

# Game Population Analysis

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# TABLE OF CONTENTS

- What's the game about?
- Concept
- Setup
- Data acquisition & transformation
- Data visualisation & interaction
- Realisation

# PATH OF EXILE



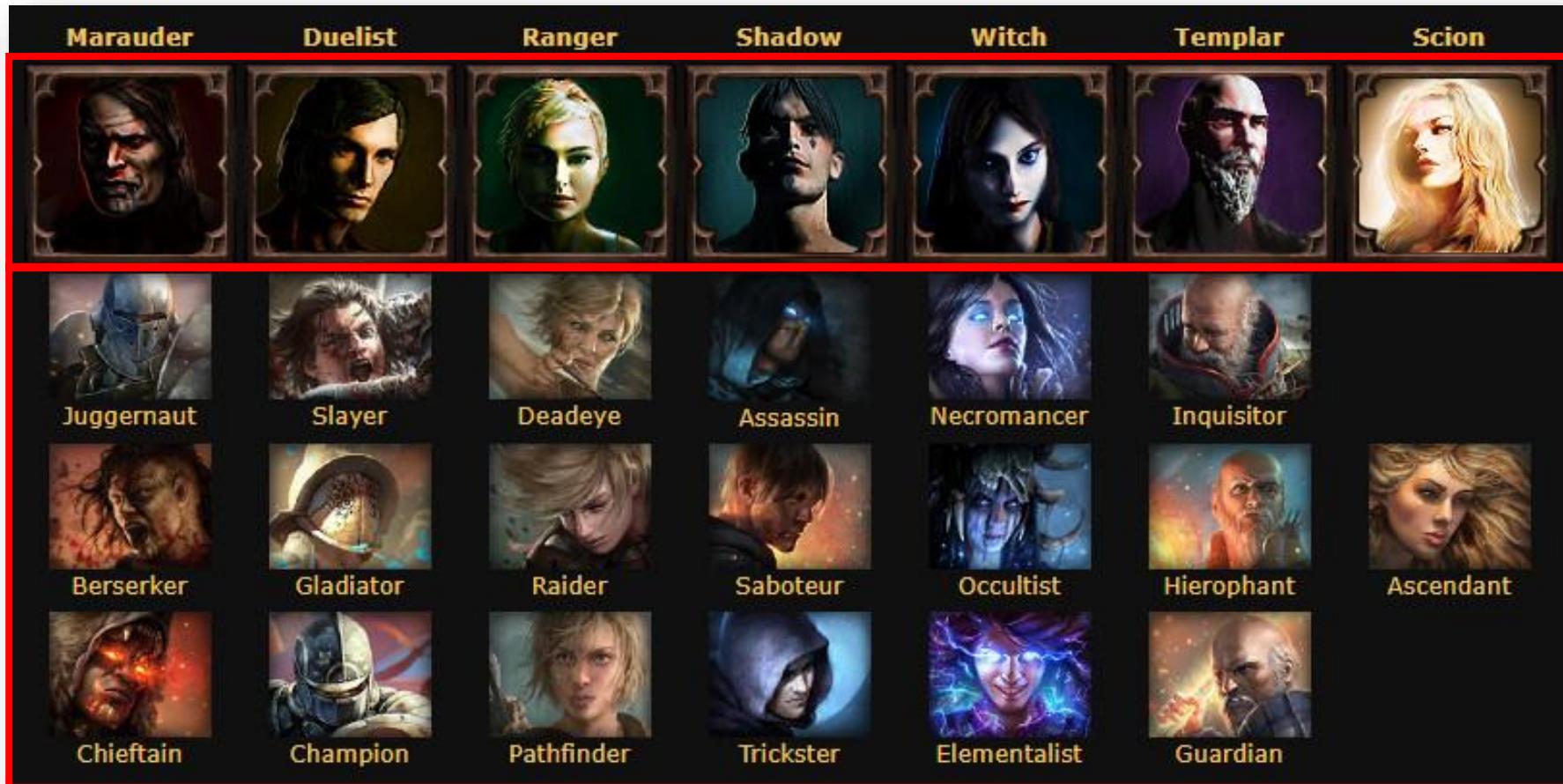
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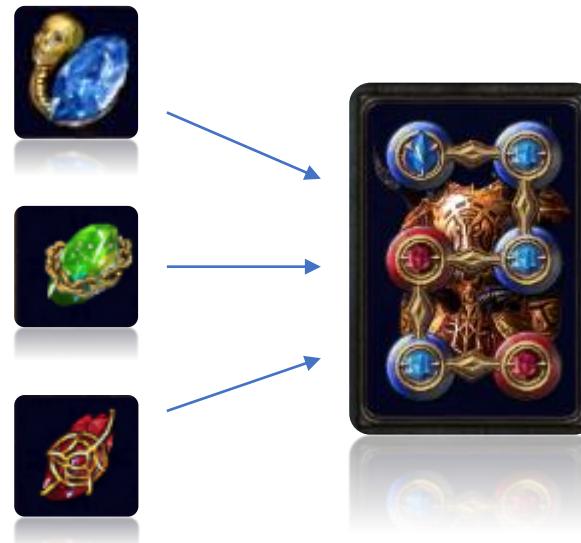
# PATH OF EXILE

skillTree

# PATH OF EXILE



# PATH OF EXILE

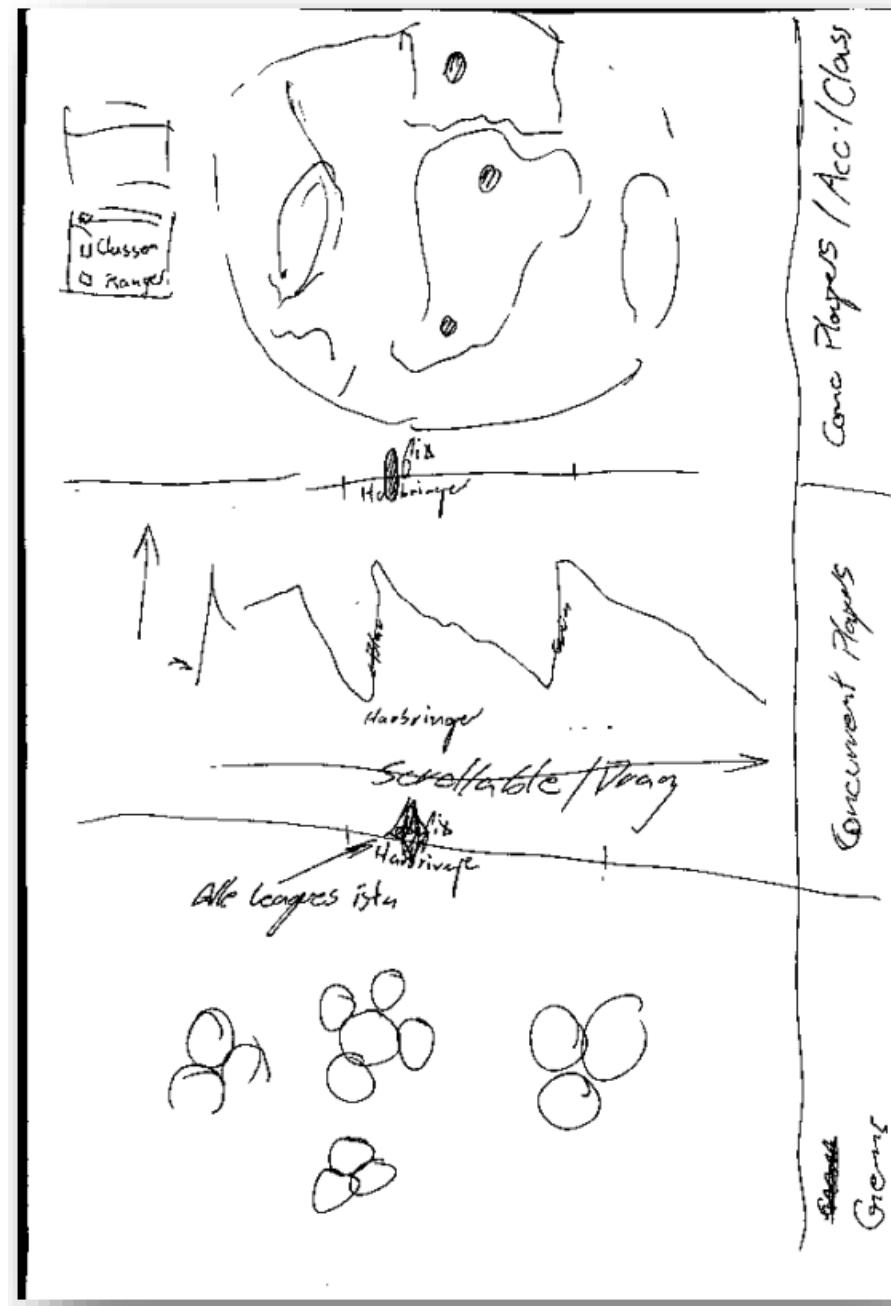


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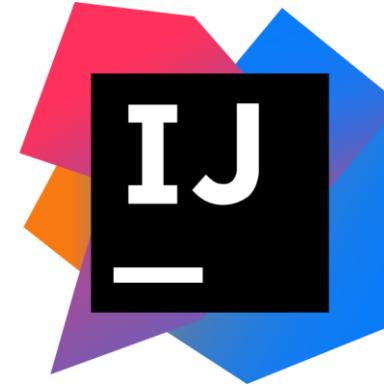


Expansion	release date	end date	release version
Metamorph league	2019-12-13		3.9.0
Blight league	2019-09-06	2019-12-09 9:00:00 PM	3.8.0
Legion league	2019-06-07	2019-09-03	3.7.0
Synthesis league	2019-03-08	2019-06-03 10:00:00 PM	3.6.0
Betrayal league	2018-12-07	2019-03-04 9:00:00 PM	3.5.0
Delve league	2018-08-31	2018-12-03 9:00:00 PM	3.4.0
Incursion league	2018-06-01	2018-08-27 10:00:00 PM	3.3.0
Bestiary league	2018-03-02 8:00:00 PM	2018-05-28 10:00:00 PM	3.2.0
Abyss league	2017-12-08 8:00:00 PM	2018-02-26 9:00:00 PM	3.1.0
Harbinger league	2017-08-04 8:00:00 PM	2017-12-04 9:00:00 PM	3.0.0
Legacy league	2017-03-03	2017-07-31 10:00:00 PM	2.6.0
Breach league	2016-12-02 8:00:00 PM	2017-02-27 9:00:00 PM	2.5.0
Essence league	2016-09-02	2016-11-28	2.4.0
Prophecy league	2016-06-03	2016-08-29	2.3.0
Perandus league	2016-03-04	2016-05-30	2.2.0

# CONCEPT



# SETUP



 **jQuery**  
*write less, do more.*

# DATA ACQUISITION

The image shows two screenshots of the poe.ninja website, a tool for Path of Exile players to track item prices and market trends.

**Left Screenshot:** The homepage features a sidebar with categories like Currency, Fragments, Watchstones, Oils, Incubators, Scarabs, Fossils, Resonators, Essences, Divination Cards, Prophecies, Skill Gems, Base Types, and Helmet Enchants. The main content area includes a "Welcome to poe.ninja!" message, a section about the game's currency system, and a "Live Updating Overviews" section with several line graphs showing price fluctuations for various items over time. Below this is a "Select your league to jump right in" section with buttons for Metamorph, HC Metamorph, Standard, and Hardcore.

**Right Screenshot:** This screenshot shows a detailed market analysis page for the "Metamorph" league. It has a sidebar with the same categories as the homepage. The main content is a table comparing "Buy" and "Sell" prices for various items over the last 7 days. The table includes columns for the item name, a "Last 7 days" percentage change, the current "Pay" price, and the "Get" quantity. A "Pick trade" dropdown menu is visible at the top right. The table lists items such as Mirror of Kalandra, Mirror Shard, Hunter's Exalted Orb, Awakener's Orb, Warlord's Exalted Orb, Redeemer's Exalted Orb, Crusader's Exalted Orb, Exalted Orb, Ancient Orb, Blessing of Chayula, Prismatic Catalyst, Divine Orb, Fertile Catalyst, and Orb of Annulment.



poe.ninja

FAQ

Go to Economy

Metamorph



Search filters...

