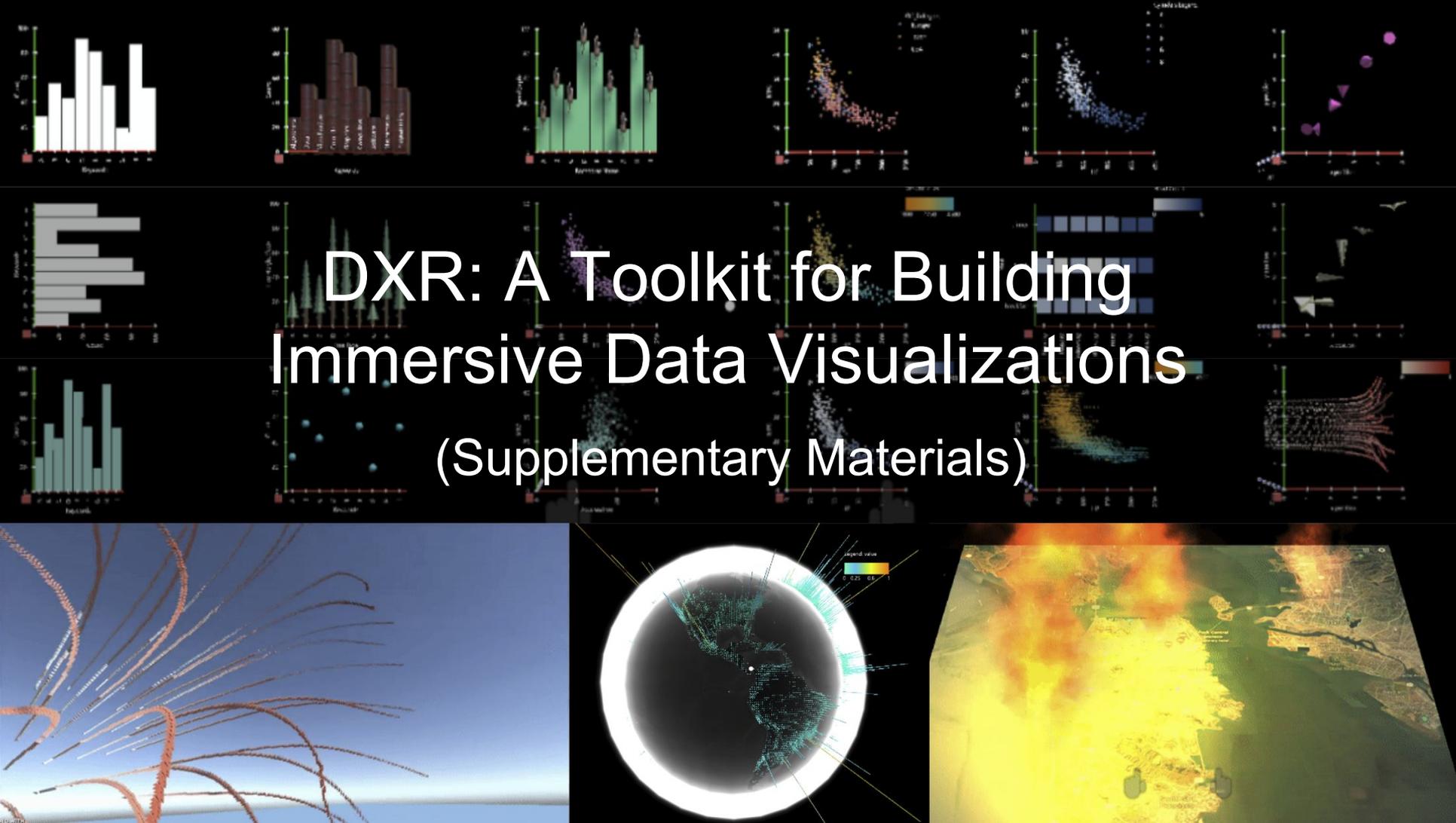
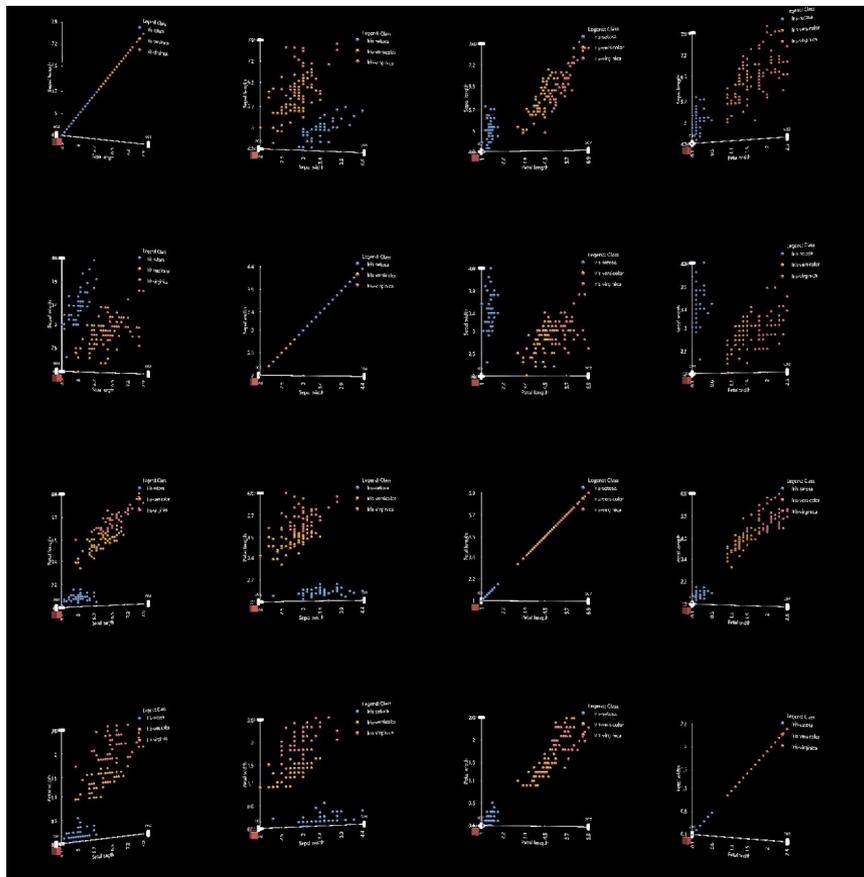


