

UI Design for Accessibility and High DPI

Charlie Macleod

Steve Van Esch



Overview

- **DPI**
- **Styling**
 - **Light, Dark, High Contrast**
- **Accessibility**
- **Custom Styling**

DPI

- **DPI is a measure of the resolution of a monitor**
- **DPI Changes from system to system**
 - Sometimes monitor to monitor
- **Scaling by Windows abstracts most of the issues for differing DPI**
 - 100% - 96DPI, 125% - 120 DPI, 150% - 144 DPI, 200% - 192 DPI
 - Still issues with multiple monitor displays with different DPI
- **How do we design our Pro Add-in UIs for multiple DPI resolutions?**

DPI Considerations

- **Good news: Pro uses WPF....and....WPF is DPI Aware**
 - WPF Adjusts, or “scales” for different DPI automatically (for the most part)
 - Pro Add-ins use WPF so inherit those benefits
- **However, WPF developers still have 2 responsibilities**
 - Layouts
 - Bitmaps
- Reference:
 - Microsoft Build 2015: Display Scaling: <https://channel9.msdn.com/Events/Build/2015/2-63>

Adaptive Layouts

- Use adaptive layouts to handle different scaling + effective resolutions
 - Eg Grid, Dockpanel, StackPanel, and variants
 - Limit “hardcoding” to margin and padding, Image sizes as needed
 - Horizontal and Vertical alignments = “stretch” will occupy available space
 - If all else fails, wrap content in a <ScrollViewer></ScrollViewer>

```
<UserControl x:Class="StyleDockpane.Dockpane1View" ...>
  <Grid>
    <Grid.RowDefinitions>
      <RowDefinition Height="Auto"/>
      <RowDefinition Height="*/>
    </Grid.RowDefinitions>
    <TextBlock Text="Please select... etc" Grid.Row="0" HorizontalAlignment="Left".../>
    <ComboBox Grid.Row="1" HorizontalAlignment="Stretch" Margin="0,5,0,5".../>
  </Grid>
</UserControl>
```

Bitmaps

- Designing bitmap assets
 - Microsoft heuristics favor downscaling over upscaling
 - Eg Given a 32x32 Bitmap, consider designing at 64x64.
 - This will support 200% – 100%. Scaled down
 - Consider using vector xaml - eg Microsoft Expression Design, <http://www.microsoft.com/expression/eng/>

```
<DrawingImage x:Key="folder"...>
  <DrawingImage.Drawing>
    <DrawingGroup>
      <GeometryDrawing Brush="#FF57A6D9" Geometry="F1M1,28L31,28 31,6 1,6 1,28z"/>
    </DrawingGroup>
    ...
  </DrawingImage.Drawing>
</DrawingImage>
<Button HorizontalAlignment="Left" ...>
  <StackPanel Orientation="Horizontal">
    <Image x:Name="Open" Source="{StaticResource folder}"
      Height="32" Width="32"/>
  </StackPanel>
</Button>
```

Add-in Styling

- **New at 1.4 is Dark Theme and High Contrast**
- **In order for your Add-ins to “blend” when theme is toggled they must be styled correctly**
 - **Note: It is not required that your Add-ins “blend” with Pro though it is desirable in most cases**

General Rules

- Use ESRI Styles (and Colors) to the greatest extent possible for:
 - TextBlock (most important)
 - Buttons (most important)
 - Other controls: TextBox, Listbox, Combobox, Datagrid, TreeView, Border, etc.

```
<TextBlock Text="{Binding Name}" Style="{StaticResource RegularText}" />
<Button x:Name="MyButton" Style="{StaticResource Esri_SimpleBorderlessButton}"

<Image Source="{Binding Thumbnail}">
  <Image.Effect>
    <DropShadowEffect Color="{DynamicResource Esri_Color_Gray145}"
BlurRadius="14" ShadowDepth="4.5"/>
  </Image.Effect>
</Image>
```

- Consult: <https://github.com/Esri/arcgis-pro-sdk/wiki/proguide-style-guide>

General Rules

- **Avoid setting background and foreground colors on User Controls.**
 - Setting background color to transparent can solve most issues allowing background color of host pane to “show through”
 - Don’t set any color at all
- **Avoid using System colors in XAML.**
 - They will not “flip” to correct “alternatives” when the theme changes
 - Esri styles and colors “flip” automatically for you at startup
 - Esri Brushes: <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/brushes.html>
 - Esri Colors: <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/colors.html>

General Rules

- **If in doubt, delete all styling on textblocks, buttons, labels.**
 - See how closely your UI matches the current theme.
 - Only fix those aspects that don't look "right"
- **Note:**
 - Most controls will inherit a basic "default" style from Pro if one is not assigned*
 - Default style will correctly style all elements in Default, Dark, or High Contrast modes
 - <https://github.com/esri/arcgis-pro-sdk/wiki/proguide-style-guide>

