BALANCE

Design Document

Presented by

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Article I. Project Information

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Section 1.02 Thesis Summary

Mobile application developers have taken advantage of the American nutrition crisis by generating thousands of applications to help uses manage their nutrition. Many of the applications that pertain towards shopping generally display detailed information on an item or allow for suggestion/comparison of items. However, they do not take into account the needs of multiple people over a series of days, which I believe is the central problem of nutrition management in the grocery store. My project ***Balance*** strives to solve this problem by presenting the nutritional contents of the aggregate items of a grocery cart in a visual format that allows the user to clearly view the nutritional contributions of a grocery item towards their nutritional needs over a set period of time, and encouraging improvement on their selection of items by reminding them of their nutritional needs and nutritional achievements of their previous shopping trip.

Section 1.03 Contribution

Balance fulfills a gap in the application market that I believe is a failing point in many Americans' nutrition habits: the grocery store. Although many apps already target nutrition and diet management, they are generally meant for use by a single person. While balancing nutrition is difficult for a single person, it becomes even more difficult when users are shopping in order to fulfill the nutritional needs of multiple people.

To fulfill this task, ***Balance*** leverages the features of the Android mobile platform (such as camera for scanning, network access, and computation) to allow the user to easily input information. ***Balance*** will seek to lighten the cognitive load of users while they shop so they can focus on their preferences and decision-making between items. By abolishing the impossible task of tracking the myriad of nutrients from the shopping process, ***Balance*** makes it easier for users to focus on buying items that are better for their overall health.

Article II. Abstract

The decline of Americans' nutritional health over the past decades has spawned a myriad of proposed solutions from the government, industry and independent groups. Widespread government interventions have generally been delivered in the form of print information. One of the most iconic pieces is the Nutrition Facts panel, which is now emblazoned on almost all food packaging due to government decree. While this accessible resource has been proven helpful in the search for healthier foods in the grocery store, it has also been proven that most Americans are unable to use this resource appropriately due to lack of nutritional literacy and numeracy.

Thus, the industry and independent groups have begun to generate applications as an alternative solution (and for profit), leveraging the rapidly expanding mobile application market as a resource. According to the Pew Internet Project survey, 35% of all adults in America own a smartphone, and this number is expected to continue rising exponentially in the coming decade [48]. Many applications have tackled nutrition issues from the vantage point of personal nutrition management (usually with a weight-loss goal) or by identifying healthier items using either side by side nutritional comparison or suggestion systems based on the users preferences.

A gap that I have identified with my market survey is an application that allows for management of nutrition for more than one person. As the grocery store is the main resource of food for most Americans, my application specifically addresses the issue of nutrition management in the grocery store. My project ***Balance*** is an Android application which presents a structured approach to grocery shopping to allow the user to improve on nutrition management of their grocery shopping.

The project translates a grocery trip into three distinct dimensions: time, people, and nutritional values. The user specifies the number of people (and meta-data about those people such as age and gender) and the number of days that this amount of grocery should last. The system calculates the nutritional needs of the people the interactor provides and then calculates the amount needed for a given period of time. This results in the nutritional goal line that the user will strive to meet. To incite improvement, ***Balance*** generates messages based on the nutritional requirements that the user hits or misses. It also saves the quantities of nutrients from the previous shopping trip so users can improve incrementally from the previous time and reach towards their ideal nutritional balance each time that they shop.

This project was largely informed by academic literature review and survey of current market applications revolving around the topic of health and nutrition. The goal of ***Balance*** is to encourage its users to become more aware of the nutritional composition of their car t and remind them to improve on achieving a balanced diet each time they shop.

Article III. Introduction

The most recent report from the Center for Disease Control and Prevention (CDC) about the nations' heath reported the highest obesity rates in the history of America; a staggering 50% increase from just 50 years ago [51]. For the past 20 years, the United States government has been battling this national health crisis, attempting to inform citizens by providing a multitude of nutritional resources in various forms. These tools, such as the Dietary Guidelines for Americans (recently revised in 2010) or MyPlate graphic are meant to educate and enable nutritional self-efficacy.

Section 3.01 Background

(a) Government involvement with nutrition management

Government involvement in food matters did not take place until food production became an industry. The construction of the transcontinental railroad meant mass transport of resources, especially livestock and foodstuffs. This, coupled with the rapid flourishing of the corn and wheat belts in the 1850's meant that more quality control was needed to ensure food safety [1]. In response to this growth, The United States Department of Agriculture (USDA) was created in 1862 with the intent of preventing the spread of diseased foodstuffs via thorough inspections.

As the USDA was expanded and modified to fit the needs of the people, nutrition gradually became a concern. A bulletin published in 1902 by Wilbur Atwater and his associates became the first move towards educating the general public on their daily nutritional needs. Atwater advocated a diet of legumes, vegetables, and proteins with limited fats and sugars included [29]. However, Atwater's views were overshadowed by a USDA publication in 1917, which pushed a balanced diet of five food groups: milk and meats, vegetables, fruits, cereals, fats and sugars. Continuous revisions have been applied until the "Hassle-Free" food guide was released in 1979; the first effort by the USDA to incorporate the increasing amount of research urging the reduction of fats and sweets in the daily diet.

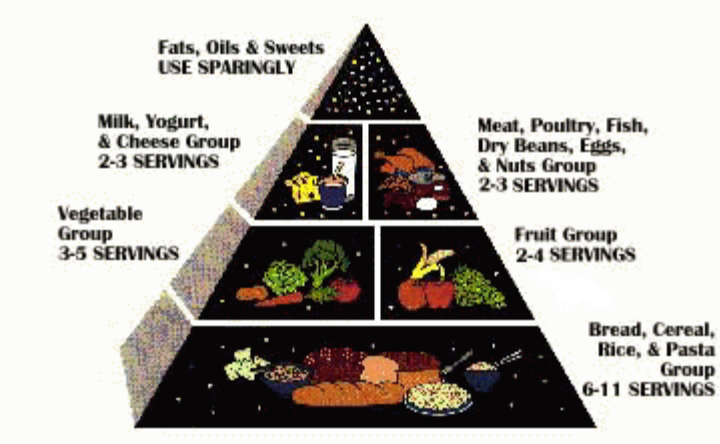


Figure 1: Food Pyramid Graphic, USDA (1)

This low-fat, low-sugar focus has been maintained in the most recent renditions (in 1992 and 2010) which are presented in the familiar pyramid format [14]. In addition, the USDA has written extensive guidelines meant to guide the daily nutritional decisions of the American people. The USDA website also offers a bounty of nutrition and diet management tools. However, it is not known

how often these tools or guidelines are accessed and used.

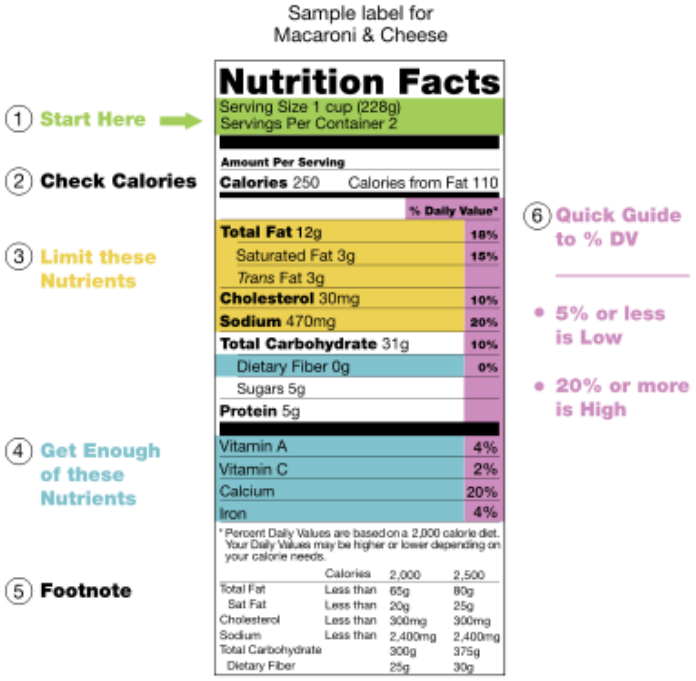


Figure 2: Nutrition Facts Panel, FDA (2)

The Food and Drug Administration (FDA) is also a governmental proponent of nutrition management. Created in 1907, the FDA's original intent was to ensure the safety and wholesomeness of the foods, drugs, cosmetics, and other chemicals that would be used or ingested by the American people [23]. Because the FDA cannot prevent ingestion of foods that may not be entirely "wholesome", the administration has made an effort to provide the people with necessary information regarding what they are eating. In 1994, food labeling became mandatory with the National Labeling and Education Act (NLEA) [42]. It provided valuable information, such as serving size, caloric information, and vitamin/mineral content. Each food would contribute to a daily total of nutrition consumed, and once the percentages were added up, could tell the consumer what they may be missing from their diet.

(b) Obesity Epidemic and Current Solutions

Food's ubiquitous presence in our lives has only become more apparent as digital media pervades our daily rituals. Consumers are swamped with advertising media in which food plays a central role. One report from 2010 states that a five year old has seen 4,000 television commercials and that at least one food ad is shown every five minutes [52]. Fast food companies in particular have taken advantage of persuasive media's omnipresent qualities and created a channel of communication that especially resonates with adolescents [35]. This relationship has often become the target of news sources which blame the media and the fast food industry for the still-inflating obesity epidemic [9, 52].

The new nutritional guidelines released by the FDA presented a challenge to the public as a new form of information delivery. Clever metaphors such as "Making Cents of the Daily % Value" were tested, though not widely practiced [9]. While consumers are able to understand the information, they are unable to understand how that food contributes to their daily diet [10]. Because of this gap, many health-conscious

consumers look instead to marketing lines that advertise “low calorie” or “no trans fat” to help them make their decisions [30].

Perhaps most notable of the recent efforts to battle obesity, especially in children, is Michelle Obama’s Let’s Move campaign. The campaign targets schools, families, and communities, encouraging kids and parents to eat healthily and get active [50, 34]. The government’s current approach to improving dietary habits is two fold: by providing information-rich material that is generally accessed through the web such as the Let’s Move website; or by enforcing programs such as the HealthierUS School Challenge (HUSSC) which focuses on improving diet and increasing time spent for physical activity in schools [18].

To manage the micro-aspects (item by item) of the American diet, the USDA has mandated the nutrition facts panel that provides detailed information on the food item. While current nutrition fact panels deliver necessary information, the format of delivery is difficult to comprehend. In a literature review done by Cowborn et al, “Consumers seemed to find it particularly difficult to use nutrition label information to place an individual product into the context of their overall diet” [16]. Another issue is that nutrients and their possible benefits (e.g. Thiamin, Niacin, or Riboflavin), are not commonly known amongst the general consumer population. A study done by Levy et al suggested that the current nutritional labels are difficult to interpret. The study suggested that “consumer nutrition guidance will be more effective if it instructs people how to balance their diets in ways that do not require quantitative tasks” [35].

Figure 3: MyPlate graphic, USDA (3)

In an effort to communicate the necessary dietary balance between the food groups, the FDA and USDA have agreed to replace the food pyramid with the MyPlate icon, The graphic has been well-received as more relatable than its predecessor, the food pyramid. However, a closer look reveals that the graphic loses much meaning in its generalization of the food groups. Dietician Betty Kovac explains:

> *“In terms of nutrition, it is not accurate to call a food protein. There are six groups that foods are divided into based on the nutrients that they contain...The plate would have been more accurate to say ‘meat or meat alternative’” [32].*

In addition, the graphic itself does not reveal the size of the plate, or the amounts that should be eaten within each section. For instance, it remains unknown whether one serving size of pasta would be adequate for the “grains” portion of the graphic. While more specific information on the plate’s composition can be found online, this requires the self-motivation of consumers to do the research.

Section 3.02 Problem Space: Nutrition Management in the Grocery Store

As the nutrition and health fields are quite broad, I have chosen to exert my efforts specifically on nutrition management in the grocery store. Amongst government efforts to educate and inform consumers, the most pervasive is the Nutrition facts panel, which can be seen on millions of food items at grocery stores.

Research suggests that there is a positive correlation between the presence of the nutrition facts panel and healthier grocery shopping decisions [7, 40]. The nutrition facts panel was designed for users to be informed on one single item, and allows for easy comparison between items [7]. While studies such as Barreiro-Hurlé et al. suggest an increase in nutritional awareness when the graphic is present, it is also stated that the educational background of the viewer plays a large part in whether or not the graphic is given any attention. Socio-economic status also plays a part. As Drichoutis et al. states, "…consumers who attach importance to price usually are less likely to use labels but those who attach importance to nutrition are, as expected, more likely to search for nutritional information" [17].

The nutrition facts panel was created to inform its viewers about the nutritional contents of a certain item and how they contribute to a balanced diet [53]. Americans struggle with this information not purely because of the format in which it is delivered, but also because of the *context* and *method* in which it must be used in order to achieve and fulfill its purpose. This struggle is caused by:

- Lack of knowledge regarding nutrients and their roles in the diet
- Lack of knowledge of what nutrients people need and in what amount that they need
- Inability to perform the calculations required to determine the nutritional requirements fulfilled by the grocery items that the shopper has selected

Studies have found that while users are able to read the nutrition facts panel and identify the quantity and percentage of contribution, viewers are generally ignorant about what value these nutrients contribute to their health and well-being [16, 34, 44].This problem is exacerbated when consumers are asked to perform calculations to see if the totaled nutrients meet their daily needs. Results of studies performed by Rothman et al. state that

> "Common reasons for incorrect responses included misapplication of the serving size, confusion due to extraneous material on the food label, and incorrect calculations. For example, only 37% of patients could calculate the number of carbohydrates consumed from a 20-ounce bottle of soda that contained 2.5 servings." [45]

The same study attributes literacy and numeracy to level of education and socio-economic status.

Figure 4: General Mills Nutrition Pane (4)

In light of this problem, supplementary nutrition information (namely for marketing purposes) has been added by many companies such as General Mills in order to advertise the nutritional benefits of their product. These labels feature bright colors font-facing surface area, which catches consumer attention and reduces the amount of time needed to examine the packaging for the information. Items with these labels have found general success amongst the nutritionally literate and illiterate alike, although they are frowned upon by nutritionists and critics [8, 36].

Article IV. Current Field

In order to target the design goals of ***Balance***, a brief field survey was conducted of both academic and market antecedents. The survey focused on nutrition and mobile applications. A cursory glance was also given to the trend of the quantified self: a developing field in which users are interested in visualizing their lives through numeric information. This research allowed me to isolate what was missing on the market, and how to move forward with ***Balance.***

Section 4.01 Related Work

There have been many academic predecessors that have tackled the nutrition issue from different angles. I have selected five that are representative of different approaches while still sharing the common mobile and health focus of ***Balance***. *Wellness Diary* is an application that was created by the Nokia Research Center in order to test the cross-cultural considerations that should go into a mobile wellness application [3]. This application is similar to those that may be found in both the Apple and Android app stores in that it offers monitoring for many facets of health such as weight and fitness. The most interesting thing about this app was that it provided many different aspects of health that it could monitor, but allowed the user to select and set their own numerical goals.

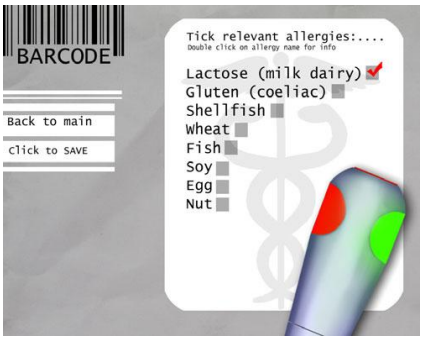


Figure 6: Nutrastick allows the user to see if products contain allergens. (5)

Figure 5: Grocery hunter gives kids a fun learning experience with well-known cartoon characters. (6)

Healthy Shelf is an app that specifically focuses on making the nutrition facts more dynamic by allowing the user alter the serving size so that they can view the total nutritional contents of the amount that they desire [21]. Two other applications help the user make healthier decisions by providing binary feedback that tells the user whether or not the item is health or not: *Nutrastick* and *Grocery Hunter* [31, 38]. *Nutrastick* is able to scan the item's barcode and then positive or negative feedback is represented with a green light or red light respectively. *Grocery Hunter* is a game for kids to play with while their parents shop to learn about whether an item is healthy or not. After scanning the item, kids are either congratulated on finding a good item, or provided a clue to continue searching for the healthy item.

The final two are systems that help users in their shopping process multiple ways including nutrition. *Clever Shopper* is a tablet application that allows grocers to compare items with metrics such as price, amount, and nutritional value [49]. *iGrocer* is another application that contains all of the feature set of *Clever Shopper* while also providing the shopper the option of automatic checkout,

store maps, and extensive shopping list and personalized item recommendations based on the nutritional profile of the user [47].

