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Introduction

Kodu Game Lab is a visual programming language that allows anyone, even those without programming knowledge and experience, to create rich 3D games. Kodu uses intuitive icons to control the characters and objects with character behaviours expressed in physical terms.

The Creating Games with Kodu Game Lab course is designed primarily for teachers looking to introduce game design into their classroom program. This two day intensive course will introduce Kodu Game Lab and demonstrate how anyone can create rich and exciting games.

The course will cover the skills needed to design and create worlds and games with Kodu Game Lab and will also investigate the design process and how Kodu can be used in the school curriculum.

Through designing and creating their own games, participants will learn how powerful and interesting games can be created with simple building blocks and techniques.

The course will:

- enable participants to program characters and objects
- enable participants to build 3D worlds
- introduce the key elements of games design
- provide a rich range of code examples
- provide a rich range of game play examples
- provide examples of how Kodu Game Lab has been used in schools
- give plenty of hands on time so that participants are confident in using Kodu Game Lab

Important Note

Kodu Game Lab is still under development. Every effort has been made to make sure that the examples contained in this manual work in the current version 1.48 of Kodu Game Lab. When using other versions of Kodu Game Lab please check http://media.planetkodu.com/workshop/resources.html for updates and workshop materials.
Module 1
Introducing Game Design and Kodu Game Lab

Activity 1.1 Introduce yourself

If you were a game character what would you be like?

Name: ______________________________________________________

Powers: ______________________________________________________

3 things that make your character special:

____________________________________________________________________________________________

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Draw your character in the space below:
**Activity 1.2 Introducing Kodu Game Lab**

During this activity we will explore Kodu Game Lab, its purpose and what others have created with it. Use the space below to record any important ideas about Kodu Game Lab.

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**Activity 1.3 What is a game?**

In this activity we will explore what makes a game, a game.

List five games that you like to play:

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Thinking about the games that you have listed, identify the key factors that make a game a game. Use the Diamond 9 graphic organiser below to show nine key factors of games with the most important factors at the top of the diamond.

“If you’ve written a software subroutine that takes more than ten arguments, look again. You probably missed a few.”

Alan Kay

“A game is a problem-solving activity, approached with a playful attitude.”

Jesse Schell
Activity 1.4 Kodu Games

Kodu Game Lab has around fifty worlds and games included by default. In this activity we will explore some of these worlds and games to learn about what can be made with Kodu Game Lab and what makes a Kodu Game Lab game.

Game Review (Example)

Name: Bonk-Out v18
Objective: Knock over the castles while protecting your sticks.
Rules: The A button launches a puck. Push bots can also launch pucks. Pucks destroy everything except the player. The player can control where the pucks go by bouncing them away.

Why is it fun? This game is easy to understand, as it is similar to the classic game Breakout. It is also fun because it is fast moving. This game would be much better if it was longer.

Your Game Review

Game Name: ____________________________________________________________

Objective: ____________________________________________________________

Rules: _________________________________________________________________

Why is it fun? __________________________________________________________
Activity 2.1 Introducing Kodu’s programming language

In this activity we will write our first Kodu Game Lab program. Kodu Game Lab contains three default tutorials and we will work through all three.

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Complete Tutorial 1

1. Open the Tutorial 1 world.

The Kodu bot tells you that “I want to visit the castle”

2. Press Esc (keyboard) or start (controller) to edit the world.

3. Select the “Add and Program Objects” icon from the toolbar.

4. Select the character by right-clicking it (keyboard) or selecting Y (gamepad). It should be now glowing yellow and the editing menu should appear.

5. Select Program by left clicking it.

The bots code should now be displayed, we have two choices now either to edit line 1 in the existing code or add a new line to the code. We will edit the first line but adding a new line of code is also a valid approach.
The first line reads

We need to change it to

6. Remove the express and hearts tiles by right clicking on them or pressing \(X\) on the gamepad

7. Add the new tiles by left clicking (or pressing \(A\) on the gamepad) the icon to the right of the do tile.

8. Select move.

9. Select towards.

The code should now be:

9. Press esc on keyboard (or twice on the gamepad) to exit the programming screens and return to the toolbar.

10. Click on Play to run the program or select with the gamepad and then \(A\) to play the game.

11. The Kodu bot should now move towards the castle.
Activity 2.2 Solve Tutorials 2 and 3

In this activity we will solve Tutorial 2 and Tutorial 3. The instructions to solving these programming challenges are included below but please attempt to solve them without the instructions if possible.

