THE MODDERS GUIDE TO SID MEIER'S CIVILIZATION V

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version 1.00

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Core Concepts

What is Modding?

Modding is a slang expression for modifying hardware or software to do something different than the designer intended. Firaxis developed Civilization V (and earlier versions) with modders in mind. A mod could be as simple as tweaking the costs of some units and buildings, changing the AI so that it plays differently or adding a new civilization to the game. Or it could be as complex as a total conversion mod that creates a new game on the Civilization engine.

This document was written to help modders get a jump start on modding Civilization V by helping to communicate what's possible, learn the technical issues and get modders as quickly as possible from coming up with a mod idea, to publishing their own mod. Although this document covers a wide range of mod concepts, it doesn't cover everything that can be done with Civ5. In particular source code mods and 3d art changes aren't covered in this document.

What has changed since Civilization IV?

Many games are moddable, but Civilization IV set a new standard by designing the game from the ground up with modability in mind. The game database (XML) was editable with a text editor, a scripting language (python) was included so players could create their own events and functions and the source code for the core DLL could be edited with a C++ compiler. This made Civilization IV more than a game, it's a foundation for modding.

As open and powerful as this engine was, there were significant limitations.

1. Mods were difficult for users to find, download and install.
2. Mods didn't work together without a significant amount of work from modders to integrate them.
3. Although python was a powerful scripting tool, it significantly impacted the games performance.

Civilization V improves on the modability offered in Civilization IV, and resolves all three of these issues. Civilization V features an in game mod menu (Mod Browser) which allows users to find, download and install mods they want to try. It is now easy to produce mods that players can run together with other mods, allowing players to choose exactly what mod or groups of mods they want to run for their game. And python has been replaced with Lua, which integrates better with the C++ core and has less of a performance impact than python.

Modular Design

Civ4 modders will be accustomed to replacing files to make changes. If a new Civ4Civilizations.xml file is added to the mod the base Civ4Civilizations.xml won't be used. That is not the case with Civilization V. Instead of replacing files all mods automatically inherit the base objects, and modders must delete those objects if they aren't to be used in this mod (this guide will cover how to do that later). A modder creating a Civil War mod can create a Union and Confederacy civilization, but will also need to explicitly delete the base civilization's so that they aren't available (otherwise, France, Russia, etc will be available civilizations in the Civil War mod).

The advantage of this is that it makes mods modular. The game assumes that all assets are being used unless a mod specifically tells it not to. That way one mod may add a Canadian civilization, one mod may remove the German civilization and replace it with a new one, and another mod may add an Atlantis civilization. These mods can all be loaded together without any special integration by a modder. With enough mods available every players preferred mix of mods can be effectively unique.

XML

XML is a format for qualifying data. It isn't a programming language, it's a language for storing information. In Civilization V XML is used to store the attributes of the different game assets. The cost of a unit, the name of a leader, the starting units for a civilization are all defined in XML.

The advantage of XML is that it is modifiable with a text editor and users don't have to learn a programming language to use it. Consider the following XML definition of a settler:

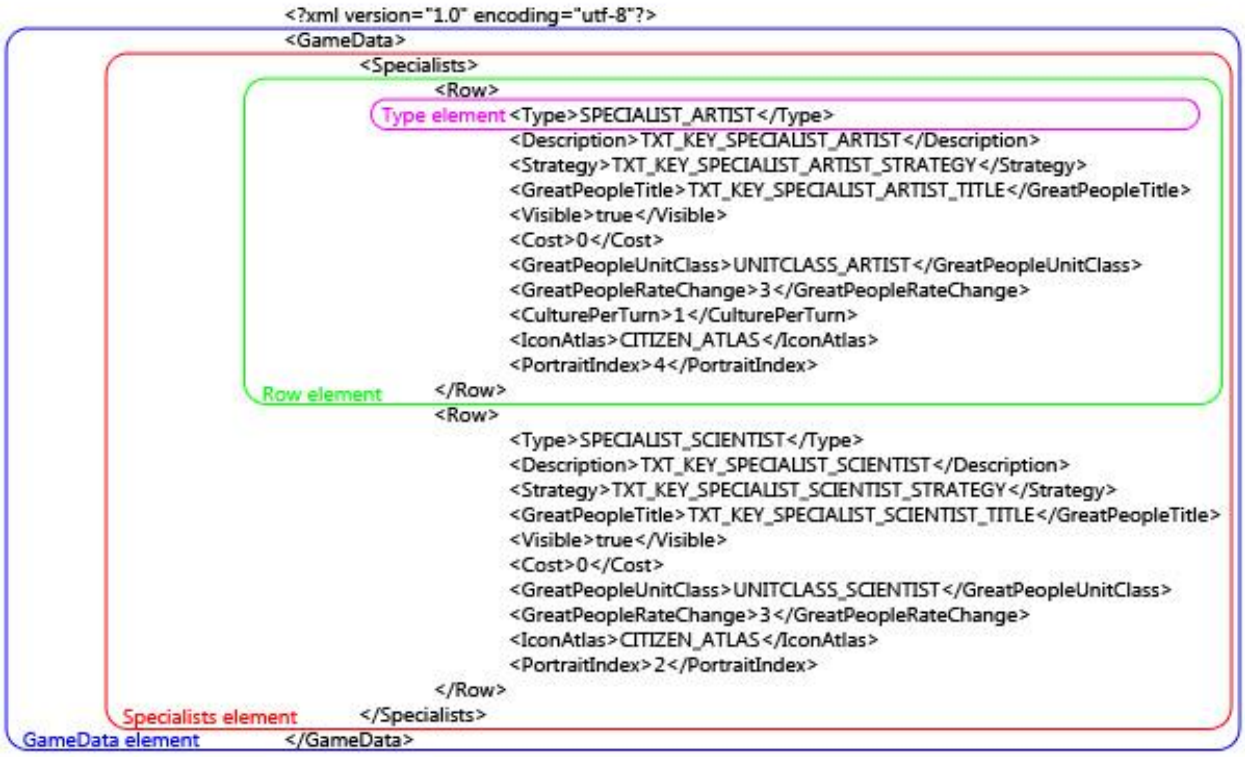
```
<Row>
        <Class>UNITCLASS_SETTLER</Class>
        <Type>UNIT_SETTLER</Type>
        <Moves>2</Moves>
        <Capture>UNITCLASS_WORKER</Capture>
        <HurryCostModifier>33</HurryCostModifier>
        <Domain>DOMAIN_LAND</Domain>
        <DefaultUnitAI>UNITAI_SETTLE</DefaultUnitAI>
        <Description>TXT_KEY_UNIT_SETTLER</Description>
        <Civilopedia>TXT_KEY_CIV5_ANTIQUITY_SETTLER_TEXT</Civilopedia>
        <Strategy>TXT_KEY_UNIT_SETTLER_STRATEGY</Strategy>
        <Help>TXT_KEY_UNIT_HELP_SETTLER</Help>
        <Requirements>TXT_KEY_NO_ACTION_SETTLER_SIZE_LIMIT_HARDCODED</Requirements>
        <Food>true</Food>
        <Found>true</Found>
        <CombatLimit>0</CombatLimit>
        <UnitArtInfo>ART_DEF_UNIT__SETTLER</UnitArtInfo>
        <UnitArtInfoCulturalVariation>true</UnitArtInfoCulturalVariation>
        <PortraitIndex>0</PortraitIndex>
        <IconAtlas>UNIT_ATLAS_1</IconAtlas>
</Row>
```

In this definition the attributes of a Settler are defined. These are divided in elements where each element has a start-tag (in < > such as <Moves>) and an end-tag (in </ > such as </Moves>). The data is between the start-tag and the end-tag is the data (the 2 that represents that the Settler has a 2 movement). Changing the movement of a settler to 3 tiles per turn is as easy as changing that 2 to a 3.

Note that <Row> and </Row> are also tags. So the entire settler definition is one element with child elements inside of it.

Don't be confused if all of the elements don't make sense yet. If it is your first time looking at XML you will probably be surprised at how much of it you can guess at. Firaxis has done an excellent job of making Tags easily readable. <Domain>DOMAIN_LAND</DOMAIN> means that the settler is a land unit. <Capture>UNITCLASS_WORKER</Capture> means that when a settler is captured it turns into a worker, etc.

Elements can contain other elements. In the above example the Row element (that has the start tag of <Row> and the end tag of </Row>) contains all the elements for a Settler. Here is a more complex example:



In the above the GameData element is the entirety of the blue region. The Specialists element is the entirety of the red region. Note that there are two Row elements within the Specialists element for two different specialists, much as the Row element contains many different elements for the attributes of those specialists. The first Row element is the green region and it is the full definition for the Artist specialist, and the purple region is a single attribute of the Artist specialist.

Schema

Schema is the definition for XML elements. In Civ terms this means that Schema determines if the <Moves> tag holds a text string, a boolean or an integer (Moves is an integer). It also defines the default settings for an attribute, unlike in Civ4 where modders had to define every attribute, in Civ5 default values are defined in schema so that if they aren't set the default value is used.

You may have noticed that there are a lot of unit attributes that weren't on the setter definition in the proceeding section. For example it doesn't say if the settler is allowed to pillage or not. There is a attribute called Pillage that is defined in schema as follows:

```
<Column name="Pillage" type="boolean" default="false"/>
```

This schema definition shows that the Pillage element is a boolean. It can be either <Pillage>true</Pillage> or <Pillage>false</Pillage>, but nothing else. We also notice that the default

value for Pillage is false. So we don't need to add it to a units definition if it is false, since that's the default. Which is why a settler doesn't need to have it set.

If you want to know what attributes are available for an object you should look at the schema definition for that object type. Sometimes we find attributes that aren't being used, things that can be used in Mods even if they aren't used in the base game. Consider the following from CIV5HurryInfos.xml:

```
<GameData>
	<!-- Table definition -->
	<Table name="HurryInfos">
		<Column name="ID" type="integer" primarykey="true" autoincrement="true"/>
		<Column name="Type" type="text" notnull="true" unique="true"/>
		<Column name="Description" type="text"/>
		<Column name="PolicyPrereq" type="text" reference="Policies(Type)"/>
		<Column name="GoldPerProduction" type="integer" default="0"/>
		<Column name="ProductionPerPopulation" type="integer" default="0"/>
		<Column name="GoldPerBeaker" type="integer" default="0"/>
		<Column name="GoldPerCulture" type="integer" default="0"/>
	</Table>
	<!-- Table data -->
	<HurryInfos>
		<Row>
			<ID>0</ID>
			<Type>HURRY_POPULATION</Type>
			<Description>TXT_KEY_HURRY_POPULATION</Description>
			<PolicyPrereq>NULL</PolicyPrereq>
			<ProductionPerPopulation>60</ProductionPerPopulation>
		</Row>
		<Row>
			<Type>HURRY_GOLD</Type>
			<Description>TXT_KEY_HURRY_GOLD</Description>
			<PolicyPrereq>NULL</PolicyPrereq>
			<GoldPerProduction>6</GoldPerProduction>
		</Row>
	</HurryInfos>
</GameData>
```

In the above we have the schema definition between <Table name="HurryInfos"> and </Table> (highlighted in red). There are eight attributes defined in schema, ID, Type, Description, PolicyPrereq, GoldPerProduction, ProductionPerPopulation, GoldPerBeaker and GoldPerCulture.

The actual assets are defined as Rows between <HurryInfos> and </HurryInfos> (highlighted in blue). There are two, HURRY_POPULATION (sacrificing population to rush production) and HURRY_GOLD (paying gold to hurry production). But the attributes for PolicyPrereq, GoldPerBeaker and GoldPerCulture are never used. These are attributes modders can use in their mods even though they aren't used in the base game.

Also notice that in the above example, schema is defined at the beginning of the file with the asset type it controls. This is different than how it was handled in Civ4, where schema was a separate file.

Understanding References

In Civilization nearly every asset relates to every other. The unit definition may reference technology's required to build that unit, a civilization definition may reference units that are unique to that civilization, a leader definition may reference a trait. This makes deleting an object more complex since all references to that object need to be deleted as well.

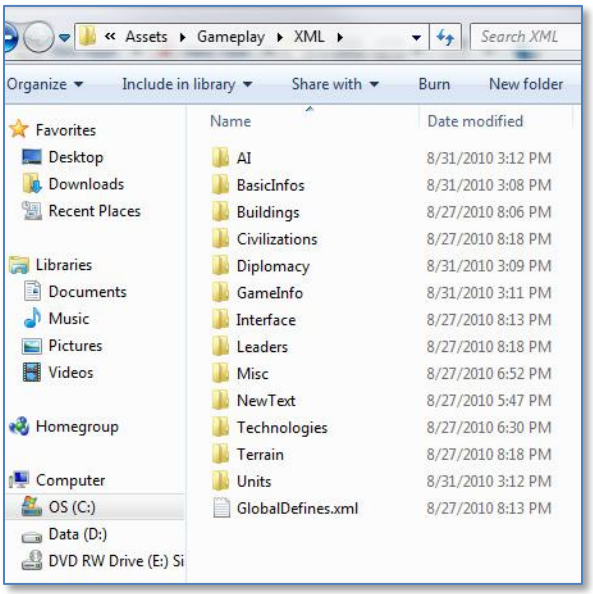
For example, if we want to make a mod that removes the Oil resource from the game. We can't simply delete the Oil resource from the CIV5Resources.xml file. If we did that we would get an error when the game loaded when the improvements loaded (because they refer to Oil as a resource that makes certain improvements valid), when the units loaded (because some units refer to Oil as a requirement to being built) and when the traits loaded (because a trait boosts Oil production).

The same is true for adding new objects to the game. If you add a new civilization and you refer to a leader that you haven't added yet, or a unique unit that you haven't added then you will get an error loading your mod.

If you want to add one piece at a time and make sure it works you may want to use already existing references until you make the ones specific to new object you are adding. If you are adding a new civilization you may want to use LEADER_WASHINGTON as the leader and UNIT_AMERICAN_B17 as the unique unit so you can load and test your civilization before going back and adding a new leader and unique unit.

XML File Structure

The XML file structure is contained in <install directory>\assets\Gameplay\XML\ directory. Unlike Civilization IV, this exact file structure isn't critical since we aren't replacing files. But it is important to know where the files exist so modders can look up the current definitions. In general schema is defined at the beginning if the file for that type of asset, so it's also a good place to look for available attributes.



GlobalDefines.xml- Contains the default definitions for a wide range of game settings such as the starting year, initial city population and max buildings per city (defaults to unlimited). Hundreds of game rules changes can be made simply by modifying the values in this file.

AI- This directory contains a wide range of AI configuration files. Things that were only possible by modding the source code in Civilization IV can be easily changed in XML. There are files for city strategies, economic strategies, grand strategies (what sort of victory the AI will pursue), military strategies, tactical moves, diplomacy and general AI defines (for things like how quickly the AI expands, how much it values gold, etc).

BasicInfos- This directory covers the definition of all the more mundane game assets. Unit Combat types are defined here, Invisibility types, domains, etc. In general these are simple declarations (just naming a type without any attributes) and they aren't commonly changed by modders. But if you set an invisibility type (for example) on a unit the game needs to have a place where that invisibility type is defined, which it is here.

Buildings- Much as you would expect the building definitions are held here. There are two files, one for the Building Classes and another for the actual Buildings.

Building Classes are base definitions for buildings, for example a Barracks. But there can be multiple Buildings for a single Building Class. So the Barracks Building Class has two Buildings referenced to it, the Barracks and the Krepost. Allowing multiple buildings to be referenced to one Building Class is the games way to replace buildings for a civilization. So one civilization builds a Krepost instead of a Barracks as a unique building. But since both Barracks and Krepost are associated with the Barracks Building Class the game can simply refer to it as a Building Class Barracks and know that it will get whatever form of the barracks is available for that player.

As an example all civilizations start with a free BUILDINGCLASS_PALACE. If you created a new civilization and gave it a unique palace your new building wouldn't be a BUILDING_PALACE, but would be associated with BUILDINGCLASS_PALACE so that when the free palace was given out your new civilization would get its custom palace instead of the standard one.

Civilizations- Civilizations, Minor Civilizations, Regions and Traits are defined here. Civilizations will probably be one of the first things people want to mod and add to and this document will cover a specific example of that later on.

Diplomacy- This is where all the text strings for things like the first greeting, declaration of war, refusal of deals, etc are all linked.

GameInfo- This is where Firaxis stuck everything that doesn't fit anywhere else. The following files and assets are defined here:

- **CIV5ArtStyleTypes.xml**- The list of the available ArtStyles for cities. This is reference for the civilization definitions. There is very little to add here since it is just a tag for the name.
- **CIV5Climates.xml**- These are the definitions for the various climate types (arid, cold, temperate, tropical, etc) with variables use by the random map generator to create the world. Though this won't be as flexible as creating a unique mapscript, this is an easy way to allow players to select maps with more or less jungle, forests, mountains, deserts, etc.
- **CIV5CultureLevels.xml**- This file is obsolete and unused in Civilization V.
- **CIV5Cursors.xml**- This is a link to the cursor animations that are used by the game. Creating a new cursor set is as easy as adding new .ani files and updating this file with the new link.
- **CIV5EmphasizeInfos.xml**- This file is obsolete and unused in Civilization V.
- **CIV5Eras.xml**- In general these are the settings for late game starts (determining how many units you start with, starting gold, if goodie huts should be spawned, etc). But it does contain some attributes for games that reach these eras such as a modifier to improvement build times, free population in new cities and the definition for the city art (so your cities

look differently in different eras). The EventChancePerTurn and SoundtrackSpace attributes in this file are obsolete.

- **CIV5Flavors.xml**- This is a list of tags used in other files for flavor types.
- **CIV5ForceControlInfos.xml**- This file is obsolete and unused in Civ5.
- **CIV5GameOptions.xml**- These are the tags for the Game Options (quick combat, raging barbarians, etc).
- **CIV5GameSpeeds.xml**- This is where the game speeds are defined. They include modifications to the build speed, population growth and improvement growth.
- **CIV5GoodyHuts.xml**- Contains all the possible goody hut results. The actual chance that each result is returned is based on the difficulty level which is configured in CIV5HandicapInfos.xml.
- **CIV5HandicapInfos.xml**- This is where the difficulty levels are set. It's a great place to see what changes at the different difficulty levels. In this file we can see that "EarliestBarbarianReleaseTurn" at settler difficulty is 10000. Most modders won't change the difficulty adjustments, but some modders increase the AI's advantage to balance for new mechanics that favor human players. Others may decrease the AI's advantage if they improve the AI enough that it doesn't need the boost.
- **CIV5HurryInfos.xml**- This is where production rush methods are defined. If you want to modify the amount production given for population sacrifice or the amount of gold per production to gold rush, this is the file to do it in.
- **CIV5IconFontMapping.xml**- This is the file where the icon assets (such as ICON_BULLET) is mapped to a picture in the icon atlas.
- **CIV5IconTextureAtlases.xml**- This is where icon atlas's (such as TECH_ATLAS_1) are mapped to specific files (such as TechnologyAtlas.dds). It is useful to see what dds files are mapped to if modders want to change the icons, or if a modder wants to add a new icon atlas.
- **CIV5MultiplayerOptions.xml**- This is where the multiplayer game options are defined. There are no attributes on these options other than their default state, and text strings. All of the real definition is handled in the source code. Because of that adding a new Multiplayer Option to this file will cause a new option to appear in the selection lists, but it won't do anything.
- **CIV5PlayerOptions.xml**- This is where all the non-multiplayer game options are defined. Just like the multiplayer game options there aren't any meaningful attributes here. The real effect of having these options enabled or disabled happens in the source code.
- **CIV5Policies.xml**- This is where all the policies are defined. Policies are all linked to a policy branch here. All aspects of a policy are defined here, though you may have to look through the several tables in this file to get all the information.
- **CIV5PolicyBranchTypes.xml**- This is where the policy branches are applied. The only real configuration stored on them is if one branch blocks another. Outside of that, they are available for modders to add or remove policy branches that policies set in CIV5Policies.xml can be configured to use.
- **CIV5Processes.xml**- The build wealth and build research options can be modified in this file if a modder wants to change the ratios.
- **CIV5Projects.xml**- Projects are defined here. Notice that there is a table defined in schema that isn't being used, Project_ResourceQuantityRequirements, which may allow modders to create some interesting projects.
- **CIV5SeaLevels.xml**- This file determines the increased probability of ocean tiles based on the players choice of sea levels.

- **CIV5SmallAwards.xml**- This file is unused in Civ5. It appears to be capable of displaying notifications when thresholds around victory points, number of cities and population are reached.
- **CIV5Specialists.xml**- This is where the specialists are defined. You can use this file to modify the amount of yields produced by various specialists, add or remove specialists from the game, or change the amount they contribute to various great people.
- **CIV5Trades.xml**- This file controls the AI weight valuations for trades (what the AI values research, culture and gold at).
- **CIV5TurnTimers.xml**- These define the turn timers when auto-end turns are set in the multi-player game options.
- **CIV5Victories.xml**- This is where the victory conditions are defined. In general the victory conditions in Civ5 don't expose much to modding. The domination victory, for example, just has the Conquest element set to true(<Conquest>true</Conquest>). What the Conquest element does is set in the source code, not exposed to XML. But looking closely at schema for this file shows that there is a table defined in schema that isn't being used, VictoryPointAwards. Firaxis has a victory point system integrated and unused in Civ5. A modder can add new Victories that don't have WinsGame set to true and then assign points to them in the VictoryPointsAwards table.
- **CIV5Votes.xml**- This file is obsolete and unused in Civ5.
- **CIV5VoteSources.xml**- This file is obsolete and unused in Civ5.
- **CIV5Worlds.xml**- This is where the world sizes are defined. The grid width and height (how tall and wide the map is) are configured here as are the default players and some tunables. Adding a new map size to this file doesn't work well because most of the map scripts refer to the map sizes by name to set variables. If the new map size isn't one of the names the script accounts for then it won't work correctly.

Interface- The definitions for interface modes, colors and player colors are here. Player colors become important if you want to look and see what player color to assign to a new civ you create. A player color is the primary color, the secondary color and the text color for players using that player color. Player color red, for example, has a primary color of red, a secondary color of white and a text color of red. In the colors file is where the colors are defined (as in exactly what "COLOR_RED" is). Civ5 uses this to assign more than just traditional colors, but has color defines for things like COLOR_TECH_TEXT.

Leaders- This folder is setup differently than the others. Rather than having a common file with all the schema and assets Firaxis has the schema in one file and each leader in their own file. This doesn't affect modability, but it does make it easier to look at all the values specific to a leader, and a bit more difficult to compare values between leaders.

Misc-This is where notifications and routes (roads and railroads) are defined. Modders may be interested in changing the yields or movement rate modifier from roads or railroads.

NewText- This is where all the text values used in the game are assigned to actual strings. Where TXT_KEY_CIV_ARABIA_DESC is set to decode to "Arabian Empire" for English players. There is a separate directory for German (de_DE), English (EN_US), Spanish (es_ES), French (fr_FR), Italian (it_IT) and Japanese (JA_JP). English modders who want to find out what a specific text value decodes to will want to look in the files in the /XML/NewText/EN_US/ directory.

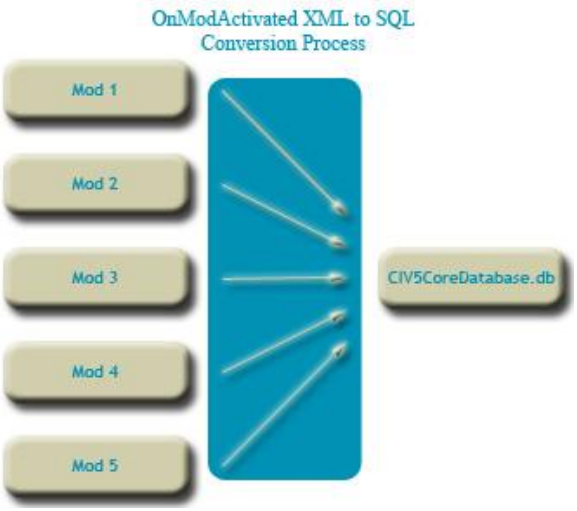
Technologies- This is where the technologies are defined. Technologies have GridX and GridY elements. These determine where the tech is displayed on the tech tree. When adding a technology you may need to update the GridX and GridY attributes of other technologies to make room for it in the tech tree.

Terrain- This is where features (including unique features), improvements, resources, terrains and yields are defined.

Units- Units and anything related to units are defined here, including promotions, builds, missions, formations, etc.

SQL

XML is just an intermediate domain specific language that is translated into SQL and then executed on the database. Typically, after you've run the game once and the XML files have not changed, you will simply load from the .db files directly. This improves performance. Firaxis kept the XML format for familiarity, it isn't directly used by the game.

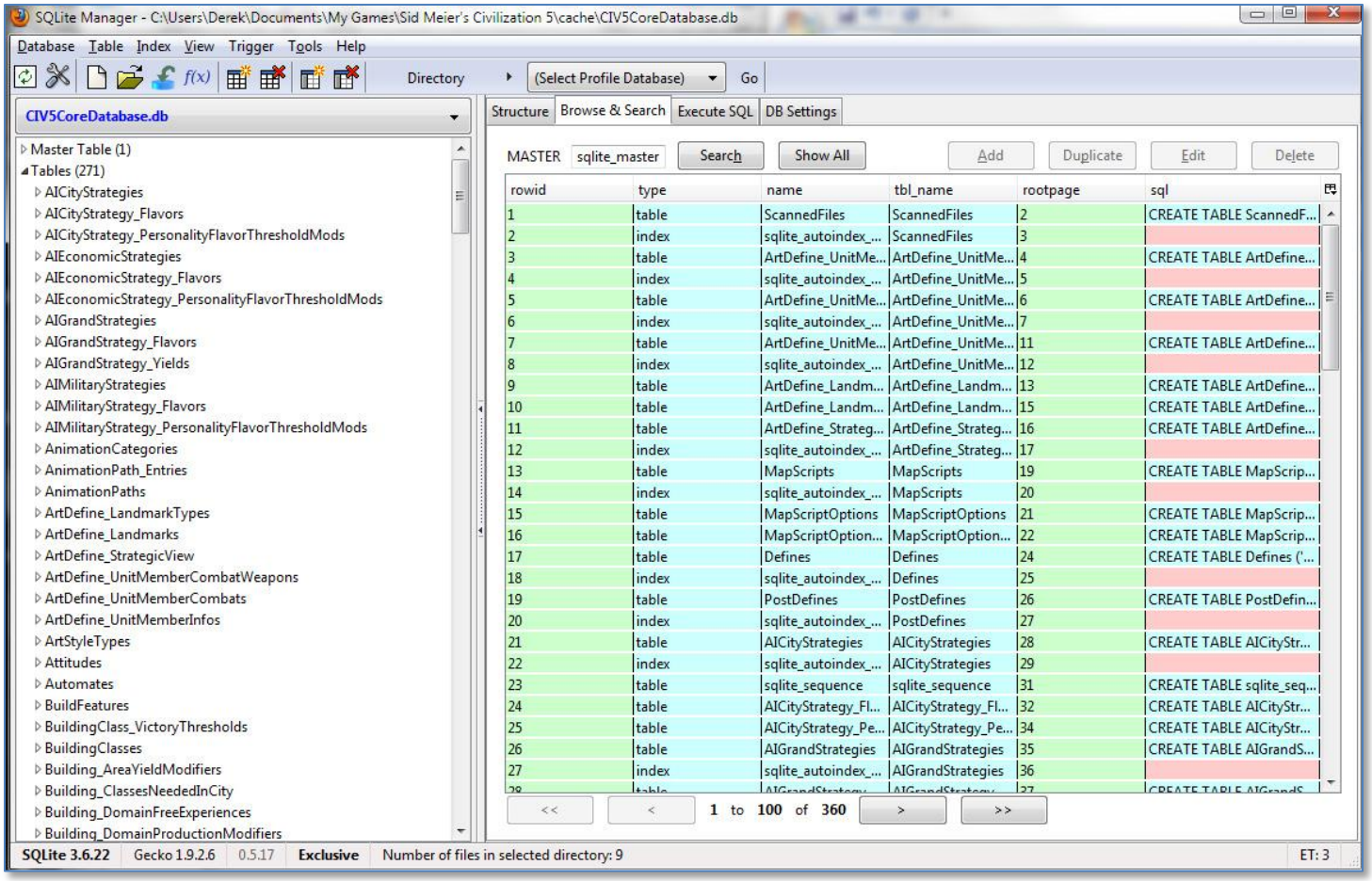


Effectively the XML files are translated into SQL queries and run against the database. Direct SQL files can also be run. SQL files have their pros and cons. The downside to SQL is that the modder must be familiar with the language whereas the upside is that they can write very complex transforms that cannot be expressed in XML.

