4 User Interaction

In this chapter we will incorporate User Interaction into our game. First, we will add the player's avatar, the pot, to the game. Then we will be implementing a drag and drop mechanism that lets the user move that pot in order to catch objects.

While implementing the drag and drop feature you'll learn how Cocos2D's touch system works in detail.

4.1 Add the Pot to the Game

The goal of our game will be to move a pot across the screen and try to catch food while avoiding catching inedible objects. Before we can implement the drag and drop mechanism we need to add the pot assets to our game, we're going to do that in the SpriteBuilder project.

Just as in the game we built in the very first chapter we are going to create an individual CCB File for this new entity. That way we can encapsulate its assets, behavior and animations nicely.

One important aspect of this game is the ability to for objects to fall into our pot. Since we are building a 2D game we need to fake the conception of depth in our scene. In Cocos2D we can use the z-order to influence which sprites are rendered in which order. Using that z-order, and using two assets for to create the pot, we can make it look like objects drop into the pot:

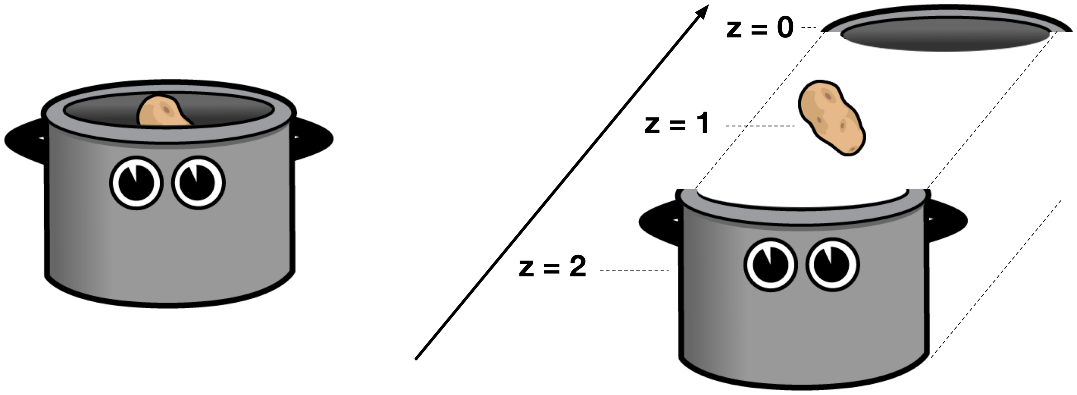
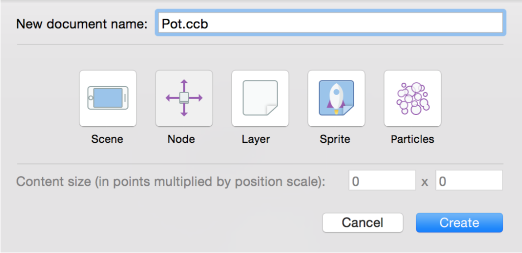


Figure 4.1: Left: Sprites rendered on different layers, Right: How the z-Order influences on which layer a sprite is rendered

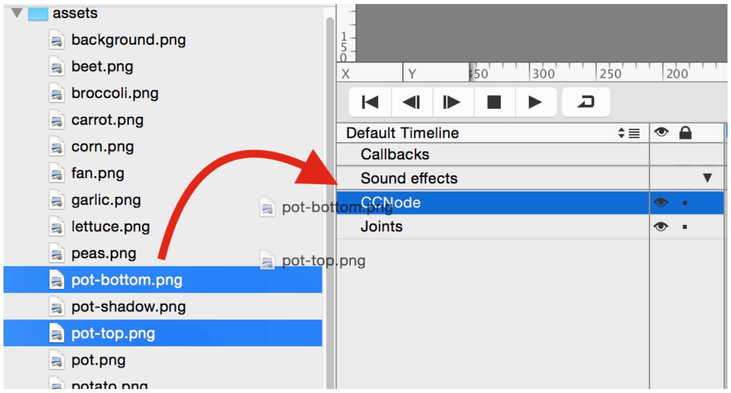
It's essential for this trick to break down the pot into two assets. Such rendering tricks are very common in 2D games!

