Editor Scripting

How it looks today and what brings the future?

Agenda

1. Introduction to Editor Scripting
2. Present - IMGUI
3. Tips & Tricks
4. Future - UI Elements
5. Noteworthy Materials & Assets

About Me

- My name is Mateusz Pusty!
- Unity Developer @ Robot Gentleman
- Worked on *60 Parsecs!*
- Co-organizer of Poznań Unity User Group meetings.
- Organizer of PGG Jam: All Play - Accessibility

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Introduction to Editor Scripting

What is Editor Scripting?

Editor Scripting is a way to make the development of your game bit easier.

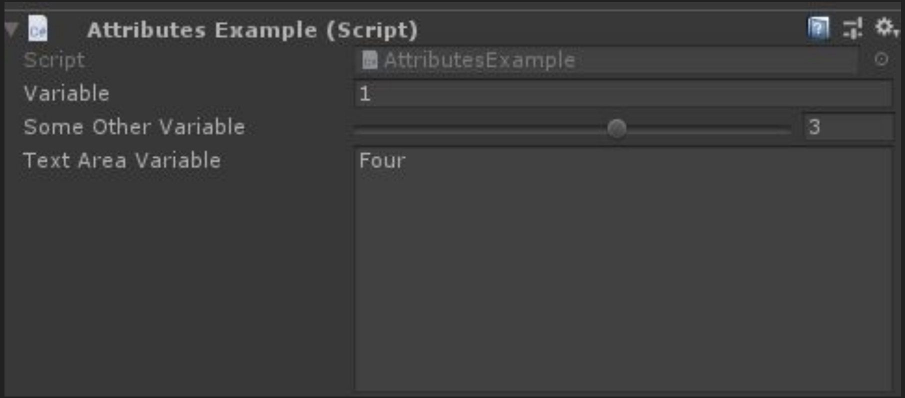
“You can use editor scripting inside Unity to make life easier for your game designers, or even yourself. With a small amount of code, you can automate some of the more tedious aspects of using the inspector to configure your behaviours, and provide visual feedback on configuration changes.”

https://unity3d.com/learn/tutorials/topics/scripting/introduction-editor-scripting

Basic Editor Scripting

Using Built-In Attributes

```
public int Variable = 1;

[HideInInspector]
public int SomeVariable = 2;

[SerializeField]
[Range(0, 5)]
private int _someOtherVariable = 3;

[SerializeField]
[Multiline(10)]
private string _textAreaVariable = "Four";
```



Attributes Example (Script)

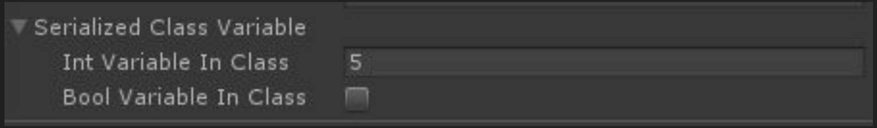
```
Script                 AttributesExample
Variable               1
Some Other Variable    3
Text Area Variable     Four
```

https://docs.unity3d.com/Manual/Attributes.html

Basic Editor Scripting

Using Built-In Attributes

```
[Serializable]
public class SerializedClass
{
    [SerializeField]
    private int _intVariableInClass = 5;

    [SerializeField]
    private bool _boolVariableInClass = false;
}

[...]

[SerializeField]
private SerializedClass _serializedClassVariable;
```


▼ Serialized Class Variable

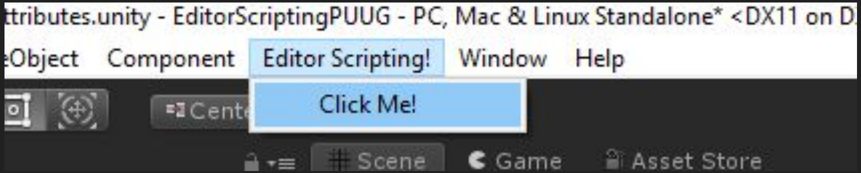
Int Variable In Class	5
Bool Variable In Class	☐

