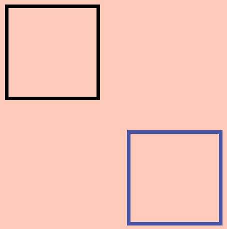
To make sure it doesn’t fly out of the borders

```
public void withinBorders(){

if(CenterX+ R >= WIDTH || CenterX-R <= 0.0)
     Vel_com[0]*= -1;

else if(CenterY - R <= 0 )
     Vel_com[1]*= -1;
}
```

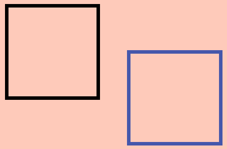


COLLISION DETECTION

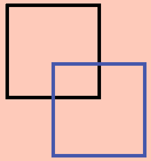
No overlap



One axis overlap

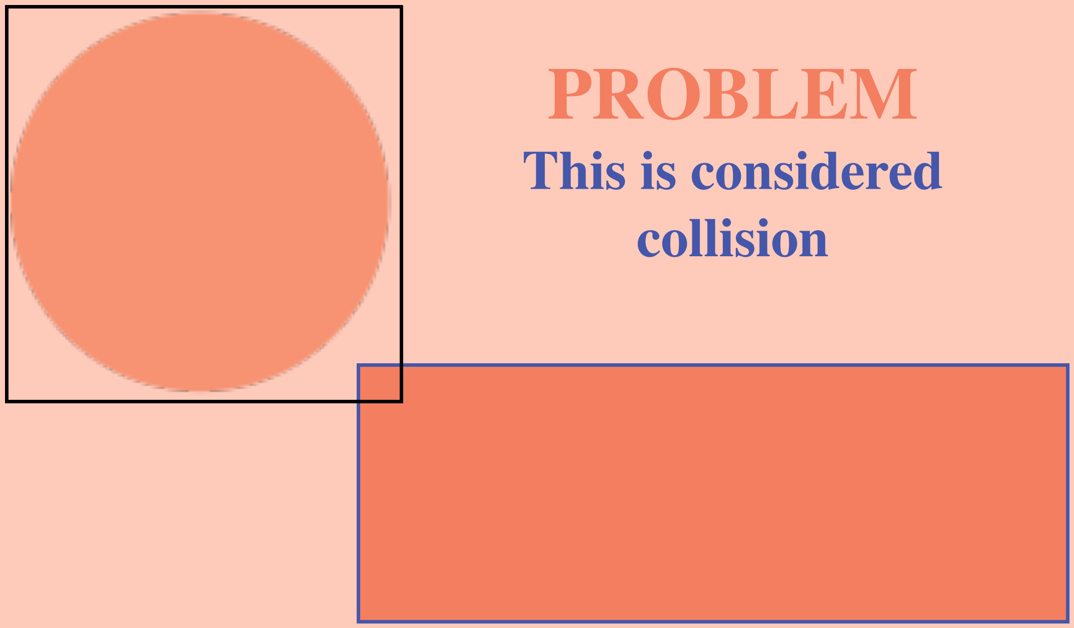


Two axis overlap



AABB collisions [3]