4.1.1 Setting Up the Pot Assets

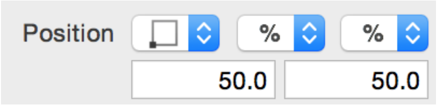
Now that we know which assets we'll use for the pot, let's set up its CCB File in SpriteBuilder:

> 1. Create a new CCB File of type *Node* and name it *Pot.ccb*:
>
> 
>
> New document name: Pot.ccb
>
> Content size (in points multiplied by position scale): 0 x 0

2. Open the new *Pot.ccb* file
3. Drag the *pot-top* and *pot-bottom* assets onto the root node of that CCB File:



4. Select the root node and set the *Content Size* to (109, 75) and the *Anchor Point* to (0.5, 0.5)
5. Select the *pot-top* sprite from the timeline and set the *Position Type* to *Percent of Parent Container*, for both *X* and *Y*. Then set the position to *(50, 50)*:



Position % %

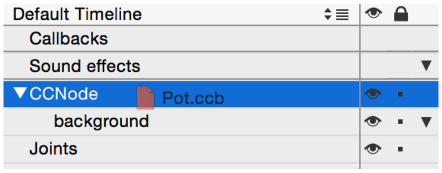
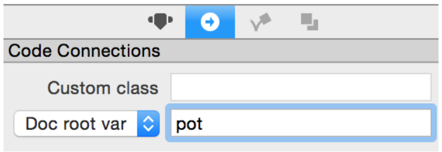
50.0 50.0

6. Select the *pot-bottom* sprite from the timeline and set up the same position as for *pot-top*
7. Finally, use the shortkey *CMD+S* to save this CCB File. That will prevent a little rendering bug in the next step

The result should be a pot that is centered on stage! You might wonder why we are setting an explicit size for the root node of *Pot.ccb*. We do that because that root node will be used to test against touch positions when we implement the dragging mechanism. Therefore we want that root node to have the same dimensions as the pot assets.

In a second we're going to move on and implement the touch handling code. First however, we need to add the pot that we created to the *MainScene.ccb* file. SpriteBuilder allows us to add a CCB File to other CCB File - that's an extremely useful feature as it allows us to reuse components in different scenes.

We'll also need to set up a code connection, so that we can access the pot from our codebase when implementing the drag and drop mechanism later on!

> 1. Open *MainScene.ccb*
> 2. Drag the *Pot.ccb* file from the left panel onto the root node in the timeline of *MainScene.ccb*:
>
> 
>
>
> 3. Set the *Position Type* of the pot to *Percent of parent container* for the *X* component
> 4. Set the *Position* to *(50, 58)*
> 5. Select the pot, open the *Code Connections* tab in the right panel and set up a connection to the *Doc root var* named *pot*:
>
> 
>
> Code Connections
>
> Custom class
>
> Doc root var pot

> 6. Finally, publish the SpriteBuilder project!

Now we can move to the Xcode project to set up the code connection variable we just defined in SpriteBuilder. Then we're ready to implement the touch handling code!

> Open MainScene.swift and add properties for our code connection at the top of the class:
>
> ```
> weak var pot: CCSprite!
> ```

There are three important things to remember about this code connection.

Firstly, all code connections should be marked as weak. MainScene has a reference to the pot sprites but does not *own* them. Instead they are owned by their parent node. For any references that don't mark an ownership, weak should be used.