https://docs.unity3d.com/Manual/Attributes.html

Basic Editor Scripting

Using Built-In Attributes

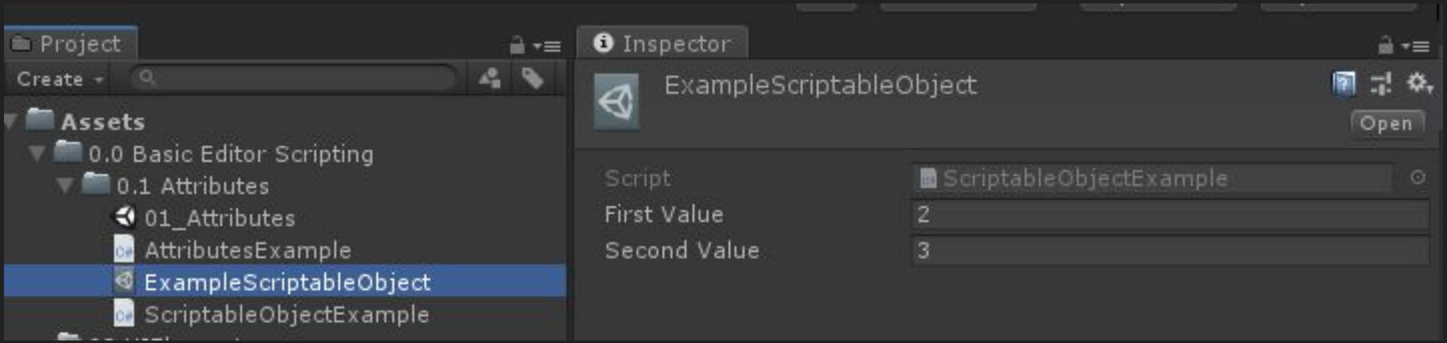
```
[MenuItem("Editor Scripting!/Click Me!")]
public static void CustomMenuEntry()
{
    Debug.Log("I am invoked from custom menu entry!");
}
```


ttributes.unity - EditorScriptingPUUG - PC, Mac & Linux Standalone* <DX11 on D
Object
Component
Editor Scripting!
Window
Help
Click Me!
Cente
Scene
Game
Asset Store

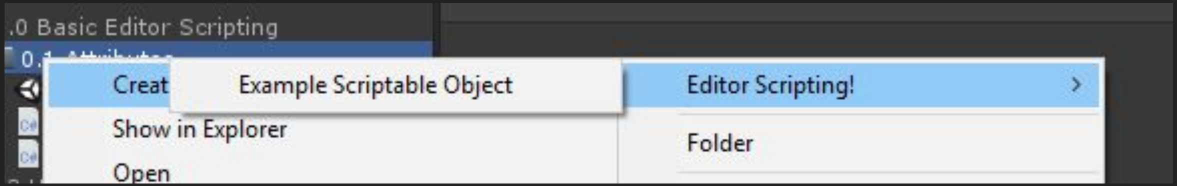
https://docs.unity3d.com/Manual/Attributes.html

Basic Editor Scripting

Scriptable Objects



Script: ScriptableObjectExample
First Value: 2
Second Value: 3

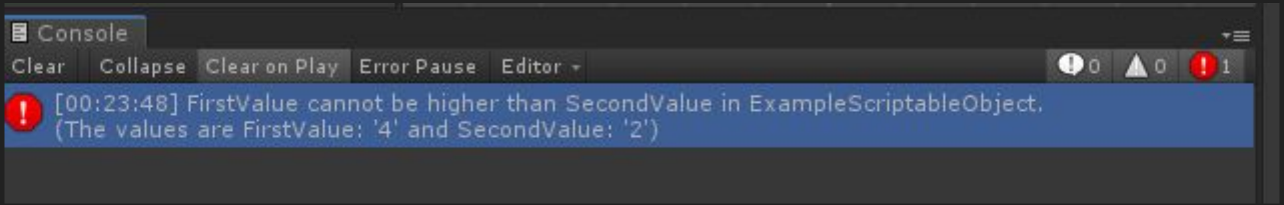


https://docs.unity3d.com/Manual/class-ScriptableObject.html

Basic Editor Scripting

OnValidate()

Allows to check custom conditions in our objects when they are modified. Works both on MonoBehaviours and ScriptableObjects (although the second one is undocumented and not detected in VS).



```
[00:23:48] FirstValue cannot be higher than SecondValue in ExampleScriptableObject.
(The values are FirstValue: '4' and SecondValue: '2')
```

https://docs.unity3d.com/ScriptReference/MonoBehaviour.OnValidate.html
https://github.com/JetBrains/resharper-unity/issues/79

Basic Editor Scripting

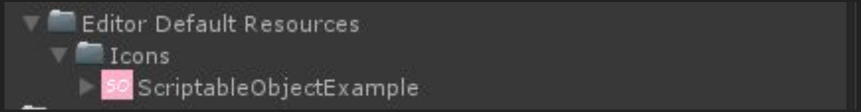
OnValidate()

