Process Book

“Feast For Your Eyes”

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Overview and Motivation

Feast Your Eyes is a fun way to explore different foods and their nutritional qualities. We provide multiple visualizations to explore foods and quickly see how healthy or unhealthy they are. We also have created a “meal planner” tool which allows you to select different foods and portion sizes to see how they together are meeting your nutrition needs.

We chose to focus our work on nutrition because it’s a topic relevant to everyone. Everyone eats, and most people feel some need to make conscious choices about the nutritional value of the food they purchase and consume. None of us have much background or research interests in nutrition, but we do find it interesting and a topic of value.

We want to provide an easy and understandable way for people to understand what they are eating or plan to eat by showing them to what degree their chosen foods fulfill their nutrition needs. It will also be a fun way to play with different options and see how that affects their diet outcome. Showing price will make it even more interesting, allowing users to discover relationships between nutritional value and cost.

One of our goals was to gain some experience building visualizations that allow the user more control over what is displayed. The meal view, in particular, was designed to allow users to choose the subject of the visualization.

Related Work

Our idea started with the data and topic, rather than a particular visualization technique. We searched through available data for something interesting, and the nutrition data caught our eye (we will discuss the data in more detail later on).

The original dataset we found appeared to be used for an app for a government website like choosemyplate.gov. Some of our team members remembered there being an interactive tool on that website which has been discontinued. We explored that website to learn about what guidelines are currently being given for nutrition plans. Here we discovered tables that give you how much of each food group you should eat based on your gender and age. Here is an example:

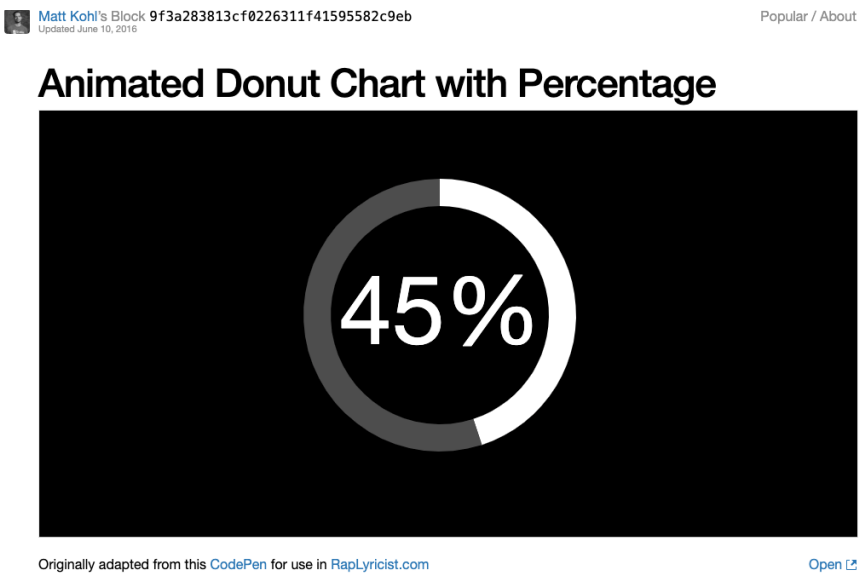
DAILY VEGETABLE TABLE

Daily Recommendation*		
Children	2-3 yrs	1 cup
	4-8 yrs	1½ cups
Girls	9-13 yrs	2 cups
	14-18 yrs	2½ cups
Boys	9-13 yrs	2½ cups
	14-18 yrs	3 cups
Women	19-30 yrs	2½ cups
	31-50 yrs	2½ cups
	51+ yrs	2 cups
Men	19-30 yrs	3 cups
	31-50 yrs	3 cups
	51+ yrs	2½ cups

That gave us the idea to customize the data shown on our webpage based on the specific needs of the person viewing it.

The linked table and scatterplot visualizations were inspired by some of the homework assignments we did during the semester. The meal planner section was partly inspired by the interactive tool that is no longer available, and was largely our own idea.

The donut charts in the table with text in the middle were partly inspired by examples online like this one:



Questions

The primary question we're trying to answer is how do the nutrient qualities and prices of common foods compare to each other?

Our original idea, based on our original dataset, was to show how different foods would fulfill the daily needs in each of the basic food groups, along with a tracker over time. However, we felt that that was becoming too much like an app rather than a visualization, and that showing nutrition facts like calories and sugars would be more interesting than food groups.

We found a new dataset to answer that new question. In addition, we thought it would add value to be able to compare prices as well, so we could answer questions like "is it more expensive to eat healthy?"

As we implemented the scatterplot, we realized that the data we were showing, which was based on the number of servings, could be misleading because of serving size. Because of this, we added an option to show the nutrition and price data per gram, which essentially shows nutrient density. This allows the visualization to answer two different questions - which foods are more nutrient-dense, and which ones will give you more nutrients per serving (which is more closely related to how much one typically eats).

Data

Once we identified a data source with detailed nutritional information about a wide variety of foods (https://fdc.nal.usda.gov/index.html), we had to do a bit of work to figure out how to extract the exact information we wanted. The nutrient names in the dataset didn't quite align with what we expected them to be, so we came up with a rough list of ones we thought would be relevant. Then we had to reference the documentation provided with the database exactly what information would align with what the average person would be interested in (there were several different measures of carbohydrate content, for instance). Using DBeaver to interact with the database, we developed a query to pull relational information about specified food items from the database.

We also found aggregate price information for some common foods at the following 2 places:
https://www.ers.usda.gov/data-products/fruit-and-vegetable-prices/
https://www.visualcapitalist.com/decade-grocery-prices/

We manually extracted daily value information for fat, carbohydrates, and protein varying by combinations of age, sex, weight, and daily calorie needs from this source, and set sugar intake to a flat rate:
https://www.nap.edu/catalog/11537/dietary-reference-intakes-the-essential-guide-to-nutrient-requirements

Data Cleaning

We kept track of how to join our different data sources for the nutrient/price datasets in fdc_usda_key.csv and pulled some additional price information manually from various "primary sources" such as Wal-Mart's website. While we only ended up displaying certain macronutrients in the visualization, we actually have around 20 nutrient columns that we could have added in if we had more time.

To approximate daily calorie needs and the recommended daily values for the other nutrients by age, sex, height, and weight, we used the Harris-Benedict Equation to calculate total daily energy expenditure for each combination, then used this as the recommended daily caloric intake (for maintaining weight) to compute the rest of the nutritional guidelines.

Both datasets are prepared and exported to json in **preprocess/wrangle.R**.

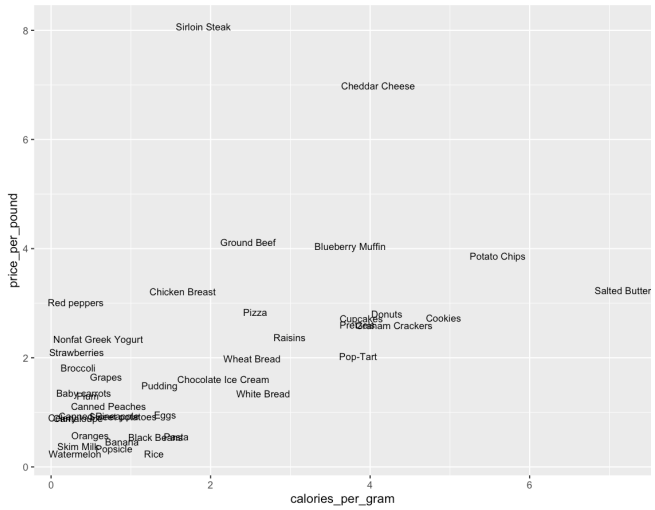
Exploratory Data Analysis

Our data was small enough that tabular analyses were sufficient to validate what we planned to do with the data. For instance, calculating price "per pound" and nutrients "per gram" for each

food helped sanity-check the numbers that came out of our processing pipeline and choose appropriate serving sizes.

category	mean_price_per_pound	min(price_per_pound)	max(price_per_pound)
grain	0.93	0.24	1.99
produce	1.34	0.24	3.01
compound	2.47	0.34	4.04
dairy	3.24	0.38	6.99
protein	4.09	0.95	8.07

Here, for instance, we can see how much more expensive dairy and meat products are than both produce items and mass-produced snacks.

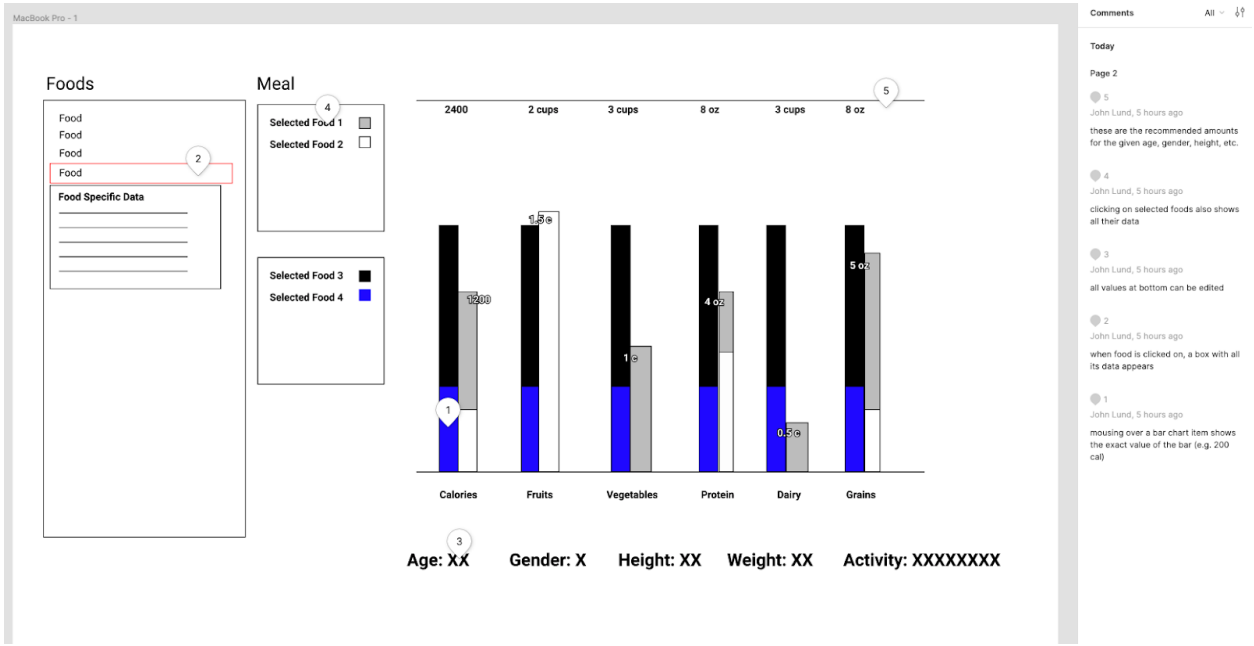


Plots like this helped show us that the serving sizes for butter, chips, and cheese should be adjusted to reflect the fact that people are probably not eating these foods at the same rate (with respect to mass) as they are things like bread or beans.

Design Evolution

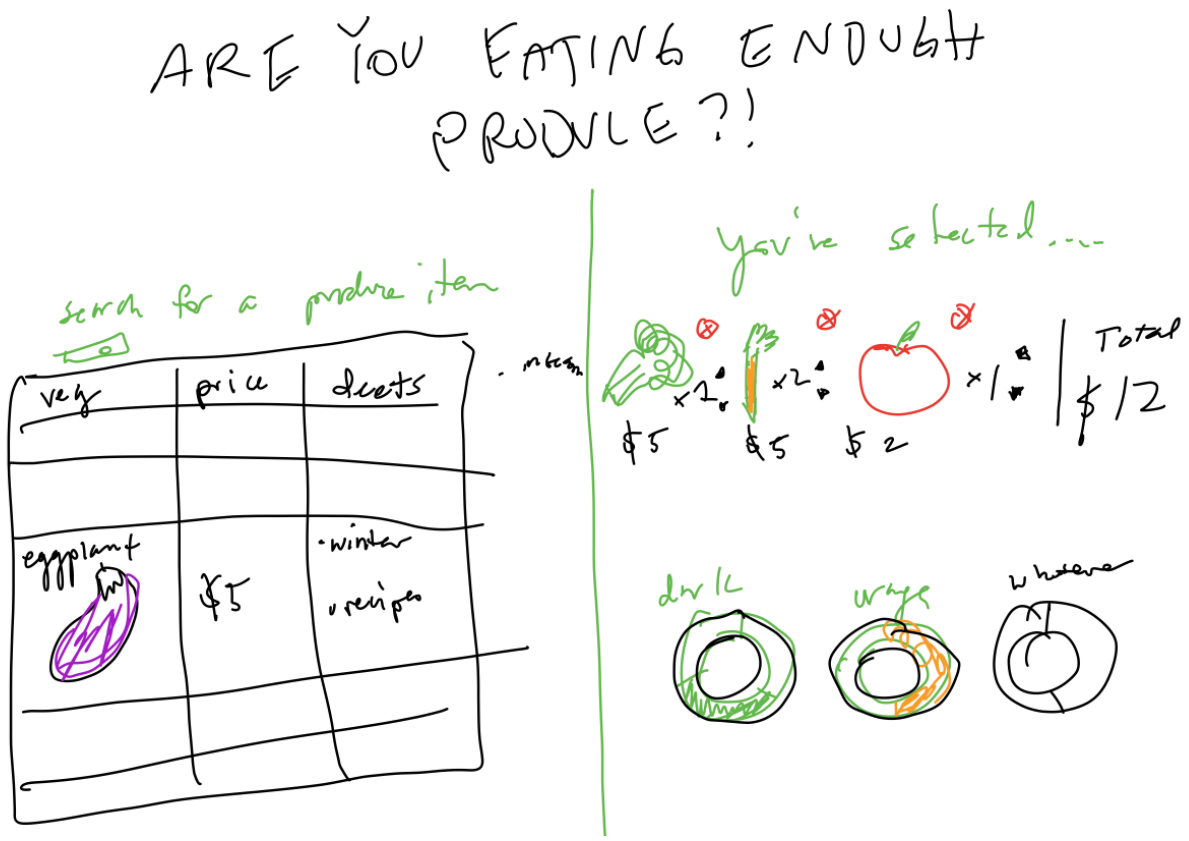
Proposal

These are our initial prototypes:



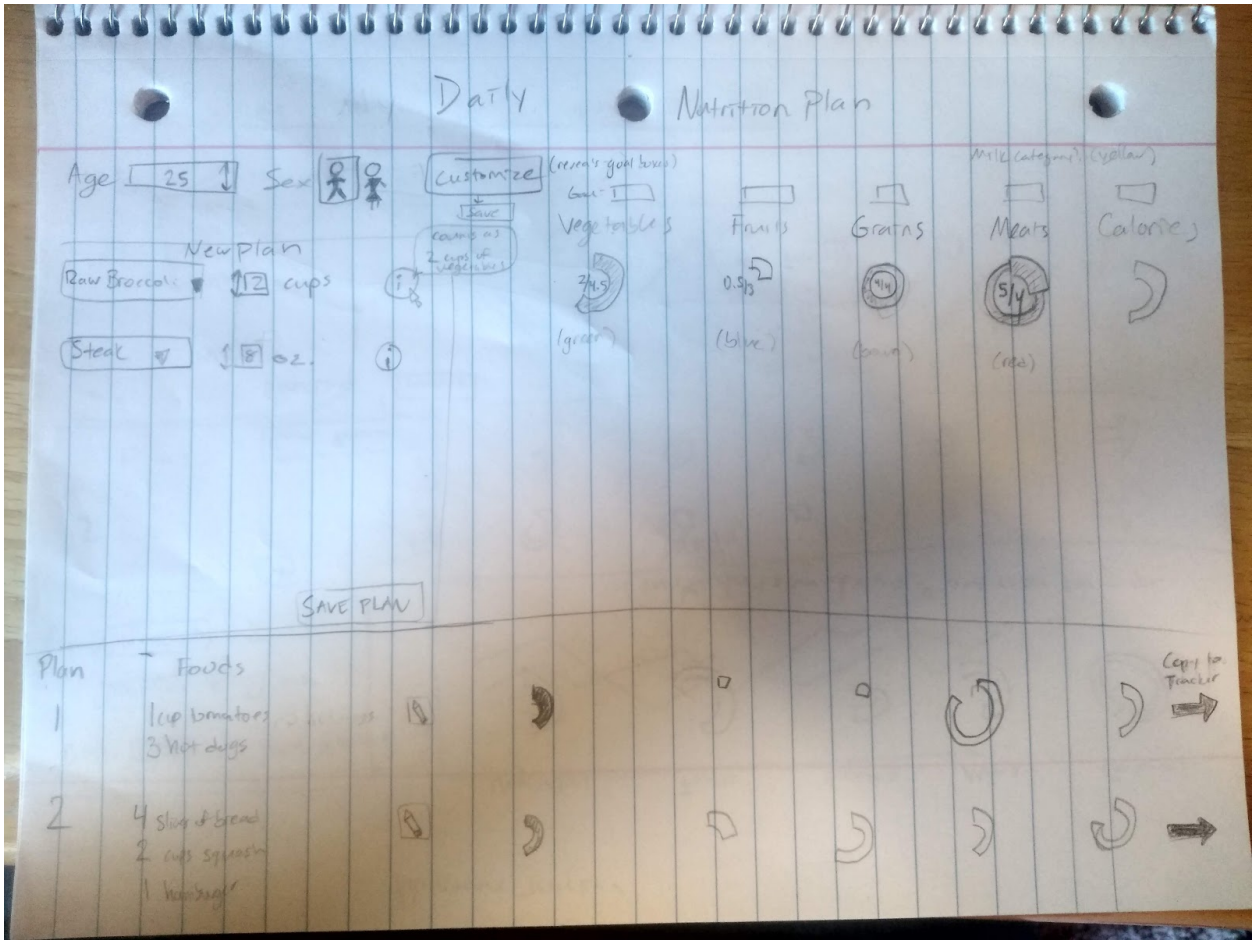
Prototype 1

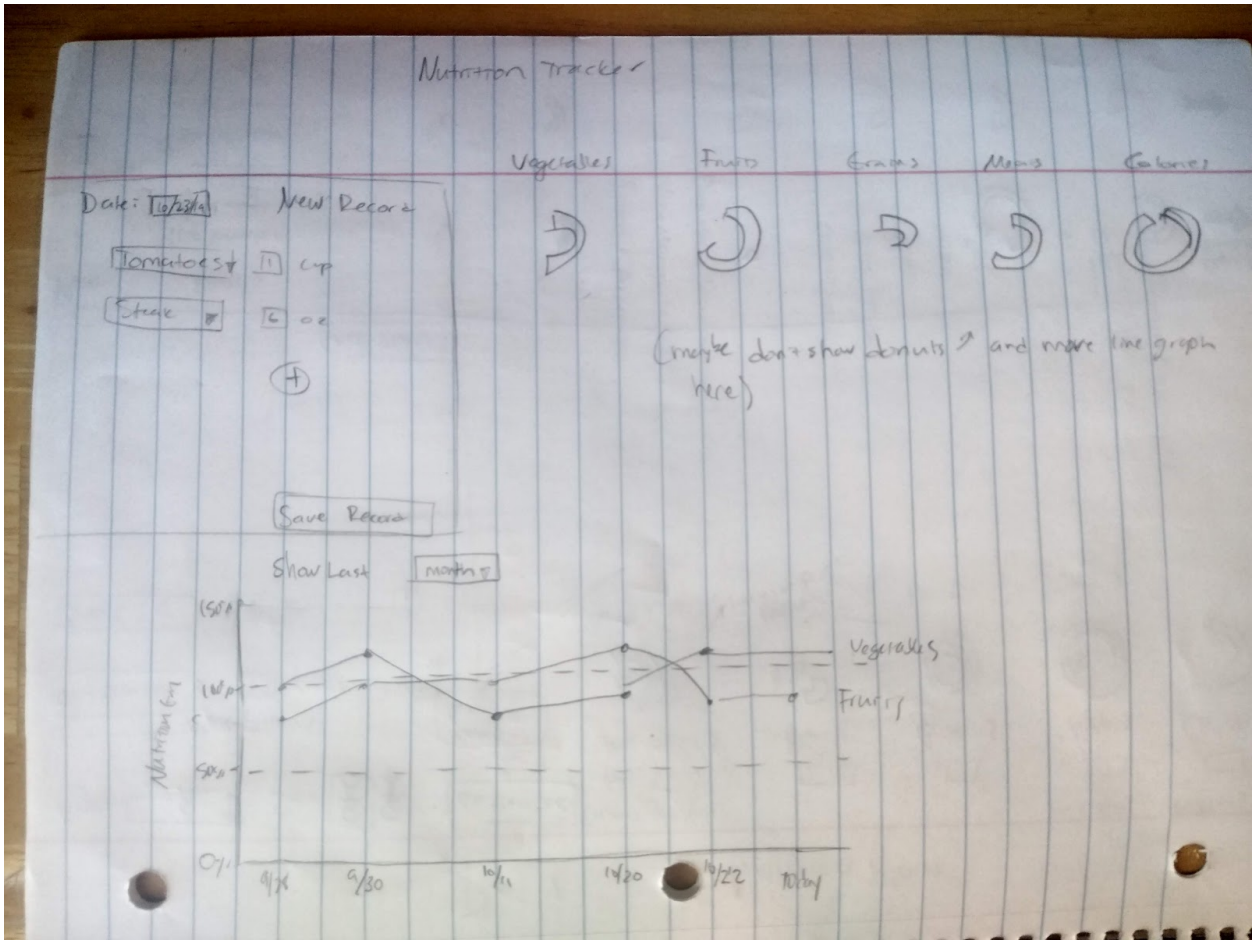
The idea behind this prototype was comparing how much foods contribute to the daily recommended amount of each food group across foods and across combinations of foods. Stacked bar charts were used for individual meal to allow users to see both the total daily contribution and how much individual foods were contributing. The bar chart groups help users compare how each meal (or group of foods) contributes to the daily recommended amounts of calories and food groups. More specific data about individual foods can be observed on demand by hovering over the name in the list on the left. The scale of the chart also changes based on the demographics of the user (age, gender, weight, etc.) such that the y max is the daily recommended amount. The overall goal is to make comparison between foods and meals easy with regard to daily recommended amounts of different food groups and calories.



Prototype 2

This idea was to have a table on the left showing the data with icons, and on the right show how much of each food group you're getting with icons. This breaks it down into subcategories as well.

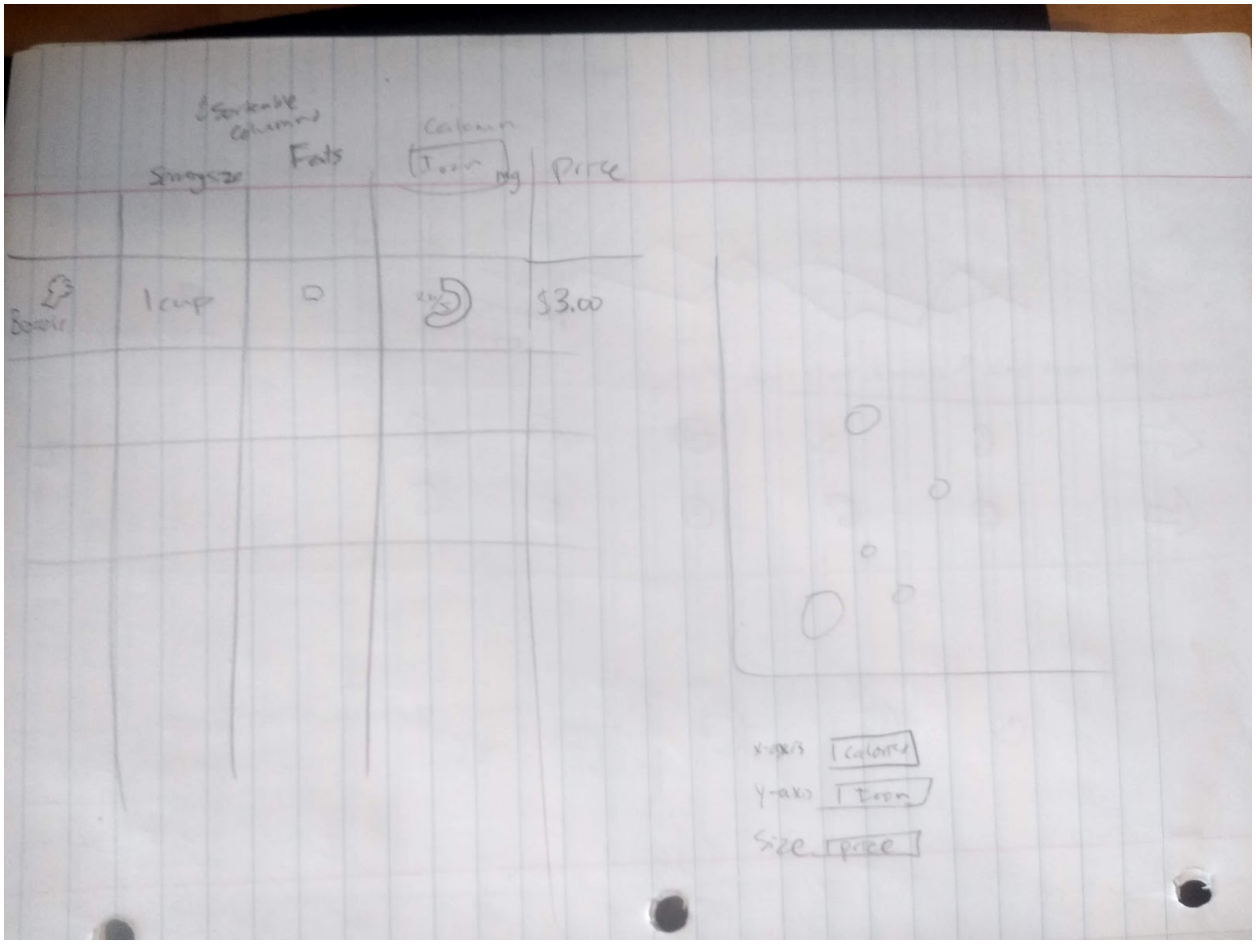

Daily Nutrition Plan
Age 25
Sex
Customize
Save
counts as 2 cups of vegetables
New plan
Raw Broccoli 2 cups
Steak 8 oz.
Veggie's goal boxes
Goal: 1
Vegetables
Fruits
Grains
Meats
Calories
Milk (category?) (yellow)
2 1/2 C
0.5 C
3/4 oz
5 1/4 oz
(green)
(blue)
(grain)
(red)
SAVE PLAN
Plan
Foods
1
1 cup tomatoes
3 hot dogs
2
4 slices of bread
2 cups spaghetti
1 hamburger
Copy to Tracker

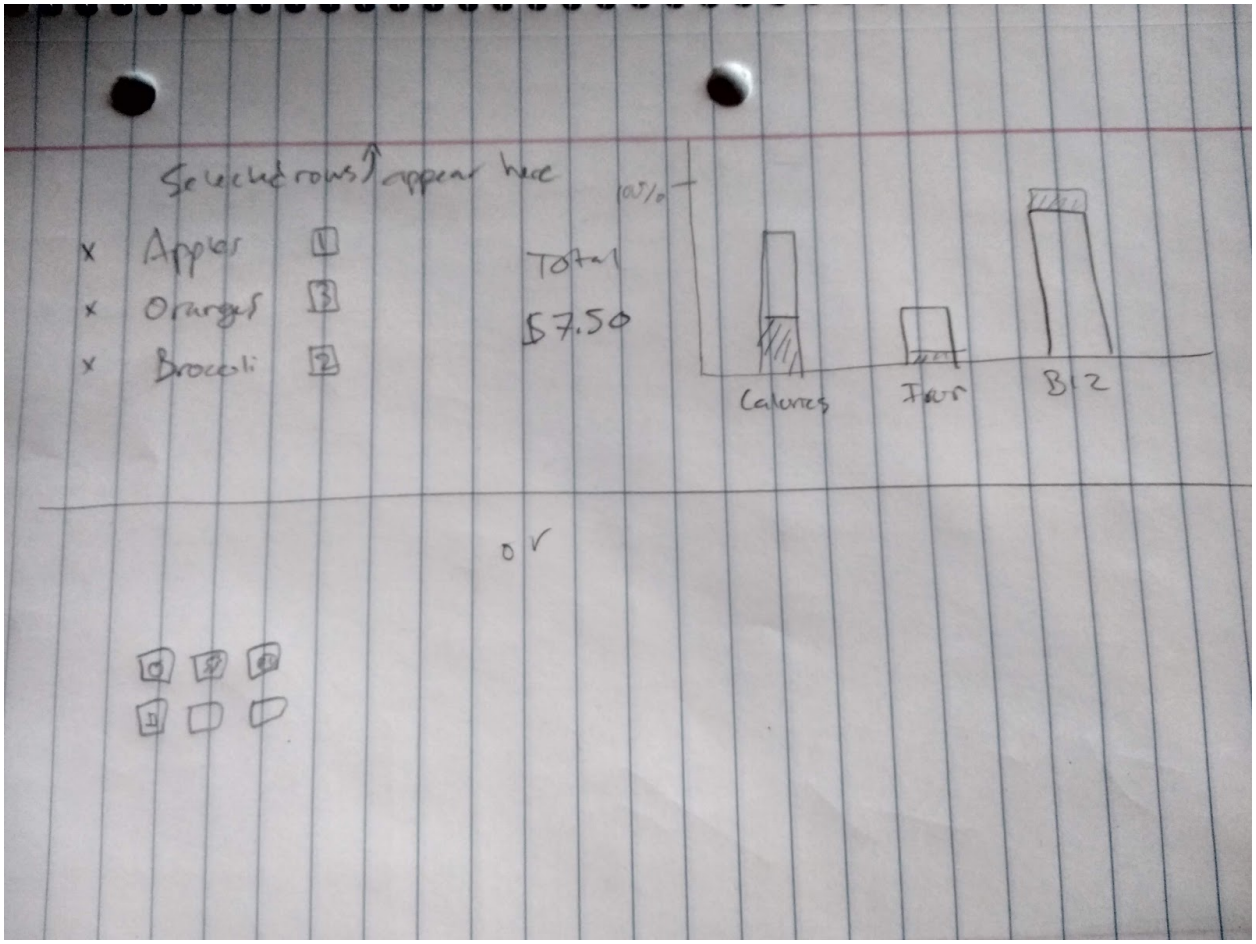


Prototype 3 (above 2 images)

The idea behind this was to allow the user to input information about themselves, which we would use to determine their nutrition needs. Users would select different foods to create a “meal plan,” and we would display how those foods combine to meet their needs for the different food groups by showing donut plots. We liked the idea of donut plots because they show progress towards a goal, or part of a whole. This was based off of our initial dataset, which gave us information about food groups, but not nutrition data like protein and carbs.
The second view would be more of a tracker, where the user would input what they actually ate, similar donut plots would show to what degree their nutrition needs were met that day, and a line plot would show their data over time so they can see if they are consistently lacking in any areas.

This was our final prototype in our proposal:





We found a dataset that we felt better met our goals, because it provides nutrition information rather than just food groups. We thought we could show all of the data in a table, with each food item we choose to include in the rows (optionally with icons by the food name), and columns will show the serving size and the nutrition facts we perceive as most relevant/interesting. Each cell will show a donut plot showing how much of their nutrition needs would be met by a serving of that food. Finally, as an optional feature if we can obtain the data, we would display the price. This table will take up the left side of the page. We think a table will be a good way for someone to view all of the information quickly without having to select each food item one by one, and the columns allow for some comparison.

On the right side, we will have a scatterplot. The user will be able to select what feature to use for the x-axis, y-axis, and circle size. We may optionally include icons of the foods on top of the circles. Circles will be color-coded based on their food group (vegetables will be green, etc.). That same color scheme will be used for the table labels.

Below the scatterplot we will have a feature allowing the user to select a group of foods and quantities to see how a “meal plan” will fulfill their nutrition needs. A stacked bar graph will display how close to 100% they are for each nutrient, with the layers of the bars being color-coded to match a food item so they can see how much each food is contributing to the nutrient. If our number of foods is small enough, we may have a grid of icons they can toggle

on/off instead of using drop-downs to select foods. If we obtain price data, we will display the total price of the selected foods next to the bar graph.
The views will be interactive. Rows in the table will be selectable/hoverable and will highlight the corresponding circles in the scatterplot, and vice versa. Tooltips will be used to provide additional information on hover. We may allow users to add foods to their “meal plan” by selecting rows in the table.

The scatterplot and bar chart used position and length encodings, which we learned are some of the most easily perceived attributes. We originally were going to use circle size as well, but since area is harder to visualize and we didn’t really need 3 channels, we chose not to use. The donut charts use angle, which isn’t at the top of the list, but not too bad, and shows a part-of-a-whole relationship, so we felt that was a good choice.