DXR: A Toolkit for Building Immersive Data Visualizations

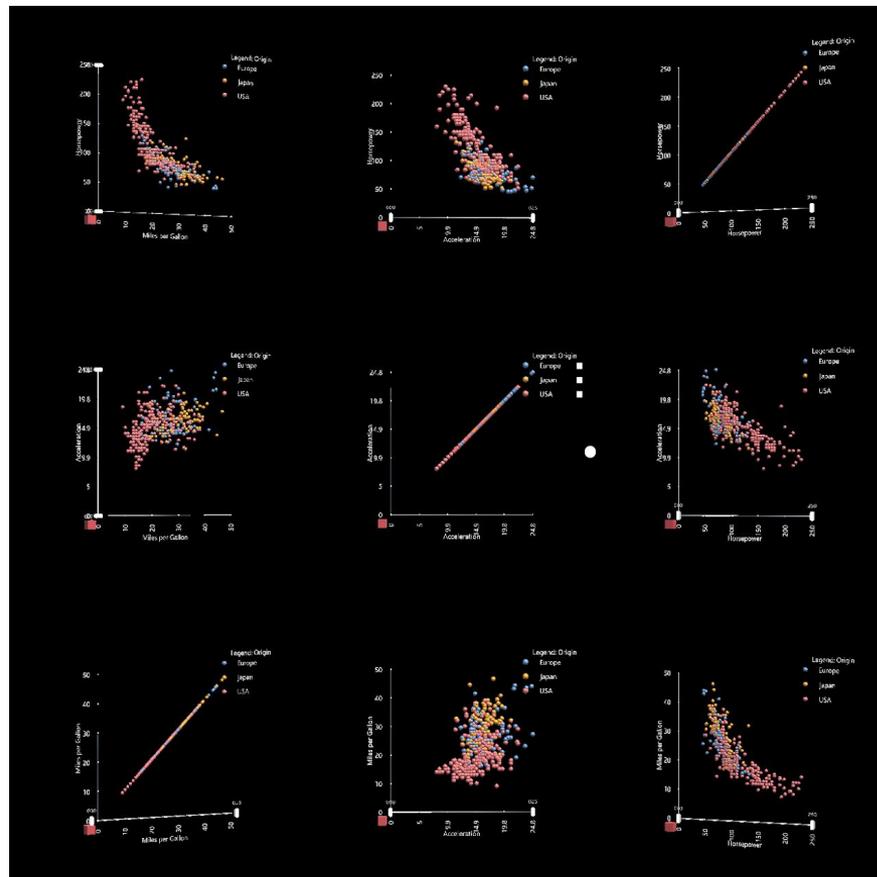
(Supplementary Materials)



