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ECS 163 - Information Interfaces
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Final Project Write Up

World Happiness Report

The dataset that we chose was the "World Happiness Report"–a survey of the state of global happiness. In the dataset, countries are given a *Happiness Rank* based on a *Happiness Score* in a scale of 0 - 10. Additionally, each country has six categories that contribute to its Happiness Score: *GDP per Capita, Family, Life Expectancy, Freedom, Generosity,* and *Trust Government and Corruption*. Each of these categories have numbers that represent the extent to which they affect each Happiness Score, so the sum of all six categories adds up to the total Happiness Score.
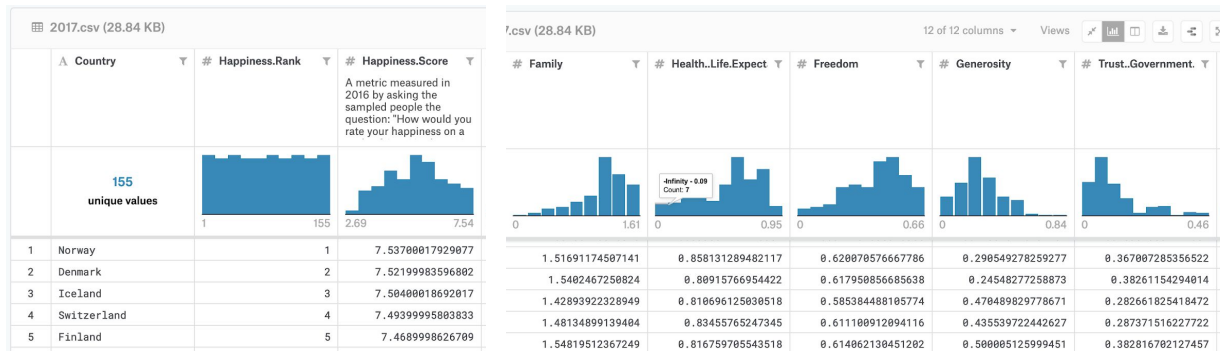
This dataset is significant because happiness is always a subjective metrics, yet people all around the world unanimously want happiness -- the concept of "the Pursuit of Happiness" even made its way into the most prominent place in the *Declaration of Independence*. Therefore, we want to visualize this data to gain more insights into this universal yet elusive concept of happiness, which is potentially beneficial in the realm of sociology and psychology.

Our Goal & Requirements

We wanted to create an information visualization that allowed the viewer to:
1. Explore the world's Happiness scores.
2. Separate and visualize each country's six Happiness categories.
3. Compare how the six categories contributed differently to each country's Happiness Score.

And fulfill the following requirements:
1. Data filtering (temporal, spatial, or by value)
2. Data selection interaction
3. User Study

4. Visual-based querying

System Overview

To facilitate these goals, we created three visualizations that interacted with and complemented each other.

In the following sections, we will describe our final system, elaborate on how and why we initially proposed to visualize the data, how the visualization changed during the process, and justify our design choices in the organizational unit of visualizations.
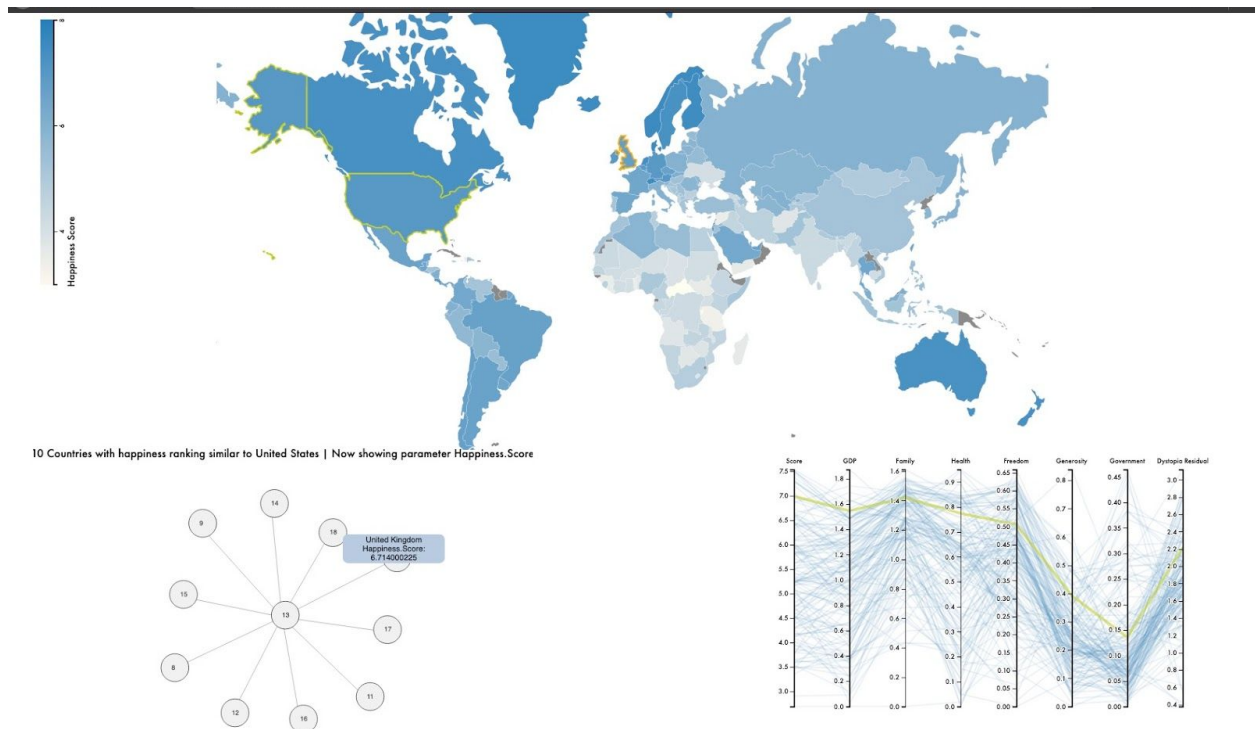
Visualization 1
Our first visualization is a Choropleth map with a color threshold corresponding to the Happiness Score of each country.