Axis-aligned bounding box



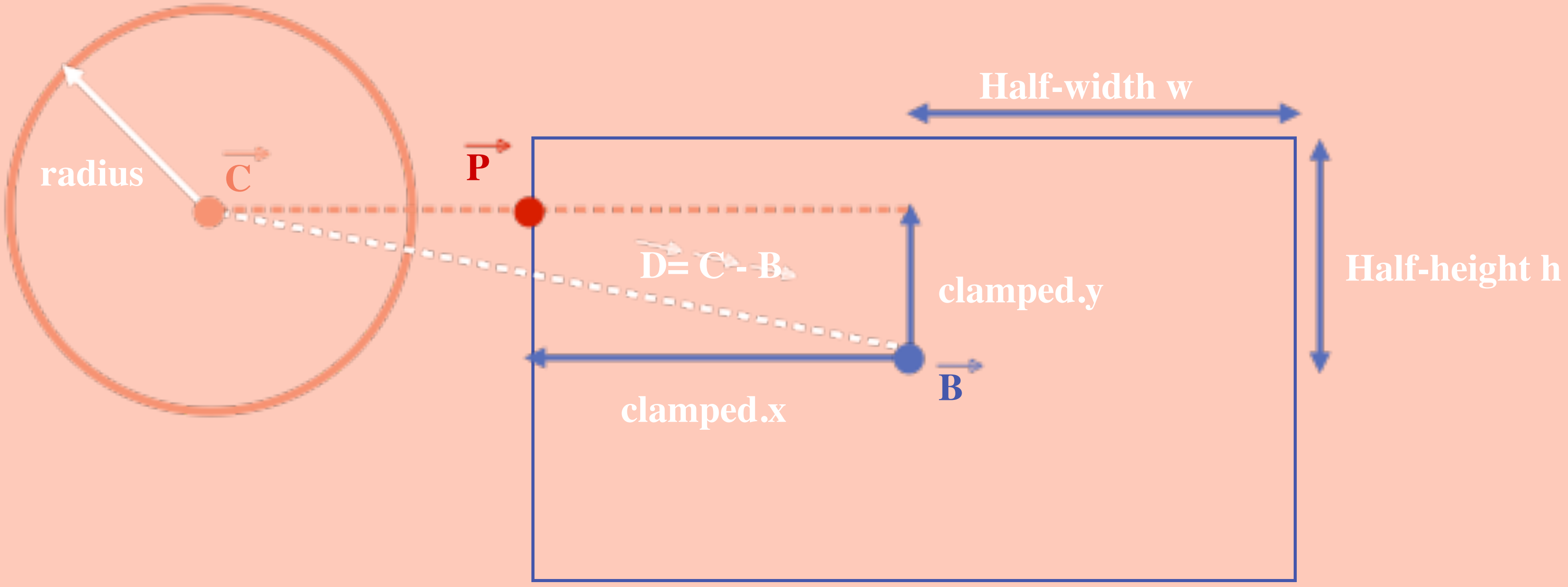
PROBLEM

This is considered collision

CHALLENGE

AABB - Circle collision detection

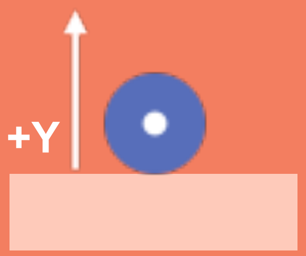
Finding $\vec{P}$



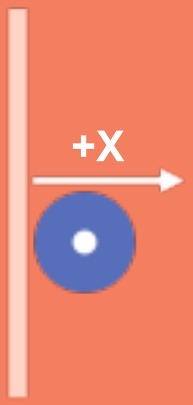
BOUNCING BACK

PROBLEM

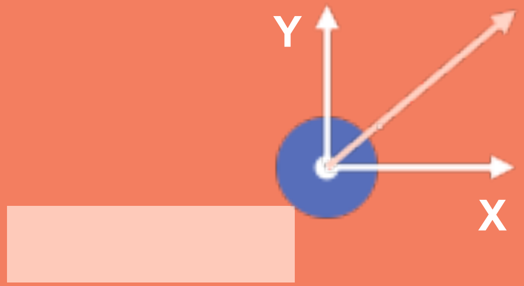
This is very hard to implement



Vy= -Vy



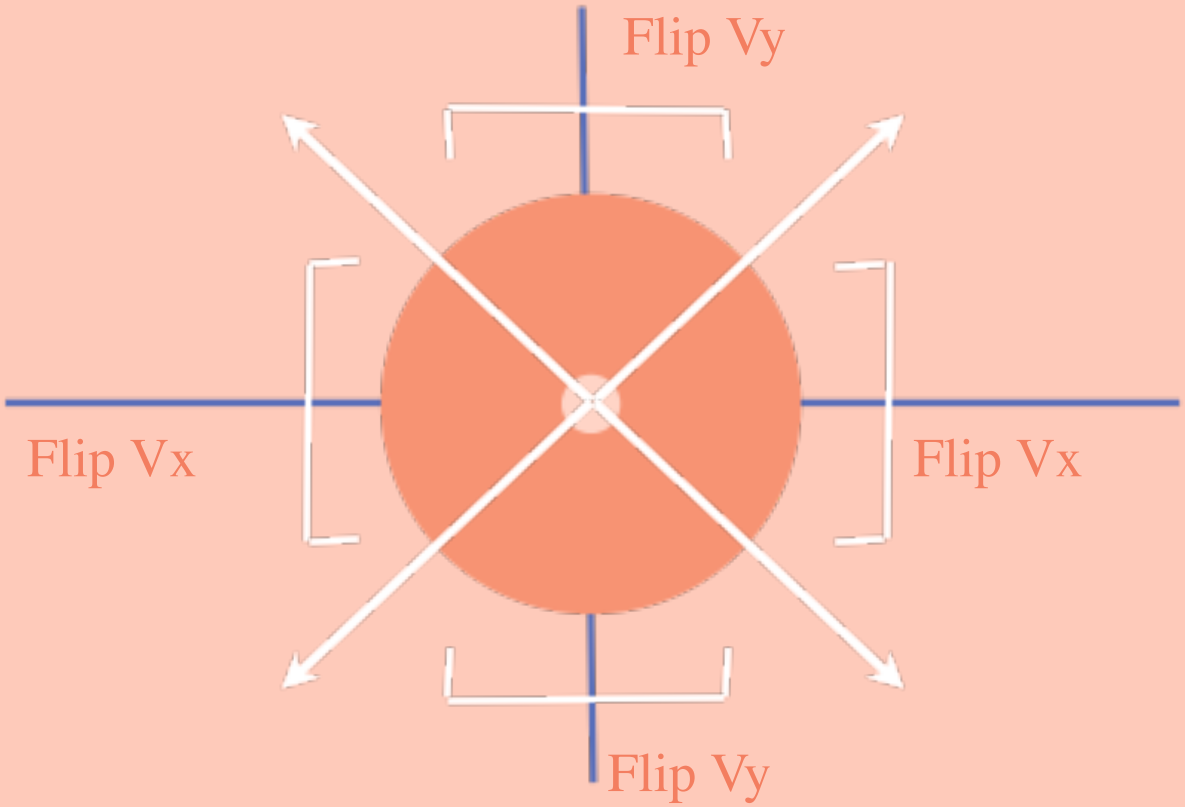
Vx= -Vx



