

## Artificial Intelligence (Steering behaviors)

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In this laboratory, students will study and implement three steering behaviors, namely, seek, wander area, and path follow. In this laboratory the jMonkeyEngine 3.0 (jME3) will solely serve as a rendering engine.

## 1 Specific Learning Goals

After finishing this worksheet, students should know and be able to:

1. Add steering behaviors, namely, seek, wander area, and path follow, to an jME3 application.

## 2 Steering Behaviors Terminology

In this practical, we are just approaching steering behaviors. These behaviors were proposed by Craig Reynolds <http://goo.gl/MYvbFs>, and fit in the Artificial Intelligence (A.I.) engine. A steering behavior is no more than a intelligent autonomous behavior associated to a A.I. controlled agent. Each behavior is constantly calculating a steering force (hence their designation), from which we infer the velocity vector to steer towards a desired goal, e.g., hide from another agent or a player. These behaviors are limited and have no global perception of a complex problem yet achieve considerably interesting results, i.e., these are not adequate for problem solving like chess A.I. but are more than adequate, for example, for generic animal behavior simulation.

Students should also read the information on creating/running/compiling jME3 projects and jME3 projects structure available at <https://goo.gl/Q115z7>.

## 3 Programming Exercises

In order to solve each of the following exercises first open the project `jME3Project5`, available at the course web page <http://www.di.ubi.pt/~agomes/tjv/>. To open a project file:

1. Open `jME3`.
2. In `jME3` choose `File > Open Project` from the main menu, and select the directory where the project folders was downloaded and select the project `jME3Project5`.
3. In `jME3` choose `Window > Action Items` from the main menu, to navigate between tasks in each exercise.

Before proceeding to the following exercises students should run the project `jME3Project5` and uncomment each of the lines in the `public static void main(String[] args)` method that ends with a `// TODO: UNCOMMENT ...` statement. These are some of the basic default features of jME3 projects, that the student may require to activate deactivate in the course game project.

**REMARK 1:**

The following exercises are to be completed by the student in the lab class. Unsolved exercises during any lab class are recommended to be completed at home.

## REMARK 2:

Each exercise is a single step of a project. Each exercise starts with a `// BEGIN OF EXERCISE` comment, and finalizes with an `// END OF EXERCISE`. Fig. 1 illustrates in Action Items (red ellipse) the tasks or TODOs to perform in the third exercise (dark square). To navigate in the source code to any of the Action Items simply double click in any of them with the left mouse button.