Resources

- Consult: <https://github.com/Esri/arcgis-pro-sdk/wiki/proguide-style-guide>
- Esri Brushes: <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/brushes.html>
- Esri Colors: <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/colors.html>

- All Pro samples are styled for the 3 modes

Styling demo

Accessibility

- **WPF**
 - **Keyboard, Tabbed Navigation**
 - **Buttons – default actions**
 - **Tooltips**

- **DAML**
 - **Keytips**
 - **Accelerators**

Keyboard Tabbed Navigation

- **Rules of Thumb:**
 - **TabOrder** should flow left to right, top to bottom*
 - **Assign tab stops to all interactive controls**
 - Include read-only text boxes if you can copy-paste their contents
 - Within a tab stop, arrow key order should match same flow as tabs
 - **Group related controls that behave as a single control together (eg Radio buttons)**
 - Provide a single tab stop
 - **Show focus (1194.21c)**

- **Note: Screen readers key off tab order.**

Keyboard Tabbed Navigation

- In most cases, the default tab order may be sufficient.
 - Follows logical order of the controls
 - However, if the default tab order is not correct, you will have to set it explicitly
 - Use `KeyboardNavigation` attached properties:
 - `TabIndex`, `IsTabStop`, `TabNavigation`

```
<TextBox TabIndex="0" HorizontalAlignment="Stretch" .../>
<TextBox TabIndex="1" HorizontalAlignment="Stretch" IsTabStop="True" IsReadOnly="True" .../>
...
<Expander IsExpanded="True" TabIndex="12" KeyboardNavigation.TabNavigation="Local">
  <StackPanel KeyboardNavigation.TabNavigation="Local">
    <RadioButton Content="None" .../>
    <RadioButton Content="Simple line callout" .../>
    <RadioButton Content="Background callout" .../>
  </StackPanel>
</Expander>
```

Keyboard Tabbed Navigation

- **WPF Buttons**

- Set **IsDefault** and **IsCancel** properties
 - **IsDefault** - <Enter> key executes action
 - **IsCancel** - <Esc> key executes action
- **ALT Text**, use “_” in the content. (Windows used “&”)
- Use **WPF KeyBinding** to assign shortcut keys
 - Never change well-known shortcut keys (Ctrl-C, Ctrl-V, etc)

```
<Button Content="_Apply" ... IsDefault="True"/>
```



```
<Button Content="Cancel" ... Command="{Binding CancelCommand}" IsCancel="True"/>
```

```
<UserControl.InputBindings>
```

```
  <KeyBinding Command="{Binding CancelCommand}" Key="Escape"></KeyBinding>
```

```
</UserControl.InputBindings>
```

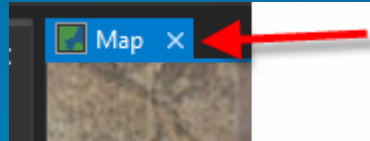

Tooltips, Alternative Text

- Supports Assistive Technology, such as Screen Readers
 - Pair Label text with corresponding TextBox
 - Provide tooltips and Image alternate text

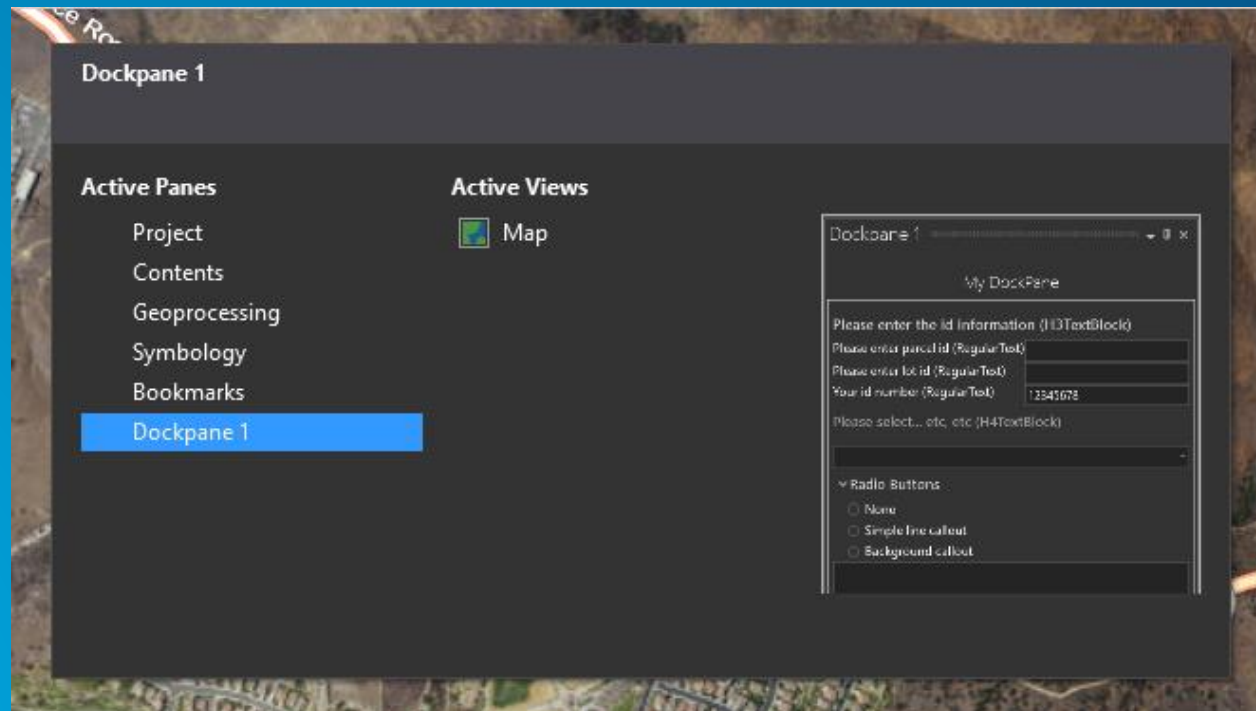
```
<Label Content="Please enter the parcel id" Grid.Column="0" .../>  
<TextBox ToolTip="Please enter the parcel id" Grid.Column="1" .../>
```

```
<Button ... ToolTip="Clicking ok saves the changes you made to the database"/>  
<Image ... ToolTip="This is an image of an open folder"></Image>
```

