The Slate UI Framework

Part 1: Introduction

Gerke Max Preussner

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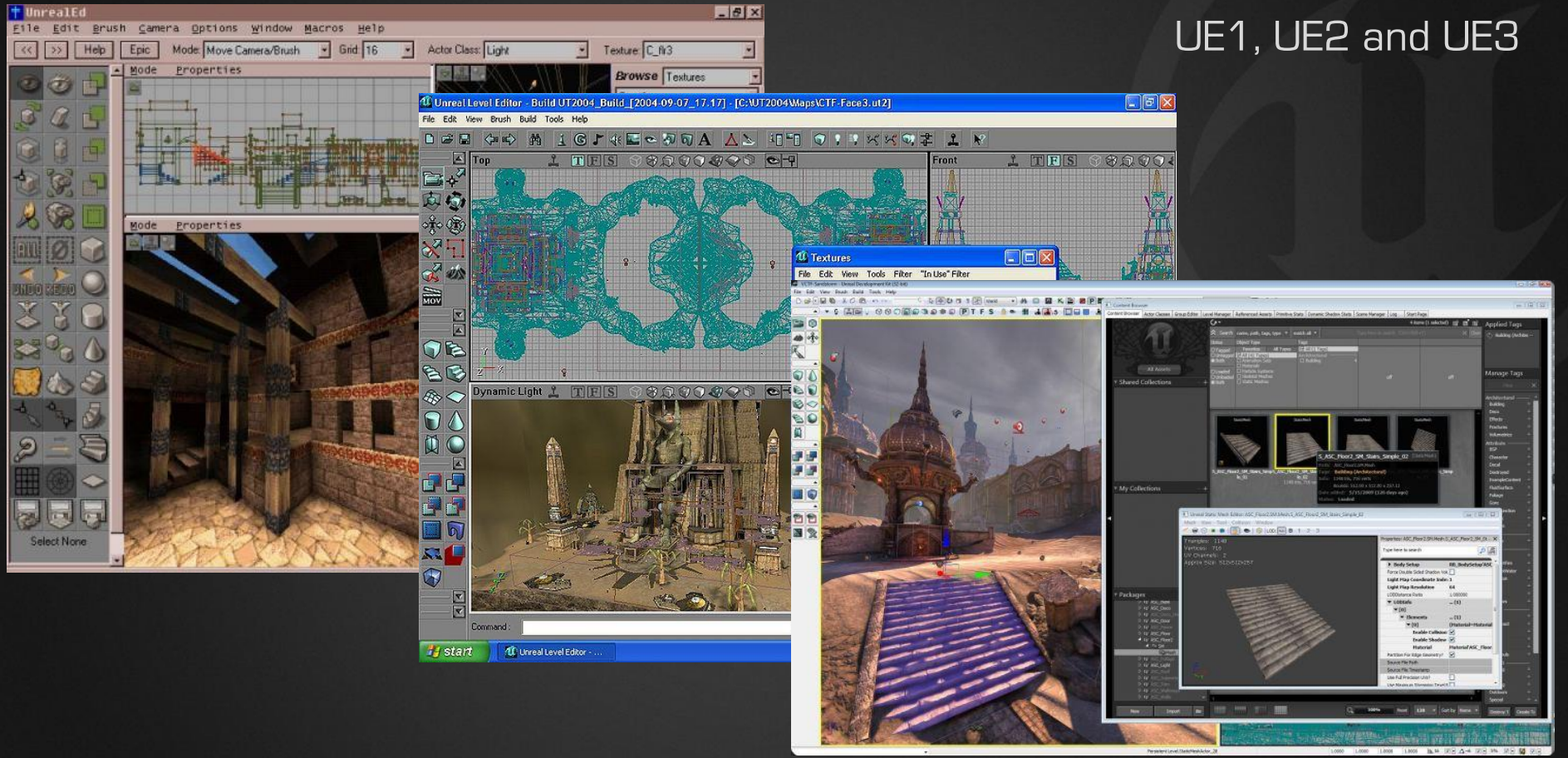
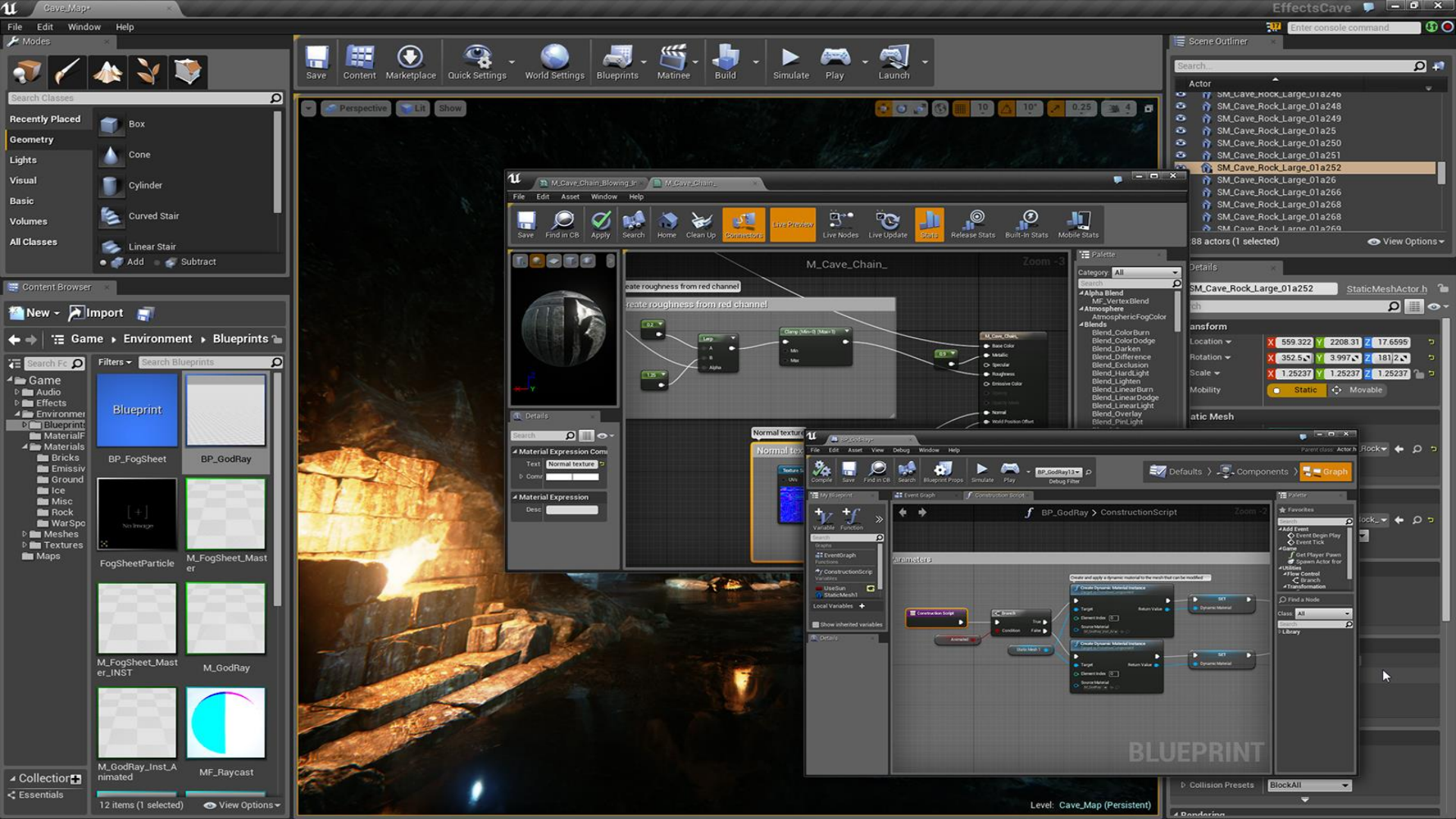
UE1, UE2 and UE3



UNREAL ENGINE


Cave_Map*
EffectsCave
File Edit Window Help
Modes
Save Content Marketplace Quick Settings World Settings Blueprints Matinee Build Simulate Play Launch
Search Classes
Recently Placed
Geometry
Lights
Visual
Basic
Volumes
All Classes
Box
Cone
Cylinder
Curved Stair
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Content Browser
New Import
Game Environment Blueprints
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Search Blueprints
Blueprint
BP_FogSheet
BP_GodRay
FogSheetParticle
M_FogSheet_Master
M_FogSheet_Master_INST
M_GodRay
M_GodRay_Inst_Animated
MF_Raycast
12 items (1 selected)
View Options
Collection
Essentials
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M_Cave_Chain_
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Details
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BP_GodRay > ConstructionScript
Parameters
BLUEPRINT
Scene Outliner
Actor
SM_Cave_Rock_Large_01a248
SM_Cave_Rock_Large_01a249
SM_Cave_Rock_Large_01a25
SM_Cave_Rock_Large_01a250
SM_Cave_Rock_Large_01a251
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SM_Cave_Rock_Large_01a268
88 actors (1 selected)
View Options
Details
SM_Cave_Rock_Large_01a252
StaticMeshActor
Location
Rotation
Scale
Mobility
Static
Movable
Collision Presets
BlockAll
Level: Cave_Map (Persistent)

Slate Design & Principles

Overview

Features

Concepts

Tools

Architecture

- Written entirely in C++
- Platform agnostic (works on mobile and consoles, too!)
- SlateCore module provides low-level functionality
- Slate module contains library of common UI widgets
- Does not require Engine or Editor modules

Current Use Cases

- Unreal Editor
- Standalone desktop applications
- Mobile applications
- In-game UI

