Diet 'nother Day

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Information Visualization - Spring 2017

1. Introduction: Project Goals

Even from our initial brainstorming, our team has one very common interest: food. Because each of us is from different cultural backgrounds as well, we started to discuss how we might be able to utilize this final project as an opportunity to explore food, healthiness, and how typical diets differ around the world. Given this interest, our first goal for the project was to design a website that would allow users to learn more about how diets differed around the world, but also how they've changed over time and how those diets relate to a country's overall measure of diet healthiness.

Second, we wanted to utilize this project as an opportunity to bring a playful nature to food and nutrition. Michelle Obama has been a recent champion of this with her campaigns Let's Move and Turnip For What. But typically, nutrition is often presented in a very rigid, clinical and oftentimes unfriendly way. Our second goal for this project was to create and convey a playful but informative message about nutrition.

Our final goal was also a personal one. We wanted to build a website that told a captivating story, one grounded in visualizations built with tools we've learned and practiced throughout this course, and also based in strong user research.

2. Related Work

Shannon: I was particularly curious to understand how related work explores the differences in diets around the world. I was inspired by (1) the Times article, "Hungry Planet: What The World Eats" that uses photography to document everything that an average family consumes in a given week, and what it costs. While not data visualization focused, I appreciated the human-centeredness of the approach and the story the authors of the article are trying to tell. It felt approachable in a non-academic way that is atypical of how nutritional information can oftentimes be presented. This article heavily influenced the fun-nature of our own storytelling approach. (2) I was also inspired by flowingdata.com's "The Changing American Diet". I felt it successfully displayed the changing consumption of different food items in a given year. I found the animation to be a distraction though, and felt that the speed of the visualization deterred me from really exploring and understanding the information on my own. I enjoyed seeing this implementation of d3.js though and it provoked our own decisions in visualization. Lastly, (3) I was inspired by National Geographic's "What the World Eats." Being able to see how diets, and consumption of different food groups changed over time in a number of countries was fascinating and definitely affected our final design. We thought only

visualizing a subset of countries was a useful approach, but also felt we could improve on the effectiveness of the pie chart visualization that National Geographic implemented.

Ed: I believe in healthy living but I am terrible at dieting properly mainly because I don't know much about nutrition and proportions. My wife is a nurse practitioner and she heavily emphasizes the importance of proper dieting whereas I focus mainly on being active. This project served as the perfect opportunity to blend the two ideologies together and see not only the state of what healthy nutrition and diet looks like in the United States but the world as well. Although I often think about health from a personal perspective, I rarely think about how countries rank compared with each other in terms of healthiness, what healthiness looks like, and the breakdown of each country's diet. Further research into this topic revealed studies like 2015's study published in "The Lancet Global Health" journal, which ranked the world's countries according to health. I also researched the history of the food pyramid, something I constantly learned about in school, as well as how the food pyramid has changed over time based on an increase in collective knowledge in food nutrition, dilution of lobbyist influence, and overall heuristic evaluation. Finding out that the US Food Pyramid has changed drastically over time, to most recently the MyPlate, it led me to think about whether other countries experience the same nutritional considerations and changes in diet. Both the pyramid and MyPlate were example visualizations that directed our final design.

Rohit: I believe in eating healthy, and as such I wanted to see how countries ranked when it came to healthy diets. Some of the visualizations which inspired me were: (1) Secret Sugar Bombs, an infographic which visualizes how much sugar daily food items contain, and, (2) Nursing Your Sweet Tooth, a powerful infographic about sugar consumption in the U.S. Both infographics use effective storytelling and visualization techniques to convey the point across, and I wanted to incorporate some of these elements into our visualization on diet trends. There's even a guessing game How Much Sugar? which educates players on how much sugar is contained in common food items - all in a fun and entertaining way. This served as inspiration to make our visualization fun and entertaining along with educating the audience on healthy foods and diet trends.

3. Visualization

Our website consists of three main components: (1) Tableau charts, (2) D3 charts, and (3) Illustrator visualization components.

