



ArcGIS API for JavaScript: Dynamic Vector Symbology

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<https://arcg.is/1STzGK0>

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DEVELOPER SUMMIT

Agenda

- What are CIM Symbols?
- Create a symbol from scratch
- Creating a web style
- Data-driven CIM





What are CIM Symbols?

Anne Fitz

CIM Symbols

High quality, scalable



Scaled vector
symbol



Scaled image

Symbol layers



Symbol



1

layer1



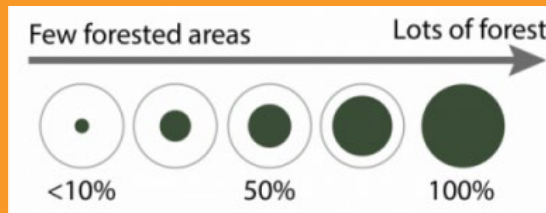
layer2



layer3

Primitive Overrides

Dynamically update attributes of an individual symbol layer using Arcade



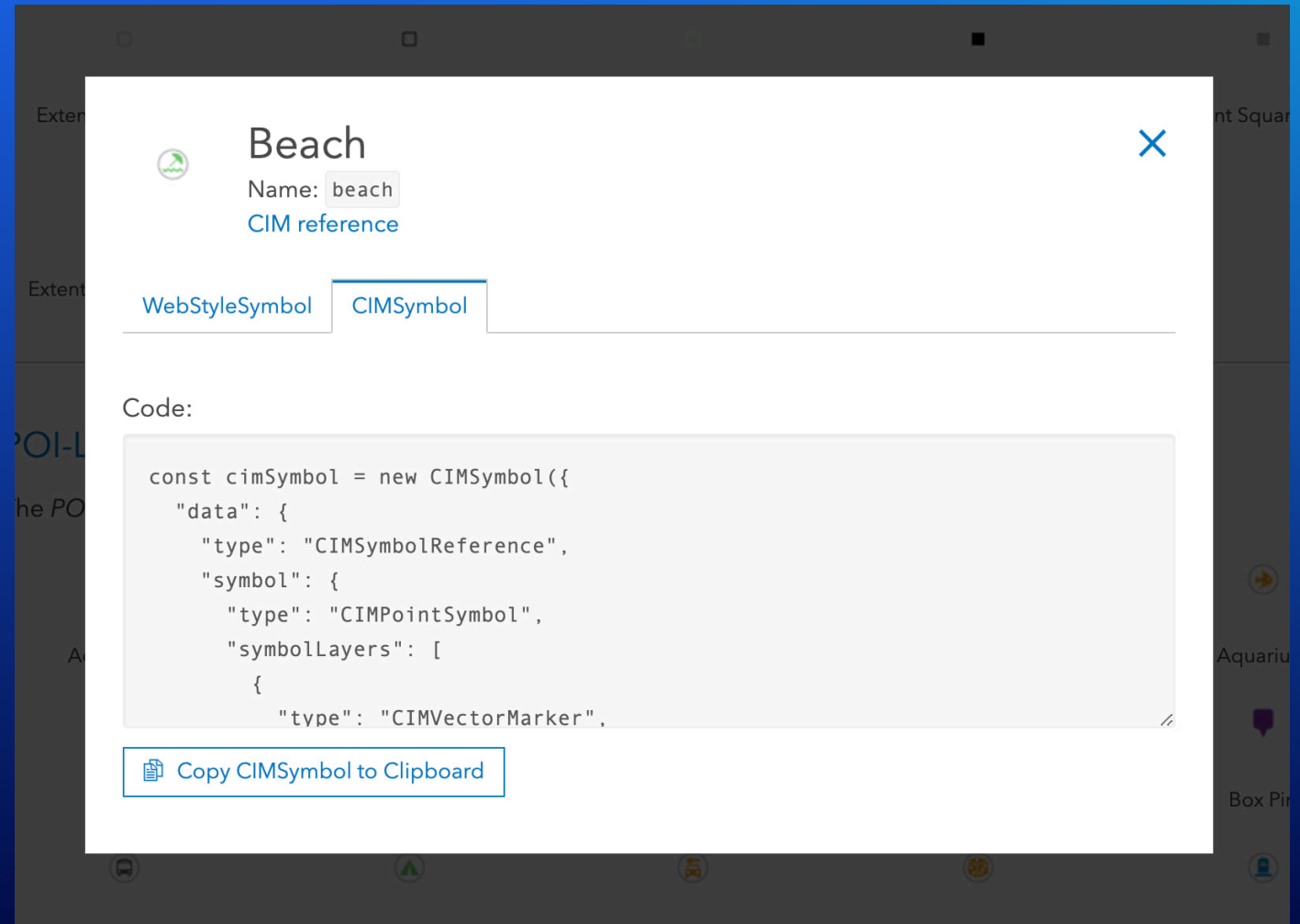
How is it used in the ArcGIS API for JavaScript?

```
// require(["esri/symbols/CIMSymbol"], function(CIMSymbol)
const cimSymbol = new CIMSymbol({
  data: {
    type: "CIMSymbolReference",
    symbol: {
      type: "CIMLineSymbol", // CIMPointSymbol or CIMPolygonSymbol
      symbolLayers: [{ ... }]
    },
    primitiveOverrides: [{ ... }]
  }
});
```

follows the [cim-spec](#)

WebStyleSymbols

- Predefined 2D CIM symbols that you can conveniently reference in your apps
- [Esri WebStyleSymbols \(2D\) guide page](#)
- Create your own web style symbols