These works demonstrated to me the different levels of scope at which applications may address the issue of nutrition in the context of grocery shopping. While some applications give simple binary feedback on whether or not items may or may not be suitable, others give some more detailed information on the nutritional composition of an item based on an user's needs. However, these systems do not provide the user a resource to learn about what nutrients they need, how much they need of it, and why they need it in their diet.

Section 4.02 Mobile Nutrition Applications

With the advent of open development for mobile applications, the mobile application markets have been flooded with apps that fit the user demands for weight loss and nutrition tracking. Health-conscious users have claimed success with many of these applications, which are nutrition databases and calorie counters that are extensions of successful websites that have been weight loss resources before this mobile trend began. Such an example is *Daily Burn*, which has its own fitness website in addition to a selection of apps that help users track their progress towards their ideal fitness and weight [4].

Figure 8: Calorific Daily Breakdown of Meals (7)

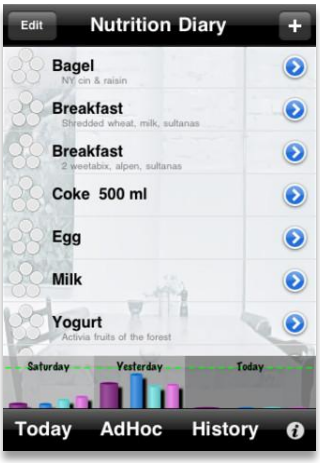


Figure 7: Nutrition Diary presents nutrition totals of meals (8)

In order to communicate the complex nutritional information, many apps present the information with graphics, or abstract the information to positive and negative categories (similar to *Nutrastick*). For instance, *Calorific* is a calorie counter that keeps track of meals, but abstracts them into three categories instead of representing all of the different food items literally [10]. The result is an easier-to-read aggregate tracker for meals that is easy to glance at even over a number of days. Along the same lines of tracking the nutritional content

Figure 9: Fooducate's nutrition presentation and Alternatives feature (9)

of meals is Nutrition Diary, an app that visualizes daily consumption using a very straightforward bar graph to monitor daily nutrient intake through meals [5].

The final category that I explored was applications that are used during grocery shopping such as *Fooducate* and *Honest Label* [22, 29]. These applications provide in-depth nutrition information on one particular item, and then produce healthier suggestions based on this one item. The information is broken down into more semantic units and graphically represented so that it is easier for the user to understand.

This survey of existing applications reaffirmed that the unaddressed issues in previous works have also been neglected in the current application market. The argument that remains is whether it is necessary for the user to have access to information that would resolve this issue. While this kind of detailed information would may not be needed by every consumer, the viable market that I explored next was the idea of the quantified self—consumers who are interested in tracking aspects of their life that they themselves may be unaware of; having access to this information empowers the consumer to change behaviors and lifestyles in order to further meet their goals, namely in the fields of nutrition and fitness.

Section 4.03 Health and Fitness Tracking Systems

Although the large-scale health and fitness tracking systems that I will discuss below are not direct antecedents of this project, they greatly influenced the design and thought process behind the design of ***Balance***: *Nike+*, *FitBit*, and *Shopwell*. The function that all three share is that they all collect the metrics that are implicit in the users' actions (which the user does not have resources to collect quantifiable data for themselves) and then present them to the user in a visually pleasing format so that the user can reflect and improve on their performance. All three also provide access to a community of users with similar interests, as well as tips and resources to motivate the user. The final commonality is that they offer access to the information and community both on the web and as a mobile application.

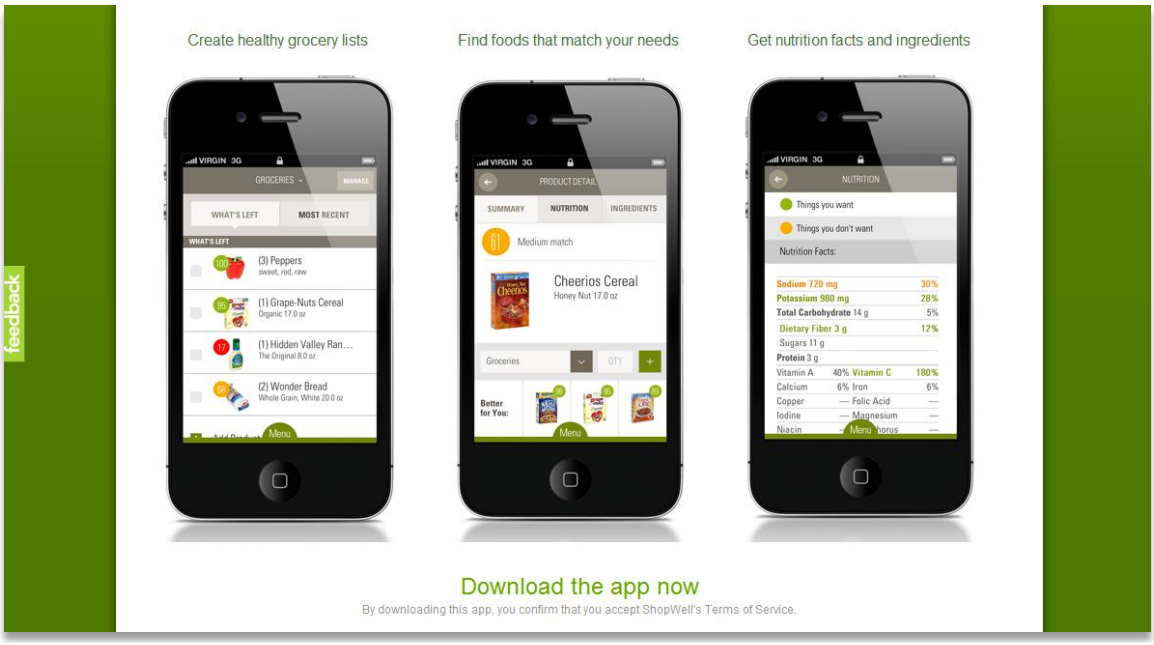


Figure 10: Shopwell application screenshot (10)

In this particular part of the survey, I focused specifically on *Shopwell* because of its focus on nutrition, shopping, and health. *Shopwell* boasts a large database of nutrients and varying health histories so that users can easily personalize their shopping lists based on the grades that the system assigns to foods. The mobile application can be used on the fly in the grocery to determine nutritional scores for foods that has caught the users' interest.

These applications exemplify growing, thriving communities of users that are using data to inform their daily decisions and motivate them to move towards their health goals. Therefore, the information that is needed is not limited to the previous achievement. Instead, users should be able to track their progress over an extended period of time. They should also be able to explore the different dimensions of the data, and gain further understanding on the effects of their actions.

After the analysis of these systems, I realized that although I have proposed ***Balance*** a singular app, ideally the application should be an extension of a larger system. This larger system would likely also be composed of a web component, which would allow the user to have a larger viewing area and easier information input. In addition, the user should be able to view multiple visualizations and information regarding the data presented (and the actions that they have taken) in order to better inform and improve their nutrition decisions. Although I was not able to implement this system, the proposed system is addressed in the "Future Work" section of this documentation.

Article V. Approach

Section 5.01 Motivation & Self-efficacy

In order to understand how to design for users who are learning self-efficacy for nutrition, I briefly examined literature on encouraging health-related behavior change. Most of the projects that result from this literature are based on support from psychological theory. Social Cognitive Theory (SCT) with a focus on self-efficacy has been of special interest to the health and nutritional field, as it has been used as a predictor of health behavior [2]. Bandura, as cited in Abhusaba et al. states, “Self-efficacy reflects a persons' belief in his or her ability to overcome difficulties inherent to performing a specific task in a particular situation” [2].

Motivation to change nutritional, health or general lifestyle habits can largely be affected by this belief in themselves and their abilities. Thus, if the desired effect is to motivate and advocate positive behavior, users should always be guided towards the positive behavior by the given design via incremental steps. If the behavior exhibited is not the desired behavior, the design of the system should allow the user to clearly view and reflect on their behavior without any negative consequences. In addition, these steps towards improvement should be incremental in difficulty, and clear feedback should be given about the success and failure in accomplishing a task [51].

One example of a project that leveraged these principles in its design was *Ubifit Garden,* a project created by Consolvo et al [13]. *Ubifit Garden* was a project that was a result of theoretical research on self-efficacy. The project focused on encouraging its users to have a more active lifestyle by reflecting the goals that the user has kept up with through visual changes in the background wallpaper of the users’ mobile device. While designing this tool, the team came up with eight strategies which greatly informed the design goals of ***Balance***: Abstract and Reflective; Unobtrusive; Public; Aesthetic; Positive; Controllable; Trending/Historical; Comprehensive [13]. These strategies are later addressed in this documentation in Section 5.03 Proposed Solution and Design Goals.

This research greatly influenced the methods that I chose to use to motivate the user towards healthier shopping habits. As previously deduced from the assessment of existing applications, the user should be able to view and reflect on the data that has been gathered. The steps towards the nutritionally balanced shopping cart should be incremental, and not rise too much in difficulty with each step. Finally, positive reinforcement or reminders should always be used and constructive feedback given in the case that the user does not perform a desired behavior.

Section 5.02 Visualization

In my review of the project antecedents, applications that were well-received by audiences generally visualized any numeric data or abstracted that data into a rating or score. There has been a great deal of

research dedicated to human perception and how to make effective visualizations, and many believe that visualization is a fantastic way to communicate large amounts of information to allow for insights that may not result from simply looking at numeric data [19, 33, 46, 55]. As stated by Larkin et al., the benefits of using visual representations of data are:

- Diagrams can group together all information that is used together, thus avoiding large amounts of search for the elements needed to make a problem-solving inference.
- Diagrams typically use location to group information about a single element, avoiding the need to match symbolic labels.
- Diagrams automatically support a large number of perceptual inferences, which are extremely easy for humans.

Visualizations in academia differ very much from their cousins in industry. The main difference lies in the directive of the user when viewing the visualization. Academic visualizations seek to open the floor for the user to gain insights on large quantities of data. When this user approaches a visualization, they are not looking for any specific information; instead, they seek to gain (possibly new) insights from the data which can then be further explored with research. Thus, the role of visualizations in academia is to allow for discovery of new patterns or insights through visual means [19].

Casual information visualizations, on the other hand, allow for users to view specific data that they desire, usually about a certain aspect or facet of life that is of personal interest to the user. As defined by Pousman et al. casual visualization "… is the use of computer mediated tools to depict personally meaningful information in visual ways that support everyday users in both everyday work and non-work situations" [43]. This type of visualization allows for particular insights: analytic, awareness, social, and reflective which are ideal for users to come to understand their daily life and routines through quantification, which applies directly to the goals that ***Balance*** has in informing the user about their shopping habits.

Section 5.03 Proposed Solution & Design Goals

Balance is a system that will provide the resources that consumers need to make informed nutritional decisions. The system will rely on the idea of *comparative shopping*, in which consumers are able to compare and contrast items and their nutritional contents with each other and against the aggregate nutritional total of their cart. The main goal of ***Balance*** is to remind consumers to improve on their diet and reach towards the requirements of a balanced diet as set by the USDA. The design goals for ***Balance*** directly address the issues stated in the problem space above (refer to Section 3.02 Problem Space). Many of these requirements originate from Janet Murray's *Inventing the Medium* and the design guidelines for lifestyle behavioral change from Consolvo et al [13, 39]. I also take into consideration the principles of casual visualization as discussed by Pousman et al [43].

PROCEDURAL

Balance will leverage the computational strength of the digital medium by performing the calculations and storing the nutritional needs that the consumer must currently keep track of for themselves. In addition, the project's reminder system will be constructed based on binary conditional logic to remind the users to improve.

PERSONAL & FLEXIBLE

Balance will help the users keep track of who they are shopping for and each individual's nutritional needs. There should be no limit on how many people that can be added. It will also take into consideration the duration in which the user wants to shop for. A personal history will be recorded and kept track of each time that the user shops, so the user can keep track of their progress towards the nutritional goal.

ENCYCLOPEDIC/COMPREHENSIVE

Balance will contain comprehensive data on the nutrients in grocery items, and also what roles the nutrients play in the users' diets.

AESTHETIC

Balance will seek to be aesthetically pleasing but not overwhelming. As Murray states, "Graphic design in digital environments must always be in the service of interaction" [38].

READABLE, CONTROLLABLE, RESPONSIVE

Balance will visualize the nutrition data of the cart in a readable manner that will change as the users interact with the application by adding or removing from the cart. Users are also able to add, delete, and edit people or their cart items in order to reflect a desired change in the system [13]. In the design of the visual representation of the nutrients, the goal is to allow for at-a-glance comparison of nutritional contributions instead of precise numeric quantities which are already displayed by the Nutrition Facts Panel to allow for quick analytic and reflective insights [43].

ENCOURAGE IMPROVEMENT, TRENDING/HISTORICAL

Most importantly, ***Balance*** will remind users each time they have achieved a goal, or surpassed their requirements on a nutrient that should be reduced in order to encourage improvement of the nutritional content of the users' cart, in line with the "positive" design criteria as presented by Consolvo et al. [13]. Informed by the guidelines stated by Stretcher et al., this project will aim to provide feedback in order to promote the user to achieve a nutritionally balanced cart:

> *"Specific behaviors must then be arranged in a series so that they may be consecutively mastered, with initial tasks being easier than subsequent tasks. As accomplishments leading to overall target behavior progress in this step-wise manner, encouragement should*

> *be given to: 1) Demonstrate the person's relative progress toward the target behavior; and 2) Attribute previous accomplishments to the person's own abilities." [51]*

In order to provide a milestone between the user and their goal line, ***Balance*** will record the nutrient totals of their previous shopping trip, and reflect those totals as a milestone goal. In the case that the user does not hit the final goal, they are still rewarded with congratulations if they exceed their previous achievement.

In summary, my approach is guided by design strategies from existing interaction design conventions and psychological theory. The overall goal for the aesthetic was to create a visual texture and interaction flow that radiates a positive energy to encourage the user to improve.

Article VI. Design & Implementation

Section 6.01 Visual Iterations & Initial User Flow

CART: CIRCULAR GRAPHIC, INITIAL VERSION

Before ***Balance*** was titled, the application was informally known as Cart. The first iteration of cart was a circular graphic that was meant to represent the proportion of necessary macronutrients. Calories was simply a numeric requirement in the center, and the exterior circle was meant to represent the ideal proportions of the three macronutrients. This and most of the iterations to come were designed for the Motorola Xoom, which offered greater screen space. The negative of designing for this particular form factor though, was that the ideal scanning input would be very difficult for the user to use.

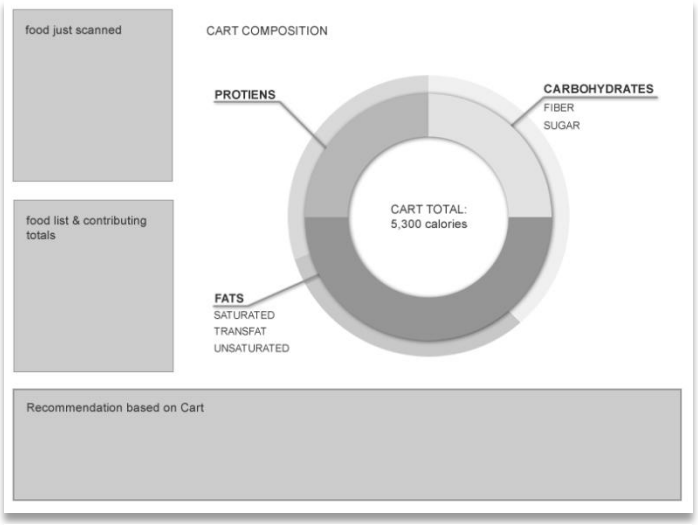


Figure 11: First iteration of cart, circular visualization

CART: CIRCULAR GRAPHIC, MICRONUTRIENTS INCLUDED

The next iteration of cart addressed the need for users to track micronutrients as well. While users scanned or added items into their cart, they would be able to see the segments and proportions of the circle fill up slowly as they meet their nutritional requirements. The inner circle was for tracking the macronutrients and the outer for tracking the micro. The criticism of this design was the unequal division of proportion given to the micronutrient circle, as the units for each micronutrient will not all be equal. This iteration brought the idea of using days as a method of reminding users of their goals. Further screens of this iteration may be viewed in the Appendices, section a.

