Visugees Final Report

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1. Motivation

We chose to work on a „Design-Study-Project" as none of the proposed projects fitted our expectations.
Together we thought about interesting topics we could study and visualize.
We then decided to tackle the very current topic "Refugees".
In our time people and media often talk about refugees and throw around with numbers. But it is very hard to understand this problem and we think its demeaning to just reduce it to numbers.
So we wanted to find a solution where we can visualize the actual data of refugees fleeing their countries and moving to others. Maybe this can help to have a real unprejudiced discourse about this topic. We started our research and found plenty of data from the UN and other sources. Henceforth nothing was in our way to start working.

1.1. Tasks

The application should inform its users about the changes in population due to wars and refugees. The user should be able to easily understand the directions and origin of the people that are fleeing from war. Additionally, the user should also have the possibility of looking at the war in a context of time and date, so questions that should be answered with this tool are: When was a war? When were people fleeing? How many?

The targeted applications' main task is to deliver insight into worldwide refugee flows, therefore we had to find an intuitiv solution to display data concerning events on our world and movements of population. The following functions will be integrated:

1. Gain insight at a glance when calling the site's landing page. Four different views will be presented, showing data from the current moment in time.
2. Compare two countries' datasets.
3. Hover over a single refugee flow to get more details.
4. Get an overview of registered wars since the 1970s at a glance including the number of refugees at each year.

1.2. Users

Geography/history teacher enriching the lesson

> A strong, information-rich yet easy to use visualization of global and regional influences on human's life would be a great chance for teachers to enhance their lessons. The possibilities to demonstrate certain topics not only static on paper or via projection but in an interactive and exciting way can be used to make learning overall more interesting.

Journalist gaining and giving more insight

> Journalism has moved to the web, and so are its possibilities to bring certain aspects of the article to life. Not only can the reader benefit from a well-created publishing reducing the barrier to understand topics described and thus improving the overall user-experience, but so can a journalist, too, when using our tool to get both a more detailed knowledge as well as a better understanding on the whole picture.

1.3. Datasets

The datasets we used:

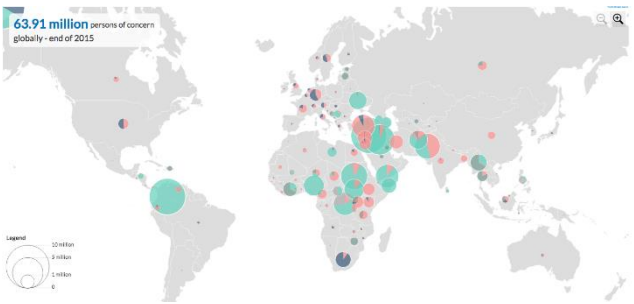
1. Population changes since the 60's[1]
2. Battle related deaths[2]
3. Territorial changes[3]
4. UN's refugee dataset[4]

2. Related Work

In our Research we stumbled upon a few other solutions on visualizing refugee data. Those helped us get a grip on the problem and we tried to get inspiration from those and make them better.

2.1. Example One

A Statistic from UNHCR
This view is very interesting and we can see in the circles how many people of interest are in those countries. But as we know pie charts are, at least most of the time, bad. And also it would be interesting to get more information about the movement of those people or the reason why they left their country.
In summary we wanted to combine this information, provided by the un, with other sources to give insight on what is happening in our world and questions like: what brings people to leave their country? Furthermore, we could explore the effects on the countries itself.



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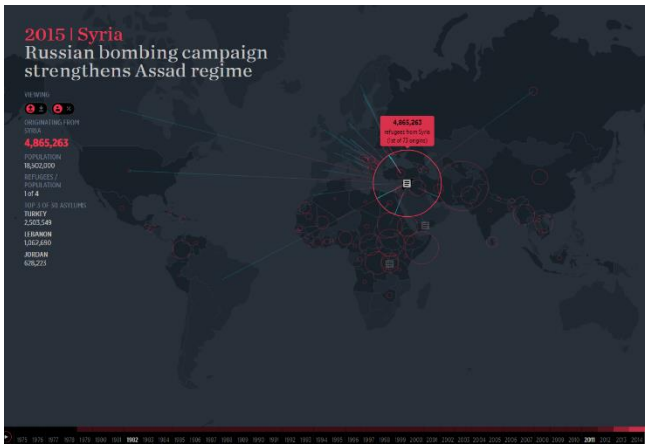
http://popstats.unhcr.org/en/overview