Tableau: For Tableau, the main challenges were creating hover and select actions that linked multiple charts on each dashboard in a coherent way. During the first round of designs, these actions were not obvious to users, and a lot of the information dynamically stored in the charts was not discoverable.
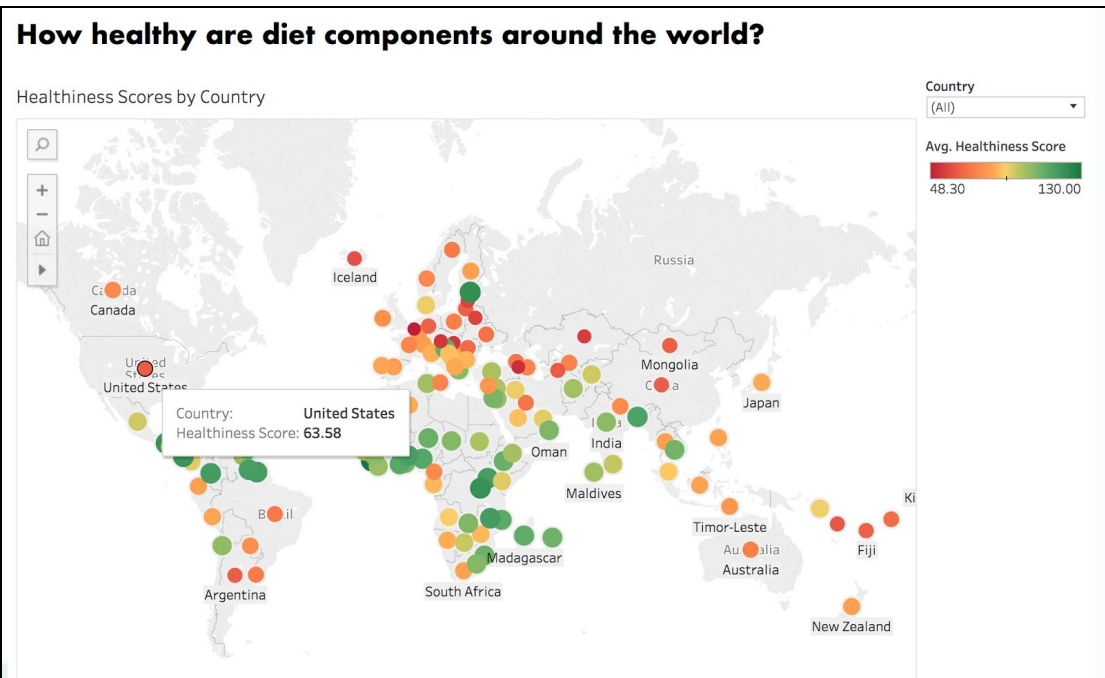
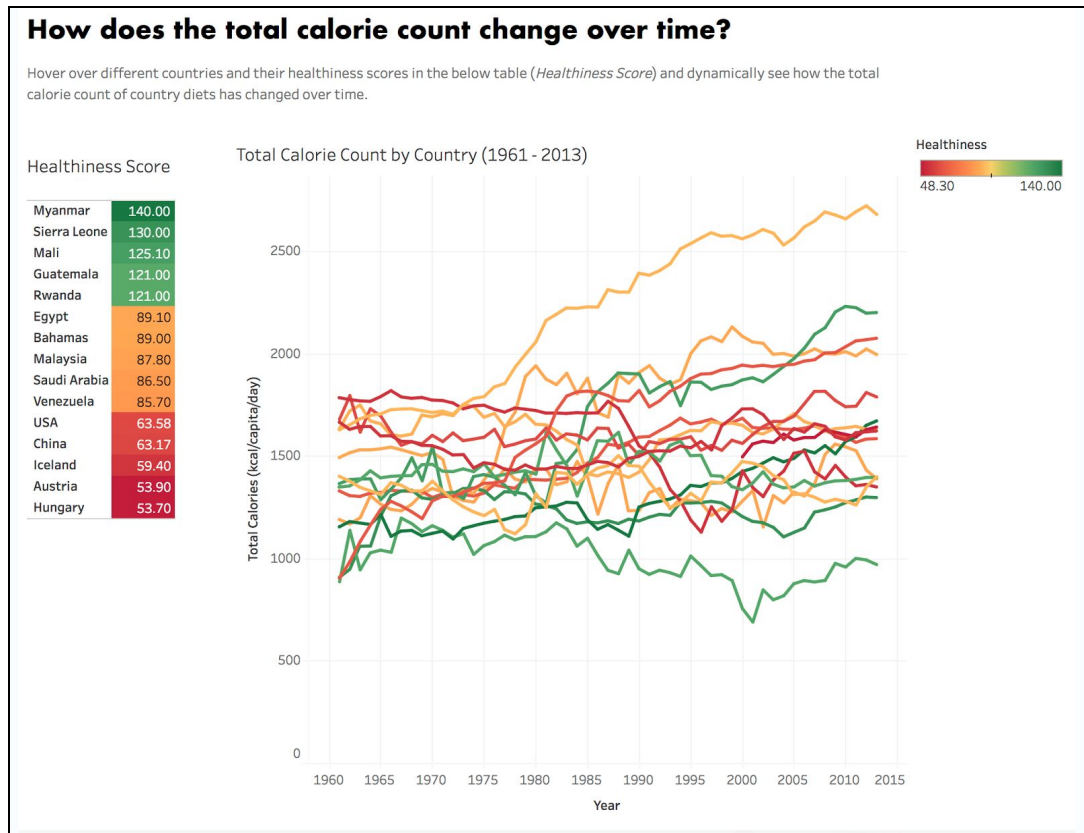# How healthy are diet components around the world?

Healthiness Scores by Country

Fig 1. Tableau Choropleth

How does the total calorie count change over time?

Hover over different countries and their healthiness scores in the below table (*Healthiness Score*) and dynamically see how the total calorie count of country diets has changed over time.

Total Calorie Count by Country (1961 - 2013)

Healthiness Score

Country	Score
Myanmar	140.00
Sierra Leone	130.00
Mali	125.10
Guatemala	121.00
Rwanda	121.00
Egypt	89.10
Bahamas	89.00
Malaysia	87.80
Saudi Arabia	86.50
Venezuela	85.70
USA	63.58
China	63.17
Iceland	59.40
Austria	53.90
Hungary	53.70

