

Physics-Based Chipmunk2D Game

Test Plan

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Revision History

Date	Version	Notes
October 25, 2015	1.0	Created document
October 31, 2015	1.1	Major additions to all sections
November 1, 2015	1.2	Final version for rev 0

1 Overview

The purpose of this document is to provide a detailed plan for the testing of our game. The following brief outline gives an overview of what is covered in this document:

- A proof of concept test is described in §2.
- The set of tests that will be used in testing the system is described in §3.
- The set of tests that will be used to ensure that the software requirements specifications are met is described in §4.
- A timeline of the test plan is given in §5.

1.1 Test Case Format

The description of the tests that will be carried out are formatted in the following way throughout the document:

Test #:	Test name
Description:	A description of what is being tested
Type:	The type of test
Tester(s):	The people who will run the test (manual only)
Initial State:	The initial state of the system being tested (unit test only)
Input:	The input that will change the state of the system (unit test only)
Output:	The relevant output that is checked (unit test only)
Pass:	The pass criteria for the relevant output in the case of unit tests, or a description of the pass criteria for other tests

1.2 Automated Testing

Automated testing will be used for testing of the game mechanics system and will be carried out via unit test suites. Stubs and drivers will not be used due to the heavy use of side-effects in game code. To ensure that unit testing can be run while the game mechanics are in development the test cases have been grouped into sections that can be fully implemented once certain subsets of the game mechanics systems are completed.

1.2.1 Testing Tools

The software tools that will be used to carry out the automated testing are listed in [Table 1](#).

Table 1: List of testing tools

Tool	Description	Use
gUnit	Unit testing framework	Unit testing

1.3 Manual Testing

Manual tests will be used for testing all aspects of the game that are not covered by the automated unit testing suite (the time that would be required to develop automated tests for these test cases would be prohibitive). The game development team will carry out these tests as the game is developed.

1.3.1 User Experience Testing

Manual testing will also be used to assess the user experience of the game. User experience testing will be completed by a testing group consisting of δ individuals who were not involved in the development of the game. The testing group will be given a copy of the game and asked to complete a survey (see [Appendix A](#)) after having played the game to provide feedback.

1.4 List of Constants

Constants used in this document are listed in [Table 2](#).

Table 2: List of constants

Constant	Value	Description
σ	60	Frame rate target
δ	3	Number of people in user testing group
Θ	6	User testing entertainment target
Ψ	2	User testing challenge range
Ω	8	User testing controls target
Φ	250	Dynamic object limit

2 Proof of Concept Testing

Before any serious development of the game begins, a proof of concept test will be carried out to show that the undertaking is feasible. The remainder of this section describes the proof of concept test in detail.

2.1 Significant Risks

The successful completion of the project depends on overcoming the following significant risks:

1. In order to use the Chipmunk2D library it must first be successfully compiled. Since we intend for the game to be compatible with Windows 7, Mac OS X, and Ubuntu, there is a significant risk for the project to fail if compilation is not achieved on all three operating systems.
2. Chipmunk2D is a large library and its use is not straight forward. Successful implementation of the library features is crucial to the success of the project and the failure of this poses another significant risk.

2.2 Demonstration Plan

For a proof of concept test we will produce a working prototype that can be run on Windows 7, Mac OS X, and Ubuntu. The prototype will consist of a game demo that implements gravity and collision detection provided by the Chipmunk2D library. Rudimentary graphics will be used for the prototype since the scope is limited only to demonstrating that the identified risks can be overcome.

The prototype will consist of a small room in which a hero character and enemies exist. The room will be bounded by a floor below and walls on the left and right, all of which the hero and enemies cannot pass through. The room will contain platforms which the hero and enemies cannot pass through from above, but may pass through from below when jumping. A rough idea of the room is given in [Figure 1](#).

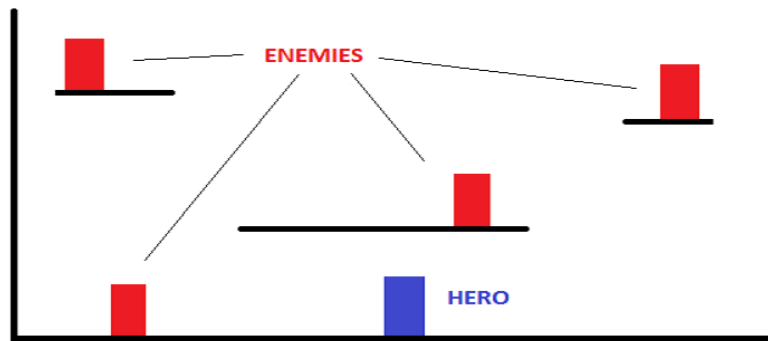


Figure 1: Proof of concept sketch

The hero character will be represented by a blue rectangle and will be controlled by the user in the following ways:

- The hero moves left and right using the 'a' and 'd' keys respectively
- The hero jumps by pressing the 'space' key
- The hero shoots a projectile in the direction of the mouse cursor by left-clicking

Enemies will be represented by red rectangles and will not have any programmed AI (they will not move or attack). The hero will be able to attack enemies with a projectile, which will knock them back when they are hit. The hero and all enemies will be subject to gravity and will free-fall when there is no platform or boundary under them.