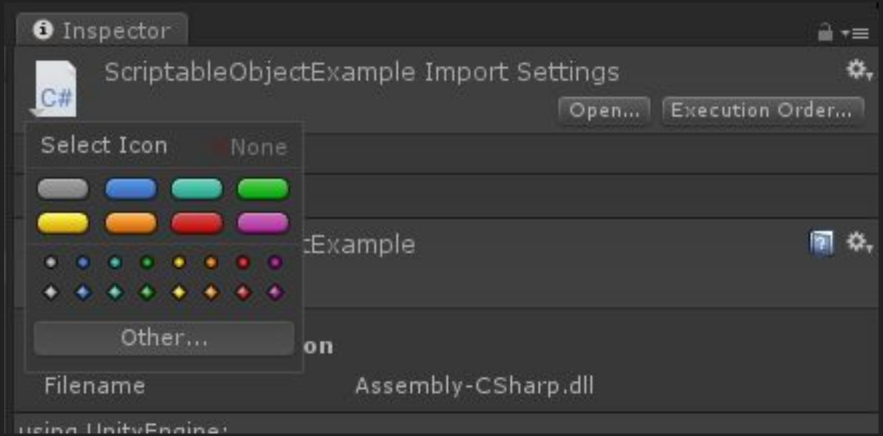
```
public class ScriptableObjectExample : ScriptableObject
{
    [...]

    public void OnValidate()
    {
        if (_firstValue > _secondValue)
            Debug.LogErrorFormat(this, "FirstValue cannot be higher than SecondValue in {0}." +
                "\n(The values are FirstValue: '{1}' and SecondValue: '{2}'",
                name, _firstValue, _secondValue);
    }
}
```

https://docs.unity3d.com/ScriptReference/MonoBehaviour.OnValidate.html
https://github.com/JetBrains/resharper-unity/issues/79

Basic Editor Scripting

Custom Script Icons

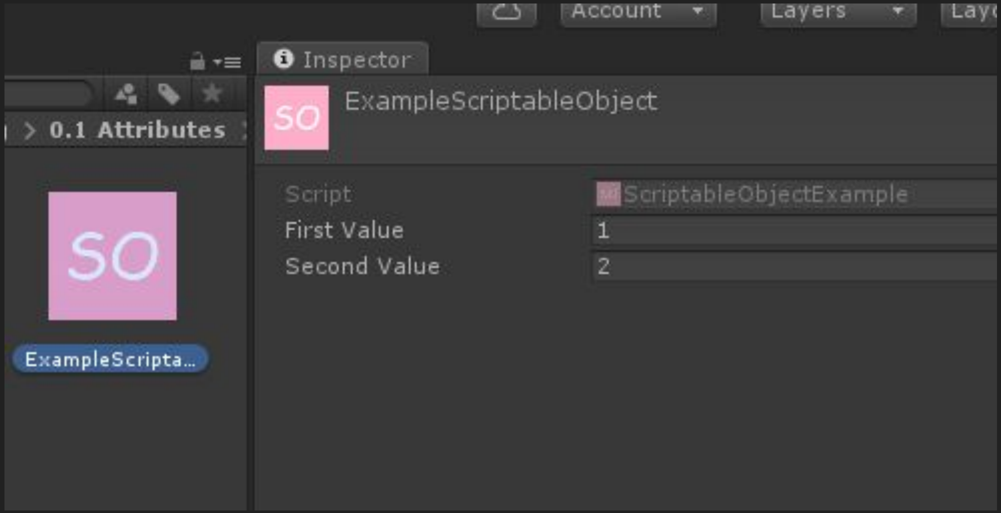




https://docs.unity3d.com/Manual/AssigningIcons.html
https://docs.unity3d.com/Manual/SpecialFolders.html

Basic Editor Scripting

Custom Script Icons



ExampleScriptableObject

Script ScriptableObjectExample
First Value 1
Second Value 2

https://docs.unity3d.com/Manual/AssigningIcons.html

Present
IMGUI

What is IMGUI?

IMGUI stands for “Immediate Mode” GUI. It’s a legacy GUI system that was used as a runtime GUI prior to 4.6 version of Unity Editor. It’s still used as a base for almost all editor code in Unity. (Although it’s being slowly replaced by UI Elements)

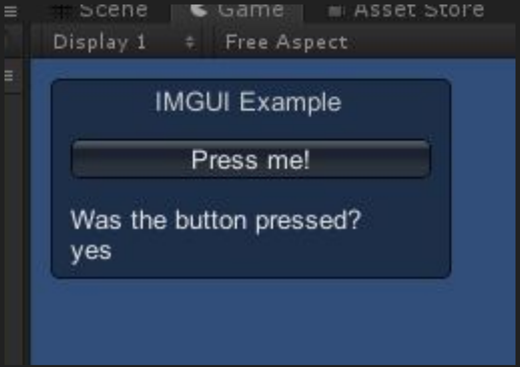
“IMGUI is a code-driven GUI system, and is mainly intended as a tool for programmers. It is driven by calls to the **OnGUI** function on any script which implements it.”

https://docs.unity3d.com/Manual/GUIScriptingGuide.html

What is IMGUI?