Viewing the database

The easiest way to view the game database is to install Firefox with the SQLite Manager addon (https://addons.mozilla.org/en-US/firefox/addon/5817/).

Once it is installed, you can open SQLite Manager by opening Firefox and going to Tools->SQLite Manager. At the top menu in the application, go to Database->Connect Database. Navigate to <My Documents>/My Games/Sid Meier's Civilization V/cache/. Now, making sure that the file type drop down is set to "All Files", select CIV5CoreDatabase.db. Select OK and you can now view the database contents.



The files in the cache folder are subject to getting deleted and replaced while the game is running so if you wish to make data changes, do so in the XML and not directly in this file.

SQL Examples

The following examples can be applied by including an sql file with your mod. It is often a faster way to modify a lot of settings rather than manually changing each one.

-- Make all buildings and units except the Settler and Scout unbuildable

```
UPDATE Buildings SET 'PrereqTech' = 'TECH_FUTURE_TECH' WHERE Type <> 'BUILDING_PALACE';
UPDATE Units SET 'PrereqTech' = 'TECH_FUTURE_TECH' WHERE Class <> 'UNITCLASS_SETTLER' and Class <> 'UNITCLASS_SCOUT';
```

-- Another way to block the creation of certain unit's

```
UPDATE UnitClasses SET MaxPlayerInstances = 0 WHERE Type IN
("UNITCLASS_SETTLER","UNITCLASS_ARTIST","UNITCLASS_SCIENTIST","UNITCLASS_MERCHANT","UNITCLASS_ENGINEER");
```

-- Display All Civilizations

```
for civ in DB.Query("select * from Civilizations") do
    print(civ.Type);
```

```
    end
```

-- Display All Units that cost more than 200

```
    for unit in DB.Query("select * from Units where cost > 200") do
        print(unit.Type);
    end
```

-- Display the RGB Values of the PrimaryColor for All Player Colors

```
    for color in DB.Query("select Colors.Red, Colors.Green, Colors.Blue from PlayerColors inner join Colors on PlayerColors.PrimaryColor
= Color.Type") do
        print(string.Format("R: %f, G: %f, B: %f", color.Red, Color.Green, Color.Blue);
    end
```

-- Display all American leaders

```
    local myCiv = "CIVLIZATION_AMERICA";
    for leader in DB.Query("select * from Leaders inner join Civilization_Leaders on Leaders.Type = Civilization_Leaders.LeaderheadType
where Civilization_Leaders.CivilizationType = ?", myCiv) do
        print(leader.Type);
    end
```

Lua

The Relationship between XML and LUA

UI's in Civ5 are an XML/Lua pair. The XML specifies the controls and hierarchy while the Lua specify the logic. XML builds the UI, it determines what buttons appear where, what the tables look like, etc, while Lua is the programming language that controls what happens when you press a button, or how the table is populated.

References

There are a lot of good Lua programming guides. Many of which can be picked up at your local bookstore or ordered from Amazon. A good online reference is the following:

Lua 5.1 Reference Manual by Roberto Ierusalimschy, Luiz Henrique de Figueiredo, Waldemar Celes: http://www.lua.org/manual/5.1/manual.html

Scripting Events

Lua scripts cannot directly call functions in other Lua scripts. Instead there is a LuaEvents interface that allows Lua Scripts to add functions that become globally available.

If you need a function to be callable by another Lua script you will need to create a LuaEvents function to do it such as:

```
LuaEvents.ToggleHideUnitIcon.Add(
function()
	if (bHideUnitIcon) then
		bHideUnitIcon = false;
	else
		bHideUnitIcon = true;
	end
end);
```

The above function has been registered with the LuaEvents engine and can be called by any Lua script by:

```
LuaEvents.ToggleHideUnitIcon();
```

Which would run the ToggleHideUnitIcon in the first script and change the bHideUnitIcon value for that script.

Creating a Mod

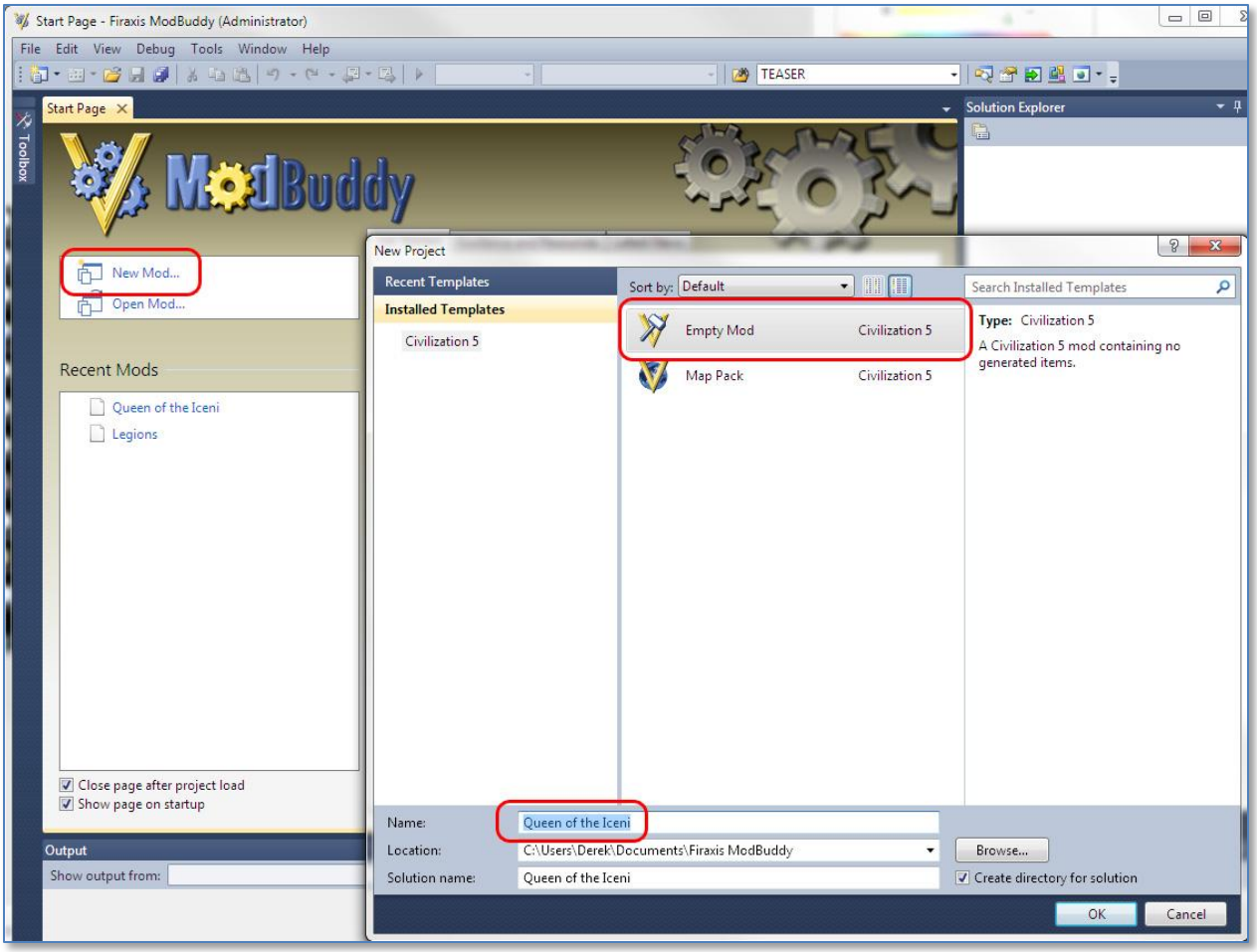
ModBuddy

ModBuddy is the primary modding tool Firaxis provides to make modding easier than it has been in prior versions. ModBuddy is a full featured XML and Lua editor with plugins built to handle building Civ5 mod project, publish mods and templates to make modding easier.

Creating a Mod

Follow these steps to get started on your own mod. (Screen shots may differ slightly from the release version since I'm using beta versions of all the tools to create this document).

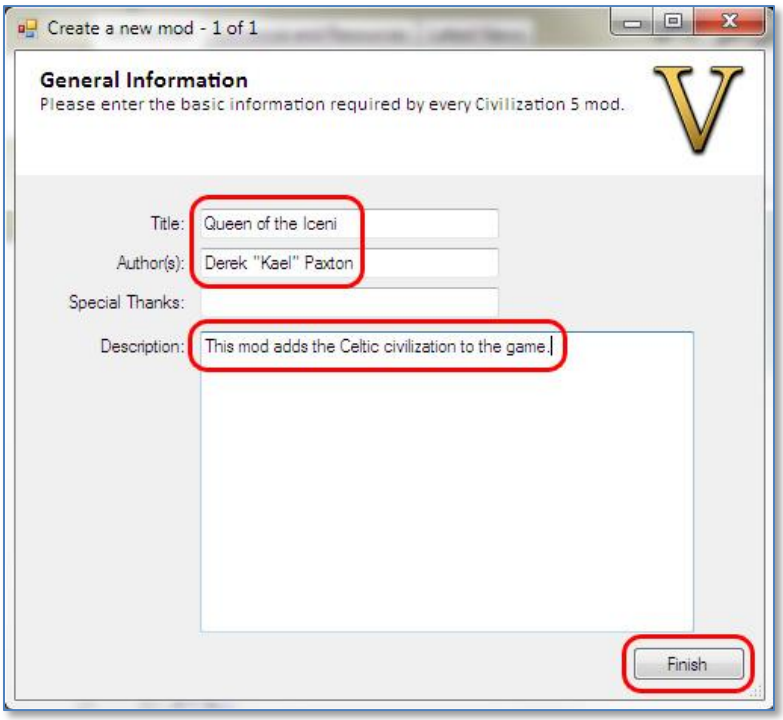
1. Load ModBuddy (the Sid Meier's Civilization V SDK).



2. From the Main menu of ModBuddy select "New Mod"

3. Select "Empty Mod", give our Mod a name and click "OK".

4. On the general information screen enter the mod's title, author and description. Note that the Mod's title and description have to be at least 8 characters long. In this example I've selected "Legends of Civilization" and the title, put my name in as the author and put in a brief description.



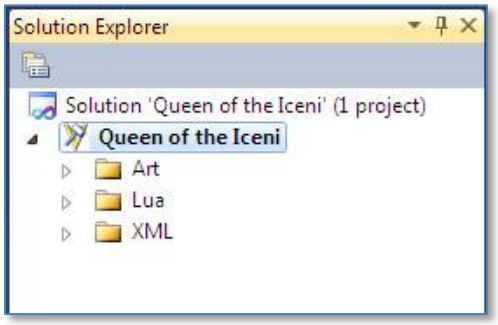
Once that is done select "Next".

That is all you need to create a new mod. The mod doesn't do

anything yet, we will get to that later sections.

Organizing Your Project

There is no required directory structure for your mod project in ModBuddy. Modders can places the files where it is convenient for them and their project. Many people may start by creating files at the root of the project but as the project grows having all the files in one location can be frustrating and waste the modders time.



Renaming, moving and deleting files, if you want to reorganize them later, is fairly easy to do (files aren't typically referenced by their path).

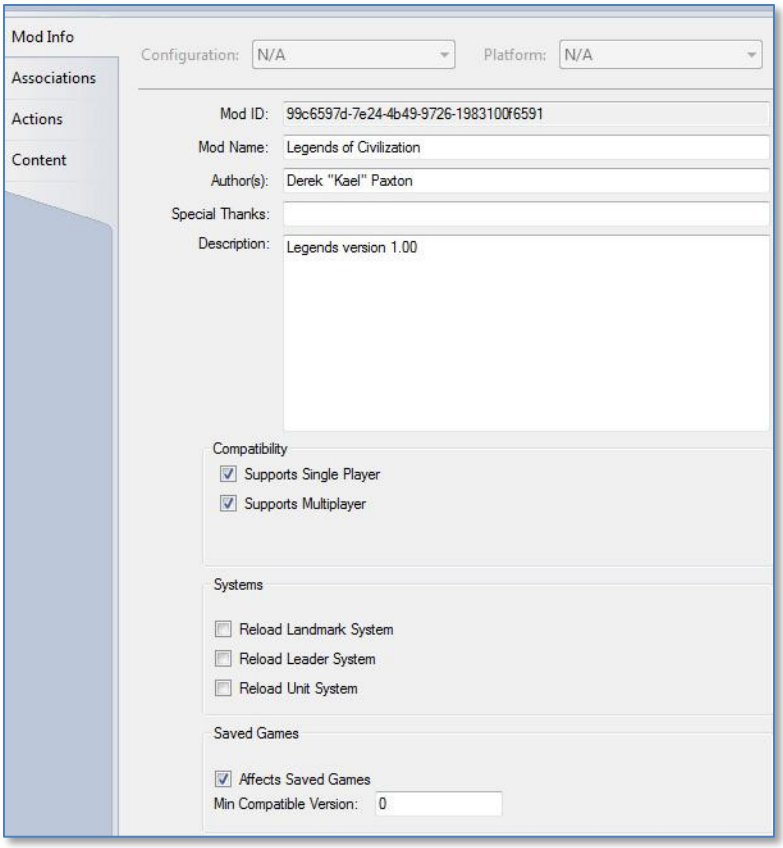
I would recommend creating three folders off of your project, Art, Lua and XML. These serve as a good base for separating the different types of files we will be working with. Within the Art, Lua and XML folders I tend to follow the same directory structure that Firaxis used with Civilization V because, it's as good as any other, and it helps me remember where things are if things are setup consistently. For example, beneath the XML directory I created a Civilizations directory to place the new civilization XML files.

There isn't any reason to create directories if there aren't any files within them. So if your mod doesn't have any art files don't bother creating an Art directory. If your mod doesn't have any XML Leaders files then don't bother creating an XML/Leaders directory.

Note: This is one way to organize your project. It is equally valid to organize your project by your assets instead of asset types. You could, for example, have a directory for each Civilization you are adding to the game. That directory would contain all the civilization XML, leader XML, unique unit XML, art, audio and Lua files required for that civilization.

Mod Properties

Right click on Mod icon in the Solution Explorer and select properties to view the mod properties. This is where the mod instructions are setup, and modders should become familiar with the options here (especially the Actions tab) to configure and enable the features their mod needs.



Mod Info- This contains all the setup information you entered

when creating your mod. It can be updated if you add new members to your team, you want to modify the description, or add thanks to more people. This is what people see when they browse for mods.

Compatibility- By default mods are listed as being compatible with Single Player and Multiplayer. Unchecking these boxes removes that compatibility. Checking or unchecking this box doesn't change the mod at all (unchecking Supports Multiplayer doesn't change a mod to make it work in multiplayer) it only controls the options available with that mod for those users.

Systems- The art system is loaded before mods are. So if your mod changes landmarks, leaders or units then these options need to be selected to allow the game to reload those graphics. As an example a later mod in this document will change the scale of unit models. That change won't take effect if we don't have "Reload Unit System" checked.

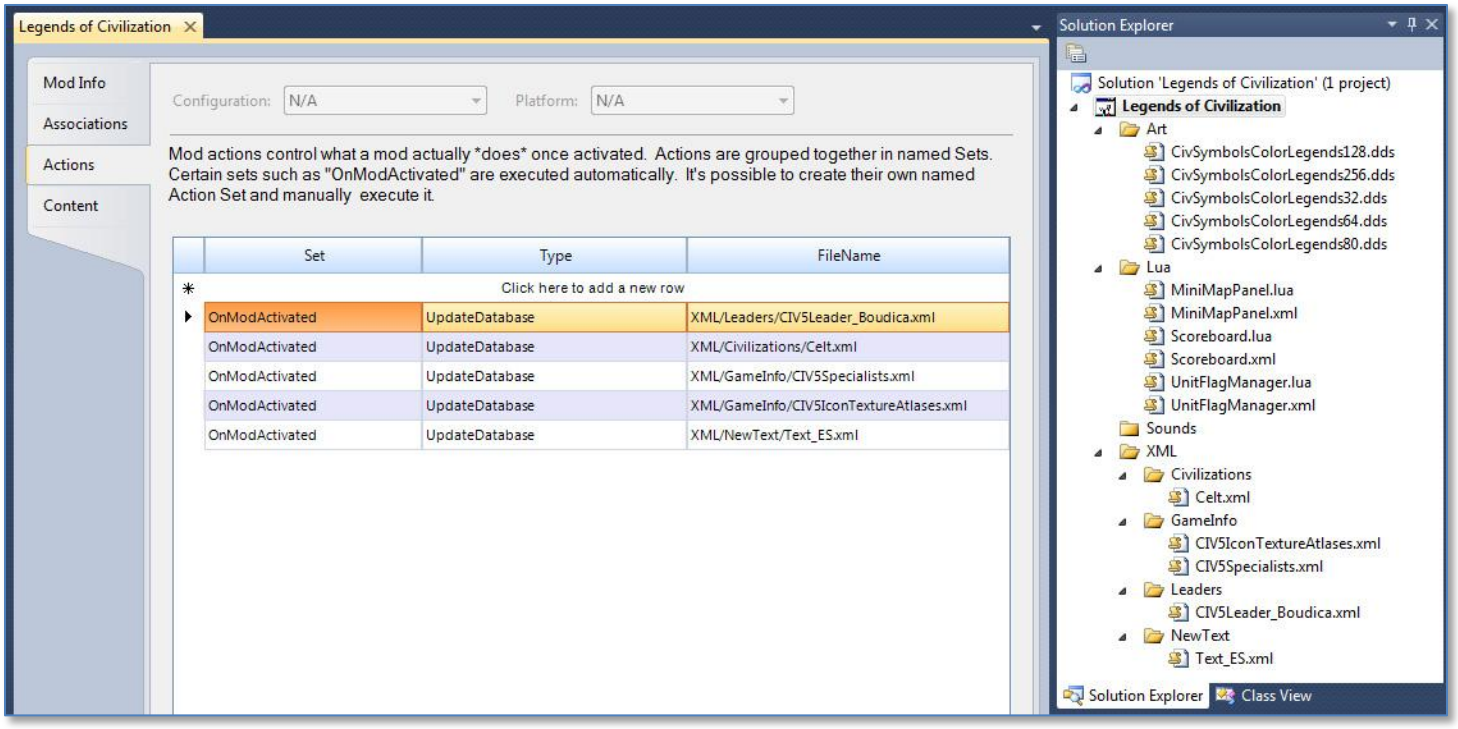
Saved Games- If the mod effects save games then this option has to be selected. It is selected by default. Unchecking this option means that saves created when this mod is running can be loaded by the base game without the mod in place. This is possible only for UI and balance mods that don't add or remove assets to the game. If you add anything, such as a new civilization, then your mod will affect save games (since the base game doesn't have your civilization and will crash trying to reference it). As with compatibility checking or unchecking this box doesn't change your mod, it doesn't make your save games any more or less compatible with the base game.

Associations- This is where associations are made to other mods. there are three types:

- Dependencies- Mods that are required before you mod can load.
- References- Optional mods that can be loaded to work with your mod (important if you are using a partially exclusive or totally exclusive mod).
- Blocks- Mods listed here cannot be loaded with your mod.

Actions- Actions are required to tell the game which files need to be run when your mod loads. By default, having files included with your mod won't change anything unless there is an action here to update the database with your file. Remember that XML isn't directly used by the game engine, the game engine uses the database, so our mod has to update the database with our XML files.

The most common "Set" you will need is "OnModActivated" (meaning to happen when the mod loads) and the most common type is "UpdateDatabase" (to apply the specified xml file). An example of a mod with applied xml files is in the following screenshot:



Note that this provides an easy opportunity to add and remove xml files from our mod from troubleshooting. If I believe a crash may be coming from my CIV5Specialists.xml file then I can remove it from the Actions list so it isn't applied and do some testing. I don't need to actually remove the file form the mod.

Content- The content screen specifies special file types within the mod much as the Actions screen is used for database updates. The following content types are available:

- **CityViewUIAddin**- Adds the UI to the City View root
- **Custom**- A custom UI which is added as an entry to the "Custom Game" menu.
- **DiplomacyUIAddin**- Adds the UI to the Leaderhead root (base diplomacy screen).
- **InGameUIAddin**- Adds to the UI of the main game interface.
- **Map**- A world builder map (this doesn't have to be defined for this map to be usable, only for it to be published and for any UI's to know about it).
- **MapScript**- A Lua map script (this doesn't have to be defined for this map to be usable, only for it to be published and for any UI's to know about it).

Creating an Object

Creating new assets with ModBuddy is very simple. This document will go through some detailed "how to" procedures later. But the overall process is that an xml file is created in ModBuddy. Within that XML file there must be a GameData element. Within that GameData element (meaning between the start tag of <GameData> and end tag of </GameData>) there must be an element that sets the asset type. Within the Element that sets the assets type there must be a Row element, and within the Row element is where all the object specific attributes exist as elements.

The following is a sample of adding a new goody hut entry. The line numbers are simply for reference, they wouldn't exist in the real XML.

```
1. <GameData>
2.     <GoodyHuts>
3.             <Row>
4.                     <Type>GOODY_SKELETON</Type>
                       <Description>TXT_KEY_GOODY_SKELETON</Description>
                       <Sound>AS2D_GOODY_WARRIOR</Sound>
                       <UnitClass>UNITCLASS_SKELETON</UnitClass>
5.             </Row>
6.     </GoodyHuts>
7. </GameData>
```

1. The first line is the start of the GameData element. This is what tells the game that we are going to be passing in some new XML.

2. Next we have an opening depending on the type of asset we are creating. If we are creating a civilization, then it is <Civilizations>, it we are creating a leader then it <Leaders>, it's a unit it is <Units>. the easiest way to see what the opening tag should be is to look at the definition of an existing version of that asset type. In this example I'm using the definition for a goody hut. The file name in ModBuddy isn't important, the directory in ModBuddy isn't important. This entry is how the game knows what sort of asset we are creating.

3. <Row> is the XML tag that tells the system that we are going to start an entry for the type defined in the prior line.

4. This is the beginning of the object specific attributes. The exact attributes vary depending on the object type. Check out similar assets for examples, and the schema at the beginning of the XML files to see what's available.

5. Every element we start with XML must be closed. We have to tell the system that we are done with the Row element. To close the <Row> element we add a </Row> tag.

6. Just as we needed to close the Row element we also need to close the <GoodyHuts> element. In this case with a </GoodHuts> tag.

7. Finally we close the <GameData> element with </GameData>.

The above example show an assets that only has one table. But most of the assets in Civilization V have multiple tables. Consider the following for the engineer specialist:

```
<GameData>
    <Specialists>
            <Row>
                    <Type>SPECIALIST_ENGINEER</Type>
                    <Description>TXT_KEY_SPECIALIST_ENGINEER</Description>
                    <Strategy>TXT_KEY_SPECIALIST_ENGINEER_STRATEGY</Strategy>
                    <GreatPeopleTitle>TXT_KEY_SPECIALIST_ENGINEER_TITLE</GreatPeopleTitle>
                    <Visible>true</Visible>
                    <Cost>0</Cost>
                    <GreatPeopleUnitClass>UNITCLASS_ENGINEER</GreatPeopleUnitClass>
```

```
                <GreatPeopleRateChange>3</GreatPeopleRateChange>
                <IconAtlas>CITIZEN_ATLAS</IconAtlas>
                <PortraitIndex>1</PortraitIndex>
            </Row>
        </Specialists>
        <SpecialistYields>
            <Row>
                <SpecialistType>SPECIALIST_ENGINEER</SpecialistType>
                <YieldType>YIELD_PRODUCTION</YieldType>
                <Yield>1</Yield>
            </Row>
        </SpecialistYields>
</GameData>
```

Here we have two tables, Specialists and SpecialistYields. Although slightly more complex for formatting (and different than how this was handled in Civilization IV) these tables are defined within the schema the top of the file. The only real disadvantage to this method is sometimes it's difficult to see all the attributes that pertain to a specific asset. The resources file, for example, has 7 tables, making it a bit of a pain to find all the attributes that are set for a specific attribute. So make sure when you copy the information for an asset, you get all the information in the file for it. Even if it is in more than one table.

Updating an Object

Sometimes you don't want to add a new asset, you just want to change an asset in the base game. This is as simple as adding an <Update> element between the asset tags (where the <Row> element typically goes).

An Update element has two child elements, a <Set> element and a <Where> element.

Set- This element uses an XML attribute to determine what change is going to take place. Such as <Set Combat="20"/>.

Where- This element determines our matching condition. Where we want the change to take place. Such as <Where Type="UNIT_JAPANESE_SAMURAI"/>.

Note that there is no difference (from an XML perspective) between <Set Combat="20"></Set> and <Set Combat="20"/>. Including the / as the last character in the tag is another way to mark that element closed. We don't commonly do it because we need to include data between the start and end tag. but in cases like these where there is no data between the tags it's slightly more clean to end the element in the start tag.

Let's put it together for a change. In Civ5 Engineer specialists and Citizens both increase production by 1. But in our mod we want Engineers to boost production by 2. This is the SpecialistYields table in Civ5 (the part that sets the Engineer's yield is highlighted in blue):

```
<GameData>
    <SpecialistYields>
        <Row>
            <SpecialistType>SPECIALIST_CITIZEN</SpecialistType>
            <YieldType>YIELD_PRODUCTION</YieldType>
            <Yield>1</Yield>
```

```
            </Row>
            <Row>
                  <SpecialistType>SPECIALIST_MERCHANT</SpecialistType>
                  <YieldType>YIELD_GOLD</YieldType>
                  <Yield>2</Yield>
            </Row>
            <Row>
                  <SpecialistType>SPECIALIST_SCIENTIST</SpecialistType>
                  <YieldType>YIELD_SCIENCE</YieldType>
                  <Yield>3</Yield>
            </Row>
            <Row>
                  <SpecialistType>SPECIALIST_ENGINEER</SpecialistType>
                  <YieldType>YIELD_PRODUCTION</YieldType>
                  <Yield>1</Yield>
            </Row>
      </SpecialistYields>
</GameData>
```

In order to change the Yield to 2 we need the following update (the line numbers are just for reference, they should not exist in real code):

```
1. <GameData>
2.     <SpecialistYields>
3.           <Update>
4.                 <Set Yield="2"/>
5.                 <Where SpecialistType="SPECIALIST_ENGINEER"/>
6.           </Update>
7.     </SpecialistYields>
8. </GameData>
```

1. This is the start of the GameData element. This is what tells the game that we are going to be passing in some new XML.

2. Next we have the name of the table. The table we are updating is SpecialistYields, so the opening element is <SpecilaistYields>.

3. On an add operation we had <Row> at this level to show we were going to start a new entry. But, to update an asset we use the <Update> tag here.

4. As discussed above there are two elements inside the <Update> tag. The first is Set. In this example we are setting the Yield to 2 with <Set Yield="2"/>.

5. This is the condition part of the update expression. The update already knows to set Yield to 2, but this is where we tell it which Yield to set to 2. In this case <Where SpecialistType="SPECIALIST_ENGINEER"/> tells it to set Yields to 2 if the SpecialistType element equals SPECiALIST_ENGINEER.

