Semi-Automated Map Layout Generation Using Arcobjects and VB.NET

Nicholas P. Taliceo

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1 Purpose

The purpose of this program is to incorporate a simple and easy to use interface for ArcGIS Desktop 10.4 that allows users to create a map layout deliverable in one dialog box. This dockable window is designed such that there are a minimal amount of required input by the user, while still giving the aesthetic appearance of the map some flexibility.

Motivation for this ArcMap program extension is to allow GIS analysts more time to focus on studying and interpreting GIS data and subsequent analysis, rather than constructing maps that are *not* intended as final output or for publication. Construction of maps for the purpose of quick visualization can be laborious, repetitive, and often yields sub-par graphics. The time taken to make these maps could be better spent in determining the "WHY" of GIS analysis. Therefore, this program is designed to create simple, perhaps utilitarian in nature, maps that can be saved or printed for rapid visualization or distribution during meetings, informal group discussions, etc.

This program was written in the VB.NET environment, utilizing ArcObjects. Upon building and loading the program into ArcMap, a button will be produced that can be added to the Page Layout toolbar. Once clicked, a dockable window will appear, allowing the user to input optional information, to produce a map layout, and to export said layout as a PDF or other savable graphic.

2 Methodology

This is a pure programming project, in the sense that there was no data collected or case studies analyzed. This program was written in the VB.NET programming language with ArcObjects. This uses the following software: Esri ArcGIS Desktop (ArcMap 10.4), Visual Studio 2015, Community Edition (.NET Framework 4.5), and ArcObjects SDK (.NET).

In addition, there are several Esri libraries referenced, namely the `Carto` library, which is the basis for the construction of map layouts. Other libraries referenced include: `ArcMapUI`, `Catalog`, `esriSystem`, `Display`, `Geometry`, and `Geodatabase`. Apart from the Esri libraries, the `stdole` library was also utilized. This library is used to create custom fonts, size, etc.

This program contains two ArcGIS add-ins: one button and one dockable window. The button add-in can be added to the standard Page Layout toolbar. When clicking this button,

1

the dockable window appears. It is this dockable window that executes the main component of the program. What's more, this window is where the user can input and edit map content prior to constructing the map.

Each map component, represented separately in the dockable window, is written in code as separate functions. These are all called when the "Map a Map!" button is clicked.

The script begins by calling the respective size and page orientation from the pre-installed map layouts. These files can be found on your computer at the following location: `C:\Program Files (x86)\ArcGIS\ Desktop10.4\MapTemplates\Standard Page Sizes\North American (ANSI) Page Sizes\The Page Layout`. The code then defines the map frame and document properties, and then calls the subsequent private subclasses. These subclasses and other details can be found within the program code.

3   Structure

In this section I will explain how to implement this program within ArcMap 10.4. These instructions will assume that the appropriate SDK and subsequent files have been downloaded and installed prior to this implementation.

Figure 1: The Map Layout Options button added to the page layout toolbar.

To enable the button that opens the dockable window, in ArcMap, navigate to `Customize` → `Customize Mode...`. When the Customize window will open, navigate to the `Commands tab` → `Add-In Controls`. Drag and drop the "Map Layout Options" button to the Page Layout toolbar, as shown in Figures 1–2.

When the "Map Layout Options" button is clicked, the dockable window will appear, which can be left as-is or can be docked to a corner of the ArcMap main window. This is illustrated in Figure 3.

All options in this window are not mandatory, and if left blank, will not be added into the map layout. Notice the pre-defined drop-down window options. Furthermore, if a saved ArcMap document contains information in the Map Properties window, then these data will be automatically loaded into this window.