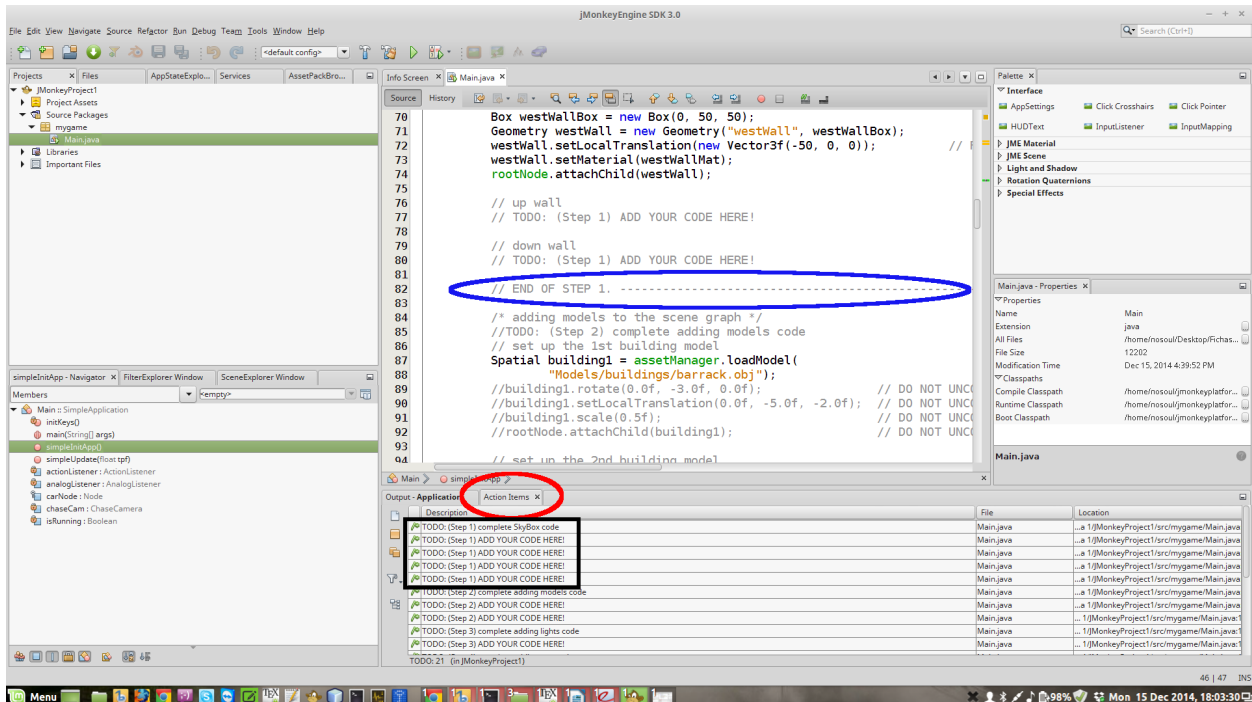


Figure 1: Exercise 3 tasks and termination comment.

## Exercise 1 — finishing the implementation of the Seek behavior

This exercise (Step 1) consists in finishing the implementation of Craig Reynolds seek steering behavior. Students must uncomment the code that renders the goal to target line and implement the seek steering behavior. In particular, carefully read any comments in Step 1 to understand what each line of code does.

Terminated this exercise the output should be the one shown in Fig. 2.

## Exercise 2 — finishing the implementation of the Wander Area behavior

This exercise (Step 2) consists in finishing the implementation of the wander area steering behavior. Students should note that this is not Craig Reynolds wander, but a simpler wander, where a position within the scene bounds is chosen randomly, after some random amount of time within the interval  $[0, \text{MaximumTime}]$ . Students should carefully read any of the comments regarding Step 2 to understand what each line of code does.

Finalized this exercise the output should be equal to the one illustrated in Fig. 3.