Slate Design & Principles

Overview

Features

Concepts

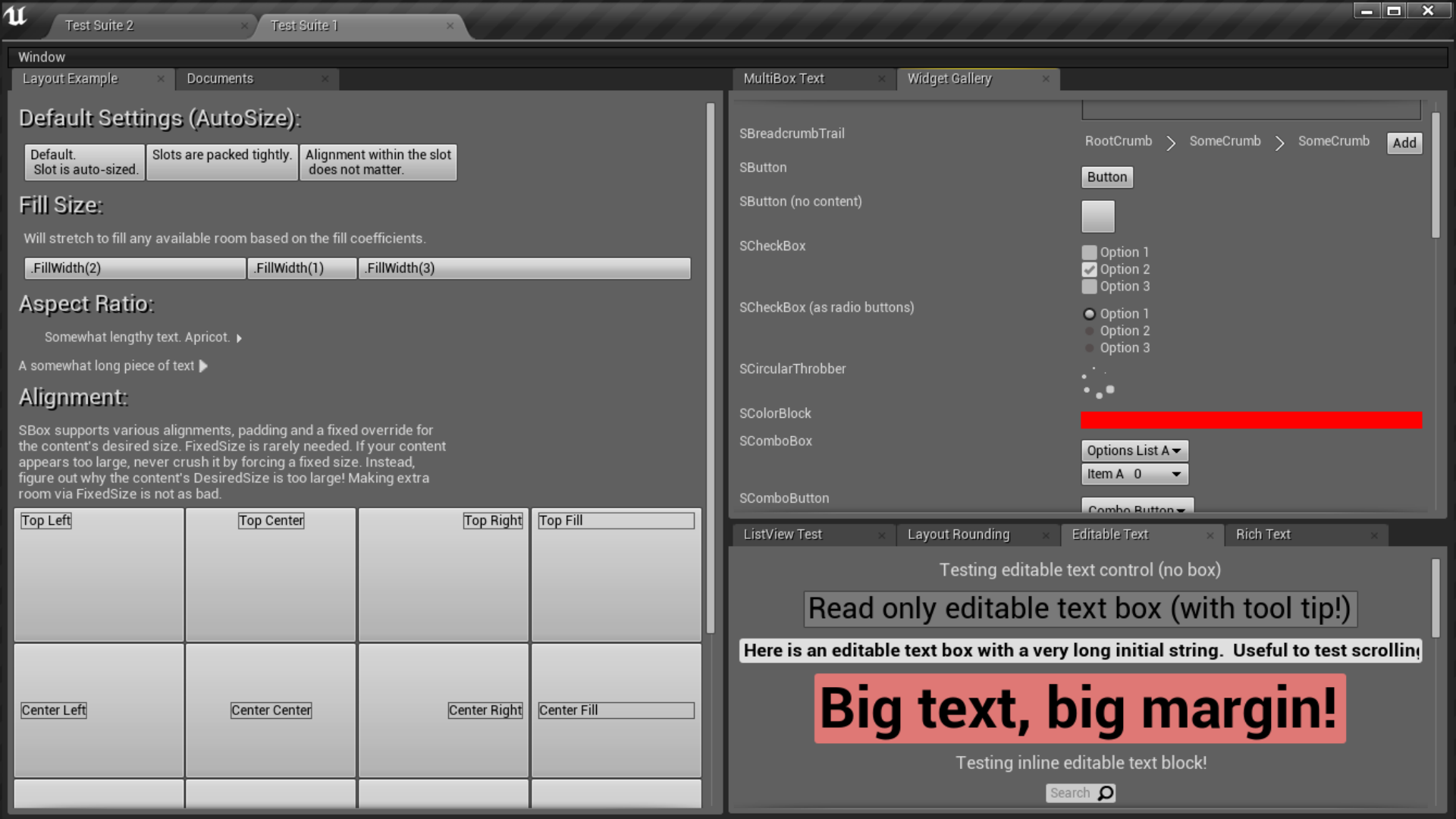
Tools

Styling
- Customize the visual appearance of your UI
- Images (PNGs and Materials), Fonts, Paddings, etc.
- Customizable user-driven layouts

Input Handling
- Keyboard, mouse, joysticks, touch
- Key bindings support

Render Agnostic
- Supports both Engine renderer and standalone renderers

Large Widget Library
- Layout primitives, text boxes, buttons, images, menus, dialogs, message boxes, navigation, notifications, dock tabs, list views, sliders, spinners, etc.


Test Suite 2
Test Suite 1
Window
Layout Example
Documents
Default Settings (AutoSize):
Default.
Slot is auto-sized.
Slots are packed tightly.
Alignment within the slot
does not matter.
Fill Size:
Will stretch to fill any available room based on the fill coefficients.
.FillWidth(2)
.FillWidth(1)
.FillWidth(3)
Aspect Ratio:
Somewhat lengthy text. Apricot.
A somewhat long piece of text
Alignment:
SBox supports various alignments, padding and a fixed override for the content's desired size. FixedSize is rarely needed. If your content appears too large, never crush it by forcing a fixed size. Instead, figure out why the content's DesiredSize is too large! Making extra room via FixedSize is not as bad.
Top Left
Top Center
Top Right
Top Fill
Center Left
Center Center
Center Right
Center Fill
MultiBox Text
Widget Gallery
SBreadcrumbTrail
RootCrumb
SomeCrumb
SomeCrumb
Add
SButton
Button
SButton (no content)
SCheckBox
Option 1
Option 2
Option 3
SCheckBox (as radio buttons)
Option 1
Option 2
Option 3
SCircularThrobber
SColorBlock
SComboBox
Options List A
Item A 0
SComboButton
ListView Test
Layout Rounding
Editable Text
Rich Text
Testing editable text control (no box)
Read only editable text box (with tool tip!)
Here is an editable text box with a very long initial string. Useful to test scrollin
Big text, big margin!
Testing inline editable text block!
Search

Slate Design & Principles

Overview

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Declarative Syntax

- Set of macros for declaring widget attributes
- Avoids layers of indirection

Composition

- Compose entire widget hierarchies in a few lines of code
- Uses fluent syntax for ease of use
- Preferred over widget inheritance
- Any child slot can contain any other widget type
- Makes it very easy to rearrange UIs in code

```
// Example custom button (some details omitted)

class STextButton
  : public SCompoundWidget
{
public:
  SLATE_BEGIN_ARGS(SMyButton )
  { }
    // The label to display on the button.
    SLATE_ATTRIBUTE(FText, Text)

    // Called when the button is clicked.
    SLATE_EVENT(FOnClicked, OnClicked)
  SLATE_END_ARGS()

  // Construct this button
  void Construct( const FArguments& InArgs );
};
```

```
// Button implementation (some details omitted)

void STextButton::Construct ( const FArguments& InArgs )
{
  ChildSlot
  [
    SNew(SButton)
      .OnClicked(InArgs._OnClicked)
      [
        SNew(STextBlock)
          .Font(FMyStyle::GetFontStyle("TextButtonFont"))
          .Text(InArgs._Text)
          .ToolTipText(LOCTEXT("TextButtonToolTip", "Click Me!"))
      ];
  ];
}
```

Slate Design & Principles

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Tools

Widget Inspector

- Visually debug and analyze your UI
- Can jump directly to widget code in Visual Studio or XCode

UDK Remote

- iOS app for simulating touch devices on your PC
- Remote server is a plug-in (enabled by default)
- Primarily used for game development

UDK Remote

View More by This Developer

By Epic Games, Inc.

Open iTunes to buy and download apps.

View in iTunes

This app is designed for both iPhone and iPad

Free

Category: Utilities
Updated: Oct 09, 2013
Version: 1.2
Size: 5.6 MB
Language: English
Seller: Epic Games, Inc.

Rated 4+

Compatibility: Requires iOS 5.0 or later. Compatible with iPhone, iPad, and iPod touch. This app is optimized for iPhone 5.

Customer Ratings

We have not received enough ratings to display an average for the current version of this application.

All Versions:
★★★★ 41 Ratings

More by Epic Games, Inc.

Epic Citadel
View In iTunes

Description

UDK Remote allows you to quickly and easily test your mobile-focused Unreal Engine 3 or 4 gameplay directly on your development computer!

UDK Remote Support ...More

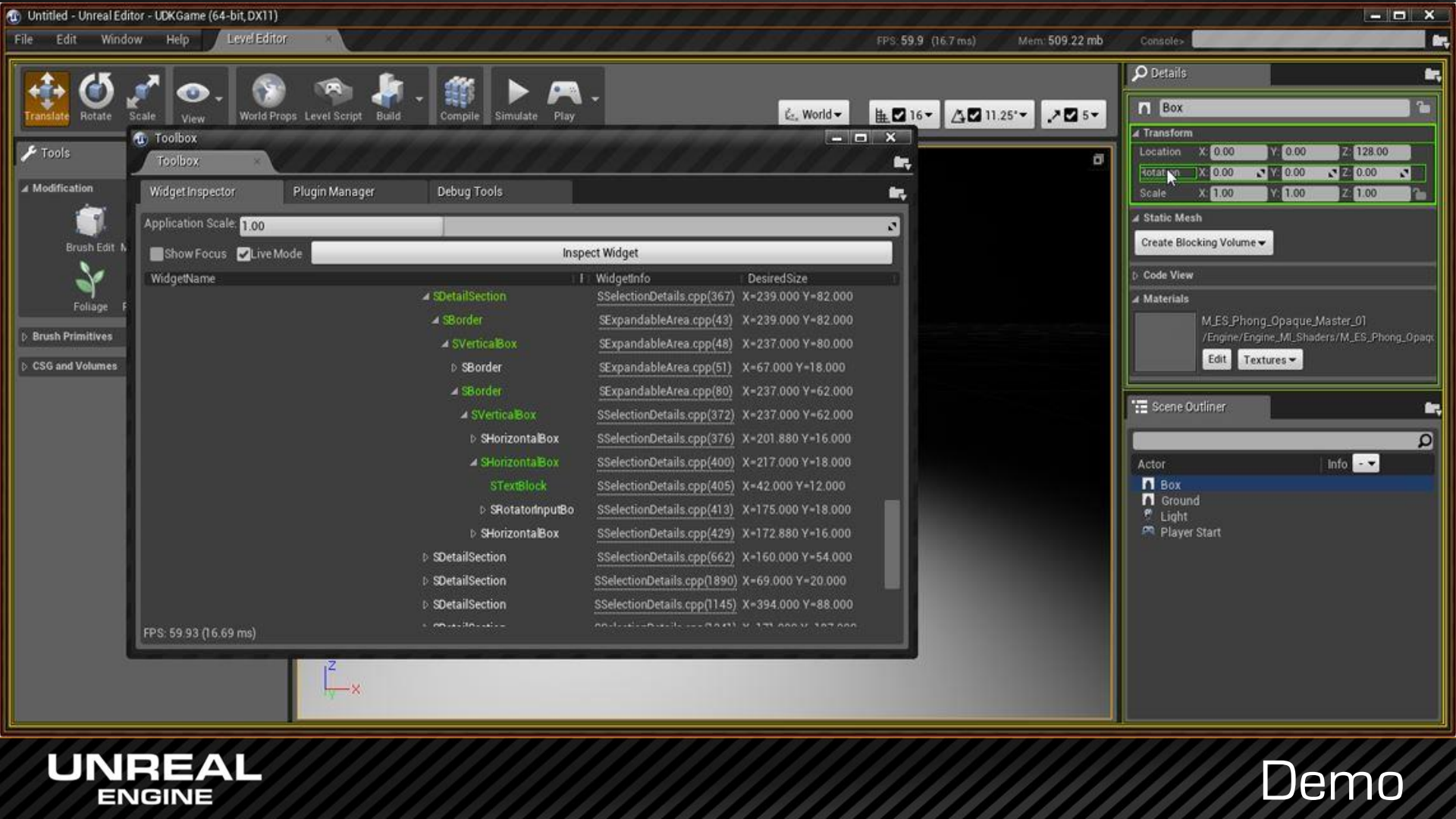
What's New in Version 1.2

- Sends to multiple ports at once (editor and game)
- Support for iPhone 5 aspect ratio
- Support for IOS 7