Peer Feedback

The following are our notes from the peer feedback we got in class.

Suggestions from peer feedback:
- need table to be scrollable
- cap the number of colors/foods in plate view
- hover selection instead of coloring stacked bar chart / hover highlight
- premade meals for storytelling
- fix columns in table to macros; nice to have is add more
- compare meals: nice to have … maybe … but if we do, color code which is "healthier" ?
- because the list of foods is long, we need a search bar for the meal maker - but can also have a grid of graphics to select like slack emojis
- nice to have: tooltip or color mapping showing healthy ranges for each variable in table

10/30 Meeting

We met to discuss changes to our design based on the peer feedback and other thoughts we had.

Table decisions
Which columns are we showing?
Default
- Calories
- Protein
- Total fat
- Sugars

- Carb by summation
- Price
- Serving size
- Food name

As a nice to have feature, the user can manually change the columns.
Table columns can be removed by clicking an X above the column

We need to find another data source for age, gender, etc. tied to daily recommended value.
We need to display a bar at the top where people can select demographic information.

For units in the table, put them in the header and make the header sticky when scrolling so they're easy to see.

Make derived columns that show nutrient density (nutrient per unit rather than per serving)
Also, show some presets by the scatterplot that guide people to interesting configurations (storytelling).

Show a tooltip on hover
- Name of food
- 3 data points that are being represented

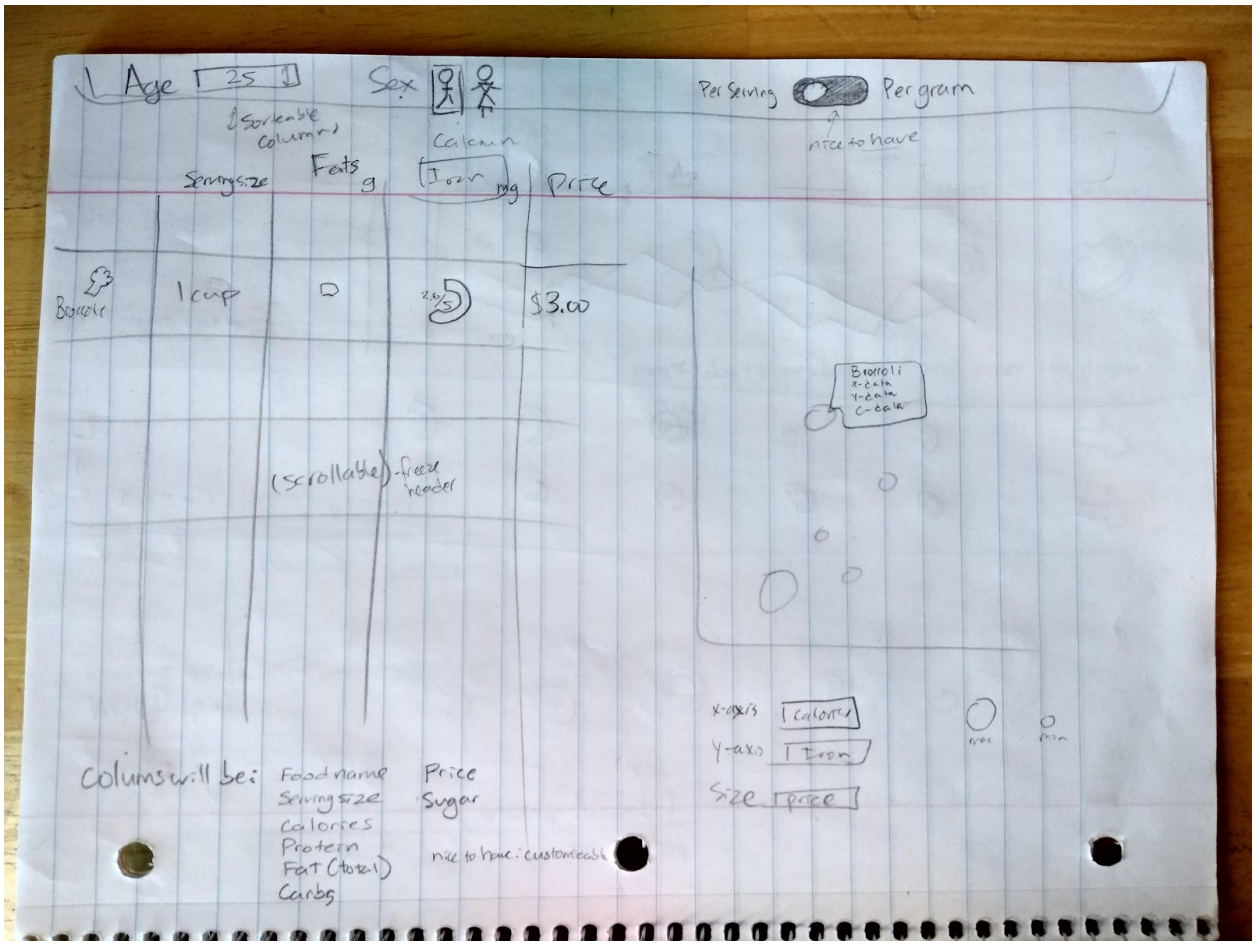
Colors of circles will indicate food group
- Vegetable - green
- Fruit - red
- Protein - purple
- Dairy - blue
- Grains - orange
- Dessert - pink
- Pizza, etc. - brown

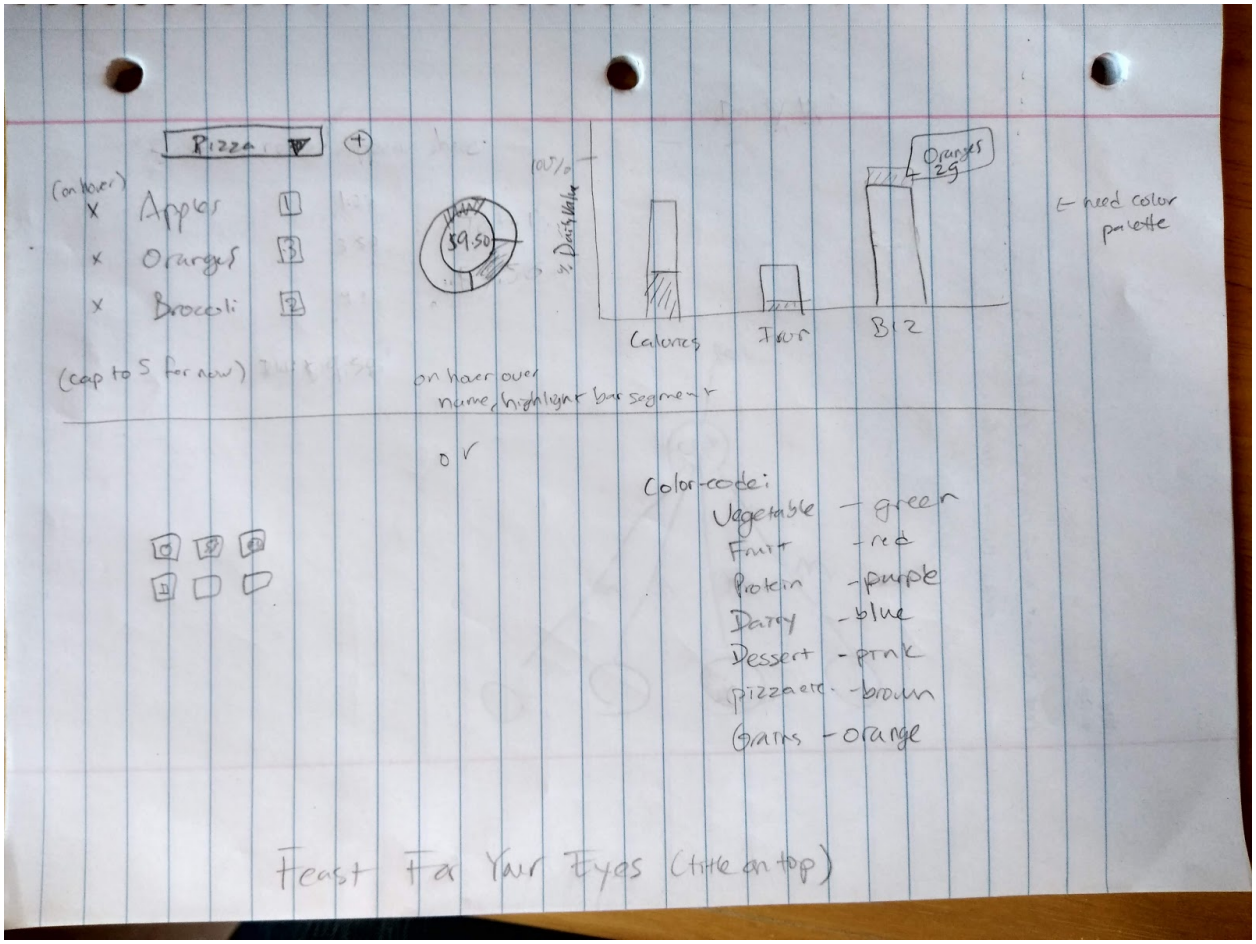
These colors were based on the food groups in MyPlate. However, we decided that Lizzie would find a good, color-blind accessible color scheme based on those basic colors.

Meal Builder
- Show search bar to help find foods to add
- Limit to 5 foods (we can revisit later)
- Nice to have: on hover, show the impact of adding the selected food)
- Only show default categories on meal plan graph
- Show price with donut chart showing the breakdown of how much each contributes

We decided to use a total width of 1500px.

Design After Feedback:

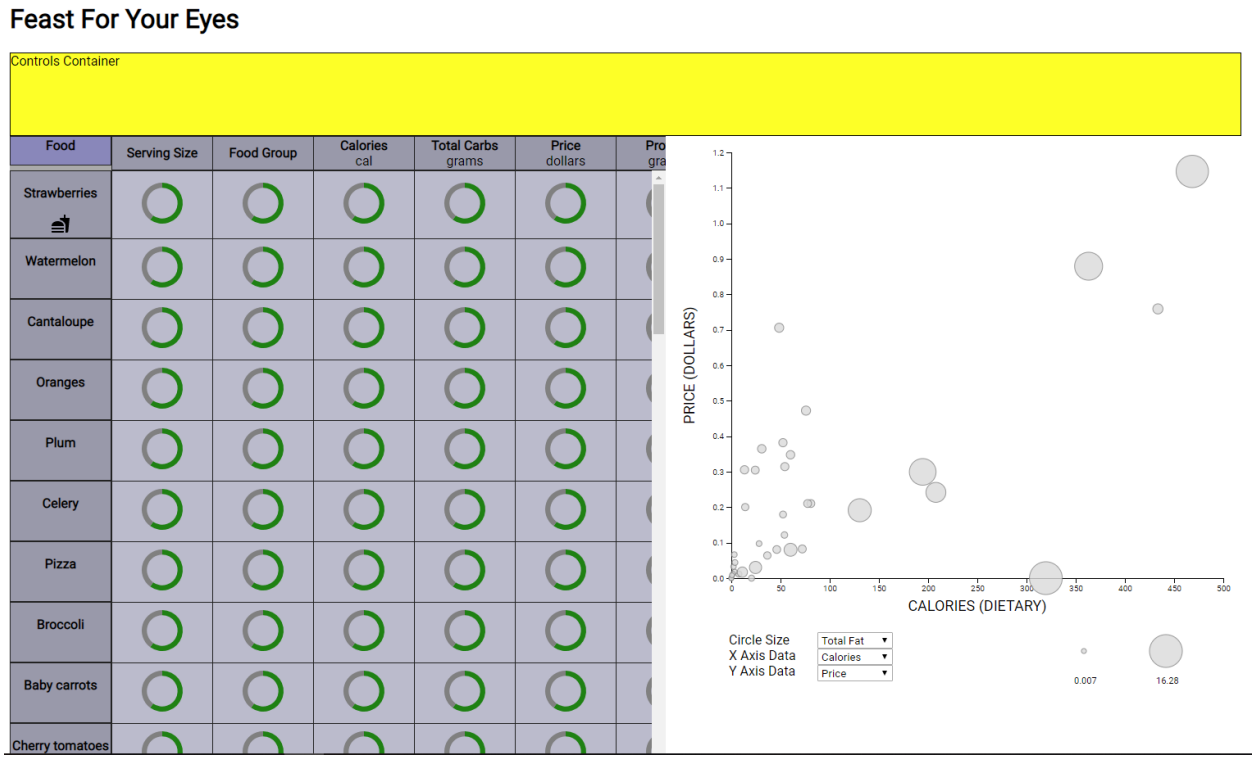




The per serving/per gram switch would be a nice-to-have feature, and the bar chart segments would be color-coded to match the food names in the menu section. We'd have to limit the menu to 5 food items since we are using color-coding.

Along with these design changes, we changed our data source and aggregated the nutrition and price data, as discussed in the Data section.

Design Changes After First Week of Coding



This snapshot shows the state of our visualization after the first week of coding.

After implementing our initial designs of the visualizations, we made a few design change decisions.

For the meal planner visualization, we decided that we shouldn't cap the number of selectable foods, since the idea is to input all the food you would eat in a day. To account for this change, the bar graphs will be one solid color, rather than segmented in different colors for each food item. As a nice-to-have feature, when a food is selected in the search bar/dropdown, the change it will have on the bar graph will be displayed in a grayed out or semi-transparent way.

In addition, we realized that the bar graphs will likely go above 100% regularly, so we will dynamically change the axis to accommodate the largest value plotted. The max will never go below 100%, and there will be a dotted line displayed at the 100% mark.

We also discussed whether or not we will allow users to choose different demographic info like gender, weight, age, etc. to adjust the target amounts for calories and daily values. We decided that this would be a nice to have feature that we'll add at the end if we have time. For now, we'll use the default values we already gathered.

We decided the food category data provided wasn't sufficient so we manually categorized each food and added it to the data.

A significant challenge was getting the headers and first column to be "sticky". We wanted these to stay in a fixed position when scrolling vertically or horizontally to make it easier to keep track of the large amounts of data in the table. We got the functionality working by adapting this example (https://jsfiddle.net/RMarsh/bzuasLcz/3/). It works fairly well right now, but the width and height have to be manually synced between the main table cells and the headers which is annoying.

Upon implementing the scatterplot, we realized that the option to display the information "per gram" as well as the default "per serving" will be important because there are some trends you can see in the scatterplot, but they may be more related to variation in serving size rather than nutrient density. We are now going to consider that a "must have" option. We decided it will only apply to the scatterplot, however, so we are going to place the switch for that underneath the scatterplot with the other controls. There is whitespace available there, and placing it there will communicate that it is only for that one visualization.

Further familiarity with the database allowed us to extract a more complete, accurate, and useful nutrition dataset in the second week. Serving sizes were roughly standardized to cups when possible so that total nutrition content values remain roughly on the same scale even when not plotted "per gram." We now have an internally complete dataset for a good handful of food items.

November 1 - TA Feedback from Kiran

We received the following feedback from Kiran over email:

The idea sounds great!

Following the links is dataset,it seems the datasets are largish. Combining datasets from data sources also takes a significant effort/time, this concerns me a bit but if you stick to the timeline in the proposal it should be okay.
Having a small subset derived for visualization is a good idea. The proposal mentions iconographic scatterplots, it is a visually appealing technique. However glyphs need to be designed properly, even for ~100 points, it can get cluttered and difficult to interpret. This can be mitigated by 'glyphing' the categories of the food, rather than each food individually or using colors.

We decided to forego the idea of using iconography in the scatterplot. Instead, we only used the glyphs with the table and menu.

I couldn't find any explanatory text for Prototype 2, but I like the final prototype.

For the table view I like the idea of donut plots. My concern is the size of the cell will cause the donut to be small, as well as depending on food and nutrient, the share will be a small part of whole, causing the donut to be a really tiny sliver, however that depends on the data! A nice touch will be to display the actual percentage in the center of the donut as text, so it's easy to read Immediately.

Upon inspecting the data, we determined that some of the donut plots would be quite full, with some even 100% full. There are many that are quite empty, but there are enough that are more full that it seems like a reasonable technique, and the empty ones stand out as being different than the others. We decided to continue with the plan to do the donut charts, including the text in the center.

The table view should probably have filtering and/or search and an option to group the foods by categories. This can be dropdown based or glyph based as you mention in the proposal.

We chose to implement sorting in each column, but didn't provide a way to explicitly filter or search the table.

The meal plan idea is great, I would love to actually use it!