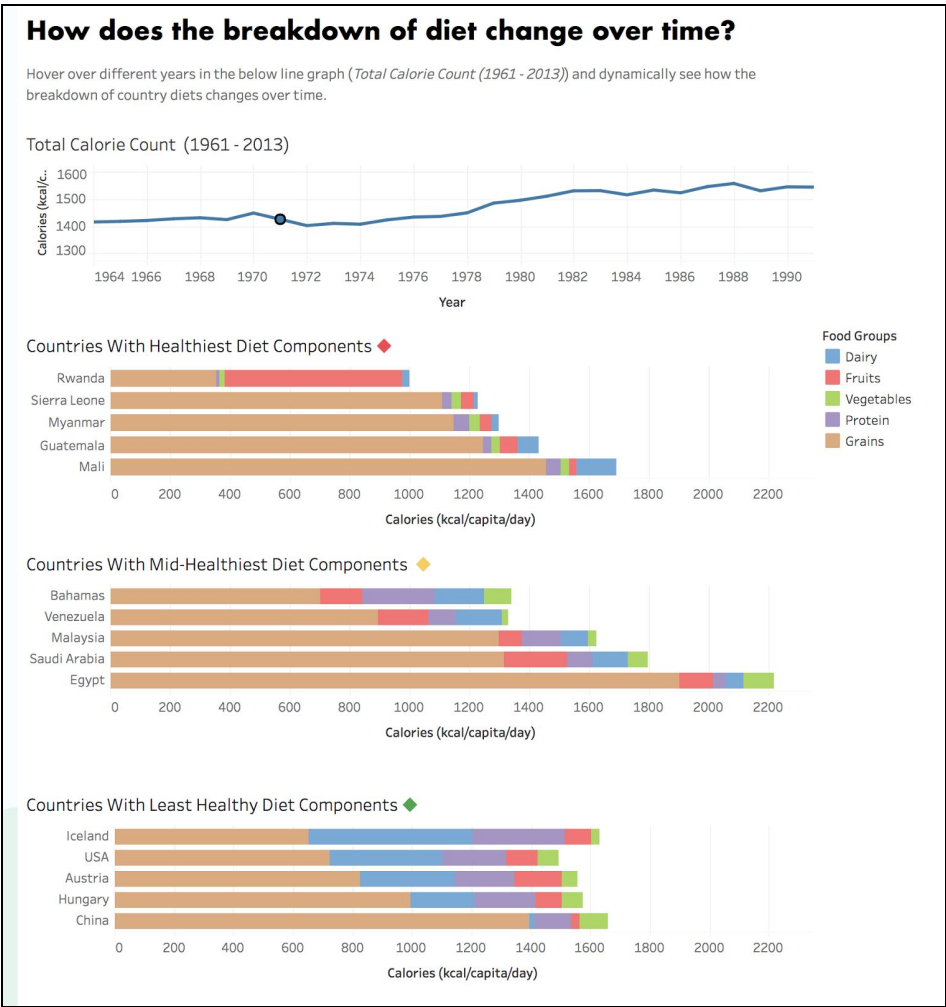**Fig 2. Tableau Line Chart**

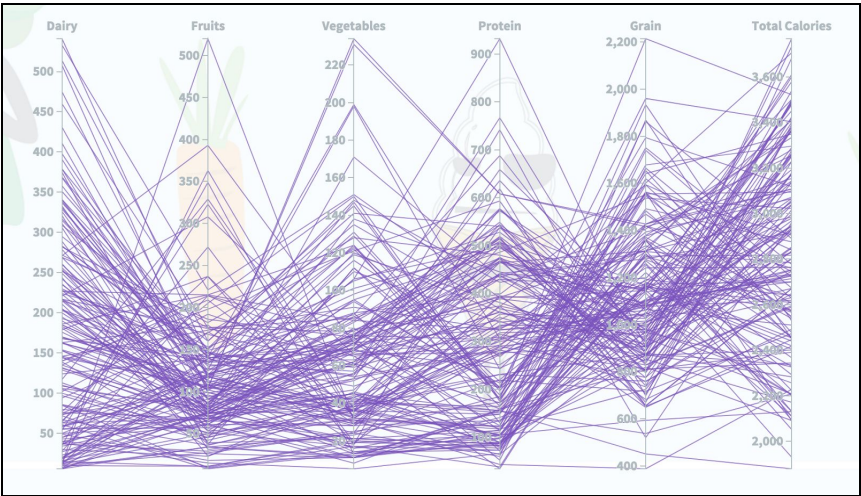**Fig 3. Tableau Bar Chart**

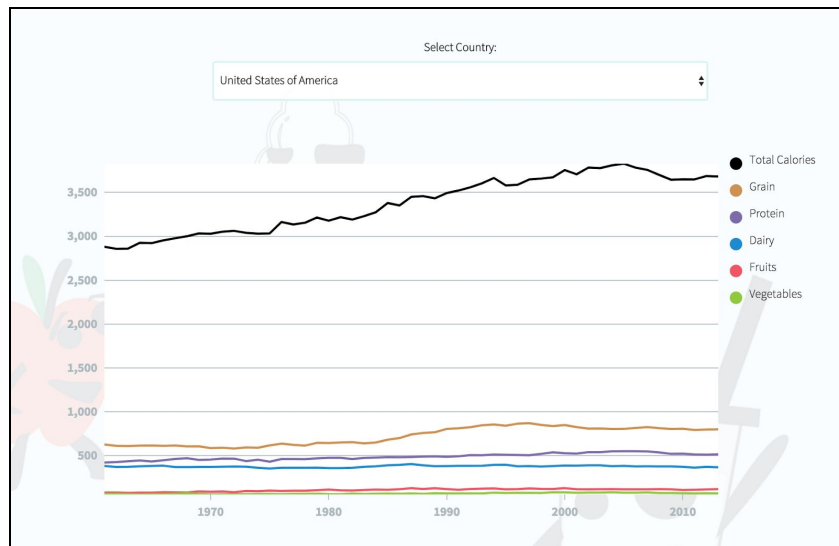**D3**

Fig 4. D3 Parallel Coordinates Chart

Fig 5. D3 Line Chart

For D3, the main challenges were getting the tooltip and mouseover highlighting to work.

Illustrator

For Illustrator, our main challenges were conveying a theme that is relatively dry but inherently interesting in a way that captures attention in a visually dynamic way. We wanted to ensure that users would not only be entertained but that the entertainment would convey important information and transitions in a memorable way. Heuristically, we struggled to find a medium that would blend in well with the data visualization charts as well as creating a style that was our own. We ended up creating our style based on the story we wanted to tell and opted for the food and people cartoon characters that would we felt would not only appeal to grown ups but just as importantly to youth who want to learn more about nutrition and the importance of maintaining a well-balanced diet.

Fig 6. Illustrator Introduction

Data

Our dataset combines data from the Food and Agricultural Organization (FAO) of the United Nations Food Balance Sheets and data from a research article published in the

Lancet by the Medical Research Council Epidemiology Unit, Institute of Metabolic Science, University of Cambridge.

The dataset from the FAO details the average number of calories (kilocalories) consumed per food group per person, per day for 187 countries from 1961 - 2013. The dataset from the University of Cambridge scores 187 countries' diets for healthiness from 0 to 100 points (the higher the score, the more healthy the diet) in 2010.

These datasets are publically available, and were joined on country name for the purposes of our data exploration and visualization.

4. Tools Used in Visualization

For this project, our aim was to implement a number of new tools we learned in class. Our main tools for data visualization were Adobe Illustrator, D3.js, and Tableau. Our main tools for data exploration was Tableau, and our main tools for web development included HTML, CSS and Javascript/D3. The site layout was initially created in Illustrator, which we implemented as a webpage using the front-end framework, Materialize CSS.

Our Tableau required quite a bit of advanced Actions and linking. We relied heavily on Tableau's public support forums for troubleshooting and achieving the best results possible.

For D3, we used publically available libraries D3 Parallel Coordiates and D3 Line Chart, which we modified to visualize our dataset.

5. Steps Required to Accomplish Goals

EDA + Design Brainstorming

We took a very iterative approach our design. First, each group member explored the data on Tableau to see what trends existed and what stories we thought were the most compelling to tell.

