

## Lab\_9

# Greenfoot Simulation (Part 2)

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420-141-VA - GAME PROGRAMMING 1 - VANIER COLLEGE

# Outline

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- Programming Projects Using Source control (such as Git)
- Setting up the Simulation Scenario
  - a) From OMNIVOX
  - b) From Github Classroom
- Retrieve the Project from Github to local Repository
- Enhance Greenfoot World
- Making the Cannon Rotate towards Mouse / Making the Cannon shoot Cannon balls
- Commit your changes and push to Github (1)
- Collisions for targets and cannon balls
- Commit your changes and push to Github (2)

# Programming Projects Using Source control (such as Git)

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## Pros

- Storage on the cloud (Github)
- Keeps track of each version of the code
- Easy to see differences between versions
- Allows to automatically merge code from multiple team members
- Facilitates team collaboration
- Used everywhere in the industry

## Cons

- New vocabulary to learn
- Takes some time to change habit on how to commit work
- Dangerous destructive commands, be careful If you use commands you don't understand

# Step 1.a: Setting up the Simulation Scenario From OMNIVOX

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## Greenfoot Simulation (Part 2)

- Download the **Lab\_9.zip** file from Omnivox, which contains the Scenario
- Unzip the contents to somewhere on your USB key or hard disk.
- Open the scenario in that location with **Greenfoot**
- You should see the standard Greenfoot interface, with an empty world

# Step 1.b: Setting up the Simulation Scenario From Github Classroom

- 1) Click on the hyperlink below to create your repository for **Lab 9** with starting files

Click [here](#)

or

<https://classroom.github.com/a/w7jHR6CW>

- 2) You must click Accept this assignment

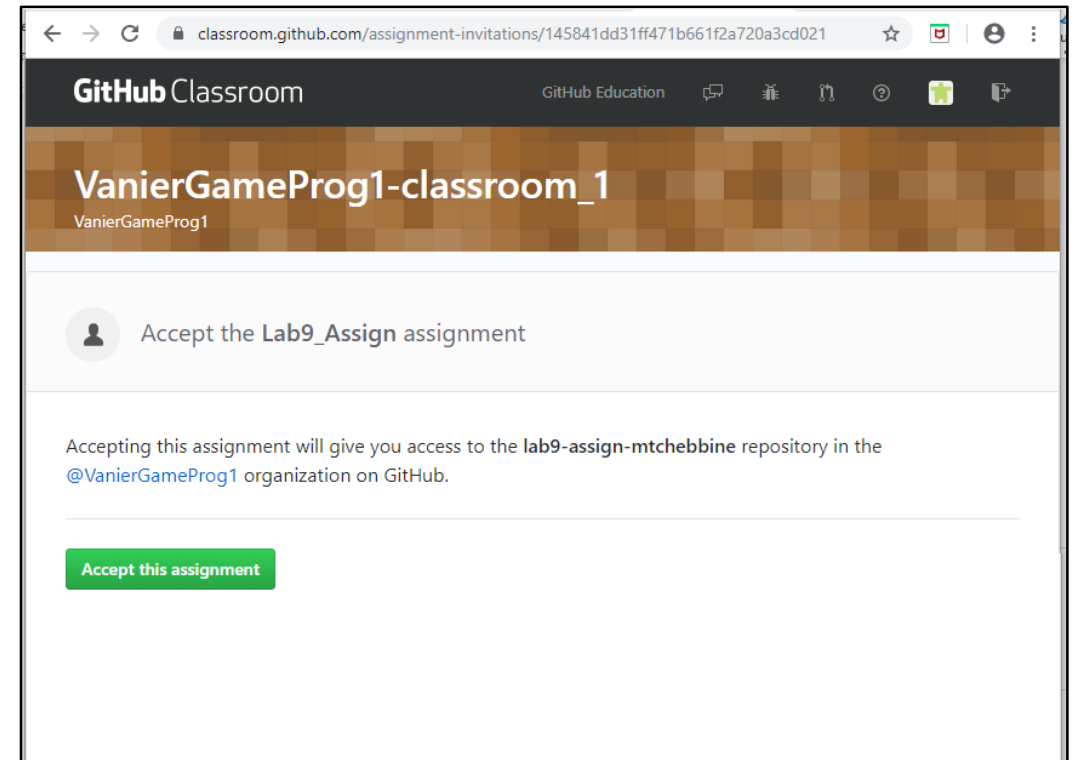


Figure 1

## Setting up the Simulation Scenario From Github Classroom (cont.)

- 3) You get the message "Your assignment has been created here"

In fact, a personal repository on the **VanierGameProg1** account is created.