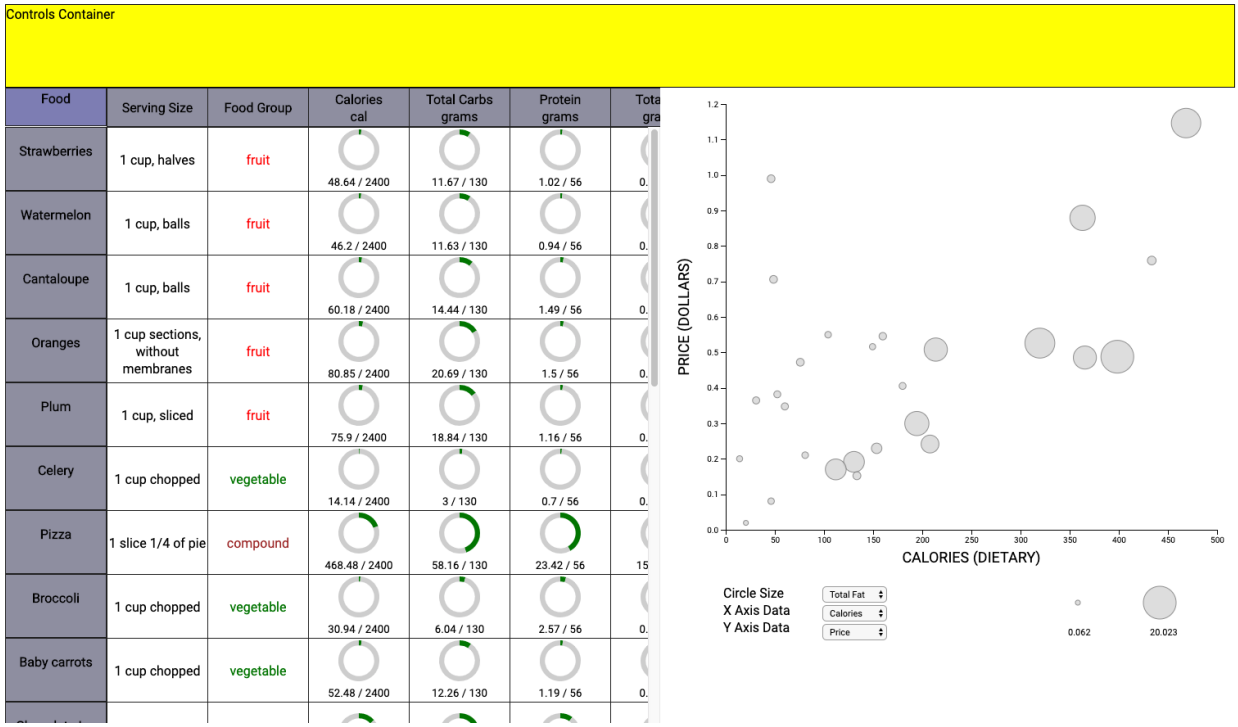
Overall this is a great proposal and I am excited to see the final result. Hope to see this project in hall of fame for next year!

We were motivated!

November 7

Here is a screenshot of our progress:

Feast For Your Eyes



The biggest changes were for getting live data to show up in the table. A label for each chart was added since some of the values are incredibly small. The label makes it easier to compare extremely small values. We decided to round the values to 2 decimal places to keep the labels short and consistent across the table. A problem with the current donut charts is that many of the values are really small. We may need to switch the scale to be relative to the max and min of the dataset or to a different visualization altogether.

Another challenge was converting some data into grams from %kcal. We had to do some research to discover the conversion. It ended up being
Grams = target_calories * %kcal / calories_per_gram_of_nutrient.

We initially planned on having the visible columns be tightly bound to the axes of the scatter plot (i.e. the first 3 columns in the table are the axes in the scatter plot), but we decided to keep them independent to avoid confusing users and allow easier browsing of the table.

We also found that the text for some of the serving sizes was extremely long and messing with the height of the cells in the table. As a result, we decided to truncate the text to fit. We may show the full text on hover, but that's undecided.

We decided that hovering over circles or rows highlights the location of the corresponding food in the other vis (scatter plot or table).

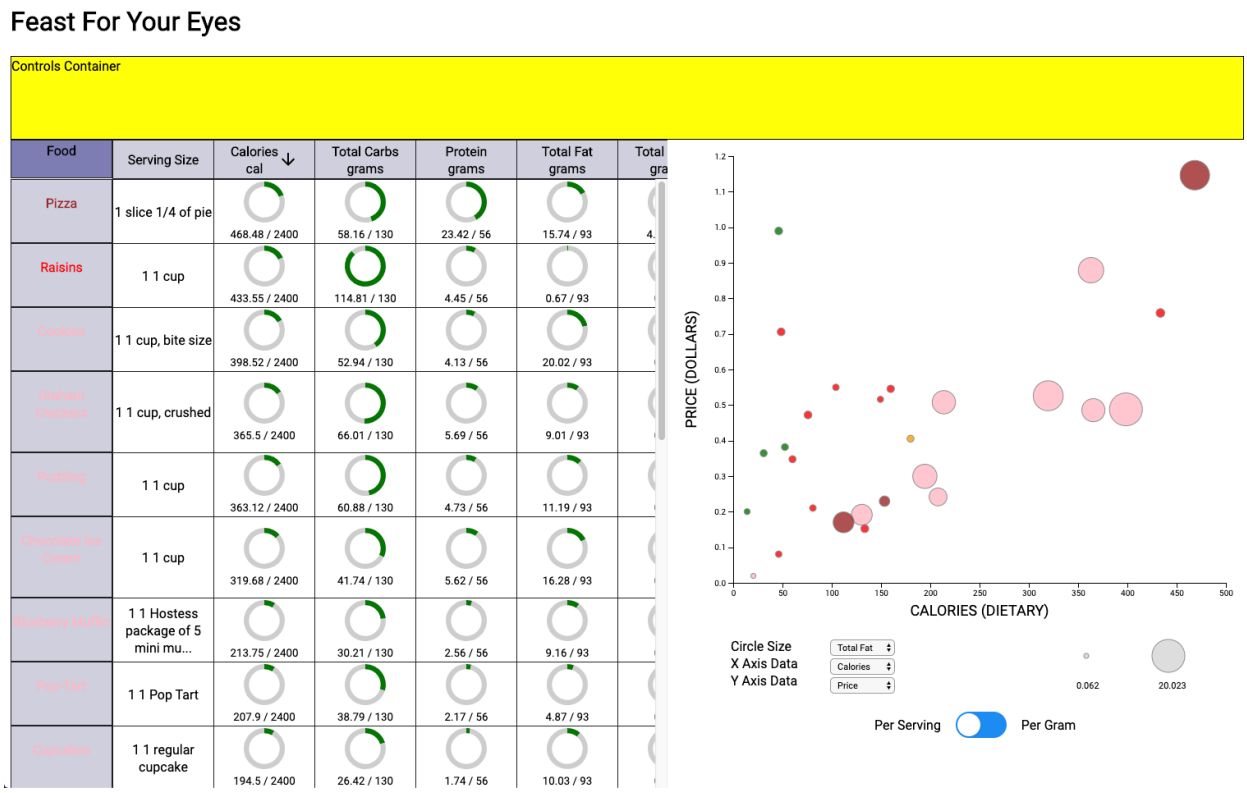
November 8

For the scatter plot we added coloring based on food group, to match the coloring done in the table. The most significant update was adding the “per gram” switch. Switching to “per gram” mode updates the axes and locations of the circles based on the value per gram rather than per serving, which is a better indicator of nutrient density.

We decided that the “per gram” mode will only apply to the scatterplot, because that information wouldn’t be useful for the other views. Accordingly, we moved the switch to be below the scatterplot instead of at the top of the page to communicate that it is a control for that view only.

We decided to try to simply color the title of each food according to the food group so we could remove the food group column from the table. We’re not sure if this will stay since this means users can’t sort by food group which may be useful. This change also necessitated lightening the sticky header and column so the titles could be read in various colors. Some of the colors still don’t look good, but they’ll be changed once Lizzie makes the new color scheme.

We also implemented sorting in each of the columns. We decided to include arrow glyphs to make it clear which column the table is currently sorted by (see the Calories column below).

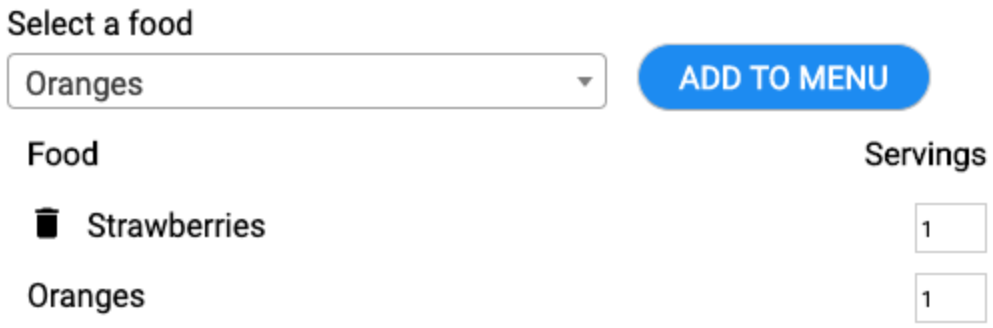


November 11 Team Meeting

We decided to switch from using an SVG for making the list of foods in the meal planner to being just a list of html objects to make it easier to change them dynamically. We also decided we should add a title for the meal planner part of the site to help visually separate it from the visualizations above and also make its purpose clear.

November 13

We fixed the meal planner list of foods to be vertical and to show a way to remove them on hover by making the trash icon appear.



Meeting with Kiran

Kiran advised that we make the following adjustments to improve our project.

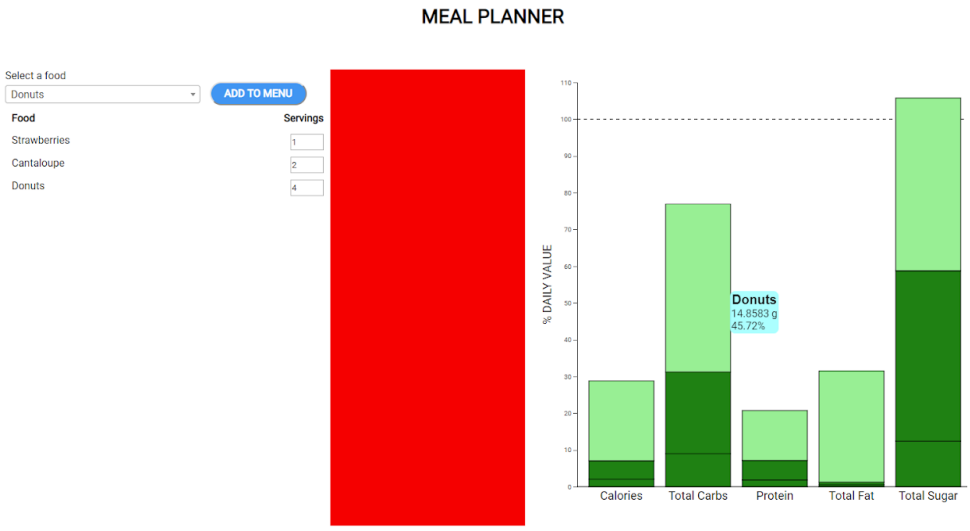
- show color legend for food groups
- make sure colors are accessible (put in process book)
- lighten cell borders
- make header and first column white background
- move values to center of donut chart and
- pick color for donut that is neutral
- remove size as an attribute of scatter plot and remove legend for circle size
- make sure height of tables and scatter plots match up, or center scatterplot vertically with table
- Fix calories sorting
- reduce width of columns if they're fixed
- make serving size a component of the fixed part of the left

- make meal planner vis separate
- try using a css library like bootstrap
- use presets for storytelling
- make sure axes on the scatter plot make sense when switched to grams

We made plans to implement all of these suggestions.

November 15

We implemented the stacked bar chart as seen below.



We chose not to color-code the bar segments, to allow for a large number of food items (no cap) to be added to the menu. When you hover over a segment, it highlights all the bar segments that correspond to that food. In the future, this will also highlight the row in the menu.

After the initial implementation, we decided to add a tooltip to show what food is highlighted as well as the precise nutrient amounts and percentages, since it is difficult to derive that number from the graph itself.

The axis always goes up to at least 100, but will expand if bars extend above 100. When this happens, the bars often don't grow or even shrink, so we animated the axis and 100% line to make it easier to see what change is happening when the axis expands. We also added animations to the bars themselves.

As Kiran suggested, we made the Meal Planner section taller to fill the screen. This may take further adjusting.

We will also need to determine what color to use for the bars, since green may be used to encode one of the food groups.

We made some changes to the scatterplot as well, as shown below.

As Kiran suggested, we removed the Circle Size option and made all the circles a uniform size. This makes it look cleaner. This involved removing the dropdown as well as the legend, so we moved the switch up where the legend was.

We changed the “Per Gram” option on the toggle switch to “Per 100 Grams.” This made the numbers and axes much nicer, since when it was Per Gram we’d get numbers like 0.003 on the axis. We added transition animations to the axes so it’s easier to notice if we’re zooming in or out when we toggle between modes or change the axes.

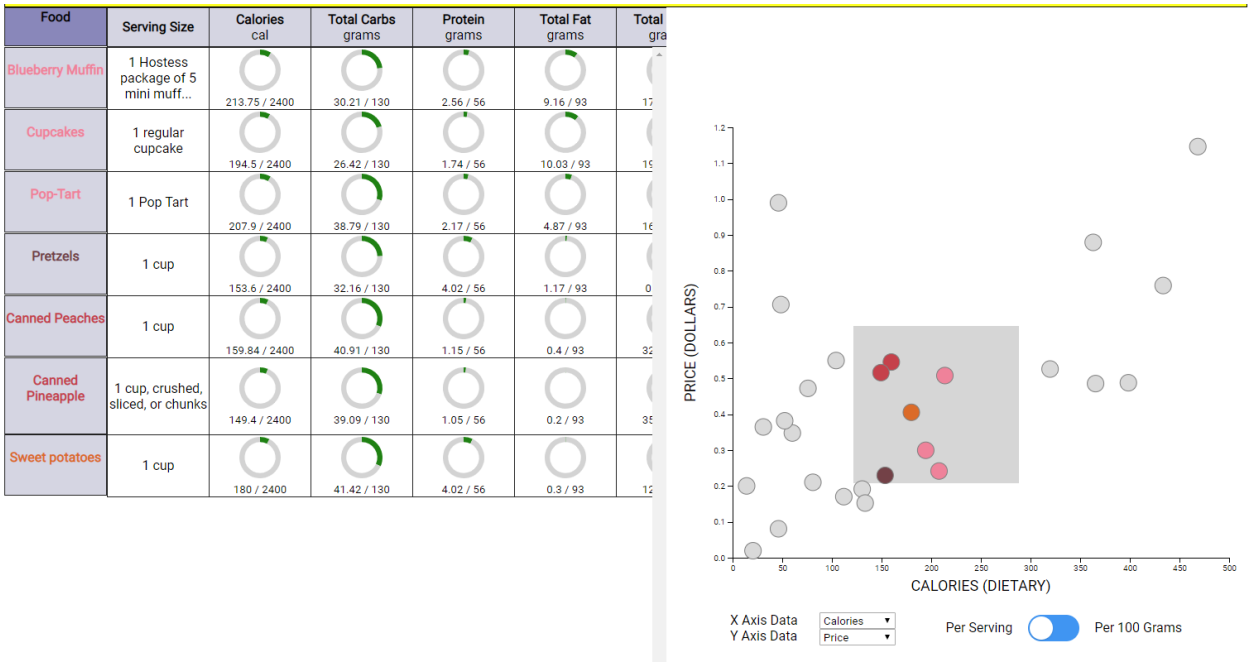
We moved the tooltip a little more to the side so it doesn’t occlude the circle. We increased the stroke width and darkened the stroke when hovering over a circle so it’s easy to see what is selected. We added an interface with the table, which we still need to implement, which will highlight rows when hovering on a circle, and vice versa. We changed the circle opacity to 1 to show the true color, and because they don’t overlap very often.

Finally, we centered the scatterplot vertically with the table to give the page a more balanced look.

You can also see in this screenshot that we started adding food icons in the table.

November 20

We added a brush to the scatterplot.