2.2. Example Two

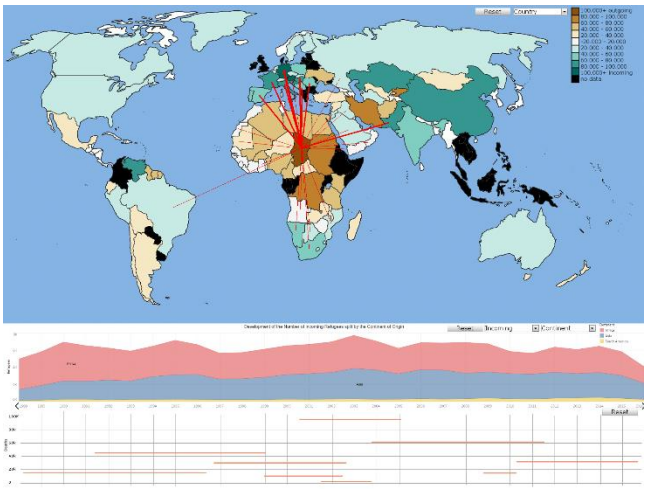
The Refugee Project
In this view we can actually see the flow of refugees. But it still has some problems. Those big red circles didn't seem really good to us. Although the information you can get on the sidebar is very interesting.



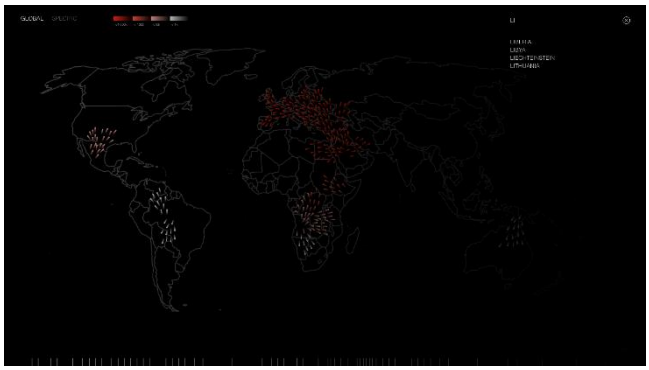
3. Approach

After analyzing the problem each of us designed a prototype. We then took the best things out of each one and put them together. Obviously we had to implement a map. We also thought about edge bundling to visualize the refugee-flow but the Effort wasn't worth the effect. We won't describe the three prototypes in too much detail here, since we already described them pretty accurate in previous assignments, but want to explain our final design choices based on these prototypes.