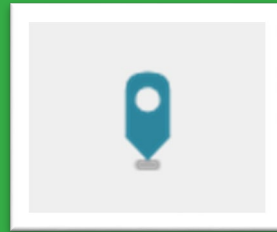
CIMPointSymbol

CIMPictureMarker



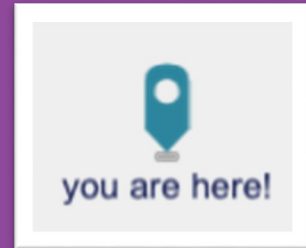
- Created from raster image file

CIMVectorMarker



- Represents vector graphics
- Constructed from MarkerGraphics

CIMTextSymbol



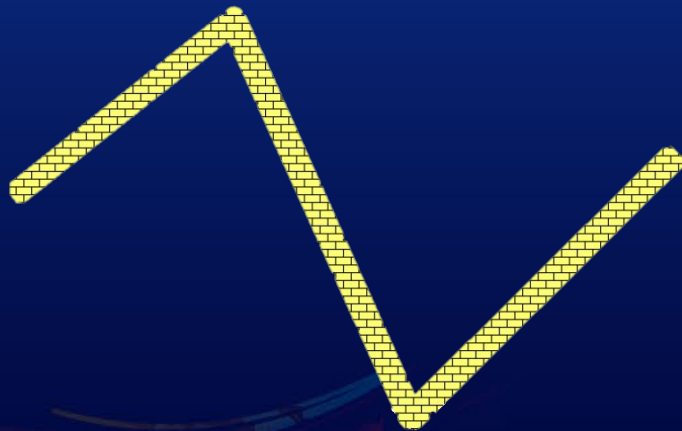
- Supported as a marker graphic on a CIMVectorMarker symbol layer