6. This is the end of the <Update> element.

7. This is the end of the <SpecialistYields> element.

8. This is the end of the <GameData> element.

Multiple Condition Updates

Sometimes we will want our update to check on more than one element before applying the update. Assume that we want to change the Food yield from Whales from 1 to 2. Consider the following sample from the Resource_YieldChanges table:

```
<Resource_YieldChanges>
        <Row>
                <ResourceType>RESOURCE_BANANA</ResourceType>
                <YieldType>YIELD_FOOD</YieldType>
                <Yield>1</Yield>
        </Row>
        <Row>
                <ResourceType>RESOURCE_WHALE</ResourceType>
                <YieldType>YIELD_FOOD</YieldType>
                <Yield>1</Yield>
        </Row>
        <Row>
                <ResourceType>RESOURCE_WHALE</ResourceType>
                <YieldType>YIELD_GOLD</YieldType>
                <Yield>1</Yield>
        </Row>
</Resource_YieldChanges>
```

We may try the following to accomplish this:

```
<GameData>
    <Resource_YieldChanges>
            <Update>
                    <Set Yield="2"/>
                    <Where ResourceType="RESOURCE_WHALE"/>
            </Update>
    </Resource_YieldChanges>
<GameData>
```

But since the above matches both on the Food and the Gold Rows (the **green** and the **blue** in the sample), both of those yields would be increased to 2.

We could also try the following:

```
<GameData>
    <Resource_YieldChanges>
            <Update>
                    <Set Yield="2"/>
                    <Where YieldType="YIELD_FOOD"/>
            </Update>
    </Resource_YieldChanges>
<GameData>
```

But in this case we would set the Food yields to 2 for all resources, including Bananas (in **red**) and Whales (in **green**) in our sample.

We need the ability to set a multi-conditional argument which we can do by adding multiple attributes to the Where element as in the following:

```
<GameData>
	<Resource_YieldChanges>
		<Update>
			<Set Yield="2"/>
			<Where ResourceType="RESOURCE_WHALE" YieldType="YIELD_FOOD"/>
		</Update>
	</Resource_YieldChanges>
<GameData>
```

Notice that in the above there is no logical qualifier between the two attributes. Attributes are "Anded" together, elements must match all of them before the Set is applied. If you want to use "Or" logic (the Set is applied if either condition is valid) then you should create separate update element that checks for each criteria.

Deleting an Object

Deleting an asset requires us to use the Delete element with an attribute to match on instead of the Row element.

For example the following code would remove the America civilization from the game:

```
<GameData>
	<Civilizations>
		<Delete type="CIVILIZATION_AMERICA"/>
	</Civilizations>
</GameData>
```

After being introduced to add and updates this syntax should be familiar. It doesn't matter what element the Delete matches on (in the example I use type), but be careful that if you are using a non-unique element. If you are deleting all the civilizations with the ARTSTYLE_EUROPEAN Art Style Type (<Delete ArtStyleType="ARTSTYLE_EUROPEAN"/>) then they will all be deleted. If another mod the player has loaded modifies an ArtStyleType to ARTSTYLE_EUROPEAN, then that civilization will be deleted by your mod. If another mod adds a civilization that is set to ARTSTYLE_EUROPEAN then your mod will delete it.

The most important thing to remember when deleting assets is that all references to that asset also need to be cleaned up or your mod will have errors loading. References in Civ5 are unidirectional, one asset refers to another, the assets don't refer to each other. Sometimes which asset refers to which isn't obvious. For example the civilization file refers to the unique unit (CIVILIZATION_AMERICA refers to UNIT_AMERICAN_B17) but the unique unit doesn't refer to the civilization it belong to. So you could delete CIVILIZATION_AMERICA without any errors. But if you deleted UNIT_AMERICAN_B17 by itself you would get an error when CIVILIZATION_AMERICA tried to reference it.

These references are the most difficult part of deleting assets since it's often difficult to tell what assets refer to the asset we are deleting. Especially if other mods refer to the assets we are deleting, for example if another mod adds a unit that require the Steam Power technology, but you have deleted that

technology. Because of this if we delete base assets it's probably best if your mod is an exclusive mod. You can't assume compatibility if you are removing base assets from the game.

Another option is to disable assets without deleting them. The ability to do this varies depending in the Asset type. If you were removing a civilization it may be best just to make it non-playable:

```
<GameData>
	<Civilizations>
		<Update>
			<Set Playable="0" />
			<Where Type="CIVILIZATION_AMERICA" />
		</Update>
	</Civilizations>
</GameData>
```

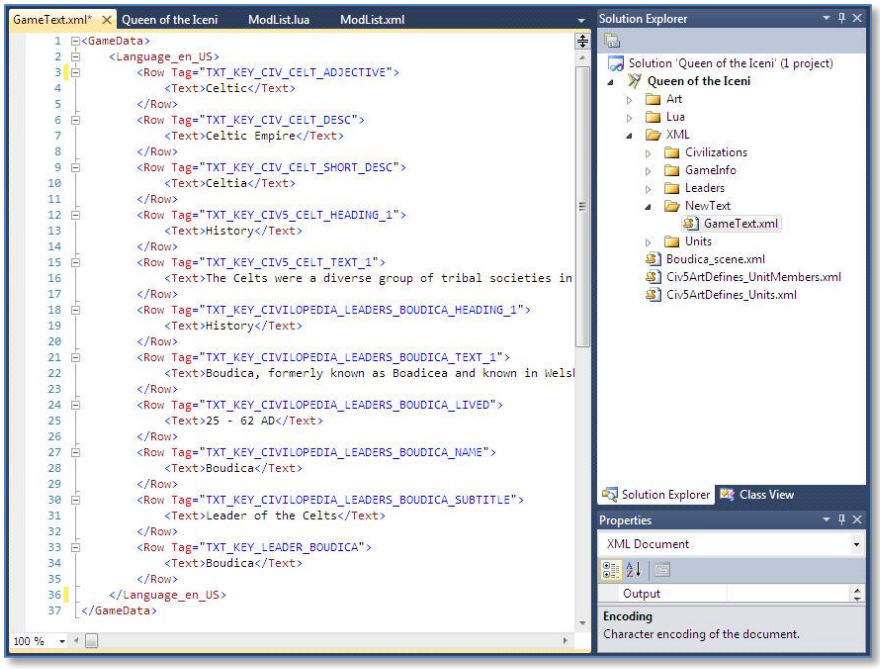
A delete with no conditions matches on everything, so it deleted on everything. The following removes all civilizations from the game.

```
<GameData>
	<Civilizations>
		<Delete />
	</Civilizations>
<GameData>
```

Deleting all the assets is also a big step. Remember that order in the file matters. So if you were to add a civilization after deleting all of them with the above code, then you would want the add to happen after the total delete. If you add your civilization before the delete then your new civ will be deleted too. This will also delete any assets from mods loaded before your mod that added civilizations.

How to: Add Text

Text is an asset type similar to civilizations, leaders and units. The asset type for English is <Language_en_US>, just as the asset type for civilizations is <Civilizations>. The <Row> element is used to add new text, but with text we have to include an attribute with the <Row> element to assign the Tag.



In the screenshot we have added new text tags in ModBuddy. The Tag is how the game refers to the text string, the entry in <Text></Text> is what the game will display for this

language when that text string is referenced. For example, with the above when TXT_KEY_CIV_CELT_DESC is referenced (as we will see in the How to: Add a Civilization section of this document) the game will display "Celtic Empire" when English is the active language.

To add the above follow these steps:

1. Create an XML folder off of the root of your project if you don't already have one. This isn't required but helps us organize our project.

2. Create a New Text folder under the XML folder. Again, this isn't required but helps us organize our project. I choose "New Text" as the folder name because that's what Firaxis called their text folder. Through this would still work regardless of the folder name.

3. Add an XML file under the New Text folder and rename it GameText.xml. As with the above this name isn't required, but it helps us to know that this is the XML file where we will store our text definitions. It would work as well if we called it Legends_text.xml, Celt_Civ_text.xml, Cabbage.xml or any file name.

4. Fill the file with the text definitions as in the screenshot above. Let's take a look at one of the values:

```
<GameData>
	<Language_en_US>
		<Row Tag="TXT_KEY_CIV_CELT_DESC">
			<Text>Celtic Empire</Text>
		</Row>
	</Language_en_US>
</GameData>
```

In the above section there is a new Language_en_US (English text) asset being added. The text decode will be used whenever TXT_KEY_CIV_CELT_DESC is used in the XML it will be displayed (to players with the English language selected) as "Celtic Empire".

Changing Text Strings

We may also want to change existing text strings in the base game. You overwrite the existing definition the same as changing any attribute. To begin you may want to look at the former text string definition. You can find base game text strings somewhere beneath "<install directory>\assets\Gameplay\XML\NewText\".

Looking through those files we can find the following text string definitions in CIV5ModdingText.xml:

```
<Row Tag="TXT_KEY_MODDING_LIKE_IT">
		<Text>Like it</Text>
</Row>
<Row Tag="TXT_KEY_MODDING_FLAG_MODERATION">
		<Text>Report</Text>
 </Row>
```

If you want to have some fun (or suspect your mod is so offensive that you will get more report clicks than Likes) you can reverse these text strings by including the following in your mod:

```
<GameData>
	<Language_en_US>
		<Update>
			<Where Tag=" TXT_KEY_MODDING_LIKE_IT "/>
			<Set Text="Report"/>
		</Update>
		<Update>
			<Where Tag=" TXT_KEY_MODDING_FLAG_MODERATION"/>
			<Set Text="Like It"/>
		</Update>
	</Language_en_US>
</GameData>
```

Just like when changing other attributes we can use Update to change text definitions. The attribute we need to match on to do this is "Tag".

How to: Add a Civilization

In this section we will go through the entire process of adding a new civilization to the game. First let's look at the schema definition for a civilization from the Civ5Civilizations.xml file:

```
<Table name="Civilizations">
	<Column name="ID" type="integer" primarykey="true" autoincrement="true"/>
	<Column name="Type" type="text" notnull="true" unique="true"/>
	<Column name="Description" type="text"/>
	<Column name="Civilopedia" type="text"/>
	<Column name="CivilopediaTag" type="text"/>
	<Column name="Strategy" type="text" default="Ask Paul"/>
	<Column name="Playable" type="boolean" default="true"/>
	<Column name="AIPlayable" type="boolean" default="true"/>
	<Column name="ShortDescription" type="text" default="NULL"/>
	<Column name="Adjective" type="text" default="NULL"/>
	<Column name="DefaultPlayerColor" type="text" default="NULL"/>
	<Column name="ArtDefineTag" type="text" default="NULL"/>
	<Column name="ArtStyleType" type="text" default="NULL"/>
	<Column name="ArtStyleSuffix" type="text" default="NULL"/>
	<Column name="ArtStylePrefix" type="text" default="NULL"/>
	<Column name="DerivativeCiv" type="text" default="NULL"/>
	<Column name="PortraitIndex" type="integer" default="-1"/>
	<Column name="IconAtlas" type="text" default="NULL" reference="IconTextureAtlases(Atlas)"/>
	<Column name="AlphaIconAtlas" type="text" default="NULL" reference="IconTextureAtlases(Atlas)"/>
	<Column name="MapImage" type="text" default="NULL"/>
	<Column name="DawnOfManQuote" type="text" default="NULL"/>
	<Column name="DawnOfManImage" type="text" default="NULL"/>
	<Column name="DawnOfManAudio" type="text" default="NULL"/>
</Table>
<Table name="Civilization_BuildingClassOverrides">
	<Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
	<Column name="BuildingClassType" type="text" notnull="true" reference="BuildingClasses(Type)"/>
	<Column name="BuildingType" type="text" reference="Buildings(Type)"/>
</Table>
<Table name="Civilization_CityNames">
	<Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
	<Column name="CityName" type="text" notnull="true"/>
</Table>
<Table name="Civilization_DisableTechs">
	<Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
```

```
        <Column name="TechType" type="text" reference="Technologies(Type)"/>
</Table>
<Table name="Civilization_FreeBuildingClasses">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="BuildingClassType" type="text" reference="BuildingClasses(Type)"/>
</Table>
<Table name="Civilization_FreeTechs">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="TechType" type="text" reference="Technologies(Type)"/>
</Table>
<Table name="Civilization_FreeUnits">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="UnitClassType" type="text" reference="UnitClasses(Type)"/>
        <Column name="UnitAIType" type="text" reference="UnitAIInfos(Type)"/>
        <Column name="Count" type="integer"/>
</Table>
<Table name="Civilization_Leaders">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="LeaderheadType" type="text" reference="Leaders(Type)"/>
</Table>
<Table name="Civilization_UnitClassOverrides">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="UnitClassType" type="text" notnull="true" reference="UnitClasses(Type)"/>
        <Column name="UnitType" type="text" reference="Units(Type)"/>
</Table>
<Table name="Civilization_Start_Along_Ocean">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="StartAlongOcean" type="boolean" default="false"/>
</Table>
<Table name="Civilization_Start_Along_River">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="StartAlongRiver" type="boolean" default="false"/>
</Table>
<Table name="Civilization_Start_Region_Priority">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="RegionType" type="text" reference="Regions(Type)"/>
</Table>
<Table name="Civilization_Start_Region_Avoid">
        <Column name="CivilizationType" type="text" reference="Civilizations(Type)"/>
        <Column name="RegionType" type="text" reference="Regions(Type)"/>
</Table>
```

Let's look at each of these values in detail:

- **ID**- This is the database starter row. It is set as 0 on the first entry but shouldn't be modified.
- **Type**- This is the key we will use to reference this civilization. We typically use CIVILIZATION_<name> (so CIVILIZATION_CANADA for Canada). We keep the object type as the first part of the name so that it doesn't get confused with another object type with the same name, and is easy to read and identify. Types have to be unique (you can't have two CIVILIZATION_CANADA's). If two objects with the same Type are loaded the one that is loaded second will replace the first one.
- **Description**- This is the text string description of the civ, for America it is "American Empire".
- **Civilopedia**- This isn't used in Civ5.
- **CivilopediaTag**- The starting text string for the pedia entry.
- **Strategy**- This isn't used in Civ5 (though Firaxis was having some fun with their default setting).

- **Playable**- If true then humans can select this as an available civilization. If false then it won't be available. Note that the default is true, so civilizations will be playable unless the modmaker specifically disables them.
- **AIPlayable**- If this is true then the AI can pick this civilization when randomly picking a civ when the game begins. If it is set to false then the AI will never pick this civilization. As with Playable this default to true unless the modder changes it. Setting both the Playable and AIPlayable attribute to false for a civilization is a good way to remove a civilization from the game without actually deleting the assets (so you won't break other mods that refer to it).
- **ShortDescription**- The short text string for this civilization. For America it is "America".
- **Adjective**- The text string for the qualifier to things that belong to this civilization. For Ameican it is "American", as in an American Spearman.
- **DefaultPlayerColor**- The default color of this civilizations borders, etc. This entry has to be specified in the CIV5PlayerColors.xml file. It is only the default because if the same civilization is in a game twice a random color will be assigned to the second instance (so players can tell them apart).
- **ArtDefineTag**- This isn't used in Civ5.
- **ArtStyleType**- Defines the art style for the buildings that are used in this Civilization's cities.
- **ArtStyleSuffix**- Used to pick different flavors of improvements and wonder art.
- **ArtStylePrefix**- Used to pick different flavors of improvements and wonder art.
- **DervativeCiv**- This isn't used in Civ5.
- **PortraitIndex**- The number of the icon in the icon atlas that is used for this Civilization.
- **IconAtlas**- The icon atlas that holds the icon for this civilization.
- **AlphaIconAtlas**- The icon atlas that has the alpha layer for this icon.
- **MapImage**- The picture (as a dds file) that is displayed when this civ is selected from the civilization selection menu. Typically this is a map of the Civilization.
- **DawnOfManQuote**- The text that is displayed on the Dawn of Man (ie: loading) screen.
- **DawnOfManImage**- The picture (as a dds file) that is show on the dawn on man screen.
- **DawnOfManAudio**- The audio file that is played on the Dawn of Man screen, typically this is a reading of the Dawn of Man quote.
- **Civilization_BuildingClassOverrides**- This is how unique buildings are implemented for a civilization. This can be used to block a civilization from being able to build a building such as this change which keeps minor civilizations from being able to build the Sydney Opera House:

```
<Row>
        <CivilizationType>CIVILIZATION_MINOR</CivilizationType>
        <BuildingClassType>BUILDINGCLASS_SYDNEY_OPERA_HOUSE</BuildingClassType>
        <BuildingType/>
</Row>
```

Or this change which switched the Castle to the Mughal fort for India:

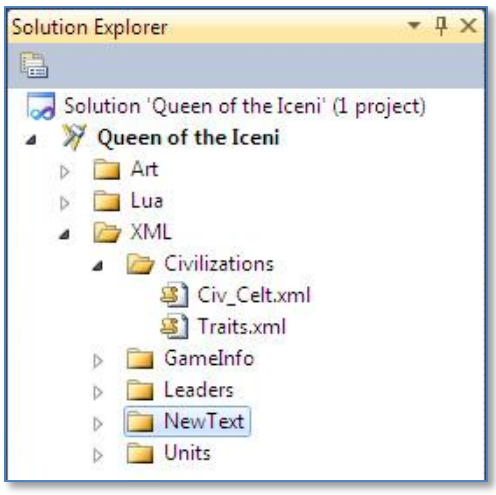
```
<Row>
        <CivilizationType>CIVILIZATION_INDIA</CivilizationType>
        <BuildingClassType>BUILDINGCLASS_CASTLE</BuildingClassType>
        <BuildingType>BUILDING_MUGHAL_FORT</BuildingType>
</Row>
```

- **Civilization_CityNames**- This is a list of the available city names for a civilization.
- **Civilization_DisableTechs**- Any techs set here for a specific civilization won't be available for that civilization to research.
- **Civilization_FreeBuildingClasses**- This is the free buildings available to a civilization when they found their first city. By default all civilizations get a free palace.
- **Civilization_FreeTechs**- These are the free techs a civilization starts with.
- **Civilization_FreeUnits**- These are the units the civilization starts with. By default all civilizations are set to start with a free settler.
- **Civilization_Leaders**-This is where leaders are associated to their civilizations. In Civ5 each civilization can only have 1 leader.
- **Civilization_UnitClassOverrides**- Much like the building class overrides this is where unique units are set with the unit they replace for this civilization.
- **Civilization_Start_Along_Ocean**- If a civilization has this set the game will attempt to start them along a coastal tile. This defaults to false in schema, so it doesn't need to be set unless the modder is setting it to true.
- **Civilization_Start_Along_River**- If a civilization has this set the game will attempt to start them along a coastal tile. This defaults to false in schema, so it doesn't need to be set unless the modder is setting it to true.
- **Civilization_Start_Region_Priority**- If a civilization has this set the game will attempt to start them in the specified region. For example Arabia has Desert set for this.
- **Civilization_Start_Region_Avoid**- If a civilization has this set the game will attempt to avoid these regions when deciding the civilizations starting location. For example Egypt is set to avoid starts in Jungles.

Unfortunately there is no complete reference for what all the attributes for all the objects types in civilization. But as you can see from the above schema most are fairly easy to figure out. You can also look for examples in the XML definitions to give hints. If you were, for example. wondering what Civilization_FreeUnits is it's helpful to see that every civilization has one for the settler.

Now that we understand the attributes that are required for a civilization we are ready to add a new civilization to the game.

1. Create the file structure. The filename and file structure doesn't matter. But I prefer to mirror Firaxis's XML folders for consistency. Create an XML folder from the root of the project, and a Civilizations folder beneath it. Within the Civilizations folder create a new file called Civ_Celt.xml.



I prefer to have each civilization have their own file to make it easier for me to find data and make changes. But it's just as viable to create a single Civilizations file as Firaxis did, or to put all your xml objects in a single file.

2. Fill in the Civ_Celt.xml file with the following information:

```
<GameData>
```

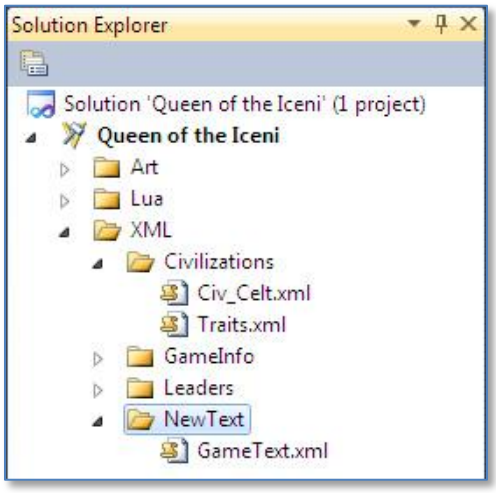
```
<Civilizations>
	<Row>
		<Type>CIVILIZATION_CELT</Type>
		<Description>TXT_KEY_CIV_CELT_DESC</Description>
		<ShortDescription>TXT_KEY_CIV_CELT_SHORT_DESC</ShortDescription>
		<Adjective>TXT_KEY_CIV_CELT_ADJECTIVE</Adjective>
		<Civilopedia>TXT_KEY_CIV_CELT_PEDIA</Civilopedia>
		<CivilopediaTag>TXT_KEY_CIV5_CELT</CivilopediaTag>
		<DefaultPlayerColor>PLAYERCOLOR_DARK_GREEN</DefaultPlayerColor>
		<ArtDefineTag>ART_DEF_CIVILIZATION_ENGLAND</ArtDefineTag>
		<ArtStyleType>ARTSTYLE_EUROPEAN</ArtStyleType>
		<ArtStyleSuffix>_EURO</ArtStyleSuffix>
		<ArtStylePrefix>EUROPEAN </ArtStylePrefix>
		<PortraitIndex>6</PortraitIndex>
		<IconAtlas>CIV_COLOR_ATLAS</IconAtlas>
		<AlphaIconAtlas>CIV_ALPHA_ATLAS</AlphaIconAtlas>
		<MapImage>MapEngland512.dds</MapImage>
		<DawnOfManQuote>TXT_KEY_CIV5_CELT_TEXT_1</DawnOfManQuote>
		<DawnOfManImage>DOM_Elizabeth.dds</DawnOfManImage>
	</Row>
</Civilizations>
<Civilization_CityNames>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<CityName>TXT_KEY_CITY_NAME_BIBRACTE</CityName>
	</Row>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<CityName>TXT_KEY_CITY_NAME_VIENNE</CityName>
	</Row>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<CityName>TXT_KEY_CITY_NAME_TOLOSA</CityName>
	</Row>
</Civilization_CityNames>
<Civilization_FreeBuildingClasses>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<BuildingClassType>BUILDINGCLASS_PALACE</BuildingClassType>
	</Row>
</Civilization_FreeBuildingClasses>
<Civilization_FreeTechs>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<TechType>TECH_AGRICULTURE</TechType>
	</Row>
</Civilization_FreeTechs>
<Civilization_FreeUnits>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<UnitClassType>UNITCLASS_SETTLER</UnitClassType>
		<Count>1</Count>
		<UnitAIType>UNITAI_SETTLE</UnitAIType>
	</Row>
</Civilization_FreeUnits>
<Civilization_Leaders>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<LeaderheadType>LEADER_ELIZABETH</LeaderheadType>
	</Row>
</Civilization_Leaders>
<Civilization_Start_Region_Priority>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<RegionType>REGION_FOREST</RegionType>
	</Row>
```

```
    </Civilization_Start_Region_Priority>
</GameData>
```

The above is the definition for our new Celtic civilization. Because we haven't created a new leader yet I'm using Elizabeth as a leader. We haven't created a unique buildings (Civilization_BuildingClassOverrides) or unique units (Civilization_UnitClassOverrides) so they aren't set. I did set the Celt's to prefer start positions in forested regions. I selected PLAYERCOLOR_DARK_GREEN as the default player color for the civilization, you can find the full list of available player colors in CIV5PlayerColors.xml (which is also where you would add new ones).

I only used 3 city names in the above example just to simplify this document. For a real civilization we would want more than three city names.

2. Define the text strings. We used a lot of text strings in the civ definition. We will have to define those in XML as well. Create a New Text directory under XML and add a new file under it. I have called mine GameText.xml.



The pedia entries use a special format. The prefix for the pedia entries is whatever we put in the CivilopediaTag attribute (TXT_KEY_CIV5_CELT). But the pedia is built form matching pairs of _HEADING_# and _TEXT_# entries. If we add a text entry for TXT_KEY_CIV5_CELT_HEADING_1, then that will be the heading for the for section of the pedia, TXT_KEY_CIV5_CELT_TEXT_1 will be the pedia entry under that heading. This way modders can add as many pedia entries as they want for a civilization (the same system is used for leaders).

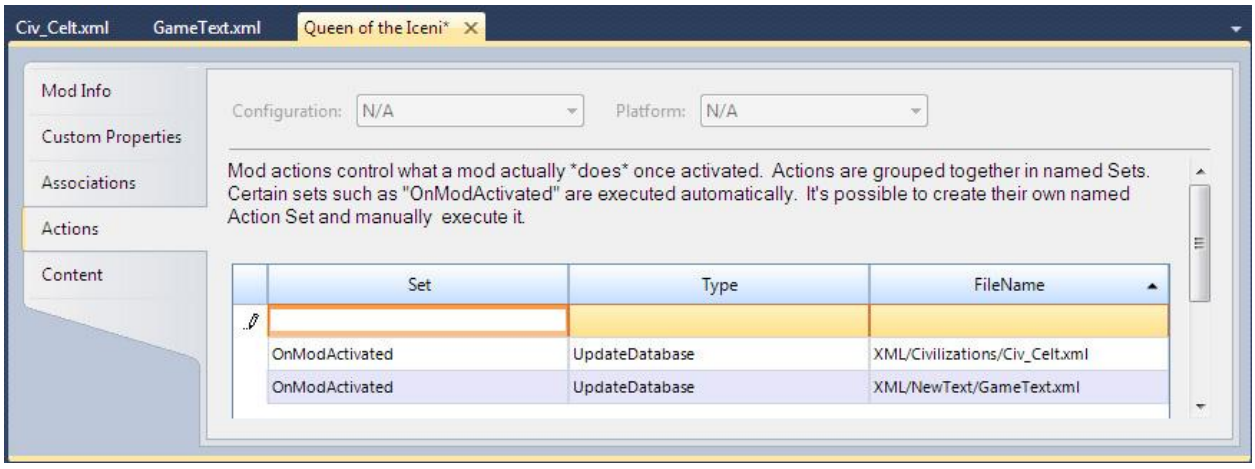
Being lazy, I also used TXT_KEY_CIV5_CELT_TEXT_1 as the Dawn of Man quote.

3. Add the following to the text file:

```
<GameData>
    <Language_en_US>
        <Row Tag="TXT_KEY_CITY_NAME_BIBRACTE">
            <Text>Bibracte</Text>
        </Row>
        <Row Tag="TXT_KEY_CITY_NAME_VIENNE">
            <Text>Vienne</Text>
        </Row>
        <Row Tag="TXT_KEY_CITY_NAME_TOLOSA">
            <Text>Tolosa</Text>
        </Row>
        <Row Tag="TXT_KEY_CIV_CELT_ADJECTIVE">
            <Text>Celtic</Text>
        </Row>
        <Row Tag="TXT_KEY_CIV_CELT_DESC">
            <Text>Celtic Empire</Text>
        </Row>
        <Row Tag="TXT_KEY_CIV_CELT_SHORT_DESC">
            <Text>Celtia</Text>
        </Row>
```

```
		<Row Tag="TXT_KEY_CIV5_CELT_HEADING_1">
			<Text>History</Text>
		</Row>
		<Row Tag="TXT_KEY_CIV5_CELT_TEXT_1">
			<Text>The Celts were a diverse group of tribal societies in Iron Age and Roman-era Europe who spoke Celtic languages.[NEWLINE][NEWLINE]The earliest archaeological culture commonly accepted as Celtic, or rather Proto-Celtic, was the central European Hallstatt culture (ca. 800-450 BC), named for the rich grave finds in Hallstatt, Austria. By the later La Tène period (ca. 450 BC up to the Roman conquest), this Celtic culture had expanded over a wide range of regions, whether by diffusion or migration: to the British Isles (Insular Celts), the Iberian Peninsula (Celtiberians, Celtici ), much of Central Europe, (Gauls) and following the Gallic invasion of the Balkans in 279 BC as far east as central Anatolia (Galatians).[NEWLINE][NEWLINE]The earliest directly attested examples of a Celtic language are the Lepontic inscriptions, beginning from the 6th century BC. Continental Celtic languages are attested only in inscriptions and place-names. Insular Celtic is attested from about the 4th century AD in ogham inscriptions, although it is clearly much earlier. Literary tradition begins with Old Irish from about the 8th century. Coherent texts of Early Irish literature, such as the Táin Bó Cúailnge (The Cattle Raid of Cooley), survive in 12th-century recensions. According to the theory of John T. Koch and others, the Tartessian language may have been the earliest directly attested Celtic language with the Tartessian written script used in the inscriptions based on a version of a Phoenician script in use around 825 BC.[NEWLINE][NEWLINE]By the early 1st millennium AD, following the expansion of the Roman Empire and the Great Migrations (Migration Period) of Germanic peoples, Celtic culture had become restricted to the British Isles (Insular Celtic), and the Continental Celtic languages ceased to be widely used by the 6th century.</Text>
		</Row>
	</Language_en_US>
</GameData>
```

4. Lastly we have to make sure our modified files update the database. On the Actions tab on the mod properties we have to add the following entries to get the game to convert our xml files to sql and write them to the game database when the mod is loaded. This is one of the few places where the file path is important, if we change our directory or file names we will have to update the entry here on the Actions tab.