Then each group member mocked up initial design sketches individually. We chose this route to maximize the diversity in our approach and ideally to take the best concepts from each design to integrate into a single idea. After talking through the strengths and weaknesses of each design as a group, we white boarded our ideas to iteratively design our final story. We did this a couple times until we finalized our story. Our storyline changed significantly over this stage of work: we first wanted to explore the unexpected correlations that a country's healthiness diet may dictate (a country's fertility, happiness,

etc), but then realized the limitations of this storyline and approach, so instead decided to just focus on how food consumption, the healthiness of diets and the division of food groups (protein, vegetables, fruit, dairy, carbohydrates) in different countries has changed over the last 70 years. In this stage of our project, we did not focus on technical limitations or aesthetics, instead chose to hone our core story to ensure the final product addressed our group goals.
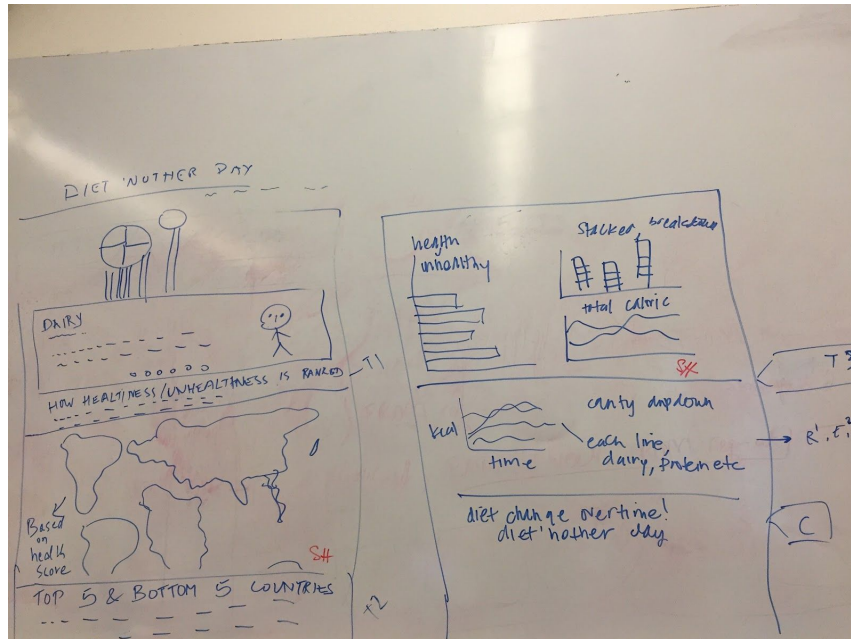

Figure 7. Initial whiteboard sketch

Creation (Tableau, d3, Illustrator)

After we had clarified our desired storyline, we divvied up technical tasks required to create the visualization. Our three main tools for creation were Tableau, D3, and Illustrator. Shannon led the Tableau work, Rohit the D3 work, and Ed the Illustrator work.

Tableau
Shannon created a number of a graphs - the map, the line graph, and stacked bar chart - in Tableau. These underwent a number of iterations, guided by feedback from heuristic evaluations, before finalizing on the design for the website.

We then hosted the dashboards on Tableau Public servers and linked the charts to the webpage.

D3
In D3, Rohit created two main graphs - one parallel coordinates and the other a line graph - only one of which was ultimately kept in the final design of the website.

Illustrator

Ed, inspired by his "boba" characters he created for his infographic visualization assignment, created characters that created the playful dynamic in our visualization.

Website Design

Rohit integrated all of the files using the Materialize CSS framework.

6. Results Obtained

Usability Testing and Heuristic Evaluation

We conducted usability testing and heuristic evaluations on our visualization with 5 individuals.

In our heuristic evaluations, we had users do a cognitive walkthrough, with the tester observing, and concluded with the user completing the following heuristic evaluation survey questions. The survey questions and response we received are included below.
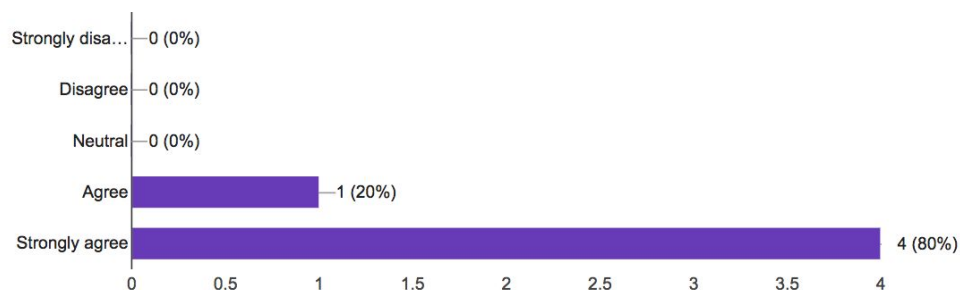
The visualization makes important information visually salient.
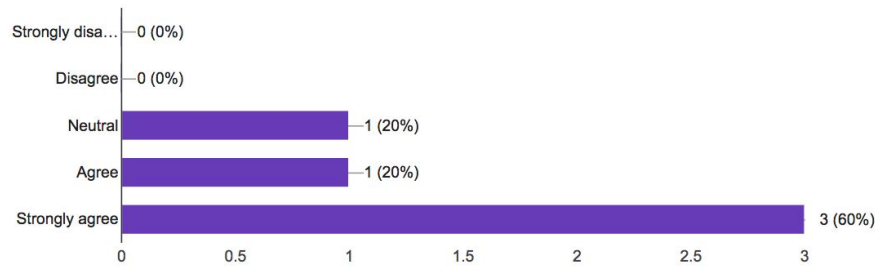
5 responses
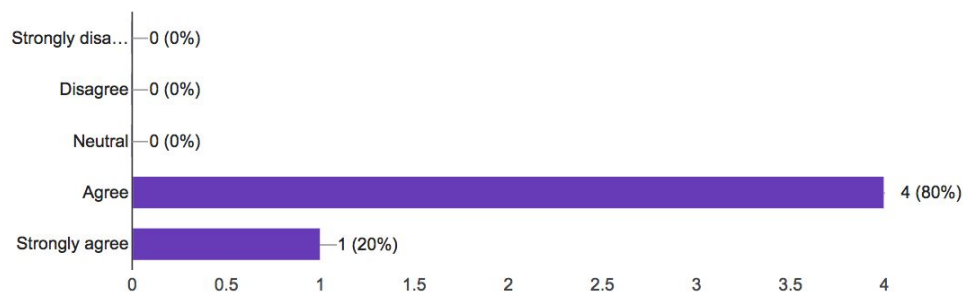
The visualization displays important information in a playful way.
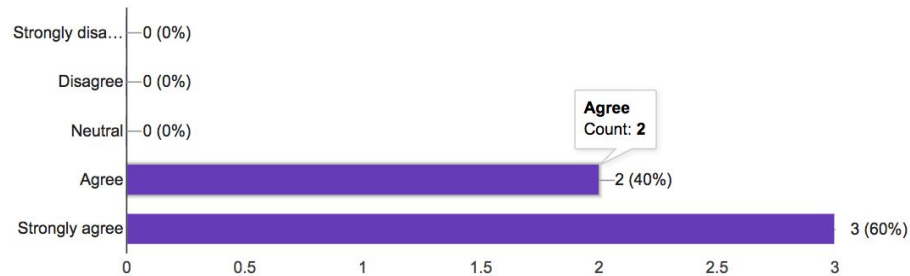
5 responses

## The visualization uses visual components appropriately.

5 responses

Strongly disa…	0 (0%)
Disagree	0 (0%)
Neutral	1 (20%)
Agree	1 (20%)
Strongly agree	3 (60%)

The visualization could make you pause and question an assumption you previously had.

