MolecularLib Docs

The documentation for the MolecularLib

USER GUIDE

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Getting Started

Overview

This document provides a concise and not-too-long documentation for all the features included in the MolecularLib package. As a reminder, this package is open-source, with its source code hosted in this GitHub repository.

In this manual, for each topic there will be, in the start of the overview section, the following
Usage:
Namespace:

Where Namespace says which namespace you must have included in the using directives at the top of the file to use the feature. The Usage shows a quick example of how it's used.

In the case that you find any bugs while using the MolecularLib, and you are sure the bug is in the package code, please send a bug report here following the template that will be prompted to you.

In the case you would like to see a new feature being implemented, please send a feature request here

Installation

If you installed the package via the Asset Store or the package manager, you can just skip this. If you are installing it via the .unitypackage file, here is how to do it, go to: **"Assets->Import Package->Custom Package..."**. In the Import Asset window, find and select the MolecularLib.unitypackage file. When the "Importing package" window shows up, check all items to be imported and then click the Import button in the bottom right of the window.

The Demos

The project contains a Demo folder with a Demo scene, a demo Volatile Scriptable Object named Volatile SO, and some scripts that implement the functionality of the Demo scene, fell free to navigate this codes, they are written in a easy to understand way to serve as documentation as well.

The Demo folder is located at **"HandsomeDynosaur/MolecularLib/Core/Demo"**.

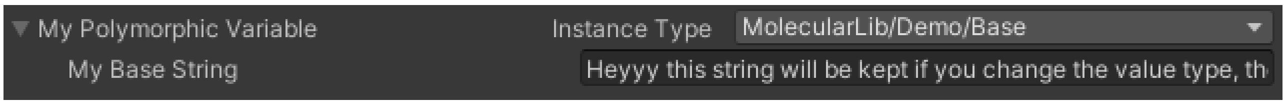
Polymorphic Variable

Overview

Declaration: PolymorphicVariable<TBase> (e.g. PolymorphicVariable<Weapon>)
Namespace: MolecularLib.PolymorphismSupport

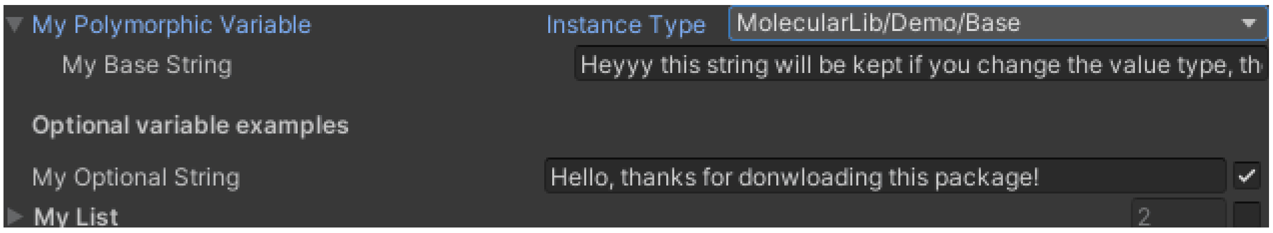
The Polymorphic Variable adds support for polymorphism in unity serializable fields. If you don't know what polymorphism is, I strongly suggest reading this page (It is very short, mostly examples).

Basically, when you declare a Polymorphic Variable (like public PolymorphicVariable<MyBaseType> myPolymorphicVar or [SerializeField] private PolymorphicVariable<MyBaseType> myPolymorphicVar) in the editor it will appear like this:



My Polymorphic Variable | Instance Type: MolecularLib/Demo/Base
My Base String: Heyyy this string will be kept if you change the value type, th

Where the instance type defines what type the variable should be. As you change the Instance Type, the field prompted in the inspector will change.



My Polymorphic Variable | Instance Type: MolecularLib/Demo/Base
My Base String: Heyyy this string will be kept if you change the value type, th
Optional variable examples
My Optional String: Hello, thanks for donwloading this package! ✓
My List: 2

You can access this value as TBase using myPolymorphicVar.Value or you can get it already converted using myPolymorphicVar.As<TDerived>(out TDerived, bool onlyPerfectTypeMatch) like this

```
if (myPolymorphicVariable.As<A>(out var asA))
    Debug.Log($"As A | aClassInt: {asA.aClassInt}");
else if (myPolymorphicVariable.As<B>(out var asB))
    Debug.Log($"As B | bClassInt: {asB.bClassInt}");
else if (myPolymorphicVariable.As<C>(out var asC))
    Debug.Log($"As C | cClassFloat: {asC.cClassFloat}");
else
    Debug.Log($"As Base | myBaseString:
{myPolymorphicVariable.Value.myBaseString}");
```

Polymorphic Variable

How to use

First, define a PolymorphicVariable<Your Base Type Here> either as a public field or as a [SerializeField] private field. After that open the inspector for the object containing the script with this field and there you go, you have successfully declared the field. Keep in mind that the PolymorphicVariable will accept ANY type that derives from the provided base type, so if you put System.object as the base type unity will get very lag, as the editor drawer will need to fetch all the types to be displayed in the popup (in this case around 70000).

In your code, you can access the value as the base provided type using myPolymorphicVar.Value. To check if the value is of a type and get the value as said type, use myPolymorphicVar.As<ExpectedType>(out var value) (this returns a bool, so you can put it inside a "if" statement). Using it like this, any type that derives from ExpectedType will NOT return true to this function. If you want those types to also return true, call the function like this: myPolymorphicVar.As<ExpectedType>(out var value, false).

```
if (myPolymorphicVariable.As<B>(out var asB)) // This will match only the B type
    Debug.Log($"As B | bClassInt: {asB.bClassInt}");

// This will match both B classes and any derived from it, in the case of the
// Demo, B and C.
if (myPolymorphicVariable.As<B>(out var asB, false))
    Debug.Log($"As B | bClassInt: {asB.bClassInt}");
```

You can also access the selected type in the inspector using myPolymorphicVar. SelectedPolymorphicType and the actual value type with myPolymorphicVar. ValueType

There is also an implicit conversion operator defined to get the value as TBase, so you can use (TBase)myPolymorphicVar, or, depending of the context, myPolymorphicVar to get the Value property.

Note: IF SOME PRIVATE fields from your selected type aren't being saved, tey setting them to public or have the [DataMember] attribute added. In the latter option you need to be 100% SURE that the class has both [Serializable, DataContract] attributes, like this:

```
[Serializable, DataContract]
public class MyClass
{
    public int myPublicField;
    [SerializeField, DataMember] private int myPrivateField;
}
```

Theoretically it shouldn't be needed though. Now **if you want to ignore a field and don't serialize it use the [XmlIgnore] ignore**

Polymorphic Variable

Limitations

- Can't do PolymorphicVariable<UnityEngine.Object> (not that that would make much sense for most cases anyway)
- Can't save classes deriving from UnityEngine.Object for now
- All the field types need to have a parameterless constructor (or no constructor).
- PropertyAttributes don't work on primitives and some unity types for now.

First off, you cannot make a PolymorphicVariable<UnityEngine.Object> as it does not make sense. See, types deriving from the UnityEngine.Object, like ScriptableObject, or Monobehaviour kind of already have polymorphism. You only assign references to those types, the PolymorphicVariable.