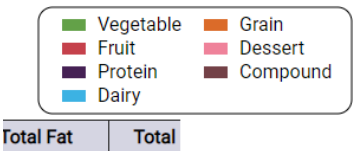


The brushed circles update the table so only the highlighted circles appear in the table. Clicking anywhere on the right side of the screen clears the brush, but not the left side, so you can still sort the table, etc.

The brush added a filtering functionality that we weren't able to achieve before. It's useful to be able to view and compare the points in a specific part of the scatterplot. It is also something that a user might expect, so it's good to have it implemented.

November 21

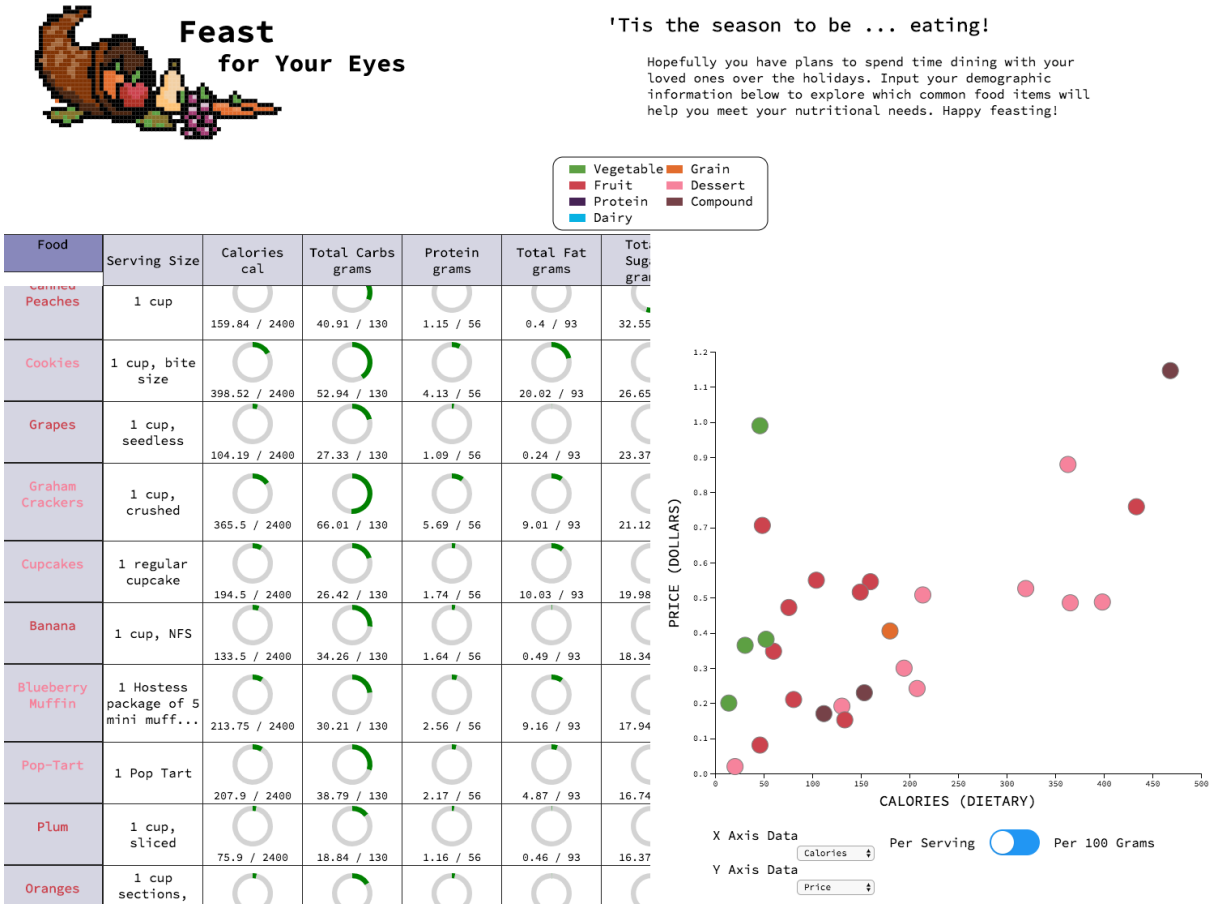
We added a color legend for the food groups.



We chose a color palette that is color-blind accessible (validated using tools provided by Coolors.co) but still closely resembles the colors used in MyPlate. We centered it between the table and the scatterplot to communicate by its position that it applies to both visualizations.

November 25

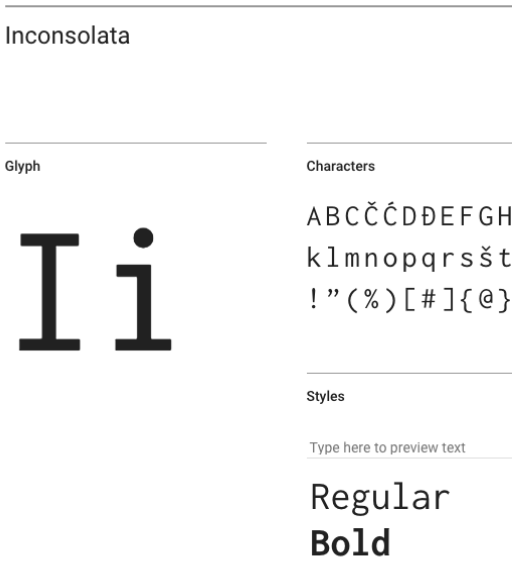
We decided to add some theming to match the pixel art Lizzie made for the icons. We added a graphic in the top left and made the font a monospace one that feels consistent with the pixelated graphics.



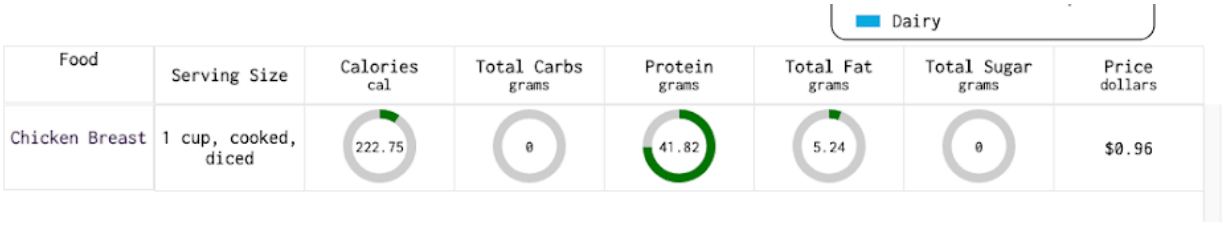
We also discussed how to handle the different recommended daily amounts of nutrients for different demographics like age, gender, etc. We decided to allow users to change the settings in a control panel at the top of the page (yet to be implemented). We chose to leave Total sugars at a default value of 60 since there aren't reliable recommended daily amounts for each demographic group and 60 was a good middle ground for those we did have.

November 26

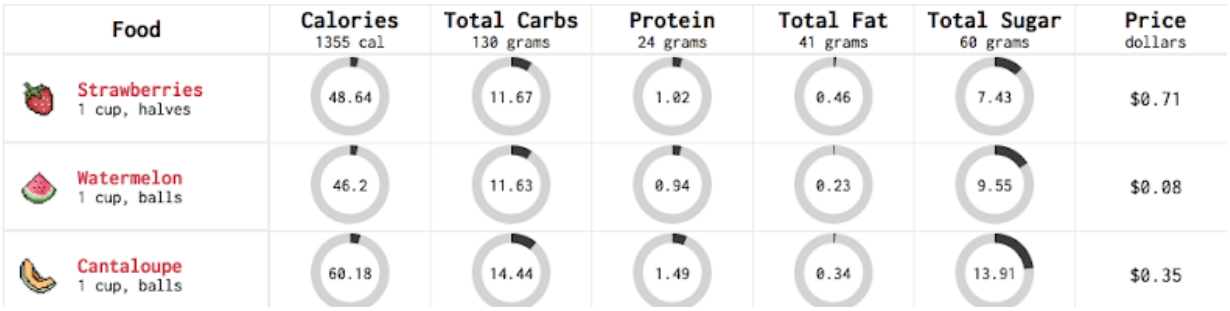
We decided to change fonts to Inconsolata since it was thinner and fit better in the visualizations (particularly the donut chart).



We also moved the text in each table cell inside the donut chart, removed the coloring of the headers, lightened the cell borders and shrunk the units text as suggested by Kiran.

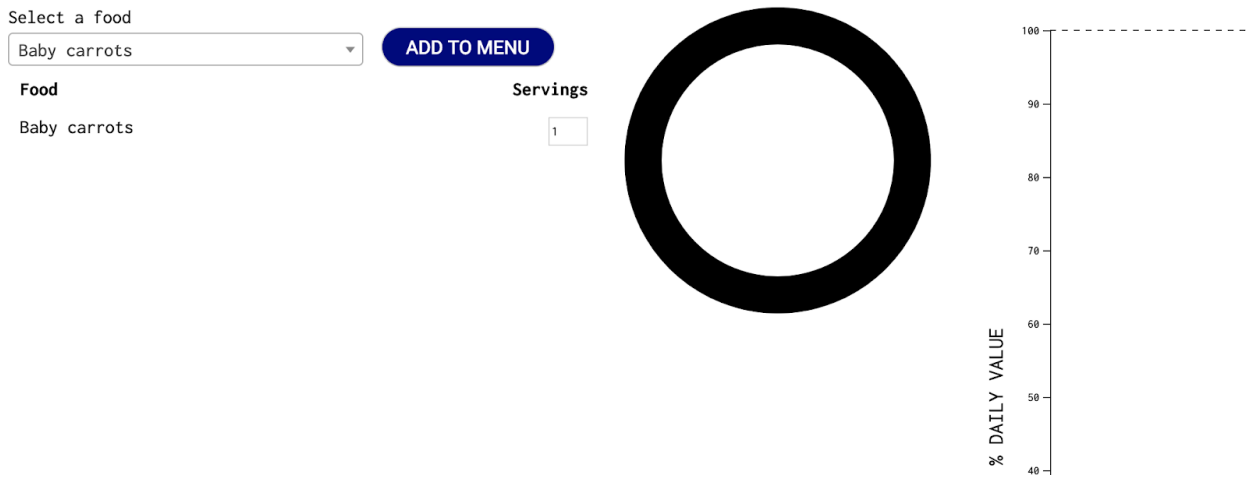


Following these changes, we rearranged the food cell to include the icon, title, and serving size since the serving size is specific to each individual food and affects every other value in the row. We also changed the color of the donut cells to gray so it wouldn’t create be confused with a food group color

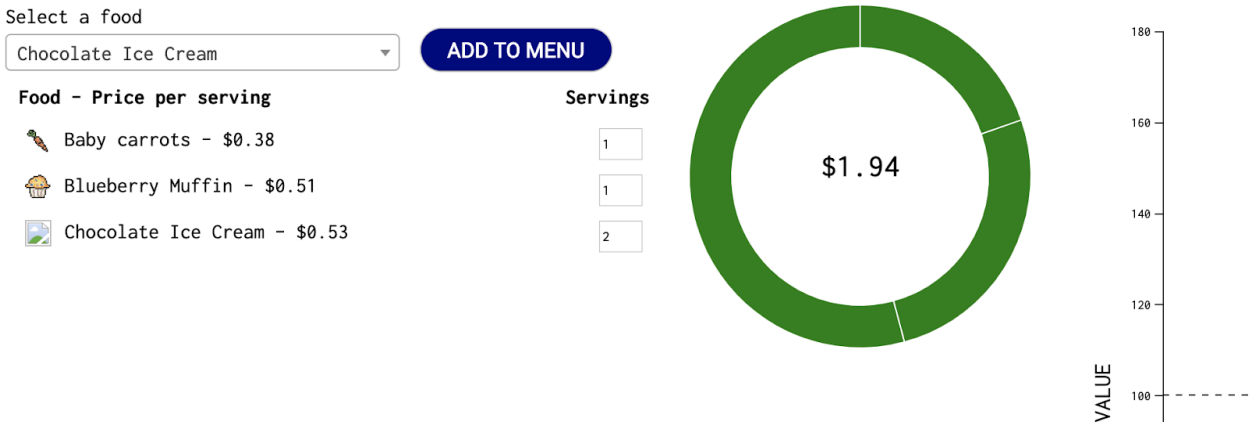


Nov 30

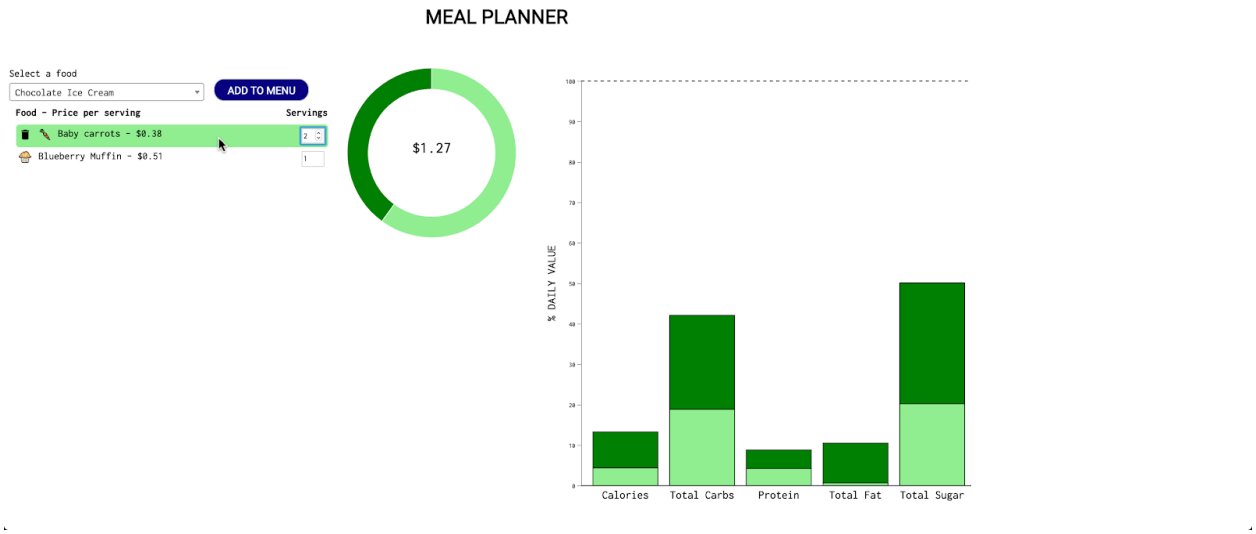
We added donut chart functionality. Getting animations and updates working correctly took an exceptionally long time since the data was being incorrectly bound to the svg group rather than the paths of the slices. The donut chart started as simply black segments.



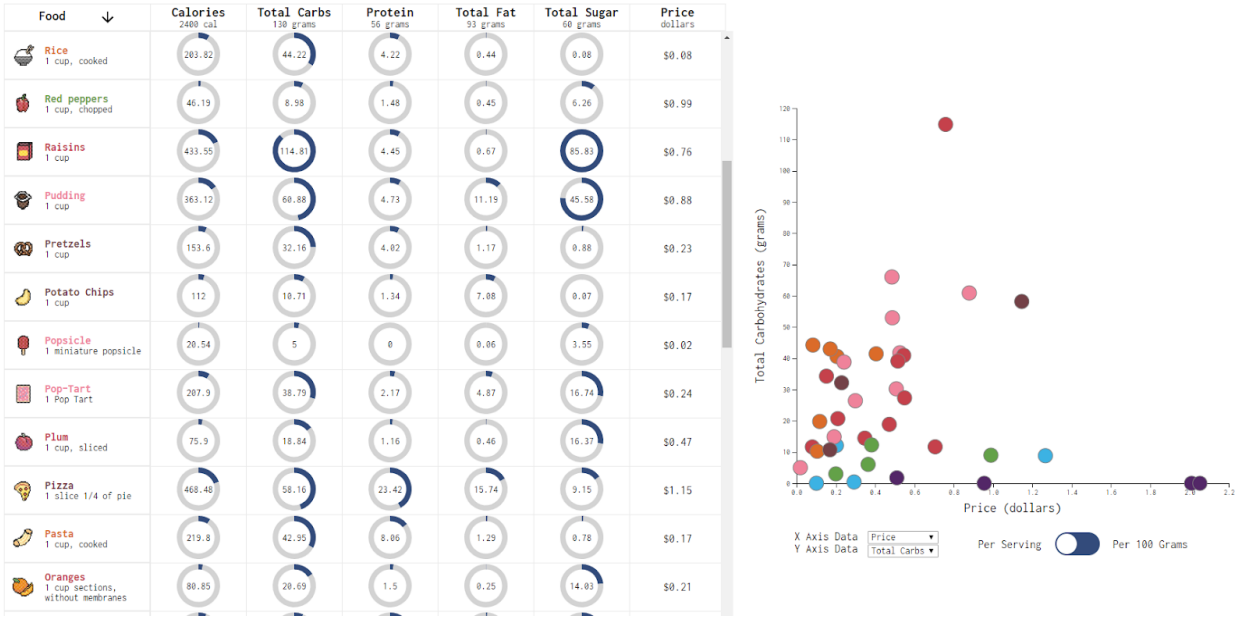
This was then switched to green segments with white dividers to remain consistent with the bar chart. Icons and price per serving was also added to the meal planner “menu” on the left.