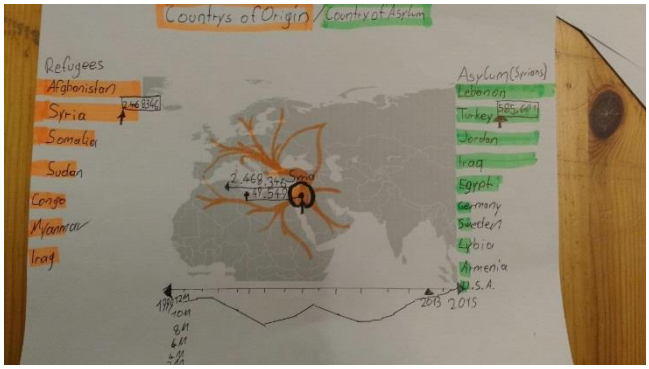
3.1. Prototype One



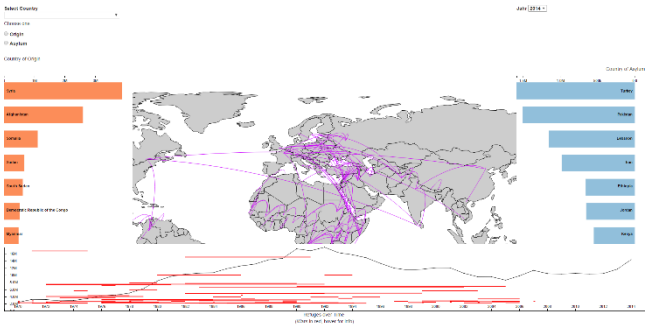
3.2. Prototype2



3.3. Prototype 3



3.4. Final Visualization



3.5. Assembly of the Final Visualization

It's one of the hardest tasks to decide what to include and what to discard in the final visualization. The most important and central element in every prototype is the map, so it's only natural to use it as the central element in our final visualization as well.
We really wanted to use edge bundling, like it is used in prototype 3, but sadly we weren't able to properly include it in our final visualization. Still, we were able to implement the neatly arranged bar charts from prototype 3 that visualize number of incoming, respectively outgoing, refugees of a country.
Prototype 2 has one important feature that is missing everywhere else – a search box. Of course we decided to include this feature in the final visualization, so now the user can search for a country and quickly see the incoming, or outgoing, refugees.
To provide more context, we agreed on using the bottom chart of prototype one, that visualizes the time and death toll of different wars over time.

So in the end we pretty much took elements from every prototype and mixed them together to one, at least in our opinion, neatly looking final visualization.

4. IMPLEMENTATION

We took a while to decide what platform to use for implementing our ideas. First, we all pretty quickly agreed on using one of the tools we already used in previous assignments. On the one hand we had Tableau, an easy to use, nice working piece of software, that would enable us to quickly make prototypes and modify them pretty easily. On the other hand, we had d3, a JavaScript library that enables the user to create more complex visualizations, but naturally is a bit trickier to use.
In the end we decided to go with d3, because we had very specific ideas that wouldn't be realizable in Tableau. So, since we didn't want to alter our ideas to much, we discarded the plan to use Tableau and took the maybe a bit harder route and used JavaScript in combination with d3 and html.

4.1. Challenges

One major challenge in creating this visualization was to keep a clear focus on the spatial placement of the different visualization graphs to avoid clutter and a hard-to-distingush view, which would make understanding the shown information as well as learning form it much harder for any user.

Despite this challenge the visual level we had to invest quite some time in understanding the libraries used as well as improving our coding skills to much an interactive web application possible.

Before starting the implementation of our visualization project the team first had to determine a final prototype to focus on. The process of extracting the best aspects of our first mock-ups and combing them in a final, well-thought view was the first major challenge we had to tackle.

As with most projects the team had to make sure that working targets and milestone products were consistent throughout the creation process and an improvement towards our final goal of providing an interesting, easy to understand as well as fun to use web application.

5. RESULTS

To present the results of our work, we chose some tasks and will now describe how a user would fulfill these tasks with our implementation. In other words: Scenarios of use. This tasks are as simplified, on the point formulated if you will, version of the tasks in the chapter "Motivation".

- Task 1: Find out which country has the highest number of incoming and which has the highest number of outgoing refugees in 2010
- Task 2: Find out the years with the highest refugee-count
- Task 3: Find out how many refugees came to Austria 2014
- Task 4: Find connection between the war data and the number of refugees

5.1. Scenario 1

The user does not have to do much to accomplish task one with our tool. In this scenario, the user would change the year to 2010 on the upper right side.

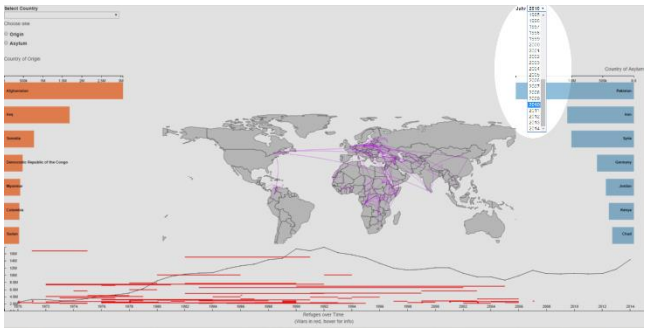


Figure 1: In the upper right corner is a drop down menu with which one can change the year of interest

After this, the user can see the country with the highest number of outgoing refugees on the left side and the country with the highest number of incoming refugees on the right side, in this example the countries are Afghanistan & Pakistan.