After that we have a new civilization in the game. We could use some art assets to make it look better, a new leader to go with it, and a unique unit and building. All of those will be covered in later sections.

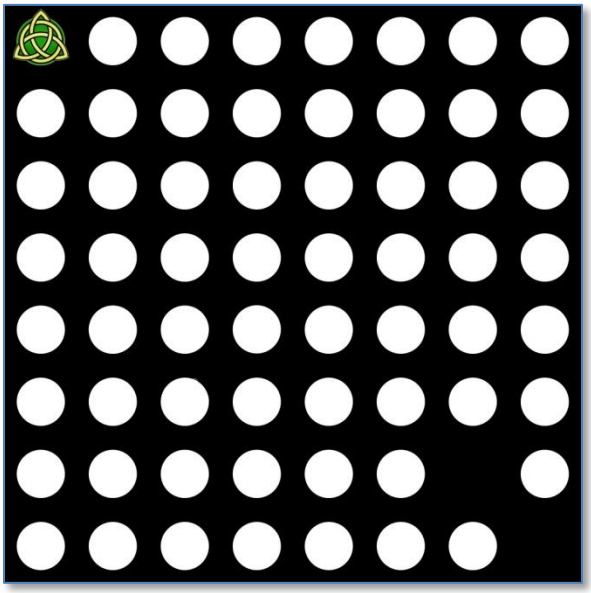
How to: Add an Icon

Now we need an icon for our civilization.

Firaxis has helped us out by providing icon templates in the <SDK install directory>\Art\ directory as .psd files. There are seven templates files, one for 32x32 icons, one for 45x45, 64x64, 80x80, 128x128, 214x214 and 256x256.

Firaxis also provided a readme for icon sizes that are required for all the asset types.

- Promotions 256, 64, 45, 32
- Buildings 256, 128, 64, 45
- Citizens 256, 128, 64, 45, 32
- Civilizations 256, 128, 80, 64, 45, 32
- Difficulties 128, 64, 32
- GameSpeeds 128, 64, 32
- Leaders 256, 128, 64
- Natural Wonders 256, 128, 80, 64, 45
- Policies 256, 64
- Resources 256, 80, 64, 45
- Technologies 256, 214, 128, 80, 64, 45
- Terrain 256, 64
- Unit Actions 64, 45
- Units 256, 128, 80, 64, 45
- Unit Flags 32
- World Sizes 128, 64, 32
- World Types 128, 64, 32



The above means that civilizations, for example, need a 256x256, 128x128, 80x80, 64x64, 45x45 and 32x32 icon. So we need to create six icons for different sizes for our civilization. Loading the IconAtlas256.psd I can use Photoshop to create an icon in the first slot.

I prefer Photoshop, but many modders like to use Gimp, which has the considerable advantage of being free. The art tool doesn't matter, as long as it can read the .psd template and save the file as a .dds file.

I prefer to create the largest icon size first, since we will shrink this file to save the smaller versions. It's also important that our icon be clear and distinctive, not only at the 256x256 size, but at the 32x32 size. So avoid designs that are to complex (the celtic knot design I used is probably too complex to look that good at 32x32, but it will do).

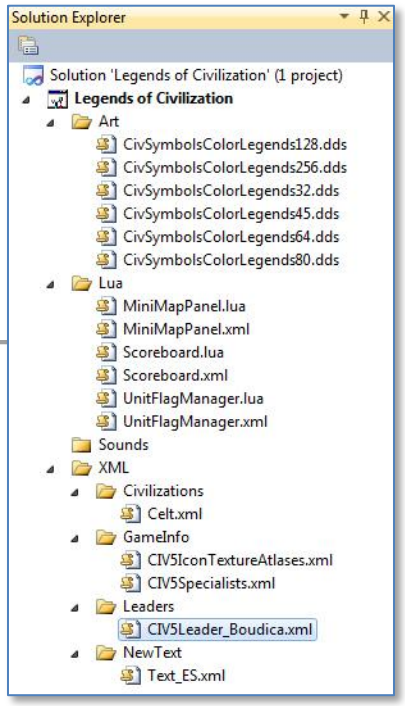
There is also an alpha layer in the psd file that defaults to the same round circles you see in the rest of the icon spaces above. The alpha layer controls what is displayed, what is white in the alpha layer is shown as part of the icon, what is black isn't. It is how the game knows what the edges of the icon are.

All the base game civilization icons are simple circles, but I got a little fancy with mine and had it extend outside of the circle, so I had to adjust the alpha layer to match.

Once you have the icon created in the template, save it as a dds file. You may need to download special plugins for your art tool of choice to be able to save dds files. I selected to call my file CivSymbolsColorLegends256.dds.

The 256x256 template is 2048x2048 pixels (eight 256 width icons across, eight 256 height icons from top to bottom). If we resize our image from 2048x2048 to 1024x1024 this will reduce our icons to 128x128, then we can save CivSymbolsColorLegends128.dds, resize to 640x640 (80 x 8) and save CivSymbolsColorLegends80.dds. And on to create a 64x64, 45x45 and 32x32 icon size dds file.

Once that is done we can add the files to our mod by creating an Art folder (though this isn't nessesary, I create it to help organize the project) and dragging and dropping our files into it.



Once all of our art files our added to the project we need to be able to reference them. to do that add a new asset type we need to add, IconTextureAtlases. Add the GameInfo folder underneath the XML folder and add an XML file called CIV5IconTextureAtlases.xml that contains the following:

```
<GameData>
	<IconTextureAtlases>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>256</IconSize>
			<Filename>CivSymbolsColorLegends256.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
		</Row>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>128</IconSize>
			<Filename>CivSymbolsColorLegends128.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
		</Row>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>80</IconSize>
			<Filename>CivSymbolsColorLegends80.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
```

```
		</Row>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>64</IconSize>
			<Filename>CivSymbolsColorLegends64.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
		</Row>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>45</IconSize>
			<Filename>CivSymbolsColorLegends45.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
		</Row>
		<Row>
			<Atlas>CIV_COLOR_ATLAS_LEGENDS</Atlas>
			<IconSize>32</IconSize>
			<Filename>CivSymbolsColorLegends32.dds</Filename>
			<IconsPerRow>8</IconsPerRow>
			<IconsPerColumn>8</IconsPerColumn>
		</Row>
	</IconTextureAtlases>
</GameData>
```

The above defines the dds files we added. The important part for each is that the Icon size specifies what size icons it holds, and the IconsPerRow and IconsPerColumm tells it how the icons are laid out. Also note that all the Atlases have the same name, what distinguishes them is what size icon the game needs. So that if we tell the game to get the 12th icon in the CIV_COLOR_ATLAS_LEGENDS it will already know that it needs it for a 128x128 size display, so it will look in CivSymbolsColorLegends128.dds and since it knows that the icons are in a 8x8 grid it knows the 12th icon is 3rd icon in the 2nd row (counting starts at 0).

Lastly we need to modify our civilization definition to use our new icon. back in our Celt.xml file we need to make the changes marked in blue:

```
<GameData>
	<Civilizations>
		<Row>
			<Type>CIVILIZATION_CELT</Type>
			<Description>TXT_KEY_CIV_CELT_DESC</Description>
			<ShortDescription>TXT_KEY_CIV_CELT_SHORT_DESC</ShortDescription>
			<Adjective>TXT_KEY_CIV_CELT_ADJECTIVE</Adjective>
			<Civilopedia>TXT_KEY_CIV_CELT_PEDIA</Civilopedia>
			<CivilopediaTag>TXT_KEY_CIV5_CELT</CivilopediaTag>
			<DefaultPlayerColor>PLAYERCOLOR_DARK_GREEN</DefaultPlayerColor>
			<ArtDefineTag>ART_DEF_CIVILIZATION_ENGLAND</ArtDefineTag>
			<ArtStyleType>ARTSTYLE_EUROPEAN</ArtStyleType>
			<ArtStyleSuffix>_EURO</ArtStyleSuffix>
			<ArtStylePrefix>EUROPEAN </ArtStylePrefix>
			<PortraitIndex>0</PortraitIndex>
			<IconAtlas>CIV_COLOR_ATLAS_LEGENDS</IconAtlas>
			<AlphaIconAtlas>CIV_ALPHA_ATLAS</AlphaIconAtlas>
			<MapImage>MapEngland512.dds</MapImage>
			<DawnOfManQuote>TXT_KEY_CIV5_DAWN_CELT_TEXT</DawnOfManQuote>
			<DawnOfManImage>DOM_Elizabeth.dds</DawnOfManImage>
			<DawnOfManAudio/>
		</Row>
...etc
```

The above tells the civilization to use the new atlas we defined and use Icon 0 (the first icon in that atlas) the civ icon. Loading up the mod we can take a look at our new icon.

How to: Add A Leader

Adding a leader is similar to adding a civilization. To create Boudica I copied all the attributes from Alexander, who I want her to act similar to. Then I switched to Elizabeth's art definitions for ArtDefineTag (the leader screen art) and PortraitIndex (the icon she uses). Last I switched her to the Hiawatha's trait of Ignore Terrain in Forest. In later sections we look at how to create new art and trait for Boudica.

This is Boudica's leader definition. I created a new file called XML/Leaders/CIV5Leader_Bouidica.xml and set this file to update the database on the actions tab of the mod properties.

```
<GameData>
	<Leaders>
		<Row>
			<Type>LEADER_BOUDICA</Type>
			<Description>TXT_KEY_LEADER_BOUDICA</Description>
			<Civilopedia>TXT_KEY_LEADER_BOUDICA_PEDIA</Civilopedia>
			<CivilopediaTag>TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA</CivilopediaTag>
			<ArtDefineTag>Elizabeth_Scene.xml</ArtDefineTag>
			<VictoryCompetitiveness>8</VictoryCompetitiveness>
			<WonderCompetitiveness>7</WonderCompetitiveness>
			<MinorCivCompetitiveness>3</MinorCivCompetitiveness>
			<Boldness>8</Boldness>
			<DiploBalance>3</DiploBalance>
			<WarmongerHate>2</WarmongerHate>
			<WorkAgainstWillingness>7</WorkAgainstWillingness>
			<WorkWithWillingness>4</WorkWithWillingness>
			<PortraitIndex>6</PortraitIndex>
			<IconAtlas>LEADER_ATLAS</IconAtlas>
		</Row>
	</Leaders>
	<Leader_MajorCivApproachBiases>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_WAR</MajorCivApproachType>
			<Bias>7</Bias>
		</Row>
```

```
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_HOSTILE</MajorCivApproachType>
			<Bias>7</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_DECEPTIVE</MajorCivApproachType>
			<Bias>4</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_GUARDED</MajorCivApproachType>
			<Bias>5</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_AFRAID</MajorCivApproachType>
			<Bias>3</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_FRIENDLY</MajorCivApproachType>
			<Bias>5</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MajorCivApproachType>MAJOR_CIV_APPROACH_NEUTRAL</MajorCivApproachType>
			<Bias>4</Bias>
		</Row>
	</Leader_MajorCivApproachBiases>
	<Leader_MinorCivApproachBiases>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MinorCivApproachType>MINOR_CIV_APPROACH_IGNORE</MinorCivApproachType>
			<Bias>4</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MinorCivApproachType>MINOR_CIV_APPROACH_FRIENDLY</MinorCivApproachType>
			<Bias>5</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MinorCivApproachType>MINOR_CIV_APPROACH_PROTECTIVE</MinorCivApproachType>
			<Bias>3</Bias>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<MinorCivApproachType>MINOR_CIV_APPROACH_CONQUEST</MinorCivApproachType>
			<Bias>8</Bias>
		</Row>
	</Leader_MinorCivApproachBiases>
	<Leader_Flavors>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<FlavorType>FLAVOR_OFFENSE</FlavorType>
			<Flavor>8</Flavor>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<FlavorType>FLAVOR_DEFENSE</FlavorType>
			<Flavor>5</Flavor>
		</Row>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
```

```
		<FlavorType>FLAVOR_CITY_DEFENSE</FlavorType>
		<Flavor>5</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_MILITARY_TRAINING</FlavorType>
		<Flavor>5</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_RECON</FlavorType>
		<Flavor>5</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_RANGED</FlavorType>
		<Flavor>3</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_MOBILE</FlavorType>
		<Flavor>8</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_NAVAL</FlavorType>
		<Flavor>5</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_NAVAL_RECON</FlavorType>
		<Flavor>5</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_NAVAL_GROWTH</FlavorType>
		<Flavor>6</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_NAVAL_TILE_IMPROVEMENT</FlavorType>
		<Flavor>6</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_AIR</FlavorType>
		<Flavor>3</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_EXPANSION</FlavorType>
		<Flavor>8</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_GROWTH</FlavorType>
		<Flavor>4</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_TILE_IMPROVEMENT</FlavorType>
		<Flavor>4</Flavor>
	</Row>
	<Row>
		<LeaderType>LEADER_BOUDICA</LeaderType>
		<FlavorType>FLAVOR_INFRASTRUCTURE</FlavorType>
```

```
                <Flavor>4</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_PRODUCTION</FlavorType>
                <Flavor>5</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_GOLD</FlavorType>
                <Flavor>3</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_SCIENCE</FlavorType>
                <Flavor>6</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_CULTURE</FlavorType>
                <Flavor>7</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_HAPPINESS</FlavorType>
                <Flavor>5</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_GREAT_PEOPLE</FlavorType>
                <Flavor>6</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_WONDER</FlavorType>
                <Flavor>7</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_RELIGION</FlavorType>
                <Flavor>5</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_DIPLOMACY</FlavorType>
                <Flavor>7</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_SPACESHIP</FlavorType>
                <Flavor>8</Flavor>
            </Row>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <FlavorType>FLAVOR_WATER_CONNECTION</FlavorType>
                <Flavor>6</Flavor>
            </Row>
    </Leader_Flavors>
    <Leader_Traits>
            <Row>
                <LeaderType>LEADER_BOUDICA</LeaderType>
                <TraitType>TRAIT_IGNORE_TERRAIN_IN_FOREST</TraitType>
            </Row>
    </Leader_Traits>
</GameData>
```

We need two more things before Boudica becomes a complete leader. First we need to modify our Celt civilization entry to make Boudica the leader. To do that we need to modify the Celt.xml entry we added from the LEADER_ELIZABETH leader to LEADER_BOUDICA.

```
<Civilization_Leaders>
	<Row>
		<CivilizationType>CIVILIZATION_CELT</CivilizationType>
		<LeaderheadType>LEADER_BOUDICA</LeaderheadType>
	</Row>
</Civilization_Leaders>
```

Secondly we need to add the text strings to our already existing GameText.xml that is used by our new leader:

```
		<Row Tag="TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA_HEADING_1">
			<Text>History</Text>
		</Row>
		<Row Tag="TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA_TEXT_1">
			<Text>Boudica, formerly known as Boadicea and known in Welsh as "Buddug" was queen of a Celtic tribe who led an uprising against the occupying forces of the Roman Empire.[NEWLINE][NEWLINE]Boudica's husband Prasutagus, ruler of the Iceni tribe who had ruled as a nominally independent ally of Rome, left his kingdom jointly to his daughters and the Roman Emperor in his will. However, when he died his will was ignored. The kingdom was annexed as if conquered, Boudica was flogged and her daughters raped, and Roman financiers called in their loans.[NEWLINE][NEWLINE]In AD 60 or 61, while the Roman governor, Gaius Suetonius Paulinus, was leading a campaign on the island of Anglesey in north Wales, Boudica led the Iceni people, along with the Trinovantes and others, in revolt. They destroyed Camulodunum (modern Colchester), formerly the capital of the Trinovantes, but now a colonia (a settlement for discharged Roman soldiers) and the site of a temple to the former emperor Claudius, which was built and maintained at local expense. They also routed a Roman legion, the IX Hispana, sent to relieve the settlement.[NEWLINE][NEWLINE]On hearing the news of the revolt, Suetonius hurried to Londinium (London), the twenty-year-old commercial settlement that was the rebels' next target. Concluding he did not have the numbers to defend it, Suetonius evacuated and abandoned it. It was burnt to the ground, as was Verulamium (St Albans). An estimated 70,000–80,000 people were killed in the three cities. Suetonius, meanwhile, regrouped his forces in the West Midlands, and despite being heavily outnumbered, defeated the Britons in the Battle of Watling Street. The crisis caused the emperor Nero to consider withdrawing all Roman forces from the island, but Suetonius' eventual victory over Boudica secured Roman control of the province. Boudica then killed herself so she would not be captured, or fell ill and died; Tacitus and Dio differ.[NEWLINE][NEWLINE]The history of these events, as recorded by Tacitus and Cassius Dio, was rediscovered during the Renaissance and led to a resurgence of Boudica's legendary fame during the Victorian era, when Queen Victoria was portrayed as her 'namesake'. Boudica has since remained an important cultural symbol in the United Kingdom. The absence of native British literature during the early part of the first millennium means that Britain owes its knowledge of Boudica's rebellion to the writings of the Romans.</Text>
		</Row>
		<Row Tag="TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA_LIVED">
			<Text>25 - 62 AD</Text>
		</Row>
		<Row Tag="TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA_NAME">
			<Text>Boudica</Text>
		</Row>
		<Row Tag="TXT_KEY_CIVILOPEDIA_LEADERS_BOUDICA_SUBTITLE">
			<Text>Leader of the Celts</Text>
		</Row>
		<Row Tag="TXT_KEY_LEADER_BOUDICA">
			<Text>Boudica</Text>
		</Row>
```

Notice that, just as with the civilizations, the CivilopediaTag attribute is a prefix for several text strings. The _NAME and _SUBTITLE are special to leaders and are displayed at the top of the pedia page. Exactly as with civilizations the _HEADING_1 and _TEXT_1 are used to create body sections in the pedia page. And there is a special tag for _LIVED which contains the years the years the leader was alive.

Finally, I would like to update the Dawn of Man (loading screen image) image for the Celt civ so that it loads with a picture of Boudica instead of the current picture of Elizabeth. As I was stretching the limits of my artistic ability to create that Celtic civilization icon, I'm going to have to find another source for a Boudica picture. Fortunately Boudica had great art in the Civilization IV: Warlords expansion, and I don't think Firaxis would mind if I borrowed it for a Civilization V mod.

A Dawn of Man picture is 1024x768 and has to be a DDS file. Outside of that any picture will do. I used photoshop to save a picture of Boudica in that size and format as BoudicaDOM.dds, included that picture with my mod and made the following change to the Celt's civilization definition (change in blue):

```
<Civilizations>
        <Row>
                <Type>CIVILIZATION_CELT</Type>
                <Description>TXT_KEY_CIV_CELT_DESC</Description>
                <ShortDescription>TXT_KEY_CIV_CELT_SHORT_DESC</ShortDescription>
                <Adjective>TXT_KEY_CIV_CELT_ADJECTIVE</Adjective>
                <Civilopedia>TXT_KEY_CIV_CELT_PEDIA</Civilopedia>
                <CivilopediaTag>TXT_KEY_CIV5_CELT</CivilopediaTag>
                <DefaultPlayerColor>PLAYERCOLOR_DARK_GREEN</DefaultPlayerColor>
                <ArtDefineTag>ART_DEF_CIVILIZATION_ENGLAND</ArtDefineTag>
                <ArtStyleType>ARTSTYLE_EUROPEAN</ArtStyleType>
                <ArtStyleSuffix>_EURO</ArtStyleSuffix>
                <ArtStylePrefix>EUROPEAN </ArtStylePrefix>
                <PortraitIndex>0</PortraitIndex>
                <IconAtlas>CIV_COLOR_ATLAS_LEGENDS</IconAtlas>
                <AlphaIconAtlas>CIV_ALPHA_ATLAS</AlphaIconAtlas>
                <MapImage>MapEngland512.dds</MapImage>
                <DawnOfManQuote>TXT_KEY_CIV5_CELT_TEXT_1</DawnOfManQuote>
                <DawnOfManImage>BoudicaDOM.dds</DawnOfManImage>
                <DawnOfManAudio/>
        </Row>
</Civilizations>
```

And that's all we need to have a new, working leader. In the next section we will cover how to add a new trait to Boudica and there will be a screenshot of the Dawn of Man screen where we can see the new screen.

How to: Add A Trait

So far we have been borrowing Hiawatha's trait for our Boudica. It works fairly well, but our civilization would be more interesting if it had a unique trait. This section will go through the simple steps to add a trait to the game.

First we need to add a new file to our mod, CIV5Traits.xml in the /XML/Civilizations directory. We will be adding a trait called Battle Fury that will give all Melee, Mounted and Gun units 2 attacks per round instead of the normal 1. This is the definition we will need to do that:

```
<GameData>
    <Traits>
        <Row>
            <Type>TRAIT_BATTLE_FURY</Type>
            <Description>TXT_KEY_TRAIT_BATTLE_FURY</Description>
            <ShortDescription>TXT_KEY_TRAIT_BATTLE_FURY_SHORT</ShortDescription>
        </Row>
    </Traits>
    <Trait_FreePromotionUnitCombats>
```

```
		<Row>
			<TraitType>TRAIT_BATTLE_FURY</TraitType>
			<UnitCombatType>UNITCOMBAT_MELEE</UnitCombatType>
			<PromotionType>PROMOTION_SECOND_ATTACK</PromotionType>
		</Row>
		<Row>
			<TraitType>TRAIT_BATTLE_FURY</TraitType>
			<UnitCombatType>UNITCOMBAT_MOUNTED</UnitCombatType>
			<PromotionType>PROMOTION_SECOND_ATTACK</PromotionType>
		</Row>
		<Row>
			<TraitType>TRAIT_BATTLE_FURY</TraitType>
			<UnitCombatType>UNITCOMBAT_GUN</UnitCombatType>
			<PromotionType>PROMOTION_SECOND_ATTACK</PromotionType>
		</Row>
	</Trait_FreePromotionUnitCombats>
</GameData>
```

The above adds the new trait to the game. It's a fairly simple definition, it gives the Second Attack promotion to all this civilizations Melee, Mounted and Gun units (Second Attack is an already existing promotion that gives units an additional attack each turn).

But we need to modify our mod properties to add this to the list of files that will update the database when the mod is loaded, we need text string decodes for the text strings we use here and we need to assign this trait to Boudica.

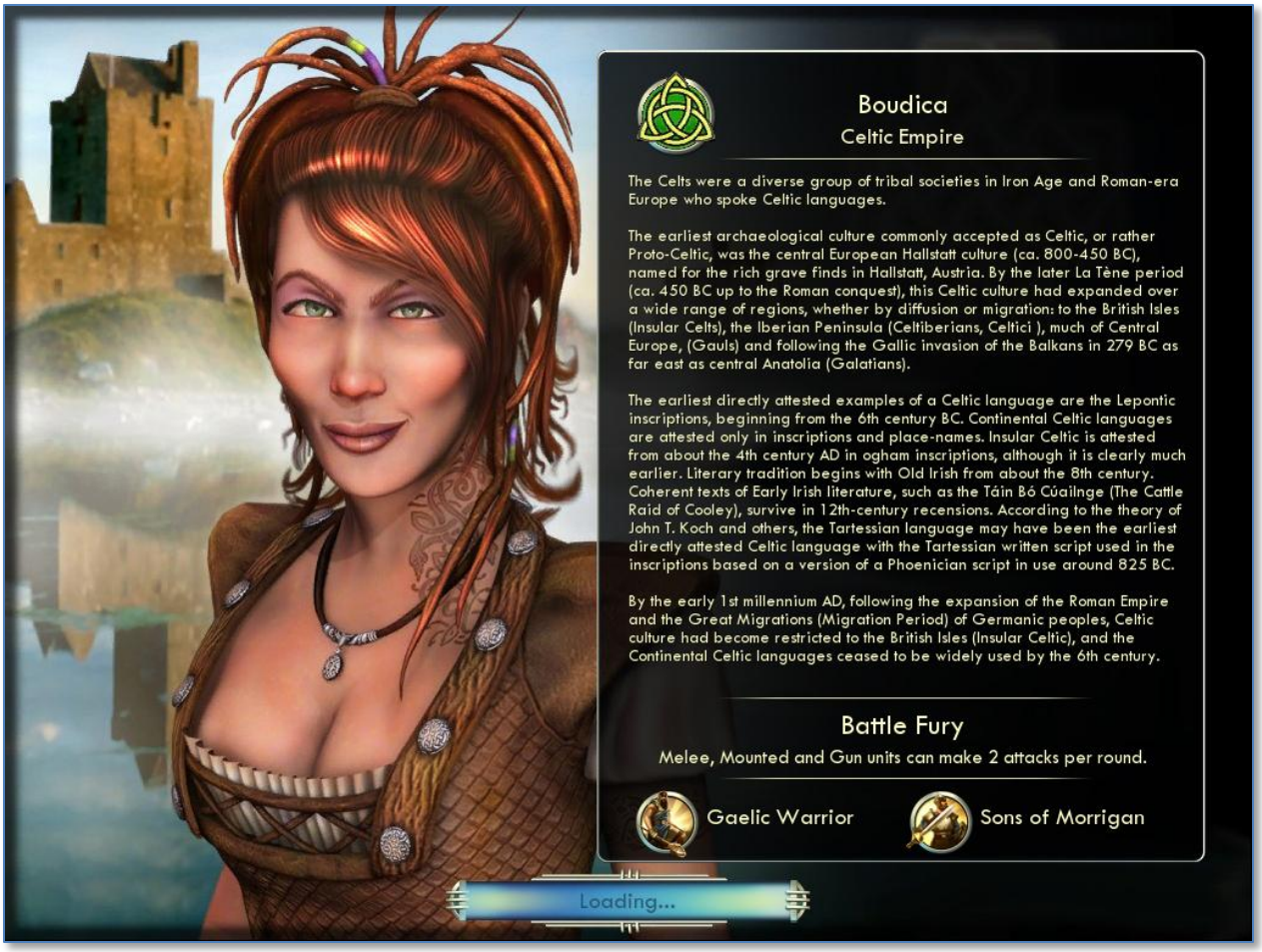
You should be familiar with adding text strings by this point. Add the following to the GameText.xml file:

```
		<Row Tag="TXT_KEY_TRAIT_BATTLE_FURY">
			<Text>Melee, Mounted and Gun units can make 2 attacks per round.</Text>
		</Row>
		<Row Tag="TXT_KEY_TRAIT_BATTLE_FURY_SHORT">
			<Text>Battle Fury</Text>
		</Row>
```

To assign this to Boudica make the following change to our Boudica leader definition:

```
	<Leader_Traits>
		<Row>
			<LeaderType>LEADER_BOUDICA</LeaderType>
			<TraitType>TRAIT_BATTLE_FURY</TraitType>
		</Row>
	</Leader_Traits>
```

Creating a new trait is as easy as that. Be sure to look through the schema definition for Traits and the XML definitions for all the existing traits to get ideas for new traits for your leaders.



