Fog of War

User Guide

v1.12

Overview

FogOfWar allows you to easily add fog to any 3D RTS.

Features:

- Works with 2D and 3D
- Varying map size
- Chunking system for infinite maps in all 3 dimensions
- Different color, filter and blurring options
- Queue-friendly tools
- Great performance (including multithreading)
- Line of Sight (occluding objects)
- View cones (using angles)
- Clear Fog (ie see through to background)
- See-through ground
- Works for both Orthographic and Perspective cameras
- Render to multiple cameras
- Save and load fog between plays
- Compatible with all devices, including mobile

Updates

v1.12

- Added chunking system for infinitely sized maps on all 3 axes
- Made FogOfWar.Reinitialize() much faster
- Added fix for clear fog
- Added Canvas and Graphic hiding in HideUnitInFog script
- Fixed pixel inaccuracy around map borders
- Fixed pixel inaccuracy with line of sight
- Added FogOfWar.VisibilityOfArea()
- Added blurring and antialiasing options
- Added antiflickering option for individual units

v1.11

- Added multithreading
- Fog color's alpha will fade the fog in and out
- New fog shapes including box and texture (with sample texture)
- Anti-aliasing on field of view
- Added team identification
- New method for calculating line of sight which greatly reduces the number of raycasts

v1.10

- Fixed shader bug in Unity 5.5.0 where depth buffer was inverted for orthographic cameras

- Made fog collider rect optional with a tick box as it seems to be buggy with lower resolution fog maps (a fix will be required for later releases!)
- Fixed bug where fog wasn't clearing on the border edges of the map
- Added slider to specify the strength of fog outside of the map area
- Added HideInFog component to automatically hide object when in the fog
- Added FogOfWarEvents component to detect when an object enters or exits fog
- Optimised fog of war shader by removing all branching
- Placed all components into components menu
- Added example 2D scene
- Fixed bug on mobile devices where depth buffer was flipped

v1.9

- Fixed bug where screen would go black when the unity editor loses focus
- Improved performance by converting shader property ids to ints on initialization
- Made fog values public

v1.8

- Made fogValues setter public to enable manual setting of fog (for loading games)

v1.7

- Improved test scenes with enemies, better trees and smoother movements
- Put all code in FoW namespace
- Added toggle for max fog distance
- Made fog values publicly accessible via property
- Added method to calculate explored percentage
- Split fog planes and physics (ie 2D and 3D)

v1.6

- Fixed bug where fog was rendering on camera's far plane
- Fog can have textures applied to them
- Unit vision angles/cones

v1.5

- Add Secondary FoW to allow for multiple cameras

v1.4

- Added support for 2D (along the X and Y axes)

v1.3

- Fog now works with orthographic cameras

v1.2

- Added Clear Fog
- Included TransparentShadowCaster (see-through ground) shader

v1.1

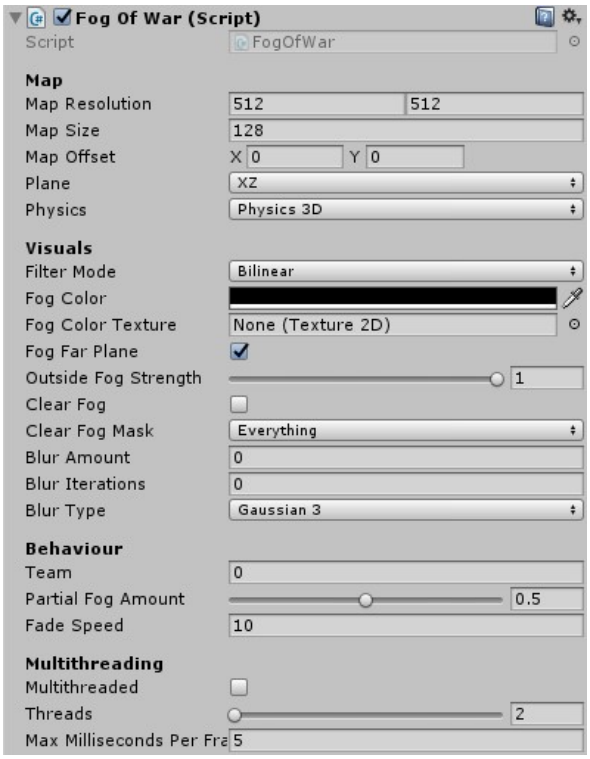
- Implemented Line of Sight
- Added new assets to demo
- Demo minimap now displays units
- Updated user guide considerably
- Added new method: Unfog(Rect)
- Camera zoomimg in the demo scene

v1.0

- Basic Fog of War implemented
- Basic demo

Components

FogOfWar



FogOfWar is the main component to handle the script. **It must be attached to the camera!**

Map	
Map Resolution	The resolution of the texture used to render the fog. Setting this to a high value can have a significant performance impact, so keep it as low as possible. It is recommended to always be a power of 2.