CIMLineSymbol

CIMSolidStroke



CIMPictureStroke



- Geometric Effects

- Dashes



- Buffer



- Arrows

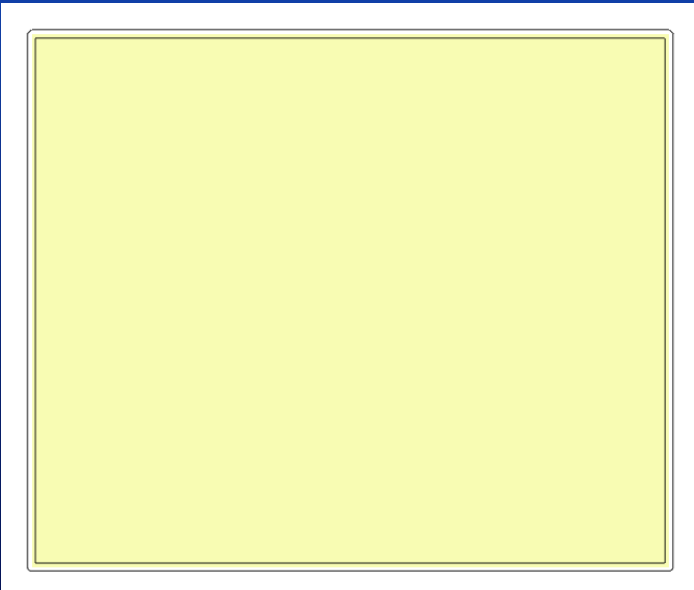


- Marker placement

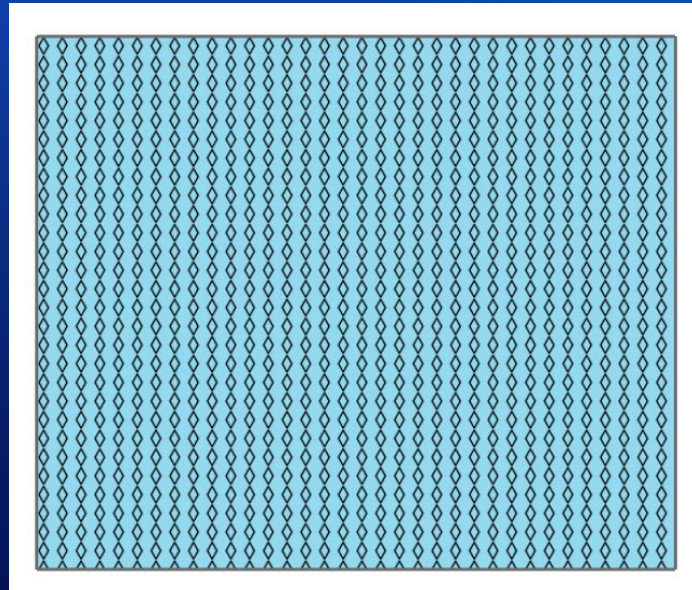


CIMPolygonSymbol

CIMSolidFill



CIMHatchFill



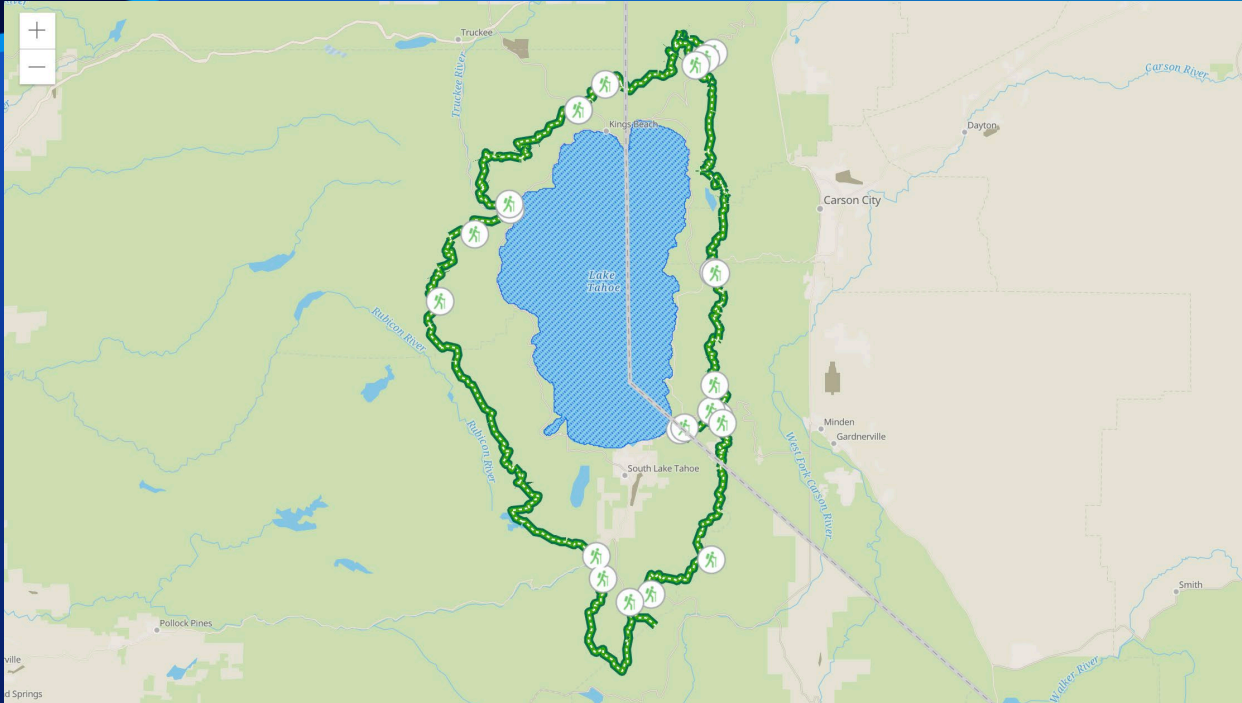
CIMPictureFill



Create a symbol from scratch

Anne Fitz





CIM Starter App

Anne Fitz

CIM Symbol Builder

The screenshot displays the CIM Symbol Builder interface. On the left, a map of California is shown with several locations marked by a custom symbol: a green tree and a black silhouette of a person walking. The locations include Medford, Sacramento, San Francisco, San Jose, Fresno, Los Angeles, San Diego, Tijuana, Mexico, Las Vegas, Salt Lake City, and Phoenix. The map includes zoom controls (+ and -) in the top left corner.

On the right, the 'Preview' panel shows a large version of the symbol being configured. Below the preview, the 'Symbol Layers' list shows the following structure:

- CIMVectorMarker
 - CIMVectorMarker
 - CIMMarkerGraphic
 - CIMSolidStroke
 - CIMSolidFill
- CIMVectorMarker
 - CIMMarkerGraphic
 - CIMSolidStroke
 - CIMSolidFill

Below the symbol layers, there is an 'ADD SYMBOL LAYER' button. The 'LAYER PROPERTIES' section includes:

- ☒ Enable
- Anchor Point
 - x: -20 %
 - y: 0 %
- Offset X: 0 pt
- Offset Y: 0 pt
- Rotation: 0 degrees

At the bottom, there are two buttons: 'APPLY TO FEATURE LAYER' and 'GET SYMBOLJSON'.

At the bottom left of the map, it says 'Esri, HERE, NPS'. At the bottom right, it says 'Powered by Esri'.

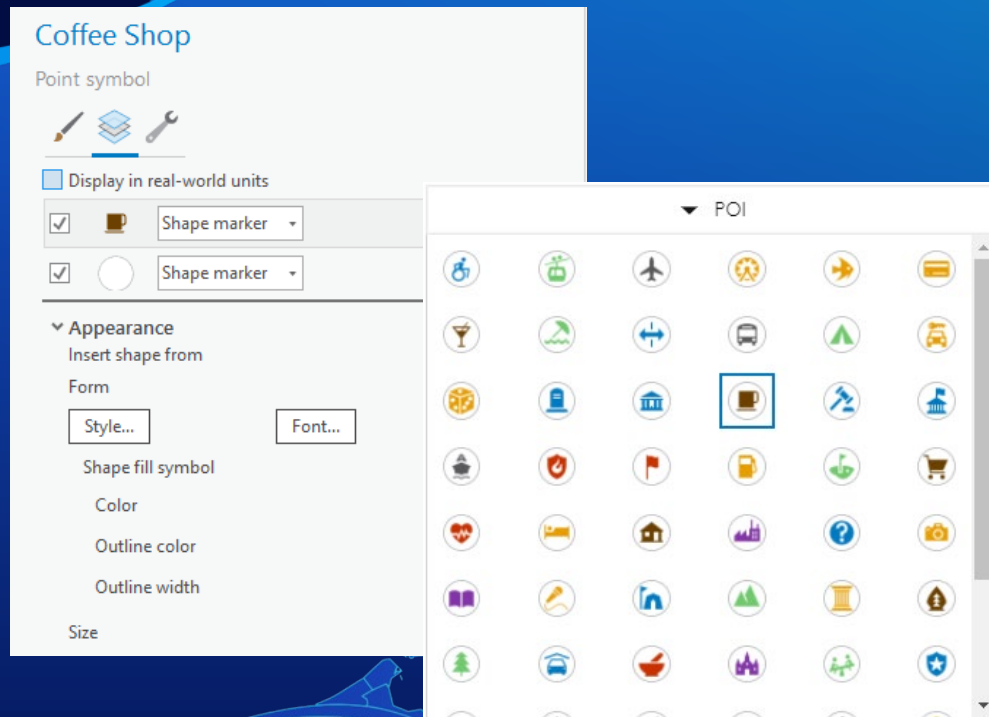


Creating a Web Style

Russell Roberts

How to create a Web Style

- Share web styles with ArcGIS Pro 2.6 and up
- Currently only points supported
- For 2D Web Styles publish picture or shape marker
- Vector symbols can be .svg or .emf format with shape marker
- Use them in web maps and 4.x web apps, runtime 100.x apps and Pro.
 - Map Viewer Beta, Experience Builder, Dashboard Beta and more