How to: Add A Unit

Units are fun, and adding them is easy. As you may have noticed in the above screenshot there are two Unique Units assigned to the Celt's in this section we will cover how to add one of them.

This document covers the technical aspects of modding, but it's worth briefly mentioning some design considerations when adding new unique units to the game. When you consider a unique unit think about when that makes the civilization powerful (unique units are typically better than the unit they replace). Consider how that matches with their trait and how that compares to other unique units. For the Celts I've added a unique unit that replaces the warrior and one that replaces the swordsman. Both are early units and both combine nicely with the Boudica's trait. That makes the Celt's very strong militarily in the early game. They don't have buildings that help with their infrastructure and none of their abilities are very helpful defensively. But they are great early game raiders.

The Gaelic Warrior is the same cost and strength of a normal warrior but he ignores terrain costs. Moving through forests, hills, jungles or across rivers happens exactly like open plains. This makes the Gaelic Warrior very quick raiders, especially with their trait ability of being able to attack twice a turn. This also helps with their forested starts.

We need to make four changes to add a new unique unit to the game. First we need to add a new file CIV5Units.xml to our mod. I added it in the XML/Units/ folder. That file needs to contain the following unit definition.

```
<GameData>
	<Units>
		<Row>
			<Class>UNITCLASS_WARRIOR</Class>
			<Type>UNIT_GAELIC_WARRIOR</Type>
			<Combat>6</Combat>
			<Cost>40</Cost>
			<Moves>2</Moves>
			<CombatClass>UNITCOMBAT_MELEE</CombatClass>
			<Domain>DOMAIN_LAND</Domain>
			<DefaultUnitAI>UNITAI_ATTACK</DefaultUnitAI>
			<Description>TXT_KEY_UNIT_GAELIC_WARRIOR</Description>
			<Civilopedia>TXT_KEY_CIV5_ANTIQUITY_WARRIOR_TEXT</Civilopedia>
			<Strategy>TXT_KEY_UNIT_WARRIOR_STRATEGY</Strategy>
			<Help>TXT_KEY_UNIT_HELP_GAELIC_WARRIOR</Help>
			<MilitarySupport>true</MilitarySupport>
			<MilitaryProduction>true</MilitaryProduction>
			<Pillage>true</Pillage>
			<ObsoleteTech>TECH_METAL_CASTING</ObsoleteTech>
			<GoodyHutUpgradeUnitClass>UNITCLASS_SPEARMAN</GoodyHutUpgradeUnitClass>
			<AdvancedStartCost>10</AdvancedStartCost>
			<XPValueAttack>3</XPValueAttack>
			<XPValueDefense>3</XPValueDefense>
			<Conscription>1</Conscription>
			<UnitArtInfo>ART_DEF_UNIT_GAELIC_WARRIOR</UnitArtInfo>
			<UnitFlagIconOffset>3</UnitFlagIconOffset>
			<IconAtlas>UNIT_ATLAS_1</IconAtlas>
			<PortraitIndex>3</PortraitIndex>
		</Row>
	</Units>
	<Unit_FreePromotions>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<PromotionType>PROMOTION_IGNORE_TERRAIN_COST</PromotionType>
		</Row>
	</Unit_FreePromotions>
	<Unit_AITypes>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<UnitAIType>UNITAI_ATTACK</UnitAIType>
		</Row>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<UnitAIType>UNITAI_DEFENSE</UnitAIType>
		</Row>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<UnitAIType>UNITAI_EXPLORE</UnitAIType>
		</Row>
	</Unit_AITypes>
	<Unit_ClassUpgrades>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<UnitClassType>UNITCLASS_SWORDSMAN</UnitClassType>
		</Row>
	</Unit_ClassUpgrades>
	<Unit_Flavors>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<FlavorType>FLAVOR_RECON</FlavorType>
			<Flavor>1</Flavor>
```

```
		</Row>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<FlavorType>FLAVOR_OFFENSE</FlavorType>
			<Flavor>2</Flavor>
		</Row>
		<Row>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
			<FlavorType>FLAVOR_DEFENSE</FlavorType>
			<Flavor>2</Flavor>
		</Row>
	</Unit_Flavors>
</GameData>
```

Notice that in the above there are a few tables that need to be updated when adding unit. The primary one is the Units table, But we also updated the Unit_FreePromotions table (to grant the promotion that allows the unit to ignore terrain costs), Unit_AITypes table (interestingly the game searches for an available UNITAI_DEFENSE unit to start the player with, since I didn't originally have this defined the Celts weren't starting with a free warrior until I fixed it), Unit_ClassUpgrades table (so that our new unit can be upgraded to a Swordsman) and the Unit_Flavors table (so different AI leaders can prefer different strategies).

The above unit uses the UNITCLASS_WARRIOR unitclass, so we don't need to define a new unitclass for it. Since it doesn't have its own unitclass, we know that this is a unique unit (that it replaces the warrior unit for a civilization).

All of the Unit attributes should be fairly easy to understand. I included a custom art definition with the Gaelic Warrior, we will go over that in the next section.

The second step to adding the unit is that we have to modify the mod properties and include the new file as one that updates the database when the mod is activated.

The third step is to add the text entries the unit requires. I didn't get fancy and add a custom pedia entry. Just the text string and a help string so the player knows what the unit does, so we only have two entries that need to be added to the text file.

```
		<Row Tag="TXT_KEY_UNIT_GAELIC_WARRIOR">
			<Text>Gaelic Warrior</Text>
		</Row>
		<Row Tag="TXT_KEY_UNIT_HELP_GAELIC_WARRIOR">
			<Text>This unit's ability to ignore terrain allows it to quickly rush into enemy lands.</Text>
		</Row>
```

The final step is we need to assign this unit as unique unit for the Celt civilization.

```
	<Civilization_UnitClassOverrides>
		<Row>
			<CivilizationType>CIVILIZATION_CELT</CivilizationType>
			<UnitClassType>UNITCLASS_WARRIOR</UnitClassType>
			<UnitType>UNIT_GAELIC_WARRIOR</UnitType>
		</Row>
	</Civilization_UnitClassOverrides>
```

That is all it takes to add a new unit to the game. In the next section we will look at how we assign new art to a unit.

How to: Change the Unit Art Defines

This document won't cover creating art assets for Civ5. Firaxis has an SDK tool called Nexus for that, but I am the wrong guy to cover it.

But we will go through the art definitions. There are two parts. The first, UnitArtInfo, is for the formation as a whole. The unit definition points to this layer, it specifies how many units (and what sort of units) make up the formation. The entire file is too long to include here, but this is one sample from it.

```
<UnitArtInfos>
	<UnitArtInfo>
		<Type>ART_DEF_UNIT_BARBARIAN_EURO</Type>
		<Formation>Barbarian</Formation>
		<DamageStates>1</DamageStates>
		<UnitMemberArt>
			<MemberType>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_ALPHA</MemberType>
			<MemberCount>2</MemberCount>
		</UnitMemberArt>
		<UnitMemberArt>
			<MemberType>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_BRAVO</MemberType>
			<MemberCount>4</MemberCount>
		</UnitMemberArt>
		<UnitMemberArt>
			<MemberType>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_CHARLIE</MemberType>
			<MemberCount>4</MemberCount>
		</UnitMemberArt>
	</UnitArtInfo>
</UnitArtInfos>
```

Notice that this is the first XML definition we have covered that doesn't start with the <GameData> field. Unit art info isn't fully integrated into the database, so dealing with it is a bit different than the other XML assets.

The above definition for ART_DEF_UNIT_BARBARIAN_EURO contains ten units in its formation. Two EURO_ALPHA unit models, four EURO_BRAVO models and four EURO_CHARLIE models. Firaxis has different models makeup the formations so it doesn't look like a clone army. To see more about those models we need to check out the UnitMemberArtInfo definitions:

```
<UnitMemberArtInfos>
	<UnitMemberArtInfo>
		<Type>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_ALPHA</Type>
		<fScale>0.14</fScale>
		<Granny>Assets/Units/Barbarian/Barbarian_EURO/Barbarian_EURO_Alpha.fxsxml</Granny>
		<Combat>
			<Defaults>ART_DEF_TEMPLATE_SOLDIER</Defaults>
			<Weapon>
				<WeaponTypeTag>BLUNT</WeaponTypeTag>
				<WeaponTypeSoundOverrideTag>BLUNT</WeaponTypeSoundOverrideTag>
			</Weapon>
			<Weapon>
				<Usage>Vs_City ShortRange</Usage>
				<fVisKillStrengthMin>10.0</fVisKillStrengthMin>
```

```
                        <fVisKillStrengthMax>20.0</fVisKillStrengthMax>
                        <WeaponTypeTag>FLAMING_ARROW</WeaponTypeTag>
                    </Weapon>
                </Combat>
                <MaterialTypeTag>CLOTH</MaterialTypeTag>
                <MaterialTypeSoundOverrideTag>FLESH</MaterialTypeSoundOverrideTag>
        </UnitMemberArtInfo>
        <UnitMemberArtInfo>
                <Type>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_BRAVO</Type>
                <fScale>0.14</fScale>
                <Granny>Assets/Units/Barbarian/Barbarian_EURO/Barbarian_EURO_Bravo.fxsxml</Granny>
                <Combat>
                    <Defaults>ART_DEF_TEMPLATE_SOLDIER</Defaults>
                    <Weapon>
                        <WeaponTypeTag>BLUNT</WeaponTypeTag>
                        <WeaponTypeSoundOverrideTag>BLUNT</WeaponTypeSoundOverrideTag>
                    </Weapon>
                    <Weapon>
                        <Usage>Vs_City ShortRange</Usage>
                        <fVisKillStrengthMin>10.0</fVisKillStrengthMin>
                        <fVisKillStrengthMax>20.0</fVisKillStrengthMax>
                        <WeaponTypeTag>FLAMING_ARROW</WeaponTypeTag>
                    </Weapon>
                </Combat>
                <MaterialTypeTag>CLOTH</MaterialTypeTag>
                <MaterialTypeSoundOverrideTag>FLESH</MaterialTypeSoundOverrideTag>
        </UnitMemberArtInfo>
        <UnitMemberArtInfo>
                <Type>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_CHARLIE</Type>
                <fScale>0.14</fScale>
                <Granny>Assets/Units/Barbarian/Barbarian_EURO/Barbarian_EURO_Charlie.fxsxml</Granny>
                <Combat>
                    <Defaults>ART_DEF_TEMPLATE_SOLDIER</Defaults>
                    <Weapon>
                        <WeaponTypeTag>BLUNT</WeaponTypeTag>
                        <WeaponTypeSoundOverrideTag>BLUNT</WeaponTypeSoundOverrideTag>
                    </Weapon>
                    <Weapon>
                        <Usage>Vs_City ShortRange</Usage>
                        <fVisKillStrengthMin>10.0</fVisKillStrengthMin>
                        <fVisKillStrengthMax>20.0</fVisKillStrengthMax>
                        <WeaponTypeTag>FLAMING_ARROW</WeaponTypeTag>
                    </Weapon>
                </Combat>
                <MaterialTypeTag>CLOTH</MaterialTypeTag>
                <MaterialTypeSoundOverrideTag>FLESH</MaterialTypeSoundOverrideTag>
        </UnitMemberArtInfo>
</UnitMemberArtInfos>
```

There are three UnitMemberArtInfo definitions in the above. Each sets the fScale (how large the unit model is) links to the actual art file (in the Granny attribute) and contains the tags used for the sound and animation effects.

Personally I'm not a huge fan of the large ten unit formations. The battles do look cool, but it's hard to distinguish all the small units on the map. So with this mod we are going to change from formations of ten units to a single large unit model.

One of the differences with the UnitArtInfo and UnitMemberArtInfo, since they aren't in the database, is that we can't use the <Update> function one them. We have to provide a complete copy of

the modified file. Also because the unit system is loaded before the mod is we need to set "Reload Unit System" in our mod properties to have our changed unit model definitions take effect.

To do that we first have to change the UnitArtInfo for each unit to switch them to one member. Again I won't include the entire file here, but just our barbarian warrior example.

```
<UnitArtInfos>
	<UnitArtInfo>
		<Type>ART_DEF_UNIT_BARBARIAN_EURO</Type>
		<Formation>Barbarian</Formation>
		<DamageStates>1</DamageStates>
		<UnitMemberArt>
			<MemberType>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_BRAVO</MemberType>
			<MemberCount>1</MemberCount>
		</UnitMemberArt>
	</UnitArtInfo>
</UnitArtInfos>
```

And secondly we need to change the definition for our ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_BRAVO to increase its size.

```
<UnitMemberArtInfos>
	<UnitMemberArtInfo>
		<Type>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_BRAVO</Type>
		<fScale>0.32</fScale>
		<Granny>Assets/Units/Barbarian/Barbarian_EURO/Barbarian_EURO_Bravo.fxsxml</Granny>
		<Combat>
			<Defaults>ART_DEF_TEMPLATE_SOLDIER</Defaults>
			<Weapon>
				<WeaponTypeTag>BLUNT</WeaponTypeTag>
				<WeaponTypeSoundOverrideTag>BLUNT</WeaponTypeSoundOverrideTag>
			</Weapon>
			<Weapon>
				<Usage>Vs_City ShortRange</Usage>
				<fVisKillStrengthMin>10.0</fVisKillStrengthMin>
				<fVisKillStrengthMax>20.0</fVisKillStrengthMax>
				<WeaponTypeTag>FLAMING_ARROW</WeaponTypeTag>
			</Weapon>
		</Combat>
		<MaterialTypeTag>CLOTH</MaterialTypeTag>
		<MaterialTypeSoundOverrideTag>FLESH</MaterialTypeSoundOverrideTag>
	</UnitMemberArtInfo>
</UnitMemberArtInfos>
```

The only change to the above is highlighted in blue. The fScale of the unit was changed from 0.12 to 0.32, so it's almost three times the size of normal.

One of the big advantages of switching from the larger formations to a single larger units is it leaves us with some unused unit art models. Before the barbarian unit formation was made up of three different unit models, Alpha, Bravo and Charlie. In our new barbarian formation we are using the Bravo model. So we have the Alpha model (which sports a cool deerskin antler headdress which is perfect for our Gaelic Warrior unit) available for use.

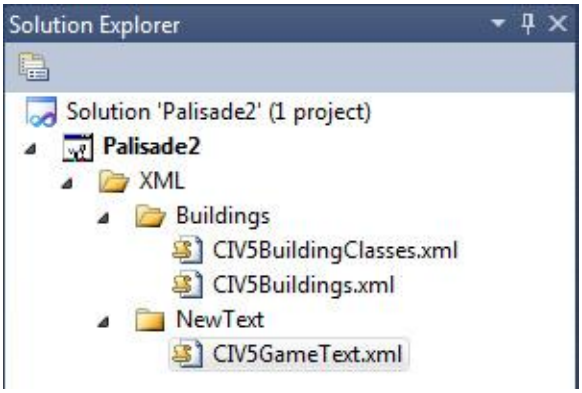
In the prior section, when we created our Gaelic Warrior we used the art definition of ART_DEF_UNIT_GAELIC_WARRIOR, now we need to add that definition to the UnitArtInfo.

```
<UnitArtInfos>
	<UnitArtInfo>
		<Type>ART_DEF_UNIT_GAELIC_WARRIOR</Type>
		<Formation>LooseCivilian</Formation>
		<DamageStates>1</DamageStates>
		<UnitMemberArt>
			<MemberType>ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_ALPHA</MemberType>
			<MemberCount>1</MemberCount>
		</UnitMemberArt>
	</UnitArtInfo>
</UnitArtInfos>
```

We don't need to change the UnitMemberArtInfo since that definition hasn't changed. Instead this tells the game to use the ART_DEF_UNIT_MEMBER_BARBARIAN_EURO_ALPHA model as a single unit formation when the ART_DEF_UNIT_GAELIC_WARRIOR definition is set.

How to: Add A Building

Buildings are easy to add to the game. In this example we will add a palisade as an early defensive building. The palisade won't require any techs, so it's available from the first turn, and can't be built in any era except the Ancient Era (during later eras player should be using walls, castles and other powerful defensive buildings).



To do this we only need to update three tables. The first is Buildings table from CIV5Buildings.xml. The following adds the Palisade building to the game:

```
<GameData>
	<Buildings>
		<Row>
			<Type>BUILDING_PALISADE</Type>
			<BuildingClass>BUILDINGCLASS_PALISADE</BuildingClass>
			<Cost>60</Cost>
			<GoldMaintenance>1</GoldMaintenance>
			<Help>TXT_KEY_BUILDING_PALISADE_STRATEGY</Help>
			<Description>TXT_KEY_BUILDING_PALISADE</Description>
			<Civilopedia>TXT_KEY_CIV5_BUILDINGS_PALISADE_TEXT</Civilopedia>
			<Strategy>TXT_KEY_BUILDING_PALISADE_STRATEGY</Strategy>
			<ArtDefineTag>ART_DEF_BUILDING_WALLS</ArtDefineTag>
			<MaxStartEra>ERA_ANCIENT</MaxStartEra>
			<MinAreaSize>-1</MinAreaSize>
			<AllowsRangeStrike>true</AllowsRangeStrike>
			<Defense>250</Defense>
			<CityWall>true</CityWall>
			<HurryCostModifier>25</HurryCostModifier>
			<IconAtlas>BW_ATLAS_1</IconAtlas>
			<NeverCapture>true</NeverCapture>
			<PortraitIndex>32</PortraitIndex>
		</Row>
	</Buildings>
```

```
</GameData>
```

Civ5 uses Buildingclasses for the replacement buildings used as unique buildings, for example the Market and Bazaar are both BUILDINGCLASS_MARKET. That way all the AI and logic can be programmed using BUILDINGCLASS_MARKET and the game can translate that to mean a Market for most civilizations and a Bazaar for Arabian players.

The next entry is the BuildingClasses table in the CIV5BuildingClasses.xml file:

```
<GameData>
	<BuildingClasses>
		<Row>
			<Type>BUILDINGCLASS_PALISADE</Type>
			<DefaultBuilding>BUILDING_PALISADE</DefaultBuilding>
			<Description>TXT_KEY_BUILDING_PALISADE</Description>
		</Row>
	</BuildingClasses>
</GameData>
```

And finally we need the text strings to support the building we added. There are three new tags we referenced in the above building definition.

```
<GameData>
	<Language_en_US>
		<Row Tag="TXT_KEY_BUILDING_PALISADE">
			<Text>Palisade</Text>
		</Row>
		<Row Tag="TXT_KEY_BUILDING_PALISADE_STRATEGY">
			<Text>Palisade's provide an early defense against attackers.  Though they are less expensive than walls, they provide only half the defense.</Text>
		</Row>
		<Row Tag="TXT_KEY_CIV5_BUILDINGS_PALISADE_TEXT">
			<Text>Built of little more than mud and raw lumber palisades were as vulnerable to the weather as they were to enemy attack.  Yet they remained popular in border cities if only because they made the people behind them feel more secure.</Text>
		</Row>
	</Language_en_US>
</GameData>
```

That's it, a complete mod that adds a new building to the game, that is modular (can be used with other mods without compatibility issues) and can be created an published within 5-10 minutes.

How to: Modify a Building

Let's assume we want to change the way that some buildings work in the game. Currently a Granary adds food to the city it is in and Hospital's allow a city to carry over 50% of its food after a population increase.

The following is the base definition for a Granary:

```
	<Buildings>
		<Row>
			<Type>BUILDING_GRANARY</Type>
			<BuildingClass>BUILDINGCLASS_GRANARY</BuildingClass>
			<FreeStartEra>ERA_RENAISSANCE</FreeStartEra>
```

```
                <Cost>100</Cost>
                <GoldMaintenance>1</GoldMaintenance>
                <PrereqTech>TECH_POTTERY</PrereqTech>
                <Help>TXT_KEY_BUILDING_GRANARY_STRATEGY</Help>
                <Description>TXT_KEY_BUILDING_GRANARY</Description>
                <Civilopedia>TXT_KEY_CIV5_BUILDINGS_GRANARY_TEXT</Civilopedia>
                <Strategy>TXT_KEY_BUILDING_GRANARY_STRATEGY</Strategy>
                <ArtDefineTag>ART_DEF_BUILDING_GRANARY</ArtDefineTag>
                <MinAreaSize>-1</MinAreaSize>
                <ConquestProb>66</ConquestProb>
                <HurryCostModifier>25</HurryCostModifier>
                <IconAtlas>BW_ATLAS_1</IconAtlas>
                <PortraitIndex>0</PortraitIndex>
        </Row>
</Buildings>
<Building_YieldChanges>
        <Row>
                <BuildingType>BUILDING_GRANARY</BuildingType>
                <YieldType>YIELD_FOOD</YieldType>
                <Yield>2</Yield>
        </Row>
</Building_YieldChanges>
```

And the following is the base definition for a Hospital:

```
<Buildings>
        <Row>
                <Type>BUILDING_HOSPITAL</Type>
                <BuildingClass>BUILDINGCLASS_HOSPITAL</BuildingClass>
                <Cost>400</Cost>
                <GoldMaintenance>2</GoldMaintenance>
                <PrereqTech>TECH_BIOLOGY</PrereqTech>
                <Help>TXT_KEY_BUILDING_HOSPITAL_HELP</Help>
                <Description>TXT_KEY_BUILDING_HOSPITAL</Description>
                <Civilopedia>TXT_KEY_BUILDING_HOSPITAL_PEDIA</Civilopedia>
                <Strategy>TXT_KEY_BUILDING_HOSPITAL_STRATEGY</Strategy>
                <ArtDefineTag>ART_DEF_BUILDING_HOSPITAL</ArtDefineTag>
                <FoodKept>50</FoodKept>
                <MinAreaSize>-1</MinAreaSize>
                <ConquestProb>66</ConquestProb>
                <HurryCostModifier>0</HurryCostModifier>
                <IconAtlas>BW_ATLAS_1</IconAtlas>
                <PortraitIndex>45</PortraitIndex>
        </Row>
</Buildings>
```

The nice thing about the <update> tag is that you only have to specify exactly what you want to change. To change the definitions for these create a new files in the mod called /XML/Buildings/CIV5Buildings.xml and add that file to update the database in the Mod's properties as we have done with all of our other changes. As with the others the filename and directory path doesn't matter except to help us organize our mod.

If we want the Granary to keep 30% of the food after a population growth, and we want to remove that ability from the Hospital and replace it with the ability to grant the Medic promotion to any units trained there we need to add the following XML to our new CIV5Buildings.xml file:

```
<GameData>
        <Buildings>
                <Update>
```

```
                <Set FoodKept="30"/>
                <Where Type="BUILDING_GRANARY"/>
            </Update>
            <Update>
                <Set Help="TXT_KEY_BUILDING_GRANARY_HELP"/>
                <Where Type="BUILDING_GRANARY"/>
            </Update>
            <Update>
                <Set FoodKept="0"/>
                <Where Type="BUILDING_HOSPITAL"/>
            </Update>
            <Update>
                <Set TrainedFreePromotion="PROMOTION_MEDIC"/>
                <Where Type="BUILDING_HOSPITAL"/>
            </Update>
    </Buildings>
</GameData>
```

The above XML makes four changes. The first is to set the FoodKept attribute of Granaries to 30 (so 30% of the food is kept after population growth). The second sets the Help attribute of Granaries to TXT_KEY_BUILDING_GRANARY_HELP. Granaries don't normally have a Help string, but we will need one so players know about the functionality we are adding. The third removes the FoodKept ability from Hospitals by setting it to 0. And the fourth is to set the TrainedFreePromotion attribute of Hospitals to PROMOTION_MEDIC, so new units trained in a city with a Hospital start with the Medic promotion.

Not only is this very simple to read, and see exactly what you have changed (in prior versions all of the xml would need to be replaced so you would need to use a compare utility to see what was changed) it also makes the changes very modular. One mod can allow Granaries to store food after growth, another could modify the Granary's cost and a third could change the Granary to a different tech.

We also need a few text strings to support this. We will need to add the new TXT_KEY_BUILDING_GRANARY_HELP text string, and we need to update the already existing TXT_KEY_BUILDING_HOSPITAL_HELP text string.

```
<GameData>
    <Language_en_US>
        <Row Tag="TXT_KEY_BUILDING_GRANARY_HELP">
            <Text>30% of [ICON_FOOD] Food is carried over after a new [ICON_CITIZEN] Citizen is born.</Text>
        </Row>
        <Update>
            <Where Tag="TXT_KEY_BUILDING_HOSPITAL_HELP"/>
            <Set Text="All newly-trained Units in this City receive the [COLOR_POSITIVE_TEXT]Medic[ENDCOLOR] Promotion, increasing the heal rate of this unit and all adjacent units by 1 per turn."/>
        </Update>
    <Language_en_US>
<GameData>
```

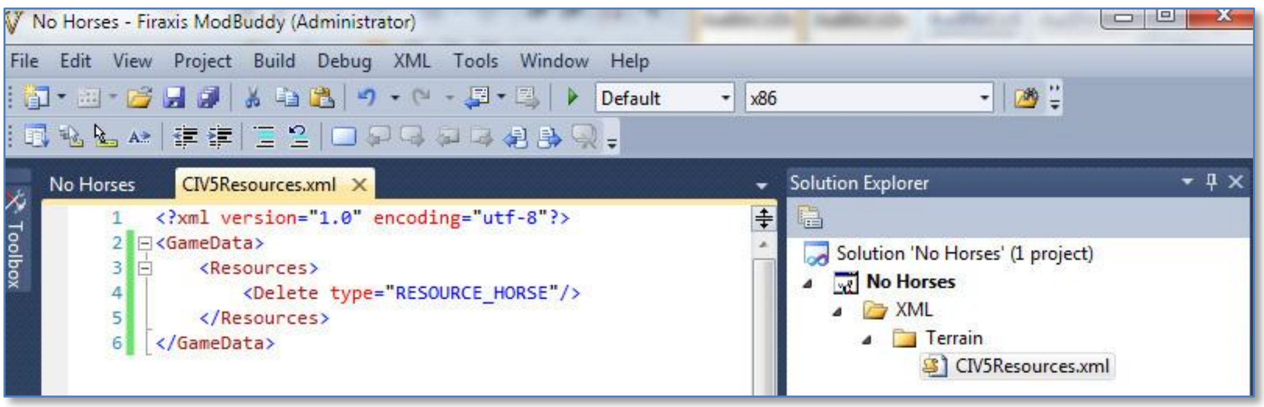
Notice that the Granary string is a new string, as we added for other assets. But the Hospital string is an update operation, which we need to change the base text string to the new one.

The process covered in this section is as valid for leaders, units and other assets as it is for buildings. The <Update> element is an easy way for modders to change existing base game assets in a modular way.

How to: Remove a Resource

Removing a resource is a good example of removing any referenced asset from Civ5. Resources are referenced by units, buildings, improvements, and other sources. So simply deleting the asset will cause errors or the game to crash.