Hidden Pane Switcher in Pro



- When a Pane is active
- Ctrl + Tab (Keep the Ctrl key down to show the window)



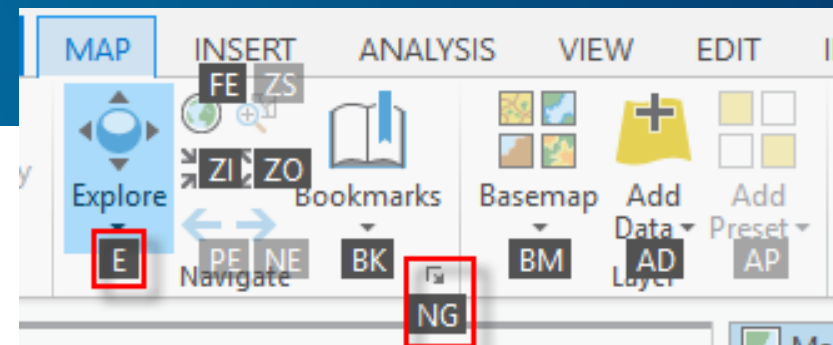
Keyboard, Tab Demo

Key Tips – Access Modifiers for Tabs and Commands

- “ALT Text” - Define in Config.daml
 - Try to use letters at the beginning of the first or second word of the label
 - Prefer letters with wide widths (w,m, and CAPITAL letters. Avoid “i” or “l”
- Keytips must be unique within the given tab or menu
 - Use launcherKeytip for Launcher Commands

```
<tab id="..." caption="FIELDS" keytip="F">...</tab>
<gallery id="..." keytip="OA" ...>...</gallery>
<menu id="..." keytip="AS" ...>...</gallery>
<comboBox id="..." keytip="N" ...>...</comboBox>
...etc.
```

```
<group id="esri_mapping_navigateGroup" caption="Navigate" launcherKeytip="NG" keytip="N"
  launcherButtonID="esri_mapping_navigationOptionsButton" >...</group>
```



Accelerators – Assign Shortcut Keys to Commands

- Define in Config.daml
 - Must reference the (Ribbon) command they are shortcut for
 - (DAML equivalent to WPF KeyBinding)

```
<accelerators>  
  <insertAccelerator refID="esri_mapping_newMapButton" flags="Ctrl" key="M,N" />  
  <insertAccelerator refID="esri_mapping_snappingOnButton2" flags="Ctrl" key="W" />  
</accelerators>
```

Keytips, Accelerator Demo

Custom Styling

- **Situations may occur when you need to apply your own custom styling**
 - **Extend an existing Esri style**
 - Eg Fontsize, Margin, Background, etc.
 - **Custom**
 - Take complete responsibility for Light, Dark, High Contrast styling of your own Add-in UI

Extend an Esri Style

- Use the WPF Style element
 - Place in UserControl Resources to make available to all your content
 - Use the BasedOn attribute to specify which Esri style you are extending

```
<Style x:Key="ButtonStyle" TargetType="Button" BasedOn="{StaticResource Esri_SimpleButton}">  
    <Setter Property="IsDefault" Value="True"></Setter>  
</Style>  
  
<Button TabIndex="5" Content="Apply" Style="{StaticResource ButtonStyle}" .../>
```