The proof of concept is given in test case format to adhere with the presentation of the other tests in this document.

Test #1:	Proof of Concept
Description:	Tests whether significant risks to the completion of the project can be overcome
Type:	Proof of Concept (manual)
Tester(s):	Game developers
Pass:	Successful development of a small demonstration which makes use of the Chipmunk2D physics engine and runs on Windows 7, Mac OS X, and Ubuntu

3 System Testing

The testing of the system is broken down into game mechanics testing and game design testing phases. The game mechanics will be developed and tested first. Once the game mechanics systems are in place, the game design development and testing phase will begin.

3.1 Game Mechanics Testing

3.1.1 Automated Testing

A limited set of unit tests will be used to test the game mechanics and physics. This test suite will be used to ensure that changes to the game do not break the basic functioning of the game. The test cases that will be used are outlined in the remainder of this section.

Test #2:	Move left
Description:	Tests if the hero moves left when the corresponding input is received when the hero is initially stationary
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with a hero object having x-velocity of zero
Input:	Keyboard function called with simulated left key down stroke
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is less than zero

Test #3:	Move right
Description:	Tests if the hero moves right when the corresponding input is received when the hero is initially stationary
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having x-velocity of zero
Input:	Keyboard function called with simulated right key down stroke
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is greater than zero

Test #4:	Stop moving left
Description:	Tests if hero stops moving left when corresponding input is stopped
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having x-velocity less than zero
Input:	Keyboard function called with simulated left key up stroke
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is zero

Test #5:	Stop moving right
Description:	Tests if hero stops moving right when corresponding input is stopped
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having x-velocity greater than zero
Input:	Keyboard function called with simulated right key up stroke
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is zero

Test #6:	Jump from static object
Description:	Tests if hero jumps off a static object when corresponding input is received
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having y-velocity of zero and a bottom edge in contact with a static object
Input:	Keyboard function called with simulated space bar key down stroke
Output:	Hero object y-velocity
Pass:	Hero object y-velocity is greater than zero

Test #7:	Wall obstructs hero moving left
Description:	Tests whether the hero is stopped by a wall object while moving left
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having x-velocity less than zero situated directly to the right of a wall object
Input:	The chipmunk cpSpaceStep function is called
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is 0

Test #8:	Wall obstructs hero moving right
Description:	Tests whether the hero is stopped by a wall object while moving right
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object having x-velocity greater than zero situated directly to the left of a wall object
Input:	The chipmunk cpSpaceStep function is called
Output:	Hero object x-velocity
Pass:	Hero object x-velocity is 0

Test #9:	Floor supports stationary hero
Description:	Tests whether the hero is supported by a floor object
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with stationary hero object situated directly on top of a floor object
Input:	The chipmunk cpSpaceStep function is called
Output:	Hero object y-velocity
Pass:	Hero object y-velocity is 0

Test #10:	Floor stops hero in free fall
Description:	Tests whether the hero in free fall is stopped by a floor object
Type:	Unit Test (dynamic, automated)
Initial State:	Custom in-game state with hero object with y-velocity less than zero situated directly on top of a floor object
Input:	The chipmunk cpSpaceStep function is called
Output:	Hero object y-velocity
Pass:	Hero object y-velocity is 0

3.1.2 Manual Testing

The following manual tests will be carried out to provide testing for game mechanics related requirements that are not covered by unit tests.

Test #11:	No mid-air jumps
Description:	Tests that the hero cannot jump when not in contact with a surface
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Hero cannot jump when not in contact with a surface

Test #12:	Zoom in test
Description:	Tests that the stage zooming works properly (in)
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Stage view can be zoomed in

Test #13:	Zoom out test
Description:	Tests that the stage zooming works properly (out)
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Stage view can be zoomed out

Test #14:	Hero death
Description:	Tests that the hero is killed when coming into contact with a fatal hazard
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Hero is killed when contacting fatal hazards

Test #15:	Stage win
Description:	Tests that the stage is won when hero comes in contact with the checkered goal
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Stage is won and user is returned to the main menu

Test #16:	General physics behaviour
Description:	Tests that the physics behaves as expected from a qualitative perspective
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Physics appears to function correctly

Test #17:	General collision behaviour
Description:	Tests that collisions behave as expected from a qualitative perspective
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Collisions appear to behave correctly

3.2 Game Design Testing

Once the game mechanics systems have been implemented and shown to be working correctly through the testing described in §3.1, the game itself will be built on top. The design of the game can be broken down into the design of the game world, graphics, and sound. Automated testing for this phase would be time-consuming and difficult to implement. Therefore, all of the game design testing will consist of manual tests.