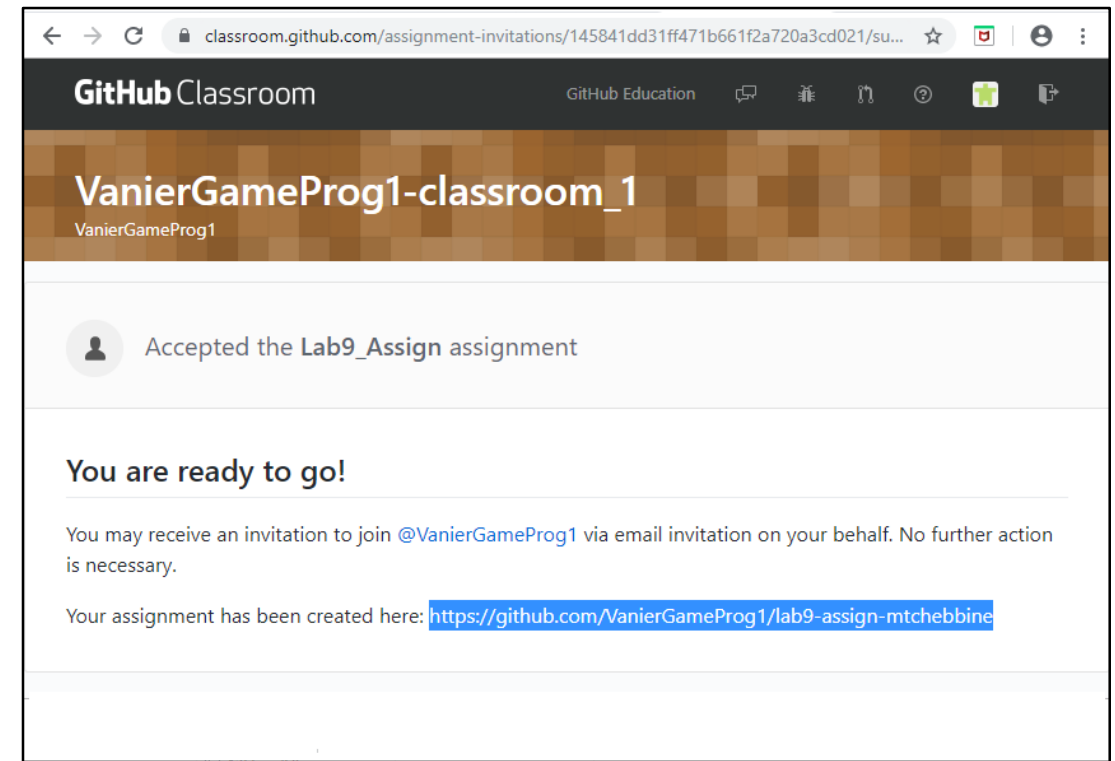


Figure 2

## Setting up the Simulation Scenario From Github Classroom (cont.)

- 4) Check that your assignment that has been created here:

<https://github.com/VanierGameProg1/lab9-assign-{username}>

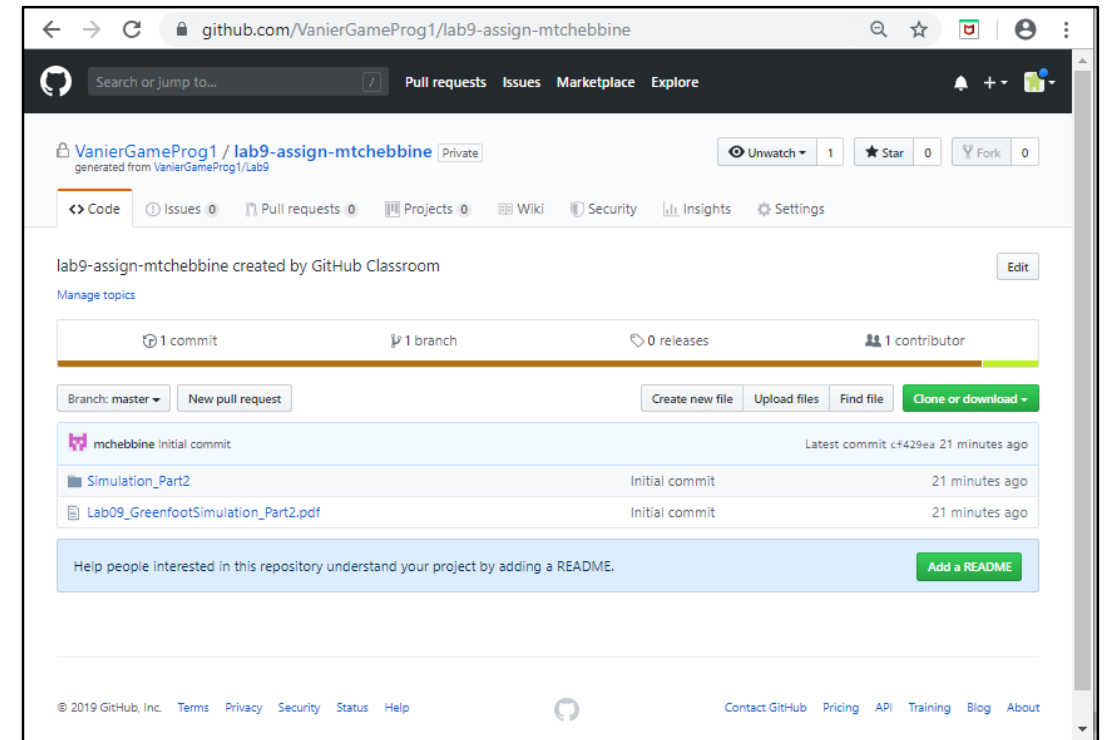


Figure 3

## Step 2: Retrieve the Project from Github to Local Repository

Retrieve the project on Github into your own personal local repository.