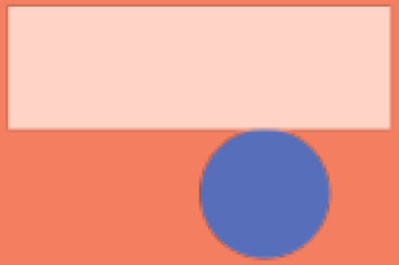
Vx= V * x/r
Vy= V * y/r

SOLUTION

ROUGH APPROXIMATION

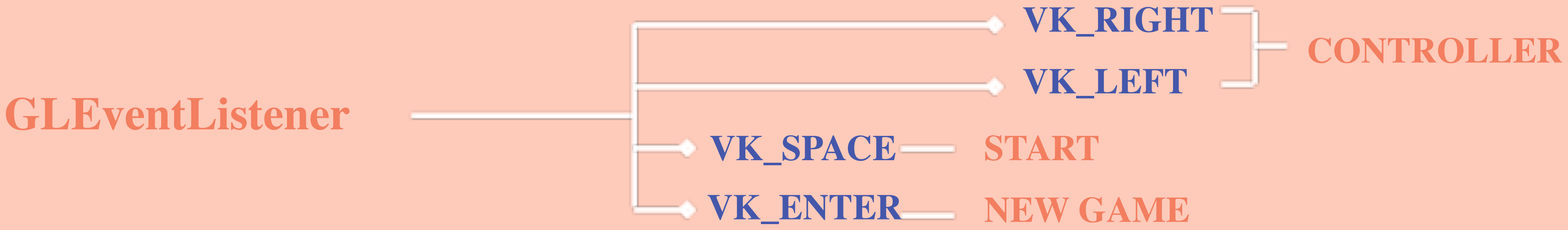


BREAKING BLOCKS



```
//In display(GLAutoDrawable drawable)
      if( !BLOCKS[i][j].isBroken() ){
         //DRAW BLOCKS
      }
      •
      •
      •
      •

      if( !BLOCKS[i][j].isBroken() && BLOCKS[i][j].collision(ball) )

                  BLOCKS[i][j].break_it();
```