Secondaraly, any field deriving from UnityEngine.Object in the instance class will NOT be serialized (saved). This is due to the fact that I still haven't found a way to serialize a reference to those Objects in a safe, fast and reliable way.

Because of how it works, every type that will be saved by the PolymorphicVariable NEEDS to have a constructor with no paramenters or no constructors at all.

For now any attribute added in fields of the instance class will be ignored unless the type is user defined. Say, a [TextArea] string str; will be shown as a normal string. A [MinMaxRange] Range myRange; will be shown properly.

How it works (In a nutshell)

Basically it uses reflection to fetch all the fields of the selected desired type and its values. Than it serializes all of that data using the XmlSerializer class. This serialized data is than stored in a string field in the SerializedPolymorphicField class. What this means, and this is the whole purpose of this topic, is that if you will mess with anything relating SerializedProperty and SerializedObject, beware that the fields shown in the editor don't exist, they are all strings containing XML data.

Custom Serialization Support

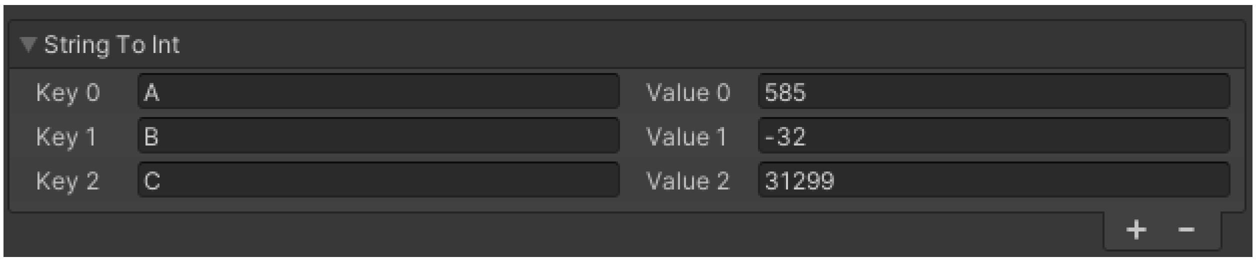
If, for any reason, you need, or want, to implement your own serialization without using the XmlSerializer (Since it doesn't support all types), you can implementing this interface IPolymorphicSerializationOverride in the type desired to have its own serialization. In case you want a example of that, check the code of the SerializableDictionary, it is used there.

Serializable Dictionary

Overview

Declaration: SerializableDictionary<TKey, TValue> (e.g. SerializableDictionary<string, int>)
Namespace: MolecularLib

As it is commonly known, unity serializes Lists, but not Dictionaries. But what is a serialized dictionary if not 2 lists, one for the keys, and one for the values? That's exactly what the SerializableDictionary<TKey, TValue> does! Right before unity serializes the class, it converts its dictionary to two list, keys and values, which are than serialized by unity. Then just after deserialization those lists are converted back to a dictionary. It also comes with a neat editor drawer! It will look like this in the inspector (if the variable is public or has [SerializeField]):



The SerializableDictionary class derives from Dictionary, so you can use it in runtime just like you would use a normal Dictionary class.

How to use

Well, as previously said, the SerializableDictionary<TKey, TValue> derives from Dictionary<TKey, TValue>, which makes its use exactly equal to the one you would have with a normal dictionary. If you want to learn more about dictionaries, go here.

Volatile Scriptable Object

Overview

Declaration: VolatileScriptableObject<TData>
(e.g. public class MyScriptableObject : VolatileScriptableObject<MyScriptableObjectData>)
Namespace: MolecularLib

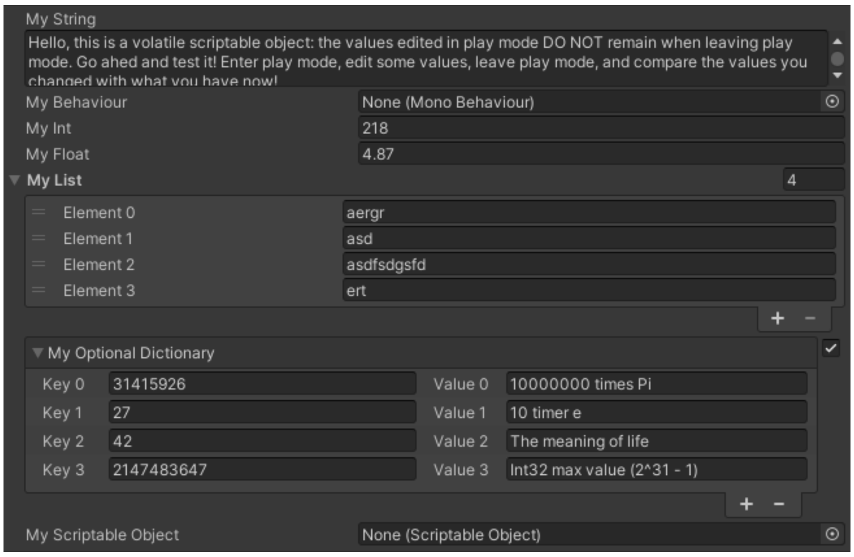
As you probably know, scriptable objects in unity have persistent data for entering and leaving play mode, so if you have an int in a scriptable object set to 100, and then, while in play mode, you change it to 50, when you exit play mode, it will still be 50, not 100. This is sometimes good and sometimes bad. One of these bad times is when you're using scriptable objects to hold changeable data, say player health. You would want for the player health to be reset when you leave play mode, but you also want to change it during play mode. If you are thinking this is a very strange way to code a game by the way, check this, it actually has some very good benefits. So, what the VolatileScriptableObject class does is that it solves this problem! You can change the data in it, and when you leave play mode it won't be changed.

There is a very good demo and implementation of this in here **"Demo > TestVolatileScriptableObject.cs"**. But if you want a quick sneak-pic of it, here it is:

```
[CreateAssetMenu(fileName = "Volatile SO", menuName = "New Volatile SO", order = 0)]
public class TestVolatileScriptableObject :
VolatileScriptableObject<TestVolatileScriptableObject.Data>
{
    // Here is a quick way of accessing the data. Can be done in other ways too.
    public Data VolatileData
    {
        get => Value;
        set => Value = value;
    }

    // Here you will put all the data you want to be volatile
    [Serializable]
    public class Data
    {
        [TextArea] public string myString;
        public MonoBehaviour myBehaviour;
        public int myInt;
        public float myFloat;
        public List<string> myList;
        public Optional<SerializableDictionary<int, string>> myOptionalDictionary;
        public ScriptableObject myScriptableObject;
    }
}
```

In the editor (not in play mode), this will look like this:



My String
Hello, this is a volatile scriptable object: the values edited in play mode DO NOT remain when leaving play mode. Go ahed and test it! Enter play mode, edit some values, leave play mode, and compare the values you changed with what you have now!