If we want to remove horses from the game (and it wasn't for these references) the following mod would work:



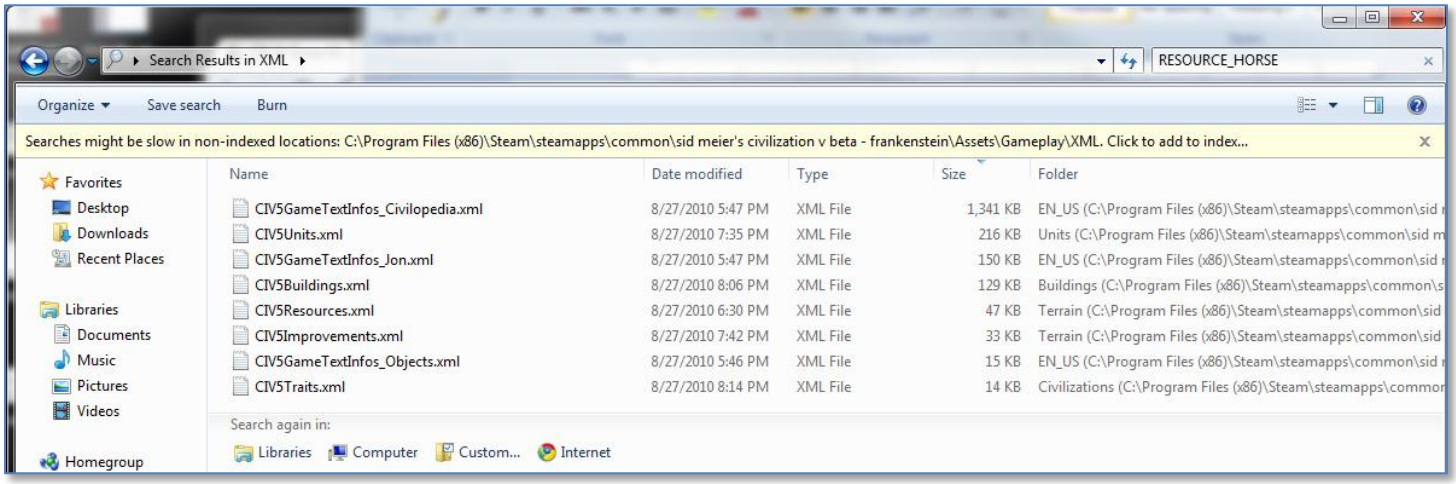
But when this mod is loaded the game crashes and we get the following errors in the Database.log file:

```
[66897.643] Validating Foreign Key Constraints...
[66897.659] Invalid Reference on Building_LocalResourceAnds.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.659] Invalid Reference on Building_LocalResourceOrs.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.659] Invalid Reference on Trait_ResourceQuantityModifiers.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Improvement_ResourceTypes.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Improvement_ResourceType_Yields.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_YieldChanges.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_Flavors.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_TerrainBooleans.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_TerrainBooleans.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_TerrainBooleans.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_QuantityTypes.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Resource_QuantityTypes.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
[66897.674] Invalid Reference on Unit_ResourceQuantityRequirements.ResourceType - "RESOURCE_HORSE" does not exist in Resources
```

[66897.674] Failed Validation.

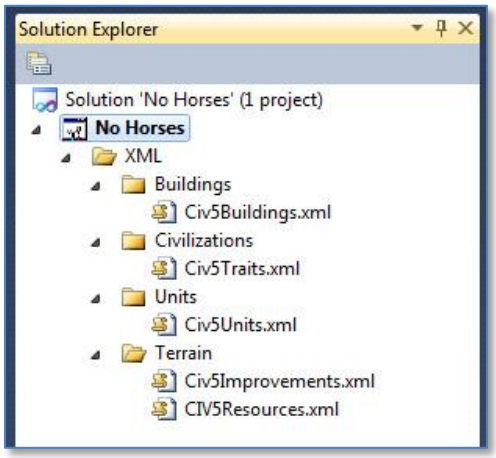
The problem is the existing references to non-existing Horses. Although the Database.log file gives us some indication of where the errors are coming from, the easiest way to find out what files contain a reference to RESOURSE_HORSE is a file search.

To do that I start in the "<Civ5 install dir>\Assets\Gameplay\XML" directory and do a search for RESOURCE_HORSE and select to have my search include file contents. Doing so gives me the following:



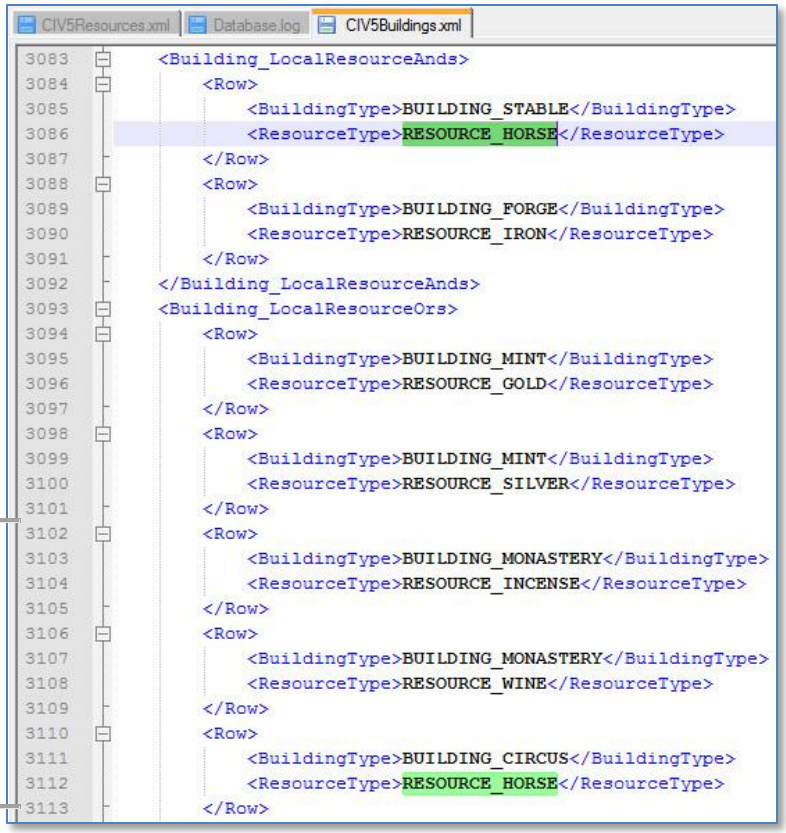
We don't need to worry about the text files. The text files are only string decodes, they don't reference anything. The fact that RESOURCE_HORSE exists in them is only part of a longer text string. That leaves us with: CIV5Units.xml, CIV5Buildings.xml, CIV5Resources.xml, CIV5Improvements.xml and Civ5Traits.xml.

My next step is to create xml files for each of the files I have to supply updates for. As stated in earlier sections, we could have all these changes in a single file and the folder and file names don't matter. I prefer to maintain Civ5's structure and filenames because it is easier for me to remember, but a single XML file called RemoveHorses.xml is just as valid.



Once we have the blank files we have to look through the original version to see what reference we need to remove. We will start with Civ5Buildings.xml.

A search of Civ5Buildings.xml shows two references to RESOURCE_HORSE. It is in the Building_LocalResourceAnds table for Stables, and in the Building_LocalResourceOrs table for the Circus. Both of these references will need to be removed by our mod before it will be able to load.



The following xml for our Mod's Civ5Buildings.xml will remove both of the references.

```
<GameData>
	<Building_LocalResourceAnds>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Building_LocalResourceAnds>
	<Building_LocalResourceOrs>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Building_LocalResourceOrs>
</GameData>
```

And we need to do the same thing for the Traits, Units, Improvements and Resources files, which leaves us with the following.

Civ5Traits.xml:

```
<GameData>
	<Trait_ResourceQuantityModifiers>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Trait_ResourceQuantityModifiers>
</GameData>
```

Civ5Units.xml:

```
<GameData>
	<Unit_ResourceQuantityRequirements>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Unit_ResourceQuantityRequirements>
</GameData>
```

Civ5Improvements.xml:

```
<GameData>
	<Improvement_ResourceTypes>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Improvement_ResourceTypes>
	<Improvement_ResourceType_Yields>
		<Delete ResourceType="RESOURCE_HORSE"/>
```

```
	</Improvement_ResourceType_Yields>
</GameData>
```

Civ5Resources.xml:

```
<GameData>
	<Resources>
		<Delete type="RESOURCE_HORSE"/>
	</Resources>
	<Resource_YieldChanges>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Resource_YieldChanges>
	<Resource_Flavors>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Resource_Flavors>
	<Resource_TerrainBooleans>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Resource_TerrainBooleans>
	<Resource_QuantityTypes>
		<Delete ResourceType="RESOURCE_HORSE"/>
	</Resource_QuantityTypes>
</GameData>
```

Once the above changes are made we will have a mod that removes horses, and all the references to horses from the game. Keep in mind that this mod will not be compatible with other mods that reference horses. If for example a mod adds a new mounted unit that has a resource require of horses. Which is why mods that delete base assets should be marked exclusive.

How to: Disable Unit Icons with Lua

In Civilization V Units have a Unit Icon floating above them. We are going to add the ability to disable that unit icon.

First we have to find what Lua file controls the unit icon. There is no easy reference for this, it takes a bit of searching. Fortunately Firaxis has used fairly explanatory names, the unit icon is controlled by the UnitFlagManager.lua and UnitFlagManager.xml files. These are both in the <Civilization V>\assets\UI\InGame directory.

First we need to add two new files to our project. Unlike XML files it is important that we maintain the same names for Lua files so rename the new files to UnitFlagManager.lua and UnitFlagManager.xml and delete the contents of both. It doesn't matter what folder these files are placed in, but to keep things well organized I created a Lua folder and added both files beneath it.

Now copy the contents of the normal UnitFlagManager.lua and UnitFlagManager.xml into our empty project copies. Lua is not as modular as XML (InGameUIAddin allows some modular Lua changes but it is limited) so the entire file needs to be copied for changes to happen.

There is more than one way to disable the Unit Icon, and different programmers will prefer different methods. But here is one way we can disable it. The UpdateVisibility() function in UnitFlagManager.lua is:

```
UpdateVisibility = function( self )
	if InStrategicView() then
		local bVisible = self.m_IsCurrentlyVisible and self.m_IsGarrisoned and g_GarrisonedUnitFlagsInStrategicView and not
self.m_IsInvisible;
		self.m_Instance.Anchor:SetHide(not bVisible);
	else
		self.m_Instance.Anchor:SetHide(not (self.m_IsCurrentlyVisible and not self.m_IsInvisible));
	end
  end,
```

Looking at this code we can see that if the game is in the Strategic view then the Unit Icon is displayed if the unit is visible, garrisoned and the unit isn't invisible. If we aren't in the strategic view then the unit icon is shown if the unit is visible and not invisible.

The easiest way to disable the Unit Icon is with the following change:

```
UpdateVisibility = function( self )
	if InStrategicView() then
		local bVisible = self.m_IsCurrentlyVisible and self.m_IsGarrisoned and g_GarrisonedUnitFlagsInStrategicView and not
self.m_IsInvisible;
		self.m_Instance.Anchor:SetHide(not bVisible);
	else

-- Modified by Kael 07/17/2010 to disable the Unit Icon
--		self.m_Instance.Anchor:SetHide(not (self.m_IsCurrentlyVisible and not self.m_IsInvisible));
		self.m_Instance.Anchor:SetHide(true);
-- End Modify

	end
end,
```

In the above code we have simply set the Unit Icon to always be hidden when the game isn't in the strategic view. In strategic view the same rules are used for displaying the Unit Icon. Also note that I have commented the change to include who made the change, when I changed it, and why I changed it. I also kept an original copy of the line in case I want to back my change out later or see what it was set to (without having to go to the original file).

I could publish my mod now and it would be a mod with disabled Unit Icons. But it isn't a very elegant solution. It would be better if the player had the ability to enable and disable the Unit Icon according to his preference. To do that let's add a new menu option to the MiniMap Options panel so that players can choose if they want to display the Unit Icon.

First we will need to extend our code change so that we use a variable instead of simply setting the Anchor Hide to true.

```
UpdateVisibility = function( self )
	if InStrategicView() then
		local bVisible = self.m_IsCurrentlyVisible and self.m_IsGarrisoned and g_GarrisonedUnitFlagsInStrategicView and not self.m_IsInvisible;
		self.m_Instance.Anchor:SetHide(not bVisible);
	else

-- Modified by Kael 07/17/2010 to disable the Unit Icon
--		self.m_Instance.Anchor:SetHide(not (self.m_IsCurrentlyVisible and not self.m_IsInvisible));
		self.m_Instance.Anchor:SetHide(not (self.m_IsCurrentlyVisible and not self.m_IsInvisible) or bHideUnitIcon);
-- End Modify

	end
end,
```

In this version rather than simply setting the Unit Icon to always be hidden when the player isn't in the Strategic View, we are using a variable to control it. If bHideUnitIcon is true it will act exactly like our previous code, hiding the Unit Icon. If bHideUnitIcon is false it will act exactly like the games default code.

We will need to set bHideUnitIcon's default value by adding the following at the top of UnitFlagManager.lua:

```
-- Added by Kael 07/17/2010 to disable the Unit Icon
local bHideUnitIcon = true;
-- End Add
```

Note that I selected true as the default value for bHideUnitIcon so that Unit Icon's will start hidden. This is a good time to load our mod and make sure that the Unit Icon is hidden.

5. We will need a text string for our menu option. Create a new XML folder. Beneath it create a NewText folder. And in that folder create a new file called GameText.xml. The file structure is just for our organization, it mirrors the file structure of CIV5's xml files. The file name doesn't matter either (the GameData tag in the file is what matters). This would work if it was called stuff.xml at the root of the project.

6. Replace any default text in the projects GameText.xml with the following:

```
<?xml version="1.0" encoding="utf-8"?>
<GameData>
	<Language_en_US>
		<Row Tag="TXT_KEY_MAP_OPTIONS_HIDE_UNIT_ICON">
			<Text>Hide Unit Icons</Text>
		</Row>
	</Language_en_US>
</GameData>
```

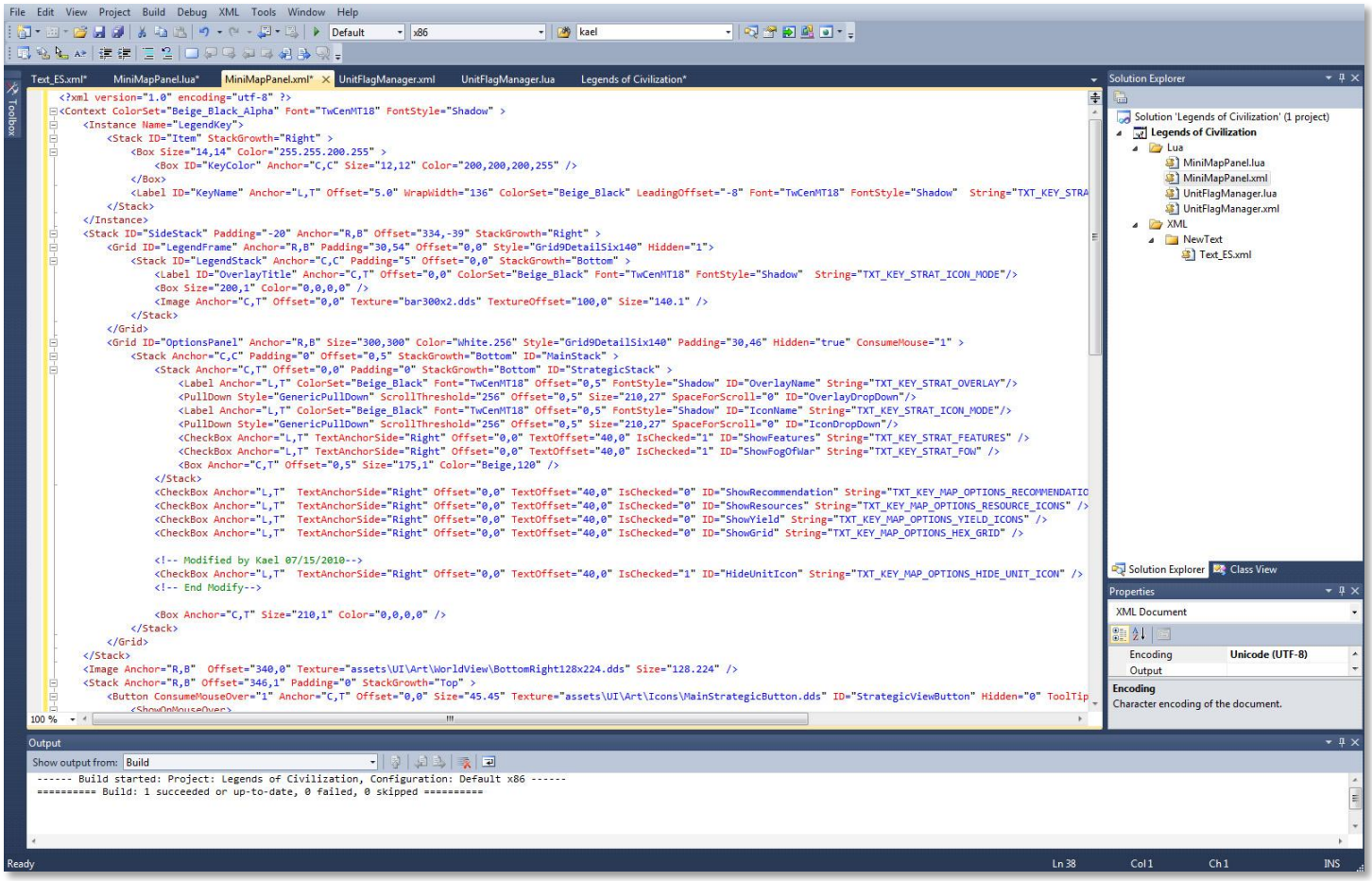
The above is a simple text string replacement. Whenever the game is set to English and encounters TXT_KEY_MAP_OPTIONS_HIDE_UNIT_ICON it will replace it with "Hide Unit Icons".

7. To add the option to enable/disable Unit Icon we will need to add two more file to our project, MiniMapPanel.lua and MiniMapPanel.xml. Just as with the UnitFlagManager files we will want to create two new empty files, rename them MiniMapPanel.lua and MiniMapPanel.xml and copy the contents of the original files into our project copies.

8. Modify the projects MiniMapPanel.xml to add the new checkbox.

```
    <Grid ID="OptionsPanel" Anchor="R,B" Size="300,300" Color="White.256" Style="Grid9DetailSix140" Padding="30,46" Hidden="true"
ConsumeMouse="1" >
        <Stack Anchor="C,C" Padding="0" Offset="0,5" StackGrowth="Bottom" ID="MainStack" >
            <Stack Anchor="C,T" Offset="0,0" Padding="0" StackGrowth="Bottom" ID="StrategicStack" >
                <Label Anchor="L,T" ColorSet="Beige_Black" Font="TwCenMT18" Offset="0,5" FontStyle="Shadow"
ID="OverlayName" String="TXT_KEY_STRAT_OVERLAY"/>
                <PullDown Style="GenericPullDown" ScrollThreshold="256" Offset="0,5" Size="210,27" SpaceForScroll="0"
ID="OverlayDropDown"/>
                <Label Anchor="L,T" ColorSet="Beige_Black" Font="TwCenMT18" Offset="0,5" FontStyle="Shadow"
ID="IconName" String="TXT_KEY_STRAT_ICON_MODE"/>
                <PullDown Style="GenericPullDown" ScrollThreshold="256" Offset="0,5" Size="210,27" SpaceForScroll="0"
ID="IconDropDown"/>
                <CheckBox Anchor="L,T" TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="1"
ID="ShowFeatures" String="TXT_KEY_STRAT_FEATURES" />
                <CheckBox Anchor="L,T" TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="1"
ID="ShowFogOfWar" String="TXT_KEY_STRAT_FOW" />
                <Box Anchor="C,T" Offset="0,5" Size="175,1" Color="Beige,120" />
            </Stack>
            <CheckBox Anchor="L,T"  TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="0"
ID="ShowRecommendation" String="TXT_KEY_MAP_OPTIONS_RECOMMENDATIONS" />
            <CheckBox Anchor="L,T"  TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="0" ID="ShowResources"
String="TXT_KEY_MAP_OPTIONS_RESOURCE_ICONS" />
            <CheckBox Anchor="L,T"  TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="0" ID="ShowYield"
String="TXT_KEY_MAP_OPTIONS_YIELD_ICONS" />
            <CheckBox Anchor="L,T"  TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="0" ID="ShowGrid"
String="TXT_KEY_MAP_OPTIONS_HEX_GRID" />

            <!-- Modified by Kael 07/15/2010-->
            <CheckBox Anchor="L,T"  TextAnchorSide="Right" Offset="0,0" TextOffset="40,0" IsChecked="1" ID="HideUnitIcon"
String="TXT_KEY_MAP_OPTIONS_HIDE_UNIT_ICON" />
            <!-- End Modify-->

            <Box Anchor="C,T" Size="210,1" Color="0,0,0,0" />
        </Stack>
    </Grid>
```

Note in the above that the change is still commented, but that commenting syntax is different in XML. A comment starts with "<!--" and ends with a "-->". The important setting in the added line are IsChecked="1", which means that the checkbox defaults to being checked. The ID of the checkbox is "HideUnitIcon" and the string that is displayed with it is "TXT_KEY_MAP_OPTIONS_HIDE_UNIT_ICON".



9. We have disabled unit icons by default and added a menu option to allow players to enable/disable unit icons. But the menu option doesn't do anything yet. When a player clicks the Hide Unit Icons checkbox it should toggle the bHideUnitIcon variable we created in the UntiFlagManager.lua file.

Lua scripts can't directly call functions in other scripts. If we want one Lua script to call a function in another we have to use LuaEvents. At the start of UnitFlagManager.lua we need to create a new LuaEvent as follows:

```
-- Added by Kael 07/16/2010
local bHideUnitIcon = true;

LuaEvents.ToggleHideUnitIcon.Add(
function()
	if (bHideUnitIcon) then
		bHideUnitIcon = false;
	else
		bHideUnitIcon = true;
```

```
        end
end);
-- End Add
```

The LuaEvents.ToggleHideUnitIcon() function can now be called by external Lua scripts and change the value in this Lua script.

10. We need the menu option we created to call LuaEvents.ToggleHideUnitIcon(). To do that we add the following to our projects MiniMapPanel.lua file:

```
-- Added by Kael 07/16/2010
function OnHideUnitIconChecked( bIsChecked )
        LuaEvents.ToggleHideUnitIcon();
        Events.StrategicViewStateChanged();
end
Controls.HideUnitIcon:RegisterCheckHandler( OnHideUnitIconChecked );
-- End Add
```

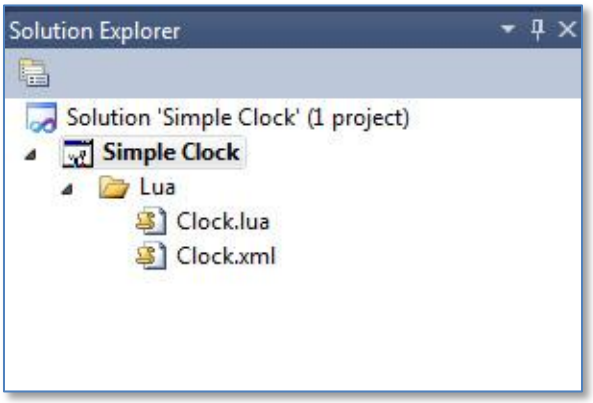
The above code registers a trigger with the HideUnitIcon (that is the ID of the checkbox we added in MiniMapPanel.xml file) checkbox. If it is checked it calls the local OnHideUnitIconChecked function. The OnHideUnitIcon checked function calls the ToggleHideIcon() LuaEvent and the Events.StrategicViewStateChanged() function. StrategicViewStateChanged() forces the flag to be redrawn, this way the game won't wait for the next time that unit is updated to add or remove the flag, it will happen as soon as the player clicks the checkbox.

That is it, a complete mod that adds the ability for players to enable and disable the unit icons through a menu option on the minimap panel. In it we covered how to add text strings, how to modify Lua scripts in our project, how to tie Lua functions to xml objects and how to call functions in one Lua script from other through LuaEvents. Once these basics are understood the hardest part becomes figuring out which script and function controls the processes we want to change (how did we know that UnitIcons were controlled by UnitFlagManager.lua) and what functions to call to do what we need (how did we know that StrategicViewStateChanged() would update the unit flags). For me that meant experimenting and reading through lots of files.

In the beginning it may take a few hours to do something like the above (it took me quite a few). But hopefully this document reduces that time considerably. And now that I understand what I had to do here my next change will be much faster.

How to: Use InGameUIAddin to create modular UI changes

There is a way to create modular Lua changes through InGameUIAddin. As of this writing this functionality is limited, it can add new UI components, but it can't remove or modify existing UI components. To remove or modify existing UI components you will need to replace the Lua and



XML files as we did in the "How to: Disable Unit Icons with Lua" section.

In this example we will add a clock to the interface. We start by adding a Clock.lua and Clock.xml file to the project. These are not replacement files, so the names don't matter. As with all Lua UI changes we need a paired XML and Lua file. The XML file provides the structure and settings, the Lua file provides the code.

First we will fill in the Clock.xml file:

```
<Context ColorSet="Beige_Black" Font="TwCenMT20" FontStyle="Shadow" >
	<Label Anchor="C,T" Offset="0,10" Font="TwCenMT20" ColorSet="Beige_Black_Alpha" FontStyle="Shadow" ID="ClockLabel"/>
</Context>
```

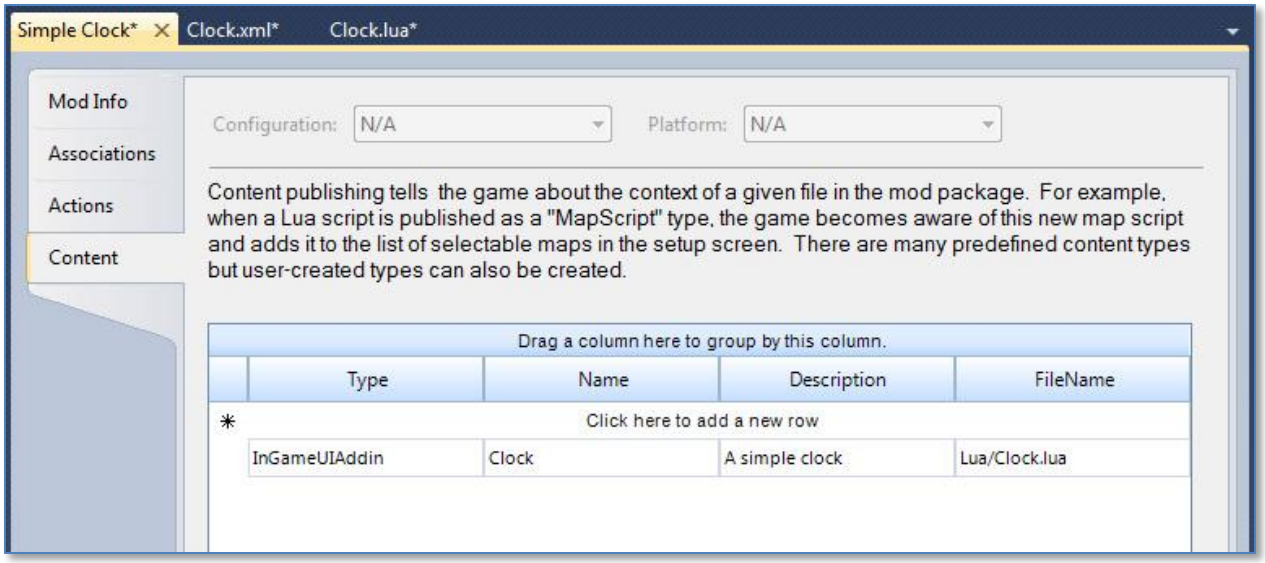
The above defines a new label with the ID of "ClockLabel". We can see the font (TwCenMT20), color (Beige_Black_Alpha) and location (centered at the top of the screen, with an offset 0 to the left and 10 down) for the label.

But at this point this is an empty label. We need Clock.lua to populate it with the time. For Clock.lua we can use the following:

```
ContextPtr:SetUpdate(function()
	local t = os.date("%I:%M");
	Controls.ClockLabel:SetString(t);
end);
```

ContextPtr:SetUpdate runs on each screen update. The above function adds this function to that process. It assigns the hour and minute to the "t" string, then sets the ClockLabel in the XML definition to that string.

Our next step is that we need to have our UI changed loaded when the mod loads, similar to how XML needs an OnModActivated and UpdateDatabase function on the actions tab for the Mod properties. For InGameUIAddin changes we have to go to Content tab of Mod Properties and specify that this is an InGameUIAddin change, and the Lua file we want activated (the matching XML file doesn't need to be specified).