Creating a WebStyle

Russell Roberts

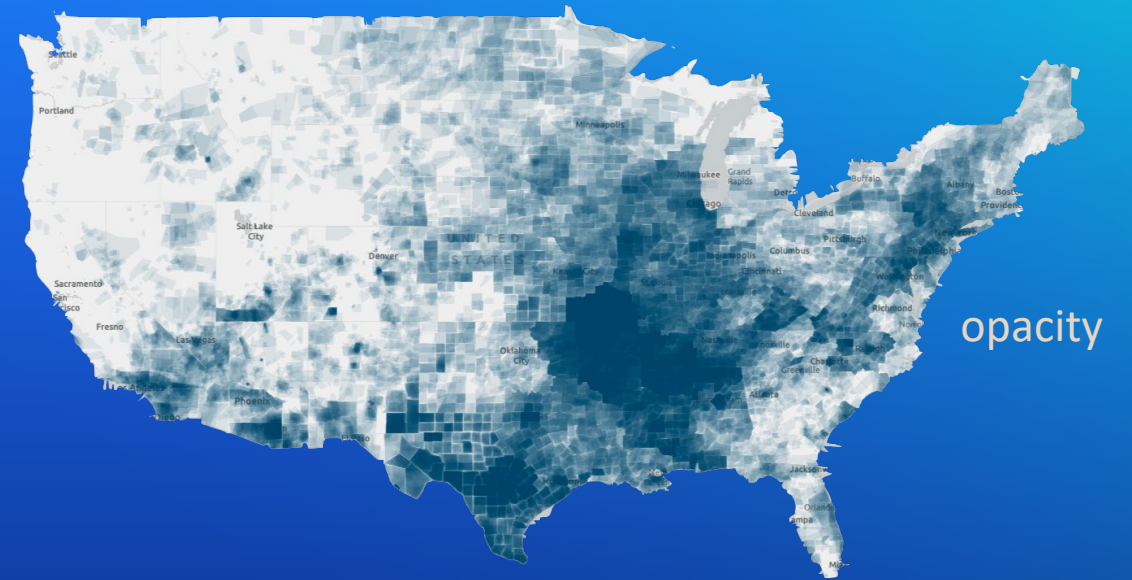


Data-driven CIM

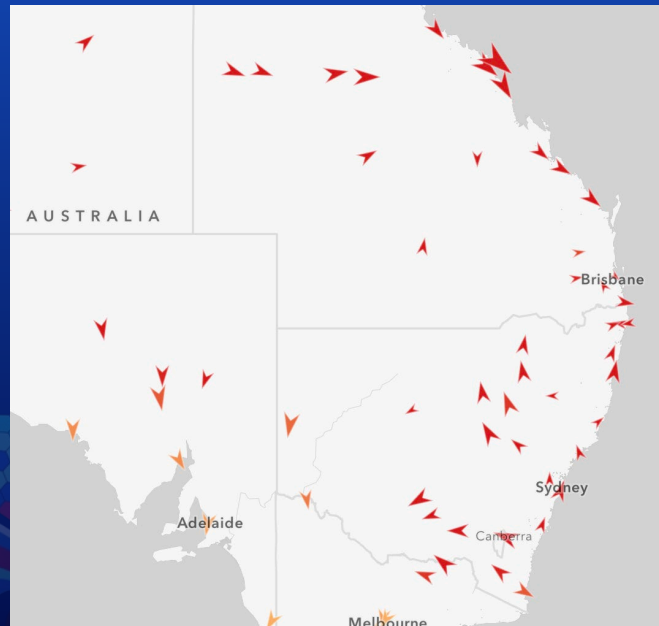
Kristian Ekenes

Data-driven mapping

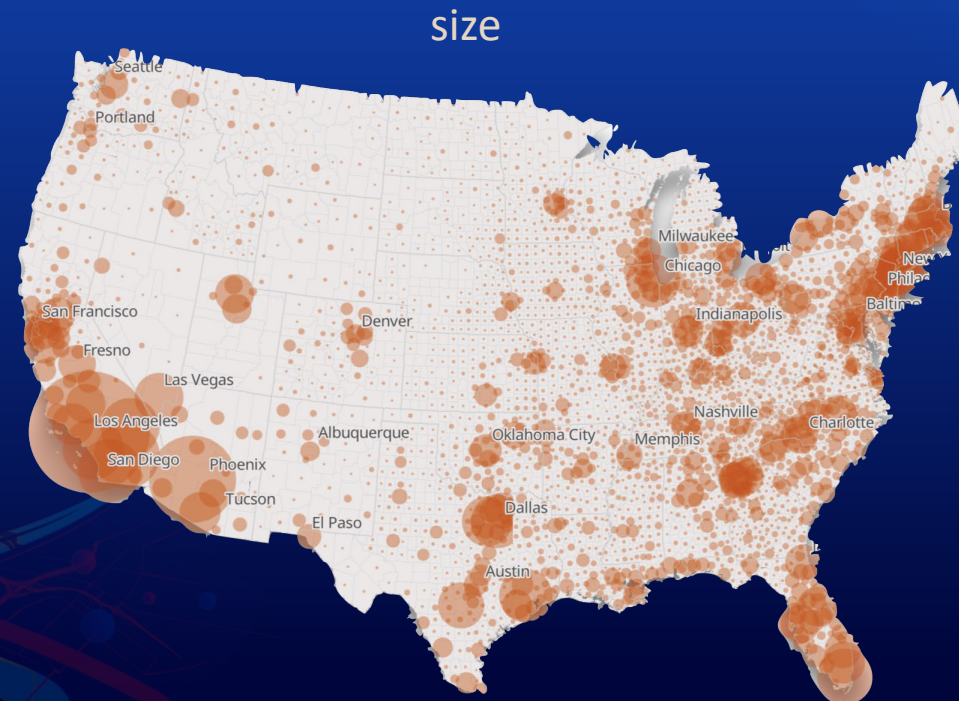
- Override a symbol's visual variable with a data value (either a field value, or an Arcade expression).