Linked scatter plot matrices (SPLOM) in DXR



Iris Dataset

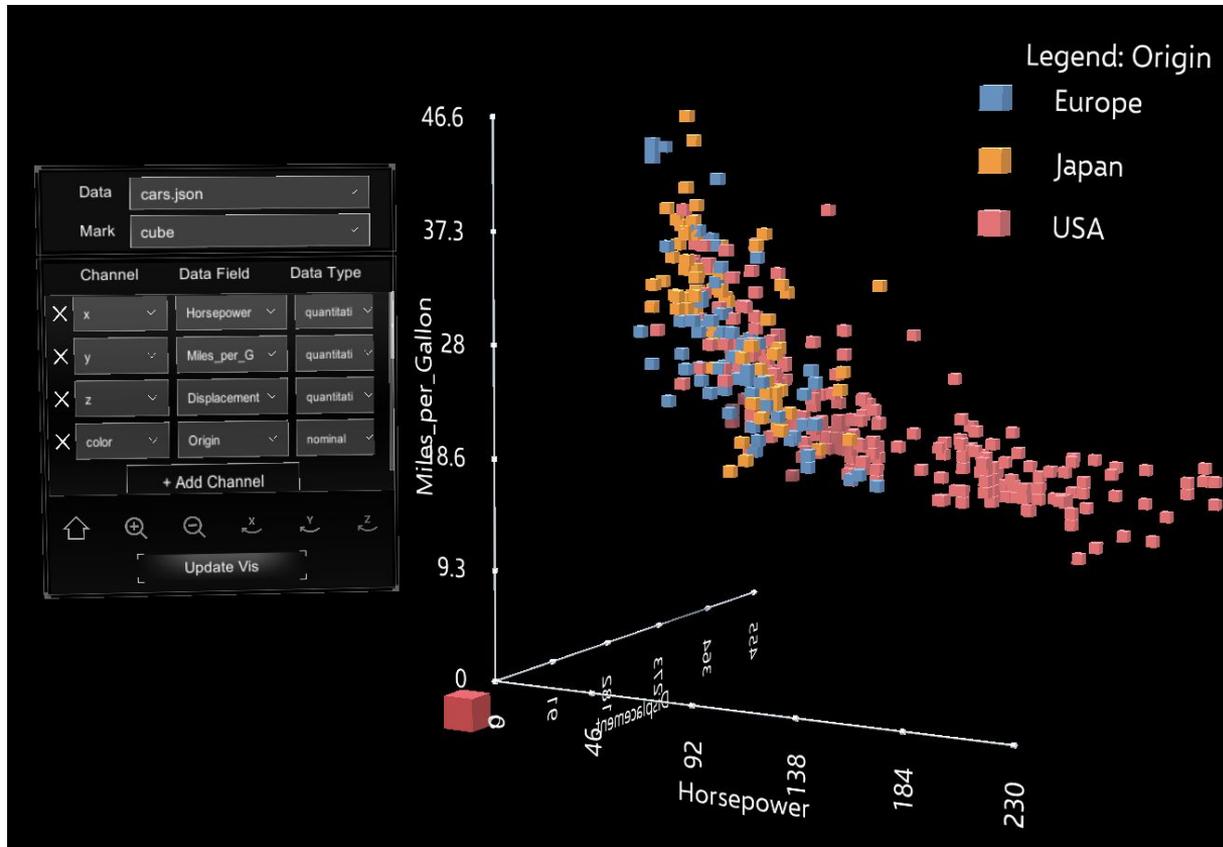


Cars Dataset