IMGUI Example

```
using UnityEngine;

public class IMGUIExample : MonoBehaviour
{
    private bool _wasPressed = false;

    private void OnGUI()
    {
        GUI.Box(new Rect(10, 10, 200, 100), "IMGUI Example");

        if(GUI.Button(new Rect(20, 40, 180, 20), "Press me!"))
            _wasPressed = true;

        GUI.Label(new Rect(20, 70, 180, 40), "Was the button pressed?\n" +
            (_wasPressed ? "yes" : "no"));
    }
}
```



Was the button pressed?
yes

https://docs.unity3d.com/Manual/GUIScriptingGuide.html

What is IMGUI?

IMGUI Classes

```
//Creating the same label using four available GUI classes.
GUI.Label(new Rect(10, 10, 100, 20), "Test Label");
GUILayout.Label("Test Label");
UnityEditor.EditorGUI.LabelField(new Rect(10, 10, 100, 20), "Test Label");
UnityEditor.EditorGUILayout.LabelField("Test Label");

//Helpful classes
UnityEditor.EditorGUIUtility
UnityEditor.EditorApplication
UnityEditor.EditorStyles
```

https://docs.unity3d.com/ScriptReference/GUI.html
https://docs.unity3d.com/ScriptReference/EditorGUI.html

Unity Serialization

Need to know.

- Read which types are serialized. https://docs.unity3d.com/Manual/script-Serialization.html
- Unity serialize data into YAML format.
- It’s possible to edit YAML files (.prefab, .scene, .asset, etc.) directly in Text Editor
- **Unity serialize object references using AssetGUID and Local IDs (translated to Instance IDs for runtime usage).**

---

https://docs.unity3d.com/Manual/script-Serialization.html
https://unity3d.com/learn/tutorials/topics/best-practices/assets-objects-and-serialization
https://docs.unity3d.com/Manual/TextSceneFormat.html

Unity Serialization

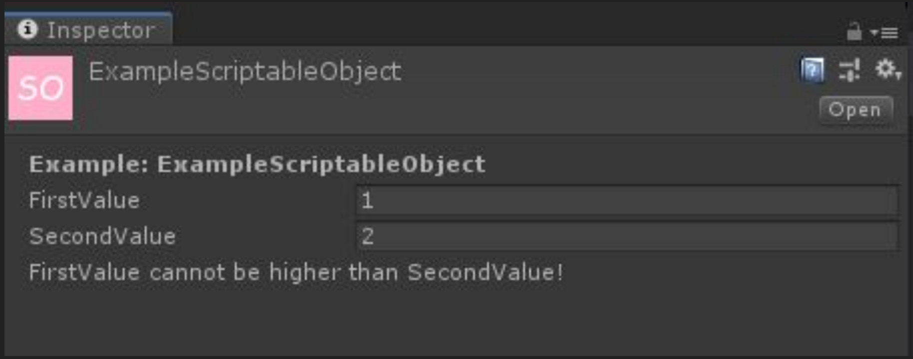
Need to know.

```
%YAML 1.1
%TAG !u! tag:unity3d.com,2011:
--- !u!114 &11400000
MonoBehaviour:
  m_ObjectHideFlags: 0
  m_CorrespondingSourceObject: {fileID: 0}
  m_PrefabInstance: {fileID: 0}
  m_PrefabAsset: {fileID: 0}
  m_GameObject: {fileID: 0}
  m_Enabled: 1
  m_EditorHideFlags: 0
  m_Script: {fileID: 11500000, guid: f9b88640025e50d439a59d741829eef0, type: 3}
  m_Name: ExampleScriptableObject
  m_EditorClassIdentifier:
  _firstValue: 1
  _secondValue: 2
```

https://docs.unity3d.com/Manual/script-Serialization.html
https://unity3d.com/learn/tutorials/topics/best-practices/assets-objects-and-serialization
https://docs.unity3d.com/Manual/TextSceneFormat.html

Advanced Editor Scripting

Custom Editor



Example: ExampleScriptableObject

FirstValue 1

SecondValue 2

FirstValue cannot be higher than SecondValue!

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

Custom Editor (Direct Method)

```
using UnityEditor;

[CustomEditor(typeof(ScriptableObjectExample))]
public class CustomEditorExample : Editor
{
    private ScriptableObjectExample _scriptableObjectExample;

    private void OnEnable()
    {
        _scriptableObjectExample = target as ScriptableObjectExample;
    }

    [...]
}
```

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

Custom Editor (Direct Method)

```
public override void OnInspectorGUI()
{
    EditorGUILayout.LabelField("Example: " + _scriptableObjectExample.name, EditorStyles.boldLabel);

    EditorGUI.BeginChangeCheck();

    _scriptableObjectExample.FirstValue = EditorGUILayout.IntField("FirstValue",
        _scriptableObjectExample.FirstValue);
    _scriptableObjectExample.SecondValue = EditorGUILayout.IntField("SecondValue",
        _scriptableObjectExample.SecondValue);

    EditorGUILayout.LabelField("FirstValue cannot be higher than SecondValue!");

    if (EditorGUI.EndChangeCheck())
        EditorUtility.SetDirty(_scriptableObjectExample);
}
```