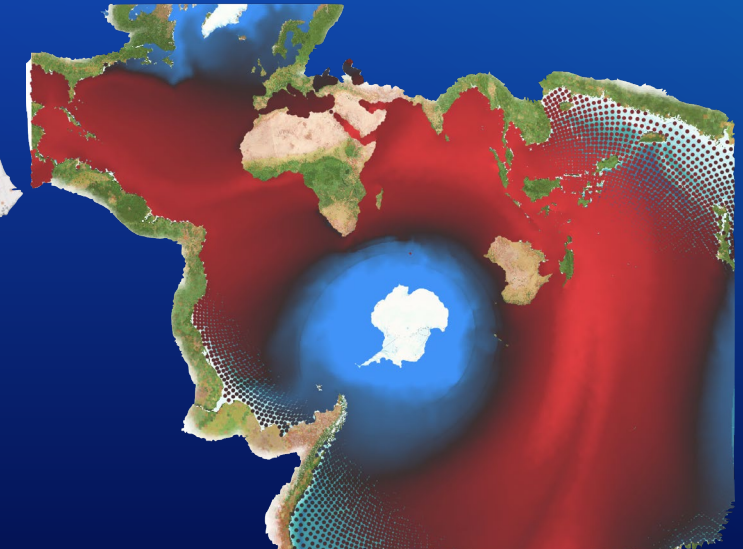
opacity



rotation



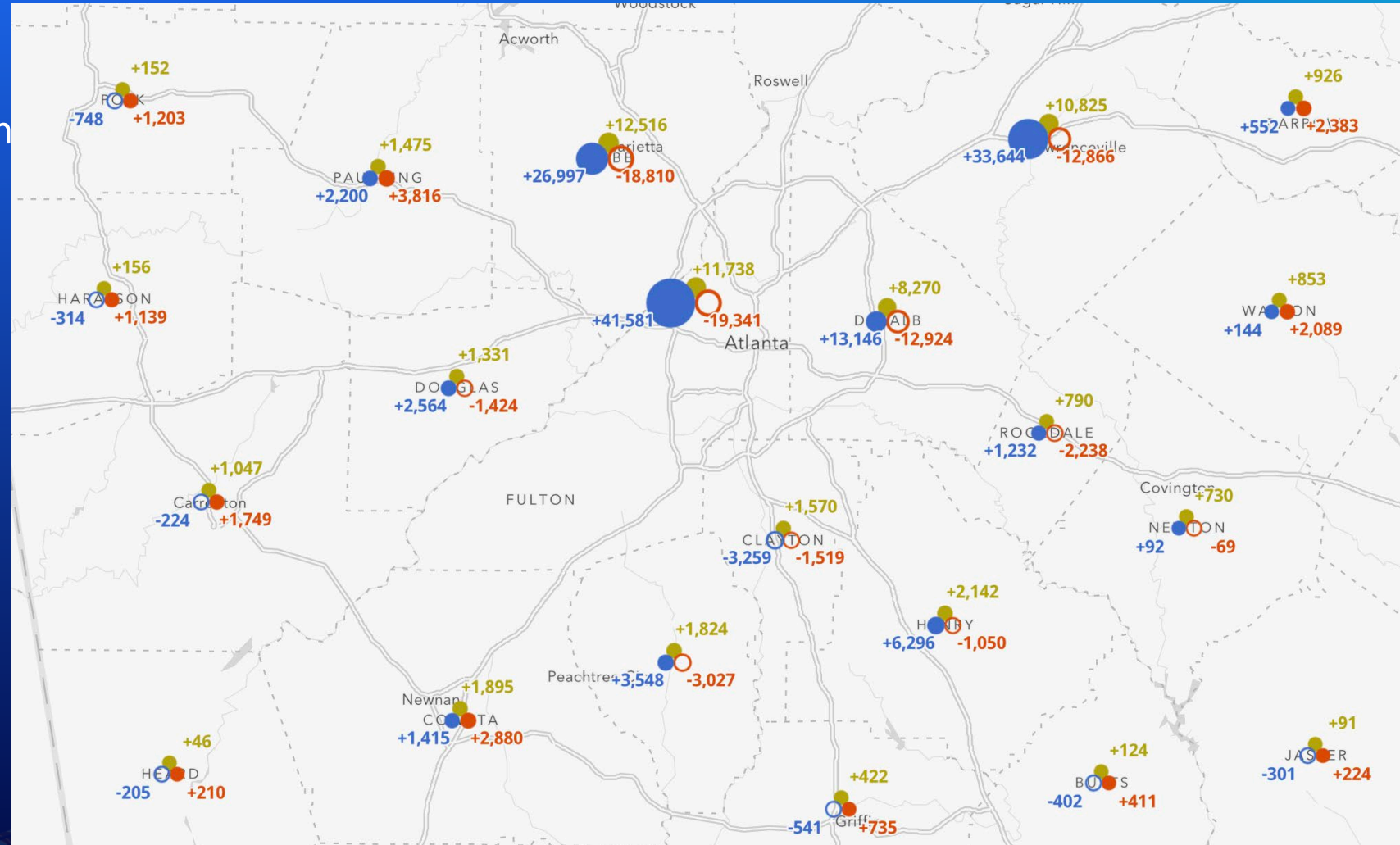
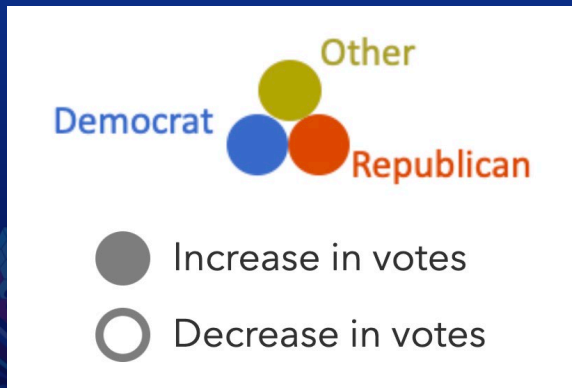
size