Alternative GUI design



GUI with interaction menu



Current GUI design

Fig. 10g: Flow data generated and visualized in Autodesk Maya

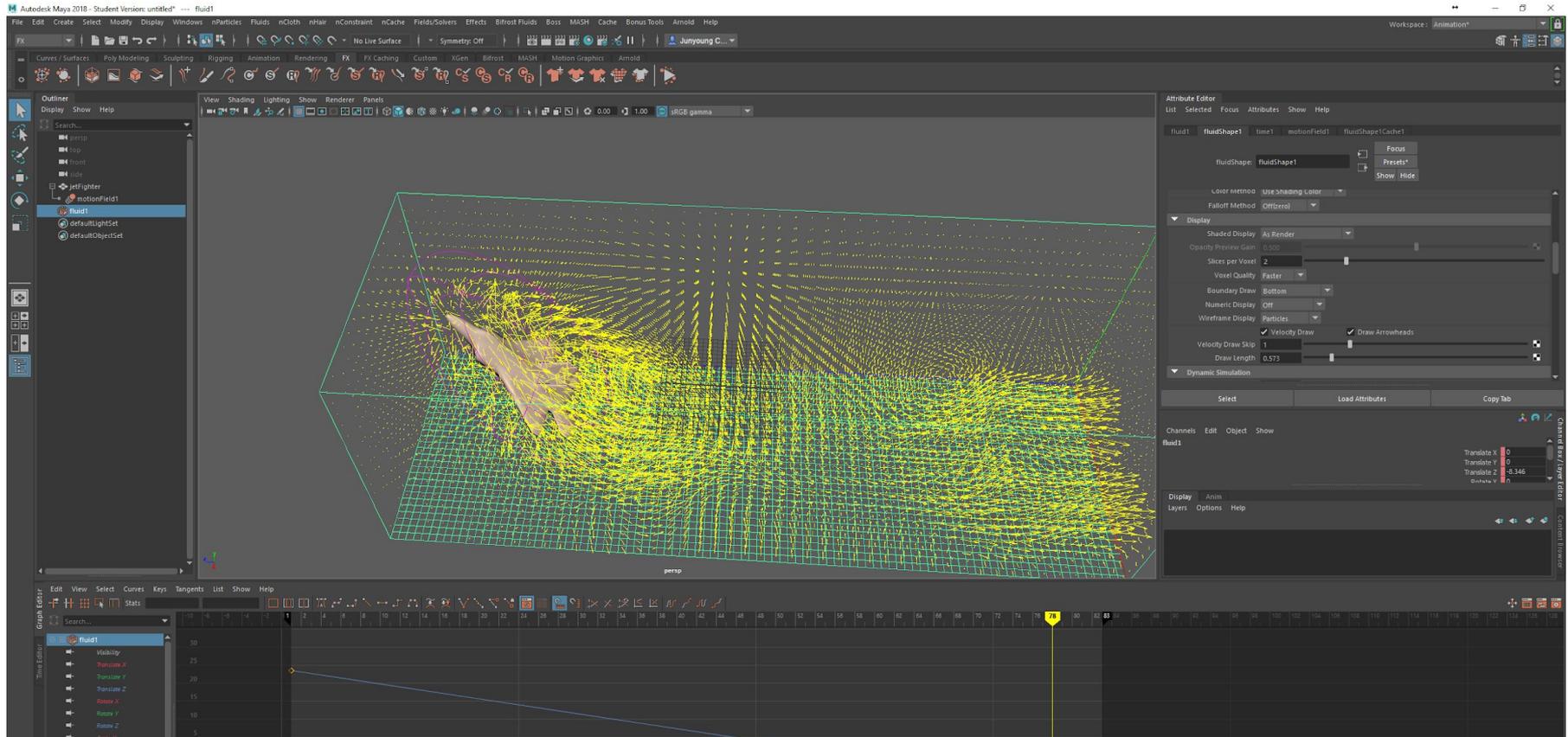
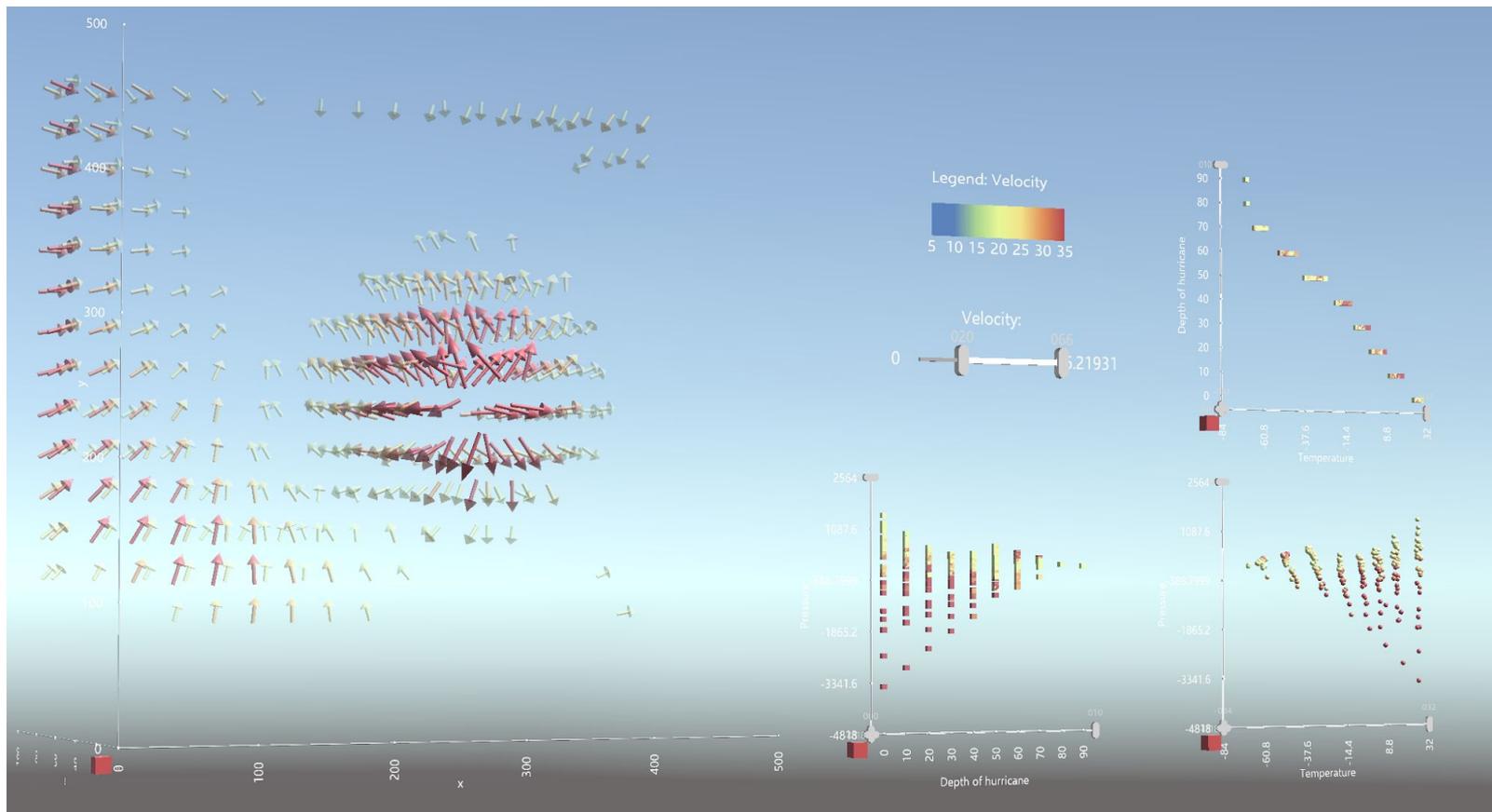
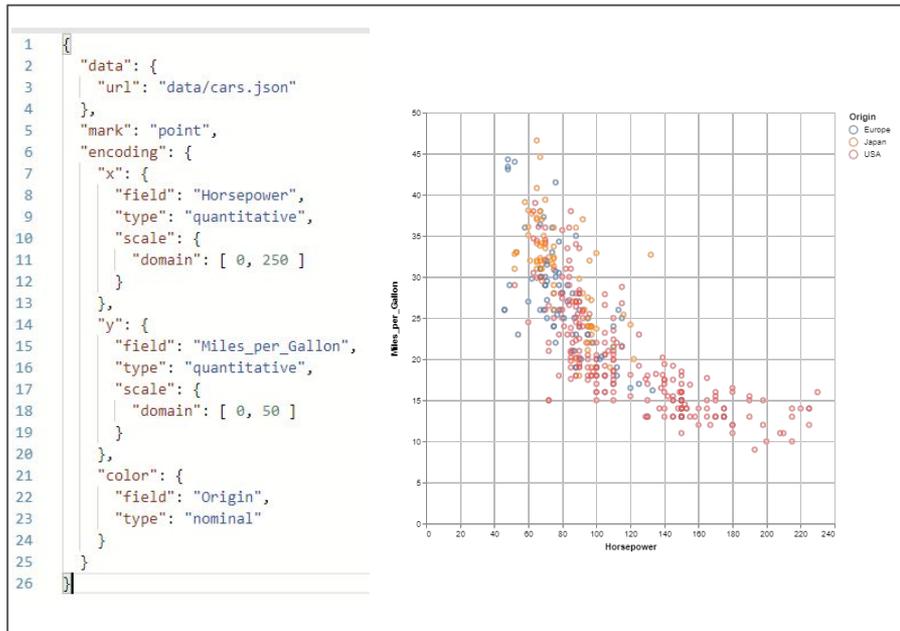