Map Size	The size of the map that the fog will cover in world coordinates. If using chunking, this should be the maximum area that the player can see if the player is in the center of the map.
Map Offset	If the map is not centered at the origin (0, 0) you can offset it with this. This has no effect when using chunking
Plane	Which plane the fog will be rendered to. 3D is usually XZ and 2D is usually XY
Physics	What physics will be used for raycasting and collision detection. This is Unity's built-in 2D or 3D.
Visuals	
Filter Mode	The filtering applied to the fog. Bilinear will have a smoother look, Point will have a pixelated feel to it.
Fog Color	The color of the fog.
Fog Color Texture	A texture that can be applied over the top of the fog.
Fog Far Plane	If true, anything at the camera's far plane will have fog rendered over it. If you want to see the skybox, set this to false.
Outside Fog Strength	Specifies how strong the fog will be outside of the fog map area. 1 = fully fogged, 0 = no fog.
Clear Fog	If true, a secondary camera will render the background content using the clear fog mask (see the Clear Fog section).
Clear Fog Mask	Determines which objects will be rendered in the clear fog (see the Clear Fog section).
Blur Amount	How far the blur will spread. This is measured in pixels of the fog texture. If this is zero, no blurring will be applied.
Blur Iterations	How many time the blur will be applied. If this is zero, not blurring will be applied.
Blur Type	The blurring algorithm that will be used. Gaussian 3 is slightly faster but usually doesn't give as good results as Gaussian 5.
Behaviour	
Team	The index of which team this fog will clear for. All units that have the same team index will have the fog cleared.
Partial Fog Amount	When a unit moves, the old visible areas will be partially fogged by this amount. This should probably not be changed at runtime.
Fade Speed	The speed at which the fog will return to the Partial Fog Amount. 0 = no transition.
Multithreading	
Multithreading	If true, multithreading will be enabled.
Threads	The total number of threads to be used on Fog of War. If Multithreading is not ticked, this will do nothing.
Max Milliseconds Per Frame	The maximum number of milliseconds that Fog Of War will spend on each frame. This applies to both single threaded and multithreaded Fog Of War. A higher value will slow performance but reduce stuttering.

Useful Functions

void Reinitialize()	Reinitializes fog texture. Call this if you have changed the mapSize, mapResolution or mapOffset during runtime. This will also reset the fog.
float ExploredArea(int skip = 1)	Returns how much of the map has been

	explored/unfogged, where 0 is 0% and 1 is 100%. Increase the skip value to improve performance but sacrifice accuracy.
void SetAll(byte value)	Sets the fog value for the entire map. Set to 0 for completely unfogged, to 255 for completely fogged.
Vector2i WorldToFogPlane(Vector3 position)	Converts a world position to a fog pixel position. Values will be between 0 and mapResolution.
Vector2 WorldPositionToFogPositionNormalized(Vector3 position)	Converts a world position to a normalized fog position. Values will be between 0 and 1.
Vector3 FogPlaneToWorld(Vector2 position, float v = 0)	Does the inverse of WorldToFogPlane().
byte GetFogValue(Vector3 position)	Returns the fog amount at a particular world position. 0 = completely unfogged, 255 = completely fogged.
bool IsInFog(Vector3 position, byte minfog)	Returns true if the position is in fog less than the specified amount. 0 = completely unfogged, 255 = completely fogged.
bool IsInFog(Vector3 position, float minfog)	Returns true if the position is in fog less than the specified amount. 0 = completely unfogged, 1 = completely fogged.
bool IsInCompleteFog(Vector3 position)	Returns true if the world position is completely fogged.
bool IsInPartialFog(Vector3 position)	Return true if the world position is at least partially fogged.
Unfog(Vector3 position, float radius, int layermask = 0)	Unfogs a part of the map. Position and radius are both in world coordinates. If a layermask is specified, Field of View will be checked
Unfog(Rect rect)	Unfogs a rectangular area on the map. Positions are all in world coordinates.
VisibilityOfArea(Bounds worldbounds)	Checks the visibility of an area, where a value of 0 is fully unfogged and 1 if fully fogged.

FogOfWarSecondary

FogOfWarSecondary has no values to change in the inspector. It must be on a camera gameobject, and will reuse the fog from the primary *FogOfWar* camera in the scene.