5 responses

Strongly disa…	0 (0%)
Disagree	0 (0%)
Neutral	0 (0%)
Agree	2 (40%)
Strongly agree	3 (60%)

Agree
Count: **2**

The visualization successfully presents multiple dimensions of the topic in a coherent manner.

5 responses

Strongly disa…	0 (0%)
Disagree	0 (0%)
Neutral	0 (0%)
Agree	2 (40%)
Strongly agree	3 (60%)
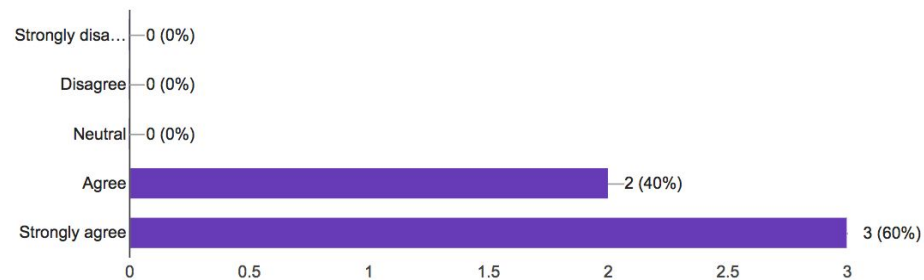
From this testing, including observation, interviewing and heuristic evaluation, we identified several improvements that we made in our final version of our visualization.

Improvements Identified

1. **Tableau Graphs:** Map, Line, Stacked bar charts
   a. **Integrating healthiness score**: For the stacked bar chart in particular, many users identified an interest in understanding how the breakdown in

diets correlated with a country's healthiness score. To meet this interest, we created three distinct healthiness sections of stacked bar charts: low, medium, and high scoring countries.

b. **Grains first**: Originally, the stacked bar charts were ordered from high to low total calorie count. We received feedback that this wasn't as clear as it could be, and instead, ordered the charts from low to high total calorie count, and grouped the largest band of the bar charts, the carbohydrates to the left of the graph, to allow for the easiest comparison of diet breakdowns.

c. **Hover and select interaction:** For stacked bar chart, we noticed that for some users the "hover" action linking the timeline and stacked bar charts was obvious, but for other users, they preferred a "select" action. To mitigate this, we implemented both interactions and found that this did not cause greater confusion when asking for user input.

d. **Color:** At first, in the map and line graphs, we colored countries using a single-color gradient. We experimented with a number of colors - ones that were part of the original color palette tied to each food group - but felt, and got feedback, that no colors of that palate were quite clear. Instead, we created a new three color gradient (green, yellow, red) that we integrated into the Illustrator files as well to clearly convey the healthy, middle, and unhealthy diets of countries.

e. **Tooltip:** We also created different variations in the formatting of the tooltip for all three Tableau graphs.

2. **Overall website design:**
   a. **Use of color:** We kept the website color palette to a minimum and used whitespaces to group and seperate content. Based on Marti's feedback during the final presentation, we added a colorful transparent background image that made the webpage look more attractive while at the same time minimizing distractions.
   b. **Changing font to be less bolded, easier to read:** We initially used the same bold fonts or the website as the Illustrator infographic Ed created. Based on the feedback received that the website presentation was hard to read, we switched to using an easy to read Sans Serif font (Futura).

3. **Story design:**
   a. **Clarifying healthiness score:** Our test users weren't clear about how the healthiness score was calculated, so we added an infographic explaining what comprised healthiness score and a list of healthy and unhealthy foods.
   b. **Adding in more countries to explore:** Marti gave us feedback to add additional countries to the infographic, so we modified our visualization to list all countries in the World Healthiness Score choropleth, This, in addition to the Parallel Coordinates chart listing the diet breakdown of all countries provides a complete picture of world healthiness and diet, The

user can drill down into further comparisons between the Top 5, Bottom 5 and Middle 5 healthy counties.

7. Demos

Visualization URL: https://rohitraghavan.github.io/dietnotherday/
Source Code URL: https://github.com/rohitraghavan/dietnotherday