3.2.1 Game World Testing

The following tests will be carried out to ensure that the game world is designed correctly.

Test #18:	All areas reachable
Description:	Tests that all areas of the game world that are intended to be reachable by the hero are in fact reachable by the hero
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	No areas are unreachable based on a thorough playthrough testing of the game

Test #19:	No “points of no return”
Description:	Tests that there are no areas of the game world that will cause the hero to become stuck (e.g. inescapable pits)
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	There are no inescapable areas detected on a thorough playthrough testing of the game

3.2.2 Graphics Testing

The following tests will be carried out to ensure that the game graphics are properly implemented.

Test #20:	Textures
Description:	Tests if textures are properly implemented
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	In-game textures appear correct by inspection

Test #21:	Lighting
Description:	Tests if lighting effects are properly implemented
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Lighting effects appear correct by inspection

3.2.3 Audio Testing

The following tests will be carried out to ensure that the game audio is properly implemented.

Test #22:	Background music
Description:	Tests if background music is properly implemented
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Background music plays while in game

Test #23:	Sound effects
Description:	Tests if sound effects are properly implemented
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Appropriate sounds play when events take place (e.g. hero death, complete stage)

3.2.4 Miscellaneous Testing

The following tests will be carried out to ensure all requirements not tested under the previous categories are met.

Test #24:	Menu system
Description:	The menu system works as intended
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	All menu options work correctly

Test #25:	General look and feel
Description:	The game has the intended look and feel
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	The game is a 2.5-D platformer with an Indiana Jones adventure theme

Test #26:	Operating system support
Description:	The game runs on Windows 7, Mac OS X, and Ubuntu
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Game can be compiled and system tests all pass on each platform

Test #27:	Spelling and grammar check
Description:	The game uses proper English and is free of any spelling or grammatical errors
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	No spelling or grammatical errors are detected (or all detected errors are corrected)

Test #28:	Hardware requirements
Description:	Tests for the minimum hardware requirements required to maintain an average frame rate of at least σ frames per second
Type:	Functional (dynamic, manual)
Tester(s):	Development team
Pass:	Game maintains frame rate of at least σ frames per second in a stage that contains Φ dynamic objects when tested on a low-performance system

3.2.5 User Experience Testing

The following tests will be carried out via a user experience survey administered to a testing group (see §1.3.1). Note that the user experience tests are planned for a

Test #29:	Entertainment
Description:	Tests that the game is entertaining
Type:	Functional (dynamic, manual)
Tester(s):	Testing group
Pass:	Average survey score of at least Θ

Test #30:	Challenge
Description:	Tests that the game is adequately challenging (not too easy or too hard)
Type:	Functional (dynamic, manual)
Tester(s):	Testing group
Pass:	Average survey score within Ψ of 5

Test #31:	Controls
Description:	Tests that the game controls are intuitive
Type:	Functional (dynamic, manual)
Tester(s):	Testing group
Pass:	Average survey score of at least Ω

4 Trace to Requirements

4.1 Functional Requirements

A trace between tests and functional requirements is provided in

5 Timeline

This document is structured to roughly match the anticipated chronology of testing. A proposed testing timeline is given in [Table 4](#).

Table 3: Requirements Traceability

Requirement	Test(s)
1	24
2	24
3	24
4	24
5	2, 4
6	3, 5
7	6
8	11
9	16
10	19
11	18
12	12
13	13
14	9, 10
15	7, 8
16	14, 17
17	14
18	15
19	24
20	25
21	25
22	20, 21, 25
23	22, 23
24	29
25	31
26	30
27	28
28	26
29	27

Table 4: Testing timeline

Completion Date	Responsible Party	Task
11/15/2015	Development team	Completion of the proof of concept demo
04/15/2016	Chao Ye	Implementation of input unit test cases
04/15/2016	Chao Ye	Implementation of collision unit test cases
04/18/2016	Steven Palmer	Completion of game design testing
Future	Testing group	Completion of user experience survey

6 Appendix A: Testing Survey

The following survey will be filled out by members of the alpha and beta testing groups.

User Experience Survey											
The following survey should be filled out after playing the game for at least 30 minutes.											
Time played:											
Please provide a ranking between 0 and 10 in each of the following categories. Please include notes on what you did and did not like, and what could be done to improve the game.											
Entertainment:	0	1	2	3	4	5	6	7	8	9	10
	[0 = most boring, 10 = most fun]										
Difficulty:	0	1	2	3	4	5	6	7	8	9	10
	[0 = easiest, 10 = most difficult]										
Controls:	0	1	2	3	4	5	6	7	8	9	10
	[0 = non-intuitive, 10 = intuitive]										
Notes:											