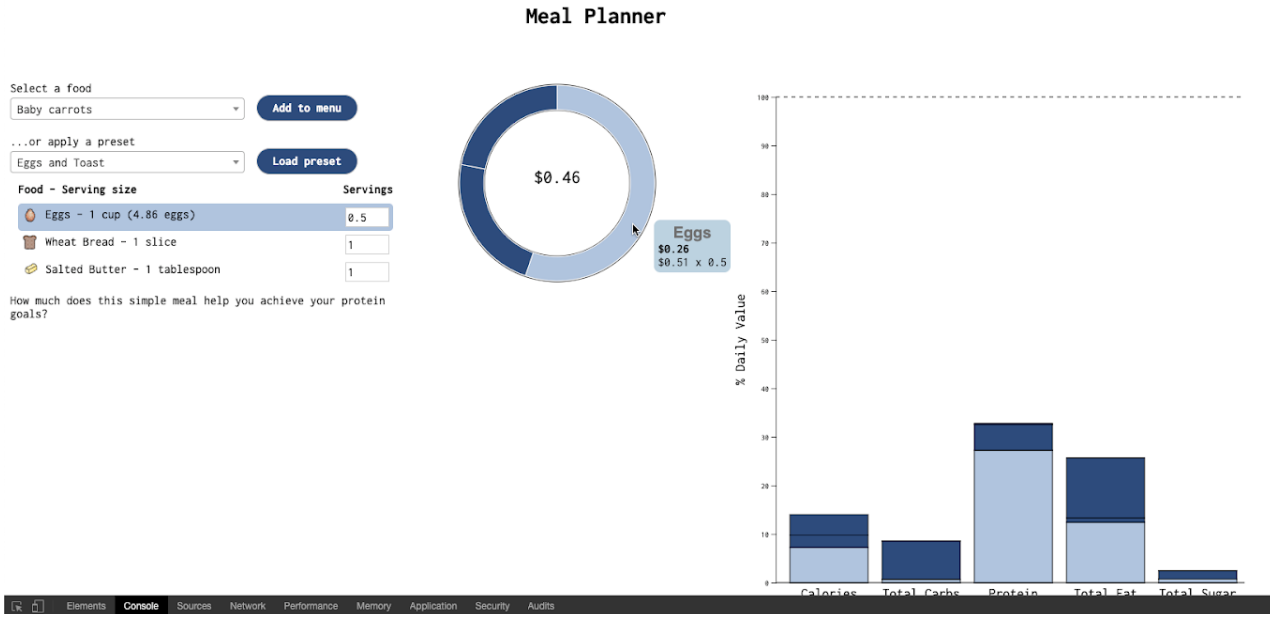
Next, synchronized highlighting was added to make viewing the impact of a given food on nutritional value and price easy to see. Again, we decided to use the same color for all segments of the donut chart and bar chart to allow an unlimited number of food items to be added without worrying about there being too many colors in the charts. We emphasized synchronized highlighting to ensure identifying individual foods in the charts would be straightforward.



We decided to change the gray in the tables to a navy color, since that wasn't being used by any food groups, and the added color makes it more visually appealing without creating ambiguity. We matched the colors for all of the buttons, switches, visualizations, highlights, and tooltips to create consistency throughout the entire page.

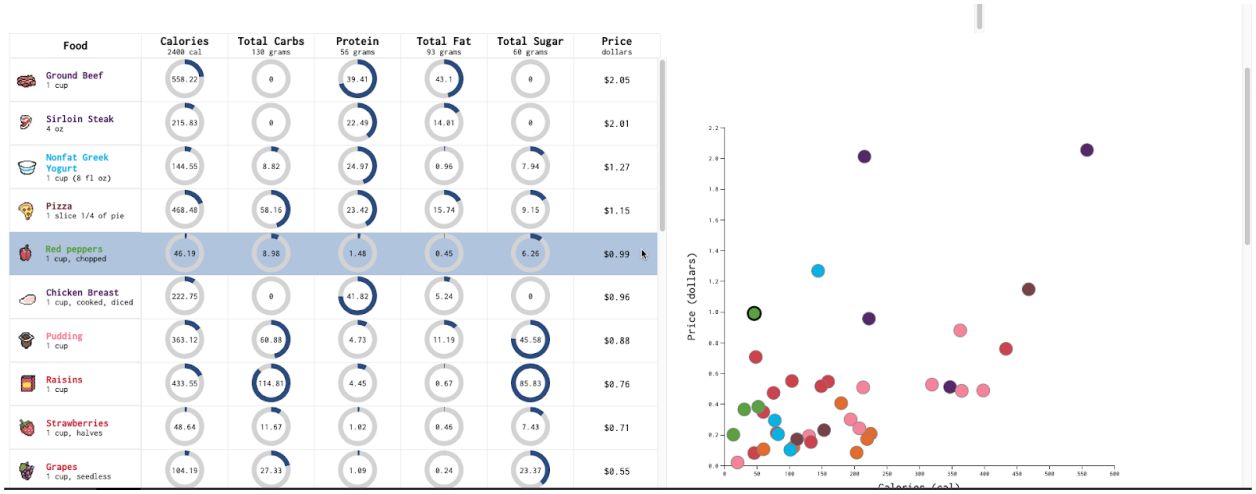


To add a "storytelling" element to the visualization, we came up with some annotated "meal" presets that allows users to compare the relative nutritional value of common food "dilemmas", such as opting for a Pop-Tart over eggs for breakfast when in a rush in the morning.

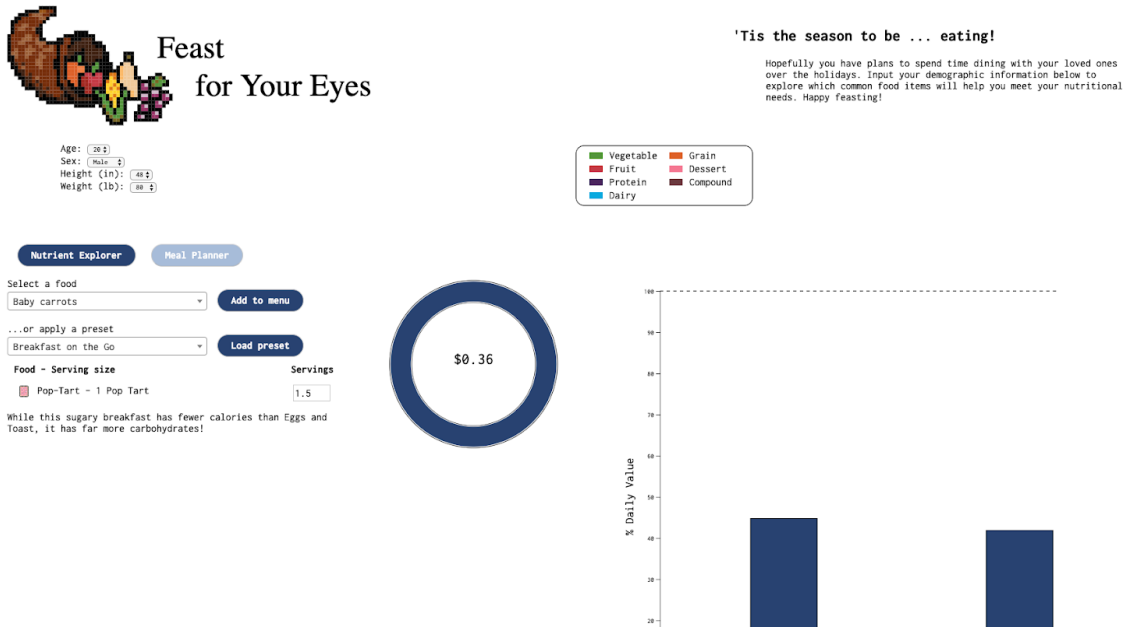


Tooltips were added to the donut chart, and the serving size of each food was included in the menu item list instead of the price; since many serving sizes are not obvious, including them with each item was more important than including the price. We included the price in the tooltip for clarity. We also slightly enlarged the input for the number of servings for readability.

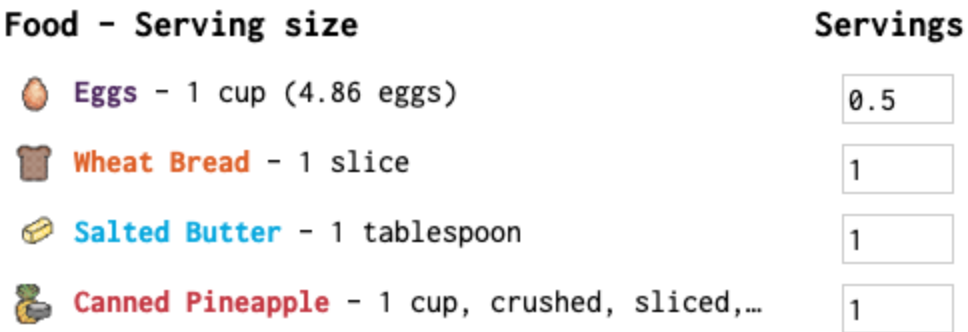
Matching the donut chart functionality, we added more interactivity between the scatter plot and table. Highlighting a circle on the chart highlights the corresponding row in the table and vice versa. This was done to make finding additional details easier when viewing the scatter plot, and to make seeing the food's place compared to the others easier when viewing the table. We also decided to make the table view scroll to the highlighted row when its corresponding circle in the scatter plot was hovered over since the table is typically longer than the viewport and not all rows are visible at once.



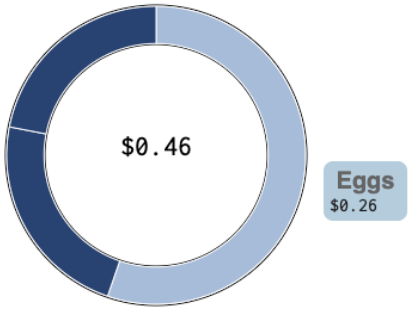
Next, we reformatted the site to only show one set of views at once. The views can be switched between with button tabs at the top. The demographic settings and food category legend stayed above them since they apply to both views.



We realized that the legend seems out of place on the Meal Planner tab since the colors of the food categories are not used anywhere. To remedy this, we colored the text of the food items in the menu, similar to how the food column in the table works. This also allowed us to encode more types of information about the food.



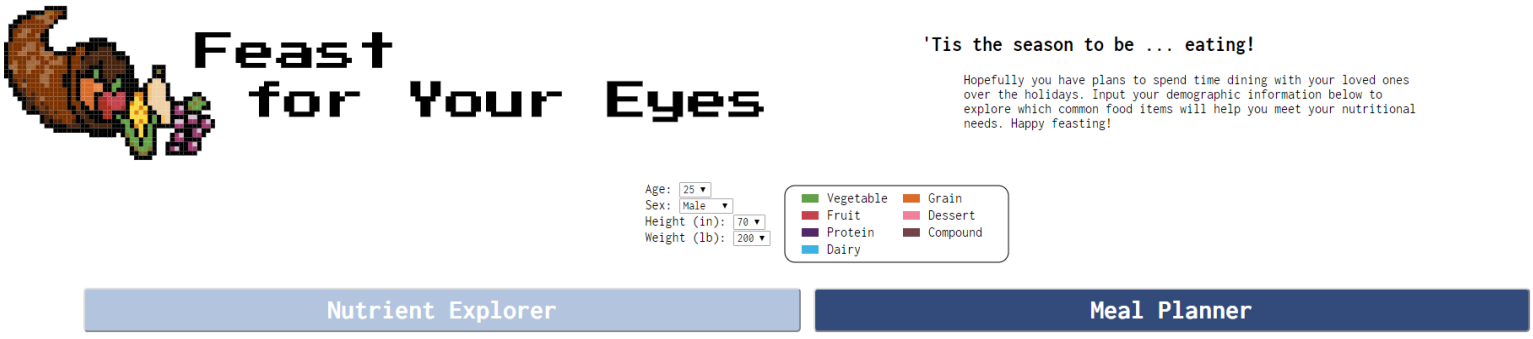
Going back to the donut chart, we decided to remove the second line of the donut chart tooltip that showed the individual price since it made the tooltip crowded and harder to read.



Implementation

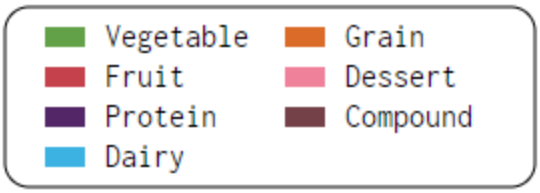
Header

Our visualization has two main components: a “Nutrient Explorer” and “Meal Planner.” The image below shows the header and main controls, which are always visible at the top of the page. The two large rectangular buttons at the bottom switch between the two main tabs, which are shown below them on the page.



At the top, obviously, we have the title and introduction to the page. On the left side in the middle, we have inputs where the user can select their age, sex, weight, and height, which we use to calculate their daily nutrition needs and customize the visualizations to them.

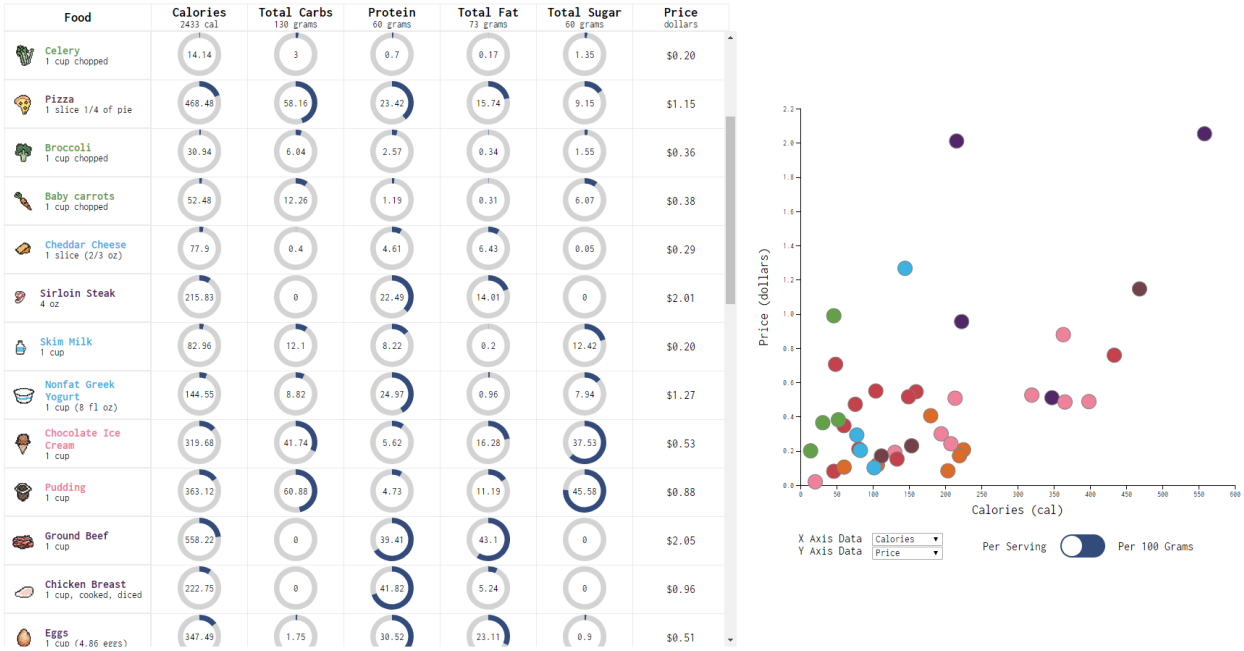
The legend, shown below, shows the colors we use to indicate food groups. This was based on the colors used in MyPlate, but adapted to be color-blind friendly.



These colors are used for the food names in the table and menu, as well as the circles in the scatterplot.