Name \_\_\_\_\_ Level 96 Depth 100 Depth Solo Ladder Exp

Show Passive Tree Heatmap

Items All

Watcher's Eye	53%
Shaper's Touch	25%
Bottled Faith	23%
Lethal Pride	23%
Rumi's Concoction	22%
Astramentis	19%
Efficient Training	18%
The Baron	17%
Atziri's Promise	16%
Cinderswallow Urn	15%
Blood of the Karui	15%
Headhunter	13%
Alberon's Warpath	13%
Geofri's Sanctuary	13%

**Main Skills (5+ links)**

Cyclone	15%
Raise Zombie	15%
Summon Skeletons	13%
Vaal Summon Skeletons	11%
Ice Nova	6%
Herald of Agony	5%

Name	Level	Life	ES	Depth	Solo	DPS	Skills / Keystones
Boo_Twitch_MVP	100	1967	300	40			
PAJAMA_Boomer...	100	4119	1794				
FivestarADDicT	100	3073	223				
zooADDicT	100	1242	10759	1			
sfgdsdfgsfgdsfg	100	1	202	26			
Xfactor_L	100	1	207	24			
morphZ_Aurablas...	100	1	8867				
morphZ_Neme	100	1756	7419				
IEEETEE	100	1637	7299				
평양면옥	100	1	345	23			
METAMORPHBITC...	100	5523	262				
전시준육천증못간찐	100	1	113	21			

LOG IN CREATE ACCOUNT CONTACT SUPPORT

UK BR BRAZIL RU DE FR ES KR

# PATH OF EXILE

## CONQUERORS OF THE ATLAS

PLAY FREE NOW!

PC XBOX ONE PS4

HOME GAME FORUM EVENTS TRADE SHOP

FORUM INDEX » RACE EVENTS AND LEAGUE LADDERS » VIEW THREAD

VIEW STAFF POSTS POST REPLY

### HARDCORE LADDER

**RULES**  
**Hardcore:** A character killed in Hardcore is moved to its parent league.

**LADDER**

Rank	Account	Character	Class	Level	Experience	Depth	Depth (Solo)
1	8 Zuki_CZ	Zuki_thisTime_Different	Scion	100	4250334444		
2	16 adrinatoren	AdrianDualWieldInc	Scion	100	4250334444		
3	MagicalPowers	Feanor_(Dead)	Trickster	100	4250334444		
4	16 FranzKafka	Rilkeisrikke	Marauder	100	4250334444		
5	xInfinite	exInfinite	Scion	100	4250334444		
6	18 Miroo	Mir_o	Scion	100	4250334444		
7	36 HoGji	HoGji_FrankerZ	Marauder	100	4250334444		
8	Steyox	SteyoNiceServerRip	Scion	100	4250334444		
9	18 Baker	SirBaker	Shadow	100	4250334444		

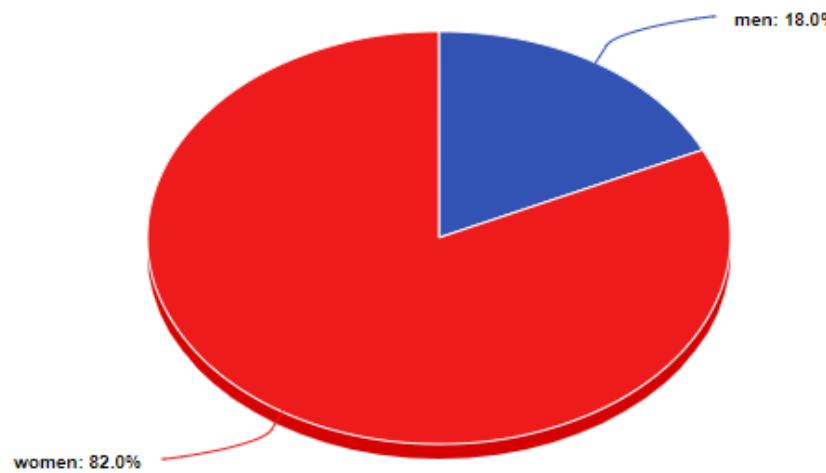
Class Filter: All Auto refresh:  REFRESH EXPORT CSV

# DATA AQUISITION



# DATA AQUISITION

- Do it yourself! Mockaroo
- Genders and skills were random but clearly off
- Mockaroo limitations



# Mockaroo

- Easy to use
- Intuitive
- Own scripting language support



Need some mock data to test your app? Mockaroo lets you generate up to 1,000 rows of realistic data for your application. Download data using your browser or sign in and create your own [Mock APIs](#). Need more data? [Plans start at just \\$50/year](#). Mockaroo is also available as a [docker image](#).

Field Name	Type
id	Row Number
playername	Username
class	Custom List
email	Email Address
gender	Gender
level	Number
country	Country Code

[Add another field](#)

# FIRST DRAFT OF DATASET

Gender	Class	Playername	Level
Female	scion	jatwell0	20
Female	scion	scarnson	44
Female	other	El Salvador	100
Female	scion	tschippindale3	89
Female	scion	pheerong9	55
Female	other	gradeyc	58
Female	other	hrowlsone	39

# FIXED DATASET

Gender	Class	Playername	Level
Female	Scion	jatwell0	20
Male	Guardian	scarnson	44
Female	Champion	El Salvador	100
Male	Champion	tschippindale3	89
Male	Scion	pheerong9	55
Female	Guardian	gradeyc	58
Female	Assassin	hrowlsone	39

# Data aquisition - problems

- Not real world data
- Dependant on «intuition»
- Has to seem realistic and plausible

# Data aquisition - solutions

- Base around real world cases (e.g. genders)
- Using real data wherever possible (skill lists)
- Randomize with a strategy behind it

# Getting the skills

- Python  
«BeautifulSoup»
- Taking data from the HTML
- Verifying skills

List									
A list of active skill gems is displayed below.									
Skill gem	+	+	+	+	+	+	+	+	+
Animate Weapon	N/A	✓	4						
Arctic Armour	N/A	✓	16						
Artillery Ballista	N/A	N/A	28						
Barrage	N/A	N/A	12						
Bear Trap	N/A	N/A	4						
Blade Flurry	N/A	✓	28						
Blade Vortex	N/A	N/A	12						
Bladefall	N/A	N/A	28						
Blast Rain	N/A	N/A	28						
Blink Arrow	N/A	N/A	10						
Blood Rage	N/A	N/A	16						
Burning Arrow	N/A	N/A	1						
Caustic Arrow	N/A	N/A	1						
Charged Dash	N/A	N/A	28						
Cobra Lash	N/A	✓	1						
Cremation	N/A	✓	28						
Cyclone	N/A	✓	28						
Dash	N/A	N/A	4						
Desecrate	N/A	✓	16						
Detonate Dead	N/A	✓	4						
Double Strike	N/A	N/A	1						
Dual Strike	✓	N/A	1						
Elemental Hit	N/A	N/A	12						
Ensnares Arrow	N/A	N/A	16						
Ethereal Knives	N/A	✓	1						
Explosive Arrow	N/A	N/A	28						
Explosive Trap	N/A	✓	1						
Fire Trap	N/A	✓	12						
Flamethrower Trap	N/A	✓	28						
Flicker Strike	N/A	N/A	10						
Frenzy	N/A	N/A	16						
Frost Blades	N/A	N/A	1						
Abyssal Cry	N/A	N/A	34						
Ancestral Protector	N/A	N/A	4						
Ancestral Warchief	N/A	N/A	28						
Anger	N/A	✓	24						
Animate Guardian	N/A	✓	28						
Berserk	N/A	N/A	34						
Bladestorm	✓	N/A	28						
Bitter Anger	N/A	✓	24						
Blood and Sand	✓	N/A	4						
Chain Hook	N/A	N/A	12						
Cleave	✓	N/A	1						
Consecrated Path	N/A	✓	28						
Decoy Totem	N/A	N/A	4						
Determination	N/A	N/A	24						
Devouring Totem	N/A	N/A	4						
Dominating Blow	N/A	✓	28						
Dread Banner	N/A	N/A	24						
Earthquake	N/A	N/A	28						
Enduring Cry	N/A	N/A	16						
Flesh and Stone	✓	N/A	16						
Glacial Hammer	N/A	N/A	1						
Ground Slam	N/A	N/A	1						
Heavy Strike	N/A	N/A	1						
Herald of Ash	N/A	✓	16						
Herald of Purity	N/A	✓	16						
Holy Flame Totem	N/A	✓	4						
Ice Crash	N/A	✓	28						
Immortal Call	N/A	N/A	34						
Infernal Blow	N/A	N/A	12						
Leap Slam	N/A	N/A	10						
Molten Shell	N/A	N/A	4						
Molten Strike	N/A	N/A	1						
Perforate	✓	N/A	1						
Assassin's Mark	N/A	N/A	1						
Arc	N/A	N/A	12						
Arctic Breath	N/A	✓	12						
Armageddon Brand	✓	N/A	28						
Assassin's Mark	N/A	✓	24						
Ball Lightning	N/A	N/A	28						
Bane	N/A	N/A	24						
Blight	N/A	N/A	1						
Bodyswap	N/A	✓	10						
Bone Offering	N/A	N/A	12						
Brand Recall	✓	N/A	16						
Clarity	N/A	N/A	10						
Cold Snap	N/A	✓	16						
Conductivity	N/A	N/A	24						
Contagion	N/A	✓	4						
Conversion Trap	N/A	✓	4						
Convocation	N/A	N/A	24						
Dark Pact	N/A	N/A	28						
Despair	N/A	N/A	24						
Discharge	N/A	N/A	28						
Discipline	N/A	N/A	24						
Divine Ire	✓	N/A	28						
Elemental Weakness	N/A	N/A	24						
Feeble	N/A	N/A	24						
Essence Drain	N/A	✓	12						
Fireball	N/A	N/A	1						
Firestorm	N/A	N/A	12						
Flame Dash	N/A	N/A	10						
Flame Surge	N/A	N/A	12						
Flameblast	N/A	N/A	28						
Flammability	✓	N/A	24						
Flesh Offering	N/A	N/A	12						
Freezing Pulse	N/A	N/A	1						