---

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

Custom Editor (Property Method)

```
[CustomEditor(typeof(ScriptableObjectExample))]
public class CustomEditorExample : Editor
{
    private SerializedProperty _firstValueProperty;
    private SerializedProperty _secondValueProperty;

    private void OnEnable()
    {
        _firstValueProperty = serializedObject.FindProperty("_firstValue");
        _secondValueProperty = serializedObject.FindProperty("_secondValue");
    }

    [...]
}
```

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

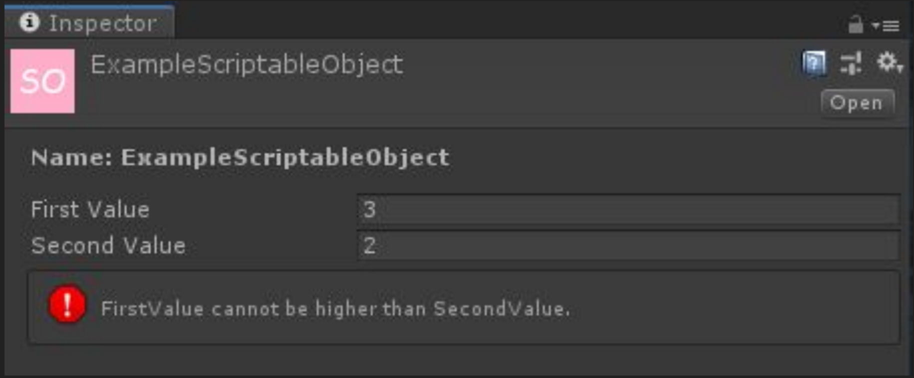
Custom Editor (Property Method)

```
public override void OnInspectorGUI()
{
    serializedObject.Update();

    EditorGUILayout.LabelField("Example: " + target.name, EditorStyles.boldLabel);

    EditorGUILayout.PropertyField(_firstValueProperty);
    EditorGUILayout.PropertyField(_secondValueProperty);

    EditorGUILayout.LabelField("FirstValue cannot be higher than SecondValue!");

    serializedObject.ApplyModifiedProperties();
}
```

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

Custom Editor (Pretty Version)



Name: ExampleScriptableObject

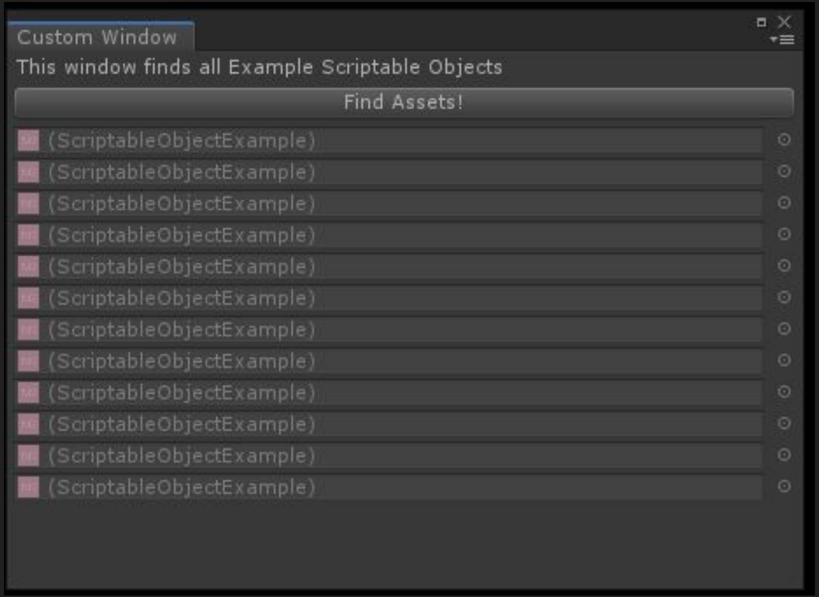
First Value 3
Second Value 2

FirstValue cannot be higher than SecondValue.

https://docs.unity3d.com/Manual/editor-CustomEditors.html

Advanced Editor Scripting

Custom Window


Custom Window

This window finds all Example Scriptable Objects

Find Assets!