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Tutorial 2 Solution

Objective: We need to reprogram the cycle bot so it can jump the river.

1. Open Tutorial 2.

2. Press Esc (keyboard) or start (controller) to edit the world.

3. Select the “Add and Program Objects” icon from the toolbar.

4. Select the character by right-clicking it (keyboard) or moving the cursor with gamepad. It should be now glowing yellow and the editing menu should appear.

5. Select Program by left clicking it or with the button on the gamepad.

The bots code should now be displayed, we have two choices now either to edit line 3 and 4 in the existing code or add a new lines to the code. We will edit the lines but adding a new line of code is also a valid approach.
Currently the lines are:

We need to change them to:

6. Add the new tiles by left clicking (or pressing \( A \) on the gamepad) the icon to the right of the do tile.

7. Select using the left mouse button or by pressing \( A \) on the gamepad.

Note click on actions to find

The code should now be:

8. Press esc on keyboard (or twice on the gamepad) to exit the programming screens and return to the toolbar.

9. Click on Play to run the program or select with the gamepad and then \( A \) to play the game.

10. The Kodu bot should now jump with either the spacebar or the \( A \) button.
**Tutorial 3 Solution**

Objective: To program the cycle bot to pick up an apple.

1. Open Tutorial 3.

2. Press Esc (keyboard) or start (controller) to edit the world.

3. Select the “Add and Program Objects” icon from the toolbar.

4. Select the character by right-clicking it (keyboard) or moving the cursor with gamepad. It should be now glowing yellow and the editing menu should appear.

5. Select Program by left clicking it or with the button on the gamepad.

The second line of code reads:

![Code Image](image)

We need to change it to:

![Code Image](image)

6. Add the new tiles by left clicking (or pressing on the gamepad) the + icon to the right of the do tile.

7. Select using the left mouse button or by pressing on the gamepad. Note click on holding group to find

The code should now be:

![Code Image](image)

8. Press esc on the keyboard (or twice on the gamepad) to exit the programming screens and return to the toolbar.

9. Click on Play to run the program or select with the gamepad and then to play the game.

10. The Kodu bot should now pick up the glowing apple and be able to cross the bridge.
Activity 2.3 Getting to Know the Bots and Objects

In this activity we will explore the various bots and objects that are available in Kodu Game Lab. We will investigate the various attributes and abilities of the different bots.

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Activity 2.4 Programming Bots

Player controlled bots
We have seen in the above tutorials that we can write simple programs in order to control a bot with the keyboard or Xbox controller. We can also map actions such as jumping to specific keys on the keyboard or gamepad.

AI bots
Let's now look at how we can program other bots that will interact with the player's bot.

Alternatively, we could use see rather than hear:

If we just want the bots to wander rather than follow we can use:
When physical sensors: 

Bots and Objects have settings that define certain attributes which determine how they appear and behave. Programming cannot modify these settings while the game is running and must be done in the design stage.

Notes
Activity 2.4 Create a two bots
In this activity we will make a simple two bot game, like tag or similar.

Create your first bot.

1. Open Small World with Water.

2. Press Esc (keyboard) or start (controller) to edit the world.

3. Select the “Add and Program Objects” icon from the toolbar.

4. Add the character by left-clicking it (keyboard) or with the button on the gamepad. Select the bot or object you want.

5. To program the bot or object select Program by left clicking it or with the button on the gamepad.

6. Add your desired code.

7. Press esc on the keyboard (or twice on the gamepad) to exit the programming screens and return to the toolbar.

8. Click on Play to run the program or select with the gamepad and then to play the game.

9. Repeat the process to add your second bot.

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Module 3
Informal Design Process

Activity 3.1 Generating Ideas

List ideas about how to improve your game

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Activity 3.2 – Game Ideas
In this activity we will generate some ideas for games we could make with Kodu Game Lab.