- Note: to extend a default Esri style use the TargetType instead of style name in BasedOn

```
<Style x:Key="MyStyle" TargetType="{x:Type Label}" BasedOn="{StaticResource {x:Type Label}}">  
    ...
```


Custom Style

- **Situations may arise where you need styles other than what Pro provides**
 - Maybe need to roll your own brushes or colors
 - Consuming 3rd party controls that must be custom styled.
- **You take responsibility for providing Light, Dark, High Contrast theme support**
 - Responsible for loading the correct (custom) style.
- **Consult: <https://github.com/Esri/arcgis-pro-sdk/wiki/proguide-applying-custom-styles>**

Custom Style

- Organize Style components into ResourceDictionaries
- Provide style components for each theme
 - Eg Light brushes, Dark brushes, High Contrast brushes
 - Eg Light control styles, Dark control styles, High Contrast control styles, etc.
- Use `FrameworkApplication.ApplicationTheme` to determine which theme is active
 - Property is set at Startup. It will never change during the session.
 - `ApplicationTheme.Default`,
 - `ApplicationTheme.Dark`,
 - `ApplicationTheme.HighContrast`
- Load your relevant (custom) resources

Styling Demo

Questions?

- Questions?

Resources

- **Pro Style Guide:** <https://github.com/Esri/arcgis-pro-sdk/wiki/proguide-style-guide>
- **ProGuide Custom Styles:** <https://github.com/Esri/arcgis-pro-sdk/wiki/proguide-applying-custom-styles> (Walkthrough)
- **Esri Brushes:** <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/brushes.html>
- **Esri Colors:** <http://esri.github.io/arcgis-pro-sdk/content/brushescolors/colors.html>