(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)
(ScriptableObjectExample)

https://docs.unity3d.com/Manual/editor-EditorWindows.html

Advanced Editor Scripting

Custom Window

```
public class CustomWindowExample : EditorWindow
{
    [...]

    [MenuItem("Editor Scripting!/Custom Window Example")]
    public static void OpenWindow()
    {
        var window = GetWindow<CustomWindowExample>("Custom Window");
        window.position = new Rect(100, 100, 300, 600);
        window.Show();
    }

    private void OnGUI()
    {
        [...]
    }
}
```

https://docs.unity3d.com/Manual/editor-EditorWindows.html

Advanced Editor Scripting

Custom Window

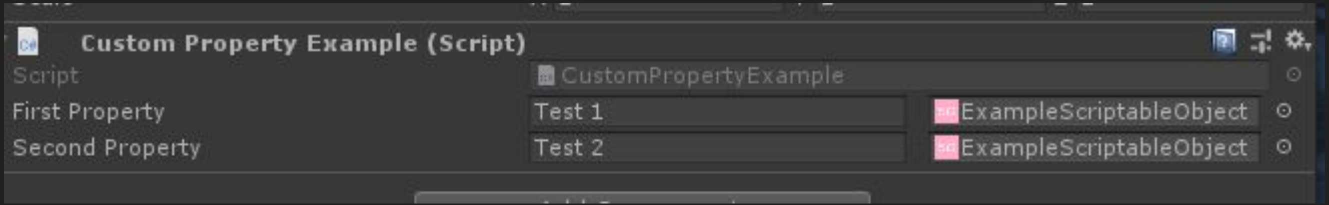
```
//Shows a window with dropdown behaviour and styling.
window.ShowAsDropDown();
//Show the editor window in the auxiliary window.
window.ShowAuxWindow();
//Show a notification message.
window.ShowNotification();
//Shows an Editor window using popup-style framing.
window.ShowPopup();
//Show the EditorWindow as a floating utility window.
window.ShowUtility();
```

---

https://docs.unity3d.com/Manual/editor-EditorWindows.html

Advanced Editor Scripting

Custom Property Drawer


Custom Property Example (Script)

Script	CustomPropertyExample	
First Property	Test 1	ExampleScriptableObject
Second Property	Test 2	ExampleScriptableObject

https://docs.unity3d.com/ScriptReference/PropertyDrawer.html

Advanced Editor Scripting

Custom Property Drawer

```
[Serializable]
public class CustomProperty
{
    public string ID;
    public ScriptableObjectExample ExampleObject;
}

public class CustomPropertyExample : MonoBehaviour
{
    public CustomProperty FirstProperty;
    public CustomProperty SecondProperty;
}
```

https://docs.unity3d.com/ScriptReference/PropertyDrawer.html

Advanced Editor Scripting

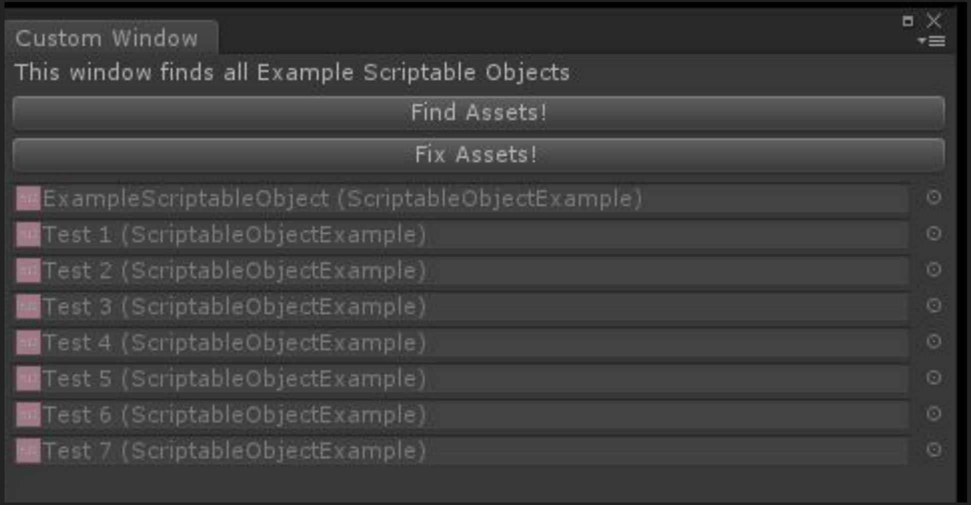
Custom Property Drawer

```
using UnityEngine;
using UnityEditor;

[CustomPropertyDrawer(typeof(CustomProperty))]
public class CustomPropertyDrawerExample : PropertyDrawer
{
    public override void OnGUI(Rect position, SerializedProperty property, GUIContent label)
    {
        var actualRect = EditorGUI.PrefixLabel(position, label);

        EditorGUI.PropertyField(
            new Rect(actualRect.x, actualRect.y, actualRect.width / 2 - 5, actualRect.height),
            property.FindPropertyRelative("ID"), GUIContent.none);

        EditorGUI.PropertyField(new Rect(actualRect.x + actualRect.width / 2 + 5,
            actualRect.y, actualRect.width / 2 - 10, actualRect.height),
            property.FindPropertyRelative("ExampleObject"), GUIContent.none);
    }
}
```