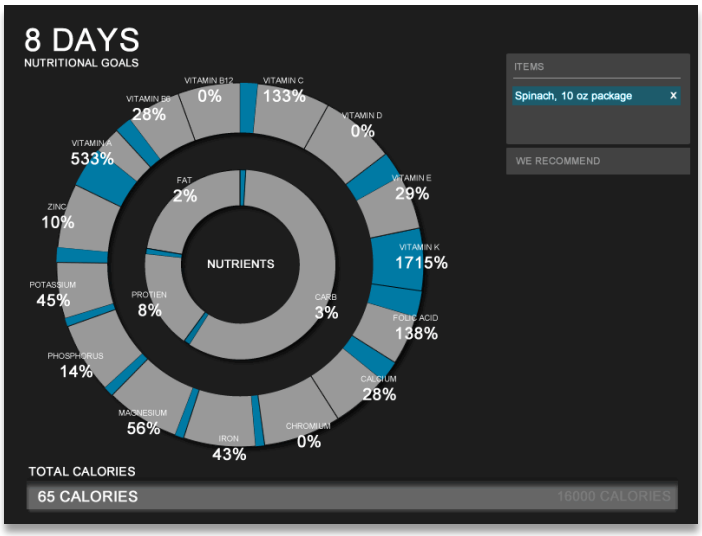


Figure 12: Second cart visualization, including micronutrients in the visual.

CART: BARCHART FORMAT

These following wireframes were the first foray into a bar chart format. After much debate, it was decided that the circle format misrepresented the quantities of the micronutrients, as not all micronutrients are proportional to each other on a daily consumption basis. This format allowed for easy comparison, and was able to demonstrate the relative quantity and comparative format that I had been hoping to achieve. The calories and macronutrients would be the first items displayed. Then, micro-nutrients could be accessed by expanding their section at the end of the graph. Further screenshots in Appendices section b. This iteration was particularly valuable in that it contained thoughts for tracking of history. Users would be able to compare nutritional quantities of carts as well as items. The system also took into account bulk purchases and distributed that quantity across a period of days.

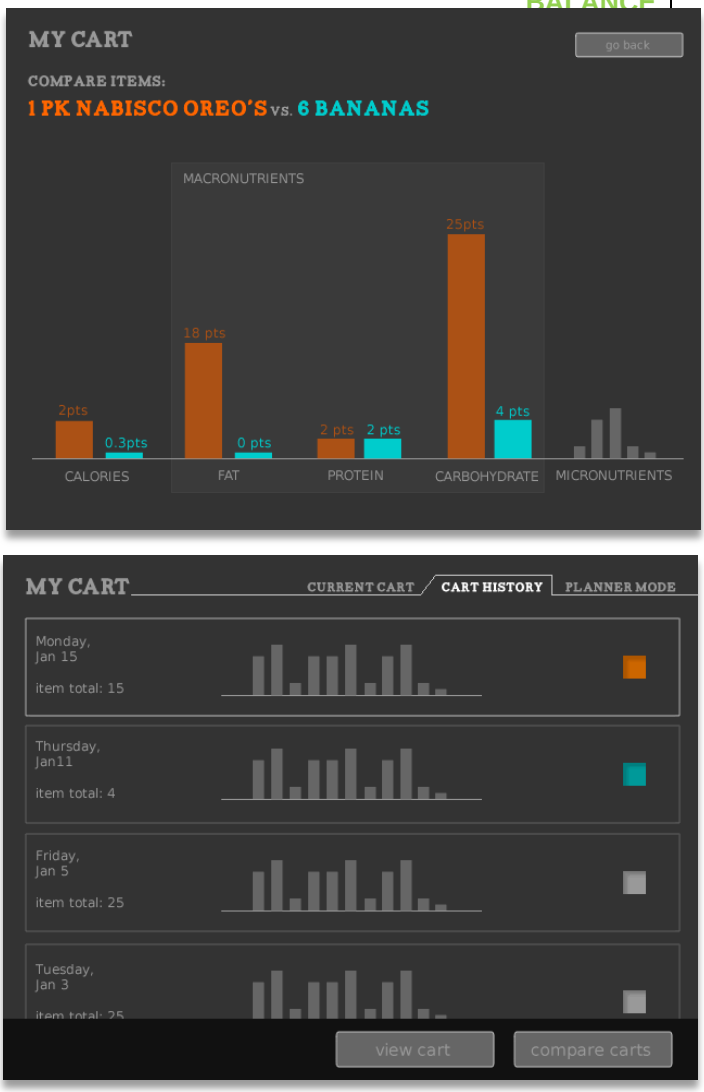


Figure 13: Comparison view and comprehensive history view

CART: BARCHART FORMAT, SEGMENTED WITH NEW INTERFACE

UI (user interface) components became the main focus after this iteration, with planning and reduction of features for implementation purposes. Visual changes for this iteration included a segmented graph, and dual-panel information delivery as well as item recommendations to push users towards a more nutritious grocery cart. This was also the first iteration that included a “Goal Line”, which made the nutritional goal that use

Figure 14: First iteration with Goal line depicted, and improve button for item suggestion.

user wants to reach while shopping visually tangible. Further visual development for this cycle can be seen in Appendices section c.

CART: BARCHART FORMAT, NEW BLUE UI

After familiarizing myself with Android, I continued to develop the look and feel of the UI to fit the new Ice Cream Sandwich release of the OS [24]. New widgets and capabilities such as fragments and action-bars made it possible for me to create a new look that I had not anticipated before starting development. This new iteration focused on the user flow from login to profile creation.

After receiving feedback from my committee and peers, the comprehensive history that the previous iteration contained was reduced to a simple arrows and lines that would act as a stepping-stone towards the final goal line. More visuals can be seen in Appendices section d.

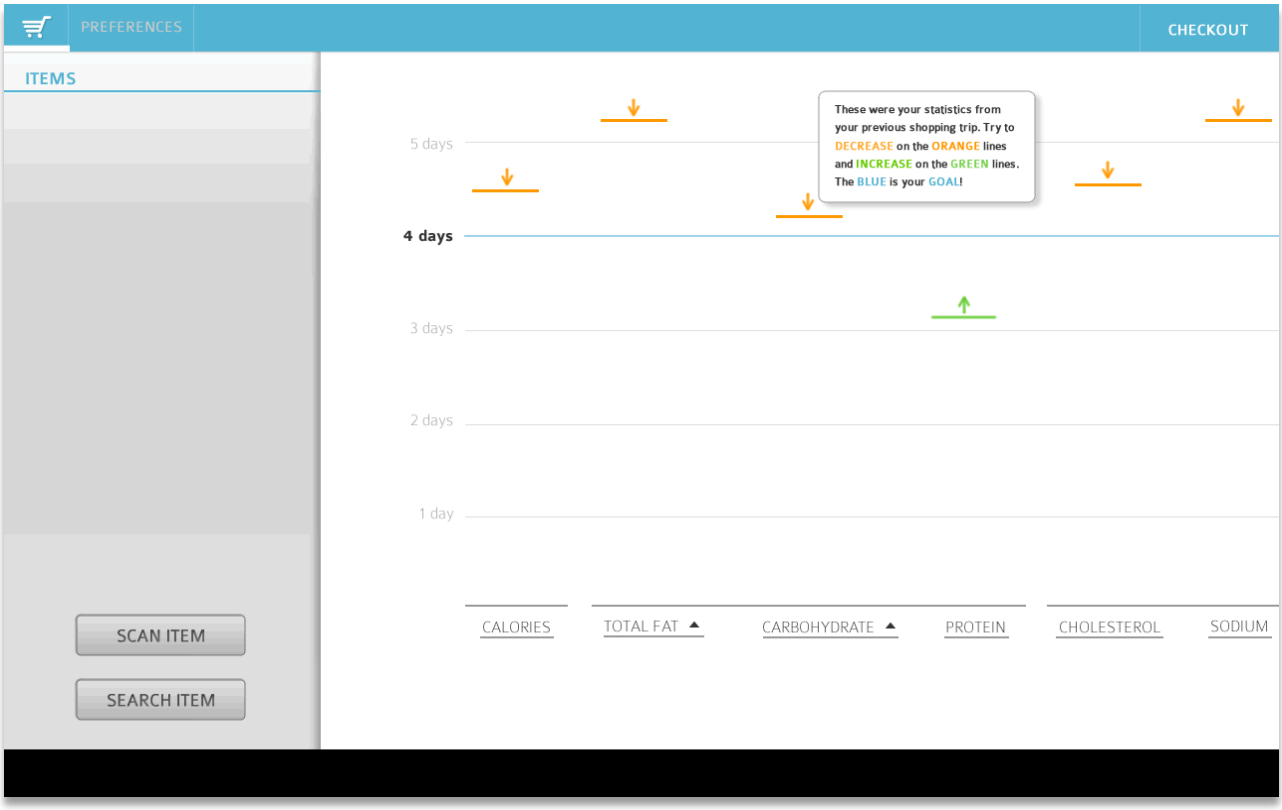


Figure 15: Advent of Previous History visualized in graph view, along with integration of Android 4.0 widgets.

While this final iteration meshed well with the design guidelines as a provided by Android, the software update of the system also led to technical issues with the scanning library. The scanning functionality outweighed the importance of the new widgets in my design, so I reverted back to Android version 2.2, Froyo. Because Froyo was built for the Android mobile phone instead of the tablet, the form factor of the phone was much more comfortable to use when shopping. Additional benefits included a larger

community of technical support and access to a much wider consumer market. The final iteration of the visual design was done alongside the implementation of the application, and can be found in Section 6.02, subsection b.

Section 6.02 System Overview and Walkthrough

(a) Technical Infrastructure

The application was created using Android SDK v. 16 and was tested on the Motorola Droid and Samsung Galaxy S, both running Froyo (API level 8, Android version 2.2. In shaping the interaction flow of ***Balance***, it was decided that the dashboard would be the definitive touch-point for the user to access all functions of the application.

The internals of the application had constant access to the Account Database, which contained all of the user information. After the user account has been created the first time, the Account object, composed of a username, password, and other metadata was passed as a Parcelable object through each Activity or screen. This object acted as a key for the other Activities to access all of the information from the other tables in the Account Database, including people (that the user shops for), current cart (which contains items with the username as part of the metadata to identify which items are in the currently existing cart of the user), and previous history (contains one row per user with metadata about the previous shopping trip's nutrient totals).

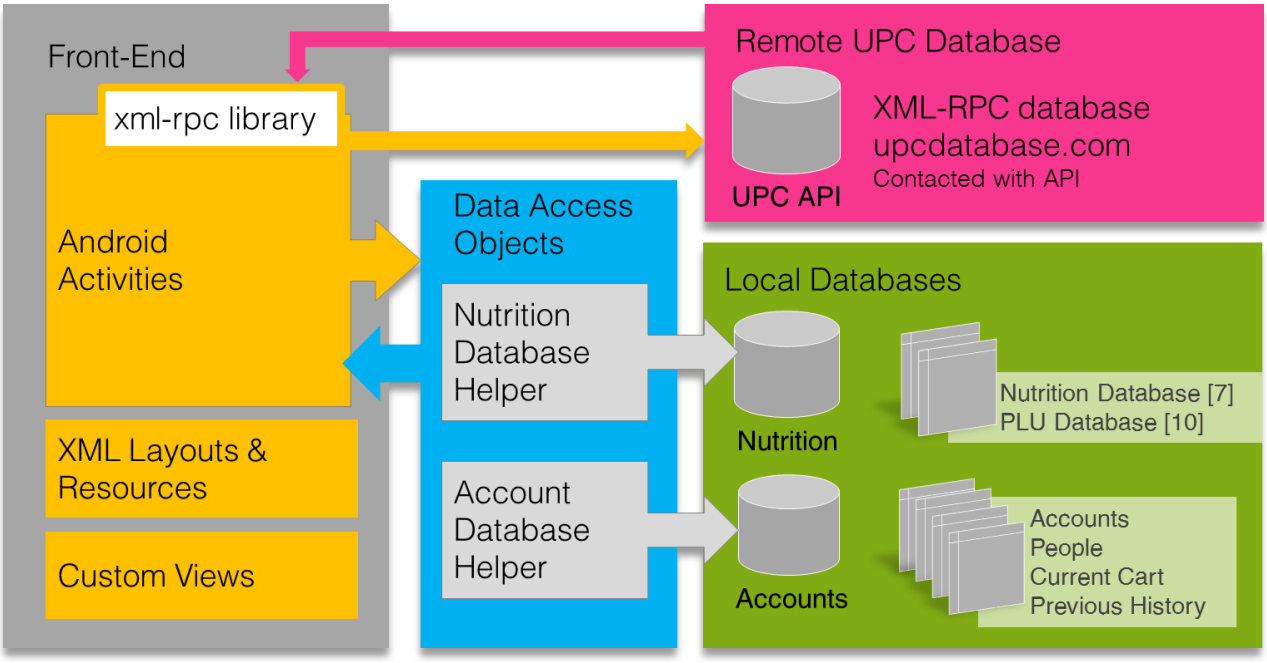


Figure 16: Back-end diagram of Balance.

Two methods are present for the user to add items to the cart: scanning and searching. The scanning function utilizes the ZXing scanning library (http://code.google.com/p/zxing/), an open source library that takes in barcodes via the in-built camera, and parses the image and returns the UPC code as a string of numbers. In order to identify the item, I pass the numbers to a UPC API (www.upcdatabase.com), which returns to me the name, size and description of the item in an XML format which I parse with XML-RPC, another open-source library for Android (http://code.google.com/p/android-xmlrpc/).

Searching for an item is a bit simpler as it utilizes the local Nutrition database that I have created. Whenever the user enters a product look up (PLU) code, I search through the PLU table in the local PLU table (from the from the International Federation for Produce Standards ,http://www.ifpsglobal.com/ProductIdentification/PLUcodes.aspx) , and return the name of the item. The name of the item is then used as the query string to retrieve nutritional information from the local nutrition database, which was obtained from the USDA (http://www.ars.usda.gov/ba/bhnrc/ndl). If the search is successful, the item and the quantity of that item that the user enters is stored in the Accounts database as a Grocery Item object. The nutrition table was and the UPC codes.

(b) Final Application Flow

The final flow that the user walks through was designed around the idea of the dashboard. All processes when exited have the options to return to the dashboard so that the user has a stable home base to return to that offers easy access to all of the apps' multiple functionalities.

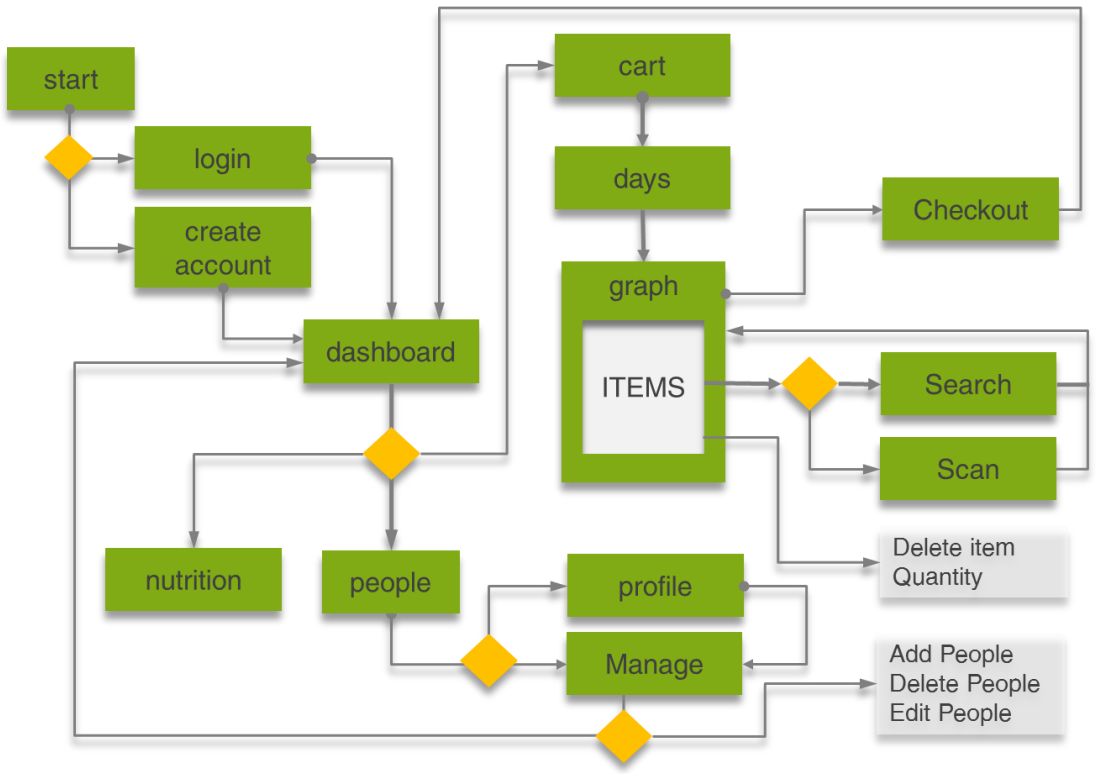


Figure 17: Flow-diagram of Balance.