In a command-line prompt (**[Win] Git Bash**):

- `git clone https://github.com/VanierGameProg1/lab9-{username}`
- `cd lab9-[TAB to autocomplete]`
- `explorer .`

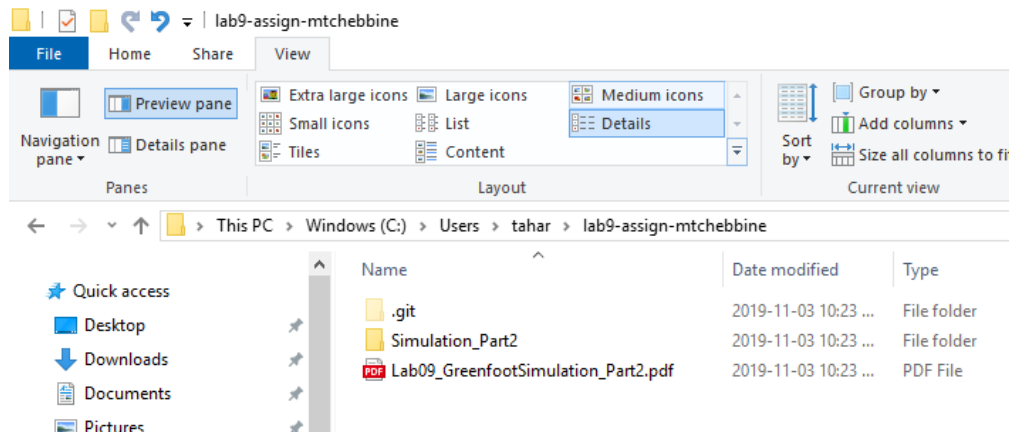


Figure 5

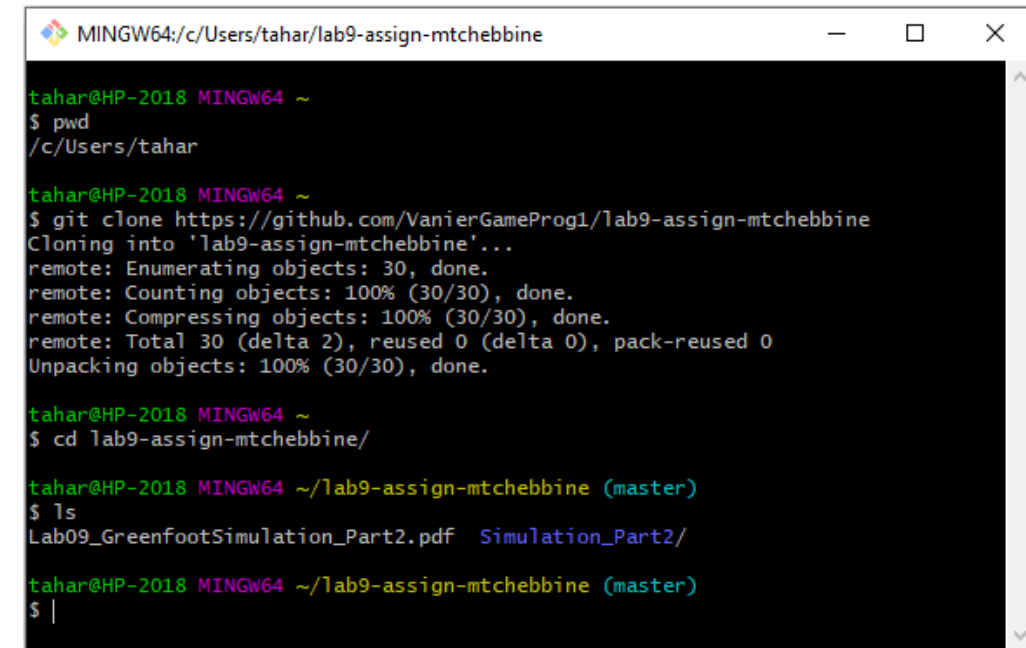


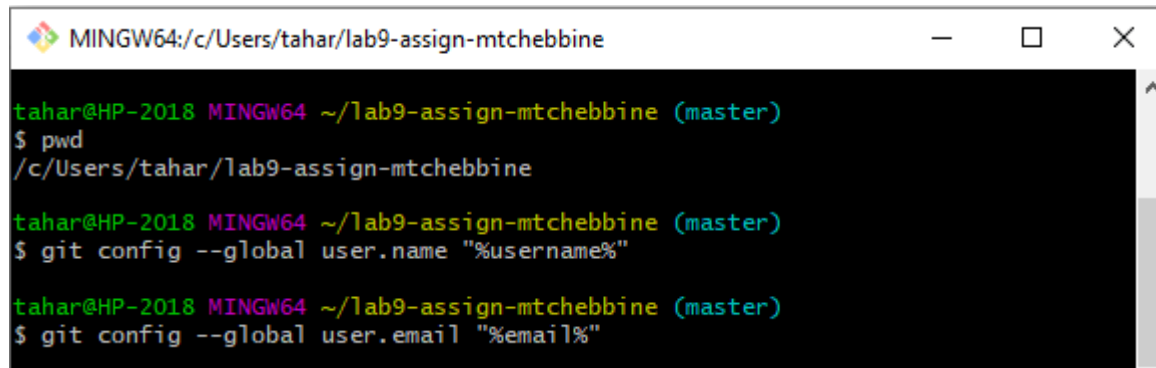
Figure 4



## Retrieve the Project from Github to Local Repository (cont.)

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- setup

A screenshot of a Windows command prompt window titled "MINGW64:/c/Users/tahar/lab9-assign-mtchebbine". The window has standard Windows window controls (minimize, maximize, close) in the top right. The terminal shows three lines of command execution. The first line shows the user running 'pwd' and receiving the path '/c/Users/tahar/lab9-assign-mtchebbine'. The second line shows the user running 'git config --global user.name "%username%"'. The third line shows the user running 'git config --global user.email "%email%"'. The prompt for each line is 'tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)'.

```
MINGW64:/c/Users/tahar/lab9-assign-mtchebbine

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ pwd
/c/Users/tahar/lab9-assign-mtchebbine

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git config --global user.name "%username%"

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git config --global user.email "%email%"
```