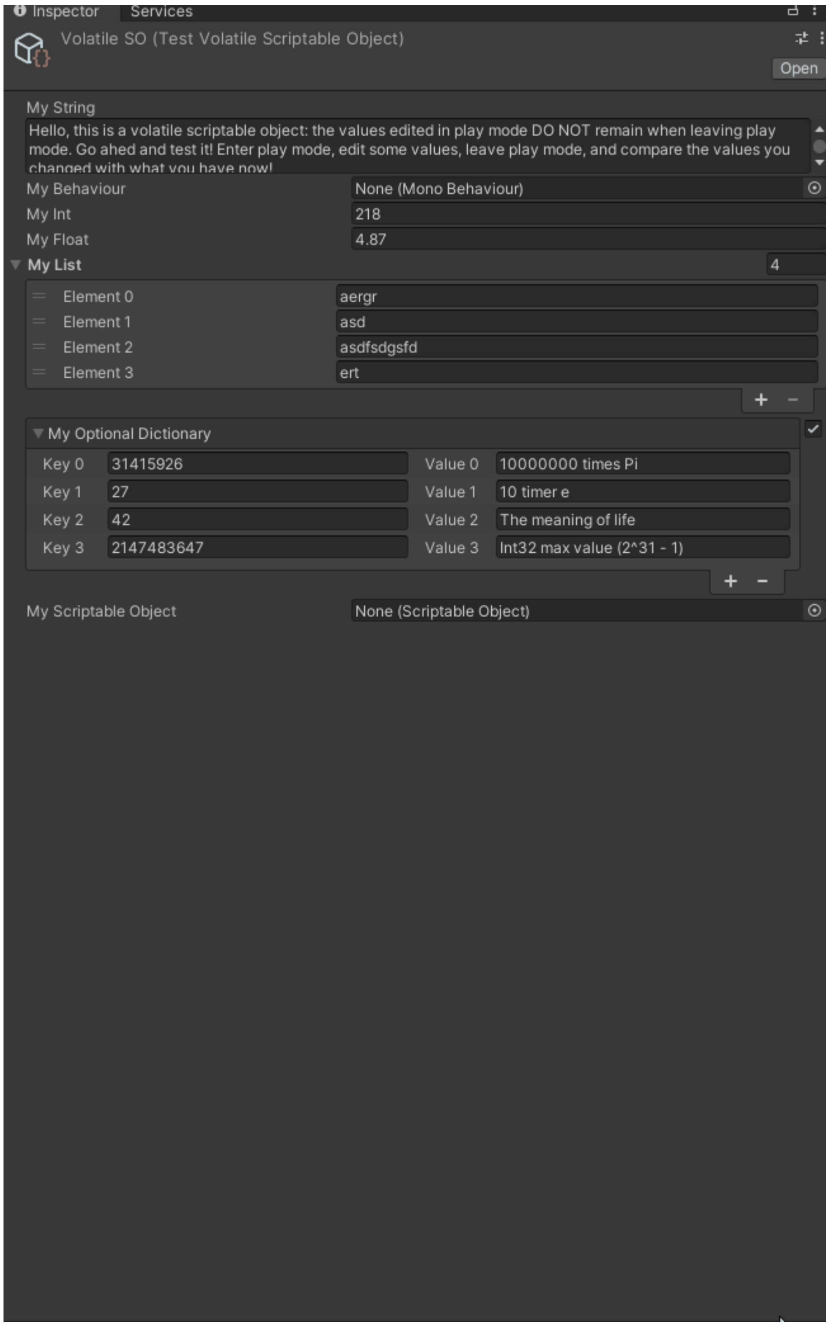
My Behaviour	None (Mono Behaviour)
My Int	218
My Float	4.87
My List	4
Element 0	aergr
Element 1	asd
Element 2	asdfsdgsfd
Element 3	ert

My Optional Dictionary ✓

Key 0	31415926	Value 0	10000000 times Pi
Key 1	27	Value 1	10 timer e
Key 2	42	Value 2	The meaning of life
Key 3	2147483647	Value 3	Int32 max value (2^31 - 1)

My Scriptable Object	None (Scriptable Object)

During play mode it will be like this:



Volatile SO (Test Volatile Scriptable Object)

My String
Hello, this is a volatile scriptable object: the values edited in play mode DO NOT remain when leaving play mode. Go ahed and test it! Enter play mode, edit some values, leave play mode, and compare the values you changed with what you have now!

My Behaviour	None (Mono Behaviour)
My Int	218
My Float	4.87
My List	4
Element 0	aergr
Element 1	asd
Element 2	asdfsdgsfd
Element 3	ert

My Optional Dictionary ✓

Key 0	31415926	Value 0	10000000 times Pi
Key 1	27	Value 1	10 timer e
Key 2	42	Value 2	The meaning of life
Key 3	2147483647	Value 3	Int32 max value (2^31 - 1)

My Scriptable Object	None (Scriptable Object)

Volatile Scriptable Object

How to use

Well, as previously shown, you will make your own ScriptableObject derive from VolatileScriptableObject<T> where T will be a class or struct that will contain all the data to be volatile.

As protected values (which you can access from your derived class) you will have
- Value
- runtimeValue
- editorSavedValue

And as a protected method you will have:
- CopyRuntimeValuesToEditorSaved() :void

Where runtimeValue and editorSavedValue are very self-explanatory, one is the value during runtime, the other, not. But you will most probably only use the Value property, and here's why: during runtime (or in builds) it will return always the runtimeValue, so it can be edited without changing the editorSavedValue. When not on play mode, it will always return the editorSavedValue, so it can be edited.

Technical Details

If you are wondering how this works, it basically stores a copy of all the values on the scriptable object. If now you are wondering how this works with reference types (e.g. List<some type>) it uses a DeepCopy method present on the VolatileScriptableObject class that serialized the data to JSON and than deserializes it using the JsonUtility class. This method is only called while entering play mode or during the editor when values are changed.

Instantiate with arguments

Overview

Usage: Molecular.Instantiate(original :GameObject, [parente :Transform], [pos :Vector3], [rot :Quaternion], arg1 :T1, arg2 :T2 …)
Namespace: MolecularLib

First off to use this, the object that you want to instantiate needs have this interface: IArgsInstantiable<>. There are a total of 10 overrides of this interface, one with no parameters, one with 1 parameter, one with 2 parameters … and one with 10 parameters. The function that this interface implements will as parameters the types passed into the interface, like so:

```
public class TestArgInstantiable : MonoBehaviour, IArgsInstantiable<float, int, string, GameObject>
{
    public float floatArg;
    public int intArg;
    public string stringArg;
    public GameObject gameObjectArg;

    public void Initialize(float arg1, int arg2, string arg3, GameObject arg4)
    {
        Debug.Log(
      $"I was instantiated with args: args1: {arg1} args2: {arg2} args3: {arg3} args4: {arg4}");
        floatArg = arg1;
        intArg = arg2;
        stringArg = arg3;
        gameObjectArg = arg4;
    }
}
```

This function "Initialize" will then be called just after the awake and after the object is in fact instantiated. To instantiate this object, for example, you would do it like this:

```
    var floatIntStringGo = Molecular.Instantiate(prefab, 23.3f, 342, "I am a string", someGo);
```

It is simple like that to use it and implement it!