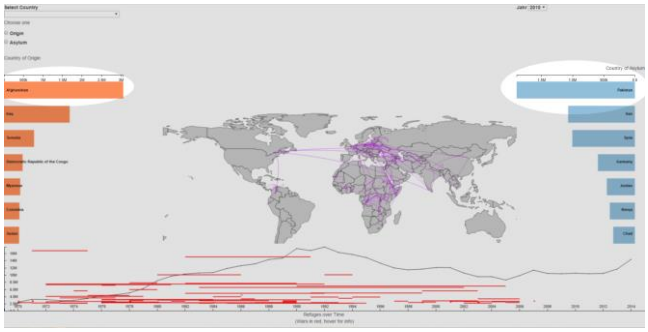


Figure 2: The bar charts show the countries with the highest incoming (or outgoing) refugees

5.2. Scenario 2

This task is very easy to do. This scenario consists of only one step: the user has to look at the bottom diagram and search the years where the black line is high.

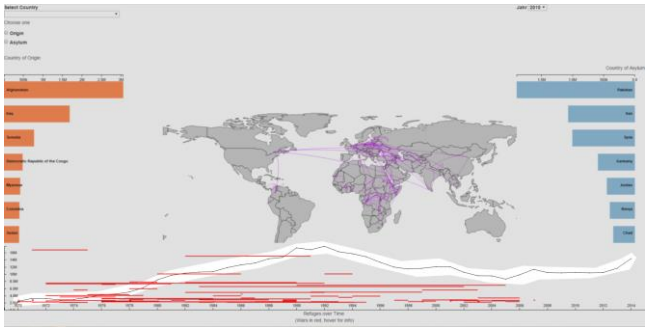


Figure 3: The line chart shows how many total refugees there were in a certain point of time

In this example the answer would be between 1990 and 1992.

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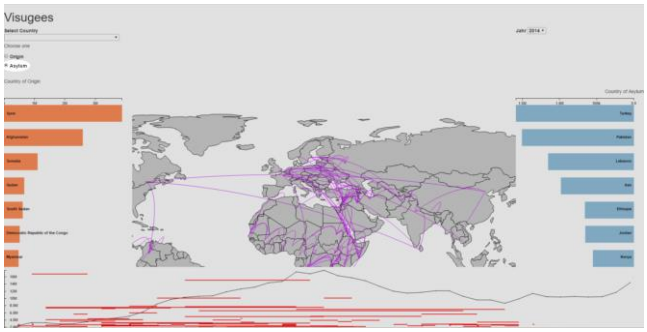
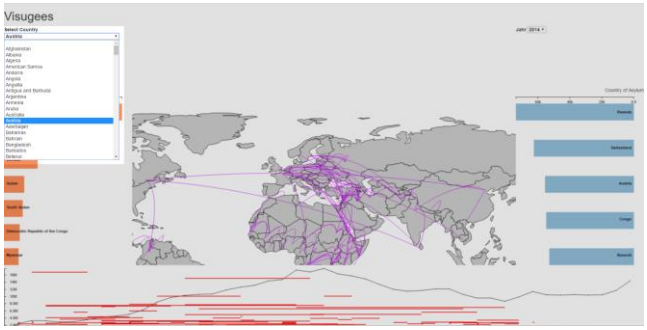
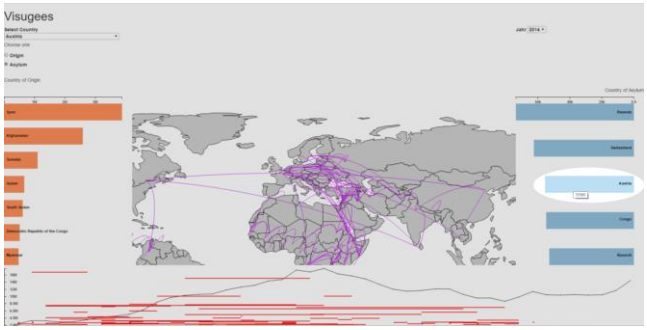
5.3. Scenario 3

First, the user has to make sure that the current year is "2014". This can be done by looking in the upper right corner and by changing the year if the wrong year is currently selected (like described in scenario 1).
After that one must click on "Asylum" to update the bar chart that shows how many people come to the country.