Secondly, we always want to declare code connections as *forcefully unwrapped optionals* as denoted by the bang (!) after the type. Swift requires that all properties that aren't optionals are either initialized with a default value or get set to a value in one of the initializers of the class. That way the compiler can guarantee that these variables never contain a nil value. Code connections however are set up after the object is initialized (they are guaranteed to be set up when didLoadFromCCB is called on the node), so technically these should be optional values. Adding a lot of code for nil checking would clutter our classes, that's why we prefer using the bang notation which basically says: *I am confident that this value will never be nil when I am trying to access it*. This is true for code connections as we know that Cocos2D guarantees to have set them up by the time didLoadFromCCB is called.

Lastly, be careful not to mark these variables as private. Otherwise Cocos2D will not have access to them and won't be able to set up the code connections.

Okay, now we have the basics set up and are ready to dive into the details of implementing a drag and drop mechanism!

4.2 Implement a Drag and Drop Mechanism

For the very first project in this book we have already implemented a basic touch mechanism. You should remember that `userInteractionEnabled` is the property that activates/deactivates touch handling for a node and that Cocos2D provides four different callbacks for different state transitions in the lifecycle of a touch. Here's the recap:

touchBegan: called when a touch begins

touchMoved: called when the touch position of a touch changes

touchEnded: called when a touch ends because the user stops touching the screen

touchCancelled: called when a touch is cancelled because user moves touch outside of the touch area of a node

Knowing that, how can we implement a drag and drop control scheme for our game? Dragging and dropping includes three different steps:

1. Pick up object
2. Drag object
3. Drop object

4.2.1 Picking Up an Object

In order to pick up an object we need to detect a user's touch and determine if the touch is within the boundaries of our object, if that is the case, we start dragging the object.

First of all, let's turn on user interaction for the `MainScene` class, so that we receive touch events.

> Add the required line to the `onEnterTransitionDidFinish` method:
>
> ```
> override func onEnterTransitionDidFinish() {
>   super.onEnterTransitionDidFinish()
>
>   userInteractionEnabled = true
>
>   // spawn objects with defined frequency
>   schedule("spawnObject", interval: spawnFrequency)
> }
> ```

Next, we need to add the touch handling method. The touch handling method will need to check if the touch is within our pot. If that is the case, the method will need to set a state variable that remembers that we are currently dragging this object. If the user moves a finger across the screen and we are currently in object dragging mode, it is important that the object follows the finger of the user.

> Add this implementation to `MainScene.swift`:
>
> ```
> override func touchBegan(touch: CCTouch, withEvent event: CCTouchEvent) {
>   if (CGRectContainsPoint(pot.boundingBox(), touch.locationInNode(self))) {
>     isDraggingPot = true
>     dragTouchOffset = ccpSub(pot.anchorPointInPoints, touch.locationInNode(
>   pot))
>   }
> }
> ```

Let's discuss this implementation briefly. You already have seen the usage of `touch.locationInNode(self)` in the first chapter of this book, where we briefly discussed touch handling (2.4.5). This method returns the touch position within a given node. In this specific case we are receiving the touch position within `MainScene`.

Next, we are using a utility function, `CGRectContainsPoint`, to check if this touch is within the pot's bounding box. `CGRectContainsPoint` takes a rectangle as its first argument and a point as its second. It returns true if the point is within the rectangle.

If the touch position is inside of the pot, we set our state variable, `isDraggingPot`, to `true`.

There is one last line that we didn't discuss upfront:

```
dragTouchOffset = ccpSub(pot.anchorPointInPoints, touch.locationInNode(pot))
```

In order to drag an object smoothly we need to remember where we touched that object when starting dragging. Take a look at the following diagram:

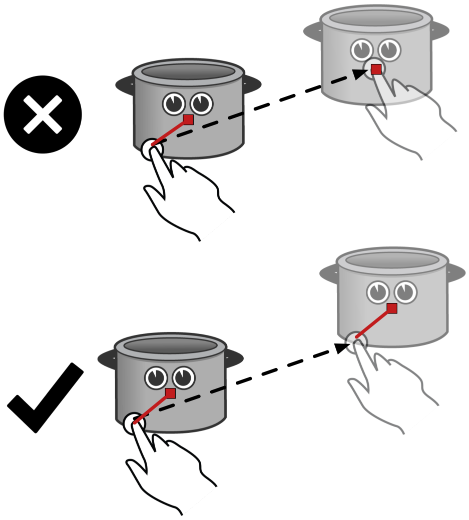


Figure 4.2: *Top Image:* incorrect implementation, object jumps to touch position. *Bottom Image:* correct implementation, touch offset is maintained while dragging the object.

As the user moves the finger, we move the object along. However, the position of the object is not exactly the touch position. Instead it is the touch position *plus* the touch offset determined when we started dragging. We determine that offset by calculating the distance between the anchor point (that's the reference point for positioning a node, typically it's in the center of the node) of the touched object and the exact touch position. We calculate that distance by subtracting the touch location from the anchor point location using the ccpSub function.

Now we know why it is important to store the touch offset!

> To wrap up the implementation of touchBegan let's add the two properties we have referenced: isDraggingPot and dragTouchOffset. Your list of properties should now look like this:
>
> ```
> weak var pot: CCSprite!
>
> private var fallingObjects = [FallingObject]()
> private let fallingSpeed = 100.0
> private let spawnFrequency = 0.5}
> private var isDraggingPot = false
> private var dragTouchOffset = ccp(0,0)
> ```

4.2.2 Moving an Object

Now we'll implement the code that actually moves the pot. That code needs to run whenever a user's finger moves. That means we need to implement the touchMoved method.

> Add the touchMoved method below the touchBegan method:
>
> ```
> override func touchMoved(touch: CCTouch, withEvent event: CCTouchEvent) {
>   if (!isDraggingPot) {
>     return
>   }
>
>   var newPosition = touch.locationInNode(self)
> ```

```
    // apply touch offset
    newPosition = ccpAdd(newPosition, dragTouchOffset);
    // ensure constant y position
    newPosition = ccp(newPosition.x, pot.positionInPoints.y);
    // apply new position to pot
    pot.positionInPoints = newPosition;
  }
```

In the first line we check if we are currently in dragging mode. If not, we do nothing and return immediately. This prevents the pot from jumping to the latest touch position if it has not been picked up beforehand.

If we are in dragging mode we continue. First we get the new touch position. Then we apply the offset that we discussed in figure 4.2 to that new position. The next line ensures that the y position of the pot stays constant, we want to allow horizontal movement only. Finally, we apply that new position to both pot parts.

Great, we're pretty close to finishing the drag and drop functionality. If you test the app in the current state you'll might see that there's one simple yet important step missing…

4.2.3 Dropping an Object

Right, the user will also want to drop the pot by releasing the finger from the screen.

Otherwise we stay in dragging mode forever and the pot will keep jumping to whichever position the user taps on the screen. That kind of teleporting would turn this game into a very simple one!

Luckily this can be easily implemented. All we need to do is to set `isDraggingPot` to false as soon as the user stops touching the screen.

> Add the touchEnded method below the touchMoved method:
>
> ```
> override func touchEnded(touch: CCTouch, withEvent event: CCTouchEvent) {
>   isDraggingPot = false
> }
> ```

Awesome! Our drag and drop code is complete!

4.3 Summary

Throughout this chapter you have implemented a drag and drop mechanism, while learning more details about the Cocos2D touch system. Drag and drop mechanisms can be used in many types of games, so what you have learned in this chapter is very valuable.

Now we can move on to the next chapter. We will implement one of the core mechanics of our game - catching objects. In the next chapter you'll also learn some interesting tricks and details about scene graphs and node transforms.

4.3.1 Grab the Source Code

You can find the Source Code for this chapter on GitHub: https://github.com/SpriteBuilder-Book/Code/tree/master/Chapter4/.