FogOfWarChunkManager

FogOfWarChunkManager will automatically move the map to center on the player. This allows for an infinite map that can run infinitely in all directions without a huge performance impact. The chunk manager also allows for vertical chunks. This is useful for games that cover multiple floors.

This component must be attached to the same game object as the FogOfWar component!

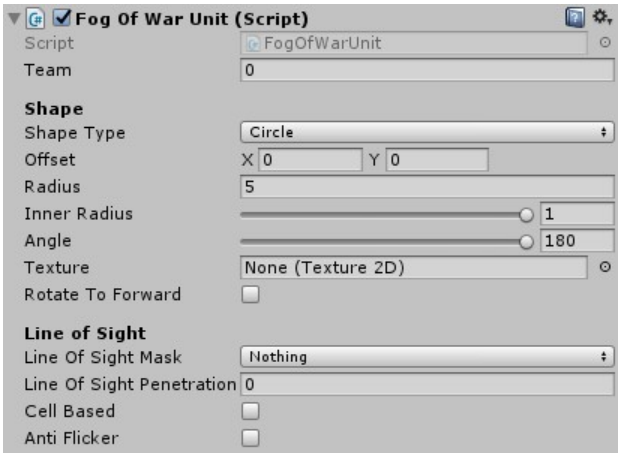
If you are making an RTS or a game where the whole scene must be updated at once, you should **not** use the chunk manager. The chunk manager works best with games where you control one character through a large environment.

There are some important things to note when using the chunk manager:

- The map resolution needs to be square and divisible by 2. It is recommended to use a power of 2.
- The map size is the size of the map that will be visible at any one time. This means that it should not cover the entire scene. It should be the maximum distance that the player can see at any time.
- The map offset has no effect when the chunk manager is enabled

Follow Transform	The game object that the fog should follow. This is usually the player.
Remember Fog	If false, the chunk manager will completely discard all fog information once a chunk is left.
Vertical Chunk Size	The size of a floor before the next vertical chunk is loaded. This should be the distance from one floor to another.
Vertical Chunk Offset	The offset from zero where the first vertical chunk is.

FogOfWarUnit

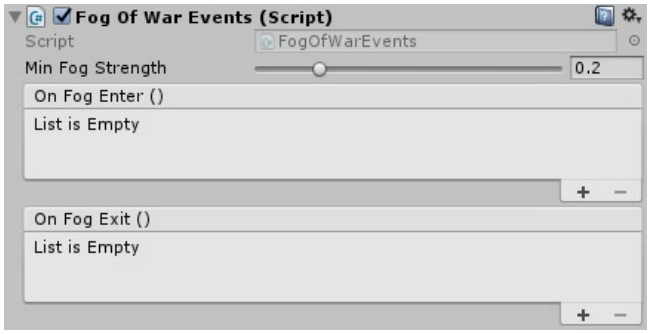


FogOfWarUnit should be placed on every unit that will have a range of vision.

Team	The index of the team that this unit is a part of. This must match the Team value on the Fog of War component for the fog to be cleared.
Shape	

Shape Type	Can be Circle, Box or Texture.
Offset	The offset from the unit's position where the shape's center will be.
Radius	How far the unit can see.
Inner Radius	How smooth the edge of the circle is. This only applies to Circle shapes.
Angle	View cone angle. 180 degrees is full vision, 0 degrees is no vision. The forward direction will always be Y+ for 2D and Z+ for 3D.
Texture	The texture that will be used to generate the shape. This must be a black and white texture where white is visible, and black is fogged. Make sure you set the texture to readable in the import settings!
Rotate To Forward	This only applies to texture shapes. If true, the texture will always face the same direction as the unit. If false, the texture will always be oriented to the world.
Line of Sight	
Line Of Sight Mask	A layer mask that specifies which objects will occlude the unit's vision. Be sure that the occluding objects have a collider on it and that they are at the same vertical height as the unit to be properly occluded. Enabling this can have a significant impact on performance with large radii.
Line Of Sight Penetration	How far through objects that the unit's vision will penetrate through.
Cell Based	Enable this if you are doing a tile-based game where one tile is the same size as one pixel on the fog map. This will make line of sight check collision properly. You would generally want to leave **Line Of Sight Penetration** to zero if this is enabled.
Anti Flicker	Enable this if flickering is occurring when using line of sight. This will snap the unit's position to the nearest fog pixel. The downside to this is that movements will become more jarring with slower movements with lower resolution maps. You can minimize this by applying a blur/antialiasing.

FogOfWarEvents



FogOfWarEvents allows you to set evens of what should happen when this GameObject enters or exits the fog. The position is based off the GameObject's Transform.