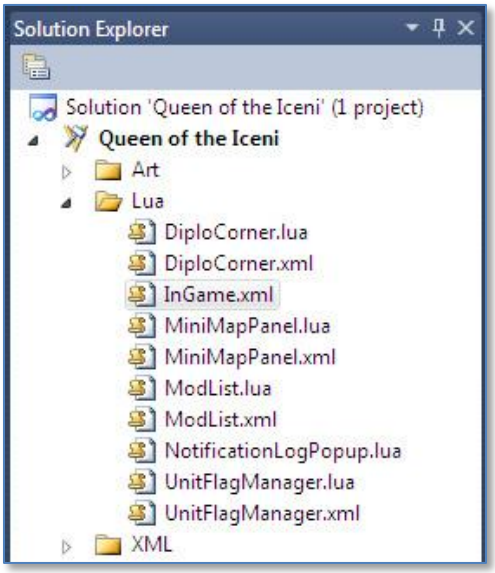
In the following screenshot we can see the clock we added (the red highlight is added just to make it easier to find in the screen shot, it was not added by the mod).

How to: Add a new screen with Lua

There is no way to know what mods you have loaded while playing. In this section we will add a new screen on the Additional Information menu that lists all the loaded Mods.

There are a few hurdles we have to work through before we add a new screen to the game. We worked through an example of using InGameUIAddin in the prior section. InGameUIAddin allows us to add new user interface aspects to the game, but doesn't allow us to modify existing UI components. To modify existing components we need to replace the those files. The problem with replacing Lua files is that this causes us to conflict with other mods that replace those same files.

For this mod to work we need to replace the following files:



DiploCorner.lua- This lua file controls the UI control on the upper right corner of the screen. We will modify this file to add our new menu option.

DiploCorner.xml- This XML file controls the XML aspects of the UI diplomacy corner control.

InGame.xml- This is the main place where Lua files are registered.

NotificationLogPopup.lua- This controls the Notification popup menu, we are going to piggy back on this event to add out new one.

And we will add two new files to control the new screen:

ModList.lua- The Lua file for the new screen.

ModList.xml- The XML file that controls the definitions for the new Mod List screen.

1. Our first step is to create the files in the Lua directory of our mod as in the above screenshot. For DiploCorner.lua, DiploCorner.xml, InGame.xml and NotificationLogPopup.lua copy the actual files from the "<Civ5 install directory>\Assets\UI\" directory into our mod copies.

The first change is a minor change to InGame.xml to load our new Lua file definition:

```
<LuaContext FileName="Assets/UI/InGame/Popups/SetCityName"          ID="SetCityName"          Hidden="True" />
<LuaContext FileName="Assets/UI/InGame/Popups/ProductionPopup"      ID="ProductionPopup"      Hidden="True" />

<!-- Added by Kael 09/17/2010 -->
<LuaContext FileName="Lua/ModList"                                  ID="ModList"              Hidden="True" />
<!-- End Add -->

<LuaContext FileName="Assets/UI/InGame/TopPanel" ID="TopPanel" />
```

All the above does is load our new ModList.lua file when the mod loads. More about the ModList.lua file later.

2. Next lets adjust the DiploCorner.lua and DiploCorner.xml to add the new menu option. The following is the addition in the DiploCoerner.lua file:

```
local g_MultiPullInfo = {};
g_MultiPullInfo[0] = { text="TXT_KEY_ADVISOR_SCREEN_TECH_TREE_DISPLAY", call=function()
Events.SerialEventGameMessagePopup( { Type = ButtonPopupTypes.BUTTONPOPUP_TECH_TREE } ); end };
g_MultiPullInfo[1] = { text="TXT_KEY_DIPLOMACY_OVERVIEW", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_DIPLOMATIC_OVERVIEW } ); end };
g_MultiPullInfo[2] = { text="TXT_KEY_MILITARY_OVERVIEW", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_MILITARY_OVERVIEW } ); end };
g_MultiPullInfo[3] = { text="TXT_KEY_ECONOMIC_OVERVIEW", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_ECONOMIC_OVERVIEW } ); end };
g_MultiPullInfo[4] = { text="TXT_KEY_VP_TT", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_VICTORY_INFO} ); end };
g_MultiPullInfo[5] = { text="TXT_KEY_DEMOGRAPHICS", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_DEMOGRAPHICS} ); end };
g_MultiPullInfo[6] = { text="TXT_KEY_POP_NOTIFICATION_LOG", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_NOTIFICATION_LOG, Data1 = Game.GetActivePlayer() } ); end };

-- Added by Kael 09/17/2010
g_MultiPullInfo[7] = { text="TXT_KEY_MOD_LIST", call=function() Events.SerialEventGameMessagePopup( { Type =
ButtonPopupTypes.BUTTONPOPUP_NOTIFICATION_LOG, Data1 = 999 } ); end };
-- End Add
```

The above adds another option to the multipull menu. If that option is selected it passes the BUTTONPOPUP_NOTIFICATION_LOG and 999 in the Data1 field. Later we will cover how to capture that event and trigger the popup menu on it.

The above works fine for adding a new menu option to the Additional Options menu. But we will want to adjust the size of the dropdown dialog to make room for the new menu option. XML controls the size and format of the UI, so we need to change the DiploCorner.xml to adjust the size.

```
<!-- ================================================================================================================-->
<!-- Notification Log DropDownButtons -->
<!-- ================================================================================================================-->
<PullDown ConsumeMouse="1" Offset="-6,0" Anchor="R,T" Size="45,45" AutoSizePopUp="0" SpaceForScroll="0" ScrollThreshold="900"
ID="MultiPull" >
    <ButtonData>
        <Button Anchor="R,T" Size="45.45" Texture="assets\UI\Art\Notification\NotificationNotes.dds"
ToolTip="TXT_KEY_DIPLO_ADDITIONAL" >
            <ShowOnMouseOver>
                <Image Anchor="R,T" Offset="0,0" Size="45.45"
Texture="assets\UI\Art\Notification\NotificationNotes.dds" />
                <AlphaAnim Anchor="R,T" Offset="0,0" Size="45.45"  TextureOffset="0.0"
Texture="assets\UI\Art\Notification\NotificationNotesHL.dds"  Pause="0" Cycle="Bounce" Speed="2" AlphaStart="0.95" AlphaEnd="0.55"/>
            </ShowOnMouseOver>
        </Button>
    </ButtonData>
    <GridData Anchor="L,T" Offset="-24.-41" AnchorSide="O,I" Style="Grid9DetailTwo140" Padding="0,0" >

<!-- Modified by Kael 09/17/2010
        <Box Color="Black.0" Size="200.260"   /> -->
```

```
                <Box Color="Black.0" Size="200.280"   />
<!-- End Modify -->
```

The above increases the size of the dropdown box from 260 to 280.

3. We piggybacked on the BUTTONPOPUP_NOTIFICATION_LOG function with our change to DiploCorner.lua. So whenever we select our new menu option it triggers as if the BUTTONPOPUP_NOTIFICATION_LOG popup had been called. If we had SDK access we would create a new BUTTONPOPUP definition for our Mod List. But without it we will have to get creative. So we call BUTTONPOPUP_NOTIFICATION_LOG and pass a value of 999 with it (normally the player number is passed, which would never be near that range).

Since we are piggybacking on the BUTTONPOPUP_NOTIFICATION_LOG function we need to block the normal BUTTONPOPUP_NOTIFICATION_LOG dialog from triggering. Which is why we added NotificationLogPopup.lua to our project.

Remember that Lua functions cannot directly call Lua functions in other files. Instead Lua registers functions with a central event service, and monitors that event service to see when it needs to act. In this case this is the normal OnPopup function from NotificationLogPopup.lua:

```
function OnPopup( popupInfo )
    if( popupInfo.Type ~= ButtonPopupTypes.BUTTONPOPUP_NOTIFICATION_LOG ) then
            return;
    end

    CivIconHookup( Game.GetActivePlayer(), 64, Controls.CivIcon, Controls.CivIconBG, Controls.CivIconShadow, false, true );
    m_PopupInfo = popupInfo;
    g_NotificationInstanceManager:ResetInstances();
    local player = Players[Game.GetActivePlayer()];
    local numNotifications = player:GetNumNotifications();
    for i = 0, numNotifications - 1
    do
            local str = player:GetNotificationStr((numNotifications - 1) - i);
            local index = player:GetNotificationIndex((numNotifications - 1) - i);
            local turn = player:GetNotificationTurn((numNotifications - 1) - i);
            local dismissed = player:GetNotificationDismissed((numNotifications - 1) - i);
            AddNotificationButton(index, str, turn, dismissed);
    end
    Controls.NotificationButtonStack:CalculateSize();
    Controls.NotificationButtonStack:ReprocessAnchoring();
    Controls.NotificationScrollPanel:CalculateInternalSize();
    if( m_PopupInfo.Data1 == 1 ) then
    if( ContextPtr:IsHidden() == false ) then
       OnClose();
   else
    UIManager:QueuePopup( ContextPtr, PopupPriority.eUtmost );
    end
    else
    UIManager:QueuePopup( ContextPtr, PopupPriority.NotificationLog );
    end
end
Events.SerialEventGameMessagePopup.Add( OnPopup );
```

In the above the OnPopup function is defined and it is registered to the SerialEventGameMessagePopup event (in **blue**). The first check of the onPopup function is to verify if

this event going through SerialEventGameMessagePopup applies to it or not. So it checks to see it the popupInfo.Type is anything other than BUTTONPOPUP_NOTIFICATION_LOG (in **red**). If it is anything other than that, it returns and ends the function.

But we will be triggering BUTTONGPOPUP_NOTIFICATION_LOG for another function, and we won't want this popup to trigger when we do it. So the following change is required to NotificationLogPopup.lua:

```
function OnPopup( popupInfo )
	if( popupInfo.Type ~= ButtonPopupTypes.BUTTONPOPUP_NOTIFICATION_LOG ) then
		return;
	end

-- Added by Kael 09/17/2010
	if( popupInfo.Data1 == 999 ) then
		return;
	end
-- End Add

	CivIconHookup( Game.GetActivePlayer(), 64, Controls.CivIcon, Controls.CivIconBG, Controls.CivIconShadow, false, true );
	m_PopupInfo = popupInfo;
	g_NotificationInstanceManager:ResetInstances();
	local player = Players[Game.GetActivePlayer()];
	local numNotifications = player:GetNumNotifications();
	for i = 0, numNotifications - 1
	do
		local str = player:GetNotificationStr((numNotifications - 1) - i);
		local index = player:GetNotificationIndex((numNotifications - 1) - i);
		local turn = player:GetNotificationTurn((numNotifications - 1) - i);
		local dismissed = player:GetNotificationDismissed((numNotifications - 1) - i);
		AddNotificationButton(index, str, turn, dismissed);
	end
	Controls.NotificationButtonStack:CalculateSize();
	Controls.NotificationButtonStack:ReprocessAnchoring();
	Controls.NotificationScrollPanel:CalculateInternalSize();
	if( m_PopupInfo.Data1 == 1 ) then
	if( ContextPtr:IsHidden() == false ) then
	   OnClose();
	else
	UIManager:QueuePopup( ContextPtr, PopupPriority.eUtmost );
	end
	else
	UIManager:QueuePopup( ContextPtr, PopupPriority.NotificationLog );
	end
end
Events.SerialEventGameMessagePopup.Add( OnPopup );
```

In the above we added an additional check. Just like the check that exits the function if the type isn't BUTTONPOPUP_NOTIFICATION_LOG, this check exits the function if the Data1 property is 999. This was we can share the BUTTONPOPUP_NOTIFICATION_LOG function without bumping into each other.

4. Finally we get to creating the code for our new screen. First we need the XML definition for the screen. The following was the definition I used for ModList.xml:

```
<Context Font="TwCenMT14" FontStyle="Base" Color="Beige" Color1="Black" >
	<Instance Offset="0,0" Name="NotificationButton" Size="890,60"  >
		<Button Size="890,60"  Offset="0,0"  StateOffsetIncrement="0" ID="Button">
			<Button Anchor="L,C" Offset="0,0" Size="64.64"  Texture="assets\UI\Art\WorldView\ActionItemsButton.dds"
Hidden="1" ID="GenericButton" />
```

```
                        <Label Anchor="R,B" Offset="5,8" Font="TwCenMT24" ColorSet="Beige_Black_Alpha" FontStyle="Shadow"
String="Turn" ID="NotificationTurnText" />
                        <Stack ID="TextStack" Anchor="L,T" Padding="10">
                                <Label Anchor="L,T" Offset="16,5" LeadingOffset="-8" WrapWidth="780" Font="TwCenMT18"
ColorSet="Beige_Black_Alpha" FontStyle="Shadow" ID="NotificationText" String="Text" />
                                <Image Anchor="C,B" Offset="0,0" TextureOffset="0.0" Texture="bar900x2.dds" Size="900.1" />
                        </Stack>
                        <ShowOnMouseOver>
                                <AlphaAnim ID="TextAnim" Anchor="C,C" Offset="10,0" Size="890,64" Pause="0" Cycle="Bounce"
Speed="1" AlphaStart="2" AlphaEnd="1">
                                        <Grid  ID="TextHL" Size="890,64" Offset="0,0" Padding="0,0"
Style="Grid9FrameTurnsHL" />
                                </AlphaAnim>
                        </ShowOnMouseOver>
                </Button>
        </Instance>
        <Box Style="BGBlock_ClearTopBar" />

        <Instance Name="ListingButtonInstance">
                <Button Anchor="L,T" Size="896,32" Offset="0,0" Color="Black.0" StateOffsetIncrement="0,0" ID="Button">
                        <ShowOnMouseOver>
                                <AlphaAnim Anchor="L,T" Size="896,72" Pause="0" Cycle="Bounce" Speed="1" AlphaStart="1.5"
AlphaEnd="1"  ID="SelectHighlight">
                                        <Grid   Size="896,36" Offset="0,0" Padding="0,0" Style="Grid9FrameTurnsHL" />
                                </AlphaAnim>
                        </ShowOnMouseOver>
                        <Stack  StackGrowth="Right" Offset="0,0" Padding="0">
                                <Box Anchor="L,T"   Offset="8,8" Size="175,24" Color="Black.0">
                                        <Label Anchor="L,T" Offset="10,0" Font="TwCenMT18" ColorSet="Beige_Black_Alpha"
FontStyle="Shadow" String="MOD TITLE" ID="Title" />
                                        </Box>
                        </Stack>
                        <Image Anchor="L,B" Offset="0,0" TextureOffset="0.0" Texture="bar900x2.dds" Size="900.1" />
                </Button>
        </Instance>

        <Grid Size="960,658" Anchor="C,C" Offset="0,36" Padding="0,0" Style="Grid9DetailFive140" ConsumeMouse="0">
                <Image Anchor="L,T" Offset="17,90" Texture="HorizontalTrim.dds" Size="926.2" />
                <ScrollPanel Anchor="L,T" ID="ListingScrollPanel" Vertical="1" Size="912,440" Offset="13,94" AutoScrollBar="1">
                        <ScrollBar  Anchor="R,T" AnchorSide="O,I" Offset="0,18" Length="404" Style="VertSlider"/>
                        <UpButton   Anchor="R,T" AnchorSide="O,I" Offset="0,0" Style="ScrollBarUp"/>
                        <DownButton Anchor="R,B" AnchorSide="O,I" Offset="0,0" Style="ScrollBarDown"/>
                        <Stack ID="ListingStack" StackGrowth="B" Offset="4,0" Padding="0" />
                </ScrollPanel>

                <Label String="TXT_KEY_POP_MOD_LIST"  ID="Notifications Label" Anchor="C,T" Offset="0,19" Font="TwCenMT20"
Color0="30.50.80.255" Color1="133.184.186.255" Color2="133.184.186.255" FontStyle="SoftShadow"  />
                <Box Anchor="C,B" AnchorSide="I.I" Offset="0,54"   Size="910,56" Color="255,255,255,0" >
                        <GridButton Anchor="L,B"  Style="SmallButton" Size="150,32"  Offset="14,0" StateOffsetIncrement="0,0"
ID="CloseButton"  >
                                <Label Anchor="C,C"  Offset="0,0"  String="TXT_KEY_CLOSE" Font="TwCenMT18"
ColorSet="Beige_Black_Alpha" FontStyle="Shadow"  />
                        </GridButton>
                </Box>
                <Image Anchor="C,B" Offset="0,110" Texture="HorizontalTrim.dds" Size="926.5" />
        </Grid>
    </Context>
```

The above can be intimidating to look at creating out of thin air. I'm sure there are guys that can create the above from scratch, but I'm not one of them. Instead I take the XML definition from a screen that is similar to the one I want to create, and I cut, adjust and add to that one until it looks like I want it. I use the Notification screen as the base for this and then copied XML from the ModBrowser (the place

you select mods from the main menu) to get the pieces I needed. Since all of Civ5's UI is in Lua it's all available to borrow from in making our own screens.

The above defines the screen, but it doesn't have any logic. That's where we need Lua. The ModList.lua file contains the following:

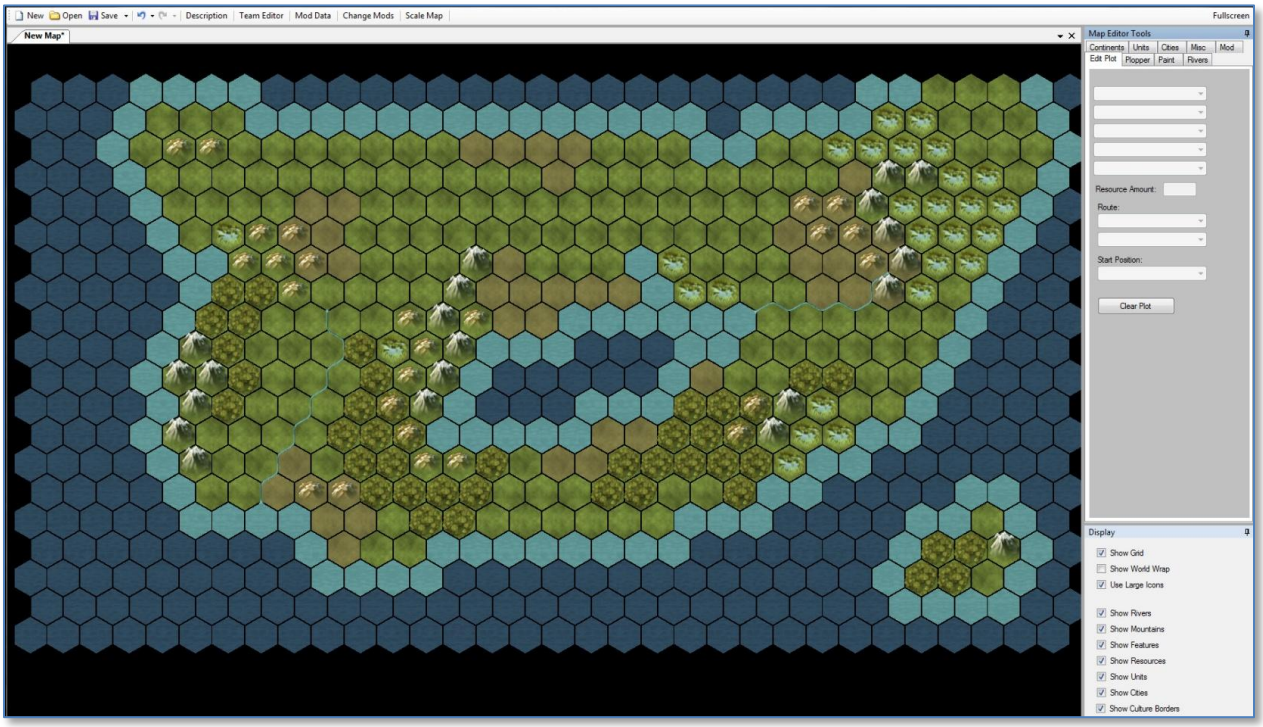
```
include( "InstanceManager" );
g_InstanceManager = InstanceManager:new( "ListingButtonInstance", "Button", Controls.ListingStack );

function OnPopup( popupInfo )

	if( popupInfo.Type ~= ButtonPopupTypes.BUTTONPOPUP_NOTIFICATION_LOG ) then
		return;
	end
	if( popupInfo.Data1 ~= 999 ) then
		return;
	end

	local unsortedInstalledMods = Modding.GetInstalledMods();
	g_InstanceManager:ResetInstances();
	for k, v in pairs(unsortedInstalledMods) do
		local modinfo = v;
		if(modinfo == nil) then
			break;
		end

		if(modinfo.Enabled) then
			local listing = g_InstanceManager:GetInstance();
			local str = modinfo.Name;
			if(modinfo.Version ~= "") then
				local version = string.format("version %s (%s)", modinfo.Version or "", modinfo.Stability or "");
				str = string.format("%s - %s", str, version)
			end
			listing.Title:SetText(str);
		end
	end

	UIManager:QueuePopup( ContextPtr, PopupPriority.NotificationLog );
end
Events.SerialEventGameMessagePopup.Add( OnPopup );

function OnClose ()
  UIManager:DequeuePopup( ContextPtr );
end
Controls.CloseButton:RegisterCallback( Mouse.eLClick, OnClose );
```

Notice that the above is very similar to the Notification log code we modified. It registers to the SerialEventGameMessagePopup (in **blue**) just like the Notification log popup did. But in this case we only allow the OnPopup function to process if the type is BUTTONPOPUP_NOTIFICATION_LOG and Data1 is 999 (in **red**).

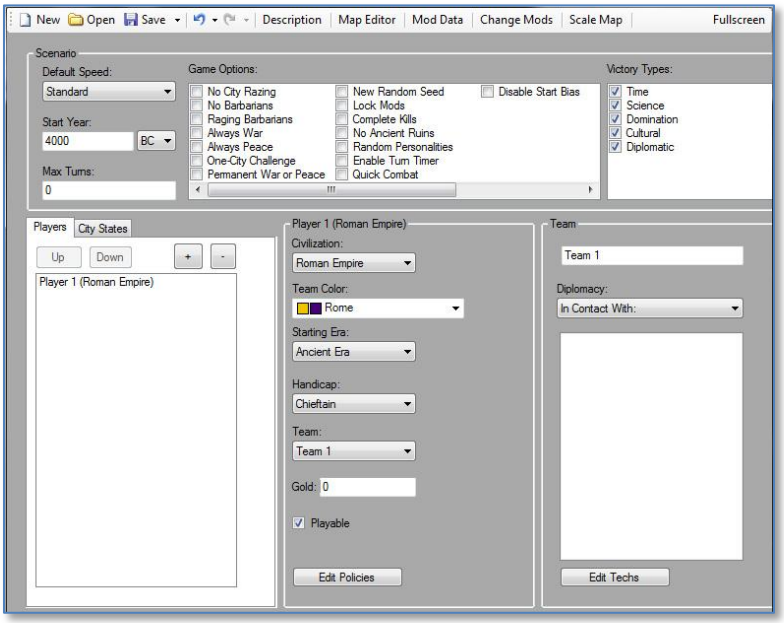
The code is fairly simply. I looked through the ModBroser Lua files to find the calls and functions I would need (that's how I found out about the Modding.GetInstalledMods() function and the .Name and .Enabled attributes for the returns). In essence the OnPopup function adds new lines to the screen display for every installed mod that is enabled for this particular game. It displays the mods name, the version and stability (Experimental, Alpha, Beta, Final) for each of these mods.

The only additional function is the code to Control the close button. A very simple example of adding a new screen to the game.

WorldBuilder

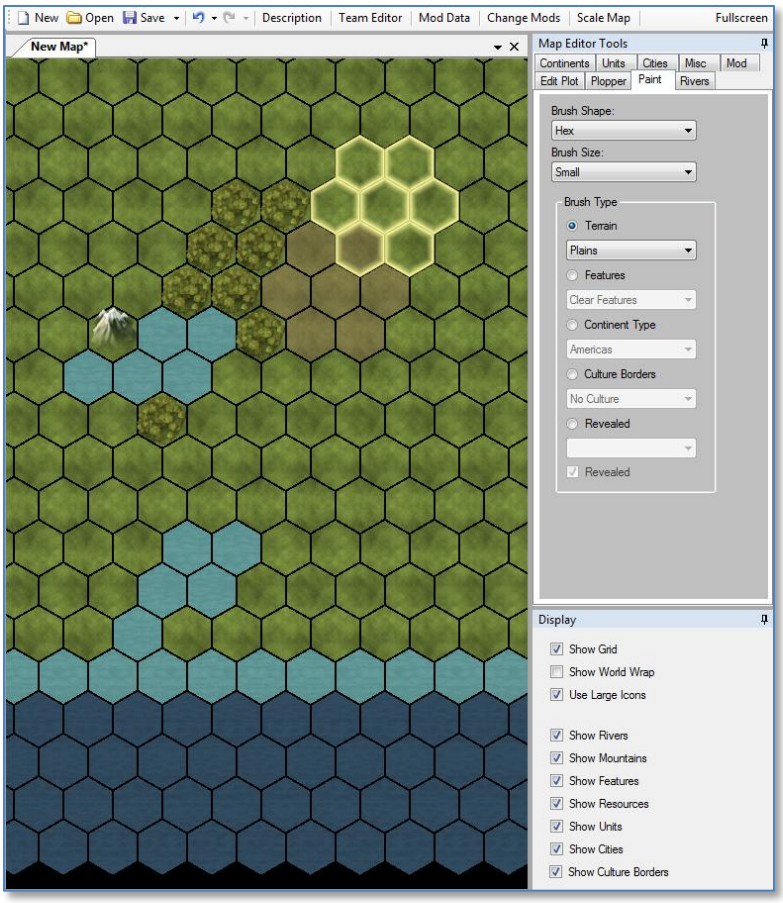


Worldbuilder is a map editor and scenario creator for Civilization V. With it maps can be created quickly, and complex scenarios with starting teams can be developed. This section will go through the options in Worldbuilder so that modders can quickly start creating their scenarios.



Across the top of the file bar there is a description option that allows you to enter your map name and a brief description for the players.

Next is the Team editor. It allows the scenario creator to assign the available civilizations for this scenario as well as their starting techs, policies, diplomacy, gold, etc. Before cities or non-barbarian units can be placed on the map those teams need to be assigned in team editor.



The map editor in WorldBuilder is fairly straight forward. The Map Editor Tools box contains all the tools needed to create an interesting map on the following tabs.

Edit Plot- This allows the selected plot to have any terrain, feature, resource and improvement set. This is also where you can set the plot as the start position for any configured players.

Plopper- This tab allows features, resources, improvements, natural wonders and roads to be quickly painted on plots.

Paint- This tab allows differing brush sizes to be used to lay down terrain, features, continent definitions, cultural borders and revealed terrain.

Rivers- If you are familiar with process of laying rivers with the Civ4 WorldBuilder (I'm fairly sure it involved sacrificing a goat) then it is vastly improved in Civ5. All the hex intersections that can support rivers can be clicked to enable or disable a river passing through that intersection.

Continents- This is where areas can be distinguished as continents (Americas, Asia, Africa and Europe).

Units- Only barbarian units can be placed unless there are players set in the team editor. If there are players set then this tab allows all units to be set on the map, and the state (health, fortified, embarked) of that unit.

Cities- Players have to be set on the team editor before this can be used. If that is done cities can be placed on the map, and the population and the buildings in that city can be set.

Misc- The Misc tab allows the world wrap and randomize resources options to be set.

Once your map is complete, select Save from the file menu to save it. It can always be reloaded to make further changes. WorldBuilder maps are saved in the "..\<My Games>\Sid Meier's Civilization V\Maps\" directory.

Saving a Map from Civilization V

If you like the map you are playing on, or believe it may make a good base for your scenario you can save it directly from the game.

To do so go to the save game menu and there is a button for "Save Map".

That will open the Save Map window where a name can be entered. Click save to save the map. The map will be saved in the "..\<My Games>\Sid Meier's Civilization V\Maps\" directory (the same directory that WorldBuilder saves its files in).

Adding the Map to your Mod

Copy the map file into your mod in ModBuddy to add it to your mod. The name and location of the map doesn't matter. I recommend creating a "Map" directory off the root of your project to place map's in, but it isn't required.