...More

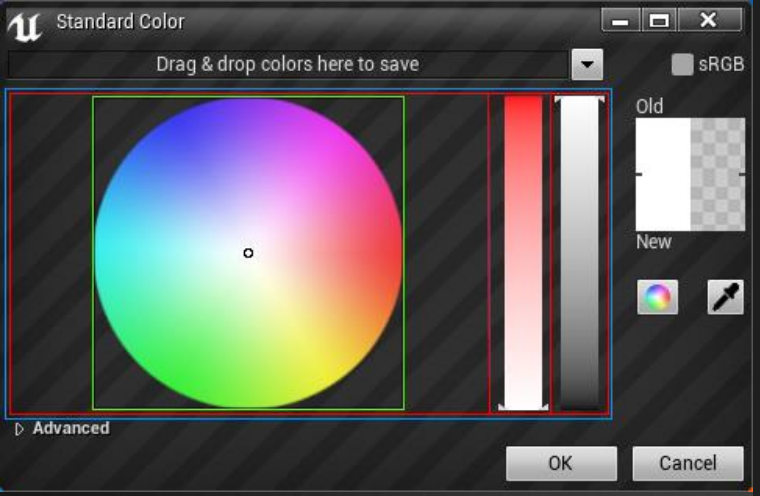
Screenshots

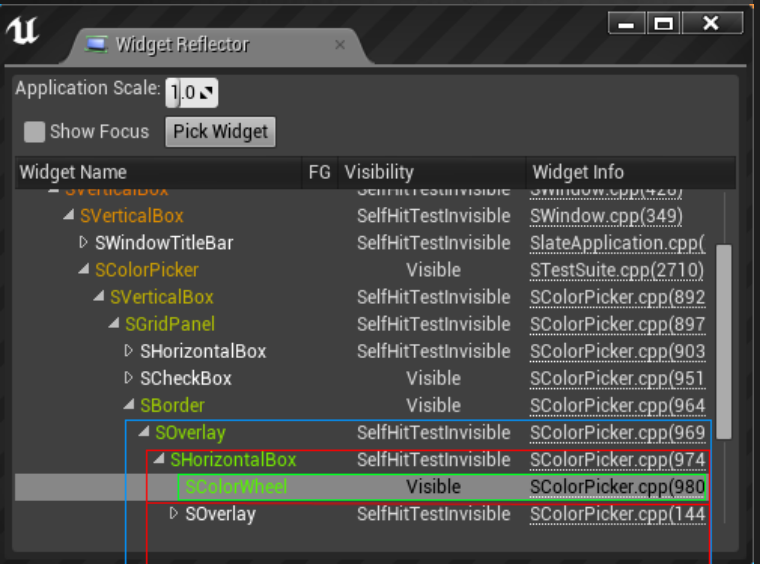
iPhone | iPad



UNREAL ENGINE

Demo






```
[
SNew(SOverlay)

// color wheel
+ SOverlay::Slot()
    [
        SNew(SHorizontalBox)

        + SHorizontalBox::Slot()
            .FillWidth(1.0f)
            .HAlign(HAlign_Center)
            [
                SNew(SColorWheel)
                    .SelectedColor(this, &SColorPicker::GetCurrentColor)
                    .Visibility(this, &SColorPicker::HandleColorPickerModeVisibility, ECo
                    .OnValueChanged(this, &SColorPicker::HandleColorSpectrumValueChanged)
                    .OnMouseCaptureBegin(this, &SColorPicker::HandleInteractiveChangeBegi
                    .OnMouseCaptureEnd(this, &SColorPicker::HandleInteractiveChangeEnd)
            ]

        + SHorizontalBox::Slot()
            .AutoWidth()
            .Padding(4.0f, 0.0f)
            [
                // saturation slider
                MakeColorSlider(EColorPickerChannels::Saturation)
            ]

        + SHorizontalBox::Slot()
            .AutoWidth()
            [
                // value slider
                MakeColorSlider(EColorPickerChannels::Value)
            ]
    ]

// color spectrum
```

Going A Little Deeper

State Updates

Widget Roles

Anatomy

Attributes

Polling instead of Invalidation

- Avoids duplicate state data
- Exception: Non-trivial data models (use caches instead)
- Performance depends on number of visible widgets

```
SNew(SColorWheel)
    .SelectedColor(this, &SColorPicker::GetCurrentColor)
    .Visibility(this, &SColorPicker::HandleColorPickerModeVisibility, EColorPickerModes::Wheel)
    .OnValueChanged(this, &SColorPicker::HandleColorSpectrumValueChanged)
    .OnMouseCaptureBegin(this, &SColorPicker::HandleInteractiveChangeBegin)
    .OnMouseCaptureEnd(this, &SColorPicker::HandleInteractiveChangeEnd)
```

Going A Little Deeper

State Updates

Widget Roles

Anatomy

Attributes

Fundamental Widget Types

- SCompoundWidget – Can have nested child widgets
- SLeafWidget – Does not contain child widgets
- SPanel – Base class for layout panels

Special Widgets

- SWidget – Root base class for all widgets (do not inherit!)
- SNullWidget – Empty default widget

User Widgets

- More efficient in terms of compile time

Going A Little Deeper

State Updates

Widget Roles

Anatomy

Attributes

Common Interfaces

- Arguments – Widget parameters that do not change
- Attributes – Parameters that are polled
- Event handlers – Usually named 'OnSomeEvent'

Common Internals

- ComputeDesiredSize() - Calculates widget's desired size
- ArrangeChildren() - Arranges children within allotted area
- OnPaint() – Draws the widget

Going A Little Deeper

State Updates

Widget Roles

Anatomy

Attributes

Common Attributes

- Enabled state, Visibility, Hit testability
- Tooltip Widget, Tooltip Text, Cursor Style
- Horizontal & Vertical Alignment , Padding

Attributes Can Be:

- Constants, i.e. IsEnabled(false)
- Delegate bindings,
  i.e. IsEnabled(this, &SMyWidget::HandleIsEnabled)

Upcoming Features

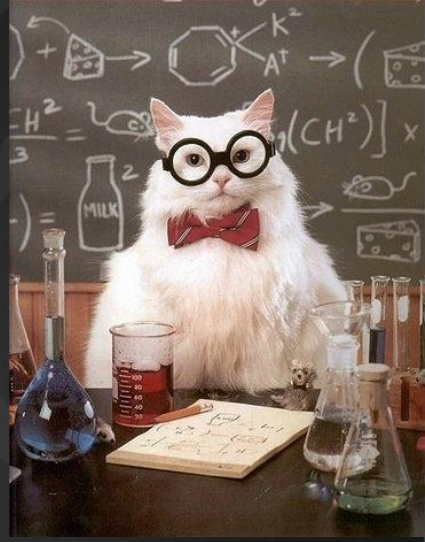
Slate Optimizations

- Decreased impact on compilation time
- Split built-in widget library into multiple modules

Unreal Motion Graphics (UMG)

- Artist friendly WYSIWYG editor
- 2D transformation and animation with Sequencer
- Blueprint integration
- Better styling system

Questions?



Documentation, Tutorials and Help at:

- AnswerHub: http://answers.unrealengine.com
- Engine Documentation: http://docs.unrealengine.com
- Official Forums: http://forums.unrealengine.com
- Community Wiki: http://wiki.unrealengine.com
- YouTube Videos: http://www.youtube.com/user/UnrealDevelopmentKit
- Community IRC: #unrealengine on FreeNode

Unreal Engine 4 Roadmap

- lmgtfy.com/?q=Unreal+engine+Trello+

The Slate UI Framework

Part 2: Game UI & Unreal Motion Graphics

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Current In-Game UI Features

HUD Canvas

VP Widgets

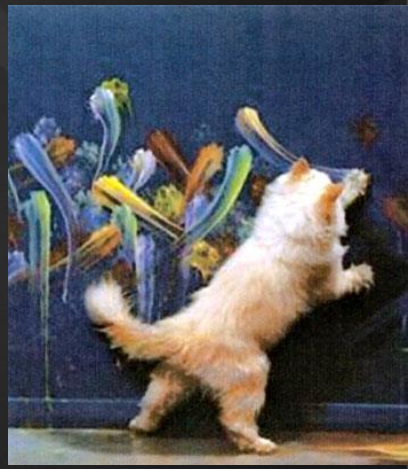
Game Menus

FCanvas

- Low-level C++ API for drawing directly to the screen
- Has been part of Unreal Engine for many years
- All functions are in FCanvas class
- DrawText(), DrawTexture(), DrawTile(), etc.
- Use AHUD.Canvas to access the canvas object

HHitProxy

- Provides basic interaction support for FCanvas
- Create one hit proxy per interactive object
- Hit proxy ID is sent to GPU for per-pixel hit tests



Current In-Game UI Features

HUD Canvas

VP Widgets

Game Menus

UGameViewportClient

- Allows usage of Slate widgets inside game view port
- Use all features of Slate (except SWindow)
- Add/RemoveViewportWidgetContent()

Things to keep in mind

- All added widgets will be layered on top of each other (SOverlay)
- Widgets should use TWeakObjPtr for UObject references

```
void APlayerController::CreateTouchInterface()
{
    ULocalPlayer* LocalPlayer = Cast<ULocalPlayer>(Player);

    // do we want to show virtual joysticks?
    if (LocalPlayer && LocalPlayer->ViewportClient && SVirtualJoystick::ShouldDisplayTouchInterface())
    {
        // load what the game wants to show at startup
        FStringAssetReference DefaultTouchInterfaceName = GetDefault<UInputSettings>()->DefaultTouchInterface;

        if (DefaultTouchInterfaceName.IsValid())
        {
            // create the joystick
            VirtualJoystick = SNew(SVirtualJoystick);

            // add it to the player's viewport
            LocalPlayer->ViewportClient->AddViewportWidgetContent(VirtualJoystick.ToSharedRef());

            // activate this interface if we have it
            UTouchInterface* DefaultTouchInterface = LoadObject<UTouchInterface>(NULL, *DefaultTouchInterfaceName.ToString());
            if (DefaultTouchInterface != NULL)
            {
                DefaultTouchInterface->Activate(VirtualJoystick);
            }
        }
    }
}
```