In the **Demo folder** there is a great example of this called InstantiateWithArgsDemoObject

Additional Notes

- You can have more than one these interfaces per object, just make sure that they are well defined.
- Reflections is NOT used at all in this system, so it adds virtually none overhead to just instantiating normally the prefab

Auto Singleton

Overview

Usage: AutoSingleton<T> (e.g. MyMonoBehaviour : AutoSingleton<MyMonoBehaviour>)
Namespace: MolecularLib

Need to use a singleton but don't want to write the same stuff every time? Just do this:
In your MonoBehaviour class, change the parent class from MonoBehaviour to AutoSingleton<YOUR TYPE HERE>, so that it looks like this:

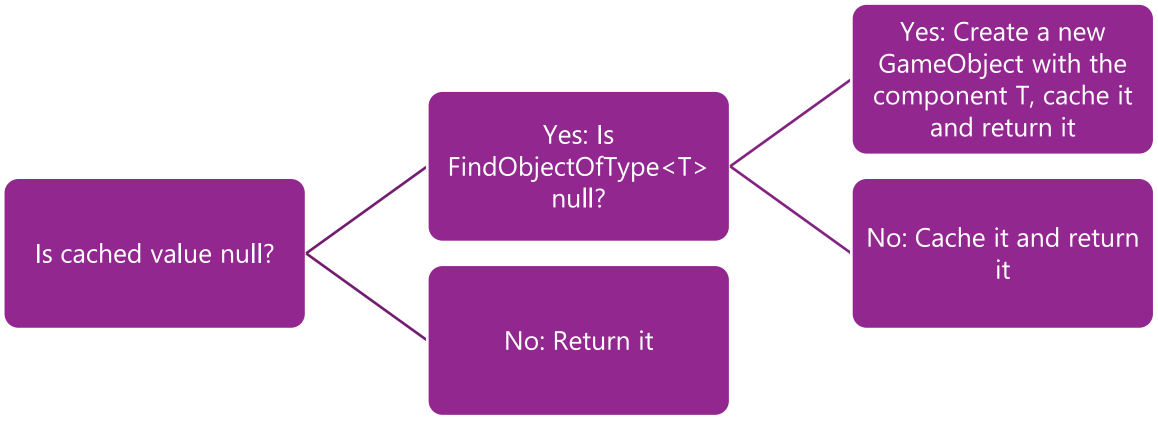
```
public class TimerManager : AutoSingleton<TimerManager>
```

Using it this way, from anywhere in the code you will be able to access TimerManager.Current and get a TimerManager instance!

Note: AutoSingleton<T> derives from MonoBehaviour

How it gets the instance?

In some ways: First, before you call Current for the first time, it has no idea where is this instance. When you call it the first time it will do the following:


Is cached value null?
Yes: Is FindObjectOfType<T> null?
No: Return it
Yes: Create a new GameObject with the component T, cache it and return it
No: Cache it and return it

This way it should never return null.

Timers

Overview

Namespace: MolecularLib.Timers

Well, it is kind of obvious what it does, so let's jump right into how to use the timers. There are two types of timers in the library:

- Timer Async
- Timer Coroutine

And the timer Async can generate a TimerReference class.

Both types of timers have the same functionalities:
- OnComplete / OnFinish
- Duration
- ElapsedSeconds
- Repeat

The main diference between Timer Async and Timer Coroutine is the way they work: Timer Async, as the name suggests, uses an asynchronous function to count the time using Task.Delay(secondsToFinish) and the ElapsedSeconds is calculated via UnityEngine.Time.time – Timer.StartTime (Timer.StartTime is set to UnityEngine.Time.time when the timer starts).

Now the Timer Coroutine uses a coroutine to count time, using yield return new WaitForSeconds(delay) and the ElapsedSeconds is also calculated via UnityEngine.Time.time – Timer.StartTime (Timer.StartTime is set to UnityEngine.Time.time when the timer starts).

Aside from how they work, **TimerCoroutine will instantiate 1, and only one thru the entire program execution, GameObject** with the TimerManager script (It has a singleton by the way). While the Async timer will not. **The Timer Async CANNOT be paused or resumed, can only be permanently stopped in repeat mode. The Timer Coroutine CAN be paused and resumed, even in repeat mode.**

The way I suggest looking at this is like so: The Async timer is a lightweight more basic version of the TimerCoroutine. If you just need a timer, real quick for some real basic stuff, use the Async, if you need it to be more controllable, use the Coroutine.

Timers

Timer Async

Namespace: MolecularLib.Timers
Usage:

- Timer.TimerAsync(seconds :float, callback :Action)
- Timer.TimerAsyncReference(seconds :float, repeat = false :bool)

These methods will create start a timer async (virtually no memory allocation on the first one, little on the second) which will use asynchronous functions to count time. The first method is used like this:

```
Timer.TimerAsync(TimerDelay, () => Debug.Log("Finished”));
```

The second one is used like this:

```
var timerReference = Timer.TimerAsyncReference(TimerDelay);

timerReference.OnFinish += () => Debug.Log("Finished");
if (timerReference.HasFinished) Debug.Log("Already finished");
Debug.Log($"There has elapsed {timerReference.ElapsedSeconds} seconds");
```

Where there is written “() =>”, if you don’t know what that is, it’s a lambda or anonymous function, don’t worry about it, they aren’t needed, you can just pass a normal void parameterless function.

Timer Reference

In the TimerReference class you have:

- bool Repeat { get; }
- float StartTime { get; }
- int DurationInMilliseconds { get; }
- bool HasFinished { get; }
- Action OnFinish { get; set; }
- float ElapsedSeconds { get; }
- int ElapsedMilliseconds { get; }
- StopOnNextCycle() :void

If you are unfamiliar with “{ get; set; }”, it just means whether you can set, get or both to that field. Check out properties

Timers

Timer Coroutine

Namespace: MolecularLib.Timers
Usage: Timer.CreateTimer(seconds :float, callback :Action, repeat :bool)

This method will create a new Timer, and if doesn't already exist, the TimerManager GameObject, with don't destroy on load and hide in inspector hide flag. You can create the timer like this:

```
var timer = Timer.Create(TimerDelay, () => Debug.Log("Finished"));
```

and for repeat:

```
var timer = Timer.Create(TimerDelay, () => Debug.Log("Finished"), true);
```

the returned value "timer" is an instance of the Timer class, containing the following:

- Methods
  - StartTimer() // You don't need to call this to start the timer using Timer.Create
  - ResumeTimer() // Resumes a paused timer
  - StopTimer() // Stops(pauses) the timer
  - RestartTimer() // Restart the timer as if it was starting now
- Properties
  - float StartTime { get; }
  - bool Repeat { get; set; }
  - bool IsStopped { get; }
  - float DurationInSeconds { get; }
  - float ElapsedSeconds { get; }
  - bool HasFinished { get; }
- Events
  - OnComplete

Note: Both the Async and Coroutine timer's 'HasFinished', in REPEAT timers, will only ever get to be true if the timer is stopped, but even than, it's better to use IsStopped or just use the event.