The setup process is critical to the goal of ***Balance***, as it imposes a framework from which users build their shopping experience. When users enter the app, they are asked to provide a login and password. They are then taken to the dashboard, from which they can access the multiple functionalities of the app. At the start, both the Cart and People functions lead to a profile setup so that the application has the necessary information to perform calculations about the user's nutritional needs.

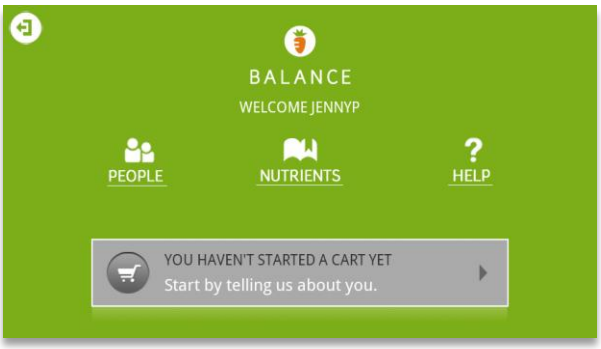


Figure 19: Dashboard

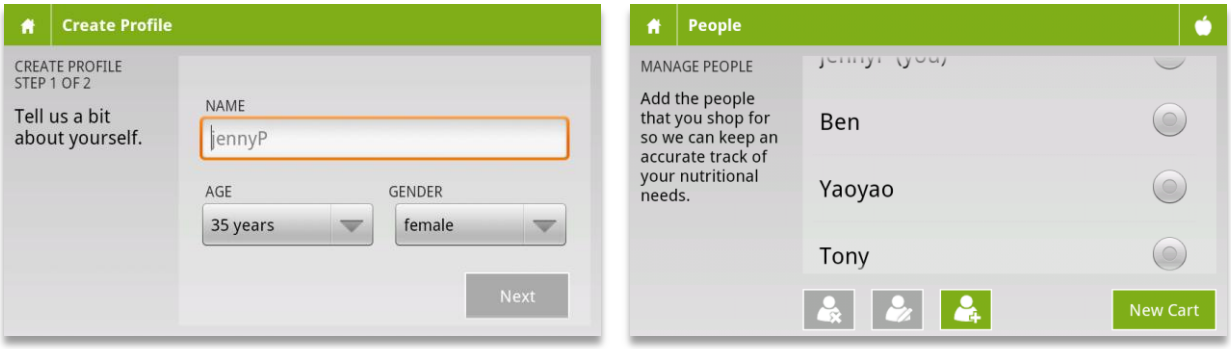


Figure 18: Profile and People screens

Users must then provide information on their shopping trip. The first prompt asks how many people the users are shopping for. During this step, users will provide meta-data on the people that they are shopping for, including age, gender, weight, and height. They are then asked the number of days that they want to shop for.

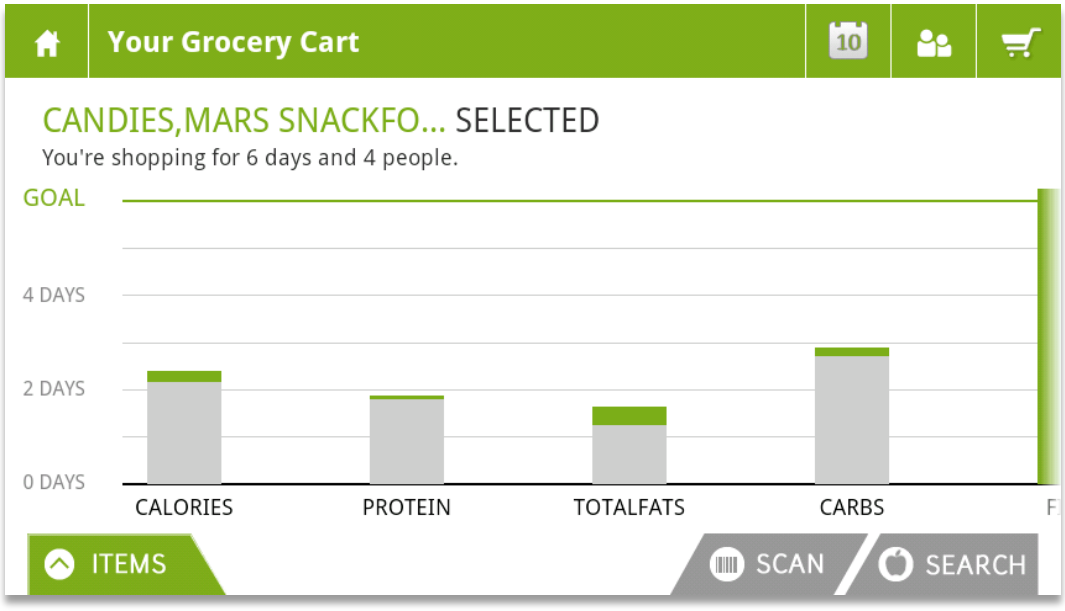


Figure 20: Graph screen with item selected.

Users are then taken to the Cart screen, where they see the nutritional metrics of their current cart in bar-chart form. The chart allows for horizontal scrolling in order to visually display the array of nutrients. The app allows for item input via scanning in or entering a PLU code of an item.

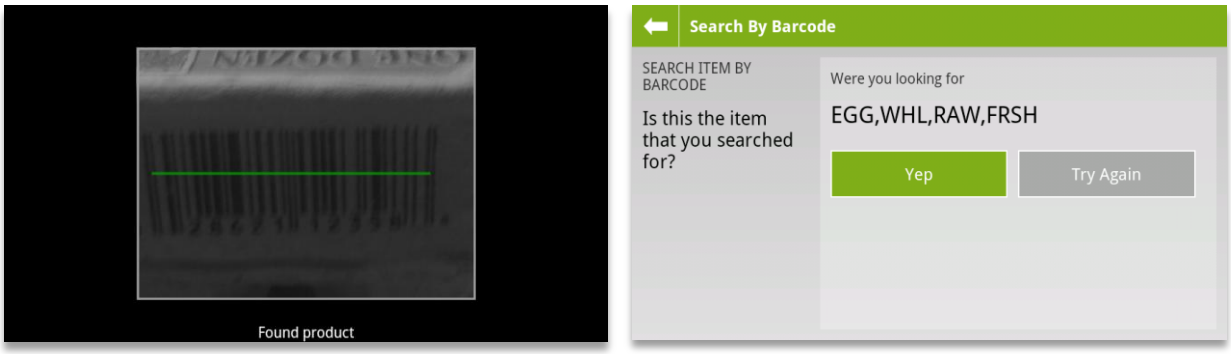


Figure 21: Scanning and item confirmation screens after scan input complete.

After the system identifies the item in the nutrition database, they input a certain quantity, and are brought back to the cart screen. Once the item is entered into the app, they can see nutritional impact of that item reflected in the visualization, which are represented by the green bars (see Figure). The grey underneath the currently selected item's nutrients represents the totals of that particular nutrient within the cart. Users are also able to select individual items or compare two items to see the nutritional values specific to those items displayed.

The visualization has three main components: the bar-chart, the goal days and the previous history values. The first is the bar chart, which displays the total nutritional values of the cart. Each vertical unit on the chart is representative of a days' worth of nutrients for the number of people that the user specified while setting up their account.

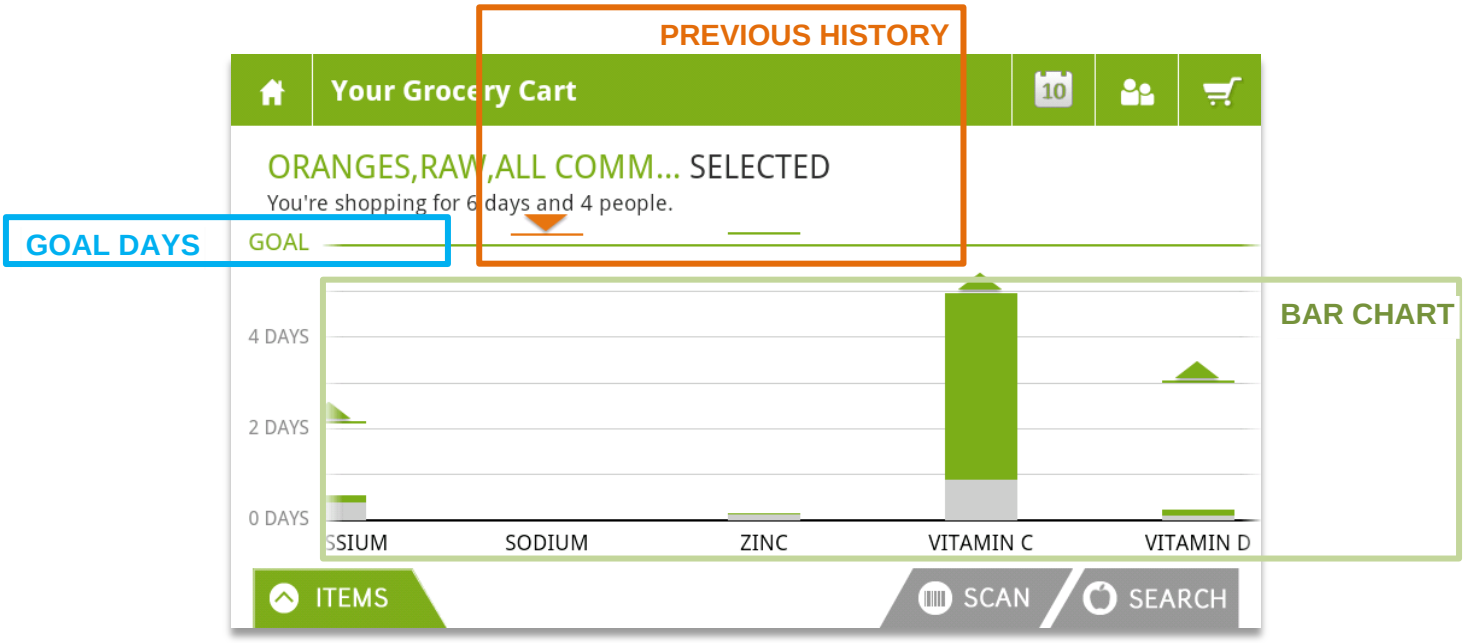


Figure 22: Breakdown of graph screen components.

For example, if the user had specified that they were shopping for a family of four for six days during setup, the “goal-day” line would be set to six, and each unit would represent the amount of that nutrient it took to feed that family of four in a day. Above each nutrient in the bar chart, markers remind the user of the amount of that nutrient was in the previous shopping cart. The user’s goal is to improve by hitting either below or above their previous achievement depending on the arrow’s direction (generally, the arrows point in the direction of the “goal line”).

In order to encourage further improvement, the system will issue messages to the user when they have hit the goal line on a specific nutrient. This can either be a congratulations, or an ecouragement ot improve by decreasing on a certain nutrient (e.g. sodium, sugar, cholesterol or saturated fat).

While users are shopping, they may have trouble comparing between the two items to find the one that will contribute a certain nutrient to their diets. The design also takes this into consideration by allowing the user to compare two items beside each other to see which would contribute more in the context of their nutrition goals.

When users are done shopping they hit the “Checkout” button, which takes them to a final screen describing their totals. It also highlights what they have improved on in this shopping trip, and what to improve on in the next shopping trip. Users must then choose between the options “I’ll Improve” or “Learn about Nutrients”. If the latter option is chosen, they are taken to the nutrient reference section of the app.

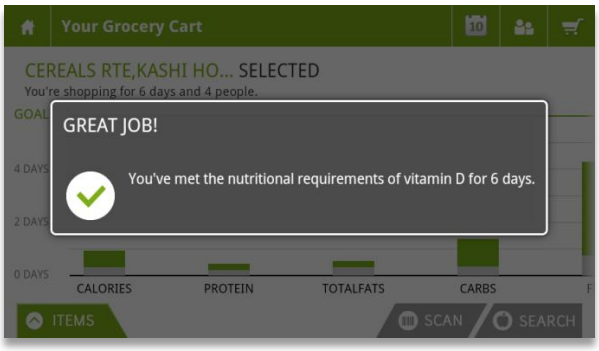


Figure 23: Notification of improvement on a nutrient.

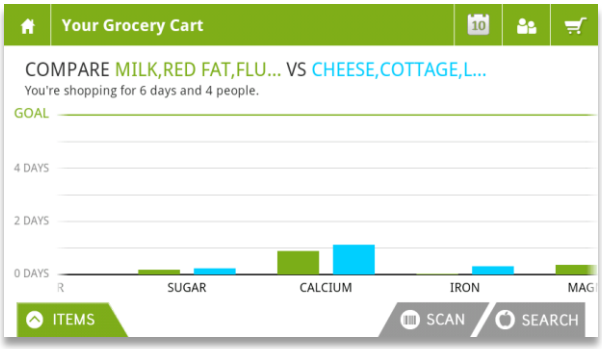


Figure 24: Comparison view between milk and cottage cheese.

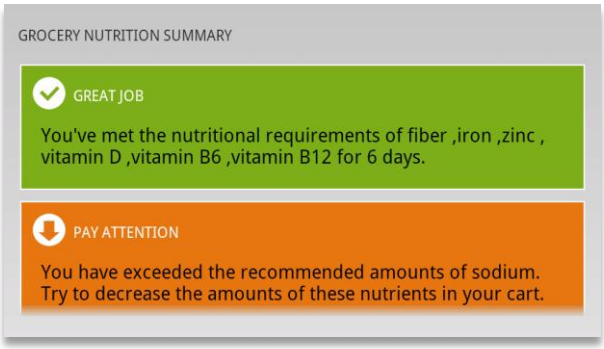


Figure 25: Checkout summary, reminding user of their success and what areas to focus on their next shopping trip.

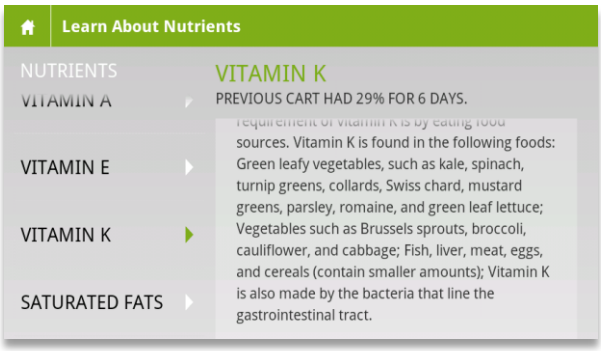


Figure 26: Nutrient Reference screen.

(c) User Feedback

To iterate and improve on the design of the application, I invited 10 peers from the digital media program to use and evaluate the application. While overall reactions and feedback were quite positive, many UI/interaction refinements were suggested for the design of the application in order to better the user experience. The resulting improvements included refinement of the features you see above. For example, the Previous History marks that are present on the graph screen did not have the arrows that indicated to the user how they should improve. I was also able to implement the “Nutrients” section, which allowed the user to browse through the nutrients and learn about the nutrient’s value and what sources they may get the nutrient from.

The testers were generally very excited about the application and saw a wide audience that would be interested in using it. Use cases that were proposed during the evaluations ranged from relatives who had health concerns regarding their diet to pregnant women who needed to be wary of their Vitamin A intake. The abstraction of the total nutritional needs of the week to a simple goal line seemed to be an effective way of decreasing the complexity of nutrition management.

(d) Known Bugs/Issues

LANGUAGE PARSING

The current application does not parse names between the UPC database and the Nutrition database provided by the FDA. I have created a method in which strings are hardcoded so that both databases recognize the names from the other (this method is located in the ScanActivity class).

PROFILE RECOGNITION

In later user testing, it was recognized that tapping on the Cart icon to create a profile from the dashboard would not be recognized by the PeopleActivity class, so there would be two users identified as the “main” in the account database. However, the profile can generally be deleted and restarted in people to set the appropriate profile.

(e) Summary of Application

Grocery shopping is can already be an overwhelming and tedious process without having to consider the nutritional side-effects of the food choices that are being made. ***Balance*** attempts to minimize the work of user input by helping the user to keep track of the nutritional needs of all of the people that they shop for. Instead of having to calculate and understand the numbers presented by the current nutrition facts panel, nutritional information is then delivered as a simple bar chart which allows the user to compare and contrast items in the context of their dietary needs. Simple messages are delivered as reminders for the user to improve or to congratulate them on a success to encourage them to continuously improve each time they shop.