ENGINE

Current In-Game UI Features

HUD Canvas

VP Widgets

Game Menus

The Hard Way
- Use FCanvas to draw your own menus
- Not recommended

The Custom Way
- Use HUD Widgets to create any menu layout

The Lazy Way
- Use GameMenuBuilder for paged menus
- FGameMenuPage - Single menu page
- FGameMenuItem - An option in a menu page
- Can be customized and styled
- Mostly used for settings screens

Unreal Motion Graphics

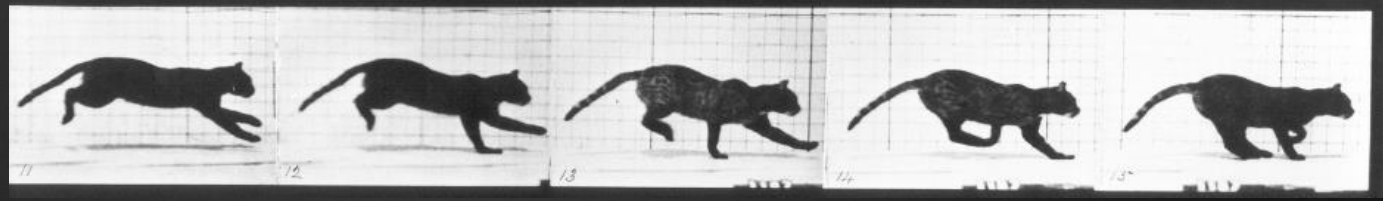
Overview

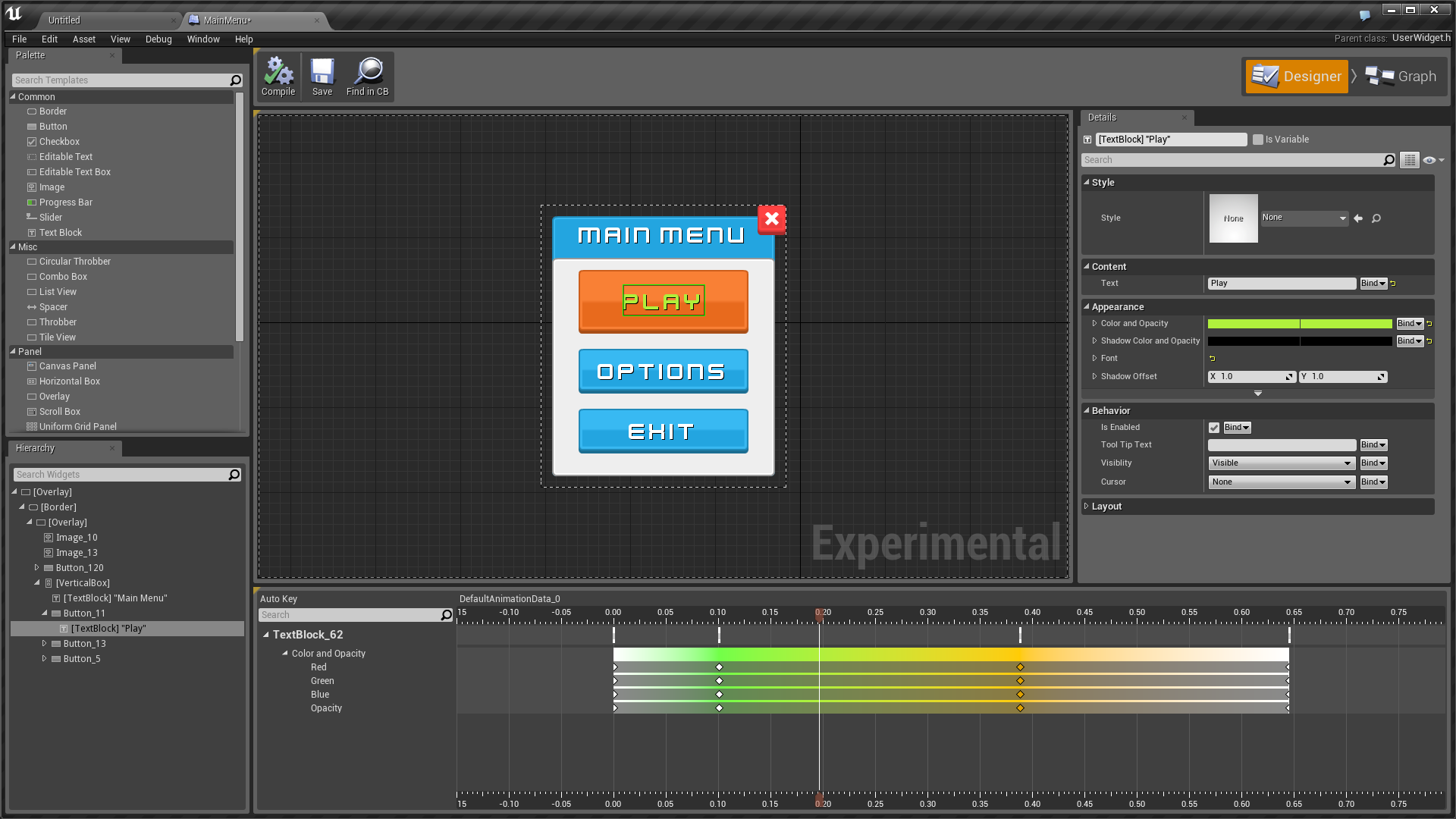
Scripting

Upcoming

One UI Solution To Rule Them All

- Built on top of Slate
- Adds real-time animation and transformation to widgets
- Integrated with Blueprints
- WYSIWYG Editor for artists and designers
- No programming required (unless you want to)
- Not officially released yet, but already in the code base