8. Table of Work

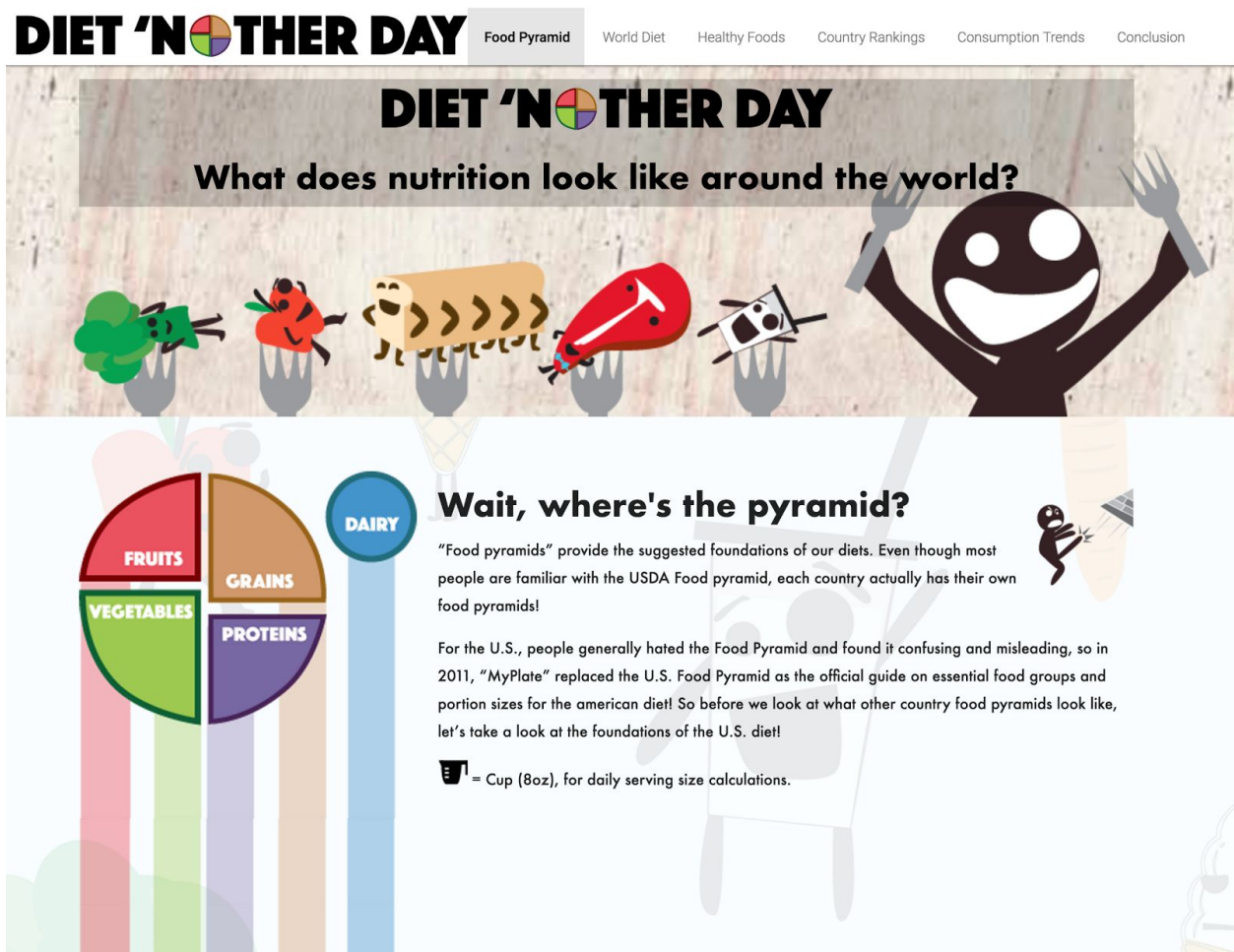| Task	Ed	Rohit	Shannon
Data scraping, cleaning	33%	33%	33%
Website layout	33%	33%	33%
Website design	-	100%	-
Illustrator visualizations	100%	-	-
Tableau visualizations	-	-	100%
D3.js visualizations	-	100%	-
Usability testing	33%	33%	33%
Report writing	33%	33%	33%

9. Additional Screenshots

Figure 8. Visualization Screenshot 1

Dairy

A healthy diet should include skim or 1% milk!

Consuming dairy products provides health benefits – especially improved bone health. Foods in the Dairy Group provide nutrients that are vital for health and maintenance of your body. These nutrients include calcium, potassium, vitamin D, and protein.

Fruits

Vary fruits and juice choices - they vary in nutrients!

Dietary fiber from fruits, as part of an overall healthy diet, helps reduce blood cholesterol levels and may lower risk of heart disease. Fruits are sources of many essential nutrients that are underconsumed, including potassium, dietary fiber, vitamin C, and folate (folic acid).

Vegetables

Choose bright colored veggies!

Vegetables are important sources of many nutrients, including potassium, dietary fiber, folate (folic acid), vitamin A, and vitamin C. Eating a diet rich in vegetables may reduce risk for stroke, cancer, heart diseases and type-2 diabetes.

Figure 12. Visualization Screenshot 2

Protein

Try a variety of protein food choices!

Proteins function as building blocks for bones, muscles, cartilage, skin, and blood. They are also building blocks for enzymes, hormones, and vitamins. Proteins are one of three nutrients that provide calories (the others are fat and carbohydrates).

Grains

Make half your grains whole grains!!

Most Americans consume enough grains, but few are whole grains. At least half of all the grains eaten should be whole grains. Dietary fiber from whole grains or other foods is important for proper bowel function and helps reduce constipation and diverticulosis.
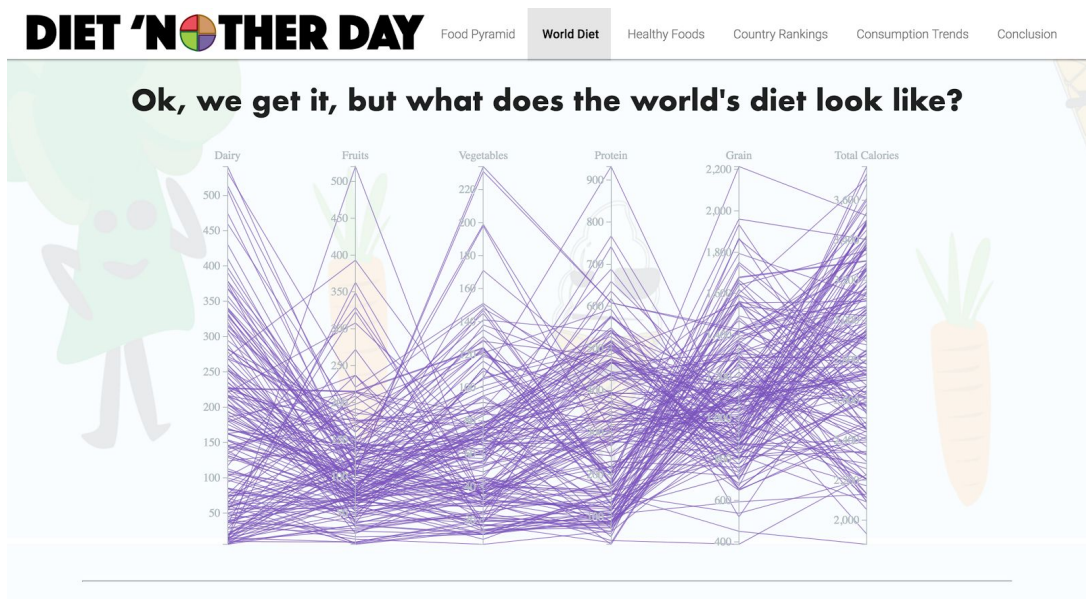
Figure 9. Visualization Screenshot 3

Ok, we get it, but what does the world's diet look like?