Figure 6

## Step 3: Open Greenfoot Simulation

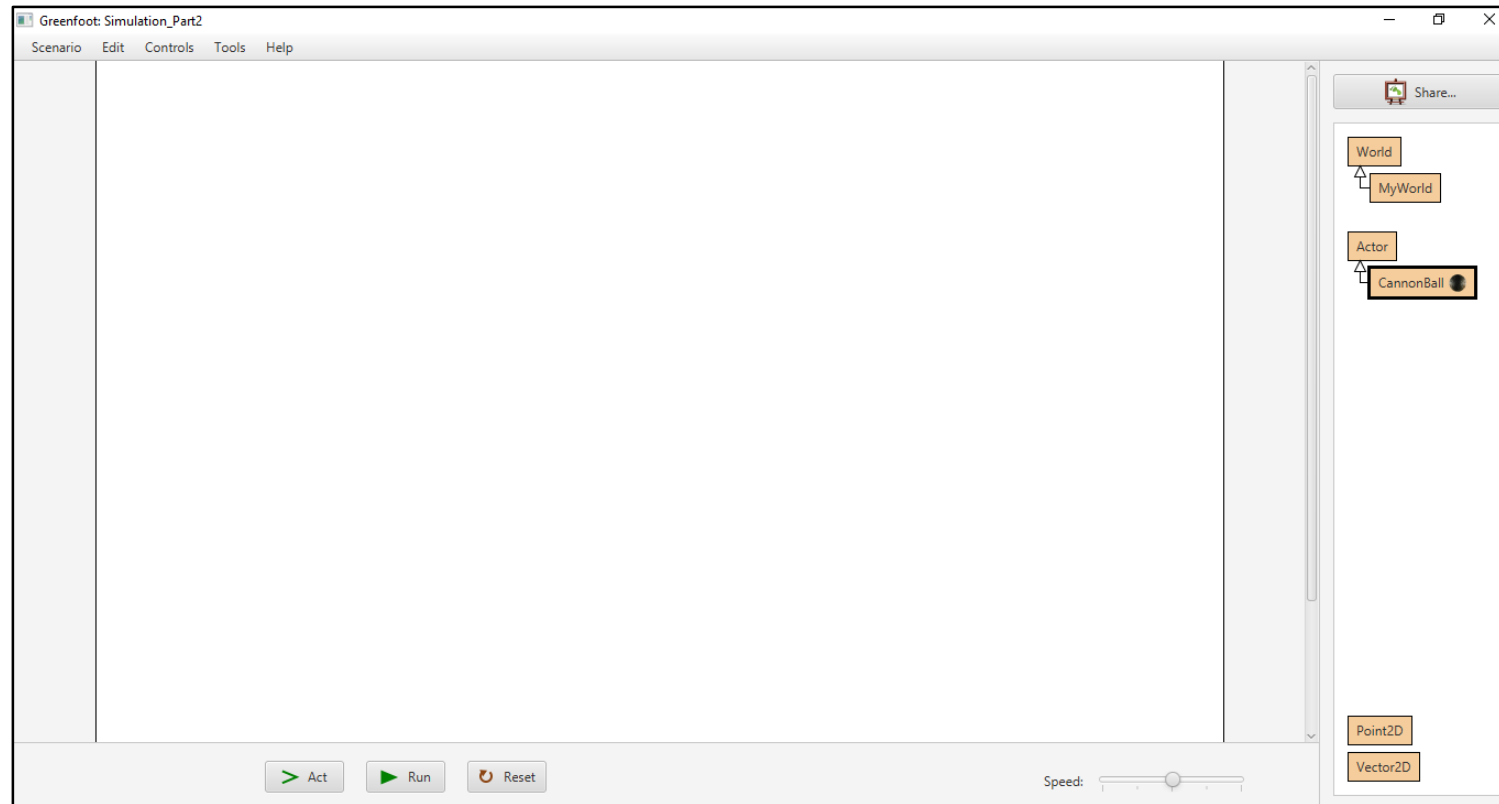


Figure 7

## Specific File in the project

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### **.gitignore**

This file contains a list of extensions or folders that should be excluded from Github. For example, source code is generally on Github, but not the .class files.

When you committed the crab code, your .class files were not included because of the .class entry in the .gitignore file

## Step 4: Enhance Greenfoot World

Instantiate 4 Cannon balls at the top of the world