Article VII. Extensions & Future Work

In future work for ***Balance***, I imagine a web application that allows the user to fill out their personal information much more easily. The benefit of a larger screen would allow for much better viewing of graphics, and would be idea for expanding the history capability of ***Balance*** to being able to track details of nutrient purchase across months or even years in the store. The databases that are now local would ideally be on an online server, which would allow for much easier expansion of feature sets as well as updates to the nutrition, user, UPC, and PLU databases. In addition to allowing for more detailed tracking and finer granularity with which the information could be viewed, porting this online would possibly incite more user activity. It may then be possible to form an online community similar to that of Shopwell or Nike+ which encourages improvement not only through data, but through social interactions based on a common goal as well.

For the application, successfully implementing the language parsing between databases would be ideal. After the technical challenge, it would be great to incorporate more motivational incentives for the user to improve on their nutritional grocery shopping. This can possibly come in the form of a simple graphic reward, or with game-like elements such as points or achievement badges. The reminder system should also become more adaptive and less binary by fitting the users' preferences (possibly allergies or dietary lifestyles such as veganism) as well as nutritional needs. In addition, it could offer the ability to give suggestions based on these preferences or nutritional needs of the user in a similar fashion as Fooducate or other existing item recommendation applications.

Figure 23: Future extension, web application

Article VIII. Conclusions

Balance has shown that through iterative design and a positively reinforced user experience, it is possible to direct a users' grocery shopping experience towards making nutritionally balanced grocery decisions. In designing ***Balance***, I aimed to allow for the ambiguity of item selection; it is possible for users to buy Oreos (which are high in saturated fats) as long as they balance their diets with enough fiber and vitamins from fruits and vegetables that they purchase as well.

In informal user tests where peers were asked to use and reflect on ***Balance***, the testees responded positively and enthusiastically to the concept of the application. Many believed that by displaying the nutritional contents of the cart graphically, they could more easily discern the values as they contribute towards their own personal diets. In addition, most noted that the lines and arrows indicating the previous history were very helpful indicators to remind them of their upcoming goals for their shopping trip. Even though a quantitative evaluation was out of the scope of this project, the working project succeeded in its main goal during the informal evaluations: to allow users to keep track and improve on their choices based on the nutritional contents of items while grocery shopping.

Article IX. Deliverables

The final deliverables for this project are as follows:

1. A functioning Android application will:
    a. Allow users to input a specific set of grocery items using either barcode or PLU code input and see the totals reflected in a bar graph visualization
    b. Give feedback based upon the users' input, and will allow the user to personalize their shopping cart options by adding in new people to shop for or changing the number of days to shop for
    c. Keep track of the previous shopping cart totals and display them in said graph visualization
    d. The application will also contain a nutrient reference with materials scraped from the USDA and CDC websites.
2. Documentation describing the application and the theory, background, and development leading up to the final version of the application.
3. A website that documents the project in brief that gives access to the gitHub source code of the application as well as the final downloadable application

Article X. Bibliography

Section 10.01 References

[1] A Condensed History of American Agriculture 1776 – 1999 in the passage of the US ECT. (1999). Agriculture, 1. Retrieved from www.usda.gov/documents/timeline.pdf.

[2] Abusabha, R., & Achterberg, C. (1997). Review of self-efficacy and locus of control for nutrition-and health-related behavior. Journal of the American Dietetic Association, 97(10), 1122-1132.

[3] Ahtinen, A., Ramiah, S., Blom, J., & Isomursu, M. (2008). Design of Mobile Wellness Applications : Identifying Cross-Cultural Factors. Human Factors, 164-171.

[4] App Store - DailyBurn Tracker. (n.d.). Retrieved April 19, 2012, from http://itunes.apple.com/us/app/dailyburn-tracker/id378928008?mt=8

[5] App Store - Nutrition Diary. (n.d.). Retrieved April 19, 2012, from http://itunes.apple.com/us/app/nutrition-diary/id326700595?mt=8

[6] Bandura A: Self-efficacy: Toward a unifying theory of behavioral change. Psychology Rev 84:191-215, 1977.

[7] Barreiro-Hurlé, J., Gracia, A., & de-Magistris, T. (2010). Does nutrition information on food products lead to healthier food choices? Food Policy, 35(3), 221-229. Elsevier Ltd. doi:10.1016/j.foodpol.2009.12.006

[8] Bialkova, S., & van Trijp, H. (2010). What determines consumer attention to nutrition labels? Food Quality and Preference, 21(8), 1042-1051. Elsevier Ltd. doi:10.1016/j.foodqual.2010.07.001

[9] Boyce, T. (2007). The media and obesity. Obesity reviews an official journal of the International Association for the Study of Obesity, 8 Suppl 1(12), 201-205. Blackwell Publishing Ltd. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17316326

[10] Calorific Diet Tracker - Android Apps on Google Play. (n.d.). Retrieved April 19, 2012, from https://play.google.com/store/apps/details?id=com.wsl.calorific&feature=nav_result#?t=W251bGwsMSwxLDMsImNvbS53c2wuY2Fsb3JpZmljIl0.

[11] Chen, C. (2007). Handbook of data visualization. Berlin: Springer.

[12] Consolvo, S., Markle, K., Patrick, K., & Chanasyk, K. (2007). Designing For Persuasion : Mobile Services for Health Behavior Change.

[13] Consolvo, S., McDonald, D. W., & Landay, J. a. (2009). Theory-driven design strategies for technologies that support behavior change in everyday life. Proceedings of the 27th international conference on Human factors in computing systems - CHI '09, 405. New York, New York, USA: ACM Press. doi:10.1145/1518701.1518766

[14] Cotugna, N. (1996). Tools to Simplify and Demonstrate the New Food Label. Journal of Nutrition Education, 28(6), 365-365. doi: 10.1016/S0022-3182(96)70136-X.

[15] Cousineau, T. M., Goldstein, M., & Franko, D. L. (2004). A collaborative approach to nutrition education for college students. Journal of American college health : J of ACH, 53(2), 79-84. doi:10.3200/JACH.53.2.79-84

[16] Cowburn, G., & Stockley, L. (2007). Consumer understanding and use of nutrition labeling: a systematic review. Public Health Nutrition, 8(01), 21-28. doi:10.1079/PHN2004666

[17] Drichoutis, A., Lazaridis, P., & Nayga Jr, R. M. (2006). Consumers' use of nutritional labels: a review of research studies and issues. Academy of Marketing Science Review, 10(9). Retrieved from http://works.bepress.com/andreas_drichoutis/5/

[18] "Eat Healthy | Let's Move!". Let's Move!. USDA, 2011. Web. 28 Sept. 2011. <http://www.letsmove.gov/eat-healthy>.

[19] Fekete, J.-daniel, Wijk, J. J. V., Stasko, J. T., & North, C. (2008). The Value of Information Visualization. Information Visualization, 1-18.

[20] Fitbit. (2012.). Retrieved April 19, 2012, from http://www.fitbit.com/

[21] Foley-fisher, Z., Centre, I., Sciences, F., Building, C., Kamal, N., & Tsao, V. (2010). Healthy Shelf : Interactive Nutritional Labels. Design, 4405-4410.

[22] Fooducate - Eat Healthy Diet - Android Apps on Google Play. (n.d.). Retrieved April 19, 2012, from https://play.google.com/store/apps/details?id=com.fooducate.nutritionapp&feature=search_result

[23] Golan, E., Kuchler, F., & Mitchell, L. (n.d.). Economics of Food Labeling. In United States Department of Agriculture website.

Retrieved from http://www.ers.usda.gov/publications/aer793/aer793a.pdf.

[24] Google (2012). Android Design: how to design exceptional android apps for ICS. Retrieved April 19, 2012, from http://developer.android.com/design/index.html

[25] Health & Fitness - Android Apps on Google Play. (n.d.). Retrieved April 19, 2012, from https://play.google.com/store/apps/category/HEALTH_AND_FITNESS?feature=category-nav

[26] Health & Fitness - App Store Downloads on iTunes. (n.d.). Retrieved April 19, 2012, from http://itunes.apple.com/us/genre/ios-health-fitness/id6013?mt=8

[27] Healthy Eating Made Simple | ShopWell. (n.d.). Retrieved April 19, 2012, from http://www.shopwell.com/

[28] Honest Label - Android Apps on Google Play. (n.d.). Retrieved April 19, 2012, from https://play.google.com/store/apps/details?id=com.ls.simpleparser#?t=W251bGwsMSwxLDIxMiwiY29tLmxzLnNpbXBsZXBhcnNlciJd

[29] In Historical Food Guides Background and Development. Retrieved March 22, 2011, from http://www.nal.usda.gov/fnic/history/index.html.

[30] Kiesel, K., & Villas-Boas, S. B. (2010). Can information costs affect consumer choice? Nutritional labels in a supermarket experiment. International Journal of Industrial Organization. Elsevier B.V. doi: 10.1016/j.ijindorg.2010.11.002.

[31] Kim, H., Kogan, A., Dasgupta, C., Novitzky, M. M., & Do, E. Y. Grocery Hunter : A Fun Mobile Game for Children to Combat Obesity. Technology, 317-320.

[32] Kovac, Betty. "MyPlate Index." medicinenet. WebMD, 22 July 2011. Web. 28 Sept. 2011. <www.medicinenet.com/myplate.htm>

[33] Larkin, J. H., & Simon, H. (1987). Why a Diagram is (Sometimes) Worth Ten Thousand Words, 99, 65-99.

[34] Let's Move. Retrieved March 22, 2011, from http://www.letsmove.gov/

[35] Levy, A. S., & Fein, S. B. (1998). Consumers' Ability to Perform Tasks Using Nutrition Labels. Journal of Nutrition Education, 30(4), 210-217. doi: 10.1016/S0022-3182(98)70321-8.

[36] Lion, F. (2011). Opposing view on health: Food makers' Labels get an F. Science, pp. 2-3.

[37] Montgomery, K. C., & Chester, J. (2009). Interactive food and beverage marketing: targeting adolescents in the digital age. Journal of Adolescent Health, 45(3 Suppl), S18-29. Elsevier Ltd. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/19699433

[38] Mulrooney, B., McDermott, M., & Earley, N. (2006). NutraStick: portable diet assistant. CHI'06 extended abstracts on Human factors in computing systems (pp. 1855–1860). ACM. Retrieved from http://portal.acm.org/citation.cfm?id=1125802

[39] Murray, J. H. (2012). Inventing the medium: principles of interaction design as a cultural practice. Cambridge, Mass.: MIT Press.

[40] Neuhouser, M. L., Kristal, a R., & Patterson, R. E. (1999, January). Use of food nutrition labels is associated with lower fat intake. Journal of the American Dietetic Association. doi:10.1016/S0002-8223(99)00013-9

[41] Nike+. (2012). Retrieved April 19, 2012, from http://nikeplus.nike.com/plus/

[42] Nutritional Labeling and Education Act (NLEA) (2004). In Food and Drug Adminstration website. Retrieved March 17, 2011 from http://www.fda.gov/ICECI/Inspections/InspectionGuides/ucm074948.htm

[43] Pousman, Z., Stasko, J., & Mateas, M. (n.d.). Casual information visualization: depictions of data in everyday life. IEEE transactions on visualization and computer graphics, 13(6), 1145-52. doi:10.1109/TVCG.2007.70541

[44] Prochaska, J.O., DiClemente, C.C., Norcross, J.C. "In search of how people change: Applications to addictive behaviors," Amer Psych, 47(9), (Sep 1992), 1102-14.

[45] Rothman, R. L., Housam, R., Weiss, H., Davis, D., Gregory, R., Gebretsadik, T., Shintani, A., et al. (2006). Patient understanding of food labels: the role of literacy and numeracy. American journal of preventive medicine, 31(5), 391-8. doi:10.1016/j.amepre.2006.07.025

[46] [S. K. Card, J. Mackinlay, and B. Shneiderman. Readings in Informa- tion Visualization, Using Visualization to Think, chapter 1, pages 1–34. Morgan Kaufmann, 1999.

[47] Shekar, S., & Nair, P. (2003). iGrocer: a ubiquitous and pervasive smart grocery shopping system. Proceedings of the 2003 ACM symposium. Retrieved from http://dl.acm.org/citation.cfm?id=952658

[48] Smith, A. (2011). Smartphone Adoption and Usage. Pew Internet and American Life Project. Retrieved April 20, 2012, from http://pewinternet.org/Reports/2011/Smartphones/Summary.aspx

[49] Srinivas, P., Huang, H., Pirzadeh, A., & Bolchini, D. (2011). Clever Shopper : Supporting In-Store Decision-Making.

[50] Stolberg, S.G. (February 9, 2010). Childhood Obesity Battle Is Taken Up by First Lady. In New York Times. Retrieved March 22, 2011, from http://www.nytimes.com/2010/02/10/health/nutrition/10obesity.html?ref=michelleobama

[51] Strecher, V. J., Devellis, B. M., Becker, M. H., & Rosenstock, I. M. (n.d.). The Role of Self-Efficacy in Achieving Behavior Change Health.

[52] U.S. Obesity Trends. (2011). In Centers for Disease Control and Prevention website. Retrieved from http://www.cdc.gov/obesity/data/trends.html

[53] Taylor, C. L., & Wilkening, V. L. (2008). How the nutrition food label was developed, Part 2: the purpose and promise of nutrition claims. Journal of the American Dietetic Association, 108(3), 618-23. doi:10.1016/j.jada.2007.12.010

[54] University of California - Los Angeles (2010, February 10). Childhood obesity: It's not the amount of TV, it's the number of junk food commercials. ScienceDaily. Retrieved March 16, 2011, from http://www.sciencedaily.com- /releases/2010/02/100209095753.htm

[55] Ware, C. (2004). Information visualization: perception for design. 2nd ed. San Francisco, CA: Morgan Kaufman.

Section 10.02 Figure References

1) “Food Guide Pyramid”. National Agricultural Library - The Food Guide Pyramid Page. USDA (n.d.). Web. 23 April 2012. http://www.nal.usda.gov/fnic/Fpyr/pmap.htm

2) “FDA Nutrition Facts Label Program”. FDA’s Food Nutrition Facts Label Programs Page. FDA, 15, Feb. 2012. Web. 23 April 2012. http://www.fda.gov/Food/ResourcesForYou/Consumers/NFLPM/ucm274593.htm

3) "USDA's MyPlate - Home page ". USDA's MyPlate - Home page . USDA, 27 Sept. 2011. Web. 28 Sept. 2011. http://www.choosemyplate.gov/

4) General Mills Nutrition Keys. Retrieved April 19, 2012, from: http://www.generalmills.com/Home/Media/Inside_General_Mills/2011_archive/front_of_package_2_4_2011

5) Foley-fisher, Z., Centre, I., Sciences, F., Building, C., Kamal, N., & Tsao, V. (2010). Healthy Shelf : Interactive Nutritional Labels. Design, 4405-4410.

6) Mulrooney, B., McDermott, M., & Earley, N. (2006). NutraStick: portable diet assistant. CHI’06 extended abstracts on Human factors in computing systems (p. 1855–1860). ACM. Retrieved March 17, 2011, from http://portal.acm.org/citation.cfm?id=1125802.

7) Kim, H., Kogan, A., Dasgupta, C., Novitzky, M. M., & Do, E. Y.-luen. (n.d.). Grocery Hunter : A Fun Mobile Game for Children to Combat Obesity. Technology, 317-320.

8) Calorific, Screenshot. Retrieved April 19, 2012 from https://play.google.com/store/apps/details?id=com.wsl.calorific&feature=search_result#?t=W251bGwsMSwxLDEsImNvbS53c2wuY2Fsb3JpZmljIl0.

9) Nutrition Diary, Screenshot. Retrieved April 19, 2012 from: http://itunes.apple.com/us/app/nutrition-diary/id326700595?mt=8

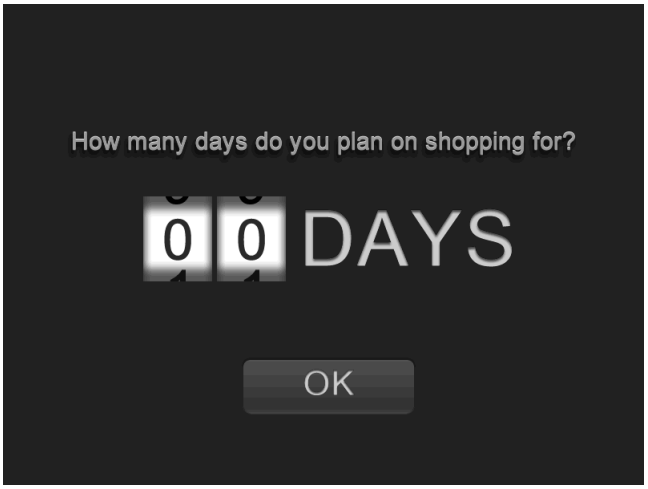
10) Fooducate, Screenshot. Retrieved April 19, 2012 from: https://play.google.com/store/apps/details?id=com.fooducate.nutritionapp&feature=search_result#?t=W251bGwsMSwxLDEsImNvbS5mb29kdWNhdGUubnV0cml0aW9uYXBwIl0.

