UNIVERSITY OF Hull

Rather Useful Seminars

Three Thing Game and MonoGame

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Getting Started on Windows 8.1

1. Install Visual Studio 2013
2. Install XNA 4.0

   https://msxna.codeplex.com/
3. Install MonoGame

   http://www.monogame.net/

- You can use this installation to create games for Windows Desktop and also ones that can be published in the Windows Store

Making a MonoGame Project

- Monogame adds new project types

MonoGame Sample Applications

- If you are new to development you might want to start from one of my sample applications
- These are guaranteed to work

MonoGame Sample Applications

- If you are new to development you might want to start from one of my sample applications
- These are guaranteed to work
  - Mostly

Cracker Chase

- Cracker Chase is not a very good game
- Chase the crackers with the cheese

How Games Work

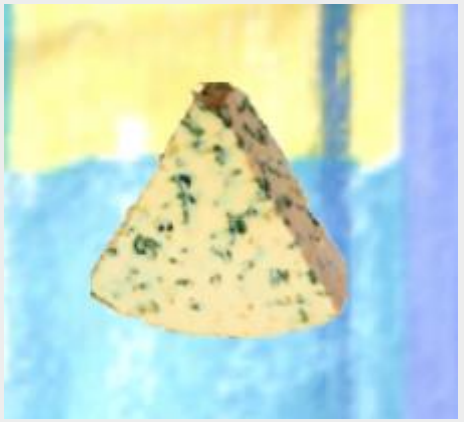
- Every game that has ever been written has these fundamental behaviours:
- Initialise all the resources at the start
  - fetch all textures, models, scripts etc
- Repeatedly run the game loop:
  - Update the game world
    - read the controllers, update the state and position of game elements
  - Draw the game world
    - render the game elements on the viewing device

Cracker Chase Behaviours

- The CrackerChase game does three things
- It loads the content
  - It updates the game
  - It draws the game
- We can take a look at how these work

A Word about Sprites

- A sprite is a game object that has a position and a texture
  - Plus a few other things
- We create these to represent game objects



Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- This is all the data held in a standard sprite

Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- The size of the screen it is part of

Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- The texture that contains the sprite image

Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- A rectangle that defines the width and height of the sprite

Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- The X and Y position of the sprite on the screen

Sprite Data

```
class Sprite
{
    protected int screenWidth;
    protected int screenHeight;

    protected Texture2D texture;
    protected Rectangle rectangle;

    protected float xPosition;
    protected float yPosition;

    protected float xResetPosition;
    protected float yResetPosition;
}
```

- The place to put it back to when the game resets

Creating a background sprite

```
Texture2D cloth = Content.Load<Texture2D>("Tablecloth");
background = new Sprite(screenWidth,
                        screenHeight,cloth,screenWidth,0,0);
```

- This is how I make a simple sprite for the background
- I want the sprite to be the width of the screen, and placed at 0,0

Creating a background sprite

```
Texture2D cloth = Content.Load<Texture2D>("Tablecloth");
background = new Sprite(screenWidth,
                        screenHeight,cloth,screenWidth,0,0);
```

- The game sets these values so that the game will automatically fit any sized screen

Creating a background sprite

```
Texture2D cloth = Content.Load<Texture2D>("Tablecloth");
background = new Sprite(screenWidth,
                        screenHeight,cloth,screenWidth,0,0);
```

- The background sprite has a reset position of 0,0 so that it is displayed over the whole screen

Lists of Sprites

```
List<Sprite> gameSprites = new List<Sprite>();

…

gameSprites.Add(background);
```

- The game contains a list of sprites that are all the objects on the screen
- Each time I create a new sprite I add one to the list

Other kinds of sprites

```
cracker = new Target(screenWidth, screenHeight,
                     crackerTexture, crackerWidth, 0, 0);
gameSprites.Add(cracker);
```

- The cracker I am chasing is a Target sprite
- This is like a Sprite, but can position itself randomly on the screen

Size Calculation

```
int crackerWidth = screenWidth/20;
```

- The game calculates the width of the cracker as a fraction of the size of the screen
- This makes the game work on any sized display

Other kinds of sprites

```
cheese = new Mover(screenWidth, screenHeight, cheeseTexture,
        cheeseWidth, screenWidth / 2, screenHeight / 2, 500, 500);
```

- A Mover sprite can be made to move around the screen

Other kinds of sprites

```
cheese = new Mover(screenWidth, screenHeight, cheeseTexture,
        cheeseWidth, screenWidth / 2, screenHeight / 2, 500, 500);
```

- A Mover sprite can be made to move around the screen
- When we create a mover we tell it how fast it is allowed to move
  - The units are pixels per second

Game Behaviours

- A game has update and draw behaviours
- These map onto the methods in the XNA game class
- What happens in the methods depends on the state of the game
  - Starting the game
  - Playing the game

The Update method

```
protected override void Update(GameTime gameTime)
{
    switch (state)
    {
        case GameStates.Start_Screen:
            updateStartScreen(gameTime);
            break;
        case GameStates.Playing_Game:
            updateGamePlay(gameTime);
            break;
    }
}
```

- The Update method is called 60 times a second when the game is running

The Start Screen Update method

```
void updateStartScreen(GameTime gameTime)
{
    KeyboardState keys = Keyboard.GetState();

    if (keys.IsKeyDown(Keys.Space))
        startPlayingGame();
}
```