Initially, our proposition was to use a globe to display each of the countries.

However, as it was pointed out by the TAs, using a globe would limit the view of the entire map and would make it more difficult for users to navigate. Instead, we opted to go for a flat map using Leaflet to address this feedback.


For our final choropleth, we used blue as our hue, as opposed to red in the initial proposal because red is alaraming, and created a scale that varied in saturation. We did this as various color saturations are easy for the viewer to visually discriminate against.
We used green and orange borders to highlight countries because these colors provided sufficient contrast to the blue, but avoided color aberration.

Upon hovering on a country, a tooltip is displayed, detailing it's Happiness Score. Upon selecting a country, Visualization 2 and Visualization 3 are updated with data corresponding to that country, and a lime selection line is delineated on the map to show what country the viewer has selected. Ten countries with similar Happiness Scores–five countries with a Happiness Ranking that are below the selected country and five that are above–are delineated in orange. As seen above, one can see what Visualization 1 would look like if the United States were selected.

Visualization 2
Our second visualization is a parallel coordinates graph, displaying the values of each country's Happiness Score and six categories. This visualization would allow the viewer to see each of the countries' Happiness categories explore the ranking of each country. When hovered over, a tooltip appears showing the name and rank of the corresponding country. When a country in Visualization 1 or any line in the visualization is selected, it's line on this graph is highlighted so that the user can see the information specific to that country. Here, one can see the change in Visualization 2 once USA is selected in Visualization 1:
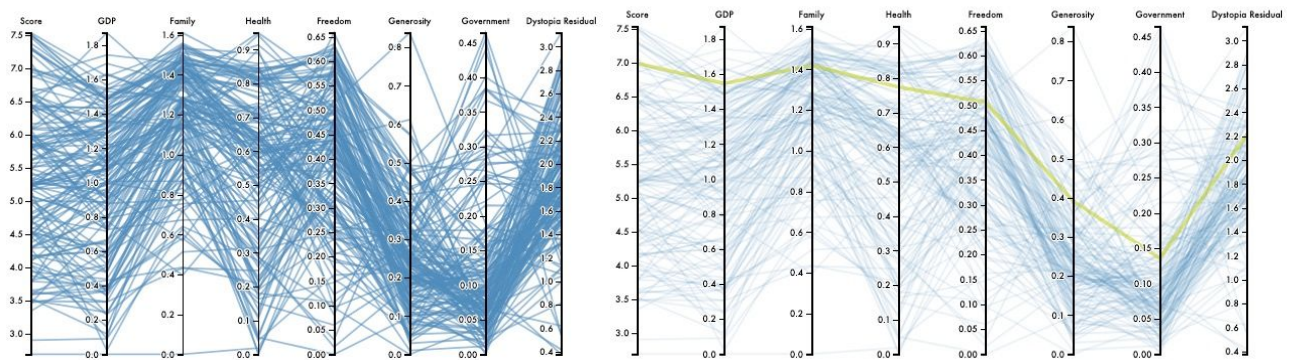
Blue lines were chosen to reflect the color of the map, and a green line was used to highlight the selected country's line from Visualization 1. To create an isolation affect around the highlighted line, we also lowered the opacity of each of the other lines.

By clicking any of the axis titles, the viewer can update Visualization 3.

Visualization 3
Our third visualization is a force directed graph that allows the viewer to compare how the six categories contributed differently to each country's Happiness Score.