color

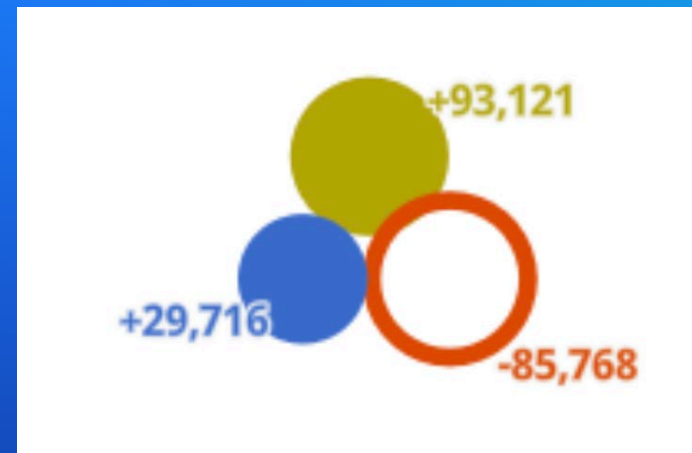
Multi-part data-driven symbols

- Multiple symbol layers.
- The visual properties of each can be controlled by data values, so you can create more complex, multi-part, data-driven visualizations.
- More complex usually isn't a good thing, but it can be!



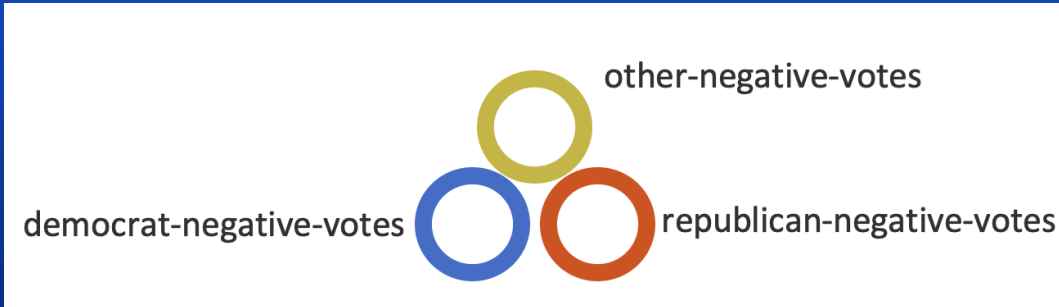
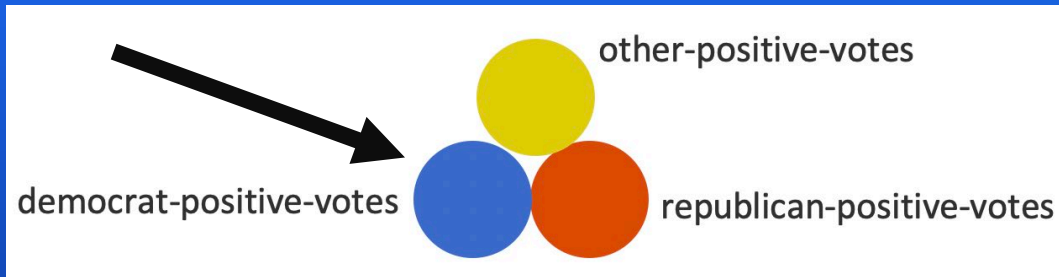
Primitive Overrides

- A property of CIMSymb^{ol}.
- Arcade expressions that dynamically return the value of a primitive's visual property.
- e.g. a primitive override targeting size returns a new size value for a targeted symbol layer (primitive).
- Typically used to change a symbol property based on a data value or expression.



```
export const stateChangeRenderer = new SimpleRenderer({
  symbol: new CIMSymbol({
    data: {
      type: `CIMSymbolReference`,
      symbol: {
        type: `CIMPointSymbol`,
        symbolLayers: [ ...
      ]
    },
    primitiveOverrides: [ ...
  ]
})
});
```

Primitive Overrides



```
const symbolLayer = {  
  type: "CIMVectorMarker",  
  enable: true,  
  primitiveName: "democrat-positive-votes",  
  frame: { xmin: 0.0, ymin: 0.0, xmax: 17.0, ymax: 17.0 },  
  anchorPoint: { x: 0.5, y: 0 },  
  anchorPointUnits: "Relative",  
}
```

```
const symbolLayer = {  
  type: "CIMVectorMarker",  
  enable: true,  
  primitiveName: "democrat-positive-votes",  
  frame: { xmin: 0.0, ymin: 0.0, xmax: 17.0, ymax: 17.0 },  
  anchorPoint: { x: 0.5, y: 0 },  
  anchorPointUnits: "Relative",  
  markerGraphics: [  
    {  
      type: "CIMMarkerGraphic",  
      geometry: {  
        rings: [  
          [  
            [8.5, 0.2],  
            [7.06, 0.33],  
            [5.66, 0.7],  
            [4.35, 1.31],  
            // additional vertices  
            // to complete the circle  
          ]  
        ]  
      },  
      symbol: {  
        type: "CIMPolygonSymbol",  
        symbolLayers: [  
          {  
            type: "CIMSolidFill",  
            enable: true,  
            color: [60, 108, 204, 255]  
          }  
        ]  
      }  
    }  
  ],  
  scaleSymbolsProportionally: true,  
  respectFrame: true  
};
```