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>   </td>
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>   <td data-sort-value="24" class="tc -value">24
>   </td>

```

# DATA TRANSFORMATION

## Python

- Pandas
- Genders
- Skills
- Character Classes

Gem types												
Active Skills												
<i>Main page: Active skill gems</i>												
Active skills have requirements based on each of the three main attributes, and can be easily identified by the attribute colour.												
Skill gem	+ (Red)	(Blue)	(Green)	(Yellow)	Skill gem	+ (Red)	(Blue)	(Green)	Skill gem			
Animate Weapon	N/A	✓	4		Abyssal Cry	N/A	N/A	34	Arc	N/A	N/A	12
Arctic Armour	N/A	✓	16		Ancestral Protector	N/A	N/A	4	Arctic Breath	N/A	✓	12
Artillery Ballista	N/A	N/A	28		Ancestral Warchief	N/A	N/A	28	Armageddon Brand	✓	N/A	28
Barrage	N/A	N/A	12		Anger	N/A	✓	24	Assassin's Mark	N/A	✓	24
Bear Trap	N/A	N/A	4		Animate Guardian	N/A	✓	28	Ball Lightning	N/A	N/A	28
Blade Flurry	N/A	✓	28		Berserk	N/A	N/A	34	Bane	N/A	N/A	24
Blade Vortex	N/A	N/A	12		Bladestorm	✓	N/A	28	Blight	N/A	N/A	1
Bladefall	N/A	N/A	28		Blood and Sand	✓	N/A	4	Bodyswap	N/A	✓	10
Blast Rain	N/A	N/A	28		Chain Hook	N/A	N/A	12	Bone Offering	N/A	N/A	12
Blink Arrow	N/A	N/A	10		Cleave	✓	N/A	1	Brand Recall	✓	N/A	16
Blood Rage	N/A	N/A	16		Consecrated Path	N/A	✓	28	Clarity	N/A	N/A	10
Burning Arrow	N/A	N/A	1		Decoy Totem	N/A	N/A	4	Cold Snap	N/A	✓	16
Caustic Arrow	N/A	N/A	1		Determination	N/A	N/A	24	Conductivity	N/A	N/A	24
Charged Dash	N/A	N/A	28		Devouring Totem							
Cobra Lash	N/A	✓	1		Dominating Blow							
Cremation	N/A	✓	28		Dread Banner							
Cyclone	✓	N/A	28		Earthquake							
Dash	N/A	N/A	4		Enduring Cry							
Desecrate	N/A	✓	16		Flesh and Stone							
Detonate Dead	N/A	✓	4		Glacial Hammer							
Double Strike	N/A	N/A	1		Ground Slam							
Dual Strike	✓	N/A	1		Heavy Strike							
Elemental Hit	N/A	N/A	12		Herald of Ash							
Ensnaring Arrow	N/A	N/A	16		Herald of Purity							
Ethereal Knives	N/A	✓	1		Holy Flame Totem							
Explosive Arrow	N/A	N/A	28		Ice Crash							

Gem types

Active Skills

Main page: Active skill gems

Active skills have requirements based on each of the three main attributes, and can be easily identified by the attribute colour.

A list of active skill gems excluding vaal skills is displayed below.

Marauder	Duelist	Ranger	Shadow	Witch	Templar	Scion

# Data transformation

- Skills and Class list are separate .csv files
- combining both
- Adding «on click» features
- Redrawing scenes

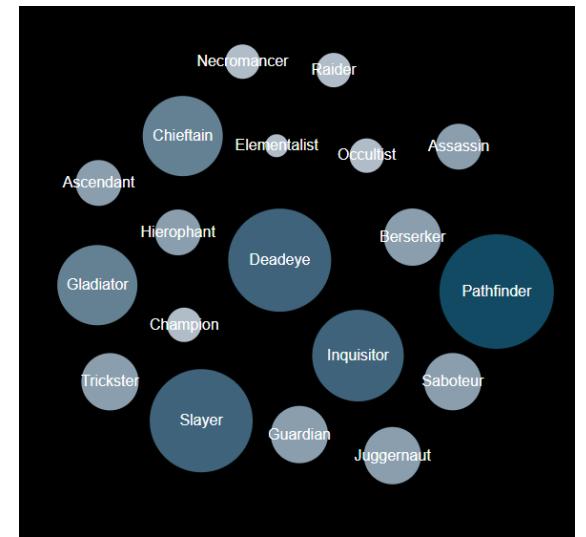
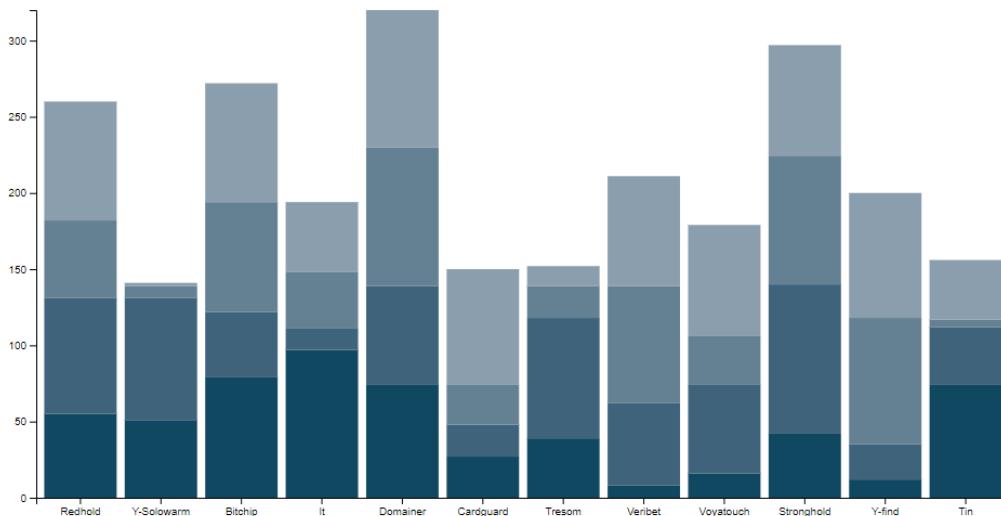
# Implementation conflicts

- Different d3js versions used
  - Resulting compatibility issues
- Solution: RequireJS
  - Create dependencies
  - Launch scripts using their dependencies

```
require.config({
  paths: {
    d3: "https://d3js.org/d3.v5.min"
  }
});