ArcGIS Pro SDK for .NET Tech Sessions

Thursday, March 09, 10:30 am - 11:30 am San Jacinto

Creating Rule Packages (RPKS) for ArcGIS Pro and CityEngine with CGA

Thursday, March 09, 5:30 pm - 6:30 pm Smoketree A – E

ArcGIS Pro SDK for .NET: Configurations

Friday, March 10, 8:30 am - 9:30 am San Jacinto

ArcGIS Pro SDK for .NET: an Overview of the Geodatabase API

Friday, March 10, 10:00 am - 11:00 am Mesquite C

ArcGIS Pro SDK for .NET: Editing and Geodatabase Integration

Thursday, March 09, 10:30 am - 11:00 am Demo Theater 2 - Oasis 1

ArcGIS Pro SDK for .NET: Getting Started

Thursday, March 09, 11:00 am - 11:30 am Demo Theater 2 - Oasis 1

ArcGIS Pro SDK for .NET: Building Configurations



esri

**THE
SCIENCE
OF
WHERE**

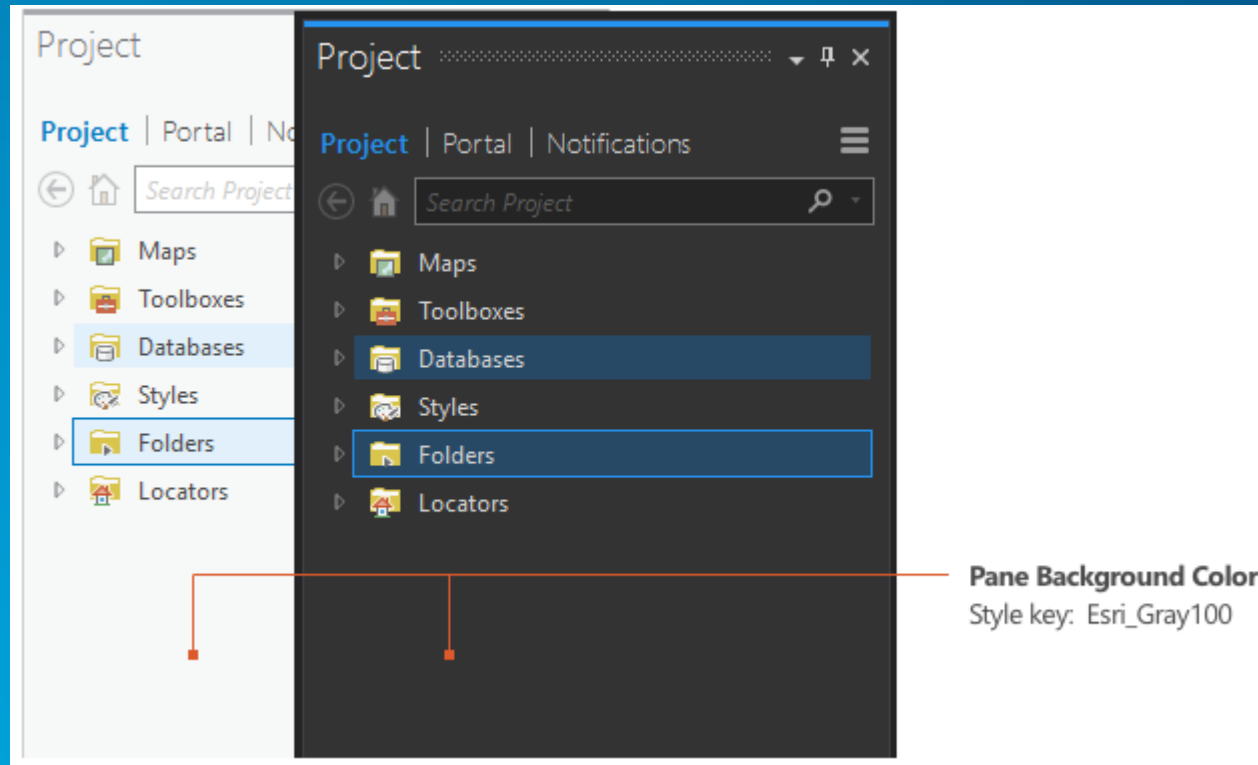
DPI Considerations

Scale factors and real devices

Scale Factor	Importance	Examples
100%	Most PC upgrades and low-cost laptops Some low-cost tablets No phones	10-12.5" 1366x768 laptop 30" 2560x1440 monitor
125%	Some PC upgrades and low-cost laptops Many low-cost phones	13.3" 1600x900 laptop 27" 3200x1800 monitor 4.5" 480x800 phone
150%	New mainstream laptops Many low-cost phones	10.6-13.3" 1080p laptop 28" 4K monitor 5" 960x540 phone
200%	New premium laptops Many mid-range phones	13.3" 2560x1440 laptop 24" 4K monitor 5" 1280x720 phone
250%	New high end, some 4K laptops Some mid-range phones	13.3" 3200x800 laptop 15.6" 4K laptop 5.7" 1080p phone
300%	New 4K laptops High-end phones	13.3" 4K laptop 4.5" 1080p phone
400%	Premium phones	5.2" 2560x1440 phone