List a game idea that you may have:

Example

Name: Duck-Out

Objective: This game is similar to bonk out except instead of castles and stick bots boats and turtles will be used and the game will be played on water. The turtles will also be able to duck under the water for two seconds in order to avoid the pucks.

Rules: The player controls the fish. The fish must protect the three turtles from the flying pucks by bouncing them away. Player can also cause the turtles to duck under the water for a short period to avoid the flying pucks.

Bots used: Boats, Turtles, fish and pucks
Activity 3.3 School Examples / Case Studies
In this activity we will take a step back from thinking about games and look at how various schools have used Kodu Game Lab in their learning program.

Notes
**KODU GAME DESIGN TEMPLATE**

Draw and label your KODU world.

<table>
<thead>
<tr>
<th>Describe the Game (and what do the players have to do?)</th>
<th>List the KODU objects and their purpose.</th>
<th>Describe how a player wins/finishes the game, how a player scores and how long your game goes for.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Collect Red Apples.</td>
<td>Apples: Get Points.</td>
<td>If game goes 20 minutes, you win by collecting Stars and Apples and you have to go through every stage and to win you have to get to the biggest area at the end of the game.</td>
</tr>
<tr>
<td>4. Don't get麾 Apples.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Get past Bad guys.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Don't get shot by cannons.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Get star in castle.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Tell part to answer.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Module 4
Creating Game Worlds

Activity 4.1 Designing Game Spaces
This activity creates understanding of resource considerations, world settings and cameras. Large worlds use a great deal of resources and is crucial to use as little land as possible.

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Activity 4.2 Design Patterns and Recipes
Design Patterns and Recipes allow programmers to use well-tested and understood approaches to solve programming problems. This activity will explain how game design patterns can help the game designer to use proven patterns for solving common game design problems. It will also introduce the concept of code recipes that are language specific solutions to common programming problems.

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Activity 4.3 Game Space Patterns

Design Pattern: Open World

Games using the open world design pattern allow the player to roam wherever they want. Open world games usually involve non-linear game play with players able choose the sequence in which they complete game tasks. The camera follows the player (which is the default with Kodu Game Lab) and therefore open world games are more suitable for single player games.

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<table>
<thead>
<tr>
<th>Image</th>
<th>Text</th>
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</thead>
<tbody>
<tr>
<td><img src="image" alt="Ground Brush" /></td>
<td>Use the <strong>Ground Brush</strong> to add and remove ground. Hold the right trigger or the left mouse button to add ground and left trigger or right mouse button to erase ground. There are a variety of different shaped brushes and the brush size can be changed as to allow the quick addition of a large area of ground but also to make intricate designs when needed. The colour of the terrain can also be selected from a range of choices.</td>
</tr>
<tr>
<td><img src="image" alt="Up / Down Brush" /></td>
<td>Use <strong>Up / Down Brush</strong> to create hills and valleys. Press the button or left mouse button to smooth the selected land. The different shaped and sized brushes can be used to create different effects.</td>
</tr>
<tr>
<td><img src="image" alt="Water Brush" /></td>
<td>Use the <strong>Water Brush</strong> to add, remove or tint water. Hold the right trigger or the left mouse button to raise the water level in your world and left trigger or right mouse button to lower the water level.</td>
</tr>
<tr>
<td><img src="image" alt="Flatten Brush" /></td>
<td>Use the <strong>Flatten Brush</strong> to create flat areas and ramps. Hold the right trigger or the left mouse button to level the selected ground and the left trigger or the right mouse button to smooth the selected ground.</td>
</tr>
<tr>
<td><img src="image" alt="Roughen Brush" /></td>
<td>Use the <strong>Roughen Brush</strong> to create bumpy areas. Hold the right trigger or the left mouse button to make the selected ground spiky and the left trigger or the right mouse button to make it hilly.</td>
</tr>
<tr>
<td><img src="image" alt="Delete Tool" /></td>
<td>Use the <strong>Delete Tool</strong> to quickly remove bots and objects from your world.</td>
</tr>
</tbody>
</table>
When editing a world, use F3 to turn on **Snap to Grid** feature so that the brush size stays constant, the cursor coordinates will be displayed in the bottom left hand corner of the screen.