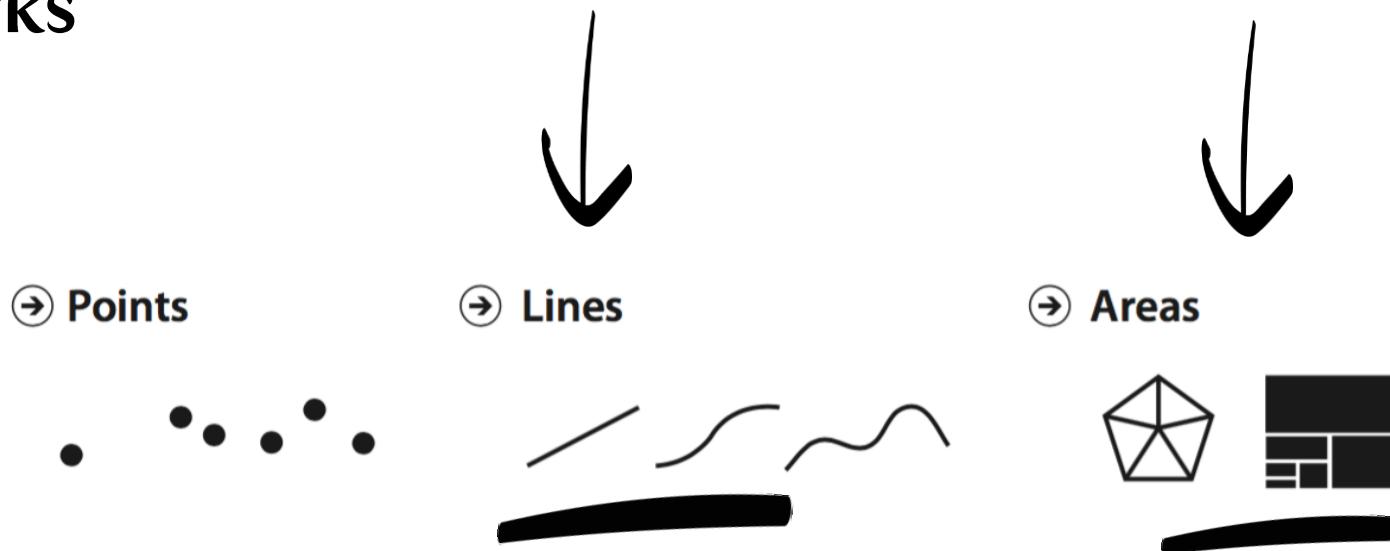
require(["d3"], function(d3) {
```

# VISUALIZATION & INTERACTION



# VISUALIZATION

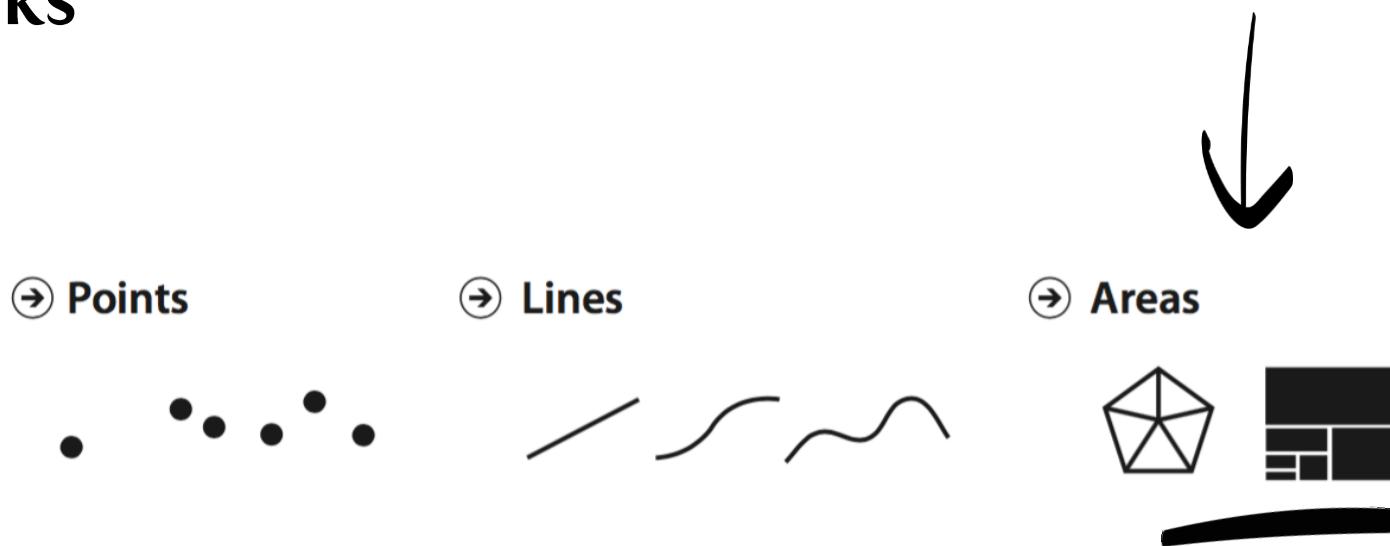
## Marks



**Figure 5.2.** Marks are geometric primitives.

# VISUALIZATION

## Marks



**Figure 5.2.** Marks are geometric primitives.

# VISUALIZATION

## Channels

Channels: Expressiveness Types and Effectiveness Ranks

④ **Magnitude Channels: Ordered Attributes**

Position on common scale



Position on unaligned scale



Length (1D size)



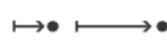
Tilt/angle



Area (2D size)



Depth (3D position)



Color luminance



Color saturation



Curvature



Volume (3D size)



④ **Identity Channels: Categorical Attributes**

Spatial region



Color hue



Motion



Shape



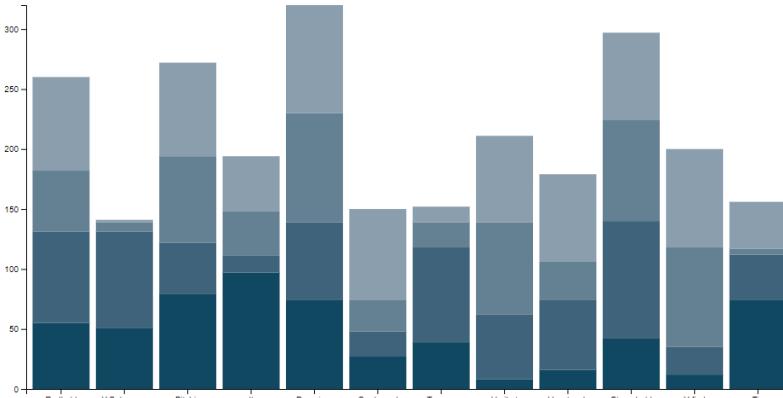
↑ Most Effectiveness  
↓ Least Effectiveness

[Same]

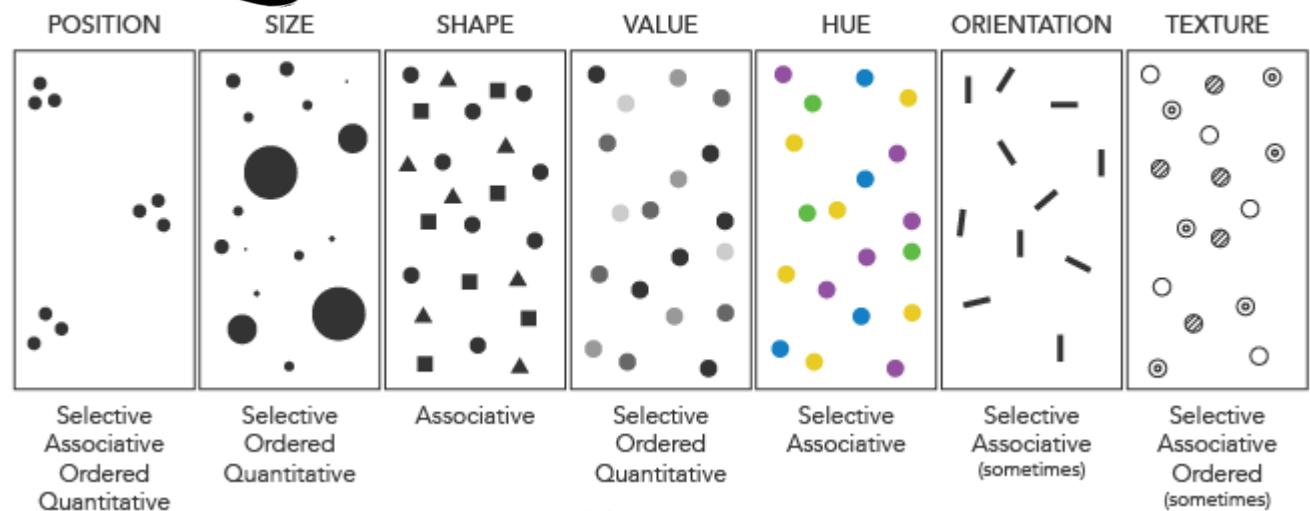


# VISUALIZATION

## Stacked-Bar-Chart



## Bertin's Visual Variables



# VISUALIZATION

## Globe Diagramm

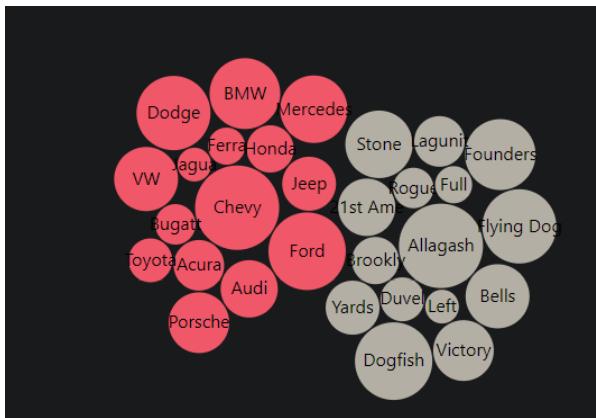


Bertin's Visual Variables

POSITION	SIZE	SHAPE	VALUE	HUE	ORIENTATION	TEXTURE
Selective Associative Ordered Quantitative	Selective Ordered Quantitative	Associative	Selective Ordered Quantitative	Selective Associative	Selective Associative (sometimes)	Selective Associative Ordered (sometimes)

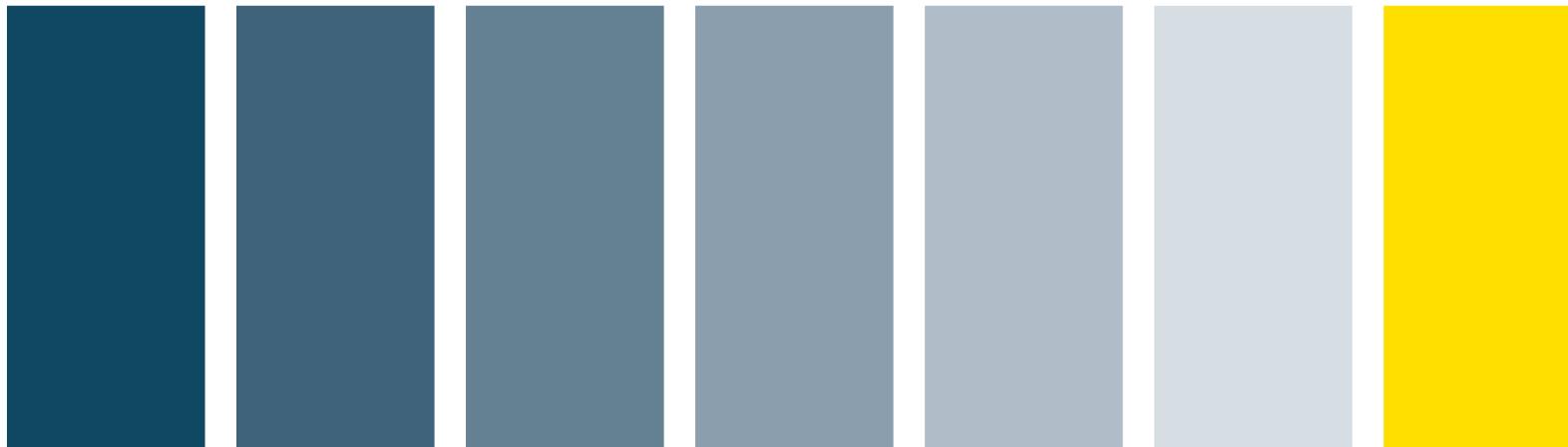
# VISUALIZATION

## Bubble Diagram



## Bertin's Visual Variables

POSITION	SIZE	SHAPE	VALUE	HUE	ORIENTATION	TEXTURE
Selective Associative Ordered Quantitative	Selective Ordered Quantitative	Associative	Selective Ordered Quantitative	Selective Associative	Selective Associative (sometimes)	Selective Associative Ordered (sometimes)



# Visualization Colors

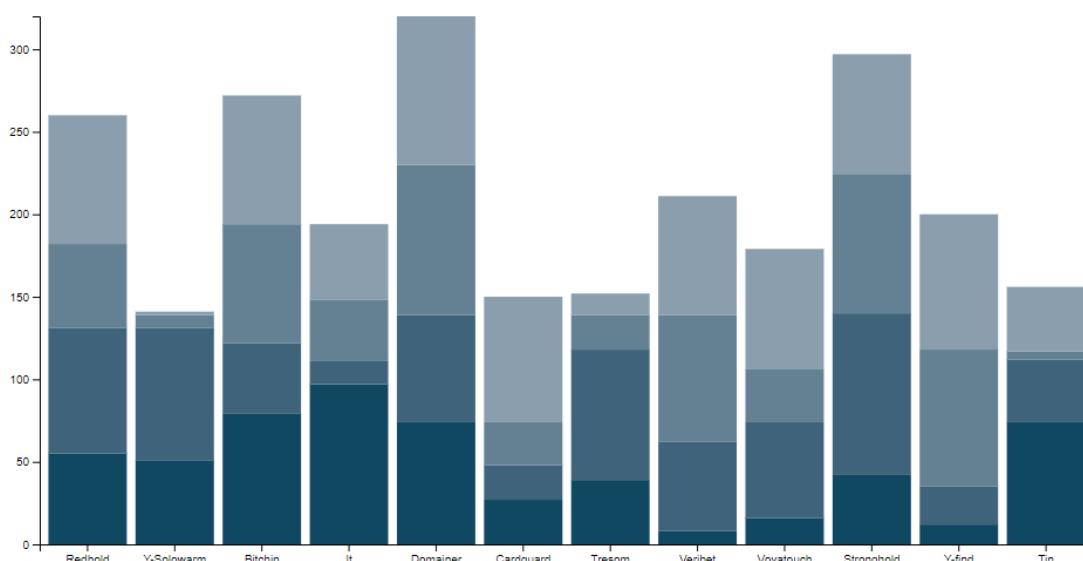
# INTERACTION

**Why do we need interaction?**

- to tell a story
- to get more information
- to understand the data

# INTERACTION

## Stacked-Bar-Chart



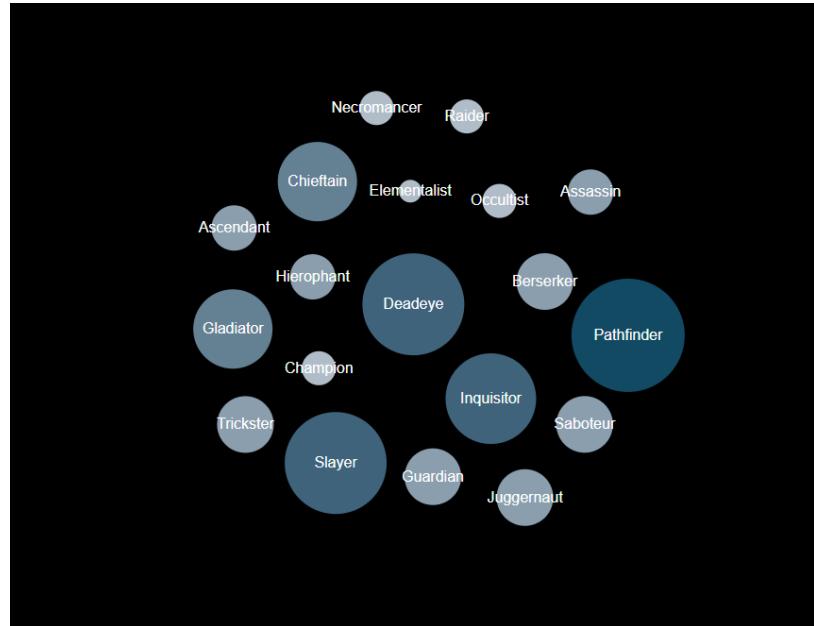
# INTERACTION

## Globe Diagramm

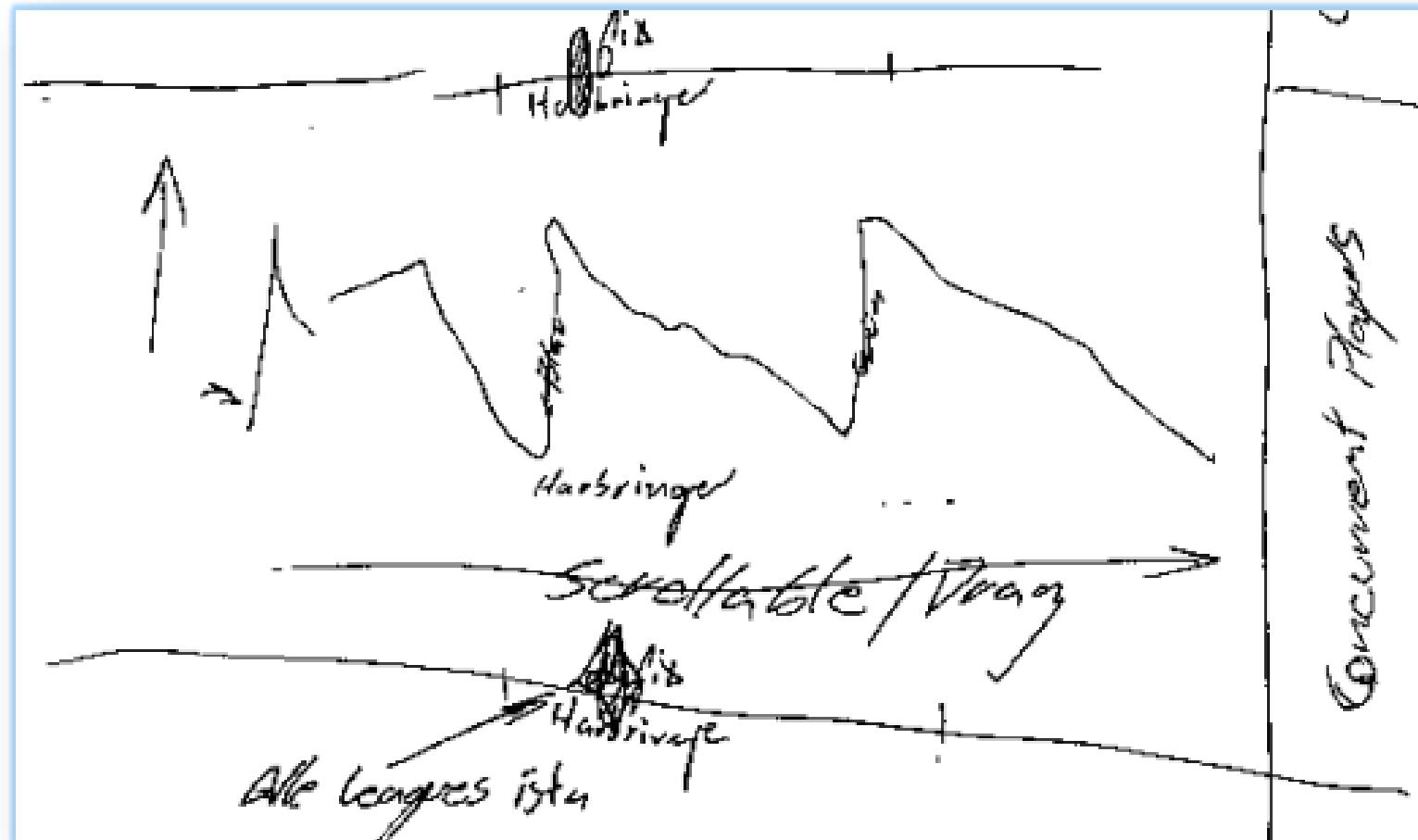


# INTERACTION

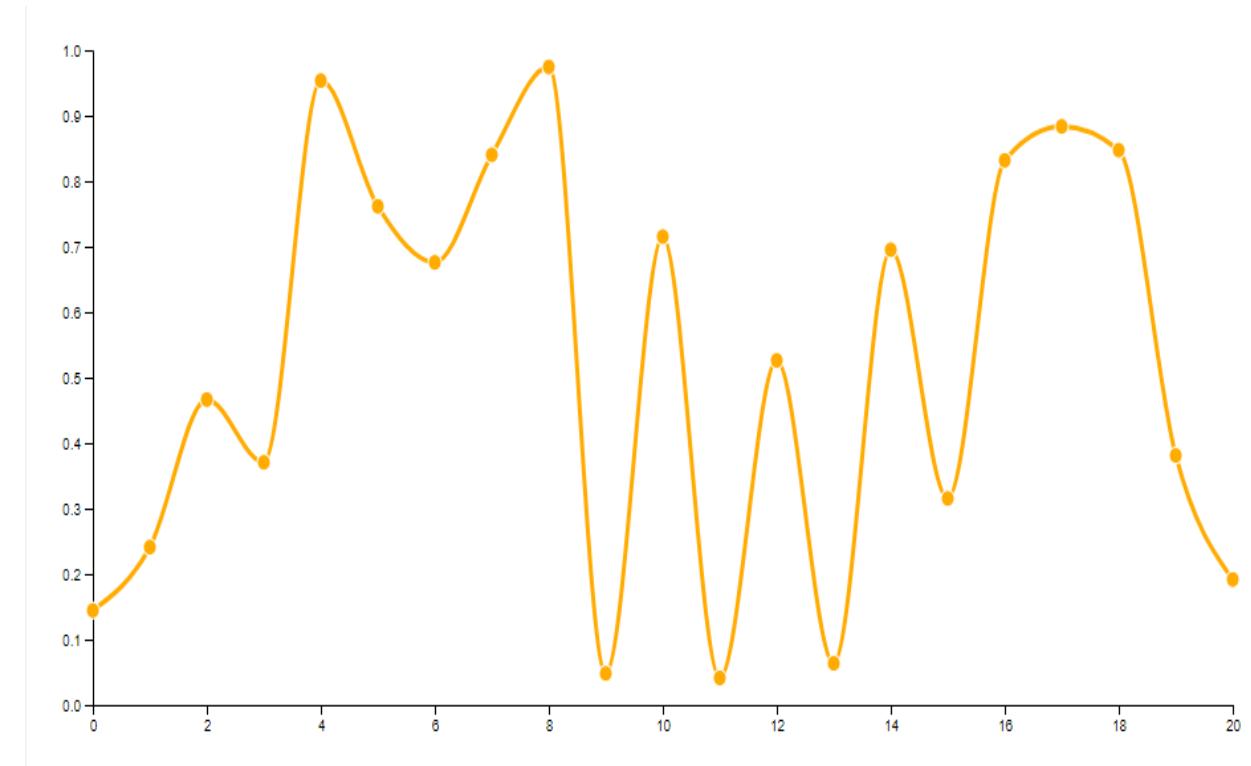
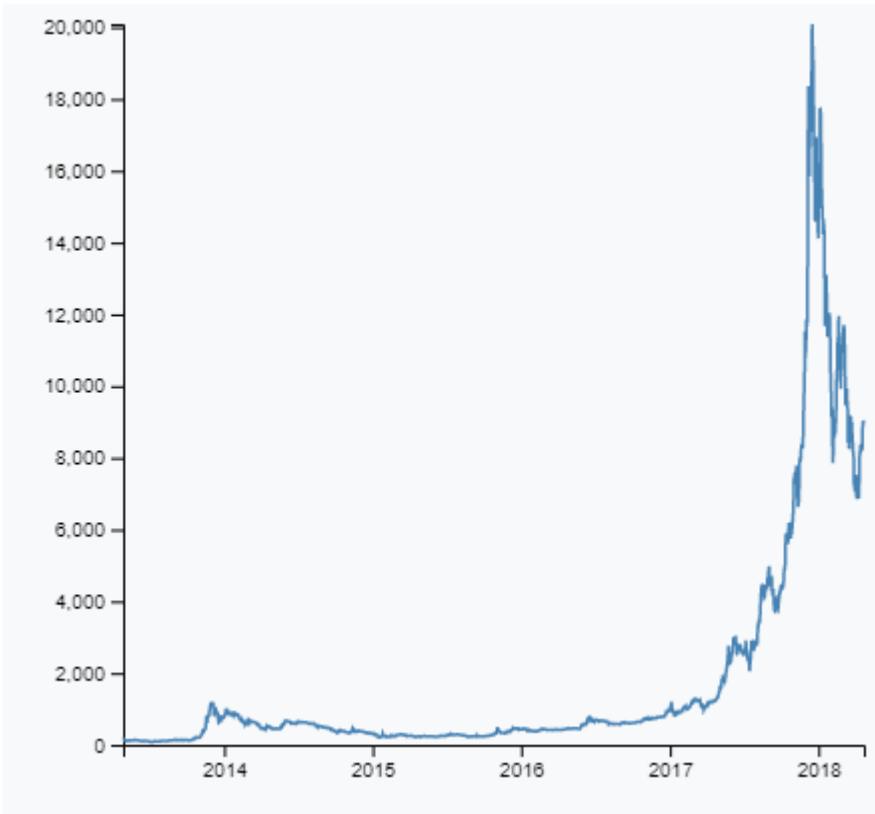
## Bubble Diagram



# STACKED-BAR-CHART

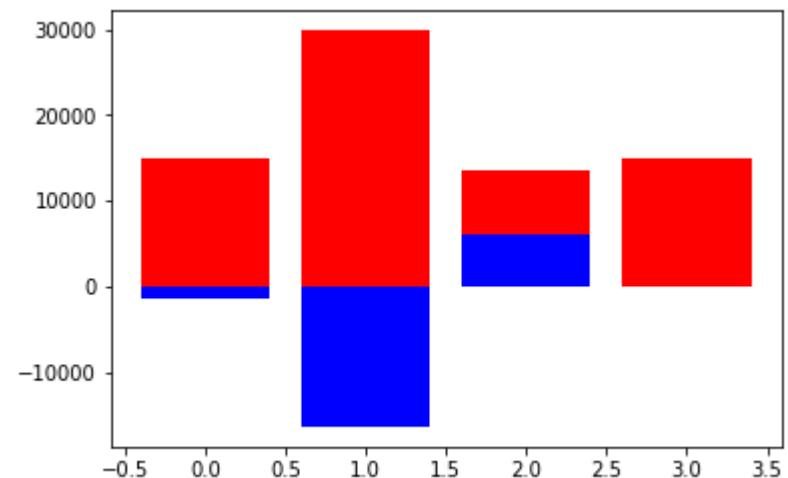
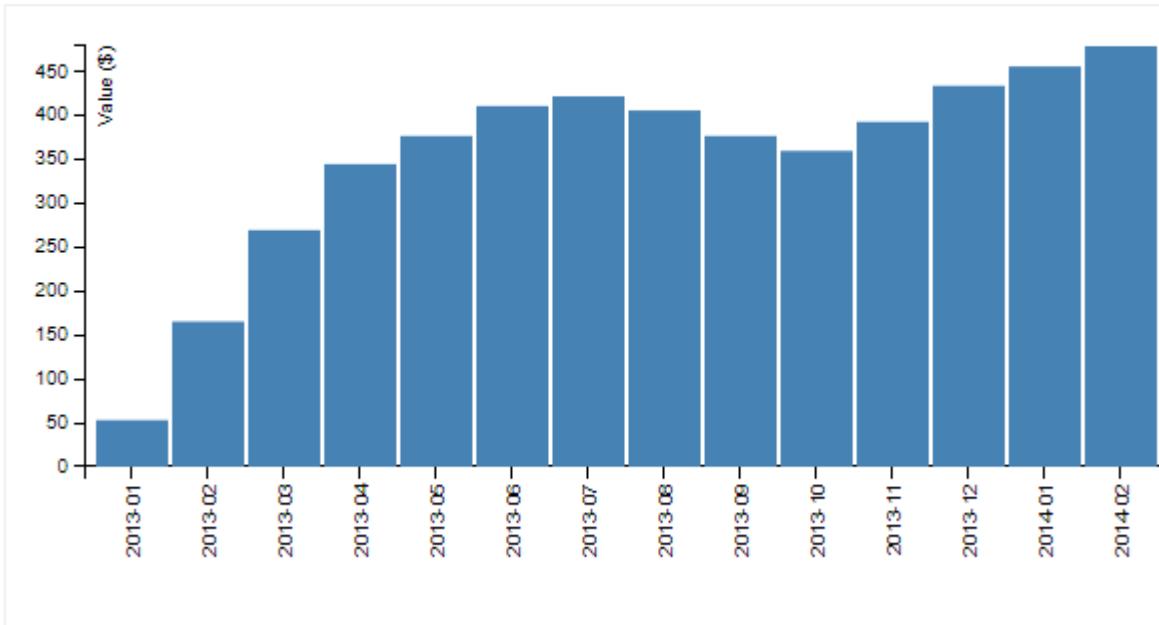


# STACKED-BAR-CHART



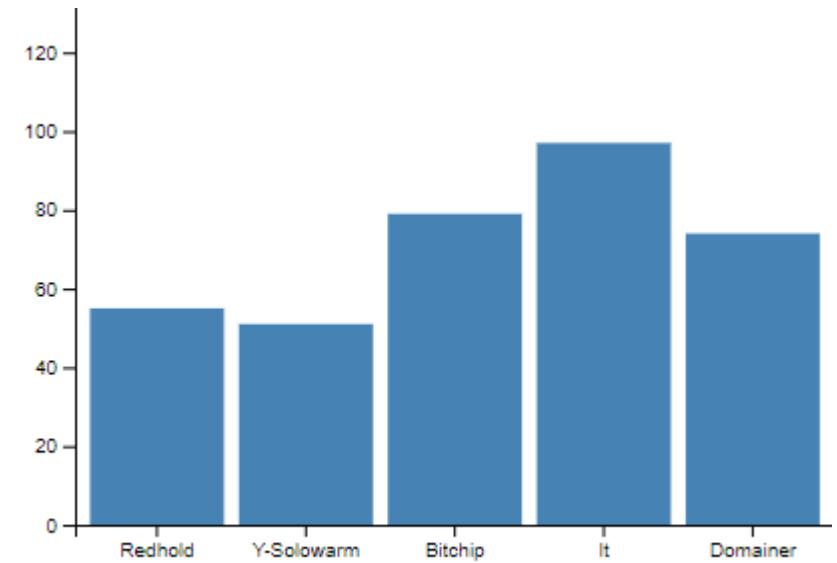
# STACKED-BAR-CHART

## Simple d3.js bar chart



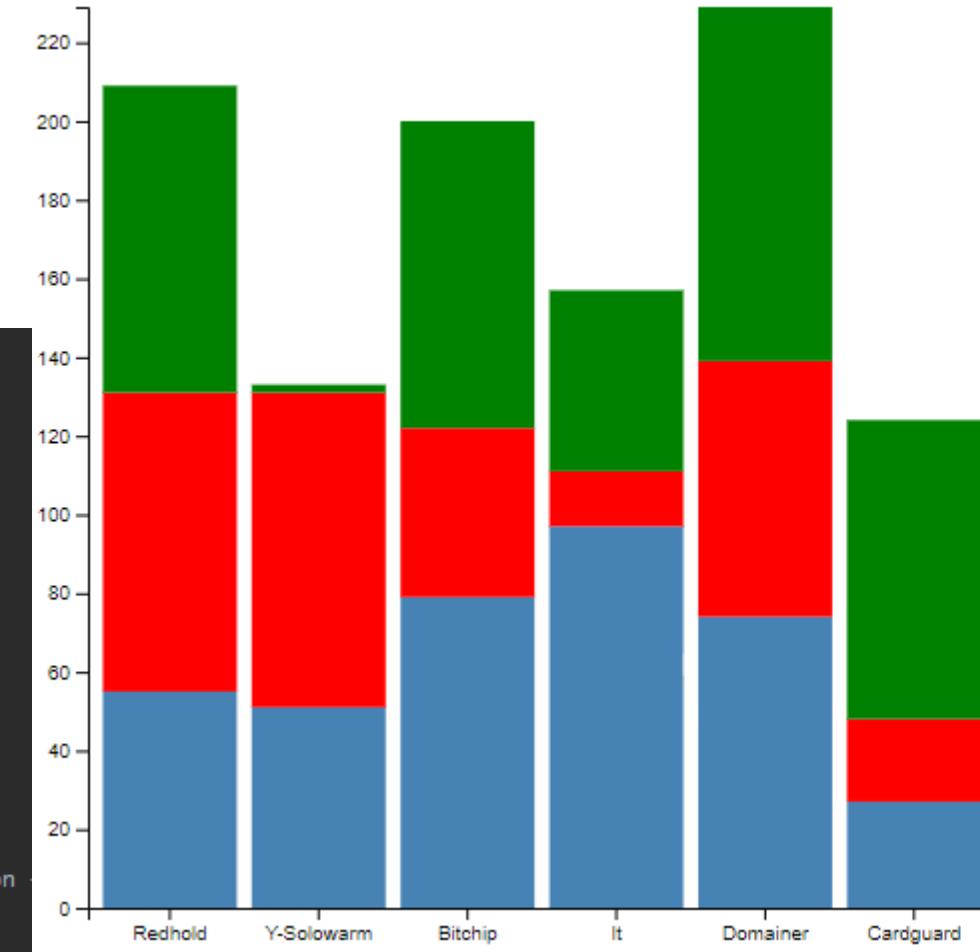
# STACKED-BAR-CHART