Color Helper

Overview

Usage: ColorHelper.METHOD() or myColorVar.EXTENSIONMETHOD()
(e.g. ColorHelper.Random(); e.g. backgroungColor.TextForegroundColor())
Namespace: MolecularLib.Helpers

The ColorHelper static class provides helper functions for the Color class in unity. It contains both static methods and extension methods for colors, here they are:

Methods

Static Methods

- **Random**
  - Returns a random color
- **Random(byte minRGB = 0, byte maxRGB = 255)**
  - Returns a random color that falls in the range(inclusive) of minRGB and maxRGB
- **FromString(string value, byte minRGB = 0, byte maxRGB = 255)**
  - Uses the GetHashCode function to convert a string to to a color, for the same string it will return the same color always. The color is also on the inclusive range of minRGB and maxRGB
- **GetTextColorFromBackground(Color background)**
  - Based on the appearance luminance of the background color, calculated via "luminance = 0.299 * background.r + 0.587 * background.g + 0.114 * background.b", if the luminance is greater than .5f, it will return a dark color, r: 16 g: 16 b: 16, if the luminance is smaller than .5f a bright color, r: 201 g: 201 b: 201
- **TextColorShouldBeDark(Color background)**
  - Exactly what the method above does except that it returns a bool instead of a color, so it the text color should be dark, return true, if should be bright, false
- **NormalizeToColor(byte r, byte g, byte b, byte a = 255)**
  - Returns a new Color based on values going from 0-255 instead of 0-1
- **FromHex(string hex)**
  - Returns a color based on a hex color string (# is optional, can be in formats: #AABBCC, #ABC, #ABCD, #AABBCCDD, AABBCC, ABC, ABCD, AABBCCDD)

Color Helper

Methods

Extenstion Methods

- **ToColor32()**
  - Converts the color to a Color32
- **ToHexString(bool addSharpAtStart = true)**
  - Converts the color to a hex string
- **ToHexStringNoAlpha(bool addSharpAtStart = true, bool add00ToEnd = true)**
  - Converts the color to a hex string ignoring the alpha component
- **TextForegroundColor()**
  - Exactly what you would get calling **ColorHelper.GetTextColorFromBackground()** (documentation in the static methods section, the last page)
- **TextForegroundColorShouldBeDark()**
  - Exactly what you would get calling **ColorHelper.TextColorShouldBeDark()** (documentation in the static methods section, the last page)
- **WithR(byte r) | WithR(float r)**
  - Returns a new color with the same values of the provided one, except the "r" value, which will be overridden with the provided one.
- **WithG(byte g) | WithG(float g)**
  - Returns a new color with the same values of the provided one, except the "g" value, which will be overridden with the provided one.
- **WithB(byte b) | WithB(float b)**
  - Returns a new color with the same values of the provided one, except the "b" value, which will be overridden with the provided one.
- **WithA(byte a) | WithR(float a)**
  - Returns a new color with the same values of the provided one, except the "a" value, which will be overridden with the provided one.

Vector Helper

Overview

Usage: myVector.SOME_EXTENSION_METHOD (e.g. position = position.WithY(y => y + 3))
Namespace: MolecularLib.Helpers

There are only extension methods, and the class they are contained is the VectorHelperExtensionMethods. So they are all used like this: myVector.METHOD()

Methods

"With" and "Without" Methods

The "With" methods are present for every vector type (Vector2, Vector3, Vector4, Vector2Int, Vector3Int). All these methods do is they return the same value except the one that was changed. So "WithX(newX)" will return the exact same Vector except for the x value, which will be newX now. There are two variants for all of these methods: With(newValue) and With(currentValue => [return new value here]). They would be used like the following:

```
var newVec2 = vec2.WithX(x => x + 1);
var newVec2 = vec2.WithX(5);
```

Remember that Vectors are structs, so they are value types, which means you need to use the return value to get the edited vector. If you only call vec2.With(3), the vec2 var will still have the old value.

The Without methods will simply call With(0), so set an value to 0

```
var newVec2NoX = vec2.WithoutX();
var newVec2NoY = vec2.WithoutY();
```

Vector Helper

Methods

"To" Methods

The "To" methods are conversion methods that will take an original Vector and change it to an VectorInt or VectorInt -> Vector. Say Vector2 -> Vector2Int, Vector4 -> Vector3Int, Vector2Int -> Vector3. It will use the provided values to create the new vector and RoundToInt to convert from float to int. Values there are created will be 0(Say, converting a Vector2Int to Vector3, the z value will be 0);

Usage will look like this:

```
vec3.ToVec2Int()
vec3.ToVec3Int()
vec3Int.ToVec2()
vec3Int.ToVec3()
vec3Int.ToVec4()
vec2.ToVec3Int()
```

"IsBetween" and "IsWithin" Methods

Usage: providedVector.IsBetween(minVector, maxVector);

The "IsBetween" methods will return true if all the components of the provided Vector falls between(less/greater NOT equal) the ones provided as min and max. False if even one of the components aren't

```
minVec4.IsBetween(minVec4, maxVec4); // Returns False
maxVec4.IsBetween(minVec4, maxVec4); // Returns False

// Returns True
(new Vector3(.5f, .5f, .5f)).IsBetween(Vector3.zero, Vector3.one);
```

Usage: providedVector.IsWithin(minVector, maxVector);

The "IsWithin" methods will return true if all the components of the provided Vector falls within(less/greater or equal) the ones provided as min and max. False if even one of the components aren't

```
minVec4.IsWithin(minVec4, maxVec4); // Returns True
maxVec4.IsWithin(minVec4, maxVec4); // Returns True

// Returns True
(new Vector3(.5f, .5f, .5f)).IsWithin(Vector3.zero, Vector3.one);
```

String Helper

Overview

Usage: myString.SOME_EXTENSION_METHOD (e.g. playerName = playerName.Color(Color.white))
Namespace: MolecularLib.Helpers

This class offers useful methods for working with rich text strings and some for just normal strings. For example:

```
    "Hello World!"
        .ToBuilder()
        .Color(UnityEngine.Color.green)
        .Bold()
        .ToString()
        .Ellipsis(50, "Label");
```

Methods

The following rich text methods have two overloads, one which manipulates a string, and one that manipulates a StringBuilder. If you will call more than one of these methods in a chain, like how it's done in the example above, it's highly recommended to use the StringBuilder version, as it's way more memory efficient and quicker. To use the string builder version, first get your string and call ".ToBuilder()"

Rich text methods (string version)

- Color(Color color) :string
- Bold() :string
- Italic() :string
- Size(float pixelSize) :string
- NewLine() :string

Rich text methods (StringBuilder version)

- ToBuilder() :StringBuilder
- Color(Color color) :StringBuilder
- Bold() : StringBuilder
- Italic() : StringBuilder
- Size(float pixelSize) : StringBuilder
- NewLine() : StringBuilder

String Helper

Methods

Other Methods

- ToColor() :Color
  - Just calls the ColorHelper.FromString() method, and return it. All that applies to that function applies to this one too. The documentation for that is on page 19
- Ellipsis(float maxWidth, Func<GUIContent, float> calcWidthFunc) :string
  - This function returns a possibly shortened string ending with "…" or the normal string, depending on whether the string fits in the provided maxWidth. In order to check if the string fits the maxWidth, a character to size function conversion is needed. That is what calcWidthFunc is.
- Ellipsis(float maxWidth, GUIStyle style) :string
  - This function returns a possibly shortened string ending with "…" or the normal string, depending on whether the string fits in the provided maxWidth. In order for this to work you need to pass the currently used GUIStyle for the place you will show the string. If you don't have the GUIStyle, check the function above, it is way more versatile.