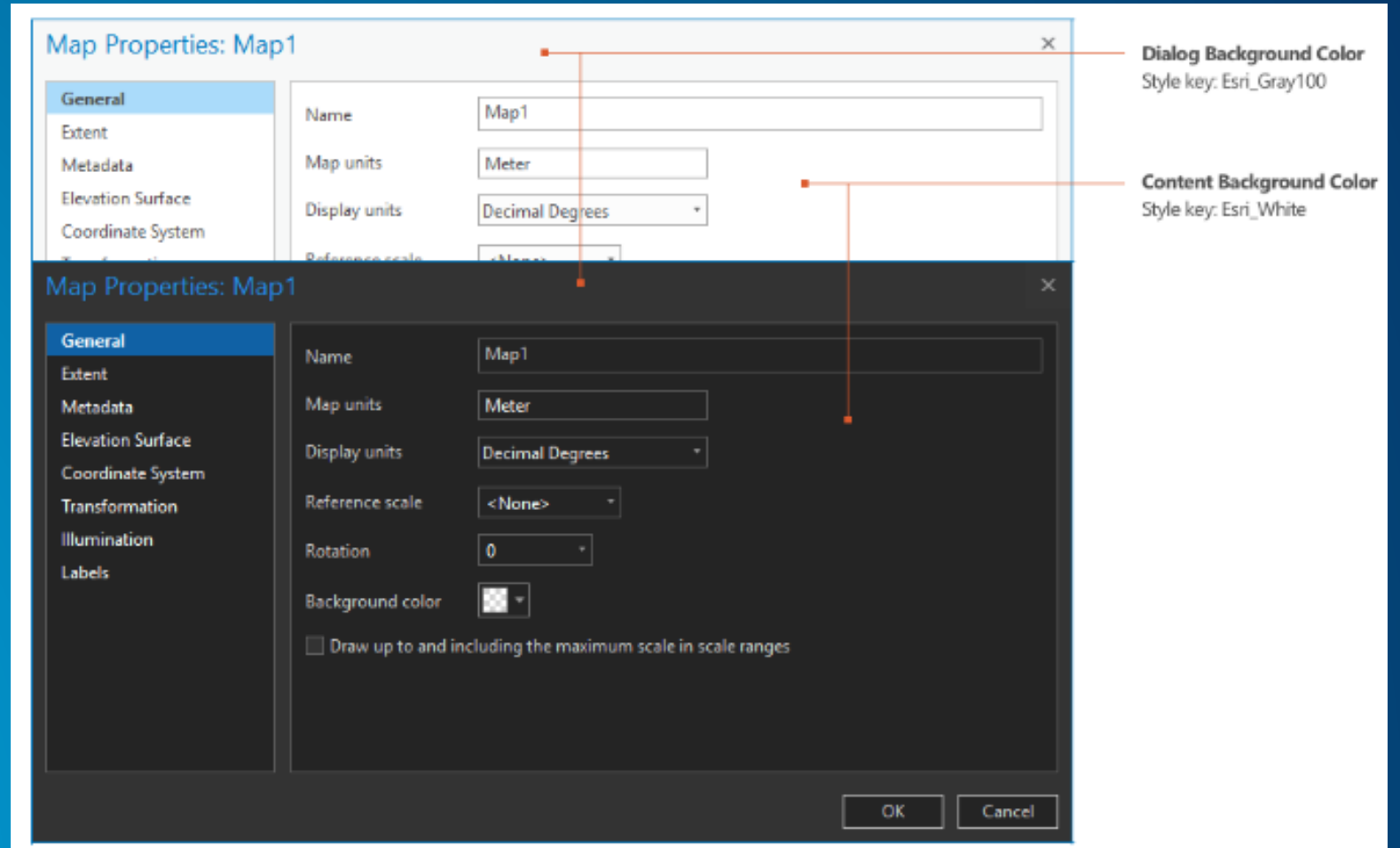
Examples

- Panes already come with the correct background color



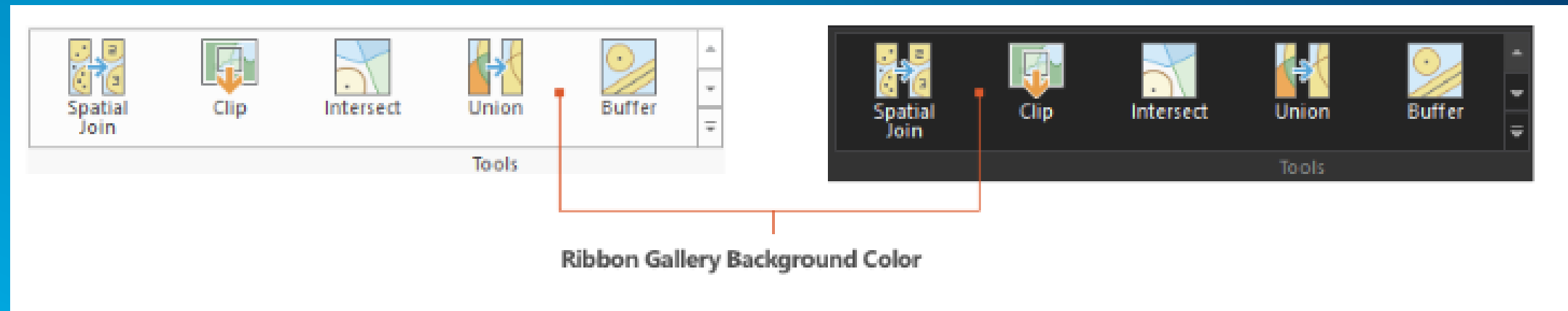
Examples

- Dialogs – at 1.4 inherit from `ArcGIS.Desktop.Framework.Controls.ProWindow`
 - Has correct background
 - Correct title bar styling
 - Avoid directly inheriting from `System.Windows.Window`