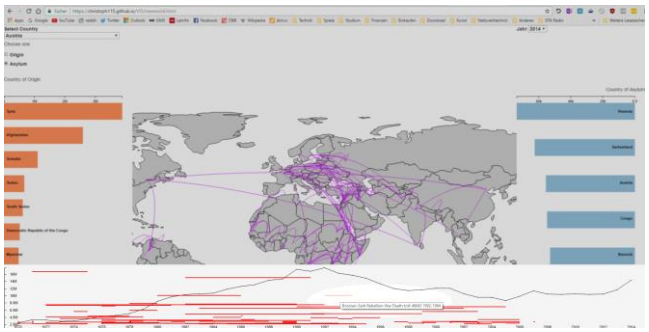
Now the user can see how many people were coming to Austria by simply hovering over the bar on correct bar right.



In this case the answer is 55560 people.

5.4. Scenario 4

To solve this problem, the user has to hover over different wars (visualized through red lines) in the bottom diagram and compare them with the black line, which visualizes the total amount of refugees.



In this example it's interesting to see that, although the most conflicts were between 1972 and 1994, the number of refugees do not really get much lower – of course, one can see a slight drop, but not as much as, at least we, expected. Also, the most wars don't have a very high death toll, just a few of them are pretty high up.

6. Discussion

6.1. Strengths

The final web application is an interactive, information-rich world map with a clutter-free, on its core aspects focusing user interface and a carefully chosen set of visualization graphs in the correct context data wise, thus providing an easy to use application.

The team has taken the aspect of color blindness very serious during its optical design considerations to provide both a set of easy to distinguish colors for everyone as well as the correct distinction of the colors used for people with color blindness. We have therefore used a blindness simulator (http://www.color-blindness.com/coblis-color-blindness-simulator/) to check if what colors to choose and settled with those in the final product.

6.2. Weaknesses

It's currently not possible to zoom in or out of the map by clicking some according buttons due to the lack of them. The current way of zooming by simply rotating the mouse wheel leads to desired effect (more or less detail of a specific map region), but it may break the coherent user experience for some consumers of the web application due to not providing a visual way of manipulating this aspect of the data.

We have not implemented a way to resize the bar charts on each side of the world map as well as the line graph on bottom of the page, thus prohibiting the user of customizing the viewing experience, i.e. showing a larger world map to cost by showing a narrower view of the bar charts.

6.3. Learned Lessons

The team has learned how to use the right graphs in the right way in a product actually used and used by others. As mentioned earlier in this work, it was quite a challenge to choose the right set of charts for visualization due to vast selection available of different ways of showing data. We have made heavy use of the information provided during the lectures of our course, which helped us guide throughout the project's design decisions.

Aside from the project's visual aspects the team has bolstered its skills in web coding as well.

7. WORK SHARING

Regarding the design decisions as well as creation of mock-ups of our web application the whole team has an equal amount of work done. We have discussed these aspects of the project always together. The remaining parts of the work done have been split as follows:

Christopher Pressler:
Final report, coding.

Maximilian Steiner:
Final reprot, coding

Thomas Schönmann:
Final report

REFERENCES

1. Citations

1. http://data.worldbank.org/indicator/SP.POP.TOTL, last reviewed 21-01-2017
2. http://ucdp.uu.se/downloads/, last reviewed 21-01-2017
3. http://www.correlatesofwar.org/data-sets/territorial-change, last reviewed 21-01-2017
4. http://data.un.org/Data.aspx?q=refugee&d=UNHCR&f=indID%3aType-Ref, last reviewed 21-01-2017

2. Related Work

1. Tufte, The Visual Display of Quantitative Information, Graphics Press, 1983, p. 197
2. T. Munzner: Visualization Analysis & Design: Abstractions, Principles, and Methods, CRC Press, 2014