Ranges

Overview

Usage:
public Range myFloatRange;
[SerializeField] private RangeInteger myIntRange;
[SerializeField] private Range<MyIComparableType> myCustomTypeRange;
Namespace: MolecularLib.Helpers

These are a collection of helper classes to express ranges (Not the C# 9 indexes ranges [3..4]). These are really useful for expressing a patrol range for some enemy, or a temperature range for a map generator, or a height range for a NPC, etc…

Moreover, all range classes derive from the master class Range<T> which derives from IRange<T> which derives from IRange where T needs to implement IComparable. So, if you have a class that implements IComparable, it will work with a nice editor and everything in a Range.

The IRange<T> interface contains two properties:
T Min { get; set; }
T Max { get; set; }

The Range interface contains one methods:
ValidateMinMaxValues();

The different range types

Range<T>

The Range<T> class is the master class for all the ones bellow, all that's valid for this is valid for the following ones.

It contains two properties:
T Min { get; set; }
T Max { get; set; }

And a set of methods:
- IsInRange(T value) :bool
- Clamp(T value) :T
- ClampCeil(T value) :T
- ClampFloor(T value) :T
- ValidateMinMaxValues()

Ranges

The different range types

The Range<T> can also be deconstructed as so:

var (min, max) = myRange;

and it also implements implicit operators so you can convert your range to and from a Range.

Range

The Range class inherits from Range<float> and implement some extra useful methods and properties:

- MidPoint :float

- Lerp(float t) :float
- LerpUnclamped(float t) :float
- InverseLerp(float value) :float
- InverseLerpUnclamped(float value) :float
- Random() :float

RangeInteger

The Range class inherits from Range<int> and implement some extra useful methods and properties:

- MidPoint :int

- Lerp(float t) : int
- LerpUnclamped(float t) : int
- InverseLerp(int value) : float
- InverseLerpUnclamped(int value) : float
- Random() : int

RangeVector

The RangeVector classes (RangeVector2, RangeVector3, RangeVetor2Int, RangeVector3Int) all derive from a tuple, like this: RangeVector2 : Range<(float x, float y)>. Because Vector doesn’t implement IComparable, that is needed. Apart from that, it works normally, as the properties are overridden to return a Vector and not a tuple.

Ranges

The different range types

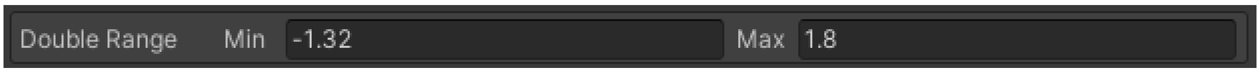
RangeVector

The RangeVector classes implements the following:

- Lerp(float t) : Vector
- LerpUnclamped(float t) : Vector
- InverseLerp(Vector value) : float
- InverseLerpUnclamped(Vector value) : float
- Random() : Vector
- GetBoundingBox() : Bounds

The int version of these vector ranges also implement GetBoundingIntBox() :BoundsInt

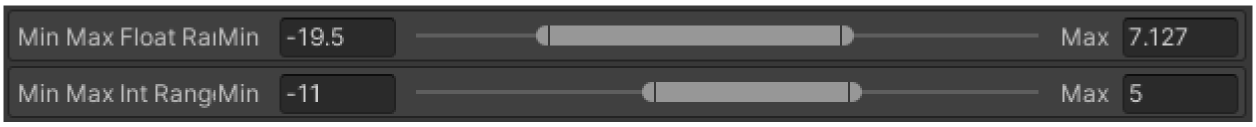
All the ranges look like this:


Double Range Min -1.32 Max 1.8

The MinMaxRange Attribute

Usage: [MinMaxRange(0, 1)] public Range myLimitedRange ;

This will make so the range can only accept values from between the ones specified in the attribute; Only supported on Range and RangeInteger. The editor will look like this:


Min Max Float RaıMin -19.5 Max 7.127
Min Max Int RangıMin -11 Max 5

Limits of the generic range class

The generic type must implement IComparable.

Maths

Overview

Usage: Maths.SOME_METHOD()
Namespace: MolecularLib.Helpers

This is a static class that implements some little useful function involving maths. Here are the functions:

Methods

- Lerp(float a, float b, float t) :float
- InvLerp(float a, float, b, float value) :float
- InvLerp(Vector2 a, Vector2, b, Vector2 value) :float
- InvLerp(Vector3 a, Vector3, b, Vector3 value) :float
- InvLerpClamped(Vector2 a, Vector2, b, Vector2 value) :float
- InvLerpClamped(Vector3 a, Vector3, b, Vector3 value) :float
- Remap(float iMin, float iMax, float oMin, float oMax, float v) :float
- RemapClamped(float iMin, float iMax, float oMin, float oMax, float v) :float
- IsAllGreaterThan(Vector3 reference, Vector3 toBeGreater) :bool
- IsAllGreaterThan(Vector2 reference, Vector2 toBeGreater) :bool
- IsAllSmallerThan(Vector3 reference, Vector3 toBeGreater) :bool
- IsAllSmallerThan(Vector2 reference, Vector2 toBeGreater) :bool
- IsWithin(this float v, float min, float max) :bool
- IsBetween(this float v, float min, float max) :bool

Lerp stands for Linear interpolation. The lerp functions here are unclamped, for the clamped ones and the ones for Vectors check UnityEngine.Mathf.Lerp and Vector.Lerp.

The InverseLerp methods do the opposite of the lerp, instead of getting a value that is t% of the way between a and b, it gets the t% value of a given value v between a and b. For a more in-depth explanation of this, check this video by Freya Holmer.

The Remap methods remap a value from the given input range to the output range. It's useful if you need to change the domain of a value. Say you have a world generator that gives you values from -1 to 1, but you need those to be in the range of 0 to 10, you would use the Remap(-1, 1, 0, 10, value) to get the value between 0 and 10 and not between -1 and 1. For a more in-depth explanation of this, check this video by Freya Holmer.

IsWithin checks if the value is greater or equal and smaller or equal than the min and max respectively. IsBetween checks if the value is greater and smaller than the min and max respectively. The other methods are very self-explanatory.