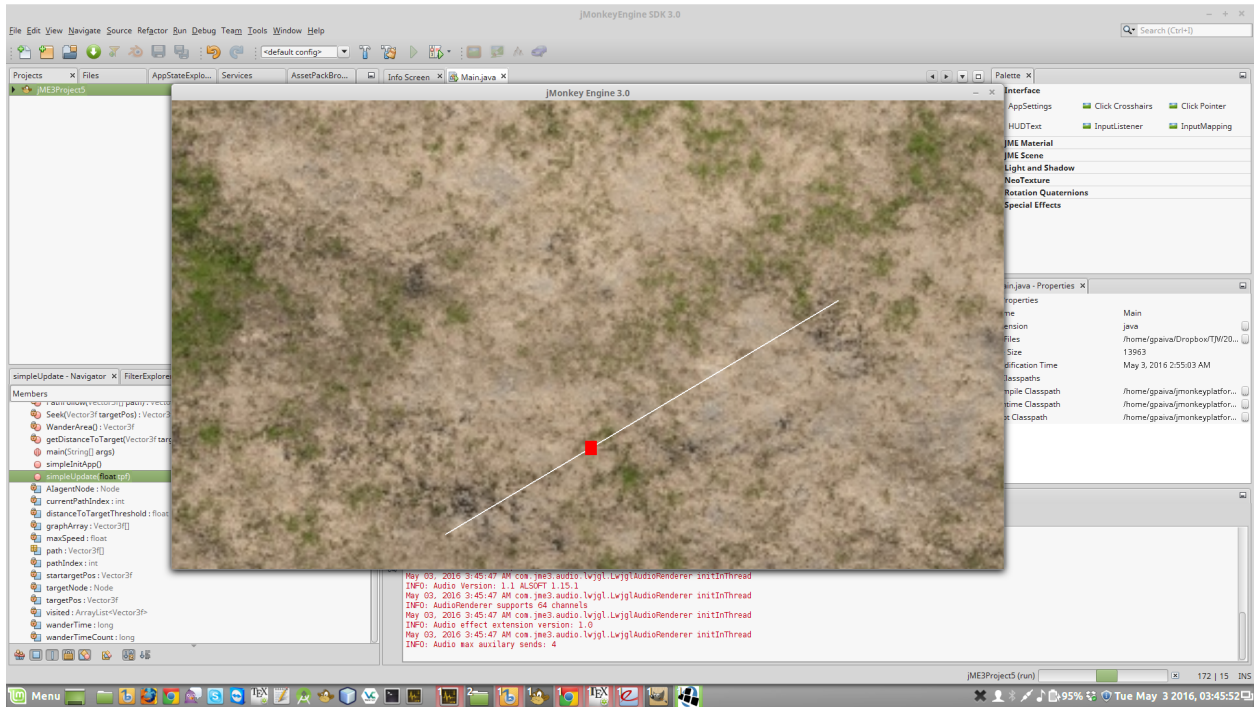


Figure 2: Exercise 1 output.

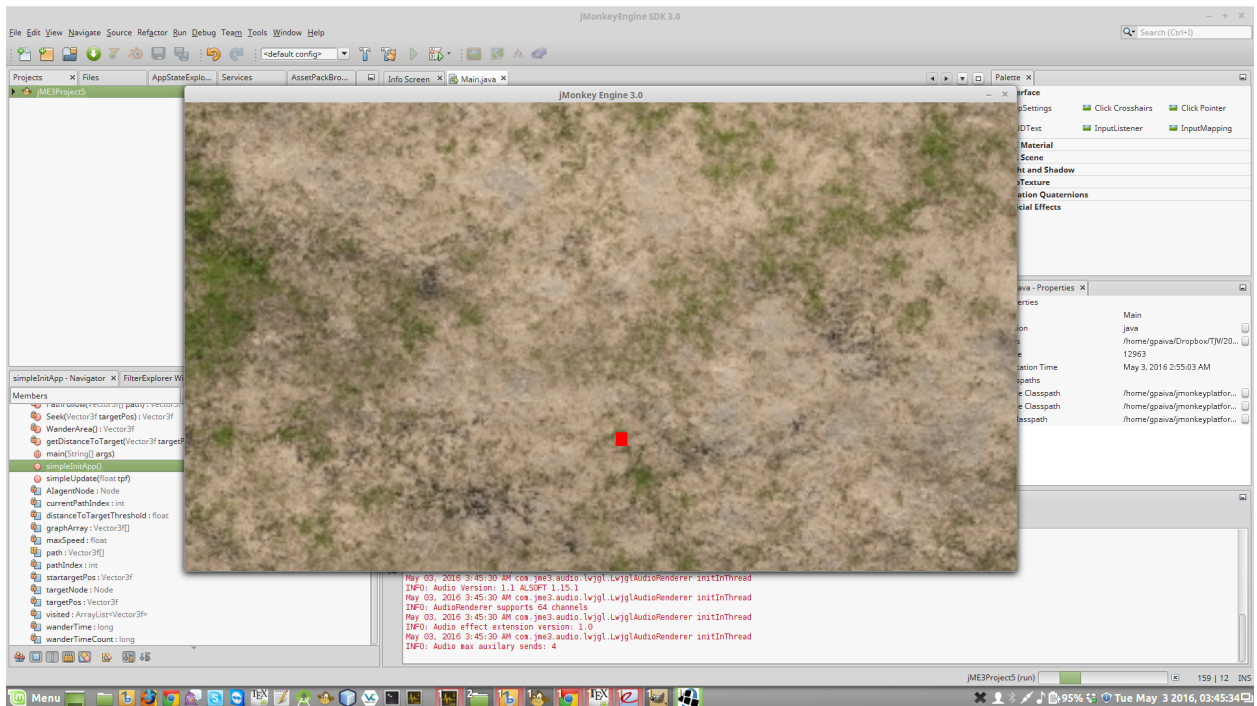


Figure 3: Exercise 2 output.