https://docs.unity3d.com/ScriptReference/PropertyDrawer.html

Advanced Editor Scripting

Editing Assets



This window finds all Example Scriptable Objects

ExampleScriptableObject (ScriptableObjectExample)
Test 1 (ScriptableObjectExample)
Test 2 (ScriptableObjectExample)
Test 3 (ScriptableObjectExample)
Test 4 (ScriptableObjectExample)
Test 5 (ScriptableObjectExample)
Test 6 (ScriptableObjectExample)
Test 7 (ScriptableObjectExample)

https://docs.unity3d.com/ScriptReference/AssetDatabase.html

Advanced Editor Scripting

Editing Assets

```
private void FindAssets()
{
    if (_foundAssets == null)
        _foundAssets = new List<ScriptableObjectExample>();
    else
        _foundAssets.Clear();

    var assetGuids = AssetDatabase.FindAssets("t:ScriptableObjectExample");

    if (assetGuids == null || assetGuids.Length == 0)
        return;

    [...]
}
```

https://docs.unity3d.com/ScriptReference/AssetDatabase.html

Advanced Editor Scripting

Editing Assets

```
private void FindAssets()
{
    [...]

    foreach(var assetGuid in assetGuids)
    {
        var assetPath = AssetDatabase.GUIDToAssetPath(assetGuid);

        if (string.IsNullOrEmpty(assetPath))
            continue;

        var asset = AssetDatabase.LoadAssetAtPath<ScriptableObjectExample>(assetPath);

        if (asset != null)
            _foundAssets.Add(asset);
    }
}
```

https://docs.unity3d.com/ScriptReference/AssetDatabase.html

Advanced Editor Scripting

Editing Assets

```
private void FixAssets()
{
    if (!EditorUtility.DisplayDialog("Are you sure?", "Are you sure? This operation can't be
undone.", "Yes", "Cancel"))
        return;

    FindAssets();

    [...]
}
```

https://docs.unity3d.com/ScriptReference/AssetDatabase.html

Advanced Editor Scripting

Editing Assets

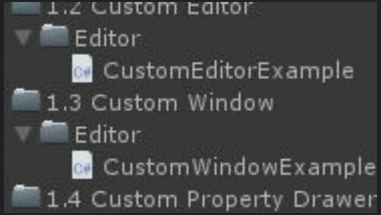
```
foreach(var asset in _foundAssets)
{
    var serializedObject = new SerializedObject(asset);

    serializedObject.Update();

    var firstValue = serializedObject.FindProperty("_firstValue");
    var secondValue = serializedObject.FindProperty("_secondValue");

    if (firstValue.intValue > secondValue.intValue)
    {
        firstValue.intValue = secondValue.intValue;
        Debug.LogFormat(asset, "Fixed object: {0}.", asset.name);
    }

    serializedObject.ApplyModifiedPropertiesWithoutUndo();
}
```

https://docs.unity3d.com/ScriptReference/AssetDatabase.html

Tips & Tricks

Tips & Tricks

Separate your editor code from runtime

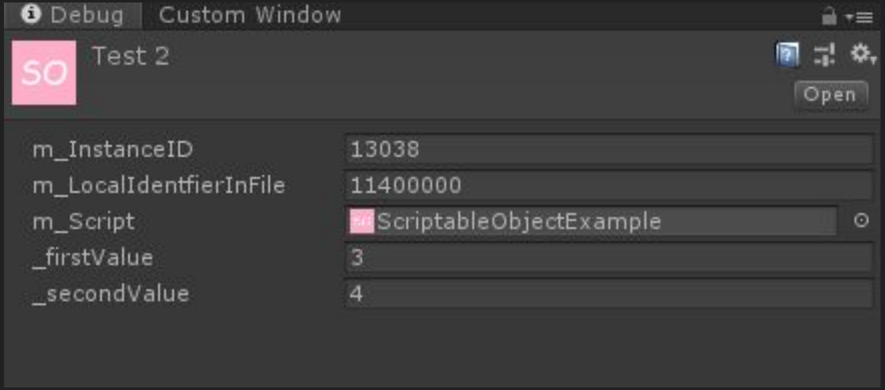


It is required for **Assembly Definitions!**

Tips & Tricks

Preview property names in Debug View.

Press ALT + LMB on field in Inspector.

