

Annex V - Game Maker

GameMaker: Studio caters to entry-level novices and seasoned game development professionals equally, allowing them to create cross-platform games in record time and at a fraction of the cost of conventional tools!

In addition to making game development 80 percent faster than coding for native languages, developers can create fully functional prototypes in just a few hours, and a full game in just a matter of weeks.

Tutorial

http://gamemakertutorials.com/?page_id=2

Drawing text to the screen is a basic part of most videogames. There are a huge number of useful applications for text. Just a few of the more common applications:

1. Score
2. HUD/Dashboard
3. Menus
4. Special effects
5. Messages and dialogs
6. Instructions/Story
7. Debugging/diagnostics/benchmarking — it can be incredibly useful to draw the current value of variables to the screen when debugging, or performance metrics.

Things to know about drawing stuff in GameMaker

1. **Draw functions only work in two places:** In the *Draw* or *Draw GUI* Events, or when drawing to a Surface. If you try to use them *anywhere* else, nothing happens. If you're drawing in the Draw GUI Event, you'll want to be familiar with the `draw_set_gui_size()` function so your Draw GUI stuff will be drawn to the proper scale if you're using Views.
2. **Drawing directly to the screen (especially text) is slow.** Draw a lot of text and performance will suffer.
3. **There are ways to improve performance when drawing text.** The most important of these is to use Surfaces. Surfaces are not available in the free edition of GameMaker, and not all hardware may support them. Using surfaces properly is *not that* difficult once you understand them, but is generally considered to be an “advanced” concept in GameMaker, and is less straightforward than drawing directly to the screen in the “normal” way.

4. **But there are challenges.** Setting up a Surface for optimizing text performance is tricky because it can be hard to know in advance how large the surface needs to be to contain the text you are drawing. Fortunately, GameMaker provides some useful functions which can enable you to get the dimensions needed for the surface: `string_width()` and `string_height()`, which give you the width and height, respectively, in pixels of a string drawn with `draw_text()` in the current font. If you're using `draw_text_ext()`, `string_width_ext()` and `string_height_ext()` are the functions to use instead. These functions allow you to create a drawing surface of proper dimensions, provided you know the string and font and can decide on a width prior to creating the surface. Keep in mind that the dimensions of a string depend on the font used to display it, so always use `draw_set_font()` to set the font to the correct one that you intend to draw the string with *before* using the measurement functions.
5. **Draw settings (for things such as color, alpha transparency, and font alignment) are global in GameMaker.** That means that if you have multiple objects which draw functions, and if any of them changes the color, alpha, or font alignment, all objects will be drawn using those same settings. For this reason, if you are using draw functions in your objects, it's best to set all the draw settings in the object in order to make sure they are what they need to be. If you *never* change color, or alpha, or font alignment, then you don't need to set that property before you use draw functions — but if you do need to change them for one object, it's best to set them to what they need in the Draw event of every object, immediately before calling the drawing routines.
6. **For serious performance optimization,** you need to [learn how GameMaker “batches” drawing operations](#), and organize your code to have the least number of drawing batches as possible.

Fonts

Everyone these days knows what fonts are, right? Fonts are like the clothes that text dresses up in when it wants to go out and be seen. In GameMaker, fonts are game resources, just like sprites, or objects, or other resources, and need to be added to the project — you don't simply have direct access to the same fonts that are installed on the system, you have to explicitly add a font to your project. If your project has no font resources set up, text drawn to the screen will still render, but oddly and probably not consistently across platforms. So, always define a font resource and make sure that it's used if you're drawing text.

To save space, you can define a font resource to include only certain character ranges, such as number digits only, or alphabet characters only, or only the upper case or lower case letters in the alphabet. If you know you won't be needing certain characters, and are concerned about the size of the game when it is built, go ahead and constrain the range. Otherwise, the default range of 37-128, covering A-z, 0-9, and special characters, is good.

For legal reasons, it's important to note that fonts are copyrighted, and most need to be licensed for commercial use. There *are* free fonts out there (google for them) with liberal licensing terms that you *may* be able to use in your project, if the terms of the license allow. Of course, you can create your own fonts. Creating your own font is outside the scope of this article, but there are tools you can use to produce your own fonts if you're crazy enough. It's probably easier to simply purchase a license for a professionally designed font.

Formatting issues

Alignment

Text alignment is set using the `draw_set_halign()` and `draw_set_valign()` functions. Use GameMaker's built-in font align constants as arguments to these functions to keep the code readable.