Initially we proposed to do this with a radar chart.

However, since the radar chart shares a lot of the same purposes as the parallel coordinates graph, we wanted to try using a visualization method that was more distinct and unique. Instead, we chose to use a force directed graph that represents countries as nodes, labeled with their Happiness Ranking. The selected country on the map is the center node, which is surrounded by it's the five countries below it and above it on the Happiness Ranking score. The length of each link represents the difference in value between the inner and outer nodes in a particular category. By selecting a different category in Visualization 2, the links in Visualization 3 are updated to reflect the new differences between the inner and outer nodes of that category. Here we can see the difference in link lengths when selecting the categories of Happiness Score and GDP:
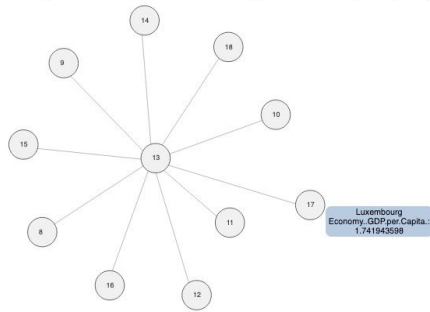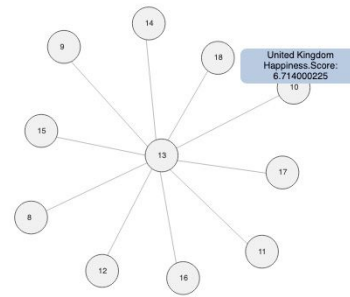
Upon hovering over a node, a tooltip is displayed detailing a country's value in a particular category and highlights the corresponding country in the map. And when clicking on the nodes, it is just like clicking on a country on the map: it selects the corresponding country to be displayed on the diagram.
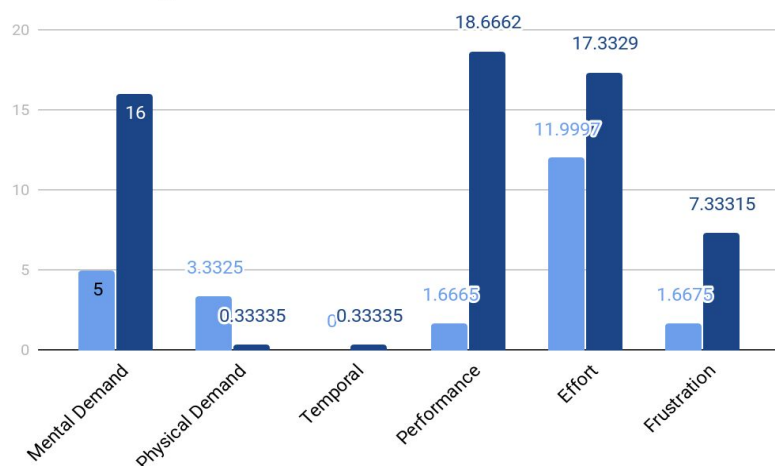
User Study Results

Defined Tasks

1. Find out the countries with similar happiness rankings with United States and where they are in the world
2. Explore how different attributes contribute to the rank within countries with similar rankings
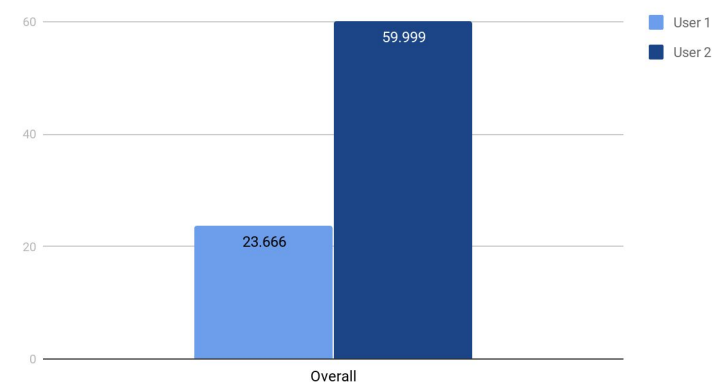3. Find out the highest ranking country in happiness