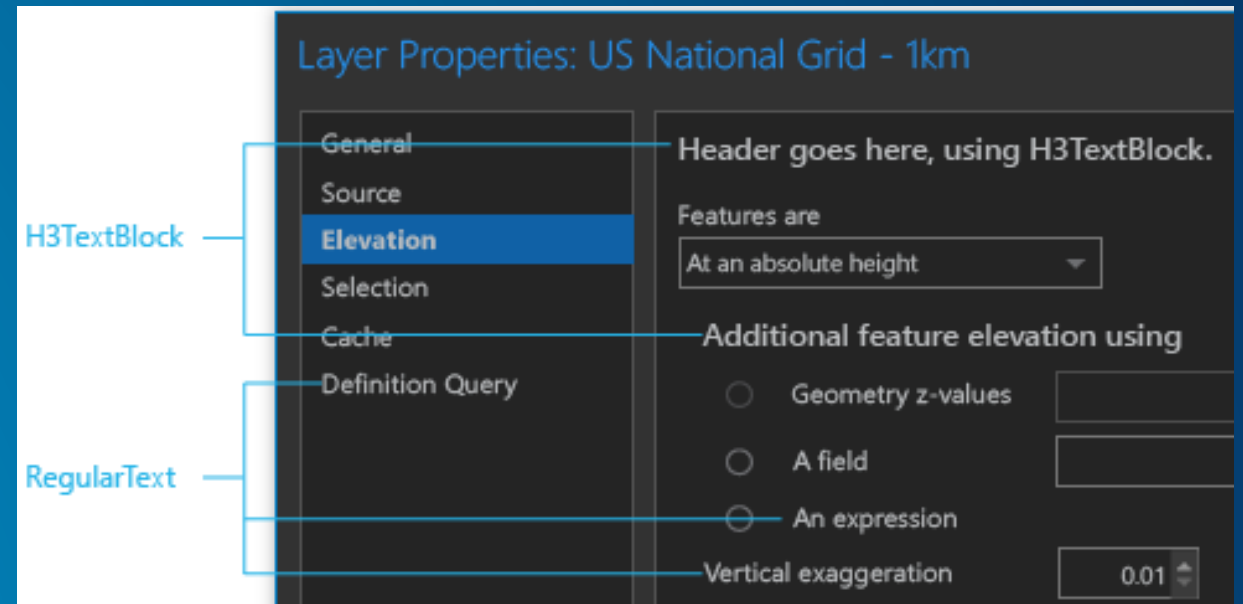
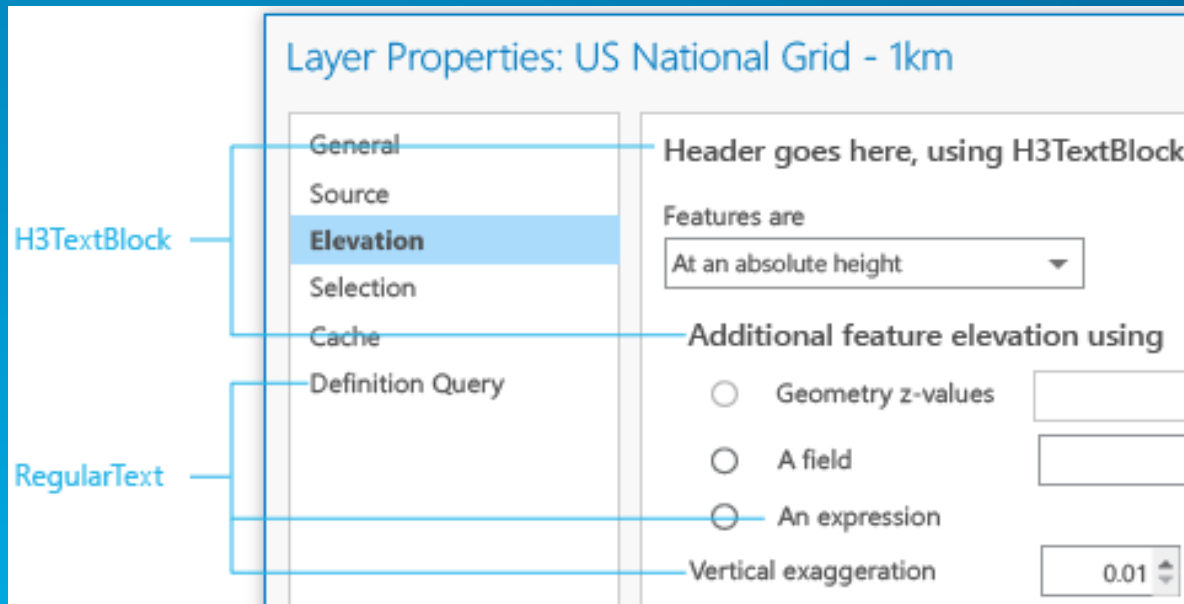
Examples

- **Galleries will inherit the correct style from the base Actipro control**
 - **BUT you are responsible for correctly styling gallery items**
 - **Use ESRI_Styles!**



Examples

- Text styles – using Esri styles ensures that the color is always correct in Default or Dark themes



Keyboard Tabbed Navigation

- **1194.21 (a) When software is designed to run on a system that has a keyboard, product functions shall be executable from a keyboard...**
- **In other words...At a minimum, every feature of an application must be available using the keyboard. (For example, you cannot have a print function that can only be accessed with a mouse.)**

Accessibility

- **Section 508 Amendment to the Rehabilitation Act of 1973**
 - <http://www.section508.gov/>
 - **GSA: <https://section508.gov/content/quick-reference-guide>**
- **4 key areas:**
 - **Visual Impairment**
 - **Hearing Impairment**
 - **Mobility**
 - **Cognitive**
- **Accessibility benefits all users not just users with disabilities**

High Contrast

- 1194.21 (j) “.....a variety of color selections capable of producing a range of contrast levels shall be provided”
- WCAG G18: “...A contrast ratio of at least 4.5:1 exists between text (and images of text) and background behind the text”
- Contrast is calculated as: (<https://www.w3.org/TR/WCAG20/#contrast-ratiodef>)
 - $(\text{foreground luminance} + 0.05) / (\text{background luminance} + 0.05)$
 - White on black is 21:1

High Contrast Mode in Pro

- High Contrast is a special display setting that provides extreme contrast for foreground and background visual elements.
 - OS Mode– Left Shift+Alt+PrintScreen
- Specifically designed for individuals with vision impairment.
 - High Contrast (white text on black background mostly)
 - Consult <https://www.w3.org/TR/UNDERSTANDING-WCAG20/visual-audio-contrast-contrast.html>
- Styling your content with Pro “Esri” styles ensures High Contrast mode support

Did you know?