New Lines

To signify a new line in a GML string, use the pound character (`#`). The GML code

```
draw_text(x, y, "Hello#World");
```

would be drawn like so:

Hello
World

You can also use a literal return in your string, but it'll make your source code look yucky.

```
draw_text(x, y, "Hello  
World");
```

Would draw to the screen exactly the same as “Hello#World”.

Escape characters

If you’re familiar with strings in programming languages, you know that it gets tricky when using certain characters that are reserved for program syntax or markup. Most languages allow you to “escape” the markup syntax so that you can still use characters normally reserved for markup purposes as literal characters in a string. GML is no exception.

#

What if you want to use a # in a string, and you don’t want it to signify a new line? Use the “\#” escape character.

The string "We're \#1!" would be drawn like so:

We're #1!

Quotes

A matched pair of quotes, single *or* double, can be used in GML to begin and end a string. If you want quotes to appear as text within a string, you can use the other type of quote to encapsulate them, like so:

```
my_string = 'This is a single-quoted string.';
my_string = "This is a double-quoted string.";
my_string = "This is 'an example' of a string including double quotes-as-text.";
my_string = "This is 'an example' of a string including single quotes-as-text.";
```

It gets tricky when you need to have BOTH types of quotes in the same sentence:

```
my_string = 'Bob said " We shouldn' + "' + "t." + "''; // Bob said "We shouldn't."
```

It looks like a mess, but you just have to do a lot of concatenation and quote your quotes with the other type of quote marks.

String concatenation

As with many languages, you can combine two strings together by adding them with the `+` operator. With number values `+` adds them; with strings, `+` concatenates the two strings together, creating a longer string made of the first one and second one stitched together. You can do this with literal string values, or with variables containing strings:

```
concatenated_string = string1 + string2;
concatenated_string = "Hello " + "World";
```

But if you try to add a string and a number, you need to tell the program to convert the number into a string. The `string()` function will convert numeric values to strings, which allows them to be incorporated into a larger string.

```
health = 100;
draw_string(x, y, "Player1 Health: " + string(health));
```

GML String functions

We've already introduced a few of the more commonly useful ones, but there are many other useful [GML string functions](#). I'm not going to go into each one in depth, but review the official documentation and keep in mind that they're out there, and can be useful. One important thing to be aware of with GML strings is that, unlike most other languages, GML strings are 1-indexed, not 0-indexed. This means that when counting the characters that make up the string, the first character is character 1, not character 0.

Keep code clean by storing strings in variables

This is perhaps obvious, but it's often useful to store a string value in a variable, to keep your code neater and easier to read.

```
draw_string(x, y, "Four score and seven years ago our fathers brought forth on this continent a new nation, whose
  created equal.##Now we are engaged in a great civil war, testing whether that nation,
battlefield of that war. We have come to dedicate a portion of that field, as a final resting place for those
  fitting and proper that we should do this.##But, in a larger sense, we can not dedicate, we can not consecrate,
struggled here, have consecrated it, far above our poor power to add or detract. The world will never
  here. It is for us the living, rather, to be dedicated here to the unfinished work which they have
  to the great task remaining before us—that from these honored dead we take increased devotion to this
  highly resolve that these dead shall not have died in vain—that this nation, under God, shall have
  people, shall not per-
```

— is a lot harder to read than:

```
draw_string(x, y, gettysburg_address);
```

— and moreover, all that text gets in the way of comprehension of what your code is doing. So use variables to store strings, and keep your code looking clean.

draw_text_ext()

While we're dealing with a very long string, it's a good opportunity to talk about a function that makes drawing them much easier.

You could manually set line breaks in a long string by sprinkling #'s every N characters or so, but that is laborious and inflexible. It's better to use the `draw_text_ext()` function, which allows you to specify a width for the line, and (optionally) also how many pixels should separate lines.

```
draw_text_ext(x, y, string, vertical_separation, width);
```

When drawn, the line will automatically break when it reaches the width provided to the function.

Formatting

GameMaker is rather limited in its typographical capability when drawing text to the screen. GameMaker Font resources, unlike an installed font on the system, are a specific size and style only. There's no bold or italic or other style options available that you can use to modify the font resource. If you want bold or italic, you have to create a new font resource, and use `draw_set_font(font)` to that resource in order to use it.