NASA TLX Results
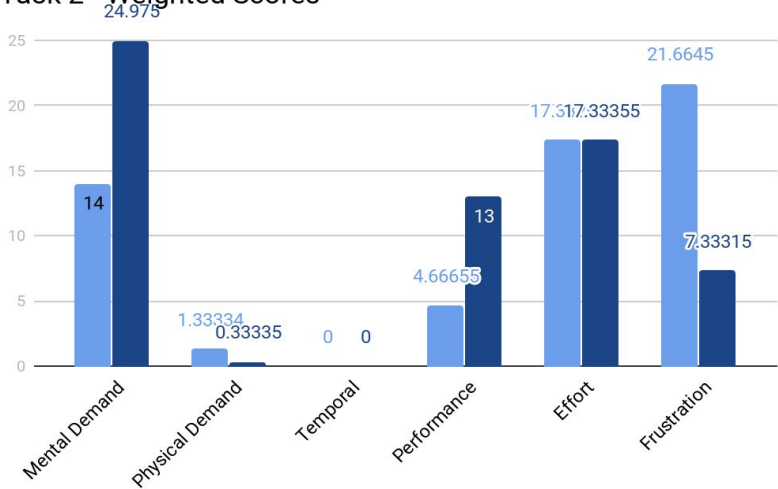
Task 1

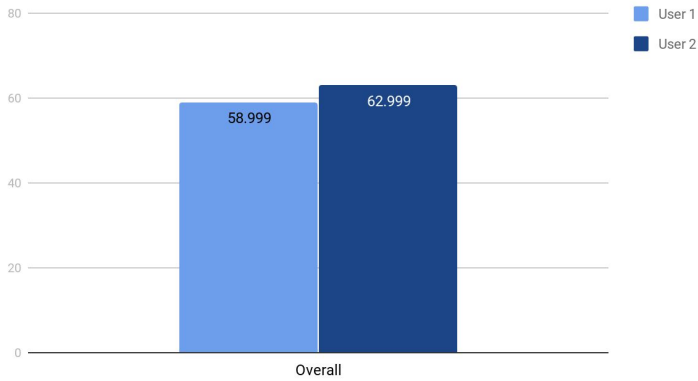Task 1 - Weighted Scores

Task 1 - Overall Workload

Task 2

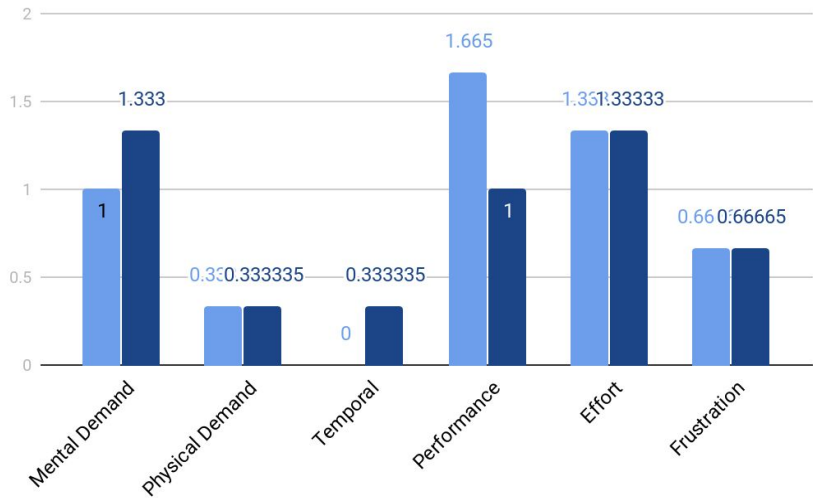### Task 2 - Weighted Scores

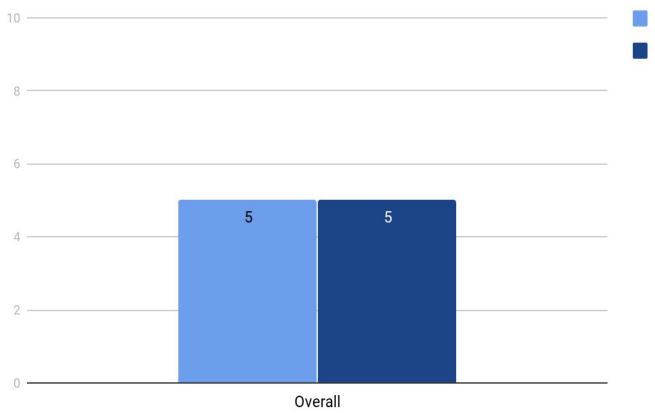### Task 2 - Overall Workload

Task 3

Task 3 - Weighted Scores

Task 3 - Overall Workoad

Information Extracted & Verbal Comments

The testers had given some comments about the usability, and we picked the most prominent and common one to tweak our designs upon. And we would not have discovered this usability issue without external input -- the function of Force-Directed Graph is a little elusive: and this is consistent with the rather high workload of Task 2, which requires users to manipulate the

force-directed diagram.

Therefore, we've added a title showing the currently-displayed parameter and country to the Force-directed diagram to make it more immediate.
And for the other tasks, the results validated the functionality of the visualization as a whole, and proved our design in usability is well-thought.

Task Assignments

Anjo: Choropleth Map, and Parallel Coordinates Graph
Henry: Force Directed Graph, and Writeup
Zhaohui: Choropleth Map, and Force Directed Graph