For More Templates, Sample Files, and Icons See

<https://compass.esri.com/resources/presentations/Pages/Main.aspx>

New Feature

Footers have been added to this template. To learn about using footers for PowerPoint 2010:

<https://support.office.com/en-US/article/Add-a-header-or-footer-882EFCEA-35CD-4B68-AC0B-041AE1BA7099>

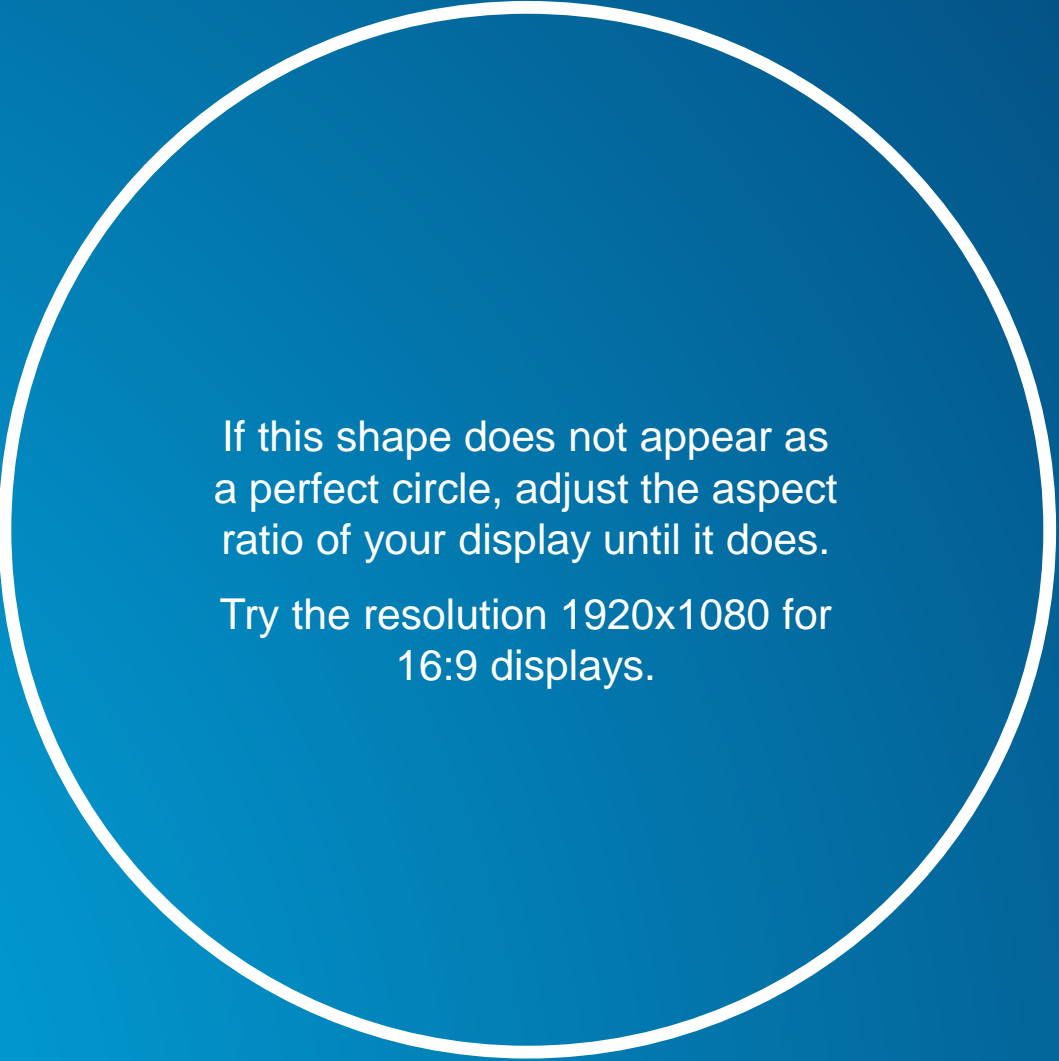
For PowerPoint 2013:

<https://support.office.com/en-US/article/Video-Add-headers-and-footers-to-a-presentation-C76A96AA-6622-442E-8B0A-ED75BBAE22B3>

Videos not working?

For video in PowerPoint, animated GIF is recommended. AVI and WMV (native PC files) will work best on a PC platform. H.264 MP4 will work only on PowerPoint 2013 and later.

Aspect Ratio Test



If this shape does not appear as a perfect circle, adjust the aspect ratio of your display until it does.

Try the resolution 1920x1080 for 16:9 displays.