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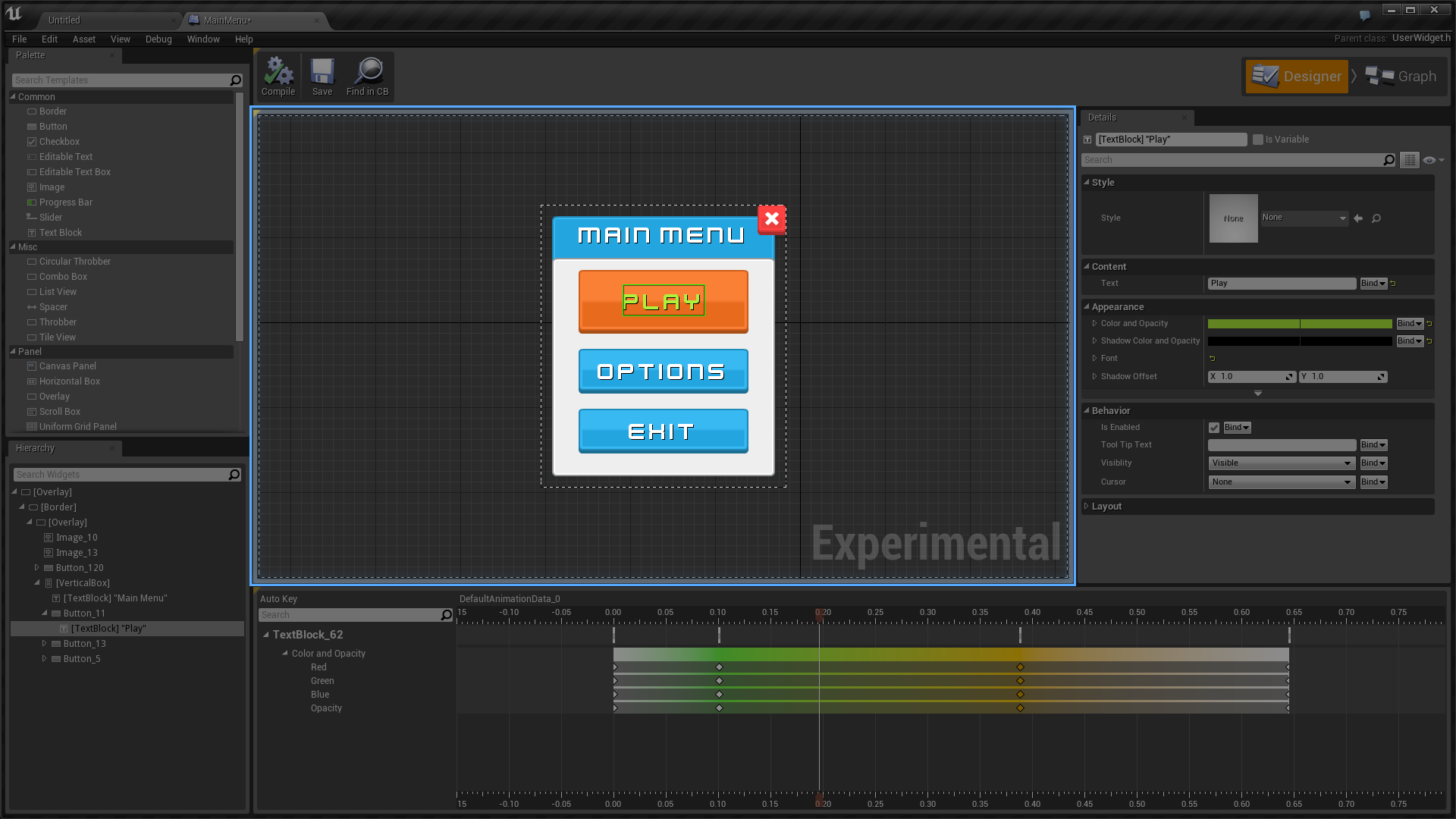
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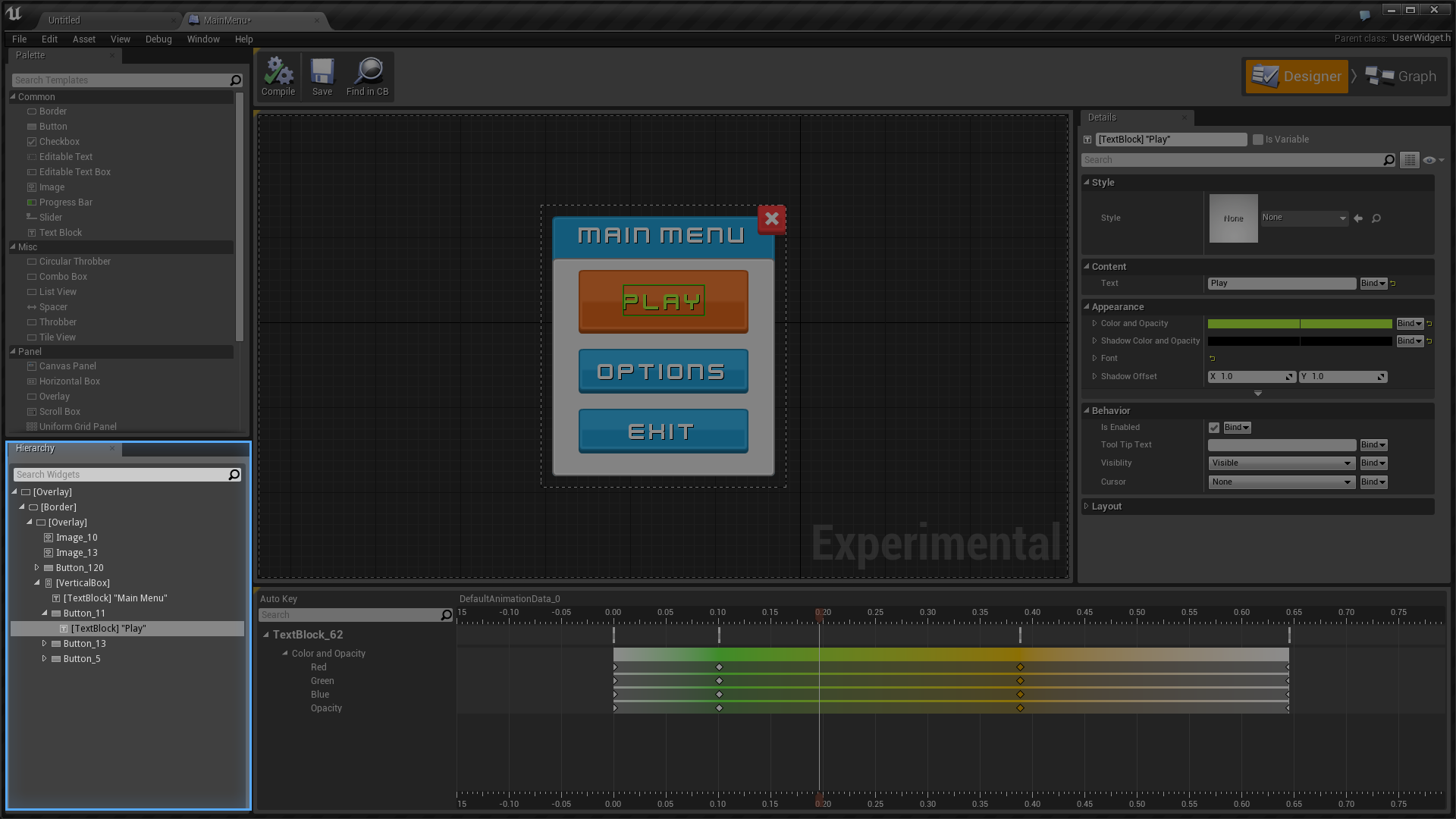
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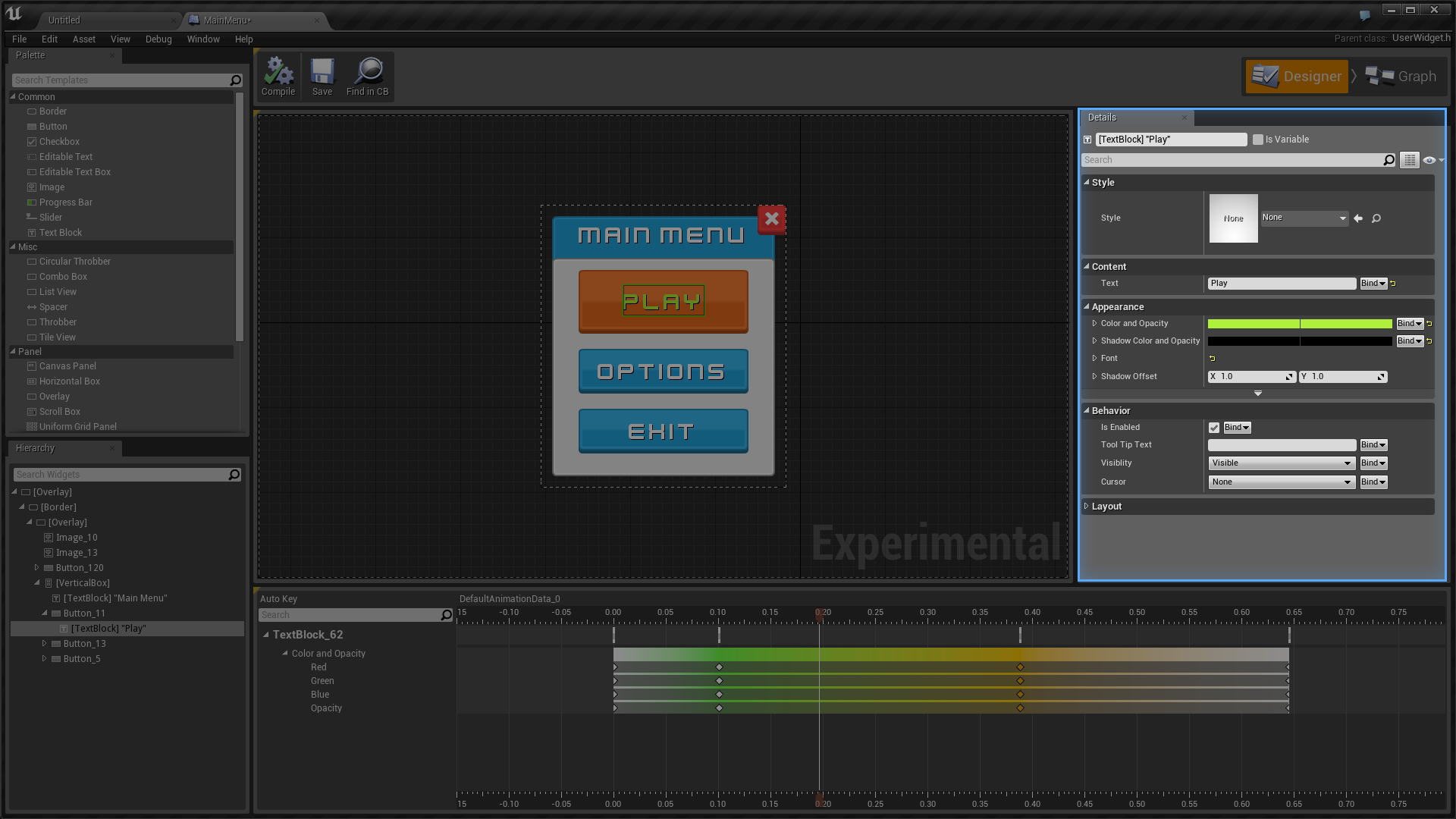
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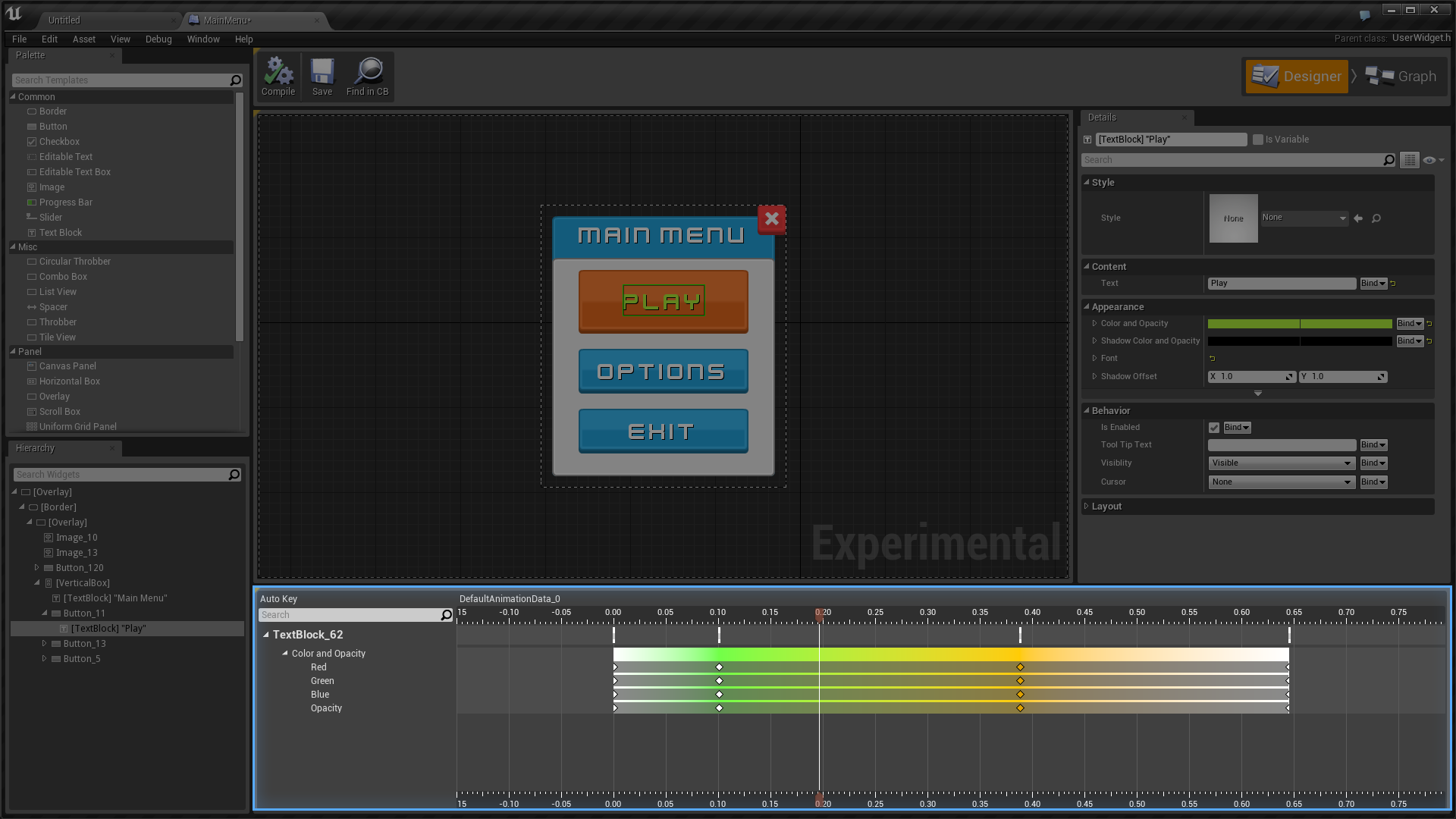
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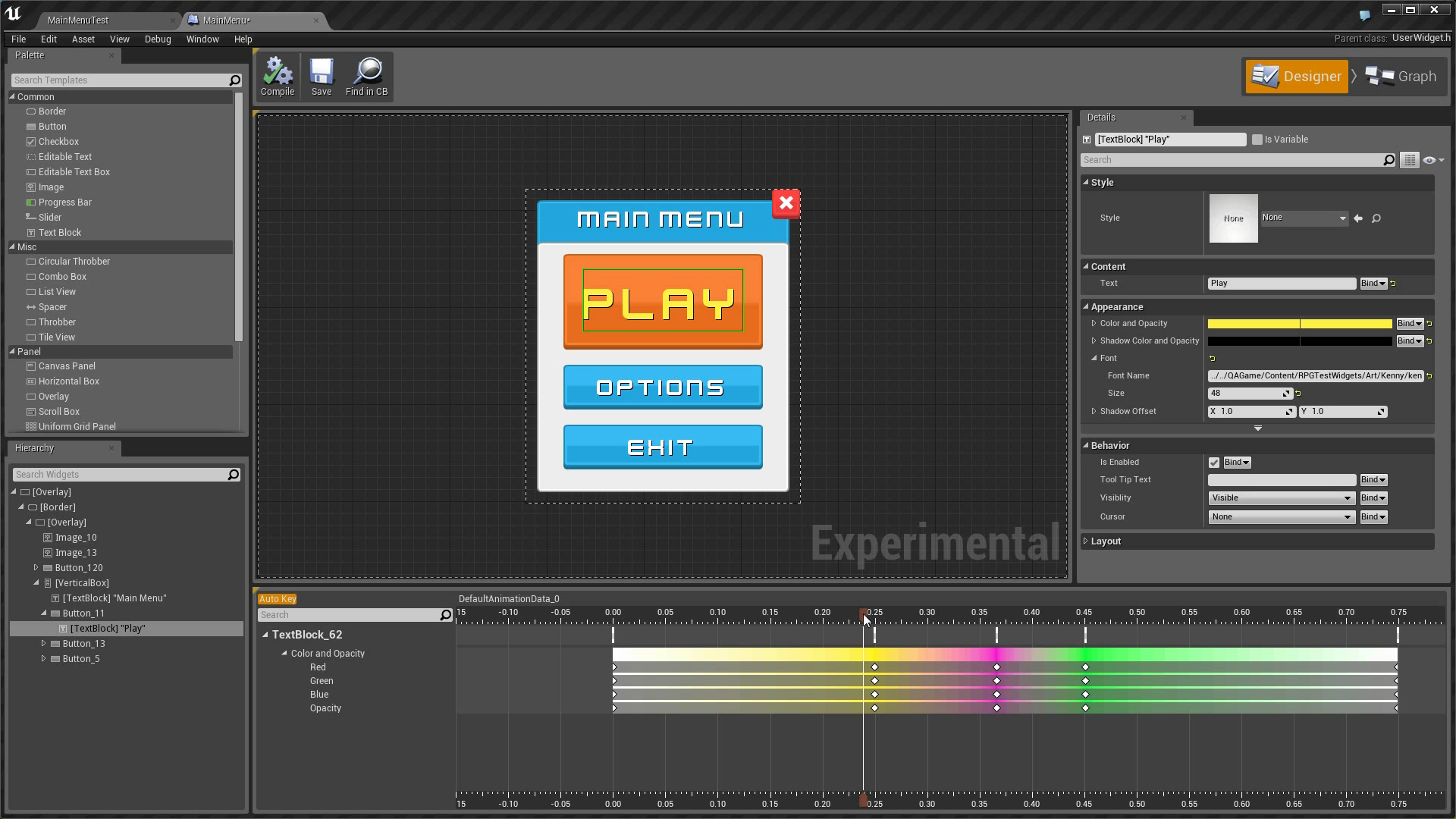
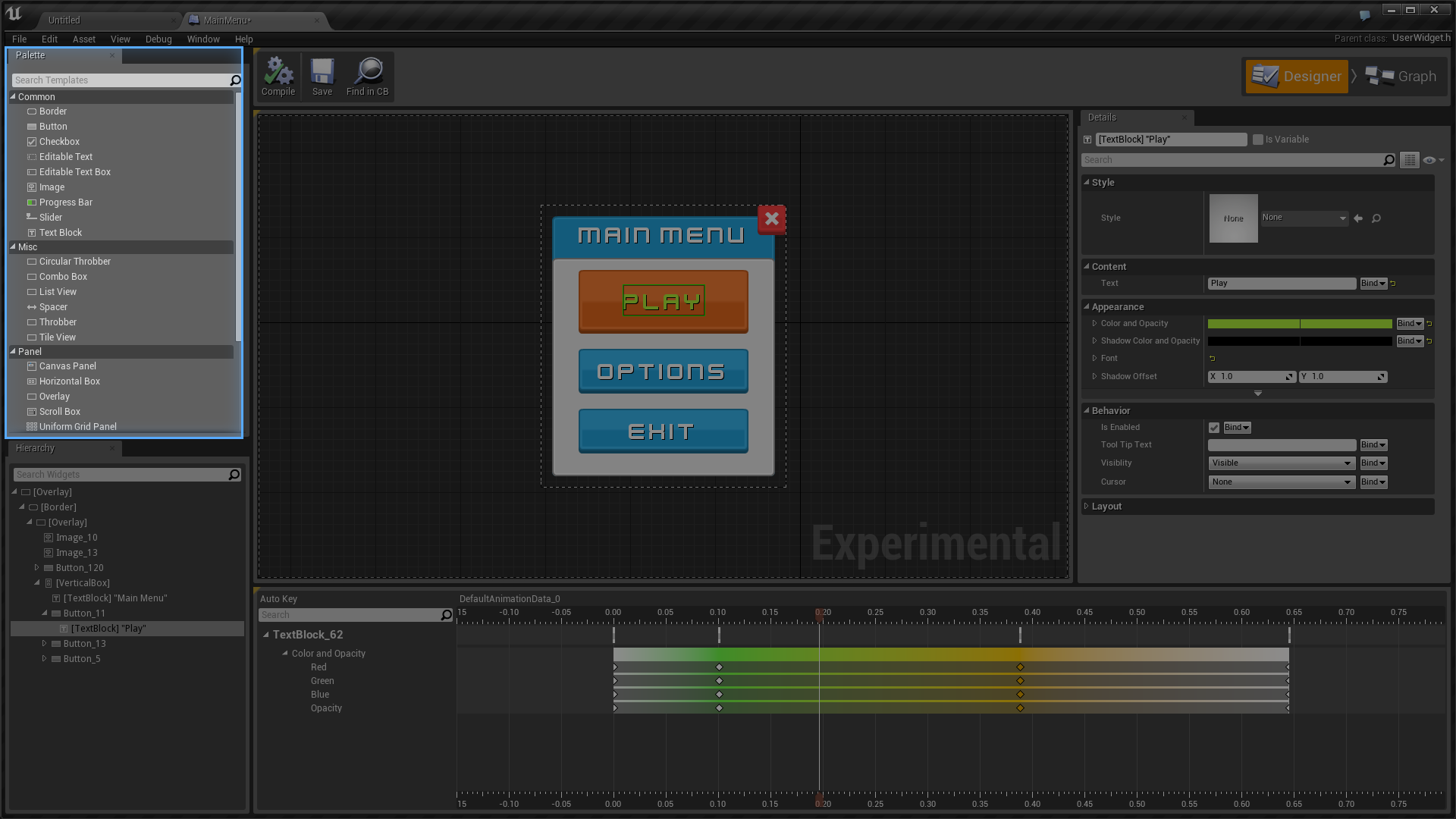