With the mod loaded your map can be selected from the setup menu. It appears with the normal game maps. In this screenshot Ireland is a map provided by the mod.

If you created custom players in the team editor then you will have a "Load Scenario" option on the setup screen. If this is unchecked your map will be loaded without any custom players, units, cities, etc. Just the map will be used. If "Load Scenario" is selected then the only civilizations/leaders from the map can be loaded.

Publishing your Mod

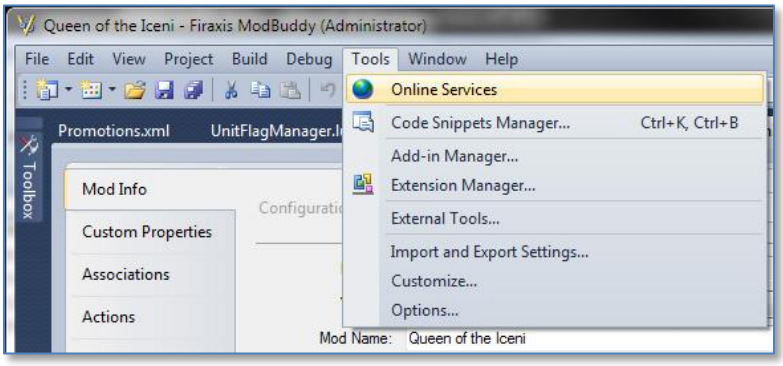
Before you can test your mod you need ModBuddy to "Build" it for you. Building is the process of taking everything you have included with your mod and putting it in a format the game can recognize. You will need to Build your mod each time you want all your latest changes to take effect. You should build frequently and test each change as you add it (rather than changing a lot of files at once then having the hard task of figuring out which change is keeping the game from loading).

Once you are ready to share your mod with others you can publish it in two different ways.

The first way is that the files can be distributed outside of the game. The Mod Browser is a great resource, but it isn't required to share mods. Your mod will be in your "..\< My Games>\Sid Meier's

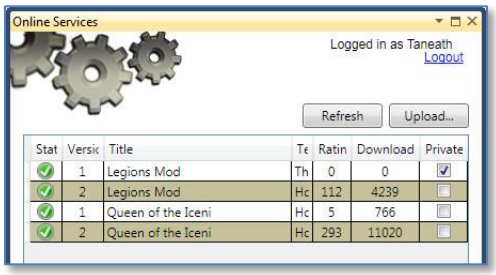
Civilization V\MODS" directory. You can zip that mod directory and share it with others (who will have to extract it to their "..\< My Games>\Sid Meier's Civilization V\MODS" directory).

The second way is through ModBuddy with the "Online Services" option under the Tools menu. This uploads your mod to the mod database so that others will see it in the mod browser.



To upload your mod go through the following steps after selecting Online Services:

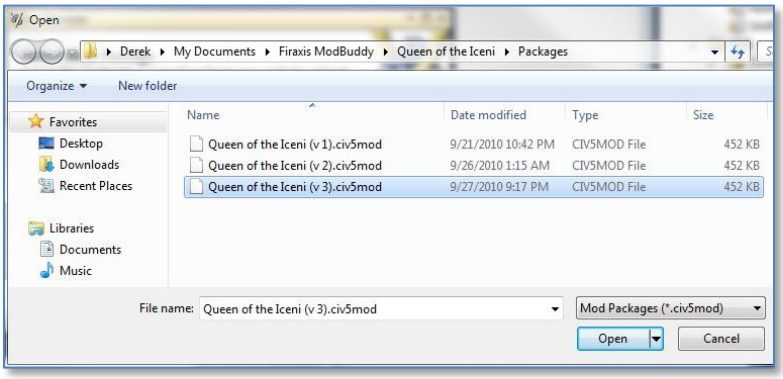
1. Login to Gamespy (if required).



2. Select Upload from the Online Services screen. Notice that this screen will also show you the status of mods you have already uploaded, including prior versions.

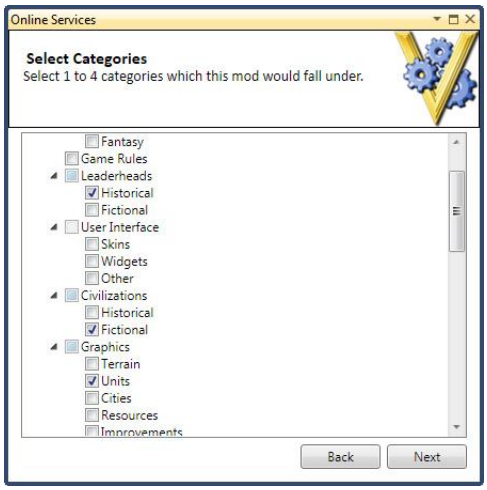
3. Click the ... button on the Select Mod Package screen to browse for the mod to upload.

4. Select the mod package. It defaults to ../My Documents/Firaxis ModBuddy/<ModName>/Packages directory. If you have multiple versions of the mod they will all appear here. Select the version you want to upload (typically the most recent version).



5. Wait while the Mod uploads.

6. Select the Mod categories that apply to your mod.



That's it, your mod should be uploaded and available for players to download.

To update a mod change the version number on your mod's property screen then reupload using the above process.

Exclusivity

There are three levels of exclusivity for Civilization V mods.

- **Nonexclusive**- Any mod can be enabled with your mod (default).
- **Partially Exclusive**- Any mod that is referenced by your mod or references your mod can be enabled.
- **Totally Exclusive**- Only mods which are referenced by your mod can be enabled.

Most mod's will be non-exclusive. Meaning that they will work with all other nonexclusive mods (and partially or totally exclusive mods that select them). If you are making a mod that adds a new civilization, new units then you will probably want to make it a nonexclusive mod.

Partially Exclusive is the appropriate setting for total conversion mods. If you make a civil war mod you probably don't want the player to run it with a Spain Civ, or with a mod that adds Firaxis as a new world wonder. If your mod deletes any base assets in the game (removes a resource, tech, etc) you will probably want it to be Partially Exclusive, since those assets may be used by other mods. If you or other mod authors set their mod to be able to run together with yours then they will be able to be run together.

Totally Exclusive is the ultimate in mod control. Your mod can't be used in combination with any other mods unless you specifically allow that mod. The only difference between this and being partially exclusive is that it keeps other mod authors from being able to allow their mods to be able to work with yours. This setting should be very rare, only for mod authors who have had problems with other mod authors marking their mods compatible and causing compatibility issues.

Troubleshooting

If you are a dumb guy like me, you spend 10% of your time creating, and 90% of the time trying to figure out why it doesn't work. Of all the files Firaxis provides to help us mod, I spend the most time looking at the debug logs.

The debug logs are located in the "..\My Games\Sid Meier's Civilization 5\Logs\" directory. There are numerous files here, I find it helpful to sort the files by date to see which file has been updated the most recently. I won't go through all the files here, only the two I refer to most commonly.

Database.log

This file contains all the exceptions when the database loads. This typically means XML reference issues. If a Civilization refers to a leader that doesn't exist anymore, or a unit refers to a resource that has been removed then the Database.log is a great place to find it.

This is a great place to find mistypes. If you have spelled LEADER_ELIZABETH incorrectly and your game is crashing on load this log file will give you a clue as to what went wrong. Here are some sample errors from Database.log:

```
[207898.601] Invalid Reference on Civilizations.Civilopedia - "TXT_KEY_CIV_RUSSIA_PEDIA" does not exist in Language_en_US
[207898.616] Invalid Reference on Feature_YieldChanges.FeatureType - "FEATURE_RIVER" does not exist in Features
```

Lua.log

Much as the Database.log helps you isolate XMl problems Lua.log helps you isolate Lua errors. Notice that in most cases (as in the example below) the Lua.log file gives you the file generating the error and the line number. Very handy when trying to figure out why your mod isn't working.

```
[202778.570] Syntax Error: [string "Lua/ModList.lua"]:165: 'end' expected (to close 'function' at line 14) near '<eof>'
[202778.570] Runtime Error: Error loading Lua/ModList.lua.
```

Design Philosophy

This section includes some insight into common design pitfalls and how to avoid them. Though the rest of the document focused on the technical issues around modding, this section is devoted to game design.

There is no perfect way to make a mod. Understanding that I am unqualified to write this section I enlisted the aid of some of my fellow mod makers (and my favorite designer) so that readers could get a wide range of opinions. Each of the Danger sections are concluded by a question that has been asked to the designers about how they deal with the challenges of development. Their responses offer very practical advice for all mod makers.

I would like to thank the following people for responding to the interview questions and providing input for this section:

- **Soren Johnson**- Civilization IV Lead Designer.
- **Jon Shafer**- Civilization V Lead Designer.
- **Sevo**- Designer of Sevomod 3, Sevo's Civilopedia and Sevo's Faces of God.
- **Rhye**- Designer of Rhye's Catapult, Rhye's of Civilization and Rhye's and Fall of Civilization.

Build the Game You Want to Play

This is the first rule: you are the only person who has to like what you have created. Don't make the mod you think other people will want, don't change a design based on outside feedback unless you agree with it. It is better to have an unpopular mod you enjoy than a popular one you don't. That goes for all the advice in this section, if you don't like it, don't use it. This is the advantage of modding, Firaxis has to worry about making sales and mass appeal, but we don't.

The truth is, if you stick to what you like in time you will find others that are looking for the same thing, so it will work out anyway.

Avoiding the Design Pitfalls

The Danger of More

"Perfection is not achieved when there is nothing left to add, but when there is nothing left to take away." -- Antoine de St. Exupery

Every new object has a cost, not just in what it takes to create, test and manage, but the player has to keep track of it as well. In general we should only add items because they offer a significant improvement to some aspect of the game, and not just to have more units, more resources, etc.

It sounds good to be able to offer a long list of new objects. That was much of the appeal of the very popular Civ3 Double your Pleasure (DyP) mod. But the success of DyP wasn't because of all the new objects, but because each one had a distinct functional purpose. Adding buildings is easy, making them truly worthwhile is the hard part.

Is it needed? Would it be missed if it was taken out? Is it functionaly unique? If the answer to these is no, it should be considered for removal.

Q: There always seems to be one more building or unit that would be perfect to have in the game, how do you decide what to include and what to keep out?

Soren Johnson

> Look at other successful games as an example of the number of units/buildings/choices to include. For example, Blizzard RTS's stick to a very rigid limit of 12-15 units per faction. That's a reasonable number of choices. We tried to have about 8-10 unit choices per era in Civ4, with the understanding that there would be some overlap. This is one area where there really might be a "magic formula" for how many choices are just right for fun gameplay.

Jon Shafer

> As a designer a lot of times you just have to go with your gut. What "too much" or "too little" means varies from person to person. I think most designers tend to lean in the direction of "what would I enjoy playing with." For example, in Civ 5 Paratroopers are in the game to start, whereas that wasn't the case in Civ 4. Why? Really, just because I thought they were cool. It's a way to spice up combat in the modern era. Once you've added or changed anything though, it's vital to play with what you've done to make sure it works. So many of the ideas I've thought were cool on paper turned out to be duds in the game. As experienced designers like to say, design is more about making something work than having cool ideas.

Sevo

> You need to be careful about adding every new unit that pops up or you can think of--at some point you'll lose focus. I prefer a slower staged approach: add a unit or two and play out a game; see how the new units work in the overall scheme. Actually, that's a point I should have made earlier: if you're in any way responsible for the overall direction and management of a mod, you ought to be playing it pretty regularly during "upgrading". It's the single best way to learn how your mod is functioning and what the problems are.

Rhye

Statistically, I decline 80% or more of the proposals I receive from users, for different reasons. One is the design scheme: often they don't fit it. Another reason is the lack of graphics: I don't add anything that hasn't an adequate representation. Another reason is complexity / feasibility: often what they propose can't be done or is too hard: but in most cases the idea is good and a simpler variant would be fine.

And a final aspect, one always has to ask himself: will the AI know how to use this change?

The Danger of Flavor

Why do games based on movies and movies based on books always seem to be bad? There are exceptions, but we are usually disappointed with the results of these conversions. The reason is that the design of the new game or movie is based so strongly on the flavor of its source that its own functional design suffers.

At some point you should look at your mod as just a functional process, a board game without any stylized components, an exercise in mathematics. A game must be enjoyable at this layer to be fun. Some games are so well designed they only exist at this layer and are still amazing to play (chess, othello, tetris, etc). But a game that has incredible flavor but no meaningful functional elements will always be a bad game.

If you fall in love with a concept that seems like a great idea, but doesn't have any functional value, the temptation will be to come up with a functional need. There isn't anything wrong with this, some ideas come from flavor, and some come from function. Different people are more apt to think from one end or the other. But, be aware of the danger that designing from flavor presents. If you aren't able to come up with an elegant functional need you are best off to remove or change the flavor rather than let the functional design suffer for it.

This danger is even more prevalent when you are basing your mod on a known source. It is nice to already have all that flavor developed for you, but it can be as constraining as it is helpful. You will either have to let your design suffer (to what level is up to your own ability to find creative elegant solutions) or be willing to step outside the bounds of the source material and develop new elements, or exclude elements despite their existence in the source when the material doesn't improve the game play of your mod.

Q: How do you balance between Function and Flavor? What do you do when you have a functional need for an element but aren't excited about the flavor ideas you have? How do you deal with a good flavor concept that has no functional need?

Soren Johnson

It's easy to think that Function (game play) should beat Flavor, but really the Flavor is the whole reason people decide to play a game in the first place. They come for the Flavor; they stay for the Function. You've got to have both elements, so if you have a nice Flavor bit without a matching Function, either work harder to find the Function or cut it out entirely.

Jon Shafer

Function and Flavor definitely need to be balanced. How you end up there can vary quite a bit from feature to feature. I think most of the time it's best to start with Flavor, because that's what's going to make your work memorable. It's one of the reasons why Alpha Centauri is such a beloved game. Every game starts with a "hook," where you're trying to sell people on an idea. In a broad sense, Civilization is about running an empire and crafting history in the way YOU'D like to see it. Everything has to somehow point back to that basic premise. You also have to apply that same thinking to individual mechanics. "What do I expect a player to think or feel when they play or use X?"

That having been said, there are also times as a designer you have an idea for a system that you're really excited about, and you have to craft some flavor around it. This is kind of how the Social Policies came to be in Civ 5. I had a pretty good idea of how I wanted the mechanics to work at the start of the project, but many of the names and details came later. And it went through a few variants - the system didn't pop out of my head fully-formed or anything like that. It needed some time and love before it ended up in a place that I was happy with.

Sevo

This is probably the most important question to answer in creation of a mod, in my opinion. This game is so open to creation and modification and there are so many interesting ideas floating around that one tends to want to throw it ALL together and it's easy to get carried away. I think what you leave OUT of a mod is as important as what you put in.

To that end, when I'm working on a mod, I tend to focus first on function and second on flavor, because if it's beautiful and it's unique but it's totally unplayable because of balance issues or game play, then no one will play it. That's really the trick, I suppose, to making a great mod: creating the flavor and style you picture without losing the function.

As to the need for a functional element without flavor and vice-versa: this is where the ingenuity and creativity of modding come into play. You will find things that are imbalanced, or pieces you need, or things that must be adjusted: you as a modder can implement them any way you can imagine, and your charge is to keep the feel of your mod while you do it. On the other hand, sometimes you have a flavor, an idea that you really love, but the function is poor. You have two choices: find a way to MAKE it function, or drop it despite its flavor.

For example, the settler religion mod: At one point I included this in Sevomod, but it completely unbalanced game play since ALL new cities started with a religion. I really like the idea, but it doesn't work in the mod, so I had to lose it. It hurts, but if you can't find a way to keep it functional, then it's better to leave it out. I've tried and dropped dozens of ideas/units/etc because they just didn't fit.

Rhye

I always tend to add only things that have both function and flavour. I mean that if I have a cool unit designed by somebody else to add, but nowhere to put it without unbalancing the game, I won't bother. And if I feel a gap should be filled by a unit, but I don't have an adequate graphical representation, I won't add it as well.

If we speak about maps, then the function is more important than the flavour. See how many giga maps are being / have been developed: they're pointless, because nobody has a computer strong enough to play them.

The Danger of Patterns

Starcraft was a big eye-opener for me, an RTS that offered 3 different forces that were balanced but completely unlike each other. It's so much easier to balance a game by making the options mirror each other but it's more enjoyable for the player to have a variety of options that are dissimilar.

We could be talking about any game feature. For example we could have a series of Civics that gave +3 research at the first level, then you could upgrade to one that gave +9 research when you learned the appropriate tech and up to +15 with the final tech. Or you could have a series of civics, one of which gave +3 research, another gave +3 gold and one that game +3 hammers. In either case the result may be balanced but uncreative, and dull for the player.

The obvious response to this is that if we don't stick to patterns then invariably some options will be better than others. Better or unbalanced options are the same as no options. But I think we have some flexibility here. This is the challenge of design, presenting the player with multiple options with different risks and rewards for each, and having each viable for different reasons or in different situations.

Q: It seems easier to build on a tested design, and have new elements be functionally similar concepts to existing ones but with a new power level or different range of effect. How do you determine when this isn't innovative enough? Or is that even a concern for a strategy game?

Soren Johnson

Innovation should not be a primary goal - fun game play should be the goal. Innovation is the process of both improving old systems as well as creating new ones out of thin air. However, it is always best to understand what your game's aesthetics are so that your new systems aren't a mis-match. For example, Civ's aesthetics are tiles, turns, and boxes-filling-up-with-stuff.

Jon Shafer

I think it comes down to having clear goals at the start. Throwing stuff at the wall until it works is one way to design a game or a mod, but it generally takes a long time and can be expensive. Once I have a rough target, my inclination is always to try the extremes, and tone things back if necessary. If you try something crazy you could strike gold, or you might not, but you'll have at least learned something, and perhaps there are some ideas you can use in other ways. If absolutely nothing works, you can always fall back on what's been done before. Fortune favors the bold!

Sevo

This is a harder question to answer, and I think it falls into the domain of "what makes a good mod". It is certainly easier to simply change combat values or movement or whatnot; to actually innovate an entirely new system is difficult.

Sometimes a new system works very well: for example the new Civilopedia I started with was well received because, I think, it was a marked improvement over the old system. On the other hand, I tried a new system for religions in "Faces of God" and while I spent hours and hours putting together the units, python, etc for that mod, in the end the system didn't lend itself to great game play; at least not as it stood and I haven't had time to go back and re-examine it. So there's a bit of trial and error involved, certainly, but hitting on a successful new idea is worth the losses you'll encounter.

Rhye

I think that this is a concern. That makes the difference between a mod for personal use and for sharing. For instance, if I just want to boost some units stats, I will not post it. Usually I'd eventually find out another mod better than mine, that does the boost I wanted, plus something else.

I'll share it if I have a unique idea instead, something that hasn't been done before by anybody.

The Danger of Complexity

Overly complex designs are the easiest mistake for a designer to make. A designer should differentiate between systems that are fun to design, and those that are fun to play, they are rarely the same.

Personally I am fighting this issue all of the time. I find myself designing the system the way I imagine, setting it down and coming back to it with a clear head to take a look at what I made. Most of the time I can cut a lot of the design without losing its functional purpose or flavor, or I find that the mod is better without it at all.

As in all things there is a balance here. Every new feature brings in some additional complexity, just as every new object adds to the amount of information the player needs to track as we discussed in the Danger of More section. Having the idea is only the start.

I was considering a manufacturing process for a mod. If you have access to dyes and cotton you can build a tailor shop that produces a “Cloth” resource. If you have access to fur you can build a leatherworker that produces a “Leather” resource. If you have cloth and leather in a city then all units produced in that city get leather breastplates that improve their combat ability. And on and on it went, it was a lot of fun to design, huge complex systems with interdependencies everywhere. It would have been a disaster to play for most players. That’s not to say that some people wouldn’t have enjoyed it, some people love complexity. Just keep in mind that what sounds reasonably simple in the design stages, when added together with everything else and in the hands of a player that hasn’t spent the hours considering and tinkering with the mod as you have, can be a substantial roadblock.

Q: How do you balance between complex ideas that bring new elements to the game and the difficulty they cause casual players?

Soren Johnson

The best place to introduce complex ideas are at the fringes, in places where the player doesn't have to understand the complexities if they he or she doesn't want to. For example, many Civ4 players probably didn't realize how Great People probabilities are calculated - but not knowing the details didn't necessarily stop them from progressing and enjoying the occasional Great Person that they got naturally.

Jon Shafer

I think systems can be designed in a way to be relatively approachable and yet still have depth. This was my goal with the Social Policies. Lots and lots of choices to make, but the system isn't impossible to figure out as a first-time player. Again, everyone's specific tastes vary, but I do feel it's possible to hit both ends of the spectrum if that's your goal from the beginning. You won't end up there accidentally though! I think you can have mechanics aimed at more experienced players, but they can't be core to the experience of playing the game, and new players should be able to safely ignore a feature if it's not something they're comfortable using.

Sevo

I don't worry too much about adding new ideas to game play, but my mod is primarily an expansion of game play so most users follow pretty readily. Even when I change stuff I find that gamers by nature are quick to pick up new functions, if they aren't too mysterious or complicated.

Rhye

I base myself on feedback. If I see that a complex change is welcome and understood anyway, it's okay. Documentation (including a site, a faq, and quick answers on the forum thread) can be important. But even more important than this, is the difficulty that it will cause me. When I add something to my schedule, I have already asked myself if it's possible to do that, and how.

Two examples of what NOT to do:

- compile a list of features and advertise it with no idea about how to do it, and
- work without a deadline, keeping postponing your work for months and months. it's true, you work for free, but if you don't finish your work you'll have really wasted your time.

The Process of Mod Building

Writing your Design Document

It’s not fun, everyone wants to get right into making changes and seeing those changes in the game. But your first step is to get a design document written. It can be a forum post you update, a Word document or just notes on paper. Without it your mod design won’t have focus and it will be difficult to make the best use of your time without a clear idea of what needs to be done. It will also be difficult for team members to help you if they don’t have access to the full design list.

I have a hard time being creative in front of a computer so I grab a notepad and pen when I want to do serious design work. Sitting in a comfortable chair I jot down ideas and think about things I want to improve. Different people have different methods, the important part is to find one that works for you.

Economics = Choice under Scarcity

A game is an entertainment activity that gives us options, and rewards us for selecting them skillfully. The quality of those options, the amount of appropriate risk and reward we get from each, the variety of options (without being overwhelming) and the successful merger of function with a matching flavor determines if the game is a good one.

To make choices we need to have some cost, something we give up to gain the advantage the option offers. This could be paid in some other resource like gold or production time, or it could be in something less definable. One of the classic early game options is, do you build the infrastructure of your cities or build defenders? If you build the infrastructure you will have better cities by the mid-game, if you last that long. But the price you pay for it is in increased risk of attack and losing the game.

That is an elegant game design (thanks to Sid Meier). To have options we need to have limits, we can't do it all so some things need to be sacrificed to gain others. That doesn't mean that all of the options need to have a direct disadvantage, it may be enough to just have the sacrifice be that you have given up taking other paths, it is economics.

I'm particularly fond of Civ4's civic design. Personally I like having civics that have a direct disadvantage along with whatever advantages it offers, but from a straight design perspective I have a deep appreciation for what Firaxis did. The civics don't need disadvantages, their disadvantage is that if you pick a civic you can't pick any of the other ones in that category.

Another truism of scarcity is that we must have good and bad elements for it to work, the Desert dilemma. From a players perspective deserts seem useless, they have a few functions but are generally the least useful of the terrains. So you may wonder why they can't be removed and replaced with something that does more. Their design function is that they aren't useful, and therefore by comparison other terrains are. The difference between the two makes the players strategic options more interesting.

When in Doubt, Trust Firaxis

The old saying is if there is a fence in the woods you should know who built it and why it was built before you tear it down. That was never more true than when making mods. I will admit, I love changing things more than I love reading about the way things work so the trap I sometimes get caught in is designing something without a good appreciation for the way its associated systems work.

My advice is before you make a significant change you review the way a similar system works in detail. If you want to make a new unitcombat, look at the ones that are already developed. Do a search in the python, xml and the SDK for matches against a similar unitcombat and see where it has been used and what it has been used for. When you understand how the data is used you will be better prepared to make your own.

The same goes for balancing. Firaxis has done more work, and has had more man hours invested in "Vanilla Civ" then we can hope to with any one mod. Don't let all of the testing and feedback go to waste. Look at the iCombat increases between upgraded units that Civ applied when you consider your own. Base your new specialists effects on those that already exist.

Prioritizing and Saying No

The sad fact is that we all have limited time. As much as we may love to mod there are only so many hours in the day and most of us have jobs and families that also demand our time (to my wife: "I mean that we want to spend time with").

We have to be careful about our ambition. If our only goal is to mod for fun, to play around, change our game and learn a little bit in the process then this isn't a big concern. If we are working with others and they have helped by devoting time and effort to your mod this becomes more important. In those situations there is some responsibility to produce a working mod.

So we have to realistically decide what will and won't be done, at least for the short term. If you aren't familiar with python or C++ then starting a mod that requires programming changes is probably going to be too much. But you could focus on xml modding only.

Once you have your idea you will need to prioritize them. I am always on the lookout for "Drool Factor", those features or additions that will make people want to download and play the mod. No one ever downloaded a mod because it had 17 different kinds of infantry or a ice cream truck unit that played music when it drove around (well, maybe I would download that mod just to try it out) so as interesting as those ideas may be they don't have any "Drool Factor".

You have read countless marketing releases talking about one game or another. What features did you read about that excited you? Those are the kinds of things that should be at the top of the priority list. I hate to spend time working on a feature that players aren't going to be excited about.

And some changes shouldn't be made at all. This is more difficult when you are working with a team that is as excited and working as hard on the mod as you are. But the mod owner has to be the one to say what is going to go in and what isn't. Remember it's easier to say no and then change your mind and add it later than it is to do all the work to make something only to remove it later on.

Building a Team

There is no magic trick to building a team. Assume from the beginning that you will need to do all of the work yourself, then start working. If people join you along the way to help out, so much the better, but don't expect it.

In most cases an idea, no matter how appealing, won't draw a team by itself. Instead the mod owner will have to show the work he has done to start getting help. The reason is that there are new ideas for mods posted every day asking for help. Naturally people don't want to spend time working on a mod idea that won't ever be released. If they see that you have put a lot of effort into it yourself the risk that their work will go wasted is lessened and they will be more apt to join.

It is my opinion that the mod owner for a complex mod should be a programmer. He doesn't need to be the best programmer on the team (I'm certainly not on my team) but he does need to understand the programming aspects. This is because the mod owner has to be the one to decide what is and isn't going to go into the mod, he won't be able to make these decisions well if he doesn't have a decent appreciation for what has to happen "under the covers" to make it work. Also the mod owner always has to be prepared to do it alone if need be. If you leave the programming aspects to someone else without an ability to pick up if they leave you may risk losing your mod if they go on to other things.

One more point about teams. This is an open, fun, collaborative process. Don't expect deadlines and arbitrary goals to be met unless you are willing to pay your team. It's the mod owners responsibility to get the work that needs to be done listed and the team members can work on different aspects as they desire. Anything more than that isn't fun for anyone. Invariably you will be working on some component and want a piece from a team member to finish it, or team members will come and go as their real lives dictate, but that is the nature of collaborative modding.

When to Release

A mod is never perfect, there is always some new feature, art or object you would love to get added before you release. The danger of that is that you may never get it out.

Momentum is important for a mod, both for you (hearing from players that enjoy your mod will give you the energy to keep going) and especially for your team (who want to see their contributions out and available). Other mod makers may have different ways of doing this but I like to set hard release dates and then work back from them instead of working from feature lists. If I commit to release a new version on the first Friday of each month then you and your team know when they have to have new stuff in by to have it included.

Releasing after certain features are in creates a pressure to get work done that may aggravate your team if they feel like they are holding up the release. Better to just tell them the dates and let them manage their part as they prefer.