Press `L` and `R` or the mouse scroll wheel to zoom in and out. Zooming in can be useful if your cursor is difficult to find because it is hidden behind land.

Important: When creating your worlds monitor the resource meter and ensure that it doesn’t enter the red area. This is particularly important when creating large open worlds.

**Design Pattern: Race**

Racing games require the player to race around a pre-defined track or space. Often there are checkpoints, with the goal either to beat opponents or register a fast time. Racing games closely mirror real life races and are therefore a simple pattern to understand and to play.

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**Recipe: Racing track opponents**

To program bots for a player to race against simply create a path and then program the bot to follow the path.

When using the Xbox controller paths are created with the Object Tool. When using the keyboard and mouse the Add Path button is in the tool menu.

Select the Object Group and then path type you want (plain, road, wall or flora). Use the `Y` button to add more nodes, move the cursor to next desired position and then press `A` to add the node. If the race track is a loop enabling multiple laps then the last node should be placed on top of the first node. Press `B` to finish.
Place the bot on the path and then use the following recipe.

**Design Pattern: Side Scrolling Games**

A platform game is a game where the player can only move in 2D dimensions, it also called a side scroller. Side Scrolling games usually require the player to do lots of jumping, over gaps and over other obstacles that may or may not be moving. Side scrolling games were extremely popular in the 80s and have a nostalgic feel when played.

**Demonstrate games Coins and Platform Cycle.**

**Key Points:**
1. Using East / West constraint on moving
2. Fixing the camera as an offset in the World Settings (extremely useful)

**Notes**

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**Recipe: Side Scrolling**

Usually a path would be best for making a side scrolling game, but you can also create land.

We need the camera to follow the player’s character from the side. To do this we will set the camera mode to fixed offset.

1. Click on World Settings
2. Select Camera Mode: Fixed setting.
3. Press the X button to place the camera in its starting position and press the A button to set the position.
Design Pattern: Maze
Using a maze as your game world turns your game into a puzzle requiring the player to use skill to find the correct route. Some mazes have a single route that needs to be discovered while other mazes have multiple possible routes.

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Recipe: Maze Game

When making a maze it is easier to start by raising the entire maze area and then lowering the maze between the walls. Raising the maze walls is much harder.

For a maze game it is useful to either set the camera as a fixed offset (as for the side scrolling game) behind the player’s bot or alternatively set the camera to first person. To set the camera to first person use the following recipe.
**Design Pattern: Fixed Game Board**

Some games spaces are small fixed areas. These game spaces are more suited to multiplayer games without split screen functionality. By having a set space and a fixed camera all players have the same perspective.

**Notes**

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**Recipe: Fixed Game Board**

We need the camera to stay in the same position for the entire game. To do this we will set the camera mode to fixed position.

1. Click on World Settings
2. Select Camera Mode: Fixed Position.
3. Press the **X** button to place the camera in its starting position and press the **A** button to set the position.
Module 5  
Game Design Patterns

Activity 5.1 Game Progress Patterns

**Design Pattern: Time Limits**  
Time Limits require a player to complete an action or achieve a goal or alternatively sets a time that the player must survive in the game in order to win. Countdown clocks usually display the time remaining to give the game a sense of urgency. Some games feature time bonuses that are gained through achieving certain tasks.

**Notes**

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**Kode Recipe: Time Limit**

Notes:
1. Make sure you attach the game timer to a bot or object that cannot be destroyed during the game.
2. Select a color to use as your timer and do not use the color score for anything else.
3. This example recipe sets the time for 30 seconds and uses the colour black for the timer. After 30 seconds the player wins the game.
4. Refer to the game Wack-a-Lama to see this recipe in action.
Design Pattern: Scores
Scores are a numerical representation of a player’s success. Points can be added to a player’s score for achieving certain goals or deducted for failed activities. A player’s score is usually displayed at all times during a game, often points achieved are displayed as an overlay as the goal is achieved adding to the sense of achievement and progress.

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Kode Recipe: Scores

Notes:

1. This recipe adds 1 point to the blue score each time a shot hits the blimp and 10 points each time a saucer is hit. When the score is more than 100 the player wins the game.