ALSO USED



GLEventListener

VK_RIGHT

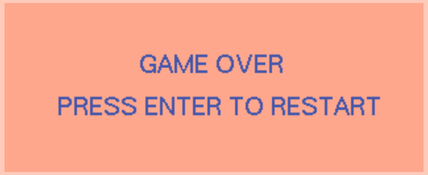
VK_LEFT

CONTROLLER

VK_SPACE — START

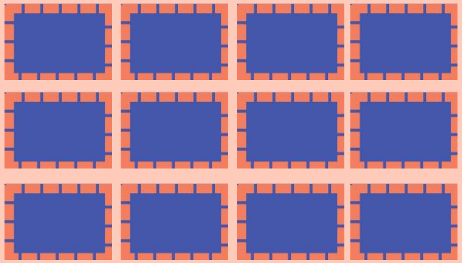
VK_ENTER — NEW GAME

glutBitmapCharacter [2]



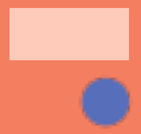
GAME OVER
PRESS ENTER TO RESTART

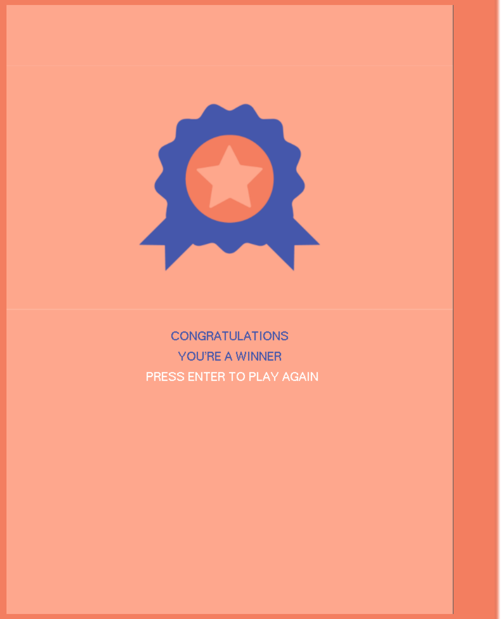
GL_TEXTURE_2
D



SCENARIOS

All blocks destroyed

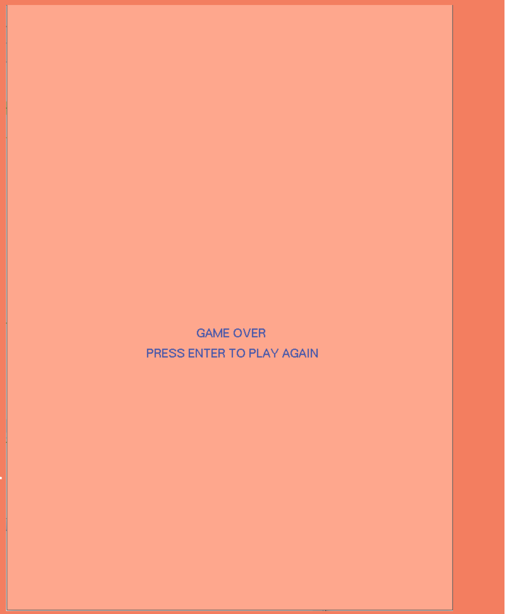




CONGRATULATIONS
YOU'RE A WINNER
PRESS ENTER TO PLAY AGAIN

WINNER

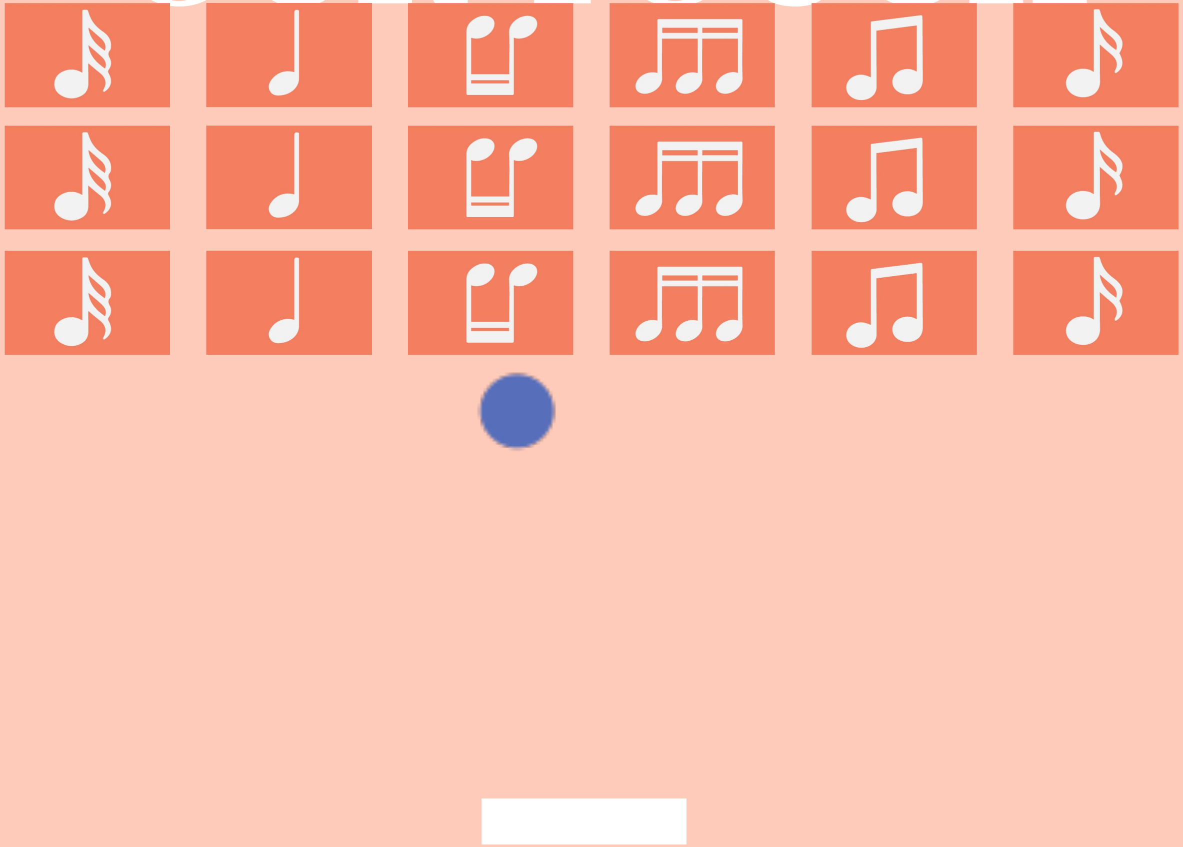
Ball falls down



GAME OVER
PRESS ENTER TO PLAY AGAIN

GAMEOVER

OUR TOUCH



ADDING SOUNDS

EACH BLOCK WAS ASSIGNED A **KEY** AT THE CREATION STAGE

```
public boolean  collision(Ball b){
  //code............
     pianoKey(this.key); //pass this block's key note
}
```

```
public static void pianoKey( int i ) {
    AudioInputStream audioIn = AudioSystem.getAudioInputStream(new
                        File ("audio\\"+i+".wav"));
    Clip clip = AudioSystem.getClip();
    clip.open(audioIn);
    clip.start();
}
```

REFERENCES

[1] Atari History. (2012). Retrieved from https://www.atari.com/history/1972-1984-0

[2] Kilgard, M. (February 23). 10.1 glutBitmapCharacter. Retrieved 1996, from https://www.opengl.org/resources/libraries/glut/spec3/node76.html

[3] DeVries, J. (2015). Collision detection. Retrieved from https://learnopengl.com/In-Practice/2D-Game/Collisions/Collision-detection