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# Workshop I

3. International JSXGraph Conference

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## Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
<b>2</b>	<b>Preliminaries</b>	<b>3</b>
2.1	Information for beginners . . . . .	3
2.2	Information for intermediate / advanced users . . . . .	3
2.3	Include JSXGraph - skeleton page . . . . .	4
<b>3</b>	<b>Not done - please apologize</b>	<b>4</b>
<b>4</b>	<b>JSXGraph and accessibility</b>	<b>5</b>
4.1	ARIA attributes . . . . .	5
4.2	Keyboard control . . . . .	5
4.3	Color . . . . .	5
<b>5</b>	<b>Some new features from 1.3.2 to 1.4.6</b>	<b>6</b>
5.1	New elements . . . . .	6
5.2	Improvements (some were overdue...) . . . . .	7
5.3	Ecosystem . . . . .	9
5.4	JSXGraph as ES6 module . . . . .	9
5.5	Support of <i>shadowDOM</i> . . . . .	9
<b>6</b>	<b>Call for help / collaboration</b>	<b>10</b>
6.1	TypeScript support via <code>index.d.ts</code> . . . . .	10
6.2	ARIA support . . . . .	10
6.3	New project <i>json2D_JSXGraph</i> . . . . .	10



## 1 Introduction

- My name is *Alfred Wassermann*
- I'm the JSXGraph lead developer, University of Bayreuth, Germany

The plan of this workshop is to summarize what happened since October 2021 and - maybe - learn some lesser known features of JSXGraph.

## 2 Preliminaries

### 2.1 Information for beginners

- <https://youtu.be/0wQPASnq86Y>
- JSXGraph handbook: <https://ipesek.github.io/jsxgraphbook/>
- JSXGraph wiki: <https://jsxgraph.org/wiki>

### 2.2 Information for intermediate / advanced users

- Previous conferences:
  - 2020: <https://jsxgraph.org/conf>
  - 2021: <https://jsxgraph.org/conf2021>
- Webinar series (7 sessions) in 2020 / 2021: <https://jsxgraph.org/wp/docs/>
- API docs: <https://jsxgraph.org/docs/>

## 2.3 Include JSXGraph - skeleton page

How to include JSXGraph:

- Local copy of `jsxgraphcore.js` and `jsxgraph.css` (download or npm)
- <https://cdn.jsdelivr.net/npm/jsxgraph/distrib/jsxgraphcore.js>
- <https://cdnjs.cloudflare.com/ajax/libs/jsxgraph/1.4.6/jsxgraphcore.js>
- **Not** recommended: <https://jsxgraph.org/distrib/jsxgraphcore.js>

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="UTF-8">
    <title>JSXGraph template</title>
    <meta content="text/html; charset=utf-8" http-equiv="Content-Type">
    <link href="https://cdn.jsdelivr.net/npm/jsxgraph/distrib/jsxgraph.css" rel="
      stylesheet" type="text/css" />
    <script src="https://cdn.jsdelivr.net/npm/jsxgraph/distrib/jsxgraphcore.js"
      type="text/javascript" charset="UTF-8"></script>

    <!-- The next line is optional: MathJax -->
    <script src="https://cdn.jsdelivr.net/npm/mathjax@3/es5/tex-ctml.js" id="
      MathJax-script" async></script>
  </head>
  <body>

  <div id="jxgbox" class="jxgbox" style="width:500px; height:200px;"></div>

  <script>
    var board = JXG.JSXGraph.initBoard('jxgbox', {boundingbox: [-5, 2, 5, -2]});
  </script>

  </body>
</html>
```

## 3 Not done - please apologize

- Continue monthly webinars
- Fill the database (improved wiki) with examples. There are more than 200 jsfiddles lying around...
- Update JSXGraph home page
- Handle GitHub issues

## 4 JSXGraph and accessibility

### 4.1 ARIA attributes

So far:

- ARIA attributes `title` and `description` added in v1.2.0 (Jan. 2021)
- JSXGraph container has attributes `aria-labelledby` and `aria-describedby`

### 4.2 Keyboard control

- Added keyboard control in v1.3.0 (Aug. 2021)

### 4.3 Color

- Optimize color palette for colorblind people
- Include the [Wong color palette](#) since v1.4.0 (Nov. 2021)

```
JXG.paletteWong: {  
  black: '#000000',  
  orange: '#E69F00',  
  skyblue: '#56B4E9',  
  bluishgreen: '#009E73',  
  yellow: '#F0E442',  
  darkblue: '#0072B2',  
  vermilion: '#D55E00',  
  reddishpurple: '#CC79A7',  
  blue: '#0072B2',  
  red: '#D55E00', // vermilion  
  green: '#009E73', // bluishgreen  
  purple: '#CC79A7', // reddishpurple  
  white: '#ffffff'  
}
```

Example:

```
var p = board.create('line', [[-1, 1], [2, -3]], {strokeColor: JXG.palette.orange})  
;
```

## 5 Some new features from 1.3.2 to 1.4.6

- JSXGraph v1.3.2 was released in September 2021
- JSXGraph v1.4.6 was released on September 30th, 2022

### 5.1 New elements

- Preliminary 3D support, see my workshop on Wednesday
- New element `foreignobject`, see Bernat Martinez's talk on Wednesday
- New element `boxplot`, see <https://jsfiddle.net/r10t32fw/> and <https://jsxgraph.org/docs/symbols/Boxplot.html>

```
var data = [57, 57, 57, 58, 63, 66, 66, 67, 67, 68, 69, 70, 70, 70, 70, 72, 73, 75,
  75, 76, 76, 78, 79, 81];
var Q = [];