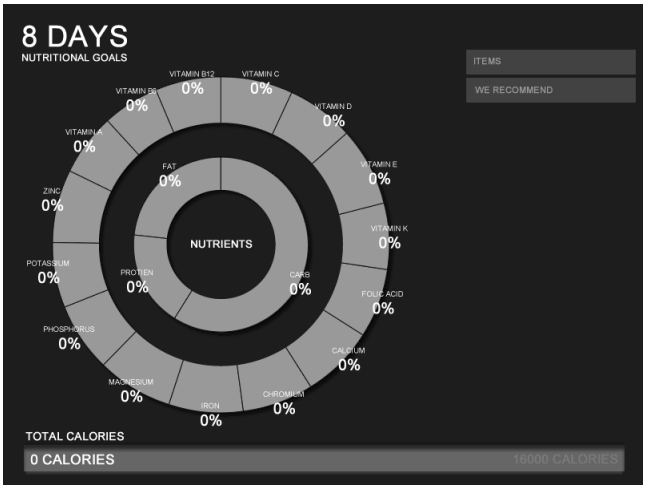
11) Shopwell, Website Screenshot. Retrieved April 19, 2012 from: http://www.shopwell.com/

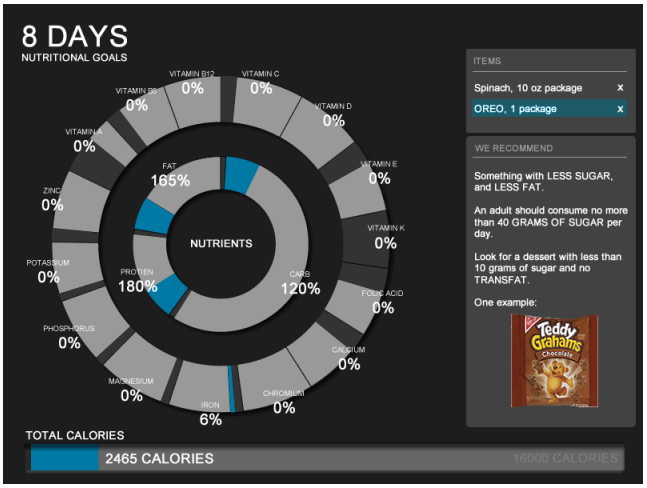
Section 10.03 Table of Figures

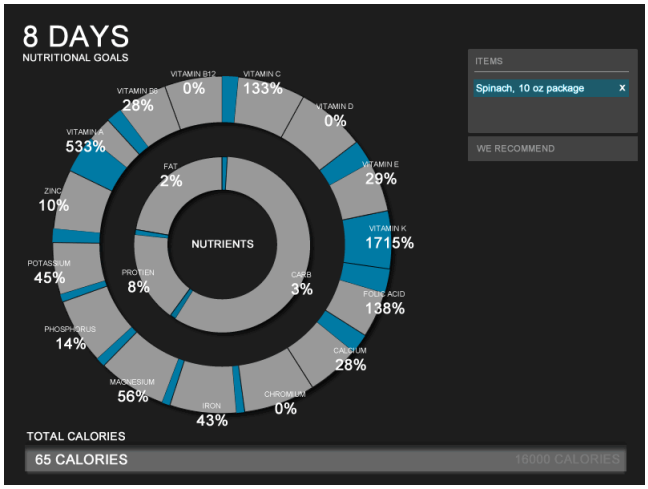
Section 10.04 Appendices

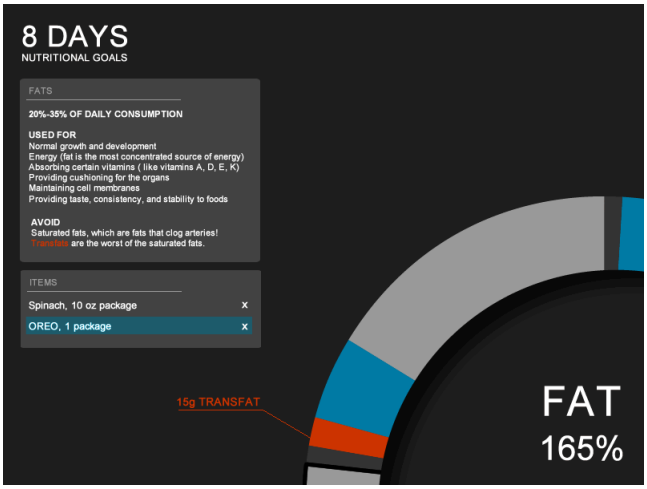
(a) Cart: CIRCULAR GRAPHIC, MICRONUTRIENTS INCLUDED



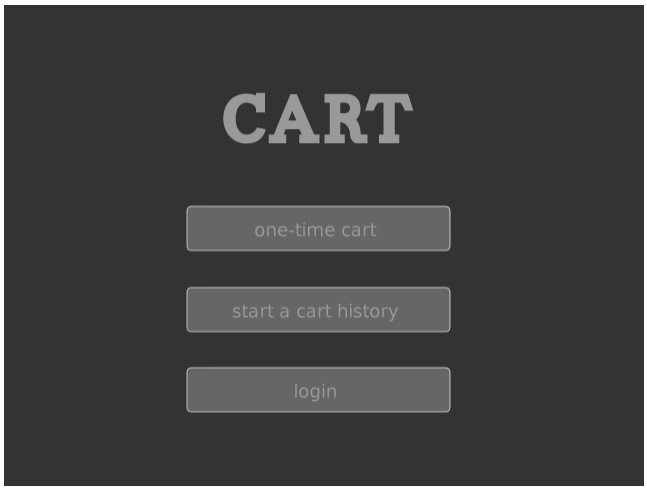


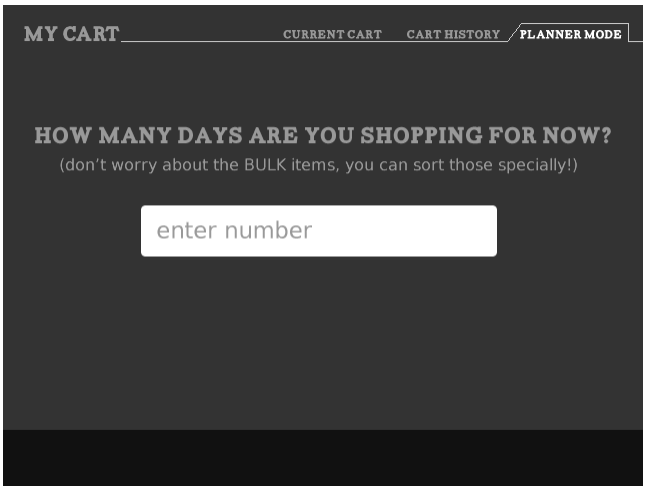


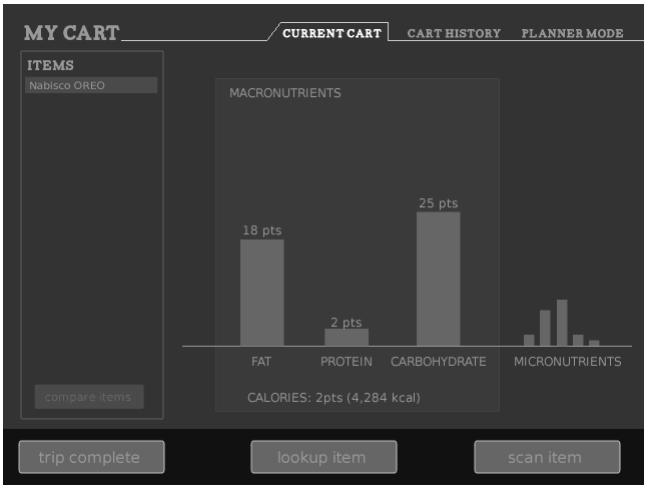


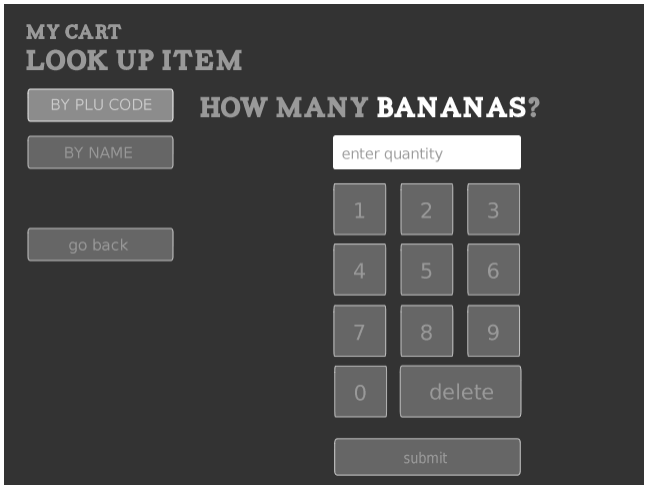


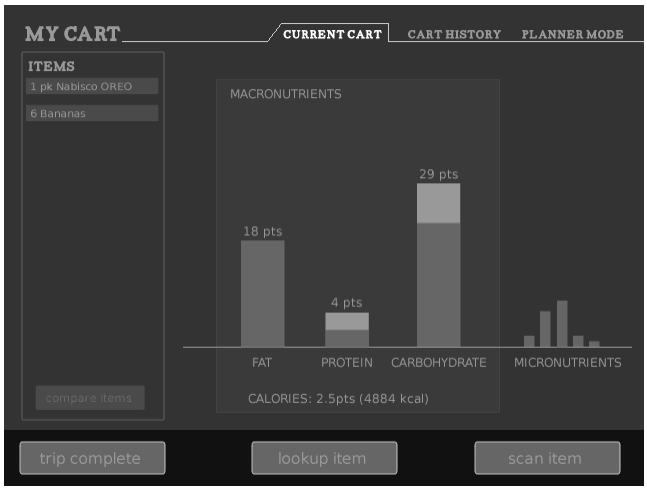
(b) Cart: Bar Chart format

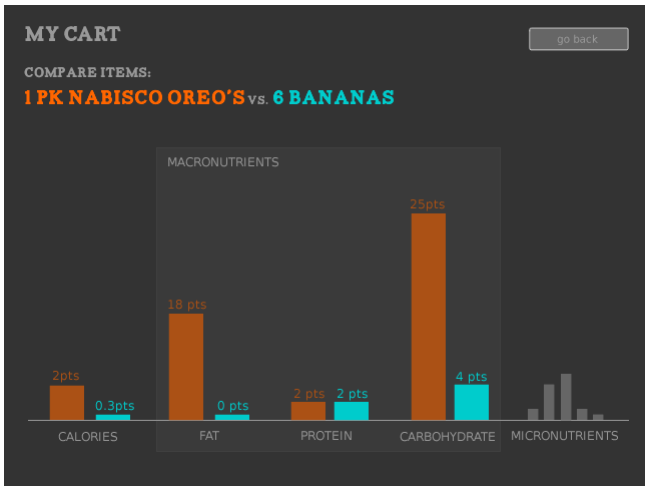


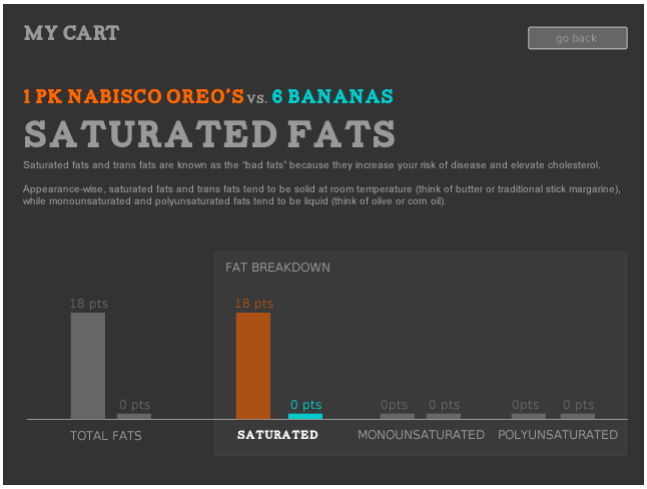


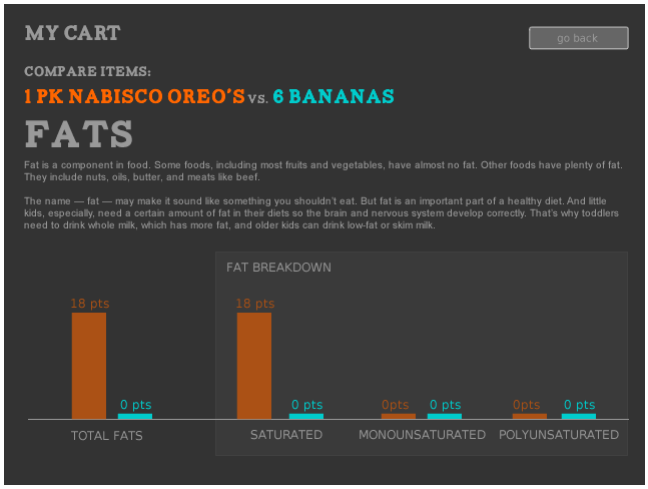


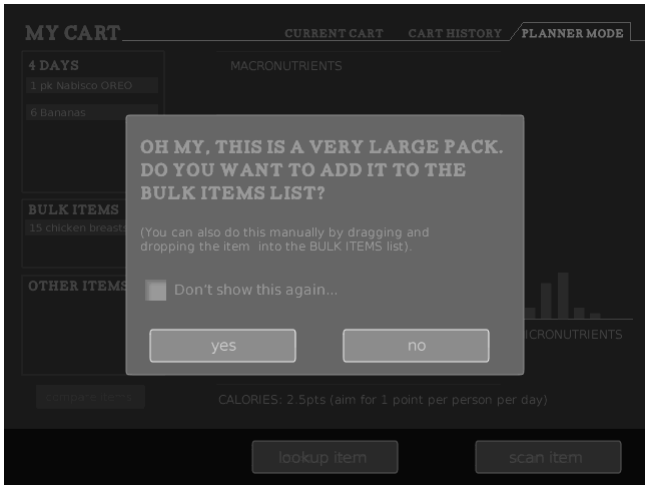


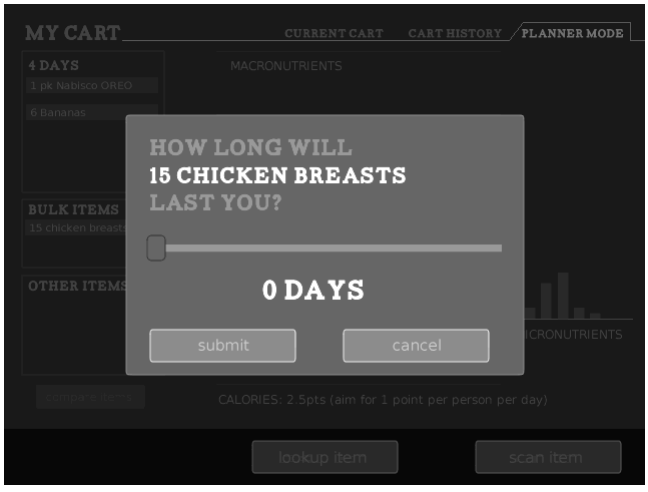

MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
ITEMS
1 pk Nabisco OREO
6 Bananas
compare items
MACRONUTRIENTS
18 pts
4 pts
29 pts
FAT
PROTEIN
CARBOHYDRATE
MICRONUTRIENTS
CALORIES: 2.5pts (4884 kcal)
trip complete
lookup item
scan item


MY CART
go back
COMPARE ITEMS:
1 PK NABISCO OREO'S vs. 6 BANANAS
MACRONUTRIENTS
2pts
0.3pts
18 pts
0 pts
2 pts
2 pts
25pts
4 pts
CALORIES
FAT
PROTEIN
CARBOHYDRATE
MICRONUTRIENTS


MY CART
go back
1 PK NABISCO OREO'S vs. 6 BANANAS
SATURATED FATS
Saturated fats and trans fats are known as the "bad fats" because they increase your risk of disease and elevate cholesterol.
Appearance-wise, saturated fats and trans fats tend to be solid at room temperature (think of butter or traditional stick margarine), while monounsaturated and polyunsaturated fats tend to be liquid (think of olive or corn oil).
FAT BREAKDOWN
18 pts
0 pts
18 pts
0 pts
0pts
0 pts
0pts
0 pts
TOTAL FATS
SATURATED
MONOUNSATURATED
POLYUNSATURATED