```
// append the rectangles for the bar chart
svg.selectAll(".bar")
  .data(data)
  .enter().append( name: "rect")
  .attr("class", "bar")
  .attr("x", function(d) { return x(d.league); })
  .attr("width", x.bandwidth())
  .attr("y", function(d) { return y(d.scion); })
  .attr("height", function(d) { return height - y(d.scion); })
  .on("mouseover", function() { tooltip.style("display", null); })
  .on("mouseout", function() { tooltip.style("display", "none"); })
  .on("mousemove", function(d){
    var xPosition = d3.mouse(this)[0] - 15;
    var yPosition = d3.mouse(this)[1] - 25;
    tooltip.attr("transform", "translate(" + xPosition + "," + yPosition + ")");
    tooltip.select("text").text(d.scion);
  });
});
```



# STACKED-BAR-CHART

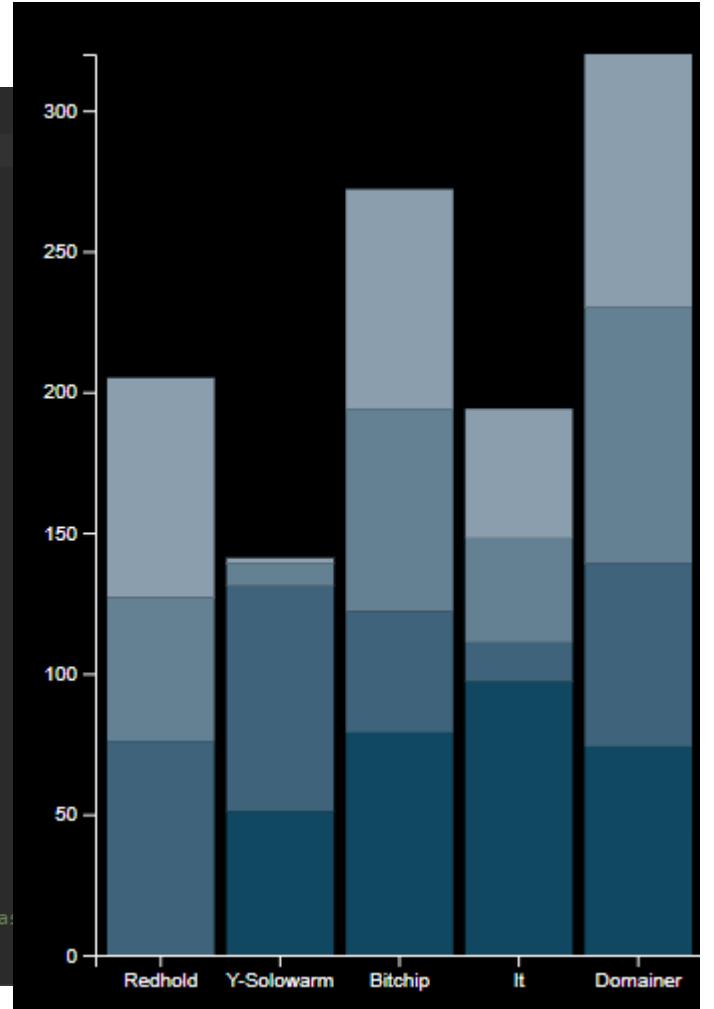
```
// append the rectangles for the bar chart
svg.selectAll(".bar")
  .data(data)
  .enter().append( name: "rect")
  .attr( svg.selectAll(".bar2")
    .attr( .data(data)
      .enter
        .attr( svg.selectAll(".bar3")
          .attr( .data(data)
            .enter().append( name: "rect")
              .attr("class", "bar3")
              .attr("x", function(d) { return x(d.league); })
              .attr("width", x.bandwidth())
              .attr("y", function(d) { return y(d.maurauder+d.scion+d.zombie); })
              .attr("height", function(d) { return height - y(d.zombie); })
              .on("mouseover", function() { tooltip.style("display", null); })
              .on("mouseout", function() { tooltip.style("display", "none"); })
              .on("mousemove", function(d){
                var xPosition = d3.mouse(this)[0] - 15;
                var yPosition = d3.mouse(this)[1] - 25;
                tooltip.attr("transform", "translate(" + xPosition + "," + yPosition
                  tooltip.select("text").text(d.zombie);
                });
  ));
```



# STACKED-BAR-CHART