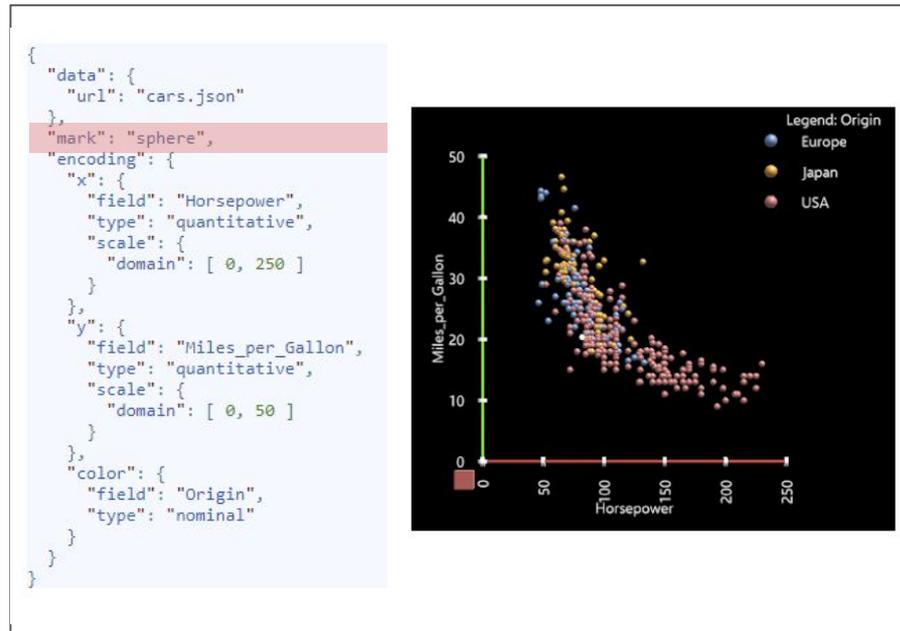
Fig. 10c example with alternative styling