- Run the scenario (Figure 8a)

Remove the Cannon balls from the world

Create new Actor classes

- Create a Cannon class with the cannon image
- Create a Target class with the target image

Setup the scene to include a cannon and multiple targets

- See image on the right for reference (Figure 8b)

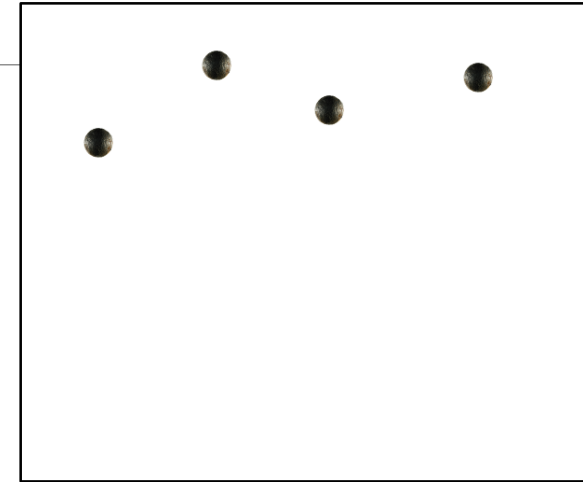


Figure 8a

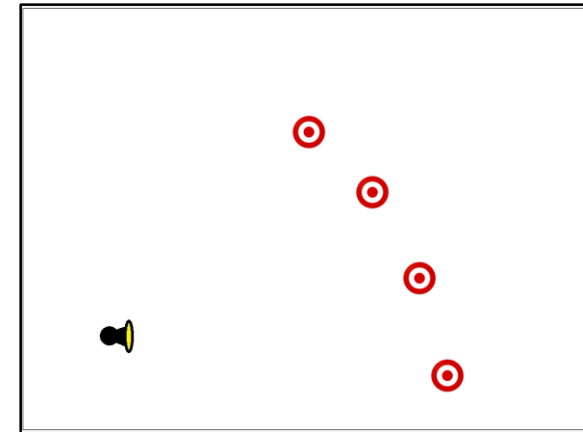
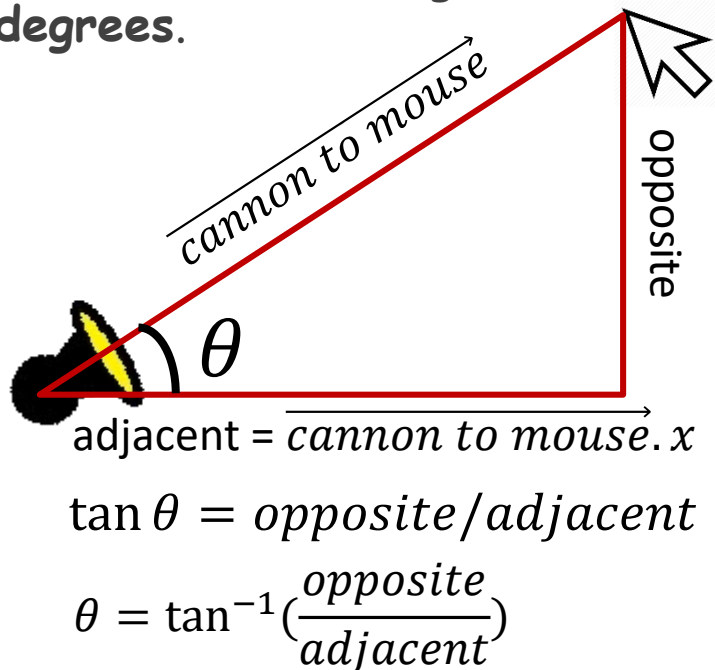


Figure 8b

## Step 5: Making the Cannon Rotate towards Mouse

Using Trigonometry, we calculate the angle for the cannon to always face towards the mouse.