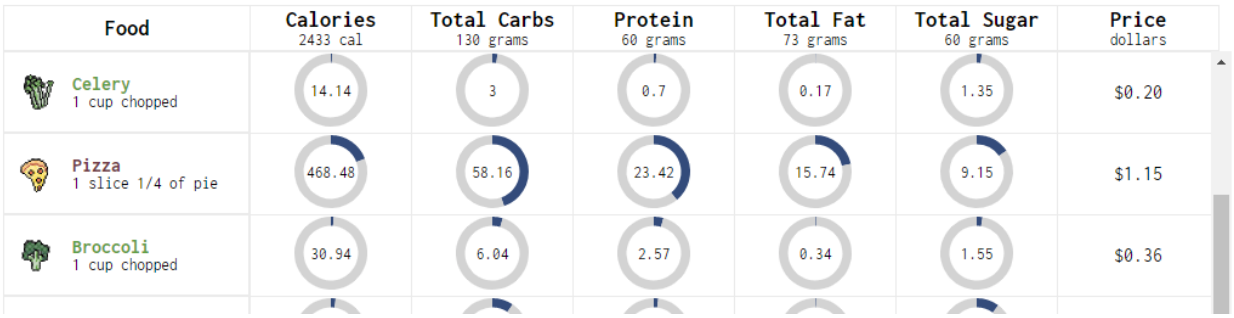
Nutrient Explorer

When the Nutrient Explorer tab is selected, the following is shown:



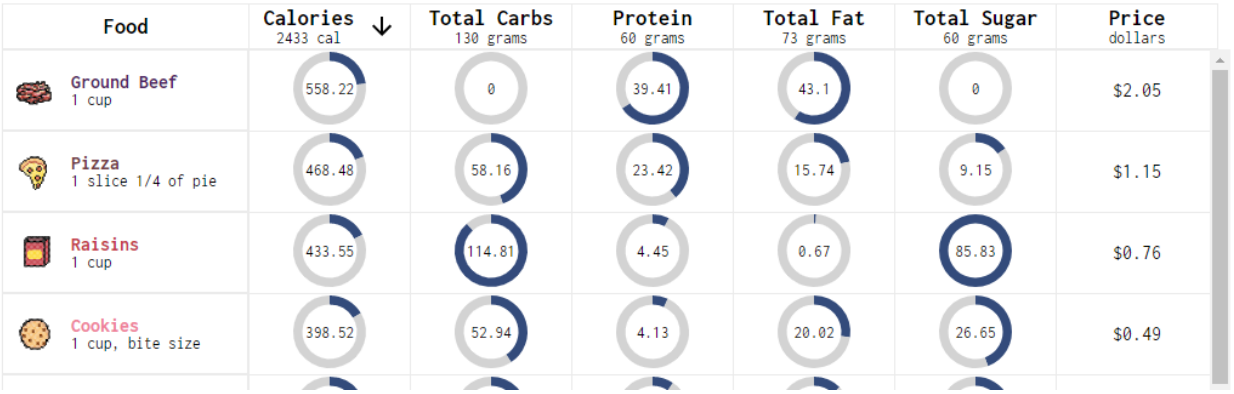
Table

On the left, we have a table showing all of the foods we chose to use for the visualizations, and on the right is a scatterplot with a circle for each of those foods. Here is a smaller snippet of the table:



In the food column, the name of the food is colored based on the food group, a hand-made icon is shown to the left of it, and the serving size is displayed below the food name. The headers of the nutrient columns, namely Calories, Total Carbs, Protein, Total Fat, and Total Sugar, also display the max daily value based on the personal body information provided in the inputs at the top of the page. Each of these columns show a donut chart, which represents what percentage of that daily value is filled by eating one serving of the food. The raw numeric amount of that nutrient is shown in the middle of the circle. The price column shows the price for one serving of the food.

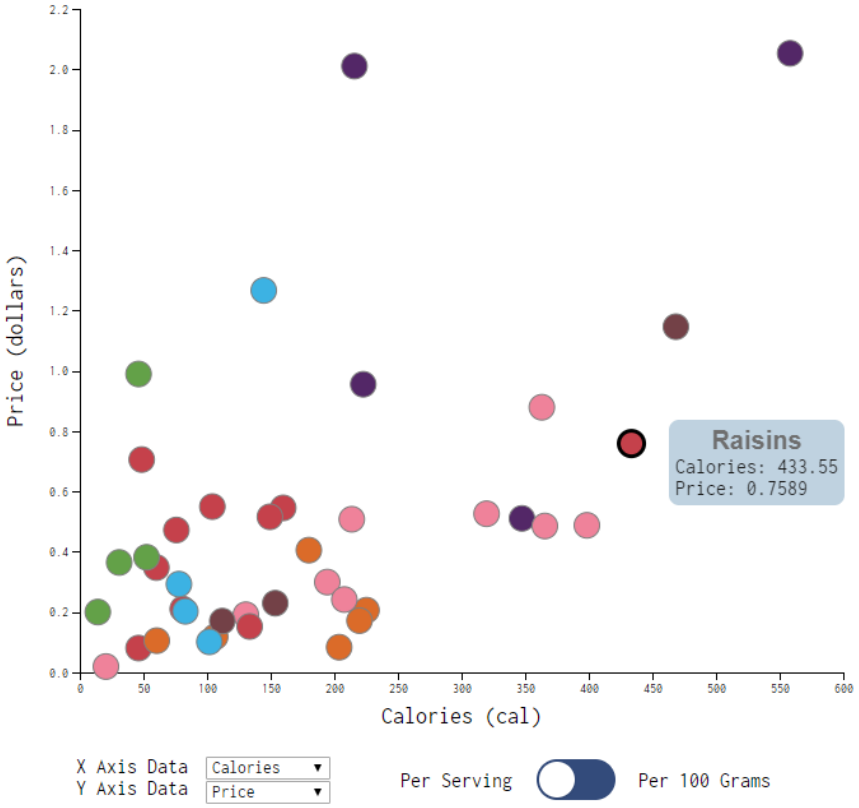
Because the number of rows in the table is large (and could easily become larger if more foods were added), the table scrolls vertically. The headers are always visible (frozen) at the top for easy reference. Clicking on a header will sort the table by that column's attribute in ascending order, and clicking it again will sort in descending order. When sorted by a certain column, an arrow glyph appears indicating which column the table is sorted by, and in what direction.



In the above example, the table is sorted in descending order by calories.

Scatterplot

The scatterplot is shown to the right of the table. Below is a screenshot. The mouse is hovering over the red circle with the thick outline next to the tooltip, but it is not visible in the screenshot.

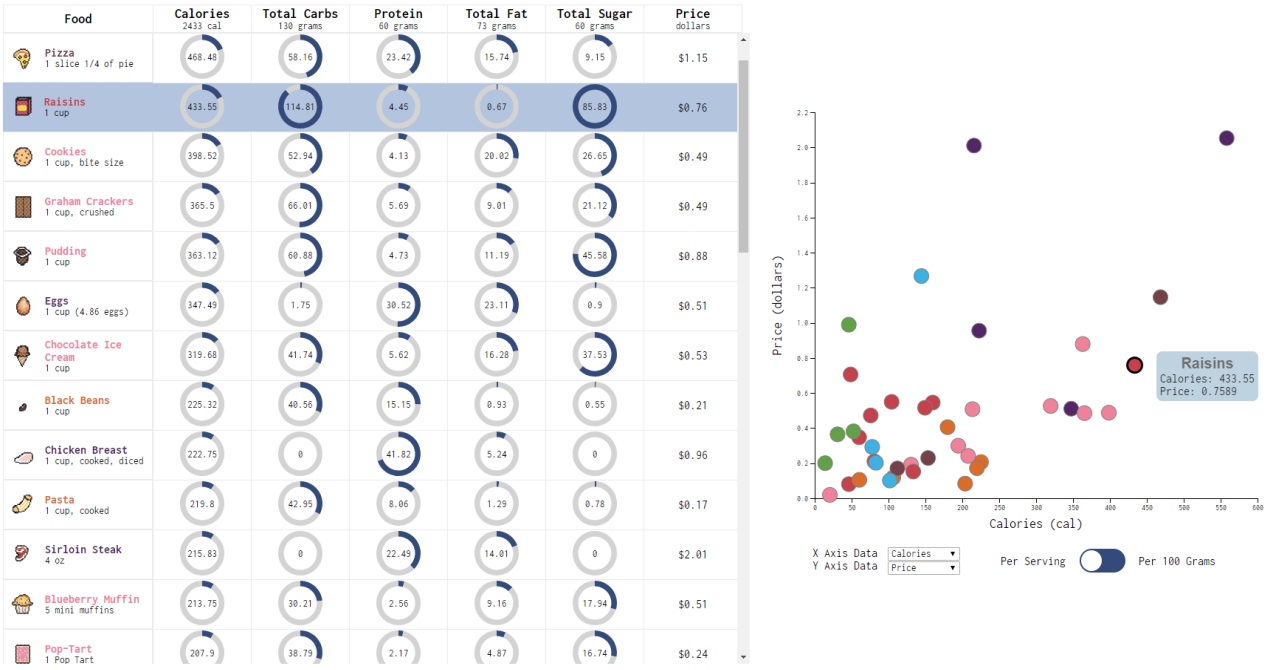


The scatterplot is quite interactive. The x-axis and y-axis can be changed to show calories, total carbs, protein, total fat, total sugar, or price by selecting the dropdowns below the plot. When changed, the axis updates (and is animated), the label changes, and the circles all move with animations. The toggle switch also allows you to switch between showing nutrients per serving (which is what is shown on the table) and showing nutrients per 100 grams. The “per 100 grams” setting is more like a “nutrient density” feature and is equal to the nutrients per serving divided by grams per serving. When the switch is toggled, the axis and circle changes are all animated.

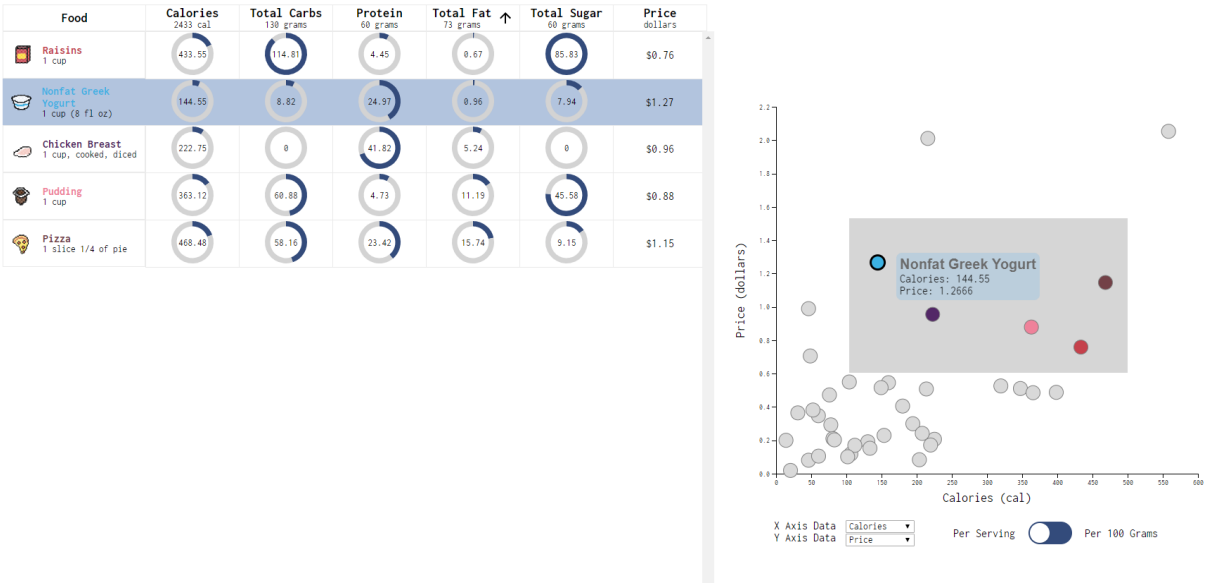
The circles are color-coded based on food group. When you mouse over one, it is highlighted with a thickened border, and a tooltip appears showing the food name, as well as the data values for the two currently selected axes.

Table-Scatterplot Interactivity

When a circle is hovered over in the scatterplot, it highlights the corresponding row in the table. If that row was not currently visible (because of the scrolling), the scrolling will automatically adjust so the row will be visible. Likewise, if you hover over a row in the table it is highlighted along with the corresponding circle in the scatterplot.



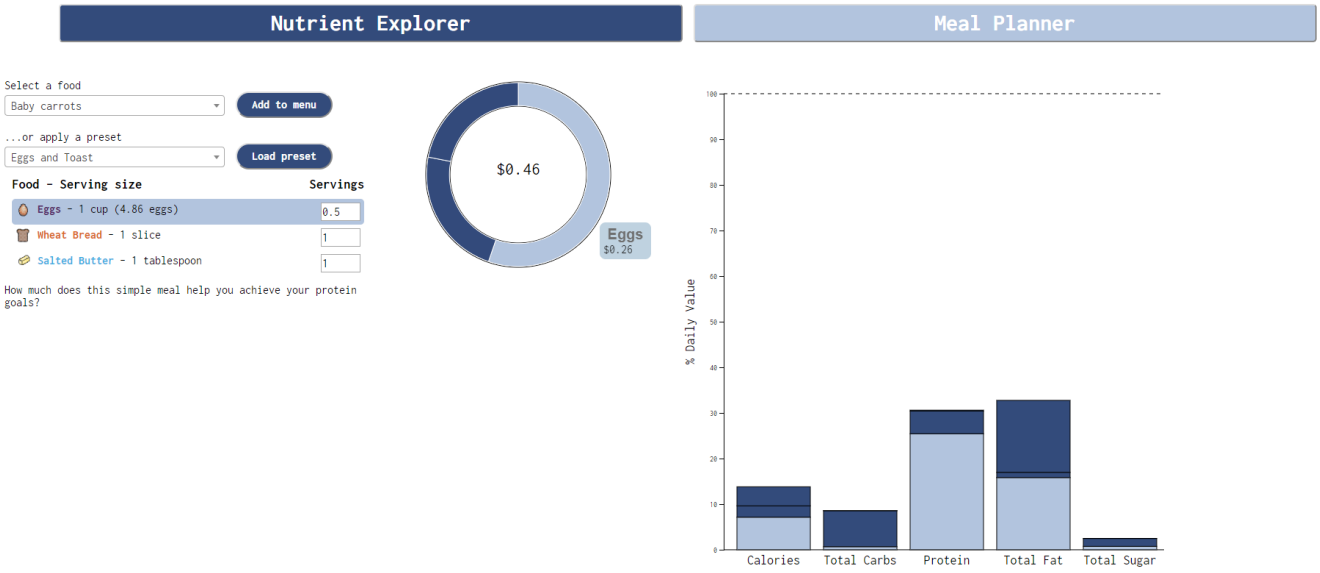
In addition, we have implemented a brush on the scatterplot, as shown below.



The circles within the brush are colored, while the rest are turned gray. Only the foods within the brush are shown in the table. The brushing, sorting, and highlighting functions all work simultaneously, as shown above. Clicking anywhere on the right side of the page clears the brush, but clicking in the table area does not clear it, which allows you to sort and explore the filtered table. If an area is brushed but no circles are contained within it, the circles all maintain their color.