2. Add this recipe to the bot that is doing the shooting.

3. This recipe works with both the keyboard and the gamepad.

4. Refer to Xevon v06 to see this recipe.
**Pattern: Health**
The health of the players bot can also be used to indicate progress within the game. A health bar shows the current health of the character and provides immediate feedback to player.

**Notes**

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**Recipe: Health**

Notes:

1. When the bot touches a coin 10 points is deducted from the bots health and the coin vanishes.
2. When the bot touches and eats an apple 10 points are added to the bots health.
3. When the bot’s health is zero the game ends.
4. The number of Hit Points (health) a bot starts with is set in the bot’s settings. Values between 0 and 1000 in increments of 5 can be set.
Pattern: Save Points

Save Points (also called Check Points) are convenient points in a game, usually after a hard section of the game has been completed where the game is either saved automatically or the player is given the option to save given the option. If the user fails during the next section of the game, the game is restarted from the save point rather than returning the player to the beginning of the game. This alleviates the problem of players needing to replay easier sections of the game in order to reach their sticking point.

Notes

Recipe: Save Points

Note:
1. The cycle bot, which is the player controlled character, is a creatable.
2. The red score is used to keep track of the players lives. A value of 1 indicates that the player is alive and playing while a value of 0 indicates that the player’s bot needs to be respawned.
3. The black score is used to keep track of the save points. 0 indicates the player is at the beginning of the game. 1 indicates that the player has reached save point 1, and so on.
4. A bot has to be created and programmed at each save point, in this example we’ve used stick bots but the type of bot doesn’t matter.
5. There isn’t any code for page 3 of the save points.
6. Use the settings of the save points to reduce the hearing to its minimum value so that the stick bot only hears the cycle bot when it is very close.
7. A different colour score could be used to track and limit the number of new lives, this is not shown in the recipe.
The player controlled bot is a creatable

Starting point (save point 0)
Successive save point will need their black points incremented by 1

**Design Pattern: Multiple Levels**

Having multiple levels in a game is a great way to convey a sense of progress to the player. Games also use levels to increase the difficulty and/or introduce new game mechanics.

**Notes**

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**Recipe: Multiple Levels**

Notes:

1. The black scores are used to keep track of which level the player is currently on.

2. The player’s bot is a creatable and therefore must be created at the start of the game.

3. Subsequent levels can be made by copying the Level 2 start and end points and incrementing the black scores in the code.

4. Set the black score to Off

The player controlled bot is a creatable
Starting point on level 1

Finishing point on level 1

Stickbot: Starting point on level 2
Stickbot: Finishing point on level 2
Activity 5.2 Game Play Patterns

Pattern: Power Ups
Power-Ups give a time limited advantage to the player that activates them. Power Ups require players to make strategic decisions about when to use them as power up need to be earned or require time to recharge.

Power-Ups solve the problem of having to complete a variety of tasks of varying difficulty as they let the user have increased abilities to face harder challenges without making the tasks (without power ups) too easy.

For example, a character may become invulnerable or be able to move faster for a period after obtaining an item or after a certain key is pressed. Sounds or visual effects can be used to signal that are power up is being used and/or about to end.

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Recipe: Power Up
Notes: This recipe programs a bot which is controlled by a player to lose the game when it is bumped into by a red cyclebot. When the player’s bot bumps and eats an apple it is powered up so that the red cycle bots are now destroyed when they are touched by the players character. The power up lasts for 5 seconds and then the player’s bot returns to its original state.

1. Notice the use of me and it.
When: bop
Do: eat

When: bop
Do: switch

When: gamepad
Do: move

When: keyboard
Do: move

When: bop
Do: vanish

When: timer
Do: switch

Page 2

Do: glow
Do: no

When: L stick
Do: move

When: cycle
Do: it
**Pattern: Transfer of Control**
Some games allow the player to control different characters at different stages of the game. This could include when a player’s character enters a car or boards a boat. The new character would usually have different abilities and therefore the game play would be different resulting in greater interest for the player.