Primitive Overrides

```
export const stateChangeRenderer = new SimpleRenderer({
  symbol: new CIMSymbol({
    data: {
      type: `CIMSymbolReference`,
      symbol: {
        type: `CIMPointSymbol`,
        symbolLayers: [ ... ]
      },
      primitiveOverrides: [ ... ]
    }
  })
});
```



```
createCircleSymbolLayer({
  primitiveName: `other-positive-votes`,
  offsetX: 0,
  offsetY: 10,
  color: oColorCIM,
  donutEnabled: false
}),
```



```
createCircleSymbolLayer({
  primitiveName: `other-negative-votes`,
  offsetX: 0,
  offsetY: 10,
  color: oColorCIM,
  donutEnabled: true
})
```



```
createCircleSymbolLayer({
  primitiveName: `democrat-positive-votes`,
  offsetX: -10,
  offsetY: 0,
  color: dColorCIM,
  donutEnabled: false
})
```



```
createCircleSymbolLayer({
  primitiveName: `democrat-negative-votes`,
  offsetX: -10,
  offsetY: 0,
  color: dColorCIM,
  donutEnabled: true
})
```

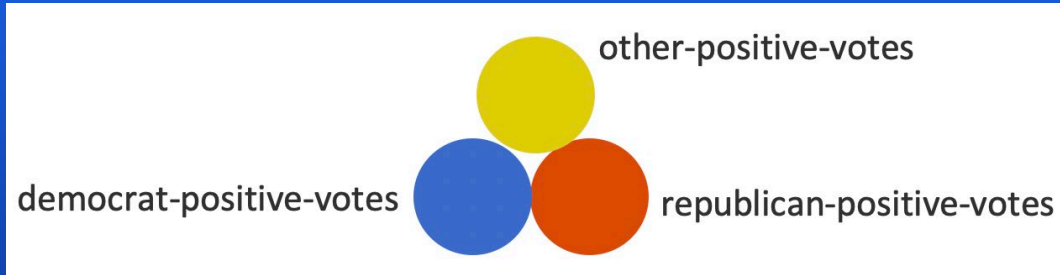


```
createCircleSymbolLayer({
  primitiveName: `republican-positive-votes`,
  offsetX: 10,
  offsetY: 0,
  color: rColorCIM,
  donutEnabled: false
}),
```



```
createCircleSymbolLayer({
  primitiveName: `republican-negative-votes`,
  offsetX: 10,
  offsetY: 0,
  color: rColorCIM,
  donutEnabled: true
}),
```

Primitive Overrides



```
var votesNext = $feature.PRS_DEM_16;
var votesPrevious = $feature.PRS_DEM_12;
var change = votesNext - votesPrevious;
var value = IIF( change > 0, change, 0);

// assign sizes to data values
// interpolate between stops
var sizeFactor = When(
    value >= 500000, 40,
    value >= 100000, 30 + ((40-30)/(500000-100000)) * (value - 100000),
    value >= 50000, 5 + ((30-5)/(100000-50000)) * (value - 1),
    value >= 10000, 1 + ((5-1)/(50000-10000)) * (value - 0.5),
    value > 0, 0.5 + ((1-0.5)/(10000) * value),
    0
);
```

```
const democratPositiveOverride2 = {
  type: "CIMPrimitiveOverride",
  primitiveName: "democrat-positive-votes",
  propertyName: "Size",
  valueExpressionInfo: {
    type: "CIMExpressionInfo",
    title: "Increase in Democrat votes",
    expression: `
      var votesNext = $feature.PRS_DEM_16;
      var votesPrevious = $feature.PRS_DEM_12;
      var change = votesNext - votesPrevious;
      var value = IIF( change > 0, change, 0);

      // assign sizes to data values
      // interpolate between stops
      var sizeFactor = When(
        value >= 500000, 40,
        value >= 100000, 30 + ((40-30)/(500000-100000)) * (value - 100000),
        value >= 50000, 5 + ((30-5)/(100000-50000)) * (value - 1),
        value >= 10000, 1 + ((5-1)/(50000-10000)) * (value - 0.5),
        value > 0, 0.5 + ((1-0.5)/(10000) * value),
        0
      );

      // adjust size based on scale
      // symbols grow as you zoom in
      // symbols shrink as you zoom out
      var scaleFactorBase = ( ${referenceScale} / $view.scale );
      var scaleFactor = When(
        scaleFactorBase >= 1, 1, // 1
        scaleFactorBase >= 0.5, scaleFactorBase * 1, // 0.6
        scaleFactorBase >= 0.25, scaleFactorBase * 1, // 0.45
        scaleFactorBase >= 0.125, scaleFactorBase * 1, // 0.3125
        scaleFactorBase * 1 // 0.1875
      );

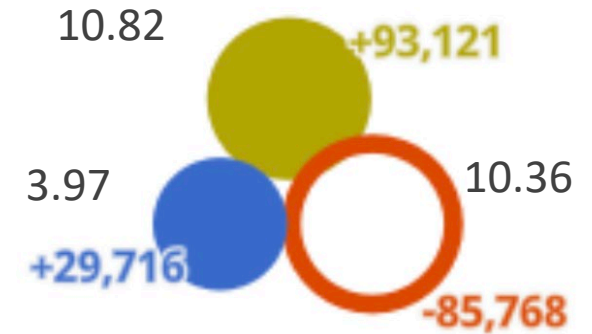
      return sizeFactor * scaleFactor;
    `,
    returnType: "Default"
  }
}
```