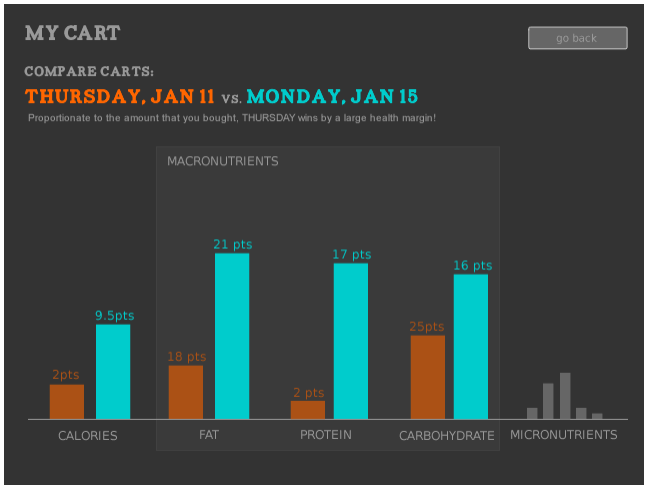

MY CART
go back
COMPARE ITEMS:
1 PK NABISCO OREO'S vs. 6 BANANAS
FATS
Fat is a component in food. Some foods, including most fruits and vegetables, have almost no fat. Other foods have plenty of fat. They include nuts, oils, butter, and meats like beef.
The name — fat — may make it sound like something you shouldn't eat. But fat is an important part of a healthy diet. And little kids, especially, need a certain amount of fat in their diets so the brain and nervous system develop correctly. That's why toddlers need to drink whole milk, which has more fat, and older kids can drink low-fat or skim milk.
FAT BREAKDOWN
18 pts
0 pts
18 pts
0 pts
0pts
0 pts
0pts
0 pts
TOTAL FATS
SATURATED
MONOUNSATURATED
POLYUNSATURATED


MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
4 DAYS
1 pk Nabisco OREO
6 Bananas
MACRONUTRIENTS
BULK ITEMS
15 chicken breasts
OTHER ITEMS
OH MY, THIS IS A VERY LARGE PACK. DO YOU WANT TO ADD IT TO THE BULK ITEMS LIST?
(You can also do this manually by dragging and dropping the item into the BULK ITEMS list).
Don't show this again...
yes
no
CRONUTRIENTS
compare items
CALORIES: 2.5pts (aim for 1 point per person per day)
lookup item
scan item


MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
4 DAYS
1 pk Nabisco OREO
6 Bananas
MACRONUTRIENTS
BULK ITEMS
15 chicken breasts
OTHER ITEMS
HOW LONG WILL
15 CHICKEN BREASTS
LAST YOU?
0 DAYS
submit
cancel
CRONUTRIENTS
CALORIES: 2.5pts (aim for 1 point per person per day)
lookup item
scan item

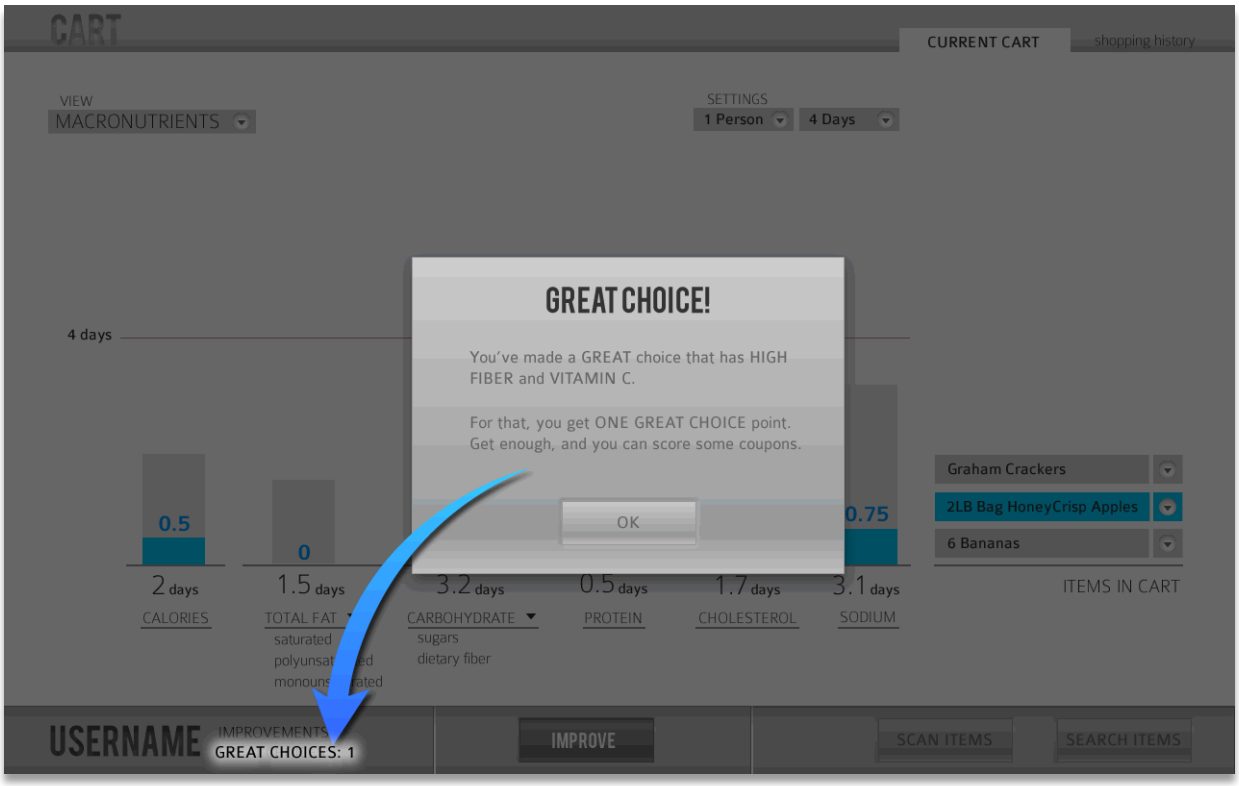

MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
4 DAYS
1 pk Nabisco OREO
6 Bananas
BULK ITEMS
15 chicken breasts
OTHER ITEMS
set time
compare items
MACRONUTRIENTS
18 pts
4 pts
29 pts
FAT
PROTEIN
CARBOHYDRATE
MICRONUTRIENTS
CALORIES: 2.5pts (aim for 1 point per person per day)
trip complete
lookup item
scan item

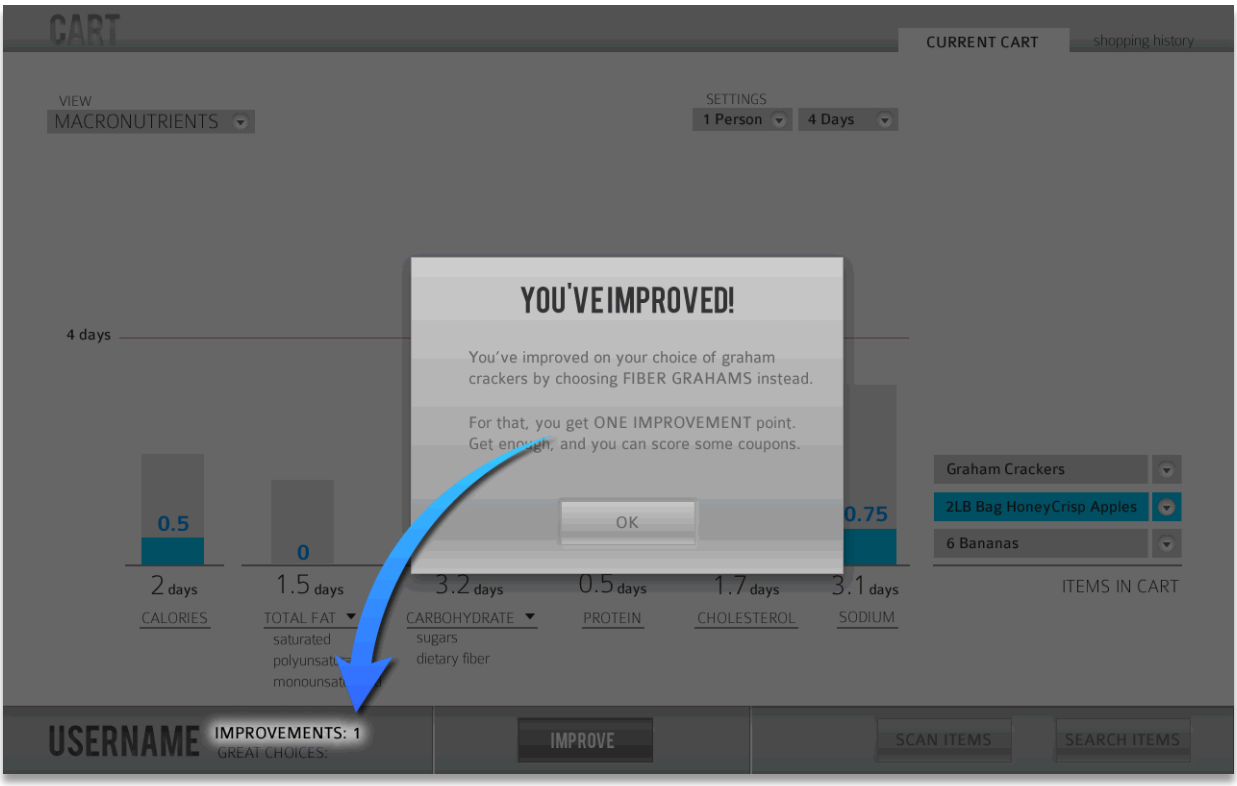

MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
Monday,
Jan 15
item total: 15
Thursday,
Jan11
item total: 4
Friday,
Jan 5
item total: 25
Tuesday,
Jan 3
view cart
compare carts


MY CART
go back
COMPARE CARTS:
THURSDAY, JAN 11 vs. MONDAY, JAN 15
Proportionate to the amount that you bought, THURSDAY wins by a large health margin!
MACRONUTRIENTS
2pts
9.5pts
18 pts
21 pts
2 pts
17 pts
25pts
16 pts
CALORIES
FAT
PROTEIN
CARBOHYDRATE
MICRONUTRIENTS

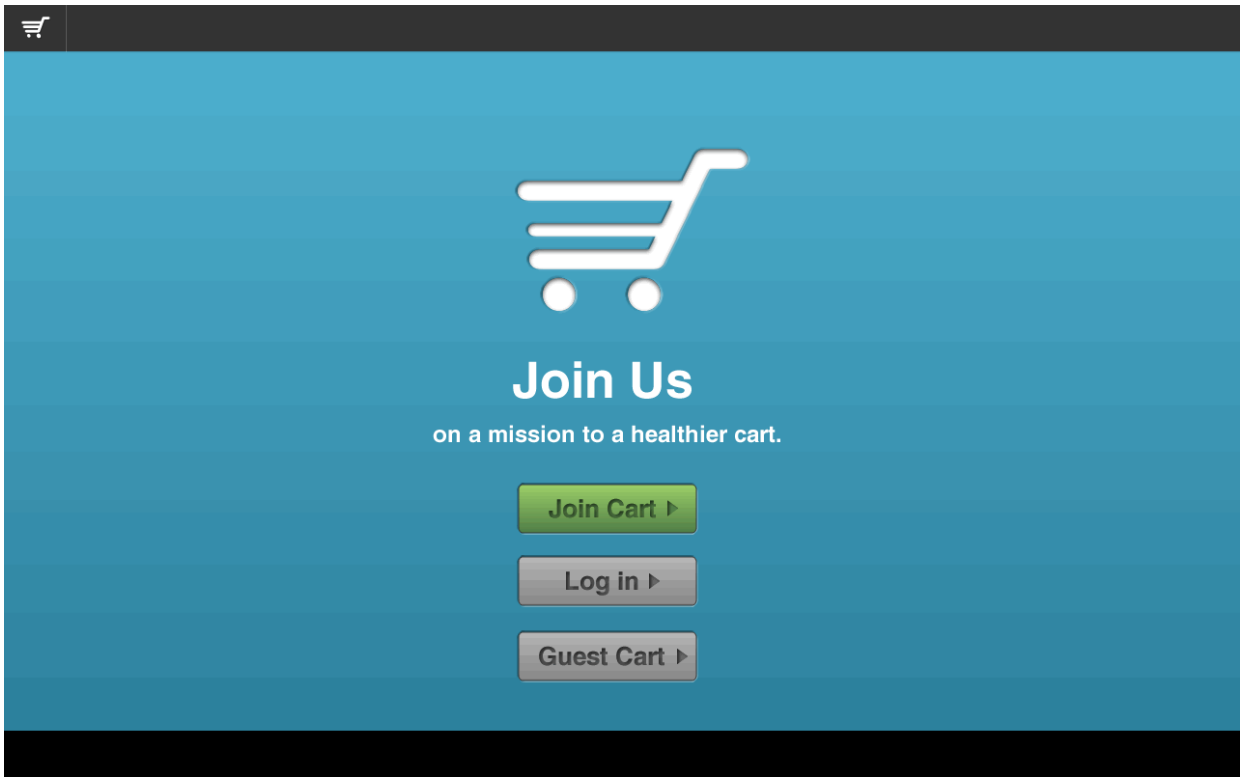

MY CART
CURRENT CART
CART HISTORY
PLANNER MODE
Monday,
Jan 15
item total: 15
Thursday,
Jan11
item total: 4
Friday,
Jan 5
item total: 25
Tuesday,
Jan 3
view cart
compare carts

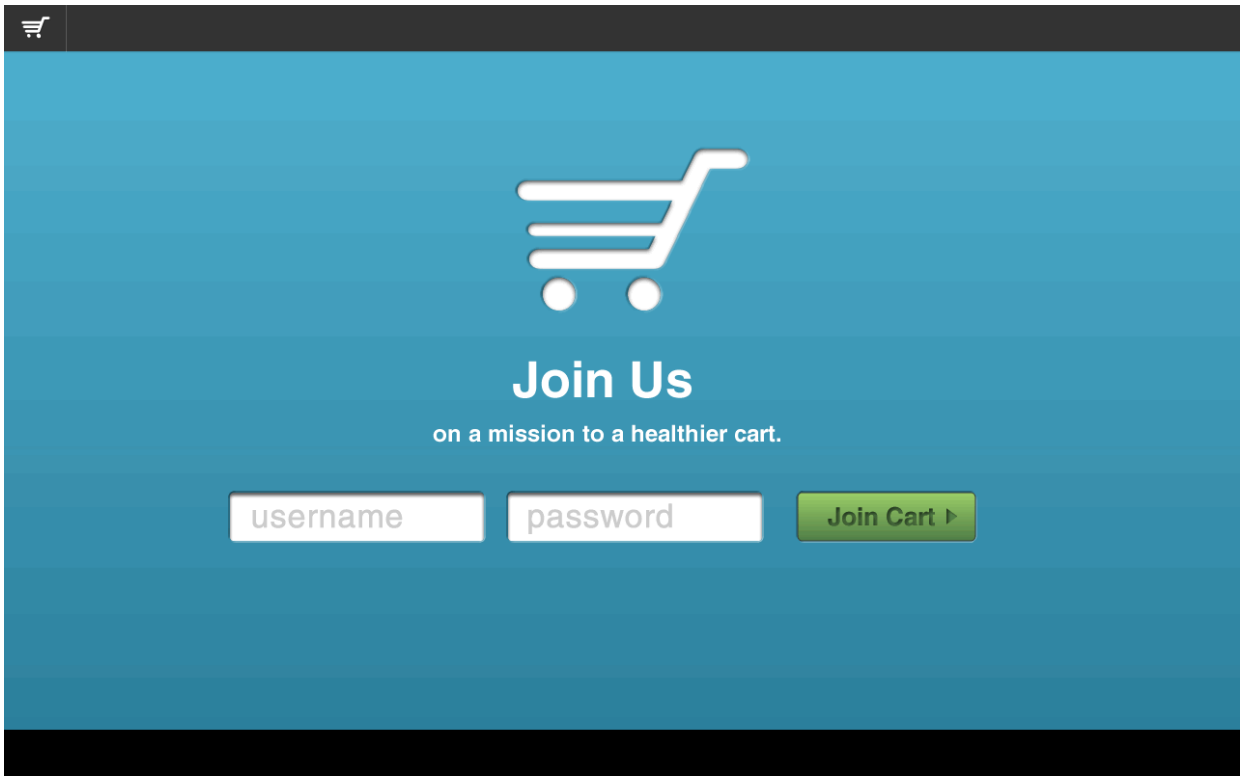
(c) Cart: Bar chart format with new segmented bars and item recommendation system