Min Fog Strength	The minimum fog strength until the OnFogEnter is registered.
On Fog Enter	An event that is called when the object enters fog that is a greater strength than MinFogStrength.
On FogExit	An event that is called when the object exits fog that is a greater strength than MinFogStrength.

HideInFog

HideInFog will hide the object when it enters fog. The object will be made invisible by enabling and disabling the Renderer, UI Canvas or UI Graphic attached to this GameObject.

Min Fog Strength	The minimum fog strength until the object is made invisible.

Known Issues

- Transparent shaders (ie blending) don't behave well with the fog. I am yet to find an efficient solution to this.

FAQs

Why does the fog appear to update at a slow frame rate?

You can easily change the update frequency in the FogOfWar component.

Updating the fog every frame for every unit can have a massive performance impact. To combat this, units update the fog individually. After a set amount of time, the fog is rendered and then the loop starts again.

If you only have a few units, updating the fog each frame may be viable. But if you have hundreds of units, the frame rate will become unbearable.

What is Clear Fog and how do I get it to work?

Clear Fog enables you to replace the fog with a different background. This can be used to create weird effects where the fog won't be just a single color.

To get it to work, there are a few steps you must take:

1. Make sure the **Clear Fog** is set to true.
2. Set the **Fog Color**'s alpha to zero.
3. Set the **Clear Fog Mask** to the objects that will appear in the background.

How can I improve performance for Clear Fog?

The main thing you want to do is make sure the **Clear Fog Mask** is set correctly. The mask should ONLY contain objects that will appear in the background (ie in the fog). Also, the camera's **Culling Mask** should contain only the objects that are NOT in the background (ie not in the fog).

You don't need to set the camera's **Clear Flags** to skybox as the skybox will be automatically set on the clear fog. This can help performance a tiny bit.

How can I have a see-through ground (ie a space scene)?

You need to have a surface for the fog to project on. But it is possible to make that surface transparent. There is a shader in the FogOfWar folder called **TransparentShadowCaster** which will allow you to do this.

One downside to this method is that objects in the background may not receive shadows.

How do I get Line of Sight working?

There are a few things you must do:

1. On each unit, make sure the Line of Sight Mask is set.
2. Make sure all occluding objects are of the same mask as set in step 1.
3. Make sure all occluding objects have a collider.
4. Make sure all occluding objects are level with the unit (ie they must be at the same height, or the unit will see right through it).
5. (Optional) Tweak the Field of View Penetration variable on the Fog of War component so that units can see the objects they are looking at.
6. (Optional) If you're game is tile-based, you should tick the Cell Based toggle.

What can I do to improve performance?

There are a number of things:

- Reduce the Map Resolution or the Unit's vision radius. This should always be the first port of call!
- Try multithreading! There are many things that dictates performance with threads, so your best bet is to open up Unity's profiler and see what works best for you.
- Blurring of large map resolutions can also have a significant impact on performance. To turn it off, set the Blur Iterations to zero. Less iterations will reduce the performance impact. I higher resolution map will also slow down the blurring process greatly.
- If you're using Line of Sight:
    - Make sure the ground/terrain is not on the same layer as the unit's Line of Sight Mask.
    - Make the Line Of Sight occlusion object's colliders as small as possible and space out the objects as much as possible. The more objects a single unit can see, the worse performance will get.
    - Consider setting the Field of View Penetration value to zero. An alternative to the penetration is to let the occlusion objects clear the fog themselves as opposed to letting the units do it.

How can I implement a minimap?

Fog of War will not generate a minimap for you, as there are many different parts to a minimap. But you can get the fog texture quite easily.

Fog is stored in a normal 2D texture with each pixel begin an 8-bit byte. A value of 0 means it is unfogged, 255 means it is completely fogged. If you want to convert the fog map to something more usable, you can find an example in the FogOfWarTestGUI.cs file (in the OnGUI() method).

How can I render fog to multiple cameras?

One camera needs to have the FogOfWar component attached. For all other cameras, you can use the FogOfWarSecondary component. It should automatically detect the original FogOfWar camera in your scene.

How do I save/load the fog?

You can access all of the fog values by **FoW.FogOfWar.current.fogValues**. This is a byte array and the size will depend on the **mapResolution** variable. You can read/write to this at any time.

Can I mix Unity's 3D physics with 2D art?

Yes! Set the FogOfWar plane to XY and physics to Physics3D.

Does FogOfWar work with tile-based games?

Yes! Just make sure to tick **Cell Based** on all units that use line of sight.

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