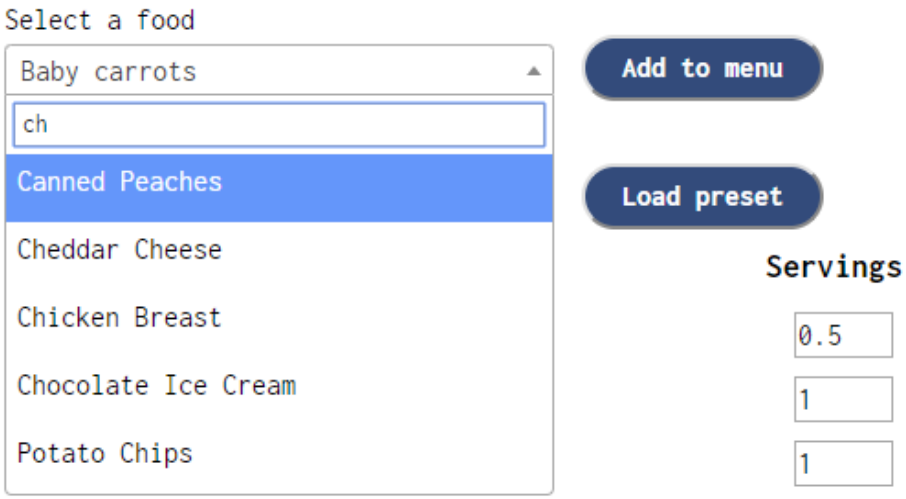
Meal Planner

When the Meal Planner tab is selected, there is originally no data visualized, but this is what it looks like with some data added:

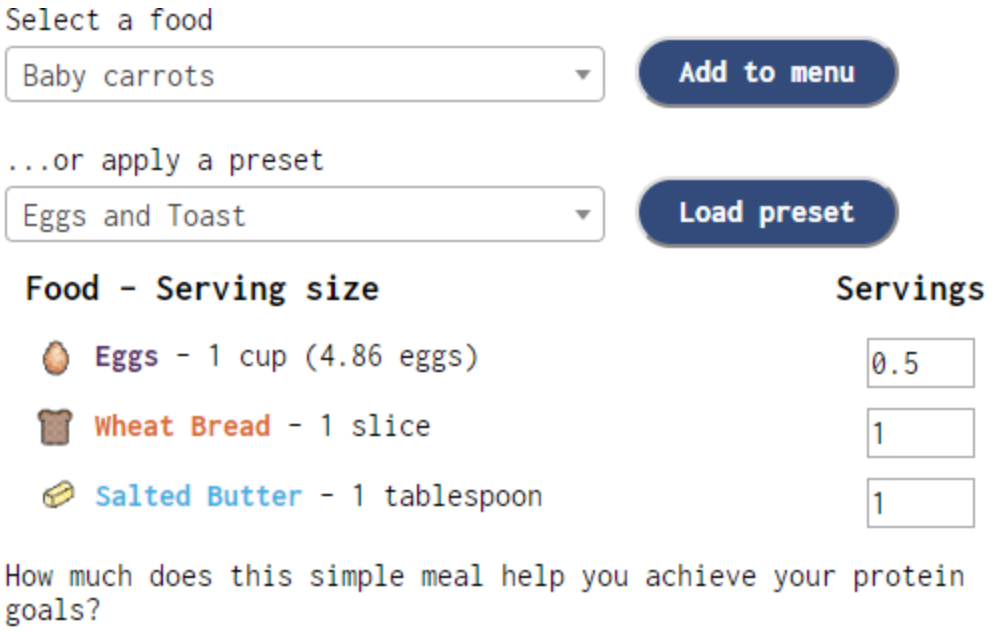


Menu

On the left is the Menu. Foods can be added using the search bar or by applying a preset. The dropdown for selecting a food allows you to scroll through all the options, as well as search. Below is a snapshot of an example search:



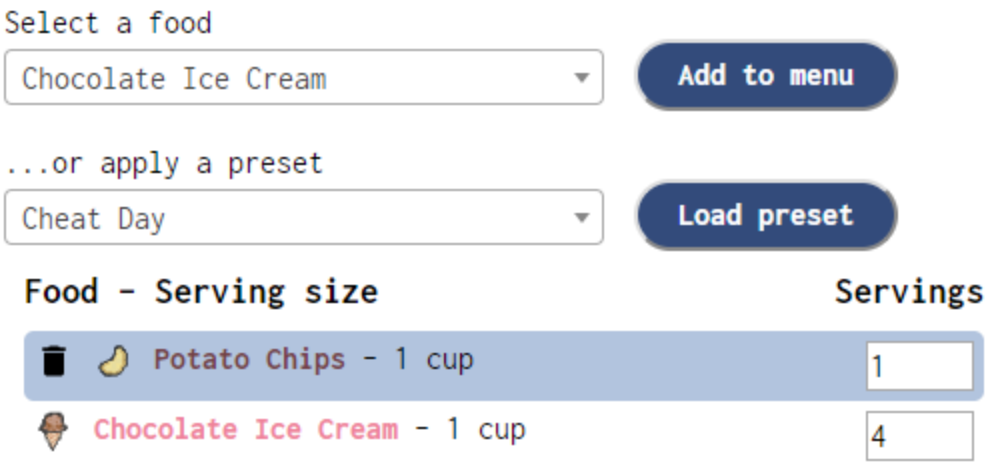
Once a food is selected, pressing the “Add to menu” makes it appear in the list below it. It does not allow adding duplicate foods. Here is a closeup of the menu:



Each row of the menu shows the food icon, the color-coded food name, and the serving size. There is also an input where the user can select how many servings of that food they would like. It forces you to pick a non-negative value below 100, and allows you to arrow up and down as well as type in a number.

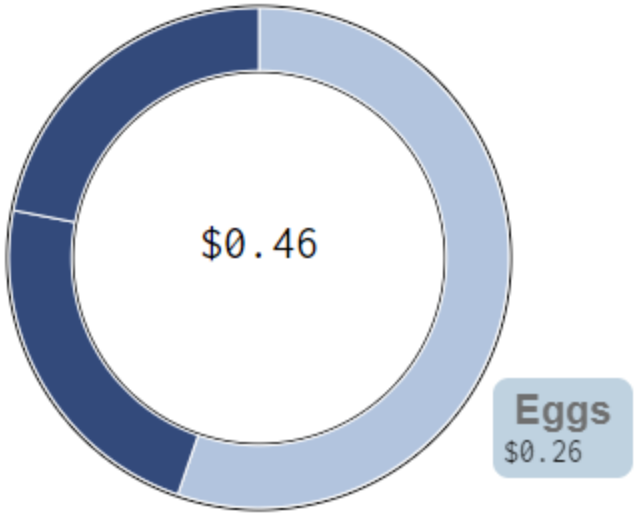
The preset dropdown has a few sample meals, including Eggs and Toast, Breakfast on the Go, Yogurt Parfait, Chicken Sandwich, Pasta with Sauteed Vegetables, and Cheat Day. This is our storytelling feature. When you select it and press the “Load preset” button, it populates the menu with that pre-made meal. It also shows a custom message below it that helps you think about the value of that meal. If you load a preset then add an additional food, the message disappears.

Hovering over a row highlights it, and makes a trash can icon appear. Clicking on it deletes that food from the menu. This is shown below.



Price Chart

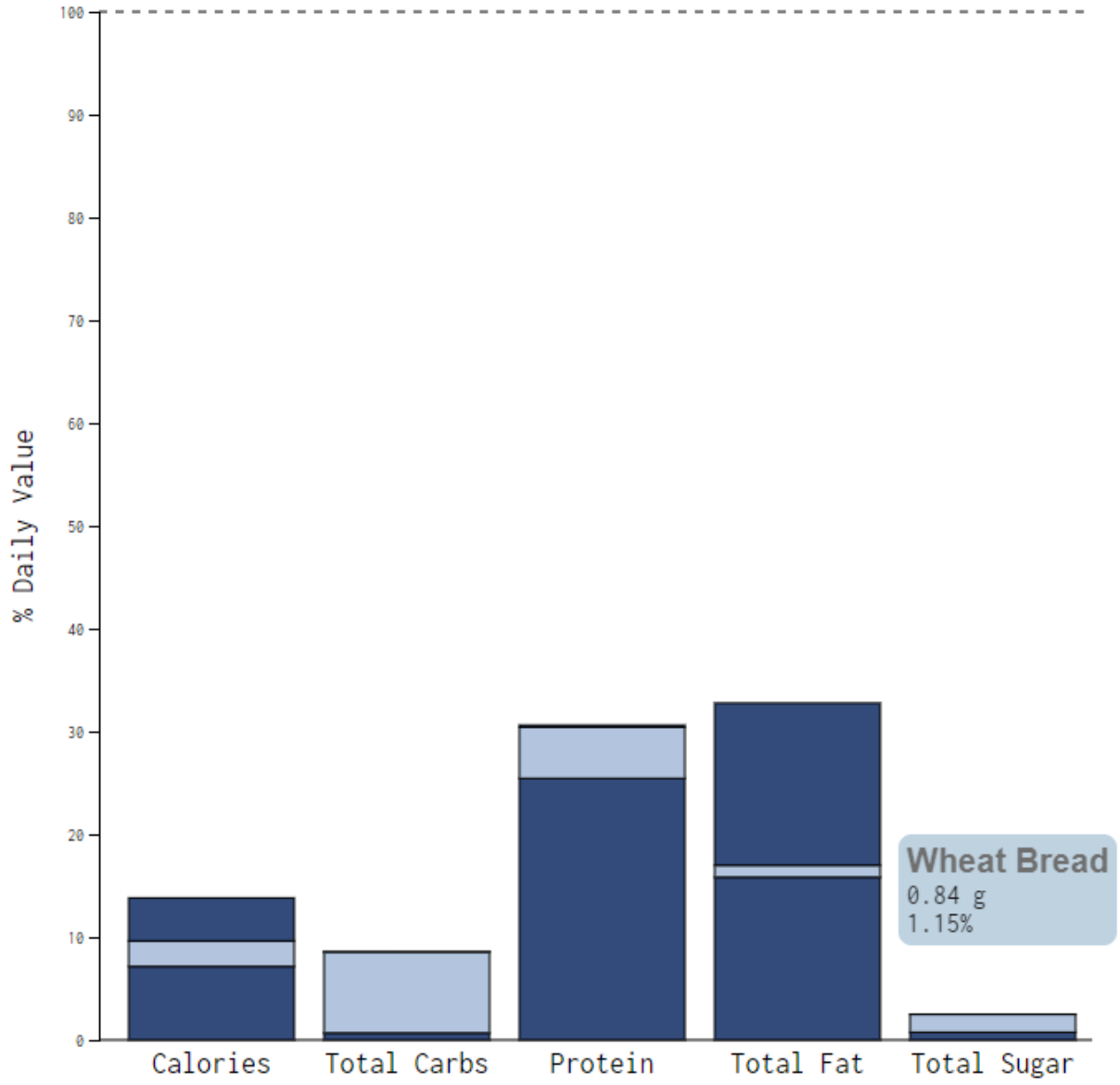
In the middle of the page is a donut chart showing the total price of the meal, as pictured below:



The total price is shown in the center of the donut chart, and all of the menu items make up a section of it. This allows you to see which food items contribute most to the total cost. Hovering over an individual section highlights it and shows a tooltip with the name of the food item it represents and its portion of the total cost.

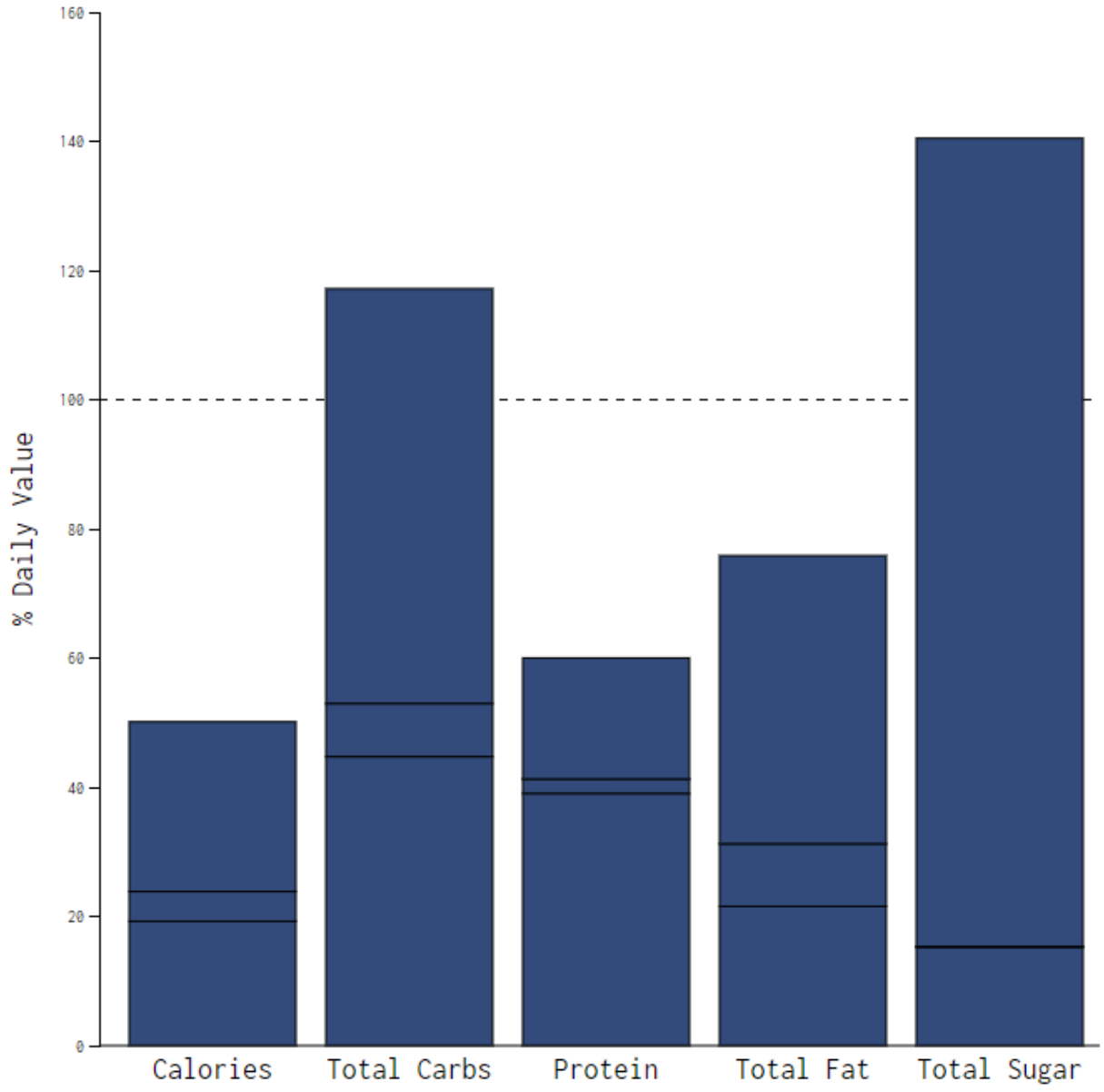
Stacked Bar Chart

On the right side of the Meal Planner, we have a stacked bar chart, shown below:



This shows how much each of your nutrient needs are met by the combined foods in your menu. There is a column for each nutrient, and the height of the bars shows what percent of your daily value is met, based on your personal body information input at the top of the page. Hovering over a section highlights all of the bar segments pertaining to that food, and a tooltip appears showing the food name, as well as the amount of the nutrient the food provides for that column, and what percent of the daily value that represents.

The y-axis always goes up to at least 100%, but if the food in the menu exceeds the 100% daily value for any nutrient, the y-axis will adjust itself to accommodate that. There is always a dashed line at the 100% mark for reference. This is demonstrated below:



Meal Planner Interaction

When the menu is updated by adding or deleting foods or changing the number of servings, the price view's donut chart and text transition with a smooth animation, along with the bar graph's

line segments and y-axis. Hovering over a row in the menu or segment of the donut chart or bar charts highlights the corresponding parts of all 3 sections. This was shown in the first image of the “Meal Planner” section.

Evaluation

It was really insightful being able to visually explore and compare this nutrition data. Some foods are commonly known to be more healthy, but being able to compare them and see how they fill up your daily needs is really interesting. For example, meats like chicken and beef obviously have lots of protein, but seeing that 1 serving of chicken fills up around 75% of your protein needs is pretty amazing.

It was interesting to notice outliers in the scatterplot and bar charts. Pizza, for example, has a lot of everything we plotted, which was very obvious. One really surprising one was raisins - they have a ton of carbs and sugar! It was also cool to see how some foods, like fruits, had lots of sugar but basically zero fat, for example, and other foods were the opposite.

Being able to create a menu and see the combined effects really brings the whole thing together. It allows you to see what combinations of food will help you meet your goals, or if you don’t really have goals, to at least become aware of what your diet is like! Without this visualization, that would be a tedious task of tracking information from nutrition labels and doing calculations on it. Our tool allows you to see it easily and in a fun and memorable way. It is also superior to nutrition labels because it is customized to your personal body statistics, and not a generic 2000-calorie diet which isn’t correct for most people.

Our visualization works really quite well, and it does answer our questions. It’s fun to use and insightful. The main thing that would improve it would be to add more data - having more foods in the dataset would make it more useful since more foods you actually eat would be on there (although too many would decrease the value of the scatterplot). Also, being able to visualize more nutrients, like individual vitamins, minerals, etc., would allow you to get a more complete picture of your dietary needs and quantify exactly which nutritional choices could lead to deficiencies. We also thought of a few minor improvements we could make, like adding text to show the nutrient total at the top of the bar chart columns, but ran out of time.