- The update method for the startscreen state is looking for the player to press the space key

The Start Screen Update method

```
void updateStartScreen(GameTime gameTime)
{
    KeyboardState keys = Keyboard.GetState();

    if (keys.IsKeyDown(Keys.Space))
        startPlayingGame();
}
```

- This is how a game will test the keyboard
- This code looks for a space key
- You can look for any key

Starting to Play the Game

```
void startPlayingGame()
{
    foreach (Sprite s in gameSprites)
        s.Reset();

    timer = 600;
    score = 0;

    state = GameStates.Playing_Game;
}
```

- When the game starts we reset each sprite and then set the score and timer values

Starting to Play the Game

```
void startPlayingGame()
{
    foreach (Sprite s in gameSprites)
        s.Reset();

    timer = 600;
    score = 0;

    state = GameStates.Playing_Game;
}
```

- This loop works through all the sprites and resets them all

Starting to Play the Game

```
void startPlayingGame()
{
    foreach (Sprite s in gameSprites)
        s.Reset();

    timer = 600;
    score = 0;

    state = GameStates.Playing_Game;
}
```

- The XNA clock ticks 60 times a second so this will give me 10 seconds of gameplay

Starting to Play the Game

```
void startPlayingGame()
{
    foreach (Sprite s in gameSprites)
        s.Reset();

    timer = 600;
    score = 0;

    state = GameStates.Playing_Game;
}
```

- Each time we eat a cracker we get 10 points

Starting to Play the Game

```
void startPlayingGame()
{
    foreach (Sprite s in gameSprites)
        s.Reset();

    timer = 600;
    score = 0;

    state = GameStates.Playing_Game;
}
```

- This starts the game playing by changing the state

Gameplay Update – cheese

```
void updateGamePlay(GameTime gameTime)
{
    KeyboardState keys = Keyboard.GetState();

    if (keys.IsKeyDown(Keys.Up))
        cheese.StartMovingUp();
    else
        cheese.StopMovingUp();

    ...
}
```

- This is part of the gameplay update method
- It tells the cheese to start moving if a key is pressed

Gameplay Update : sprites

```
void updateGamePlay(GameTime gameTime)
{
    ...
    foreach (Sprite s in gameSprites)
        s.Update(1.0f / 60.0f);
    ...
}
```

- This part of the update method updates each sprite

Gameplay Update : sprites

```
void updateGamePlay(GameTime gameTime)
{
    ...
    foreach (Sprite s in gameSprites)
        s.Update(1.0f / 60.0f);
    ...
}
```

- This tells the sprite that a 60th of a second has gone by since the last update
  - We change this if the speed of the game changes

Gameplay Update : Targets

```
void updateGamePlay(GameTime gameTime)
{
    ...
    foreach(Target t in crackers)
    {
        if(cheese.IntersectsWith(t))
        {
            BurpSound.Play();
            t.RandomPlace();
            score = score + 10;
        }
    }
}
```

- This code checks to see if the cheese has hit a cracker

Gameplay Update : Targets

```
void updateGamePlay(GameTime gameTime)
{
    ...
    foreach(Target t in crackers)
    {
        if(cheese.IntersectsWith(t))
        {
            BurpSound.Play();
            t.RandomPlace();
            score = score + 10;
        }
    }
}
```

- If it has we play a burp sound and update the score

Gameplay Update: state

```
void updateGamePlay(GameTime gameTime)
{
    ...
    timer = timer - 1;

    int secsLeft = timer/60;
    messageString = "Time: " + secsLeft.ToString() + " Score: " + score;

    if (timer == 0)
        gameOver();

}
```

- This updates the timer and status
- When the timer reaches 0 the game ends

Drawing the game world

```
void drawGamePlay()
{
    spriteBatch.Begin();

    foreach (Sprite s in gameSprites)
        s.Draw(spriteBatch);

    float xPos = (screenWidth - messageFont.MeasureString(messageString).X) / 2;

    Vector2 statusPos = new Vector2(xPos, 10);

    spriteBatch.DrawString(messageFont, messageString, statusPos, Color.Red);

    spriteBatch.End();
}
```

- There are separate draw methods for the gameplay and start modes

Drawing the game world

```
void drawGamePlay()
{
    spriteBatch.Begin();

    foreach (Sprite s in gameSprites)
        s.Draw(spriteBatch);

    float xPos = (screenWidth - messageFont.MeasureString(messageString).X) / 2;

    Vector2 statusPos = new Vector2(xPos, 10);

    spriteBatch.DrawString(messageFont, messageString, statusPos, Color.Red);

    spriteBatch.End();
}
```

- Each sprite is asked to draw itself

Sprite Drawing

```
public virtual void Draw(SpriteBatch spriteBatch)
{
    rectangle.X = (int)Math.Round(xPosition);
    rectangle.Y = (int)Math.Round(yPosition);
    spriteBatch.Draw(texture, rectangle,
                     Color.White);
}
```

- The sprite uses the data it holds to draw the texture at the right place on the screen

Making the Game

- The game is very simple, but can be expanded by adding more items
- We can also give items behaviours very easily
- The game has been structured so that it is easy to make new types of sprite
- Sample code at:

  www.ratherusefulseminars.com

Also available....

www.robmiles.com