Figure 10. Visualization Screenshot 4

In 2016, The Lancet ranked 191 countries from most healthy to least healthy!
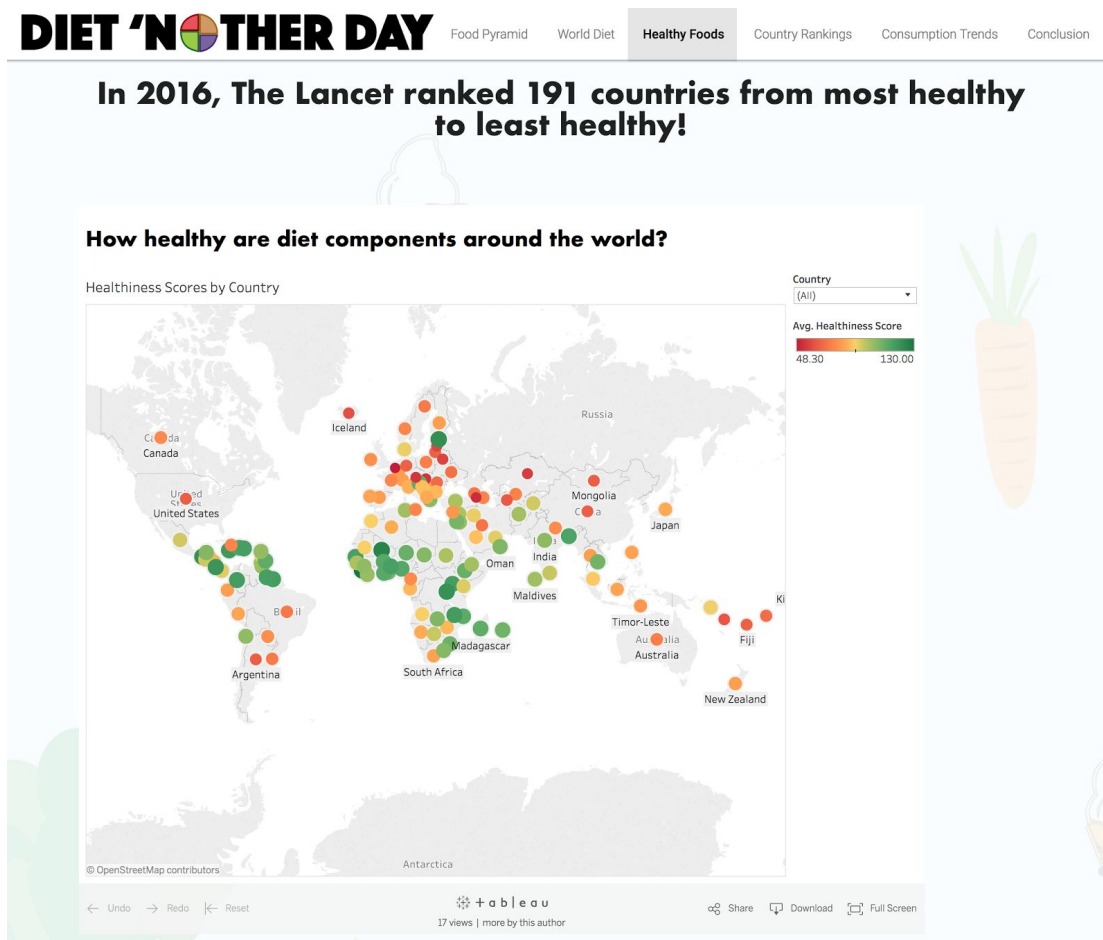
Figure 11. Visualization Screenshot 5

But wait, how is the healthiness determined?

SCORE — + EAT MORE

HEALTHY ITEMS

− EAT LESS

+

SCORE — + EAT LESS

UNHEALTHY ITEMS

− EAT MORE

=

TOTAL — + HEALTHY

COUNTRY HEALTHINESS SCORE

− UNHEALTHY

Unfortunately, just because something is in a food group does not make it a healthy food item...

Hi, I'm dairy!

Big whoop! So are we, pal!

Figure 12. Visualization Screenshot 6

So what are healthy and unhealthy food items?

Healthy	Unhealthy
Fruits	Unprocessed red meats
Vegetables	Processed meats
Beans and legumes	Sugar-sweetened beverages
Whole grains	Saturated fat
Milk	Trans fat
Fish	Dietary cholestrol
Dietary fiber	Sodium