MainMenuTest
MainMenu
File Edit Asset View Debug Window Help
Parent class: UserWidget.h
Palette
Search Templates
Common
Border
Button
Checkbox
Editable Text
Editable Text Box
Image
Progress Bar
Slider
Text Block
Misc
Circular Throbber
Combo Box
List View
Spacer
Throbber
Tile View
Panel
Canvas Panel
Horizontal Box
Overlay
Scroll Box
Uniform Grid Panel
Hierarchy
Search Widgets
[Overlay]
[Border]
[Overlay]
Image_10
Image_13
Button_120
[VerticalBox]
[TextBlock] "Main Menu"
Button_11
[TextBlock] "Play"
Button_13
Button_5
Compile
Save
Find in CB
Designer
Graph
MAIN MENU
PLAY
OPTIONS
EXIT
Experimental
Details
[TextBlock] "Play"
Is Variable
Search
Style
Style
None
None
Content
Text
Play
Bind
Appearance
Color and Opacity
Shadow Color and Opacity
Font
Font Name
../../QAGame/Content/RPGTestWidgets/Art/Kenny/ken
Size
48
Shadow Offset
X 1.0
Y 1.0
Behavior
Is Enabled
Tool Tip Text
Visiblity
Visible
Cursor
None
Layout
Auto Key
DefaultAnimationData_0
Search
TextBlock_62
Color and Opacity
Red
Green
Blue
Opacity