```
// GENERATE THE BARS
for(i = 0; i< 4; i++){ //4 is the current number of leagues

    svg.selectAll(".bar"+i)
        .data(data)
        .enter().append( name: "rect")
        .attr("class", "bar"+i)
        .attr("x", function(d) {return x(d[Object.keys(d)[0]]); })
        .attr("width", x.bandwidth())
        .attr("y", function(d) {
            var obj = d[Object.keys(d)[1]]; //takes the second column value
            for(j = 0; j<i; j++){
                if (i > 0) {
                    obj = obj + d[Object.keys(d)[j+2]];
                }
            }
            return y(obj);
        })
        .attr("height", function(d) {return height - y(d[Object.keys(d)[i+1]]);})
        .attr("playerCount", i+1)
        .attr("lastColor", "")
        .attr("classSelected", "0")
        .attr("id", function(d) {
            //generate a unique id
            var e = d[Object.keys(d)[0]]+_+d[Object.keys(d)[d3.select(this).attr("playerCount")]]+_+d3.select(this).attr("class");
            return e;
        })
}
```



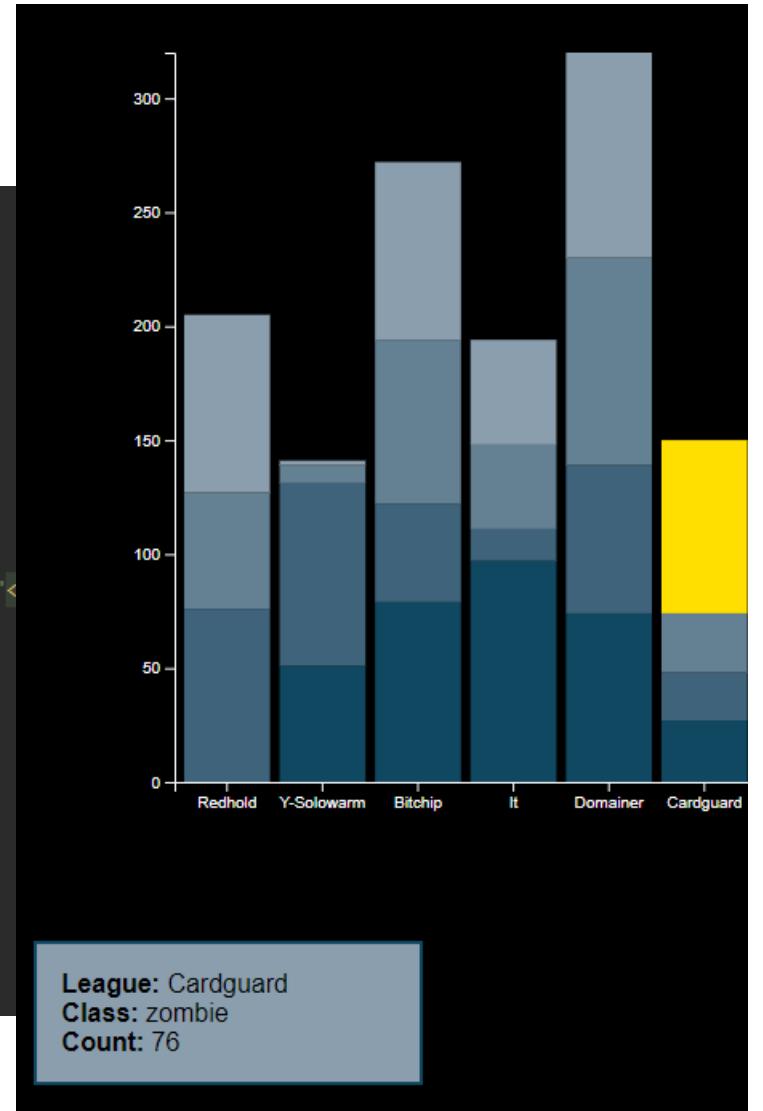
# STACKED-BAR-CHART

```
.on("click", function(d) {
  var playerCount = d3.select(this).attr("playerCount");
  //get the unique class of this bar
  var e = d[Object.keys(d)[0]]+_+d[Object.keys(d)[playerCount]]+_+d3.select(this).attr("class");

  if(d3.select(this).attr("classSelected") !== "1") {
    $("#" + e).css('fill', selectedColor);
    d3.select(this).attr("classSelected", "1");

    // CODE THAT DISPLAYS THE SPECIFIC VALUES OF SELECTED
    var infoDivID="infoDiv"+d3.select(this).attr("id");
    $('#selectedDiv').append( "<div id='"+infoDivID+" class='infoDiv'><strong>League: </strong>" +d[Object.keys(d)[0]]+_+
      "<strong>Class: </strong>" +d3.keys(data[0])[playerCount]+ "<br>" +
      "<strong>Count: </strong>" +d[Object.keys(d)[playerCount]]+_<br>" +
      "</div>" )
  }
  else {
    $("#" + e).css('fill', d3.select(this).attr("lastColor"));
    d3.select(this).attr("classSelected", "0");