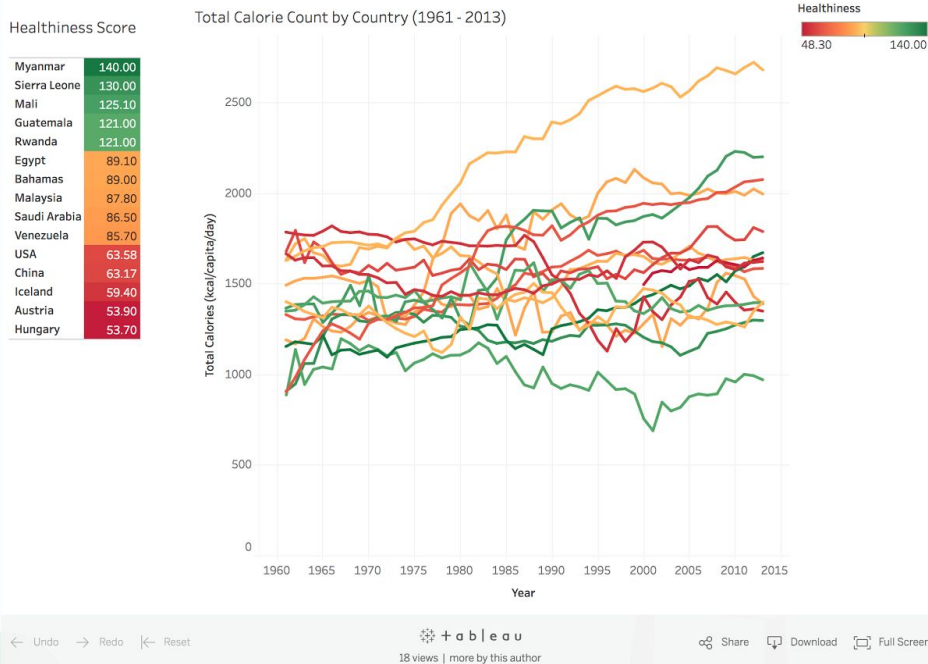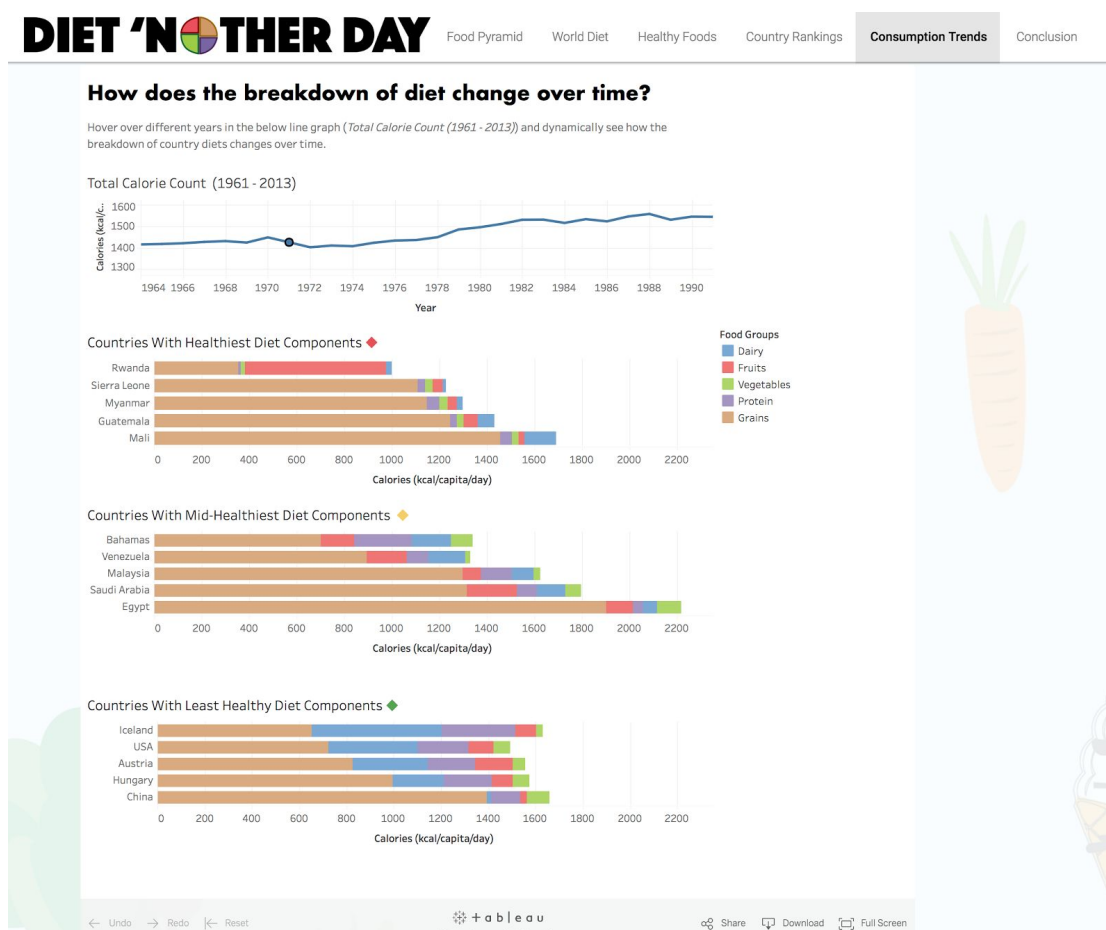DO EAT THESE!

DON'T EAT THESE!

Figure 13. Visualization Screenshot 7

Figure 14. Visualization Screenshot 8

Figure 15. Visualization Screenshot 9

Figure 16. Visualization Screenshot 10

Figure 17. Visualization Screenshot 11

So what does all of this mean?

Well, we see that diets change over time as some foods become more popular and some more available!

1960 ▶ 2015

And in order to know what we should eat, we've learned that there's a difference between food items and food group.

So if you want to be healthy:

1. Eat the right food items!

2. Eat enough healthy items from each food group!

Remember us?

(FOOD ITEMS)

vs

(FOOD GROUPS)

Figure 18. Visualization Screenshot 12

2. Eat enough healthy items from each food group!

(FOOD GROUPS)

But again, just as diets change over time, so do our food pyramids as we learn and adapt to improving understandings of nutrition and visual design!
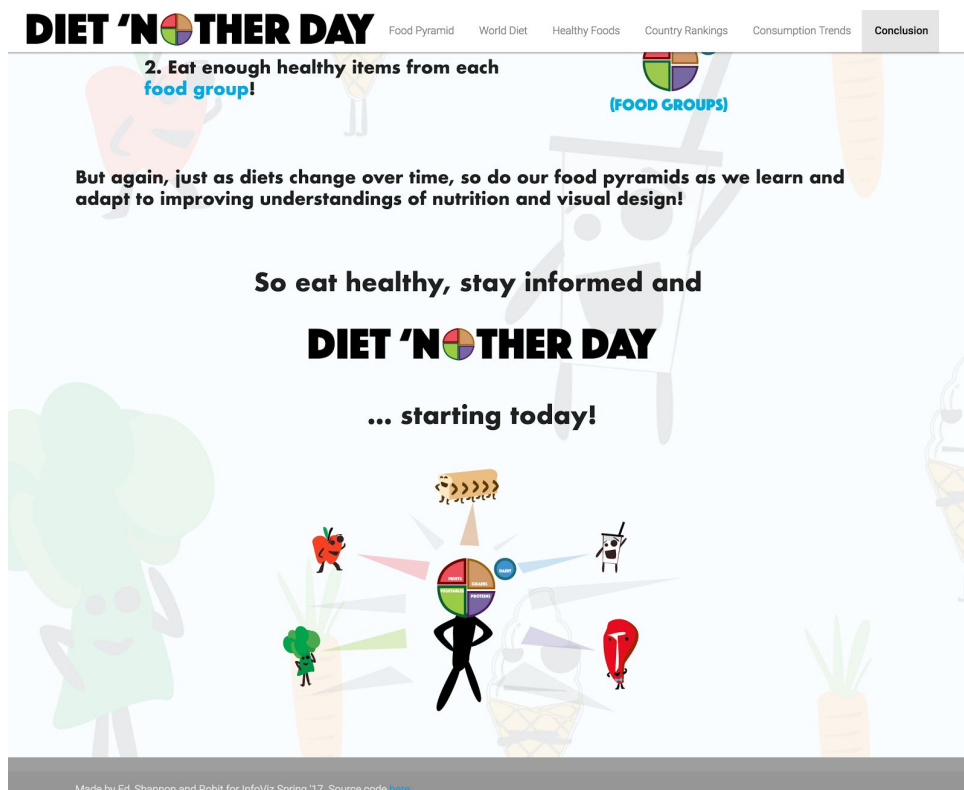
So eat healthy, stay informed and

DIET 'N⬤THER DAY

... starting today!

Figure 19. Visualization Screenshot 13