Primitive Overrides

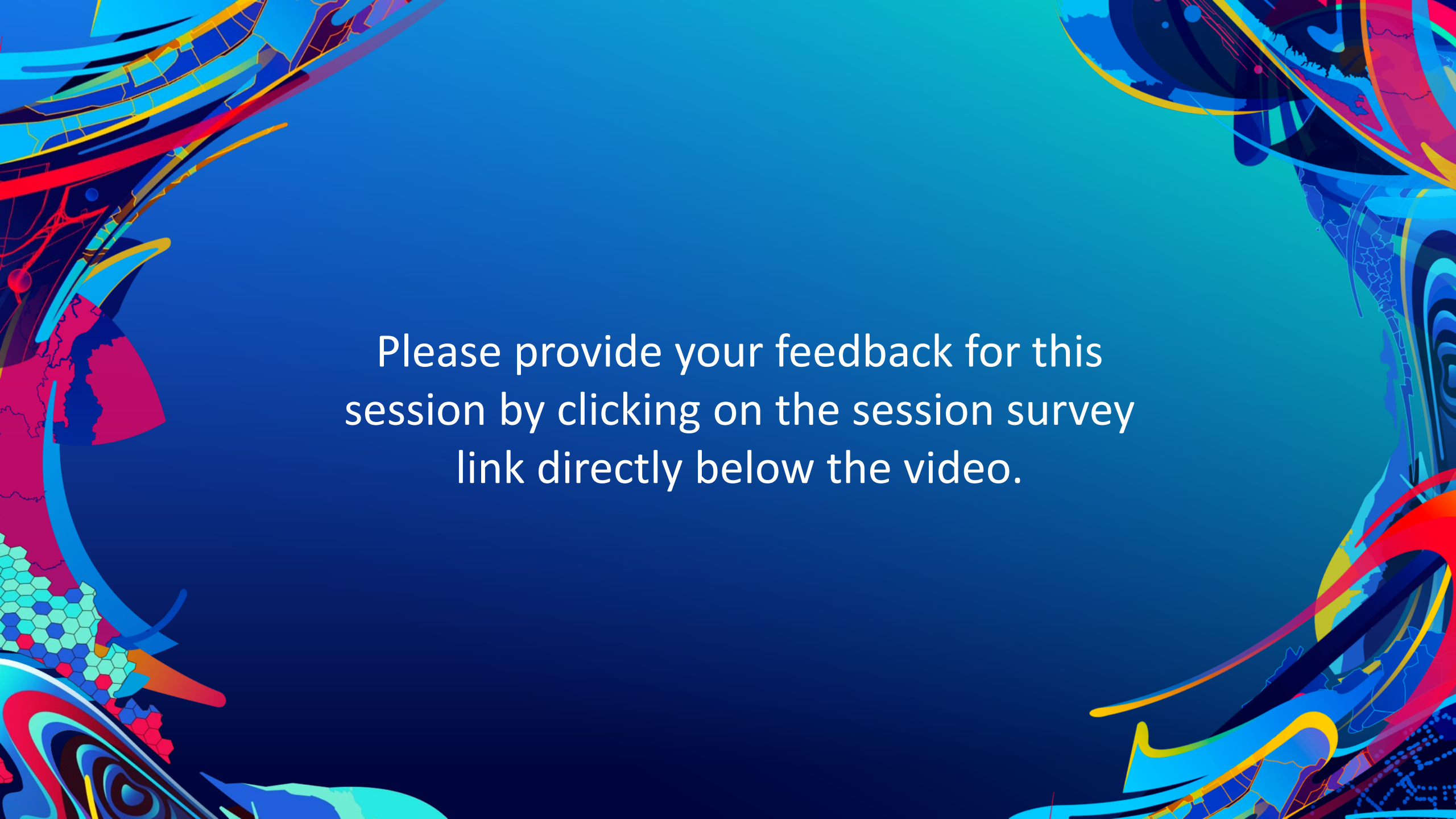
```
var votesNext = $feature.PRS_DEM_16;  
var votesPrevious = $feature.PRS_DEM_12;  
var change = votesNext - votesPrevious;  
var value = IIF( change > 0, change, 0);  
  
// assign sizes to data values  
// interpolate between stops  
var sizeFactor = When(  
    value >= 500000, 40,  
    value >= 100000, 30 + ((40-30)/(500000-100000)) * (value - 100000),  
    value >= 50000, 5 + ((30-5)/(100000-50000)) * (value - 1),  
    value >= 10000, 1 + ((5-1)/(50000-10000)) * (value - 0.5),  
    value > 0, 0.5 + ((1-0.5)/(10000) * value),  
    0  
);
```

```
var change = votesNext - votesPrevious;  
var value = IIF( change < 0, Abs(change), 0);
```

Computed sizes



All other symbol layers are assigned a size of zero, and therefore aren't drawn.

The background is a vibrant, abstract composition. It features a central area of solid blue and teal. The left and right sides are framed by complex, colorful patterns. On the left, there are swirling shapes in red, yellow, and blue, along with a section of a hexagonal grid in shades of green and blue. On the right, there are more swirling patterns in blue, red, and yellow, with some areas resembling a stylized face or mask. The overall effect is dynamic and visually stimulating.

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