### Exercise 3 — finishing the implementation of the Path follow behavior

This exercise (Step 3) consists in finishing the implementation of Craig Reynolds path follow steering behavior. In particular, carefully read any comments in Step 3 to understand what each line of code does.

Finalized this exercise the output, after some translation backwards of the camera, should be equal to the one illustrated in Fig. 4.

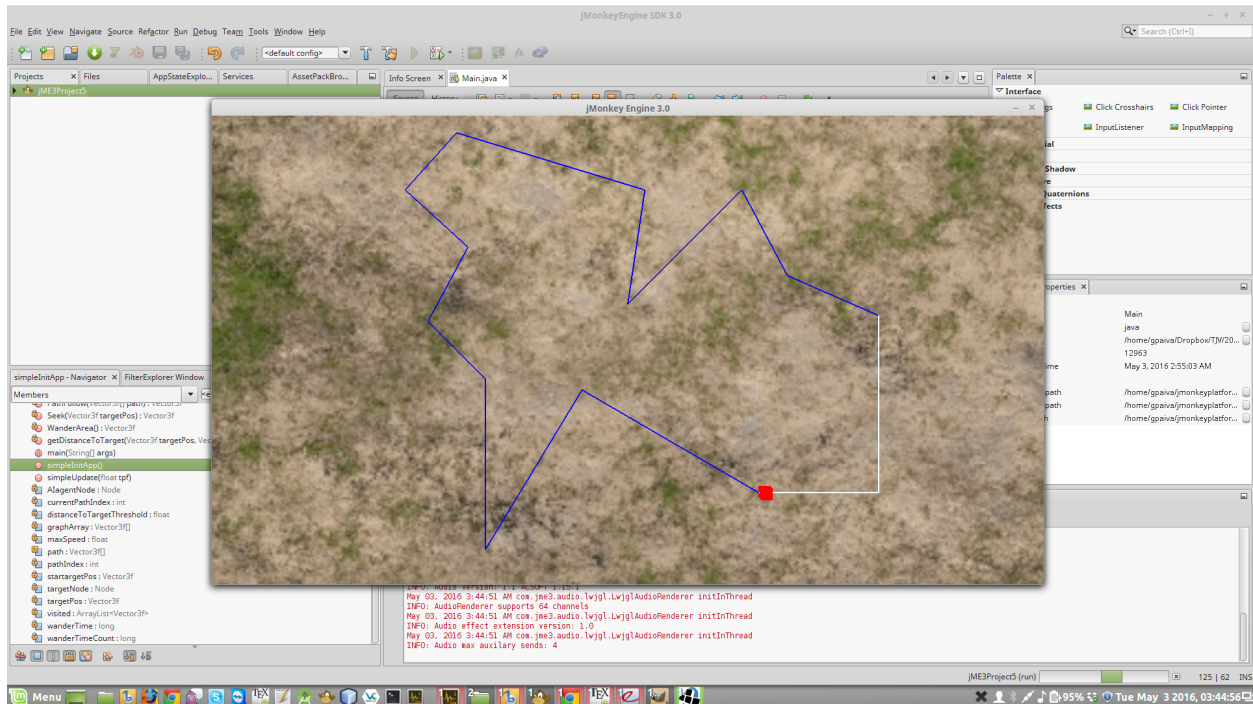


Figure 4: Exercise 3 output.

## References

- [1] jMonkeyEngine Tutorials and Documentation <https://goo.gl/kQzBSY>, last access on 04/05/2016.
- [2] Wikipedia SkyBox (Video Games) <https://goo.gl/ZIDexi>, last access on 04/05/2016.
- [3] Craig Reynolds steering behaviours <http://goo.gl/7yB24v>, last access on 04/05/2016.
- [4] Craig Reynolds Steering behaviors envato tutorials <http://goo.gl/OK3K8E>, last access on 04/05/2016.