    // CODE THAT RESETS THE SPECIFIC VALUES OF SELECTED
    var infoDivID="infoDiv"+d3.select(this).attr("id");
    $('#' + infoDivID).remove();
  }
})
```

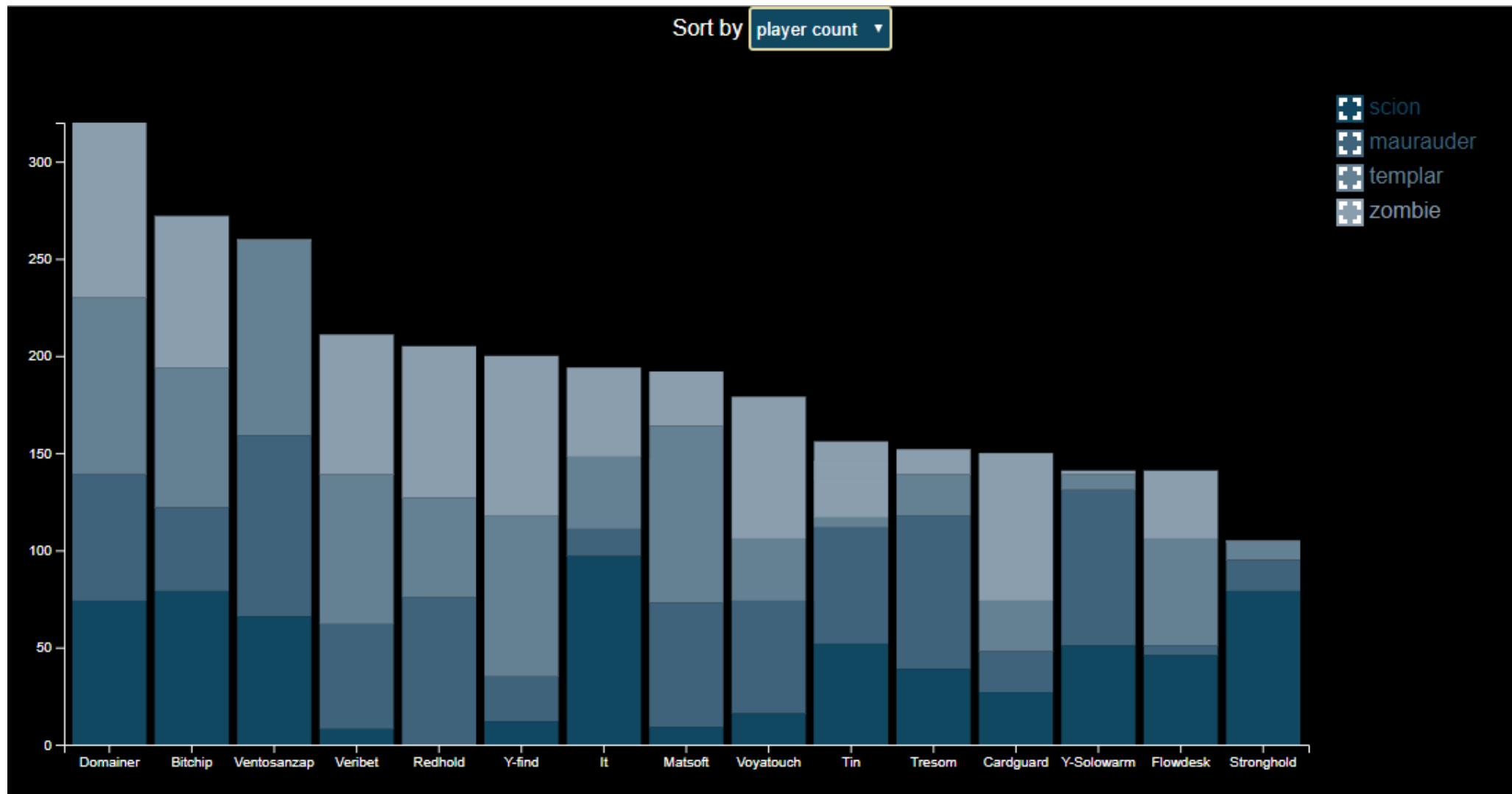


# STACKED-BAR-CHART

```
var size = 20;  
LegendSvg.selectAll("mydots")  
  .data(function(d){return classData})  
  .enter()  
  .append( name: "rect")  
  .attr("x", 0)  
  .attr("y", function(d,i){ return i*(size+5)})  
  .attr("width", size)  
  .attr("height", size)  
  .style("fill", function(d, i){ return colors[i]})  
  .style("outline", "dashed")  
  .style("outline-offset", "-5px");  
  