This means that if you want to use bold text in a sentence, you need to create a second font resource for the bold font, draw your normal text, then switch fonts to the bold font, and draw the bold text, *somehow* positioning the two different drawings so that they look like they're a single block of text. You have to leave a hole in your normal text where the bold word will appear. This is *not* easy, nor is it generally recommended. If you really want it, and are masochistic enough to put yourself through the trial and error to do it, go ahead. But before too long you'll probably realize that it's not worth the effort.

Special Effects

Scrolling text

Scrolling text is extremely easy to do. The `draw_text` function must be called by some object, and includes arguments for the `x` and `y` where the text will be drawn. Simply change the `x` and `y` over time, and you have moving text. The easiest thing to do is to set the instance that is drawing the text in motion.

Typewriter text

Another easy to implement technique is “typewriter text” — that is, displaying a string one character at a time as though it were being typed out.

First, let’s take a string stored in a variable, `my_string`.

`string_length(my_string)` will give you the length of `my_string`.

`draw_text(x, y, my_string)` would draw the entire string at once. But we want to draw it one letter at a time.

The GML function `string_copy(string, index, length)` comes in handy here. We can use this instead of `string` in our `draw_text` function:

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Note that this will type at `room_speed` characters per second, which at 30 fps is extremely fast. You may want to type slower, in which case you can slow down the function in one of several ways. You can use an alarm to increment `typed_letters` every `N` steps, rather than increment it in the Draw event. Or you don’t want to bother with an Alarm event, you could do something like this:

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2

3

This would give a typing speed of `room_speed/10`, or 1 character roughly every 0.33 seconds for a 30 fps room, or 3 characters/second, which is a bit more reasonable. You can adjust this rate to taste.

If you want the text to reset and type over again when the message is completed, you can do this:

```
if typed_letters < length {typed_letters+=0.1;} else {typed_letters = 0;}
```

Additionally, you can optionally add code to play a sound with each letter, or start a sound when the typing starts and stop the sound with the full length string has been reached.

Marquee text

The Typewriter Text technique can be modified slightly to draw a scrolling marquee:

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4

5

```
//In the Create Event  
/*Hint: you may want to pad the end of your marquee string with extra spaces so it  
will scroll all the way off your marquee.*/
```

6

```
my_string = "Some text for your marquee "  
start_letter = 0;
```

7

```
marquee_length = 10; // or however many letters in your marquee  
type_rate = 3/room_speed; // 3 char per second
```

```
//In the Draw Event
```

```
while marquee_scrolling{  
draw_text(x, y, string_copy(my_string, start_letter, ceil(start_letter +  
marquee_length)));  
start_letter += type_rate;  
if (start_letter > string_length(my_string)) start_letter = 0;
```

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}
```

Blinking text

Blinking is annoying in web pages, but can be a very useful effect in games. Blinking attracts the eye, and can get attention where it's needed. Of course, blinking can be done with any graphical element, not just text.

Blinking is just turning on the drawing and then turning it off on a cycle, using a timer, such as an Alarm Event.

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```

The above code gives a 50% “duty cycle” (the blink is “on” 50% of the time, “off” 50% of the time). It’s possible to vary the duty cycle in a variety of interesting ways...

```
1
2
3           //In the Create Event
      blink = true; //(or false, if you want the initial state to be off)
      blink_on_steps = room_speed/2;
      blink_off_steps = room_speed/4;
4
1
2
3           //In Alarm[0]
      if blink {alarm[0] = on_steps;} else {alarm[0] = off_steps;}
      blink = !blink;
```

This blink code will result in a blink that stays on for 0.5 seconds, and blinks off for 0.25 seconds.

Even more sophisticated blink periods can be achieved using math functions rather than a static value. Setting `alarm[0] = irandom(10)` would result in a random flicker. Think of creative ways to use other math functions to create interesting effects. If you come up with a good one, share your code by posting a comment to this article.

Yet another way to flicker or blink text is through varying alpha. Or by switching colors. Or even size.

What next?

If you’re familiar with other programming languages, you may be disappointed at the limits of the built-in functions for manipulating strings. There are a lot of things you can do more easily in other languages than in GML, unfortunately. Since GML only has two data types, strings are extremely important, but because games tend to focus more on graphics, sound, and interface, the average GameMaker developer can get by with the string functions that do exist, for the most part.

There are a number of [useful GML scripts](#) for doing more advanced things with strings that have been collected at [gmlscripts.com](#). Many of the functions built in to more mainstream programming languages can be found there.

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<https://csanyk.com/2013/05/gamemaker-tutorial-string-handling-and-drawing-text/>