MunchCrunch: a Game to Learn Healthy-Eating Heuristics
Anna Mansour, Mugdha Barve, Sushama Bhat and Ellen Yi-Luen Do
School of Interactive Computing
(* College of Architecture & Health Systems Institute)
Georgia Institute of Technology
{amansour, mugdha.barve, sue.bhat & ellendo}@gatech.edu

ABSTRACT
Children and adolescents are at an age where they are beginning to gain autonomy over choosing the foods they eat, yet may not have adequate support or information to make informed choices. This paper describes the design of a heuristic-based health game called MunchCrunch to help this age group learn more about healthy and unhealthy foods to develop balanced eating habits.

Category and Subject Descriptors
B.4.2 Hardware, D.m Software, H.5.2 User Interfaces, J.4 Computer Applications

General Terms
Design, Human Factors, Measurement

Keywords
tangible game, health, healthy eating, children, adolescents, food pyramid

1. INTRODUCTION
What kind of information would be useful to a kid staring at the pantry looking for a snack? When faced with such situation, would a teenage girl choose the peaches canned in syrup, or go for the bag of peaches in the freezer? Would a ten-year-old boy go for the milk or the orange juice to soothe his sore throat?

Data from National Center for Health Statistics surveys (1976–1980 and 2003–2006) show that the prevalence of obesity has increased from 5.0% to 12.4% for children aged 2–5 years; from 6.5% to 17.0% for those aged 6–11 years, and from 5.0% to 17.6% for those aged 12–19 years. Obese children and adolescents are more susceptible to risk factors associated with cardiovascular disease and diabetes [2]. With aisles full of tasty treats and persuasive advertisements surrounding children and adolescents [8], it seems that they need to learn more about healthy food heuristics to guide food choices and to fight obesity.

2. GAMES FOR HEALTH
Many games have been developed to encourage healthy eating habits. For example, Brain Gain [6] provides relevant heuristics by having players choose between foods. It uses colorful, memorable images to teach food facts. Fatworld [5] is a computer game where players create an avatar with a particular health disposition. These avatars are situated in a broader community and the effects of the decisions they make, such as eating and exercising habits, are reflected in the microworld. Studies show that more cooperation and interaction occurred among children (even those that are physically challenged) when they play against each other rather than against the computer opponent [1]. Researchers also found that a combination of physicality and higher levels of cognitive activity can promote a deeper understanding compared to just passive listening or watching while adding to the level of fun [7].

3. MUNCHCRUNCH
MunchCrunch is a health trivia team game designed to be both entertaining and educational. The goal of the game is to answer simple questions about food and fill the categories – represented by meters – of a virtual food pyramid by answering questions in each category. We have incorporated the heuristic-style presentation of healthy eating information in an interactive and competitive physical environment to encourage interest, engagement, and understanding [1, 3].

We have three main goals in creating MunchCrunch: (1) teach heuristics about food that will actually be remembered and used when making eating decisions, (2) design a game that adolescents would like to play multiple times, (3) be entertaining and, by virtue, increase the likelihood of continued playing.

The game features collaboration between team players, a physical game environment, heuristics of relevant information and competition among teams. The collaborative aspect of the game encourages sharing information and discussions among team players. The physical environment promotes more interest.
and understanding as compared to a desktop environment [3]. The heuristics in the form of quiz questions are built on interesting food facts that youths (and adults) can relate to and use in their daily lives. Teamwork and quick thinking make this game competitive, which adds to its entertainment value and encourages the players to learn more about healthy-eating practices.

3.1 Design of the game

The main component of the MunchCrunch game is an electronic touch screen console that houses the questions, scores and other visual cues. Figure 1 shows the game interface with the score meters on the right, the question area and question category generator on the left and indicators for the two buzzer buttons (the A and L keys).

Figure 1. MunchCrunch Interface. Food categories (top to bottom): Eat Sparingly, Dairy, Nuts, Poultry & Fish, Fruits & Veggies, Healthy Fats, Whole Grains, Potluck.