CART
CURRENT CART
shopping history
VIEW
MACRONUTRIENTS
SETTINGS
1 Person
4 Days
GREAT CHOICE!
You've made a GREAT choice that has HIGH FIBER and VITAMIN C.
For that, you get ONE GREAT CHOICE point.
Get enough, and you can score some coupons.
OK
4 days
0.5
0
0.75
2 days
1.5 days
3.2 days
0.5 days
1.7 days
3.1 days
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM
Graham Crackers
2LB Bag HoneyCrisp Apples
6 Bananas
ITEMS IN CART
USERNAME
IMPROVEMENTS:
GREAT CHOICES: 1
IMPROVE
SCAN ITEMS
SEARCH ITEMS

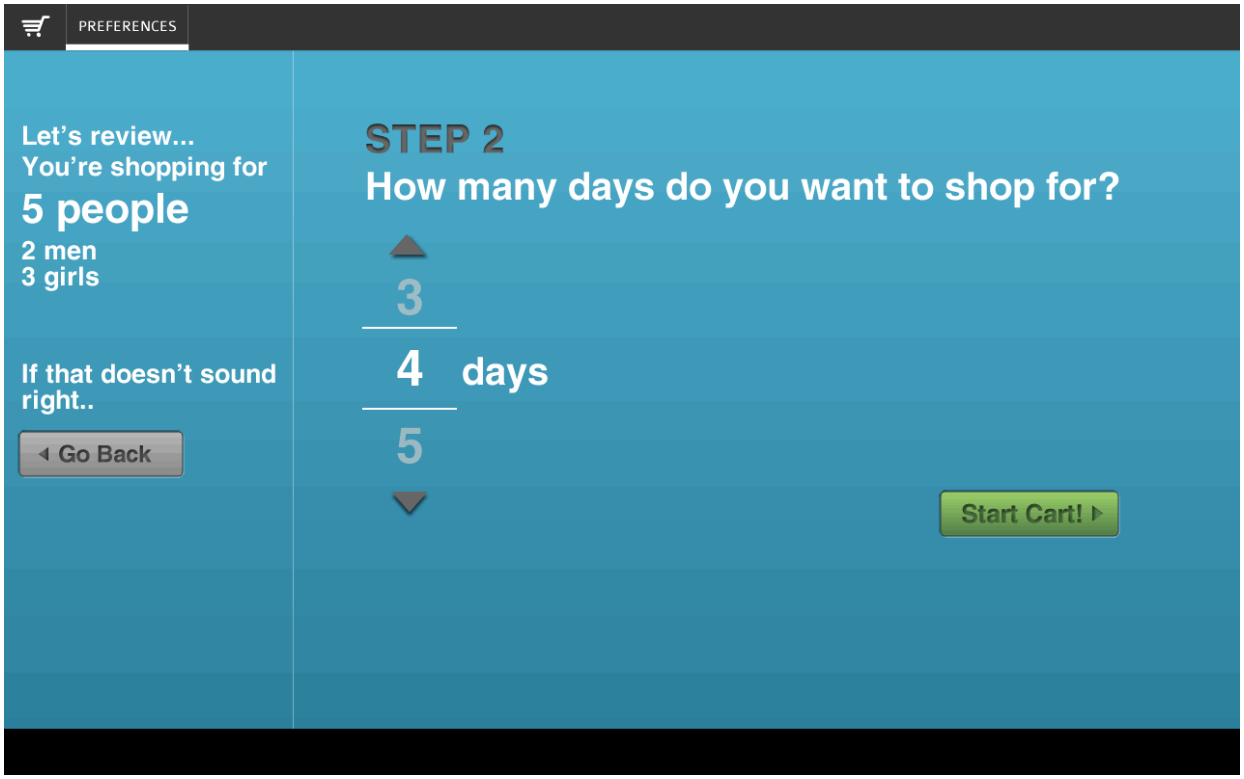

CART
CURRENT CART
shopping history
VIEW
MACRONUTRIENTS
SETTINGS
1 Person
4 Days
YOU'VE IMPROVED!
You've improved on your choice of graham crackers by choosing FIBER GRAHAMS instead.
For that, you get ONE IMPROVEMENT point.
Get enough, and you can score some coupons.
OK
4 days
0.5
0
0.75
2 days
1.5 days
3.2 days
0.5 days
1.7 days
3.1 days
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM
Graham Crackers
2LB Bag HoneyCrisp Apples
6 Bananas
ITEMS IN CART
USERNAME
IMPROVEMENTS: 1
GREAT CHOICES:
IMPROVE
SCAN ITEMS
SEARCH ITEMS

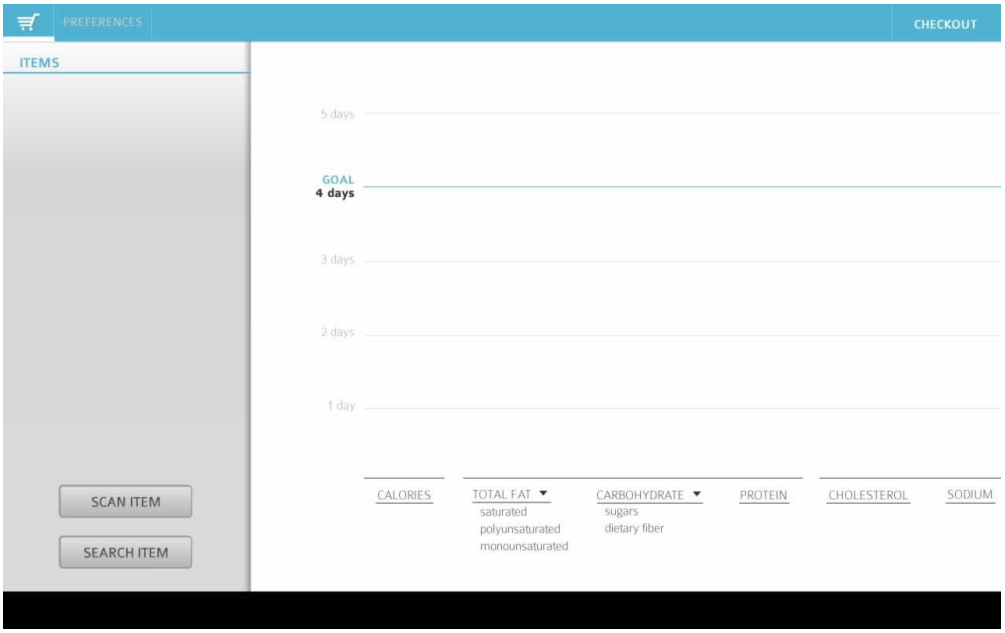
(d) Cart: Final tablet iteration

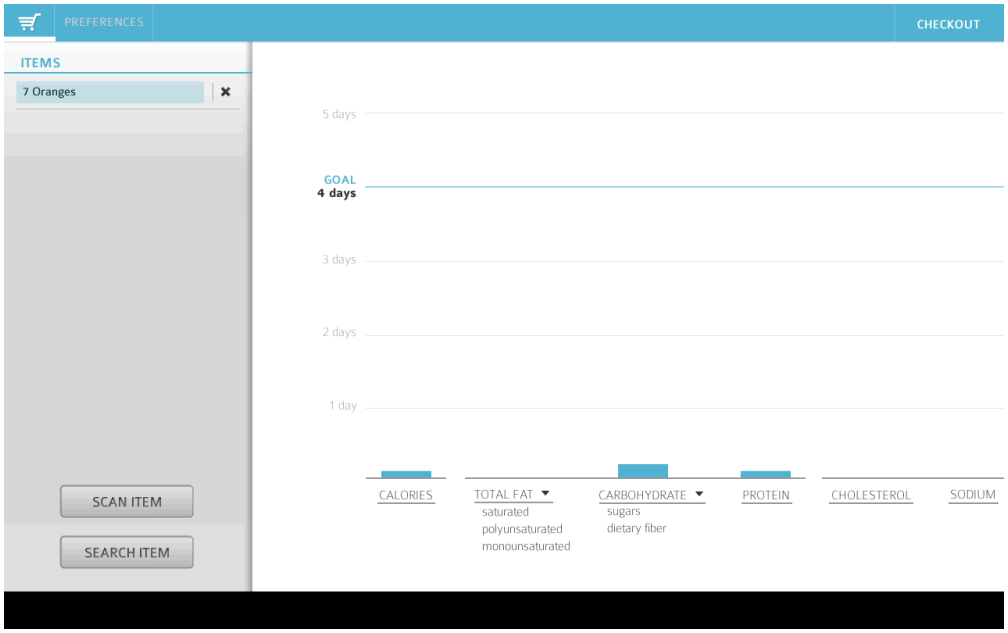


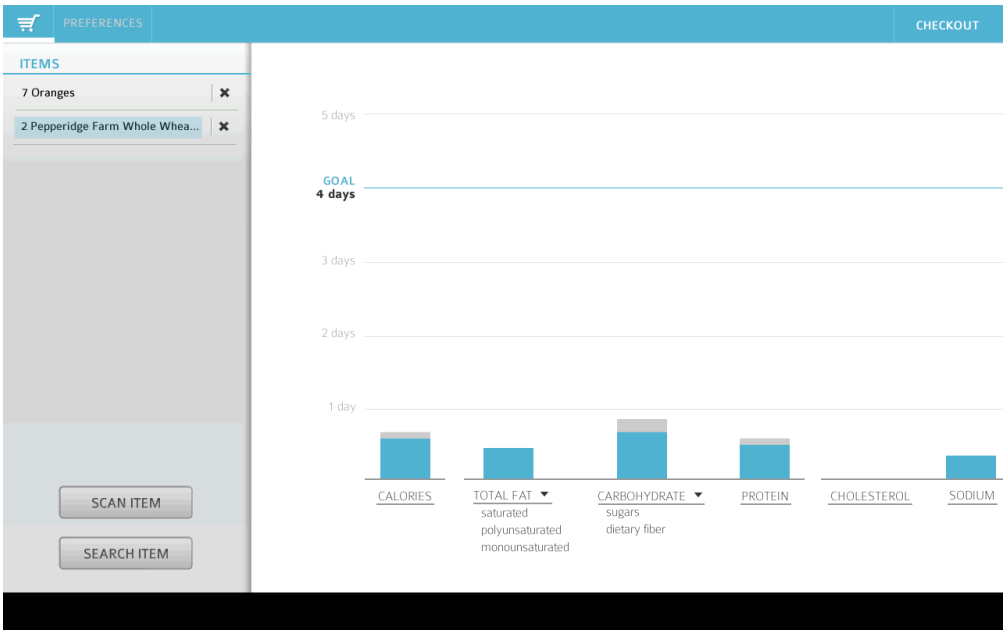


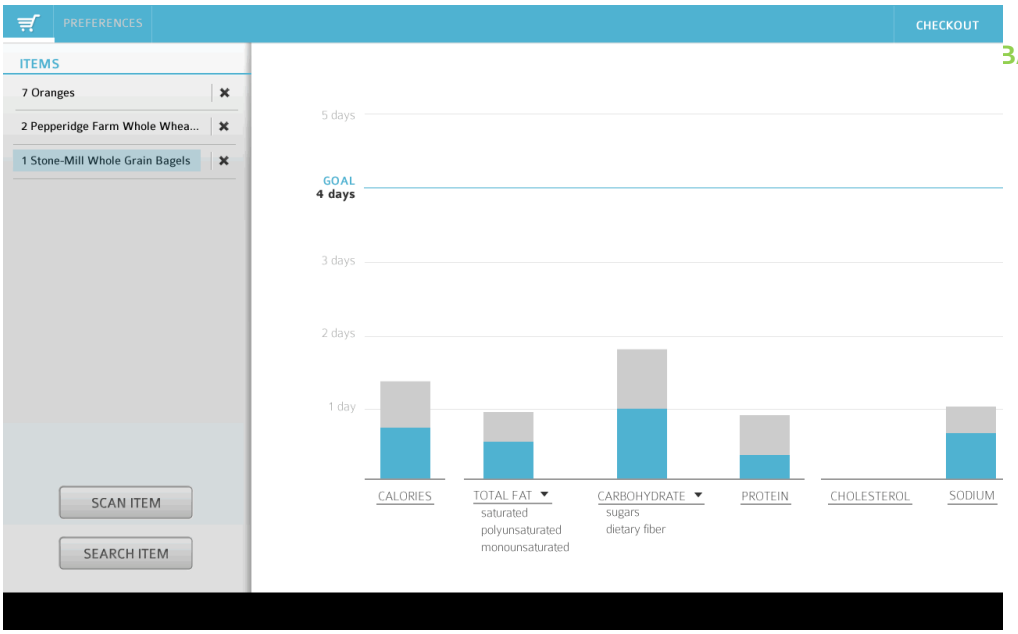

PREFERENCES
STEP 1
Tell us about you and who you shop for.
2
0
0
3
Add
Add
Add
Add
1 CHILD
Name none entered
Gender Female
Age 10 years
Height 4 ft 10 in
Weight 92 pounds
1 ADULT
Name none entered
Gender Male
Age 36 years
Height 5 ft 7 in
Weight 150 pounds
1 ADULT
Name none entered
Gender Male
Age 36 years
Height 5 ft 7 in
Weight 150 pounds
1 ADULT
Name none entered
Gender Male
Age 36 years
Height 5 ft 7 in
Weight 150 pounds
1 CHILD
Name none entered
Gender Female
Age 10 years
Height 4 ft 10 in
Weight 92 pounds
Next step

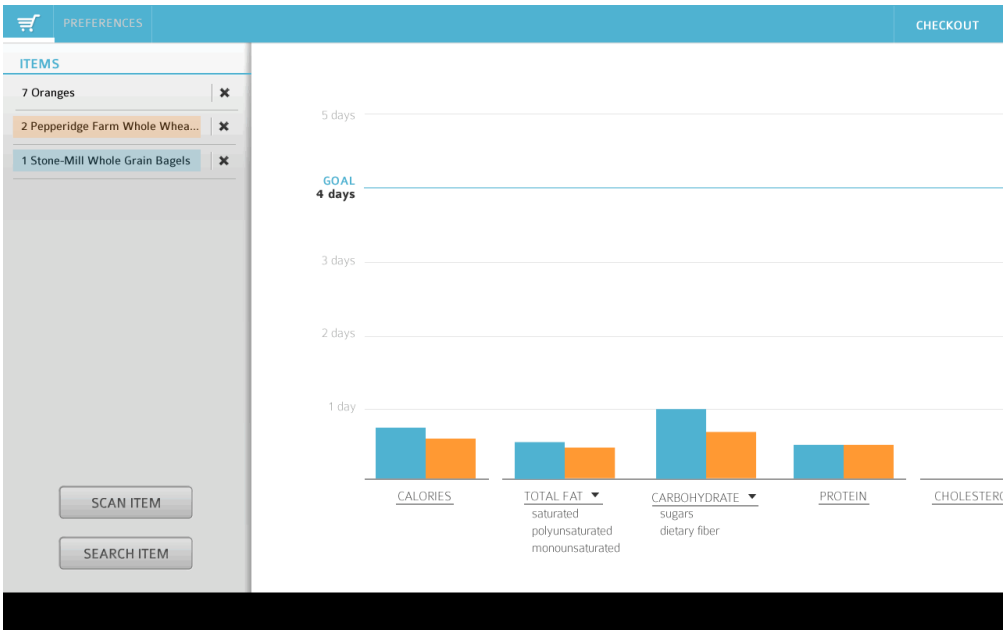

PREFERENCES
Let's review...
You're shopping for
5 people
2 men
3 girls
If that doesn't sound right..
Go Back
STEP 2
How many days do you want to shop for?
3
4 days
5
Start Cart!


PREFERENCES
CHECKOUT
ITEMS
SCAN ITEM
SEARCH ITEM
5 days
GOAL
4 days
3 days
2 days
1 day
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM


PREFERENCES
CHECKOUT
ITEMS
7 Oranges
SCAN ITEM
SEARCH ITEM
5 days
GOAL
4 days
3 days
2 days
1 day
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM


PREFERENCES
CHECKOUT
ITEMS
7 Oranges
2 Pepperidge Farm Whole Whea...
SCAN ITEM
SEARCH ITEM
5 days
GOAL
4 days
3 days
2 days
1 day
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM


PREFERENCES
CHECKOUT
ITEMS
7 Oranges
2 Pepperidge Farm Whole Whea...
1 Stone-Mill Whole Grain Bagels
SCAN ITEM
SEARCH ITEM
5 days
GOAL
4 days
3 days
2 days
1 day
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN
CHOLESTEROL
SODIUM


PREFERENCES
CHECKOUT
ITEMS
7 Oranges
2 Pepperidge Farm Whole Whea...
1 Stone-Mill Whole Grain Bagels
SCAN ITEM
SEARCH ITEM
5 days
GOAL
4 days
3 days
2 days
1 day
CALORIES
TOTAL FAT
saturated
polyunsaturated
monounsaturated
CARBOHYDRATE
sugars
dietary fiber
PROTEIN