Other Helpers

Play Status

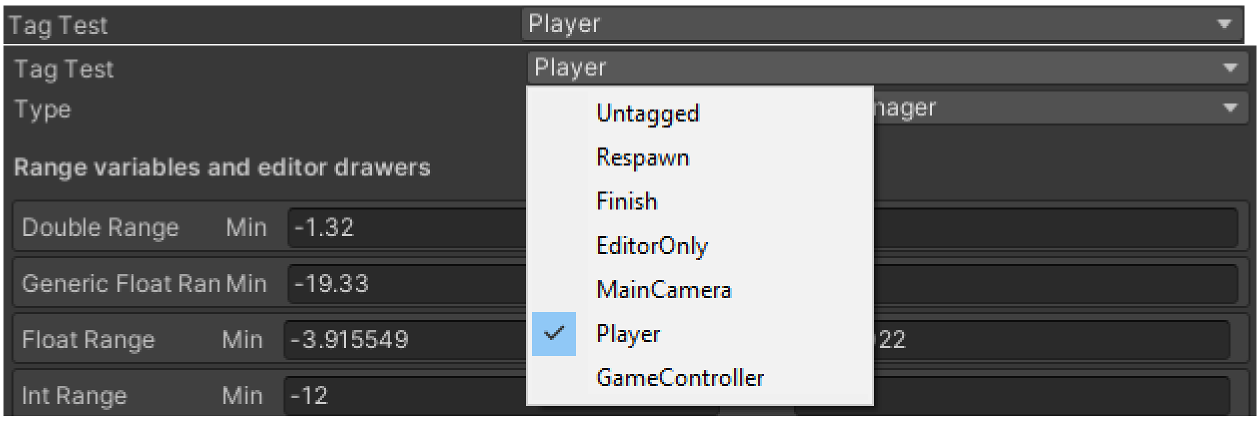
Usage: PlayStatus.IsPlaying
Namespace: MolecularLib.Helpers

This is the simplest class in this library. When the game scene load, it sets its IsPlaying property to true. Yes, it does the same than Application.IsPlaying. This class only exists because not always you can call Application.IsPlaying.

Tag

Usage: public Tag playerTag;
Namespace: MolecularLib.Helpers

This provides a safe tag wrapper that makes so you don't need to use string bindings at all while working with tags in unity! One less point of failure! Just declare as a field in your MonoBehaviour a tag like this: public Tag myTag; and check out the editor. It should look like this:


Tag Test Player
Tag Test Player
Type
Range variables and editor drawers
Double Range Min -1.32
Generic Float Ran Min -19.33
Float Range Min -3.915549
Int Range Min -12

Untagged
Respawn
Finish
EditorOnly
MainCamera
✓ Player
GameController

You can than call

```
tagTest.CompareTag(gameObject);
// Or
gameObject.CompareTag(tagTest);
```

You can also get the tag as a string using the Tag.TagName property
It also offer implicit operators to do the conversion from Tag to string and string to Tag.

Other Helpers

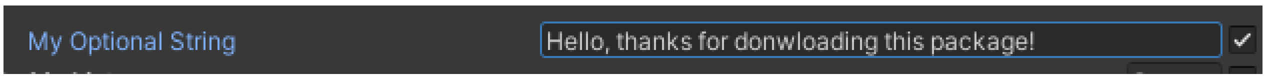
Optional

Usage: public Optional<int> myOptionalInt
Namespace: MolecularLib.Helpers

This is extremely useful for when you want to have a value that can be optional. In the code it will look like this:

```
    [SerializeField] private Optional<string> myOptionalString;
```

In the editor it will look like this:


My Optional String   Hello, thanks for donwloading this package!

Where you can toggle the right toggle to enable or disable the value.
In code you will access that like this:

```
  if (myOptionalString.HasValue)
      Debug.Log(myOptionalString.Value);

  // Or simply (Using implicit operators)

  if (myOptionalString)
      Debug. Log (myOptionalString);
```

Other Helpers

Type Library

Usage: TypeLibrary.AllAssembliesTypes
Namespace: MolecularLib

Well, sometimes it is needed to access all the types that are present in the project (mostly for the next helper topic). To simplify that process and avoid it being done twice or more, the TypeLibrary static class will, after the assemblies are loaded, fetch and cache all the types present in the app domain. If you don't want to use it, and neither want to use the Type Variable nor the PolymorphicVariable, remove USE_TYPE_LIBRARY from the Scripting Define Symbols in **"Project Settings > Player > Script Compilation > Scripting Define Symbols"**.

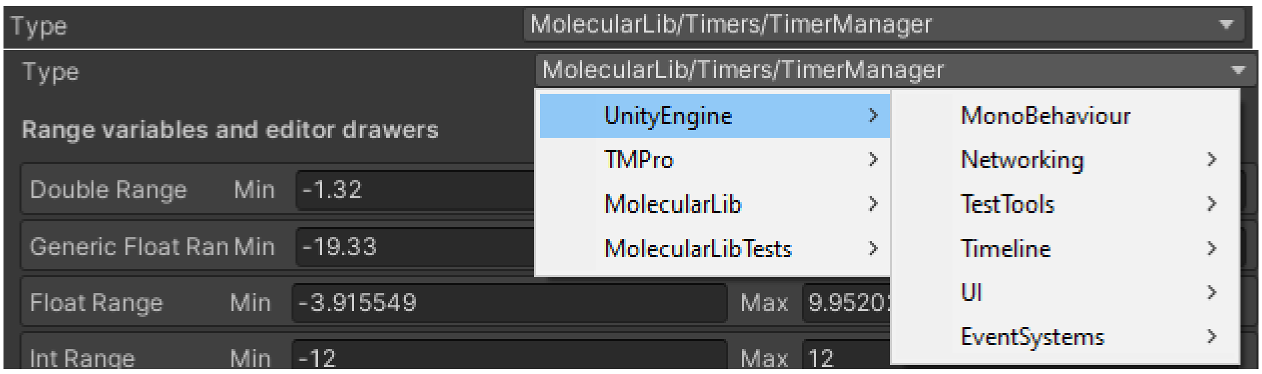
The class provides 3 properties:

- AllAssembliesTypes { get; } :IEnumerable<Type>
- AllNonUnityAssembliesTypes { get; } :IEnumerable<Type>
- AllAssemblies { get; } :IDictionary<string, Assembly>

Type Variable

Usage: public TypeVariable<Base> myType;
Namespace: MolecularLib.Helpers

There are two ways of using the type variable: TypeVariable<Base> and [TypeVariableBaseType(typeof(Base))] TypeVariable. But both of them accomplish the same result: A variable that stores a type in the object:


Type
MolecularLib/Timers/TimerManager
Type
MolecularLib/Timers/TimerManager
Range variables and editor drawers
Double Range Min -1.32
Generic Float Ran Min -19.33
Float Range Min -3.915549 Max 9.9520
Int Range Min -12 Max 12
UnityEngine
TMPro
MolecularLib
MolecularLibTests
MonoBehaviour
Networking
TestTools
Timeline
UI
EventSystems

If you go back to the first section of this manual, PolymorphicVariable<Base>, you will see that it uses this in its implementation. In the code you access the type via the implicit conversion or using TypeVariable.Type.