Java uses **radians** for angles, Greenfoot uses **degrees**.



```
public class Cannon extends Actor
{
    public void act()
    {
        MouseInfo mouse = Greenfoot.getMouseInfo();

        if (mouse != null)
        {
            Vector2D cannonToMouse = new Vector2D(mouse.getX() - getX(),
                                                    mouse.getY() - getY());

            double adjacent = cannonToMouse.getX();
            double opposite = cannonToMouse.getY();

            double angleRadians = Math.atan2(opposite, adjacent);
            double angleDegrees = Math.toDegrees(angleRadians);

            setRotation((int) angleDegrees);
        }
    }
}
```

## Step 6: Making the Cannon shoot Cannon balls

The code for aligning the cannon can be refactored in the method **alignWithVector()**:

```
public void alignWithVector(Vector2D v)
{
    double adjacent = v.getX();
    double opposite = v.getY();

    double angleRadians = Math.atan2(opposite, adjacent);
    double angleDegrees = Math.toDegrees(angleRadians);

    setRotation((int) angleDegrees);
}
```

Then, we instantiate Cannon Balls towards the mouse when the mouse is clicked. The velocity can be set by normalizing the vector and multiplying with a constant.

```
private static final double CANNON_BALL_VELOCITY = 1500.0;

public void act()
{
    MouseInfo mouse = Greenfoot.getMouseInfo();

    if (mouse != null)
    {
        Vector2D cannonToMouse = new Vector2D(mouse.getX() - getX(),
                                                mouse.getY() - getY());
        alignWithVector(cannonToMouse);

        if (Greenfoot.mouseClicked(null))
        {
            cannonToMouse.normalize();
            cannonToMouse = Vector2D.multiply(cannonToMouse, CANNON_BALL_VELOCITY);

            CannonBall newBall = new CannonBall();
            newBall.setVelocity(cannonToMouse);
            getWorld().addObject(newBall, getX(), getY());
        }
    }
}
```

# Commit your changes ! (1)

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## Step 7: Commit your changes and push to github

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Try to remember the following commands

- `git add *`
- `git status` */\*check that files are there\*/*
- `git commit -m "Add cannon rotation and shoot balls in world"`

(if you need to enter your name and email, just use the setup commands and commit again)

And then push your commit to Github

- `git push`  
*/\* Push the files to your repository, if you don't do this step, your files will not be saved online \*/*
-



```
MINGW64:/c/Users/tahar/lab9-assign-mtchebbine

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git add *

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git status
On branch master
Your branch is up to date with 'origin/master'.

Changes to be committed:
  (use "git reset HEAD <file>..." to unstage)

    new file:   Simulation_Part2/.gitignore
    new file:   Simulation_Part2/Cannon.ctxt
    new file:   Simulation_Part2/Cannon.java
    new file:   Simulation_Part2/Matrix2D.ctxt
    new file:   Simulation_Part2/Matrix2D.java
    modified:   Simulation_Part2/MyWorld.class
    modified:   Simulation_Part2/MyWorld.ctxt
    modified:   Simulation_Part2/MyWorld.java
    modified:   Simulation_Part2/Point2D.class
    modified:   Simulation_Part2/Point2D.ctxt
    modified:   Simulation_Part2/Point2D.java
    new file:   Simulation_Part2/SimulationActor.ctxt
    new file:   Simulation_Part2/SimulationActor.java
    new file:   Simulation_Part2/SimulationWorld.ctxt
    new file:   Simulation_Part2/SimulationWorld.java
    new file:   Simulation_Part2/Target.ctxt
    new file:   Simulation_Part2/Target.java
    modified:   Simulation_Part2/Vector2D.class
    modified:   Simulation_Part2/Vector2D.ctxt
    modified:   Simulation_Part2/Vector2D.java
    modified:   Simulation_Part2/project.greenfoot
```

Figure 9a

```
MINGW64:/c/Users/tahar/lab9-assign-mtchebbine

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git commit -m "Add cannon and targets in world"
[master ffcf6c7] Add cannon and targets in world
21 files changed, 759 insertions(+), 50 deletions(-)
create mode 100644 Simulation_Part2/.gitignore
create mode 100644 Simulation_Part2/Cannon.ctxt
create mode 100644 Simulation_Part2/Cannon.java
create mode 100644 Simulation_Part2/Matrix2D.ctxt
create mode 100644 Simulation_Part2/Matrix2D.java
rewrite Simulation_Part2/MyWorld.class (99%)
rewrite Simulation_Part2/Point2D.class (69%)
create mode 100644 Simulation_Part2/SimulationActor.ctxt
create mode 100644 Simulation_Part2/SimulationActor.java
create mode 100644 Simulation_Part2/SimulationWorld.ctxt
create mode 100644 Simulation_Part2/SimulationWorld.java
create mode 100644 Simulation_Part2/Target.ctxt
create mode 100644 Simulation_Part2/Target.java
rewrite Simulation_Part2/Vector2D.class (81%)
rewrite Simulation_Part2/Vector2D.ctxt (60%)

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ git push
Enumerating objects: 36, done.
Counting objects: 100% (36/36), done.
Delta compression using up to 2 threads
Compressing objects: 100% (24/24), done.
Writing objects: 100% (24/24), 9.81 KiB | 295.00 KiB/s, done.
Total 24 (delta 9), reused 0 (delta 0)
remote: Resolving deltas: 100% (9/9), completed with 8 local objects.
To https://github.com/VanierGameProg1/lab9-assign-mtchebbine
   cf429ea..ffcf6c7  master -> master

tahar@HP-2018 MINGW64 ~/lab9-assign-mtchebbine (master)
$ |
```