Q[0] = JXG.Math.Statistics.min(data);
Q = Q.concat(JXG.Math.Statistics.percentile(data, [25, 50, 75]));
Q[4] = JXG.Math.Statistics.max(data);

var b = board.create('boxplot', [Q, 0, 3]);
```

## 5.2 Improvements (some were overdue...)

- Get term of Lagrange polynomial, see
  - <https://jsfiddle.net/q4sutav7/2/>
  - <https://jsxgraph.org/docs/symbols/JXG.Math.Numerics.html#lagrangePolynomialTerm>

```

var points = [];
points[0] = board.create('point', [-1,2], {size:4});
points[1] = board.create('point', [3,-1], {size:4});
var f = JXG.Math.Numerics.lagrangePolynomial(points);
var graph = board.create('functiongraph', [f, -10, 10], {strokeWidth:3});
var dl = board.create('functiongraph', [JXG.Math.Numerics.D(f), -10, 10], {dash:1})
;

var txt = board.create('text', [-3, -4, () => f.getTerm(2, 't', ' * ')], {fontSize
: 16});

function addPoint() {
  points.push(board.create('point', [(Math.random()-0.5)*10, (Math.random()-0.5)
*3],{size:4}));
  board.update();
}

function removePoint() {
  if (points.length > 2) {
    board.removeObject(points[points.length - 1]);
    points.pop();
    board.update();
  }
}

document.getElementById('add').addEventListener("click", addPoint, false);
document.getElementById('remove').addEventListener("click", removePoint, false);

```

- Allow labels for minor ticks, see <https://jsfiddle.net/5d7yh1f4/1/>

```

const board = JXG.JSXGraph.initBoard('jxgbox', {
  boundingbox: [-9, 9, 9, -9],
  axis: true,
  defaultAxes: {
    x: {
      ticks: {
        minorTicks: 7,
        ticksPerLabel: 4,
        minorHeight: 20,
      }
    },
    y: {
      ticks: {
        minorTicks: 3,
        ticksPerLabel: 2,
        minorHeight: 20
      }
    }
  }
});

```

```

    }
  }
});

```

- Attribute `hasInnerPoints` for curves

- <https://jsfiddle.net/fLzb7ogs/>
- <https://jsfiddle.net/khjg05eq/>

```

var p1 = board.create('point', [-1, -2], {
  name: "p1",
  visible: false, function(phi){ return a.Value()*(1-Math.cos(phi));}
});
var p2 = board.create('point', [1, 2], {
  name: "p2",
  visible: false
});

var a1 = board.create('circle', [p1, p2], {
  hasInnerPoints: true,
  fixed: true
});
var a2 = board.create('circle', [p2, p1], {
  hasInnerPoints: true,
  fixed: true
});
var c1 = board.create('curveintersection', [a1, a2], {
  hasInnerPoints: true,
  fillColor: 'yellow', fillOpacity: 0.5,
  highlightFillColor: 'blue', highlightFillOpacity: 0.5,
});

```

```

var graph = board.create('curve',
  [ (phi) => 1 - Math.cos(phi),
    [1, 0], 0, 2 * Math.PI
  ],
  {
    curveType: 'polar',
    fillColor: JXG.palette.orange,
    fillOpacity: 0.5,
    highlightFillColor: JXG.palette.red,
    highlightFillOpacity: 0.5,
    fixed: false,
    hasInnerPoints: true
  }
);

```

- Improved handling of `keepaspectratio: true` (suggested by Murray Bourne, still not perfect)
- Fullscreen mode is now independent from browser zoom level (webkit problem)
- New attribute `rotatable` for two finger handling
- Enable intersection curve / circle



### 5.3 Ecosystem

- Many new examples in [API docs](#)
- New unit test system “Karma/Jasmine”, see <https://github.com/jsxgraph/jsxgraph/tree/master/test>
- JSXGraph in [H5P](#)
  - See <https://github.com/jsxgraph/H5P.JSXGraph>
  - Branches:
    - \* `main`: insecure, not save against XSS
    - \* `security`: should be safe against XSS

### 5.4 JSXGraph as ES6 module

Make JSXGraph available as ES6 module

```
<div id='jxgbox' class='jxgbox' style='width:500px; height:500px'></div>

<script type="module">
  import 'https://jsxgraph.org/distrib/jsxgraphcore.js';

  const board = JXG.JSXGraph.initBoard('jxgbox', { boundingbox: [-5, 5, 5, -5],
    axis: true });
  const A = board.create('point', [-1, -1], { name: 'A' });
  const B = board.create('point', [3, -1], {});
  board.create('line', [A, B]);
</script>
```

### 5.5 Support of *shadowDOM*

What is *shadowDOM*?

- Think of the video tag `<video>`: Built from HTML tags (e.g. control buttons), the developer has no access to
- “Namespace” for CSS and `getElementById()`
- Useful to create *web components*
- Suggested by Holger Engels from kmap
- See <https://www.npmjs.com/package/kmap-jsxgraph>

## 6 Call for help / collaboration

### 6.1 TypeScript support via `index.d.ts`

- Contributed by David Holmes from STEMCstudio <https://stemcstudio.com>
- Not fully complete. Please, send pull requests if something is missing.
- Meanwhile many pull requests “from outside”
- Please help with continuous improvement of `index.d.ts`

### 6.2 ARIA support

Further improve ARIA support

- See Murray Bourne’s suggestions at <https://groups.google.com/g/jsxgraph/c/tJzEcvnBJ3U>

### 6.3 New project `json2D_JSXGraph`

- JSON 2D Graphics interface for JSXGraph
- See <https://github.com/jsxgraph/jsxgraph/issues/448>
- Github: [https://github.com/jsxgraph/json2D\\_JSXGraph](https://github.com/jsxgraph/json2D_JSXGraph)