// Add one dot in the legend for each name.  
LegendSvg.selectAll("mylabels")  
  .data(d3.keys(data[0]))  
  .enter()  
  .append( name: "text")  
  .attr("x", size*1.2)  
  .attr("y", function(d,i){ return i*(size+5) + (size/2)})  
  .style("fill", function(d, i){ return colors[i]})  
  .text(function(d, i){ return d3.keys(data[0])[i+1] })  
  .attr("text-anchor", "left")  
  .style("alignment-baseline", "middle");
```



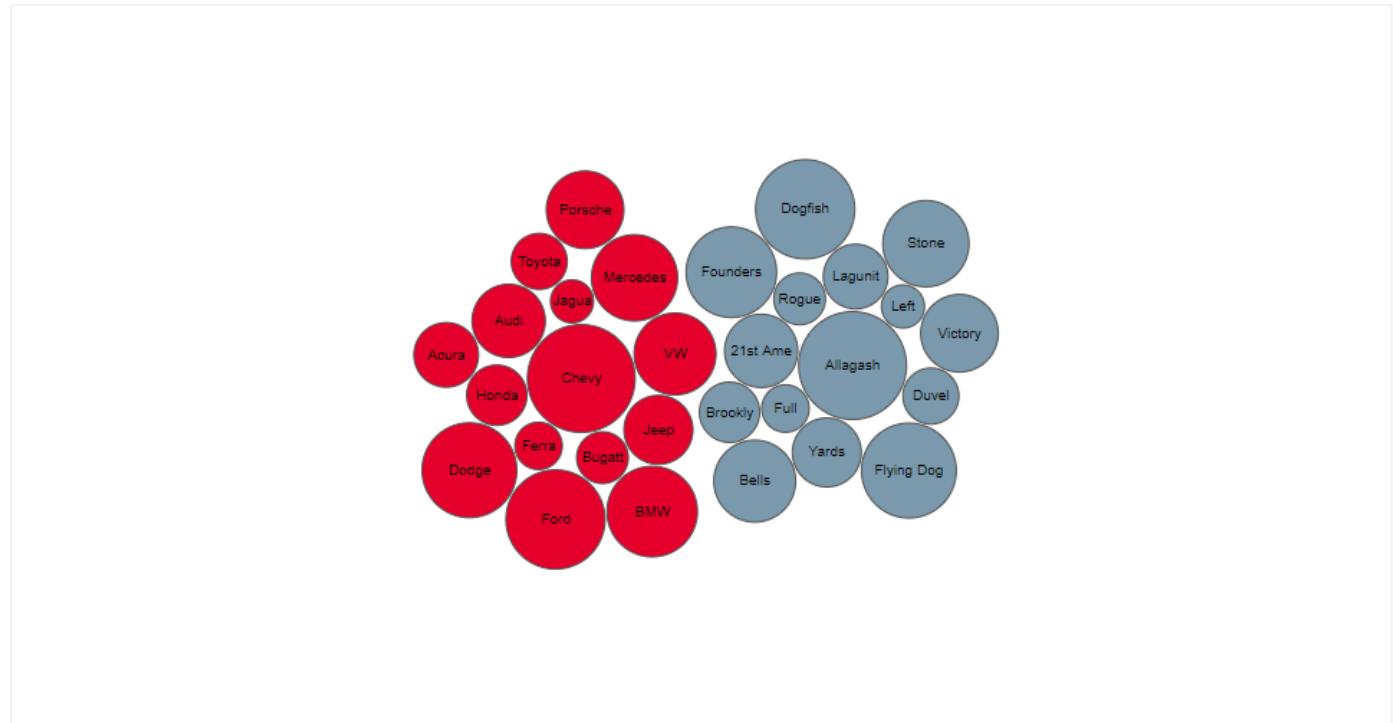
# STACKED-BAR-CHART



# Based on existing d3js library

- Only works with very specific dataset
- Not much interactivity
- Breaks with larger datasets, or more than a handful of clusters

Clustered Force Layout Bubble Chart



<https://bl.ocks.org/ctuft/f38ef0187f98c537d791d24fda4a6ef9>

# To make it work

- Represent cluster bubble size with class popularity
- Show all clusters as single bubbles, at first
- On «click» on a cluster node, sub-nodes

# To make it work

- Resulting issues: node physics, collision breaks
- Too many individual rows of datasets results in too many clusters and nodes

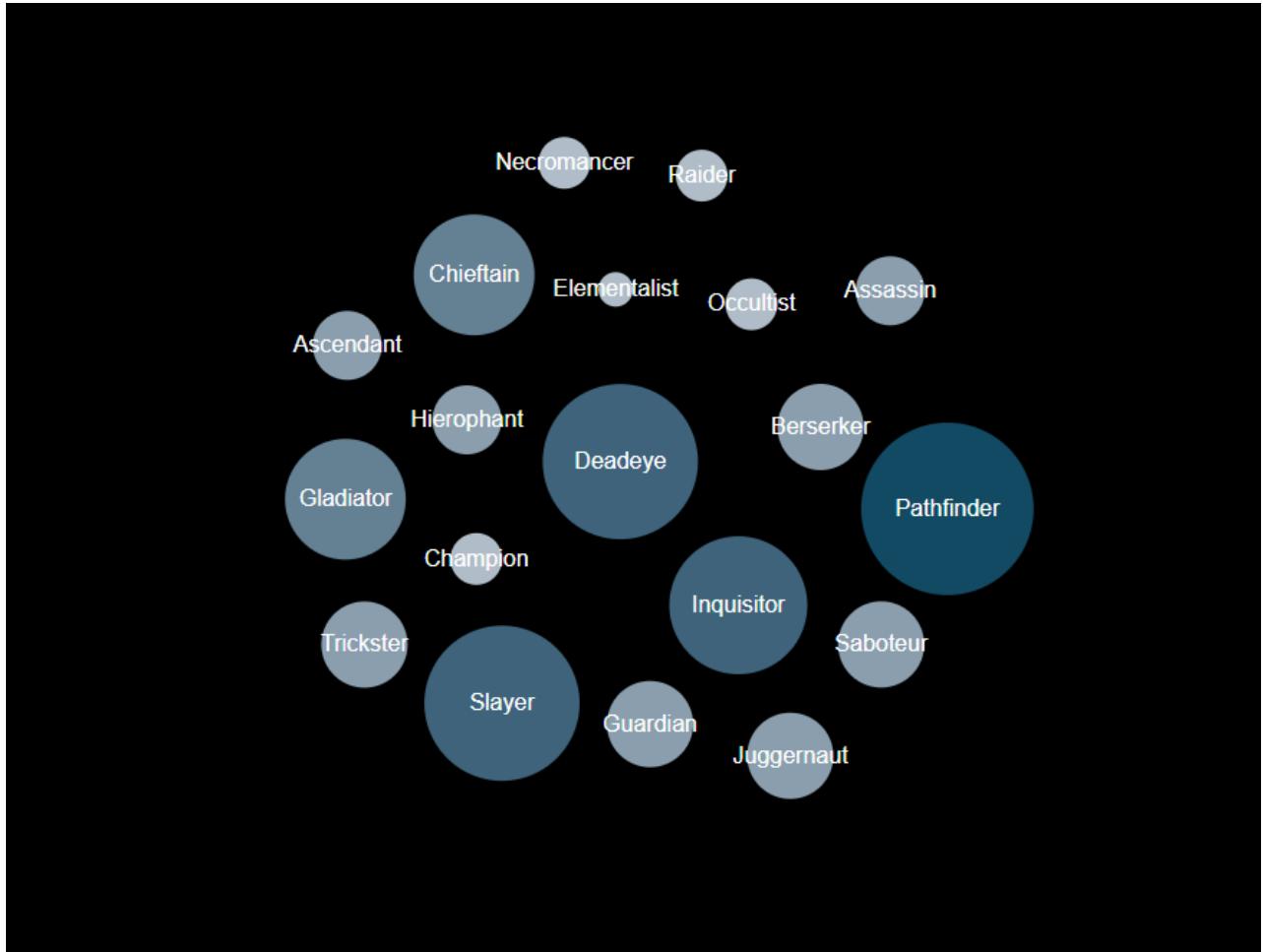
# Bubble-Chart - old version

- Different colors
- Not able to drag clusters around



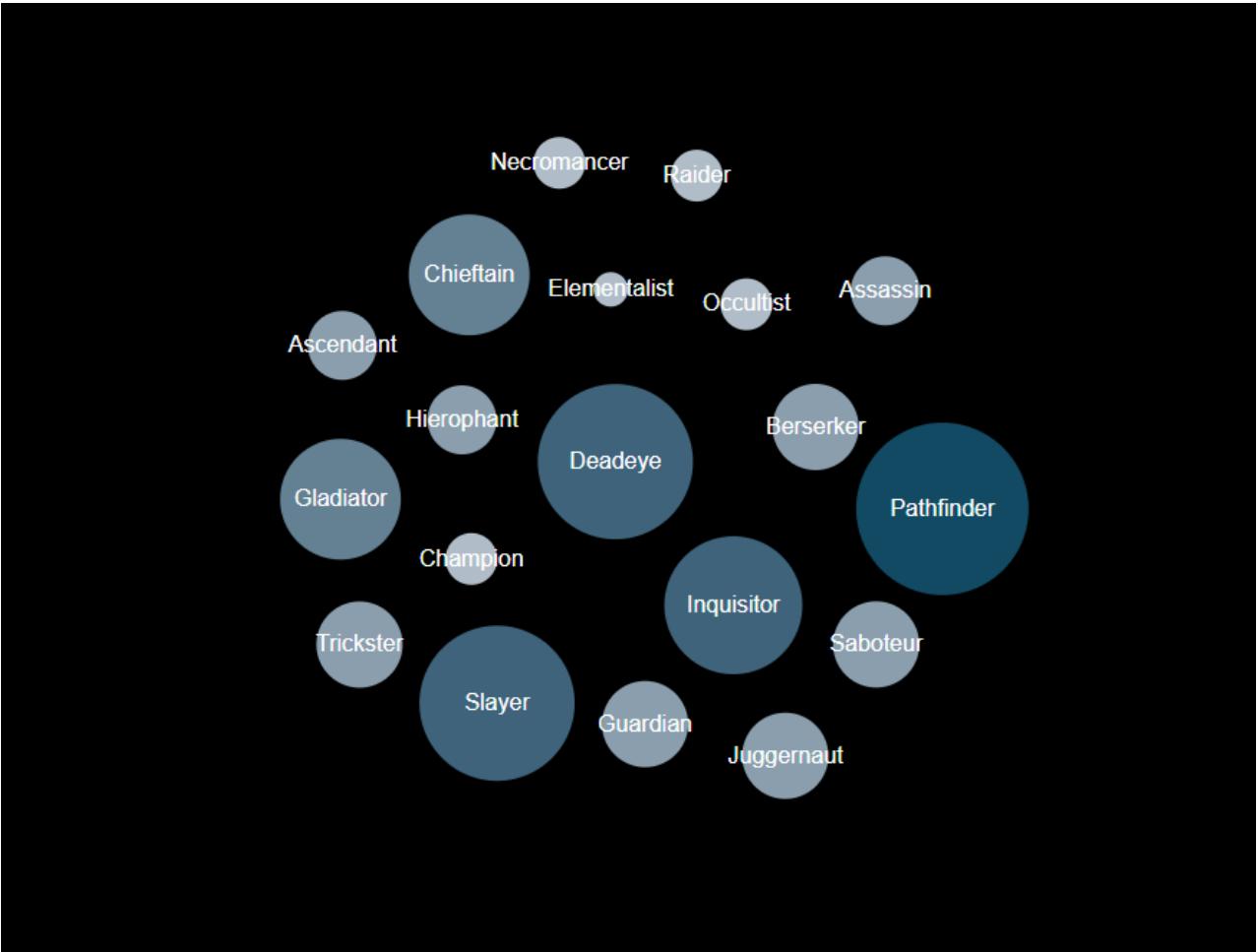
# Bubble-Chart

- Based on existing code
- Added and changed features
- Interactivity



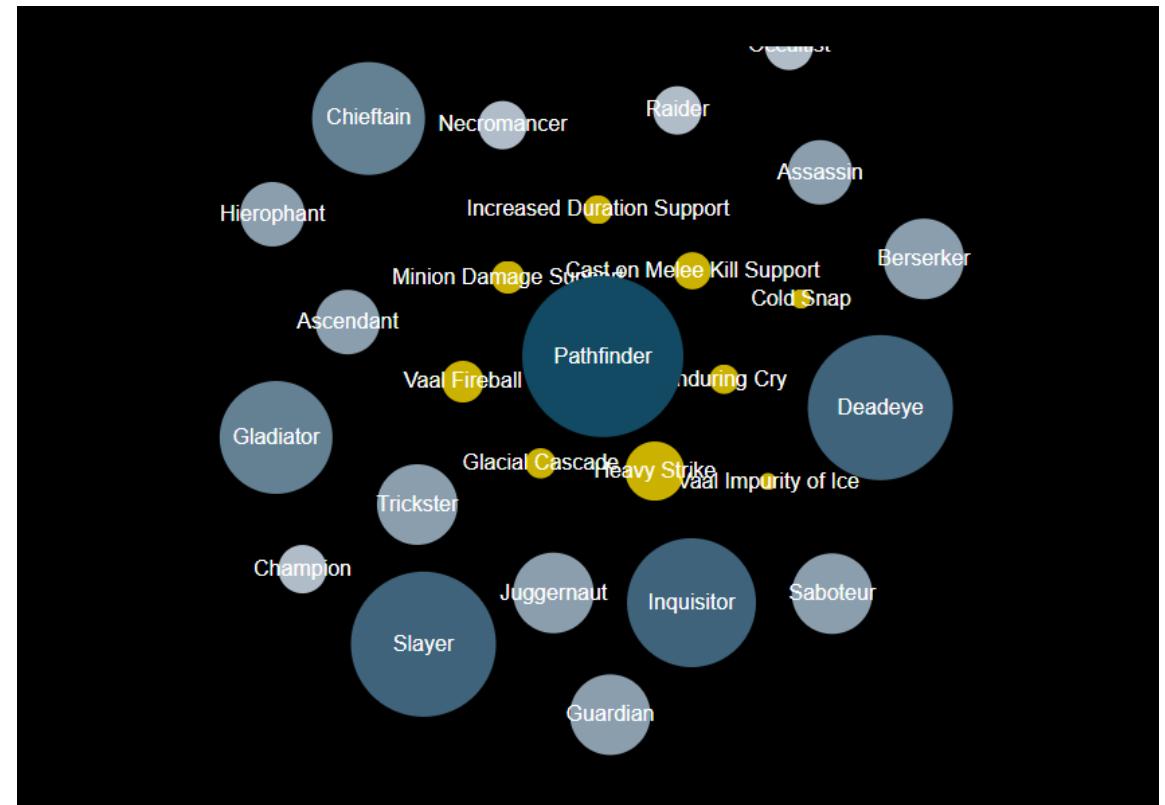
# Bubble-Chart

- Various sizes represent class popularity
- Draggable clusters



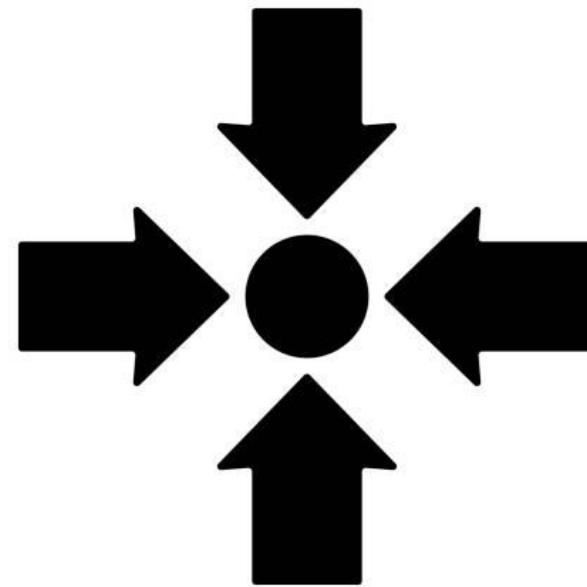
# Bubble-Chart

- Expandable skills
- Size of bubbles around the class bubble represent skill popularity (top chosen skills)



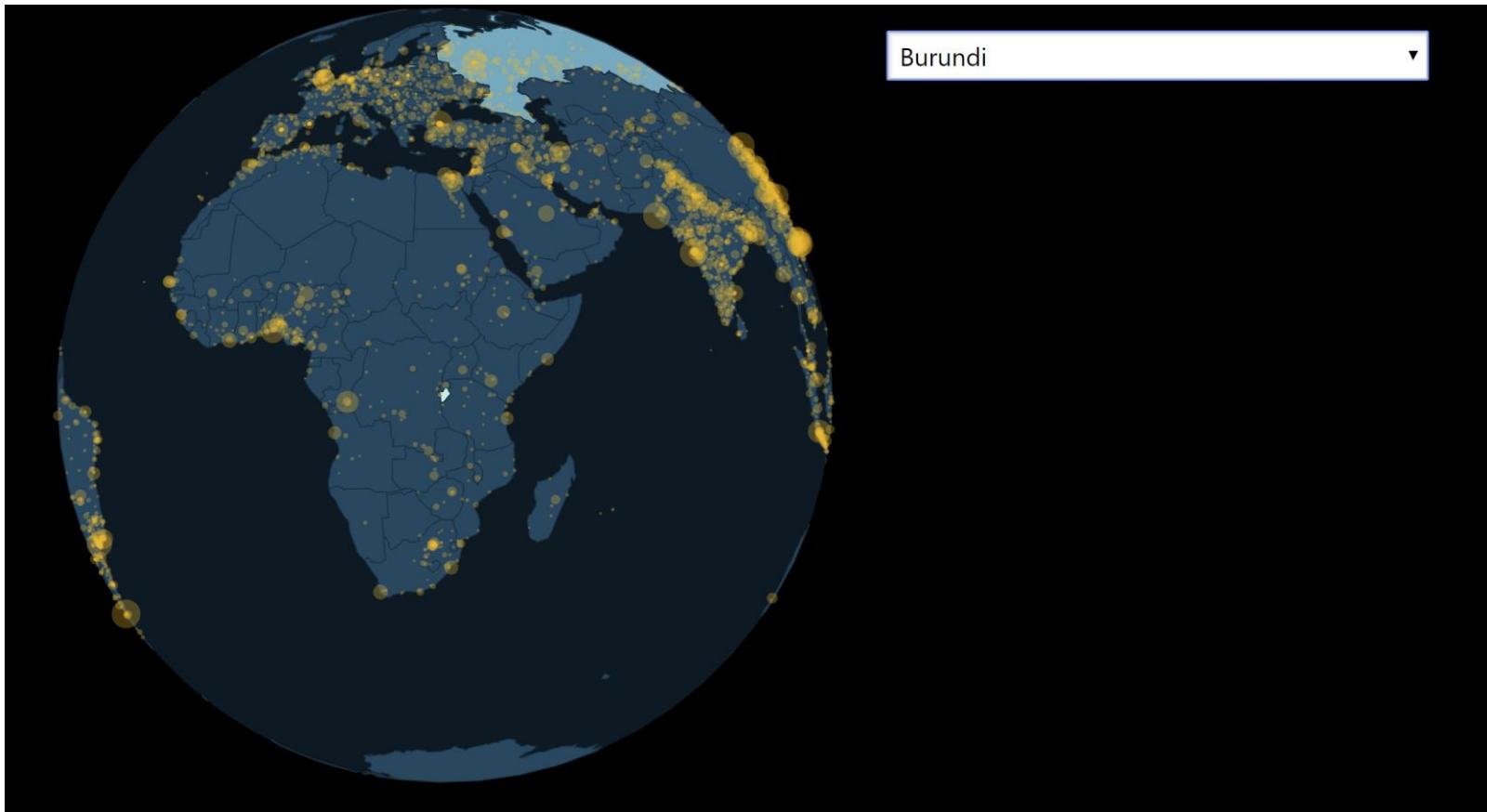
# Physics

- Constantly pushed towards the middle
- Collision
- Fixed class bubble sizes
- Draggable



# GLOBE

- first version



# GLOBE

- second version



# GLOBE

- final version



**League:** Breach  
**Country:** Ethiopia  
**Count:** 9

# DEMO