Untitled
MainMenu
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DefaultAnimationData_0
Search
TextBlock_62
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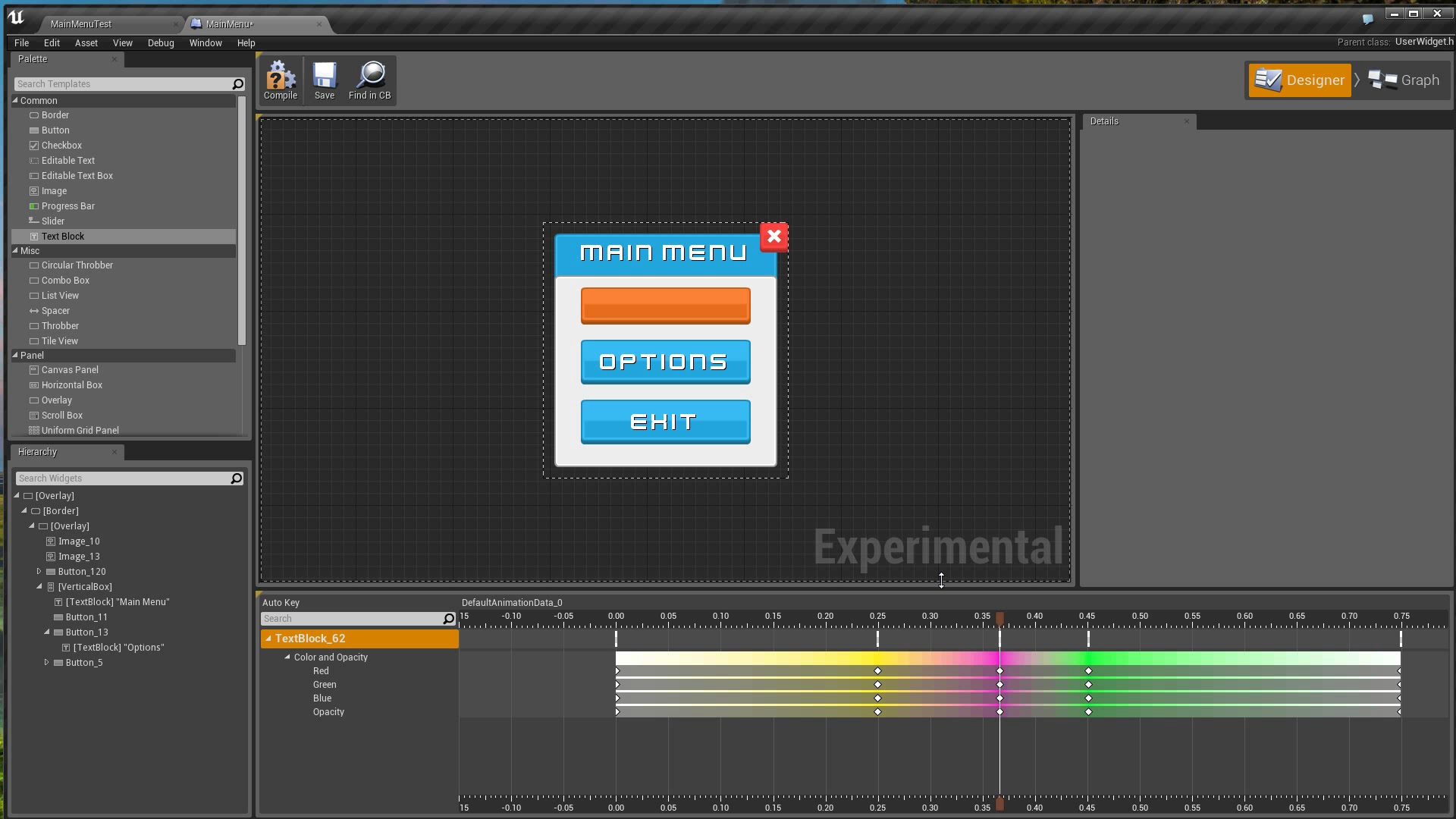
Green
Blue
Opacity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Red
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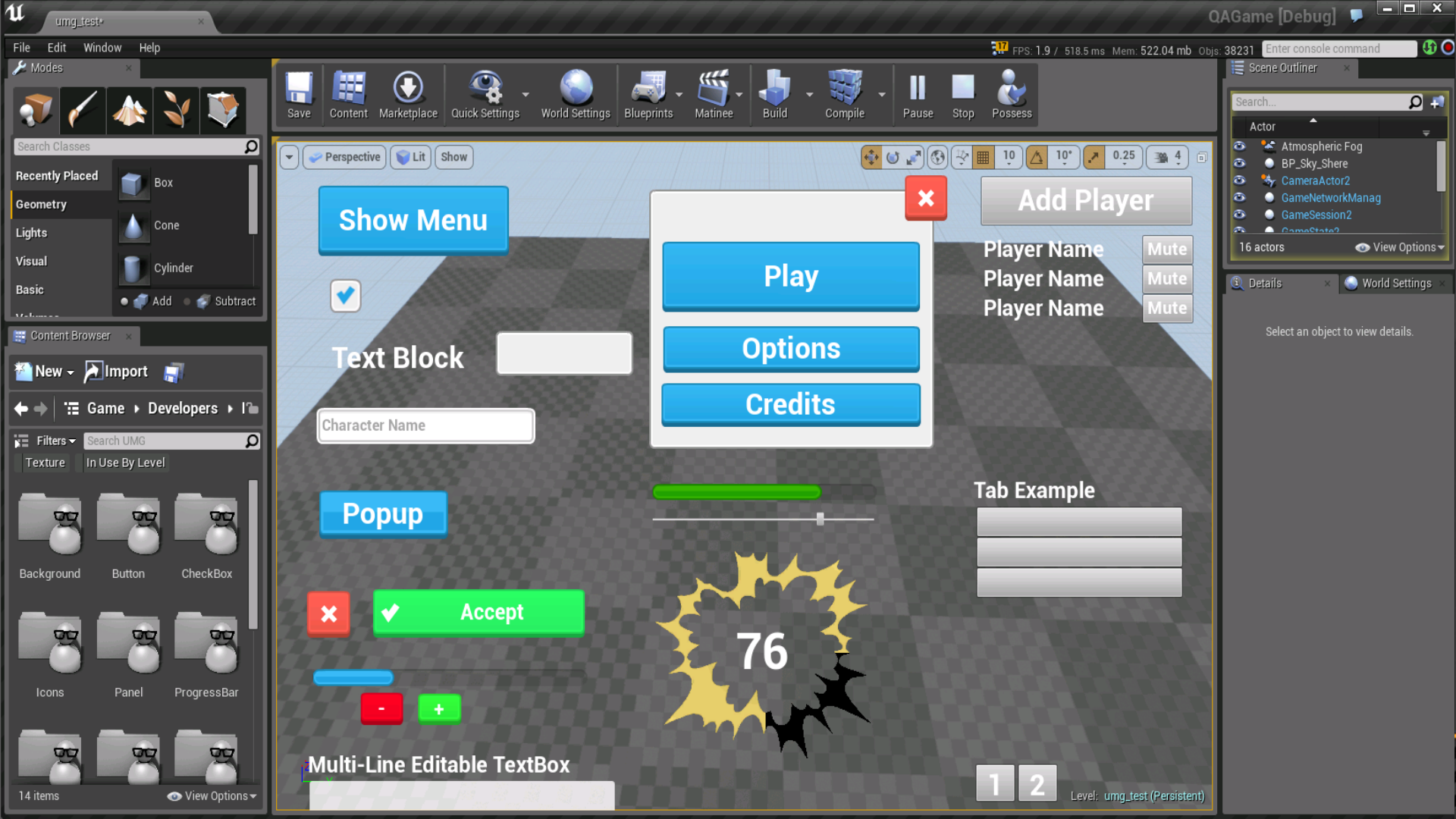
Blue
Opacity


umg_test*
QAGame [Debug]
File
Edit
Window
Help
FPS: 1.9 / 518.5 ms Mem: 522.04 mb Objs: 38231
Enter console command
Modes
Search Classes
Recently Placed
Geometry
Lights
Visual
Basic
Box
Cone
Cylinder
Add
Subtract
Content Browser
New
Import
Game
Developers
Filters
Search UMG
Texture
In Use By Level
Background
Button
CheckBox
Icons
Panel
ProgressBar
14 items
View Options
Save
Content
Marketplace
Quick Settings
World Settings
Blueprints
Matinee
Build
Compile
Pause
Stop
Possess
Perspective
Lit
Show
Show Menu
Text Block
Character Name
Popup
Accept
-
+
Multi-Line Editable TextBox
Play
Options
Credits
Add Player
Player Name
Player Name
Player Name
Mute
Mute
Mute
Tab Example
76
1
2
Level: umg_test (Persistent)
Scene Outliner
Search...
Actor
Atmospheric Fog
BP_Sky_Shere
CameraActor2
GameNetworkManag
GameSession2
16 actors
View Options
Details
World Settings
Select an object to view details.

Unreal Motion Graphics

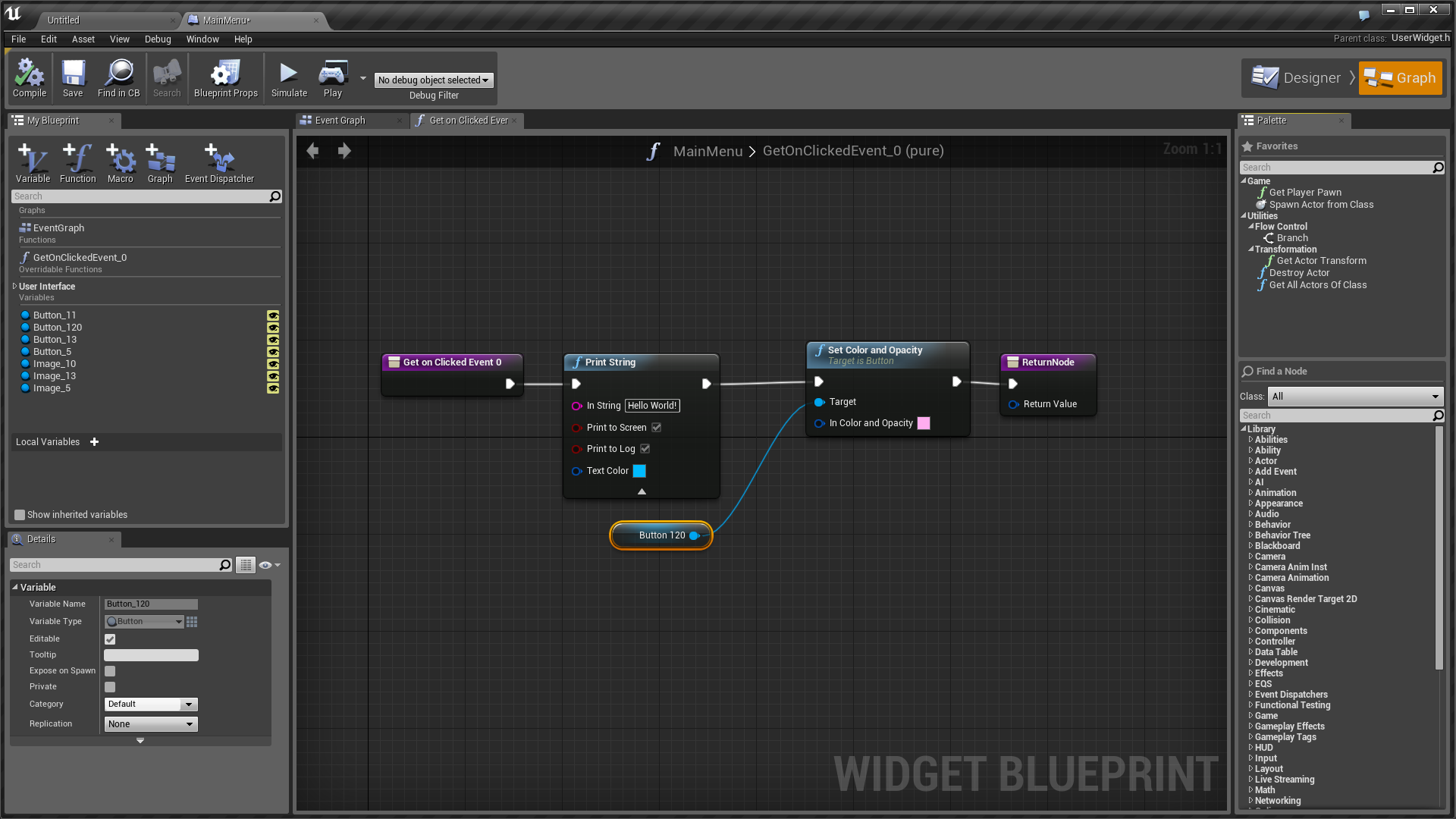
Overview

Scripting

Upcoming

Adding Behavior to your UI

- Designers should not have to write code!
- Blueprints allow scripting of UI
- You can still use C++ as well, but probably won't