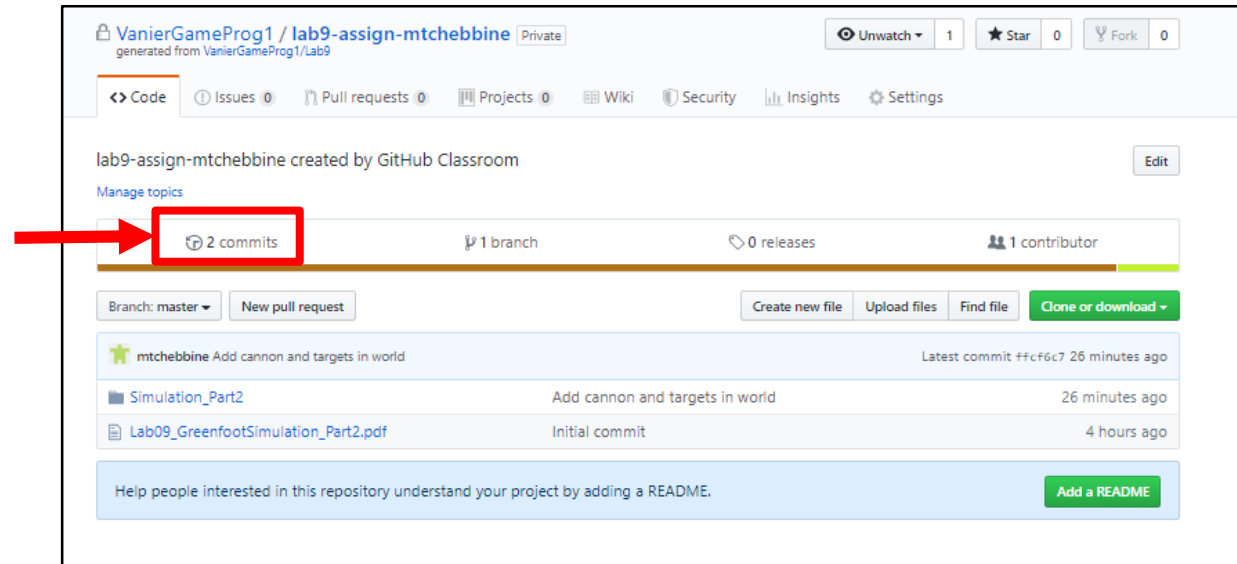
Figure 9b

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**Double check on Github that your files have been added.**

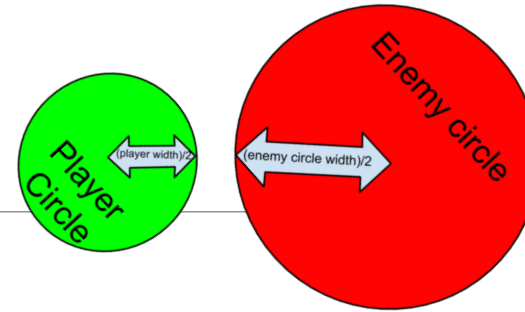
Look at your commit

Look at the difference from the previous version by clicking on your new commit



**Figure 10**

# Projectiles and Collisions



## Projectiles at constant speed

- Instantiate a projectile at an initial position
- Set the velocity vector towards a destination ( $v = \text{destination} - \text{initial}$ )
- Set the magnitude of your vector to be the speed you need (normalize then multiply by speed)

## Detecting collision between 2 circles of arbitrary position (Vector2 $c_1$ and $c_2$ ) and radius (float $r_1$ and $r_2$ )

- Calculate distance between 2 centers ( $c_1$  and  $c_2$ )

$$d = \sqrt{(c_2.x - c_1.x)^2 + (c_2.y - c_1.y)^2}$$

- if ( $d < r_1 + r_2$ ), then the 2 circles collide

You can get projectiles collision circle approximately by setting the radius to half the size of the sprite

Every frame, detect collision between each pair of circles that can collide

## Step 8: Collisions for targets and cannon balls

Targets can check for collision with each Cannon balls.