**Notes**

**Recipe: Transfer of Control**

Notes:

1. This example shows how a player controlled cycle bot can “get into a boat” which the player then controls.

Cyclebot: Initial player controlled bot

Floatbot: Player controlled bot once the cyclebot has boarded it.
Pattern: Big Boss
Games or levels in games often finish with a battle with a Big Boss. The Big Boss is a much more difficult opponent and often has different abilities to the previous opponents. Battling the Big Boss is a great way to build a sense of progress and to give closure to game.

Notes
**Recipe: Big Boss**

Notes:
1. The bots hit points settings for a Big Boss can be increased and therefore made harder to defeat.
2. The bots damage points can be increased to make the attacks more damaging.
3. This only one example of how a big boss could be made.
4. The number of creatables that can exist at a single time can be limited using the object settings. In this case we will limit the number to 5.

Rocks are thrown by the Boss, so create a single creatable rock.
Activity 5.3 Game Information Design Patterns

It is important to communicate with players so that they clearly understand the state of the game and their progress within it. Game information can be communicated with text, sounds, scores and change to the game space. Clear communication helps prevent frustration and unexpected outcomes for the player.

Pattern: Alarm

Alarms can be used in games to warn players of danger. They can be used indicate that a phase of the game is about to begin or end. Different sounding alarms can be used to notify the player of different events.

Recipe: Alarm

This recipe shows how an alarm can be used to indicate that cycle bot is close by.
Pattern: In Game Information

Dialog boxes can be used to display information to the user, this information may simply notify the user of their progress in the game or it may provide information that the player needs to successfully complete the game.

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Recipe: Dialog

There are three kinds of dialog boxes in Kodu Game Lab: Full Screen and two Thought Balloons, one in which the lines are displayed sequentially and one in which lines are displayed randomly.

Full screen is used to give general messages to the player, while speech dialog boxes are used when specific characters are used provide information to the player.

In this example a full screen dialog will be displayed when the black score reaches five points.

Use the button once you selected the icon to select which type of dialog will be used.
Module 6
A Game Design Approach

Activity 6.1
In this example we will investigate design processes suitable for use by students.

Jesse Schell says, “think of a problem, identify the best way to solve the problem, implement, test.”

Some advice:

Plan your game on paper.

Start with simple game play and then expand it.

Test, test and test.

Describe the design process that you plan to use with your students

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Activity 6.2
In this activity we will investigate some of the functionality in Kodu Game Lab that makes life easier for game designers.

Identifying risks: Can we do this in Kodu?

There are many things that are possible or impossible to create with Kodu Game Lab. When designing a new game it is crucial that the game designer identifies the parts of the game that may not be possible and creates them first, that way if the game is impossible to create time has been wasted.

Debugging: Why isn’t this working?

When the game is not playing as expected there are debugging lines that can be turned on. As the name suggests the Debugging Lines of Sights and Sounds will show where the bot can and can’t see and hear and is very useful in discovering why any code is not working as expected.
Copy, Paste, Clone: Is there a quicker way to do this?

When creating multiple bots with the same programming it is often quicker and easier to clone and paste the bot or object. Bots and objects can also be cut and pasted between projects.

Use the \[ L \] to cut and \[ R \] to clone and paste or alternatively right click the object with the mouse.

Using Versioning: Whoops my game no longer works!?

When saving major changes to Kodu Game Lab games it useful to save it as a new version. This effectively creates backups of your game which is useful if you happen to make changes that cause your game to stop working. When saving a new version of a game Kodu will warn you and suggest that you save it as an increment, press \[ Y \] to do this.
Using the Resource Meter: Why is my game running so slowly?

Kodu Game Lab is for making small games and when games get too large Kodu starts to slow down, often making the game unenjoyable and unplayable.

The resource meter can be displayed by turning it on in the World Settings.

Ensure the resource meter stays out of the red while testing your game. Sometimes your code can be modified to limit the resources used eg by minimising hear commands but usually it will be necessary to reduce the amount of land used in the game.
Module 7
Next Steps

How do you plan to use Kodu Game Lab at your school?

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Kodu Resources

Websites

http://fuse.microsoft.com/kodu
http://planetkodu.com
http://boards.kodux.com

All workshop materials are downloadable from

http://media.planetkodu.com/workshop/resources.html