Editor Helper

Overview

Usage: EditorHelper.METHOD()
Namespace: MolecularEditor

This class offers useful functions for handling editor drawers and custom inspectors. Most of the methods are used internally, but as they still are pretty useful, the class and methods are left as public. The methods can be split up in 3 categories: UIElements; IMGUI; General Utilities;

Methods

"UIElements"

- LinkNodes(this GraphView grapView, Port outputPort, Port inputPort)
- ButtonWithText(Action clickEvent, string text) :Button
- ToolbarButtonWithText(Action clickEvent, string text) :ToolbarButton
- MakeBorder(this VisualElement container, float borderWidth, Color borderColor, float borderCornerRadius = 0)
- MakeTopBorder(this VisualElement container, float borderWidth, Color borderColor, float borderCornerRadius = 0)
- MakeBottomBorder(this VisualElement container, float borderWidth, Color borderColor, float borderCornerRadius = 0)
- MakeLeftBorder(this VisualElement container, float borderWidth, Color borderColor, float borderCornerRadius = 0)
- MakeRightBorder(this VisualElement container, float borderWidth, Color borderColor, float borderCornerRadius = 0)

"IMGUI"

- DrawBoxWithTitle(Rect totalPos, GUIContent tittle) :Rect
- BeginBoxWithTittle(GUIContent tittle, params GUILayoutOption[] options) :Rect
    - Use this only in custom editor, not in drawer
- EndBoxWithTittle()
    - Use this only in custom editor, not in drawer
- AutoTypeFieldInfo(ref Rect rect, FieldInfo fi, object targetObj, string label = null)
    - Check the item below the item below, this method just calls it with conversions
- AutoTypePropertyInfo(ref Rect rect, PropertyInfo pi, object targetObj, string label = null)
    - Check the item below, this method just calls it with conversions

Editor Helper

Methods

- AutoTypeField(ref Rect rect, Type valueType, object value, string labelStr = null) :object
  - For whenever you have a field, but it's not in a SerializedProperty, but you would really like to use EditorGUI.PropertyField(). This function simply does the right editor for the provided type. It even supports Custom Property Drawers! The only unsupported thing for now is the use of custom property attributes.
- AutoTypeFieldGetHeight(Type valueType, object value, string labelStr = null) :float
  - Gets the height of the to be drawn field using AutoTypeField();
- TypeField<TBaseClass>(Rect rect, string label, Type currentValue, bool showBaseType) :Type
- TypeField(Rect rect, string label, Type currentValue, Type baseType, bool showBaseType) :Type
- DrawTypeField(Rect rect, string label, List<Type> types, Type current) :Type

"General Utilities"

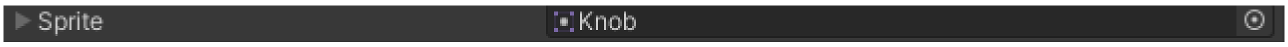
- UnitySerializesBindingFlags :BindingFlags { get; }
- AllTypes :IReadOnlyList<Type> { get; }
  - List of all types gotten from the TypeLibrary class mentioned in page 31
- GetTypesForPopup<TBaseClass>(bool showBaseType) :List<Type>
- GetTypesForPopup(Type baseType, bool showBaseType) :List<Type>
- Tex2DOfColorScreenSize(Color32 color) :Texture2D
- Tex2DOfColorAndSize(Color32 color, int width, int height) :Texture2D
- Tex2DOfColorScreenSize(Color color) :Texture2D
- Tex2DOfColorAndSize(Color color, int width, int height) :Texture2D
- Tex2DOfColor(Color color) :Texture2D
- GetTargetValue<T>(SerializedProperty property) :T
  - This functions returns the actual value contained inside a SerializedProperty. A great example of its use is in the SerializableDictionary and Range editors. If you are doing a custom editor to a custom type of yours that doesn't derives from UnityEngine.Object you probably got stuck trying to access the actual value of the property. This function does exactly that.

Enhanced Sprite Editor Drawer

Overview

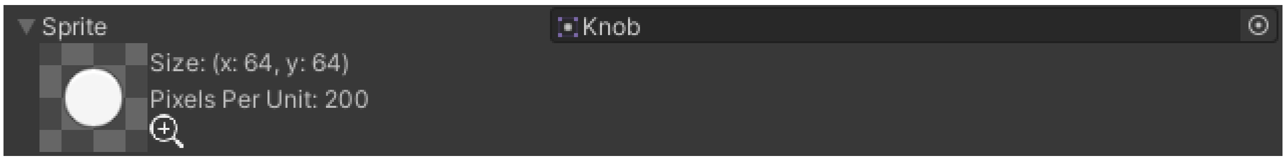
Usage: Just go on normally with your day declaring normal Sprites
Namespace: Not Applicable ;)

This editor drawers looks like this when closed:



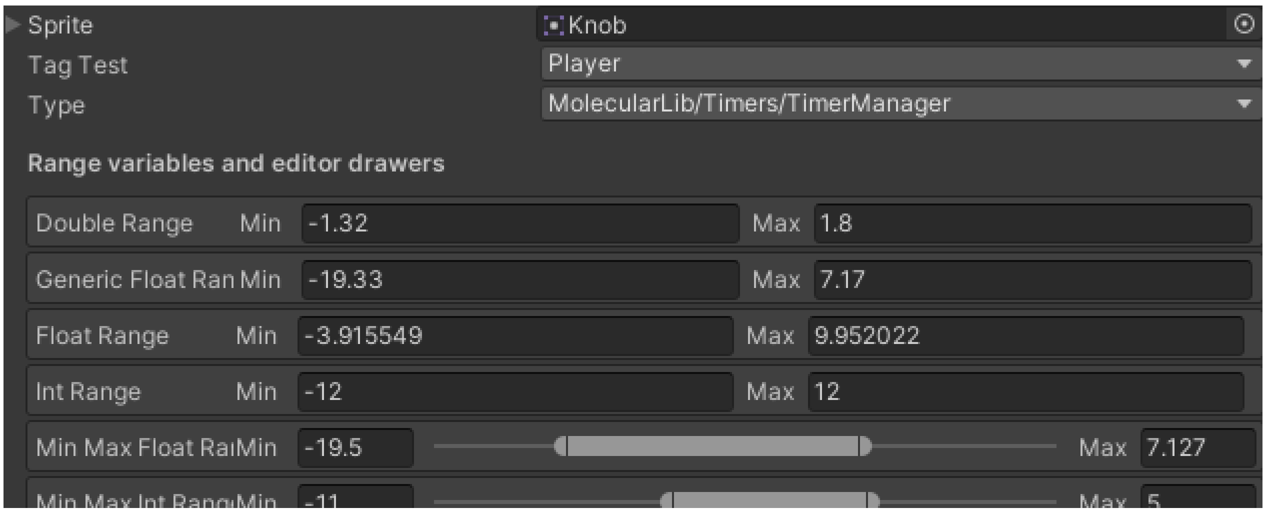
Sprite
Knob

And like this when opened



Sprite
Knob
Size: (x: 64, y: 64)
Pixels Per Unit: 200

Where if you click and drag the zoom icon you can increase or decrease the size of the preview.



Sprite — Knob
Tag Test — Player
Type — MolecularLib/Timers/TimerManager

Range variables and editor drawers

Double Range	Min	-1.32	Max	1.8
Generic Float Ran	Min	-19.33	Max	7.17
Float Range	Min	-3.915549	Max	9.952022
Int Range	Min	-12	Max	12
Min Max Float Ra	Min	-19.5	Max	7.127
Min Max Int Rang	Min	-11	Max	5

How to disable it

In case you don't like this editor drawer, or want to do your own, just go here **"HandsomeDynosaur/MolecularLib/Core/Editor"** and inside that folder delete the file **"SpriteEditorDrawer.cs"**. Just keep in mind that if you update the package the file will come back.