Some Vega-Lite examples work in DXR with minor edits

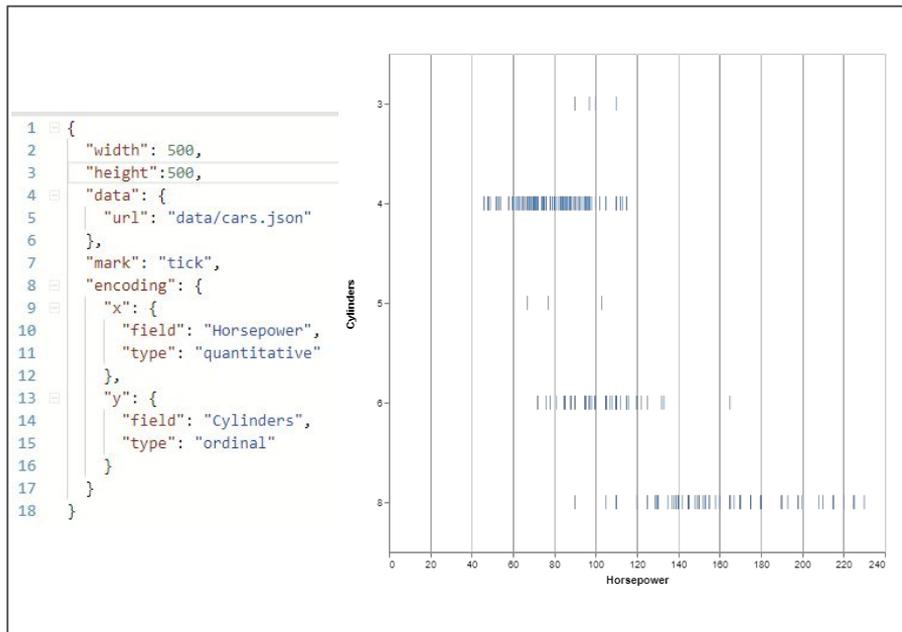


Vega-Lite specifications and result



DXR specifications and result

Some Vega-Lite examples work in DXR with minor edits



Vega-Lite specifications and result



DXR specifications and result

Inference example

```
{
  "data": {
    "url": "cars.json"
  },
  "mark": "sphere",
  "encoding": {
    "x": {
      "field": "Horsepower",
      "type": "quantitative",
      "scale": {
        "domain": [ 0, 250 ]
      }
    },
    "y": {
      "field": "Miles_per_Gallon",
      "type": "quantitative",
      "scale": {
        "domain": [ 0, 50 ]
      }
    }
  },
  "color": {
    "field": "Origin",
    "type": "nominal"
  }
},
"interaction": [
  {
    "field": "Origin",
    "type": "toggleFilter"
  },
  {
    "field": "Horsepower",
    "type": "thresholdFilter"
  }
]
}
```

concise specifications



```
{
  "data": {
    "url": "cars.json"
  },
  "mark": "sphere",
  "encoding": {
    "x": {
      "field": "Horsepower",
      "type": "quantitative",
      "scale": {
        "domain": [
          0,
          250
        ],
        "type": "linear",
        "paddingInner": "0.05",
        "paddingOuter": "0.05",
        "range": [
          "0",
          "500"
        ]
      }
    },
    "axis": {
      "face": "front",
      "orient": "bottom",
      "title": "Horsepower",
      "length": 500,
      "color": "#ff0000",
      "ticks": true,
      "values": [
        "0",
        "50",
        "100",
        "150",
        "200",
        "250"
      ],
      "tickCount": 6,
      "labels": true
    }
  }
},
}
```

inferred specifications

```
"y": {
  "field": "Miles_per_Gallon",
  "type": "quantitative",
  "scale": {
    "domain": [
      0,
      50
    ],
    "type": "linear",
    "paddingInner": "0.05",
    "paddingOuter": "0.05",
    "range": [
      "0",
      "500"
    ]
  },
  "axis": {
    "face": "front",
    "orient": "left",
    "title": "Miles_per_Gallon",
    "length": 500,
    "color": "#00ff00",
    "ticks": true,
    "values": [
      "0",
      "10",
      "20",
      "30",
      "40",
      "50"
    ],
    "tickCount": 6,
    "labels": true
  }
},
"color": {
  "field": "Origin",
  "type": "nominal",
  "scale": {
    "type": "ordinal",
    "domain": [
      "Europe",
      "Japan",
      "USA"
    ],
    "paddingInner": "0.05",
    "paddingOuter": "0.05",
    "range": "category",
    "scheme": "tableau10"
  }
}
```

```
"legend": {
  "type": "symbol",
  "gradientWidth": 200,
  "gradientHeight": 50,
  "face": "front",
  "orient": "right",
  "x": 500,
  "y": 500,
  "z": 0,
  "title": "Legend: Origin"
},
"interaction": [
  {
    "field": "Origin",
    "type": "toggleFilter",
    "domain": [
      "Europe",
      "Japan",
      "USA"
    ]
  },
  {
    "field": "Horsepower",
    "type": "thresholdFilter",
    "domain": [
      "0",
      "230"
    ]
  }
],
"width": 500,
"height": 500,
"depth": 500
}
```

Performance evaluation table (Construction Times in seconds)

Data Size	Random_Cube_HL	Random_Fire_HL	Random_Cube_VR	Random_Fire_VR	Random_Cube	Random_Fire	Flow_Cone	Flow_Arrow
10	0.074	0.080	0.016	0.022	0.021	0.026	0.048	0.041
100	0.113	0.174	0.017	0.050	0.050	0.116	0.129	0.112
1000	0.527	1.134	0.092	0.388	0.381	1.013	0.868	0.689
10000	5.000	11.517	0.846	4.277	4.279	9.804	8.518	6.545

Performance evaluation table (Frames Per Second)

Data Size	Random_Cube_HL	Random_Fire_HL	Random_Cube_VR	Random_Fire_VR	Random_Cube	Random_Fire	Flow_Cone	Flow_Arrow
10	60.00	30.02	60.00	58.72	177.11	163.93	171.39	149.65
100	60.05	4.82	60.00	60.00	161.32	138.55	150.09	61.04
1000	49.18	0.51	60.00	59.70	80.70	45.19	73.63	42.44
10000	5.45	NA	22.60	6.30	9.45	3.96	12.00	0.72