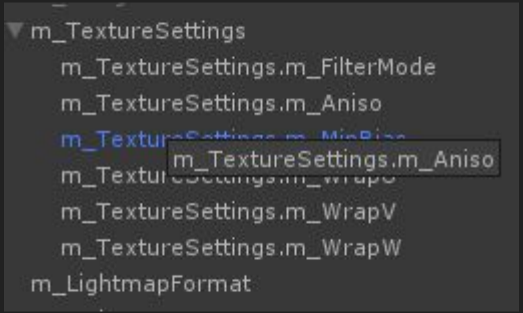


m_InstanceID	13038
m_LocalIdentfierInFile	11400000
m_Script	ScriptableObjectExample
_firstValue	3
_secondValue	4

Tips & Tricks

Use full property path for complex structures.

```
serializedObject.FindProperty("m_TextureSettings.m_Aniso");
```



▼ m_TextureSettings
m_TextureSettings.m_FilterMode
m_TextureSettings.m_Aniso
m_TextureSettings.m_MipBias
m_TextureSettings.m_WrapU
m_TextureSettings.m_WrapV
m_TextureSettings.m_WrapW
m_LightmapFormat

m_TextureSettings.m_Aniso

Tips & Tricks

Decompile Unity for examples.

https://github.com/Unity-Technologies/UnityCsReference

Tips & Tricks

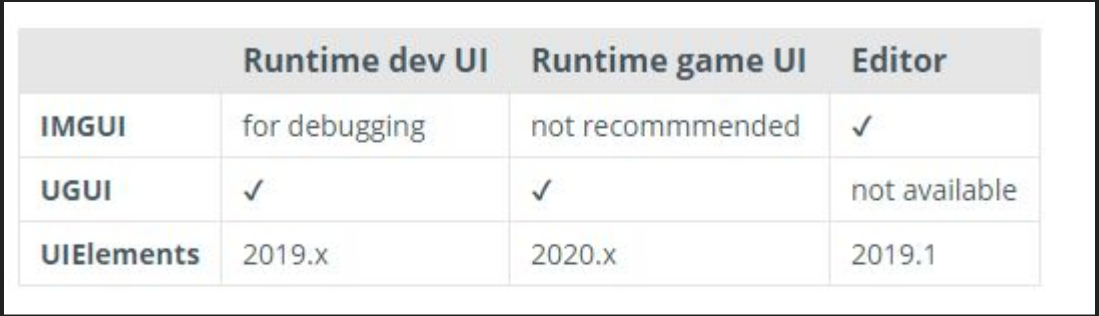
Use Singletone SO for EditorWindow persistent data.

```
private static ScriptableObjectExample _instance;

public static ScriptableObjectExample Instance {
    get {
        if(_instance == null) {
            var guid = AssetDatabase.FindAssets("t:ScriptableObjectExample")[0];
            var path = AssetDatabase.GUIDToAssetPath(guid);

            _instance = AssetDatabase.LoadAssetAtPath<ScriptableObjectExample>(path);
        }

        if (_instance == null) {
            _instance = CreateInstance<ScriptableObjectExample>();

            AssetDatabase.CreateAsset(_instance, "ScriptableObjectExample.asset");
            AssetDatabase.SaveAssets();
            AssetDatabase.Refresh();
        }

        return _instance;
    }
}
```

Future
UI Elements

What are UIElements?

UIElements is an experimental feature that is going to replace current UI systems (both Legacy and the 4.6 version) as an editor and runtime UI framework. Currently some of the editor features in 2018.3 and 2019.1 are already ported with UIElements



	Runtime dev UI	Runtime game UI	Editor
IMGUI	for debugging	not recommmended	✓
UGUI	✓	✓	not available
UIElements	2019.x	2020.x	2019.1

https://docs.unity3d.com/Manual/UIElements.html

What are UIElements?

UIElements are basically Unity implementation of old school web design principles. They are build using three main elements:

- UXML File - it is used to define the structure of our UI.
- USS File - basically a CSS file with smaller amount of features
- UQuery - queries that allow to search for elements in structure and assign new classes, etc (basically a jQuery)

https://docs.unity3d.com/Manual/UIElements.html

What are UIElements?

- They are built using open-source Flexbox integration called Yoga.
- Unity have also created in editor tools for debugging UIElements (that is basically the Developer modes from web browsers)
- It is a retained mode.
- Despite what documentation says you can use it in > 2019.1 versions of Unity.

https://github.com/facebook/yoga

Noteworthy
Materials & Assets

Talks

Unite LA talk about UIElements

https://www.youtube.com/watch?v=MNNURw0LeoQ&t=838s

Unite talks Scriptable Objects

https://www.youtube.com/watch?v=6vmRwLYWNRo

https://www.youtube.com/watch?v=raQ3iHhE_Kk

Unite Berlin talk about Editor Scripts in Scene View

https://www.youtube.com/watch?v=Ah9CuzGa2vw

Odin

Inspector & Serializer

https://assetstore.unity.com/packages/tools/utilities/odin-inspector-and-serializer-89041

Serializer

https://github.com/TeamSirenix/odin-serializer

This talk and project

https://github.com/Sygan/EditorScripting-Talk

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