Untitled
MainMenu
File Edit Asset View Debug Window Help
Parent class: UserWidget.h
Compile Save Find in CB Search Blueprint Props Simulate Play
No debug object selected
Debug Filter
Designer Graph
My Blueprint
Variable Function Macro Graph Event Dispatcher
Search
Graphs
EventGraph
Functions
GetOnClickedEvent_0
Overridable Functions
User Interface
Variables
Button_11
Button_120
Button_13
Button_5
Image_10
Image_13
Image_5
Local Variables
Show inherited variables
Details
Search
Variable
Variable Name Button_120
Variable Type Button
Editable
Tooltip
Expose on Spawn
Private
Category Default
Replication None
Event Graph
Get on Clicked Ever
MainMenu > GetOnClickedEvent_0 (pure)
Zoom 1:1
Get on Clicked Event 0
Print String
In String Hello World!
Print to Screen
Print to Log
Text Color
Set Color and Opacity
Target is Button
Target
In Color and Opacity
ReturnNode
Return Value
Button 120
WIDGET BLUEPRINT
Palette
Favorites
Search
Game
Get Player Pawn
Spawn Actor from Class
Utilities
Flow Control
Branch
Transformation
Get Actor Transform
Destroy Actor
Get All Actors Of Class
Find a Node
Class: All
Search
Library
Abilities
Ability
Actor
Add Event
AI
Animation
Appearance
Audio
Behavior
Behavior Tree
Blackboard
Camera
Camera Anim Inst
Camera Animation
Canvas
Canvas Render Target 2D
Cinematic
Collision
Components
Controller
Data Table
Development
Effects
EQS
Event Dispatchers
Functional Testing
Game
Gameplay Effects
Gameplay Tags
HUD
Input
Layout
Live Streaming
Math
Networking

Unreal Motion Graphics

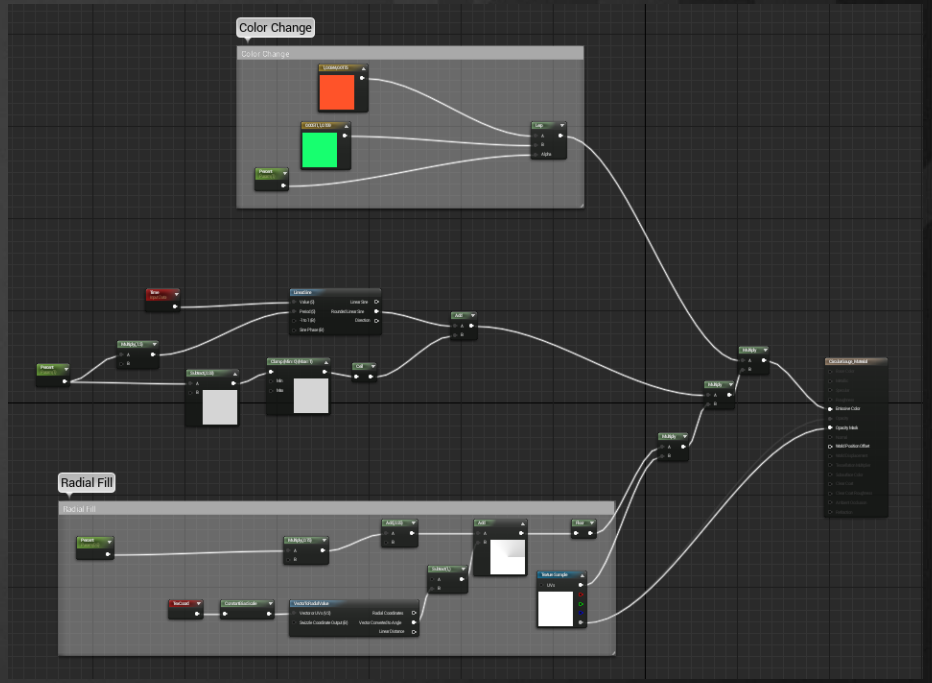
Overview

Scripting

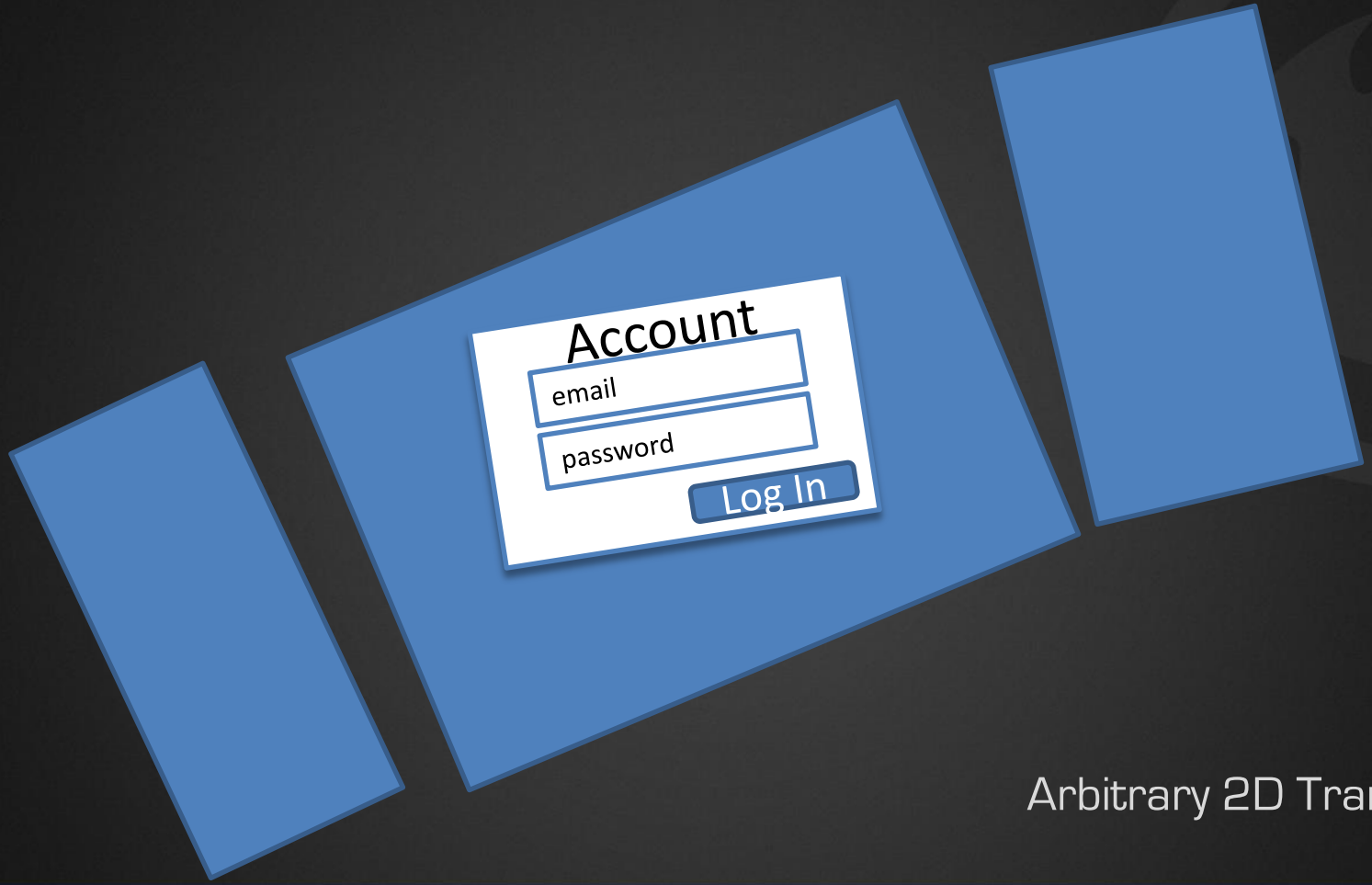
Upcoming

Currently working on:

- Materials!
- 2D Transforms
- Style assets
- Special effects
- In-game 3D UI
- Workflow polish

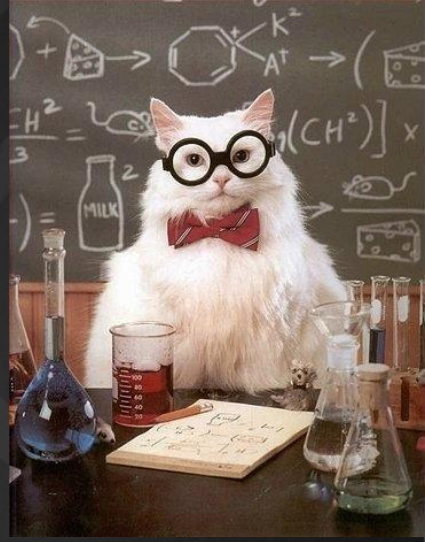



100



Arbitrary 2D Transforms

Questions?



Documentation, Tutorials and Help at:

- AnswerHub: http://answers.unrealengine.com
- Engine Documentation: http://docs.unrealengine.com
- Official Forums: http://forums.unrealengine.com
- Community Wiki: http://wiki.unrealengine.com
- YouTube Videos: http://www.youtube.com/user/UnrealDevelopmentKit
- Community IRC: #unrealengine on FreeNode

Unreal Engine 4 Roadmap

- lmgtfy.com/?q=Unreal+engine+Trello+