Multiple-choice questions are divided into eight categories based on the Harvard Healthy Eating Pyramid1 [4]: Eat Sparingly; Dairy; Poultry, Fish & Eggs; Nuts; Fruits & Veggies; Healthy Fats; Whole Grains; Potluck.

Figure 2. Healthy Eating Pyramid (Harvard School of Public Health, 2008).

Figure 3. Meters from the scoreboard on the interface.

3.2 Playing the game

Each team has a set of “meters”, one for each food category, that are filled by correctly answering the questions in that category. As shown in Figure 2, the categories are grouped by the tier they share on the Harvard pyramid. For example, a player needs to answer two “Eat Sparingly” questions to fill the meter in tier one (the top of the pyramid), three questions for tier two “Dairy” and four for Tier three - two for the Poultry, Fish, & Eggs meter, and two for the Nuts meter. These quotas were determined by weighting the proportion of the pyramid covered by each category (see Figure 3).

Each turn, players decide which team will answer the next question by “racing” to be the first to hit their buzzer. The team that won the race presses the “Next Question” button and a random question from one of the food categories appears on the screen. When using a touch screen, the players can press the buttons on screen to choose questions. However, the game also works well on the normal desktop and laptop devices as the buzzer buttons are mapped to specific keystrokes and/or mouse clicks. External buzzers can also be connected to the device, or even placed far away from the game display to encourage players to physically “race” to hit the buzzer.

After selecting a correct answer, the current team is confronted with a choice: (1) Keep: put the points in their own meter of the appropriate category. Or (2) Pass: put the points in the opponent team’s meter of the appropriate category. A team can only make this choice if they correctly answer the question. The teams have to keep in mind that exceeding the meter quota in a category will make them lose points. Hence, a team would want to choose “Pass” if their meter in the category of the question is full (to avoid losing points) or if the opponent team’s meter for that category is full (to make them lose points). The number of points lost will depend on the category of food in the Harvard pyramid. For example, according to the Harvard

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pyramid, we need to eat higher quantities of whole grains, healthy oils, and fruits and vegetables each day than dairy products, questions from the former categories are worth four points and from the latter, only two points.

Let us consider an example of a team correctly answering a question and choosing the “pass” option. In this scenario, Team A is beating Team B by one point with a score of 12. The two teams race to determine which of them gets to answer the next question. Team B hits their buzzer first in the race and presses the “Next Question” button to receive a question from the Fruits & Veggies category (Figure 4).

Figure 4. Team B receives a “Fruits & Veggies” question.

Team B chooses the correct answer, “Lots of sugar”, and is confronted with the choice to keep or pass (Figure 5).

Figure 5. Team B answers correctly and chooses to “Pass” to Team A. Team A’s Fruits & Veggies meter is full.

Since Team A’s Fruits & Veggies meter is full they decide to “pass” and overflow Team A’s meter. This causes Team A to lose a point (Figure 6). Had Team A’s Fruits & Veggies meter had not already been filled, Team B might have decided to choose “keep” and increase their own score. If the team gets the answer wrong, then the opponent team gets a chance to answer the same question. For instance, Team A answers “Coconut is:” incorrectly by choosing “a good source of fruit”. Team B then gets a chance and chooses the correct answer “High in unhealthy fat”. Because Team B gets it right, they can choose to Keep or Pass.

Figure 6. As a result Team A loses a point.

Further, if both teams answer incorrectly, the right answer is displayed on the screen and neither team receives points. There is no direct penalty for a wrong answer. In this design, players do not have to know the answers to all the questions in order to succeed and learn.

Answering questions incorrectly may, in fact, benefit players because they still learn the right answer and, sometimes unexpectedly, wrong answers. Many players might assume that all fruits are good choices for a snack, but learning about the harmful fats in coconut can alert them to pay more attention to more information about fruits. After each question is answered and scored, the two teams race again to choose which team will answer the next question on the quiz. The game may end in two ways: either a team fills the slots for all their own meters or the players complete 35 questions. In both cases the team with the most points wins the game.