1. Retrieve the list of cannon balls
2. For each cannon ball, calculate the distance with target
3. Test if the distance is less than the target's radius + ball's radius
4. When collision is detected, replace target image

```
import greenfoot.*; // (World, Actor, GreenfootImage, Greenfoot and MouseInfo)
import java.util.*;
```

← You need to import this for List

```
public class Target extends Actor
{
    public void act()
    {
        // Detect intersection with each cannon ball in the World
        List< CannonBall > cannonBalls = getWorld().getObjects(CannonBall.class);

        for (int i=0; i < cannonBalls.size(); i++)
        {
            CannonBall ball = cannonBalls.get(i);
            Vector2D targetToBall = new Vector2D(ball.getX() - getX(), ball.getY() - getY());
            double distance = targetToBall.magnitude();

            if (distance < getImage().getHeight() / 2 + ball.getImage().getHeight() / 2)
            {
                setImage(new GreenfootImage("targetDestroyed.png"));
            }
        }
    }
}
```

## Step 9: Run Greenfoot Simulation

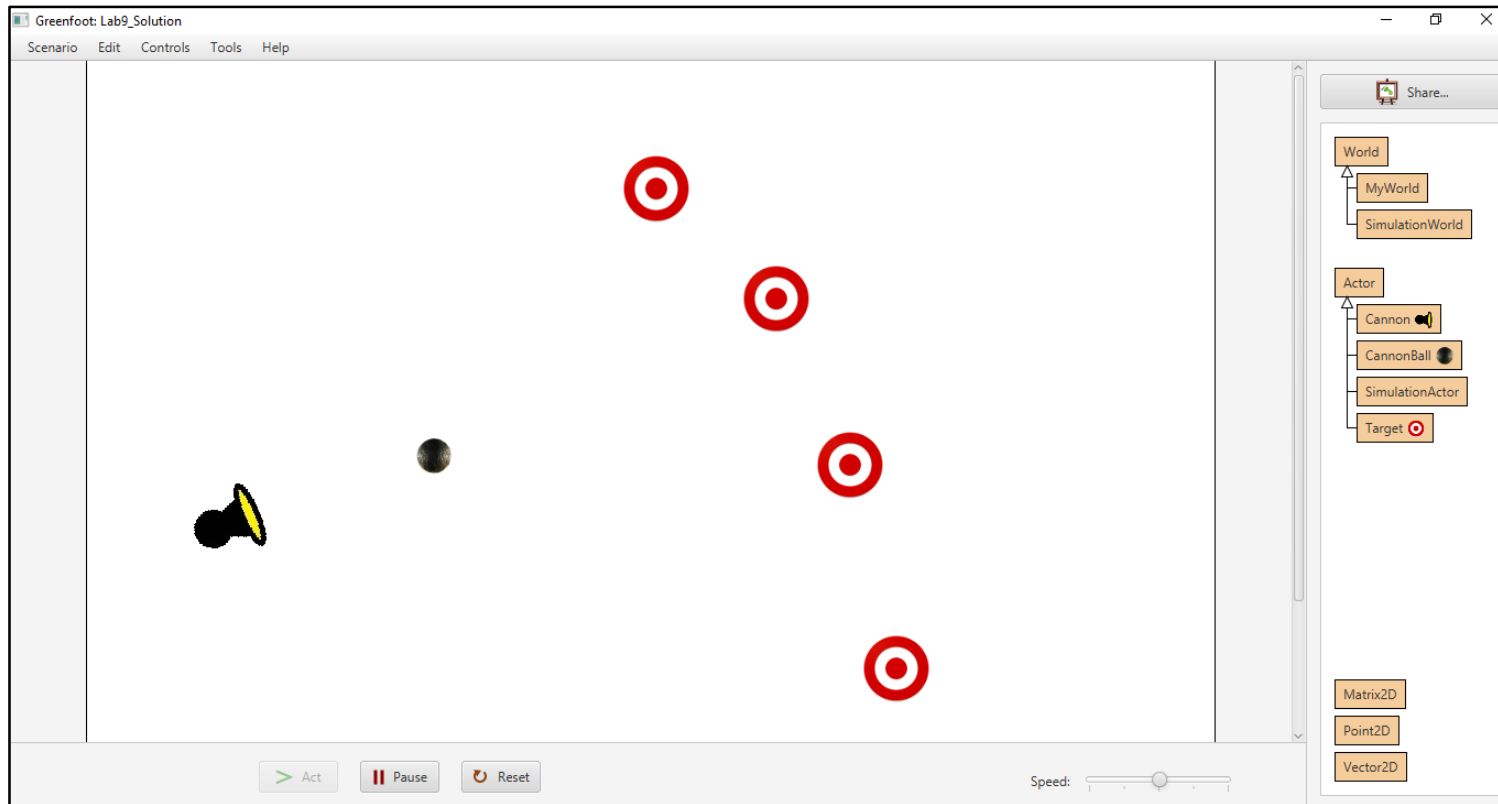


Figure 11

# Commit your changes ! (2)

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## Step 12: Commit your changes and push to github

---

Try to remember the following commands

- `git add *`
- `git status` */\*check that files are there\*/*
- `git commit -m "Add targets in world"`

(if you need to enter your name and email, just use the setup commands and commit again)

And then push your commit to Github

- `git push`  
*/\* Push the files to your repository, if you don't do this step, your files will not be saved online \*/*
- 

Double-check Github.com for your commit