Options for input include: a title, subtitle, author, credits, and a text description box. These are all inputted by the user as text. The North arrow, scale bar, and projection (if one exists) will appear on the map automatically. There are other predefined placements for the legend and text box, as well as options for page size and orientation. The author information, credits, and projection font size will change based on the page size. Furthermore, there is a button to change from layout view to data view, and a button to export the map as a PDF file or other graphic type. Finally, the "Make a Map!" button will create a map with the given input and go directly to layout view.
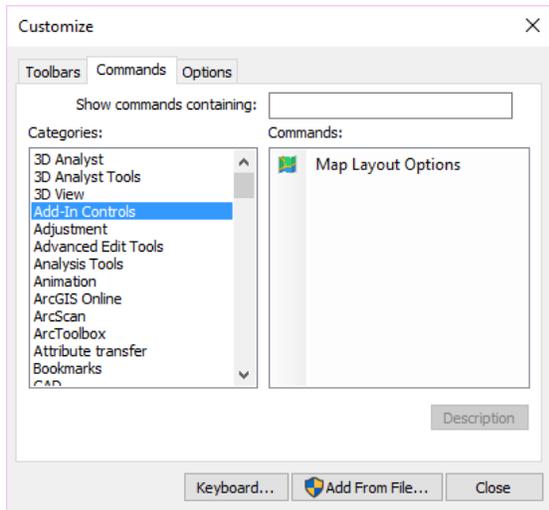
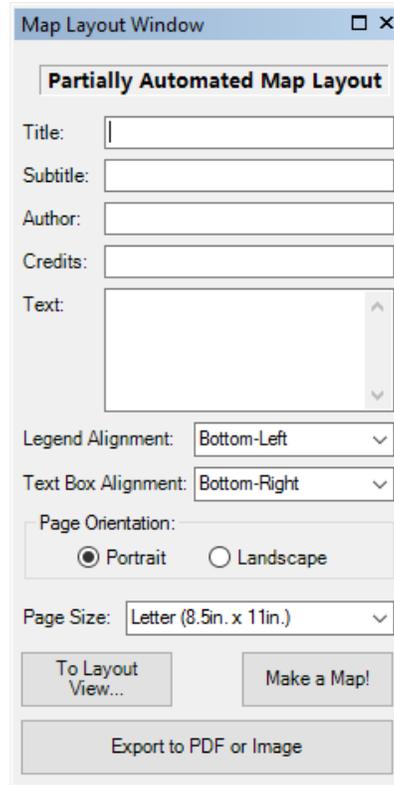Figure 2: The customize window containing the Map Layout Options button.

Figure 3: The black dockable window that allows user to input map layout options.

4 Discussion

In all, the main goals of this project have been satisfied, albeit there is room for improvement and modifications. Given the assumption that the appropriate version of ArcMap and ArcObjects SDK are installed, this program *should* run properly without any crucial errors.

I am overall quite pleased with the results of my program. Since launching preliminary versions of this extension, I have used it several times and find it very convenient. The incorporation of both the dockable window and the button (which opens the dockable window) gives a wider flexibility when working with multiple open windows in ArcMap. What's more, the incorporation of filling in predefined fields under the Map Properties Window upon startup results in a toolbar that requires virtually no work on the user's end.

The subsequent subsections will describe these successes and limitations.

4.1 Accomplishments

This tool incorporates all of the necessary map elements: title, author, date, scale bar, legend, North arrow, border, and projection. It also includes the option to incorporate credits, a subtitle, and a description text box into the map, as well as to change the page orientation to either landscape or portrait, and the page size (currently only three options, but more can easily be added), on demand.

Although there are not many aesthetic options and customizable changes that the user can define, this tool does successfully create a sufficient map layout that can quickly and easily be exported or printed at the will of the user.

4.2   Limitations

Despite that all of the aforementioned goals of the project have been met, there are several aspects of this program, that as the programmer, acknowledge to be limitations and would like to revise.

One of the most significant *potential* limitations that this program has is its dependences on predefined map layouts offered by Esri. These layouts are the most basic, standard layouts, creating only a specific page size and orientation (e.g., 8"×11" portrait page layout). These are saved to the computer with each installation of ArcMap. Therefore, if the standard installation saves to a different folder (e.g., Program Files → ArcGIS *vs.* Program Files (x86) → ArcGIS), then this program will not work. Furthermore, these will also not work if you do not have ArcGIS 10.4 installed on your personal computer, or if you are using a newer version of ArcMap.

Another limitation to this program is the lack of customizability in terms of aesthetic appeal. For instance, dynamic text box sizes, different font styles, and graphics placement is naturally limited. Therefore, while I do give *some* options, ultimately these will be far from all-inclusive. For instance, it may often be the case that the user needs to manually adjust the placement of the legend or description box. Ultimately, these are difficult or impossible to fix programmatically.

The final major limitation is that this program currently only designed for map layouts with only one data frame present. If there are more than one data frame present, this program will crash.

4.3   Further Work

Aside from solving the challenges discussed in the limitations section (4.2), there are other aspects of this program that I would like to explore further. First and foremost is to ensure the continued usability of this program in future versions of ArcMap or its successor, namely, ArcMap 10.5 and eventually ArcGIS Pro. The former may require a few slight modifications, but the latter may require a considerable amount of additional work, as the SDK for ArcObjects has changed from ArcMap to ArcGIS Pro.

In addition, I would like to implement aesthetic enhancements to the map output. For instance, I would like to include perhaps a more elaborate text box and legend that includes a drop shadow and background color. I would also like to include bold titles for the credits and projection graphic boxes. Finally, it may be useful to allow for more paper sizes to become available, as well as the incorporation of the button that calls the print command in ArcMap.

References

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