4. DISCUSSION

We created MunchCrunch as a fun environment for adolescents to learn about food. The game provides useful knowledge – in the form of heuristics – to inform them when choosing what foods to eat. By arming adolescents with knowledge, they may begin to make eating choices that turn into healthy habits and avoid health problems in the future. Six high school seniors and 12 graduate students from Georgia Tech have played with the MunchCrunch game. They said they had fun playing the game and enjoyed the collaboration, competition, and meaningful food facts. It is worth noting that our group of high school players could not wait to have a chance to race and clamored over the computer keyboard in anticipation throughout the game. Having other people physically present – and in teams – allows for collaboration and increases the excitement in the game. The division of players into teams also pools the players’ existing knowledge together. One of our early play sessions involved graduate students playing individually (not in teams). These players sometimes would have “no idea” what the correct answer to the questions should be and wanted to confer with someone else. It seemed that having a team would eliminate this frustration. After observing this, we asked the graduate students to play in teams and noticed an immediate increase in energy, participation and ability to answer questions correctly; they seemed to have more fun and increased their collective food knowledge when playing in teams. One group was proud of
their teammate who knew that dark chocolate has more health benefits than milk chocolate (“Wow, dude, how did you know that!”); the game fostered an incentive to be a food fact guru.

Seeing the positive effects of collaboration, we arranged for the high school students to play in teams. During game-play, they actively discussed and debated the game questions and shared knowledge to answer most of the questions correctly. One team was stumped by a question asking about sources of protein other than meat. One of the team members recalled that his family eats a lot of tofu and was able to help his team win that question. Collaboration in teams helps overcome the issue of individuals’ limited knowledge about food. MunchCrunch supports an environment for adolescents to talk about their food knowledge among their peers with a sense of pride and gain peer recognition.

4.1 “Way better than health class”
MunchCrunch seems to offer an entertaining way to learn relevant information that students can actually apply. From our interaction with the high school students, it was evident that they want to know how to choose foods, but need information that is relevant and easy to apply. They were interested in the format and content of the questions. One high school senior wished he knew more about which foods provided him with which vitamins; another said she wanted to know more about serving sizes. The students expressed that the simple heuristics in MunchCrunch were a “nice change” from the large blocks of “supplemental” text found in many games intended to be educational. Several students remarked that learning health information through MunchCrunch was “way better than health class”. When asked if they would play it outside of school, all of them immediately responded with a simultaneous “Yeah!” and suggested playing it through Facebook or cell phones either alone or with others.

4.2 Point System
MunchCrunch has a scoring system that guides players to take an active role in the educational content of the questions. Players are required to make an assessment about what foods they are collecting and decide whether to keep or give their questions to another player. This adds an element of fun while also supports learning. MunchCrunch requires players to judge the questions they encounter in an abstract sense – according to the category of food – and make a decision. By allowing players to make judgments about how to affect another player negatively with food choices, they may be able to learn implicitly what would be a positive food choice.

5. FUTURE WORK
What remains to be studied is whether players retain the heuristics from the game, an important question of evaluation. Do they learn? Can they apply what they learned in the future? In observing game play, we found that even graduate students of varying ages were unaware of many simple, critical food guidelines. This seems to indicate that an older audience could also welcome a heuristics game like MunchCrunch. From preliminary game play, it seems that the context in which it is situated might play a large role in the effectiveness of the game. It may be valuable to seek out a community partner or school as a venue to further explore our questions. In future work we would like to perform more extensive user studies, in the context of these settings, to evaluate the game. This would include a preliminary survey to determine what kind of information about eating students would like to know, which would be used to contribute to game questions. We would then look at how well students learn and retain the nutrition information, as well as to what extent they incorporate the learned material into their lives. Future development of our game could extend to a mobile application. As mobile devices become more commonly used by adolescents, porting MunchCrunch into these devices would provide a more convenient and accessible means to review the food knowledge. Additional components to encourage user-generated content could also be integrated and studied. For instance, we are interested in developing a feature that allows players to add their own questions to the question repository. Incorporating these modifications would provide additional facets for understanding the role of technology in facilitating learning about food and (un)healthy eating. In undertaking these studies, we endeavor to find effective ways to prepare young adults to manage their own health in the future. We hope that MunchCrunch will instigate a new initiative in engaging young people with food health education through games.

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7. REFERENCES