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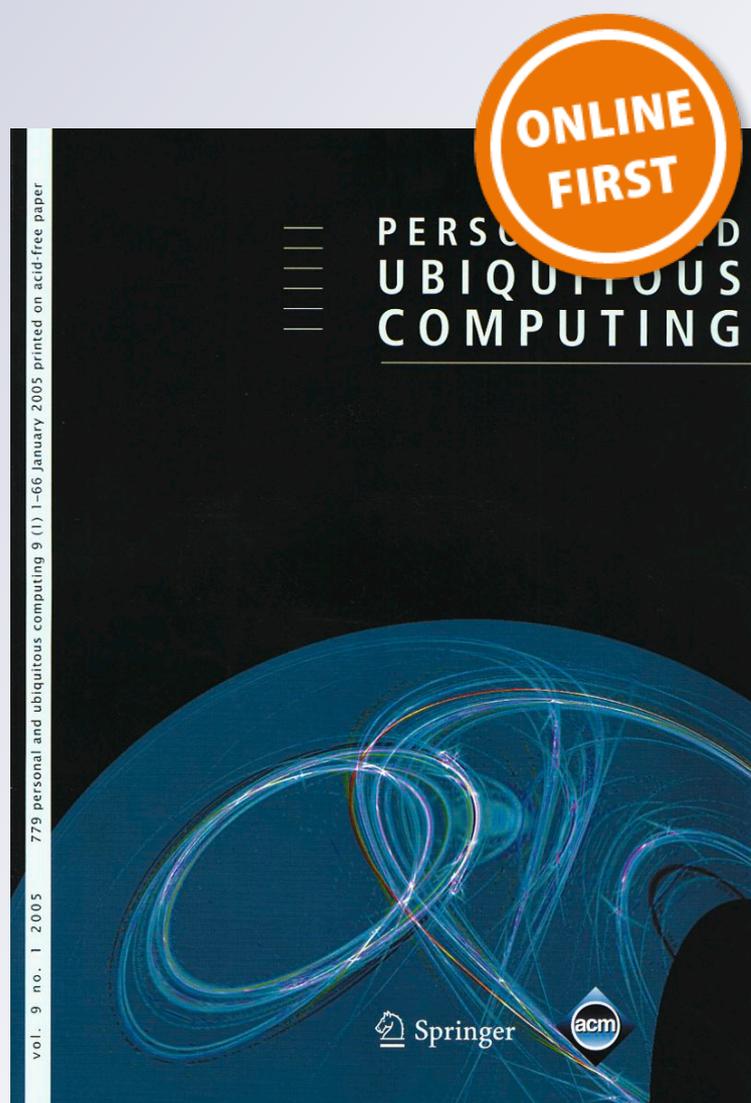
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LunchTime: a slow-casual game for long-term dietary behavior change

Rita Orji · Julita Vassileva · Regan L. Mandryk

Abstract Eating out has recently become part of our lifestyle. However, when eating out in restaurants, many people find it difficult to make meal choices consistent with their health goals. Bad eating choices and habits are in part responsible for the alarming increase in the prevalence of chronic diseases such as obesity, diabetes, and high blood pressure, which burden the health care system. Therefore, there is a need for an intervention that educates the public on how to make healthy choices while eating away from home. In this paper, we propose a goal-based slow-casual game approach that addresses this need. This approach acknowledges different groups of users with varying health goals and adopts slow technology to promote learning and reflection. We model two recognized determinants of well-being into dietary interventions and provide feedback accordingly. To demonstrate the suitability of our approach for long-term sustained learning, reflection, and attitude and/or behavior change, we develop and evaluate LunchTime—a goal-based slow-casual game that educates players on how to make healthier meal choices. The result from the evaluation shows that LunchTime facilitates learning and reflection and promotes positive dietary attitude change.

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1 Introduction

Eating out is increasingly becoming part of our lifestyle. A recent statistic from the United States indicates that the fast food industry serves more than 50 million Americans every day, generates $65 billion annually, and accounts for more than half of an average American's yearly food budget [1]. However, people find it difficult to make choices consistent with their health goals when eating away from home and the recent dramatic rise in health conditions, such as obesity and diabetes, has been attributed to poor dietary choices [2]. For example, the rise in obesity is often linked to an increase in consumption of high-energy dense and large portion sizes of 'away-from-home' food [2]. More generally, it has been shown that healthy eating choices and habits established by an individual can decrease the risk of some chronic diseases, while unhealthy choices lead to increased incidences of certain chronic diseases [2]. Hence, concern about food choices and their effect on health is of primary concern for well-being researchers; many of whom have suggested that most of the chronic diseases and health conditions that burden the health care system (e.g., diabetes (type 2), heart diseases, high blood pressure, and obesity) can be prevented through lifestyle changes [3, 4]. To help customers make healthy choices, many restaurants provide nutritional information for their menu, yet customers continue to eat unhealthy options from fast food restaurants. This may be partly because the information provided is superficial and gives no knowledge of how one option compares to another for managing choices.

Persuasive technology is a term used to describe technologies that change human behavior and/or attitude in an intended way without using deception or coercion [5]. To promote healthy lifestyle changes, many persuasive

technological interventions have been proposed—mostly based on tracking and monitoring food intake (e.g., [4]), or providing just-in-time information or messages to remind users of the need to make appropriate food decisions at the point of purchase [6]. However, hungry restaurant-goers are likely more influenced by the sight and smell of the foods than by just-in-time information, suggesting that knowledge-based decisions must be supported by information presented before people arrive at the restaurant [6]. Some researchers, for example, [7], have investigated the benefit of educational games in helping adults learn how to make healthy food choices. Most of these games, however, are not tailored to induce behavior change in line with individuals' health goals but instead are based on a one-goal-fits-all approach. The interventions generally aim at helping people manage their weight, whereas lifestyle/ behavior change interventions need to address other health goals such as managing diabetes, managing blood pressure, building muscle, or even general well-being. Moreover, the games are built on a fast technology principle—which imposes some in-game time-related constraints, therefore allowing little or no room for reflection.

To address the shortcomings of previous solutions, we examined how a goal-based intervention can be used to encourage behavior change toward a healthy diet using a slow-casual (slow, simple, easy to learn, and easy to play) educational and reflective game, called LunchTime. Slow game is a term used to describe games that relax the time dynamics often used in "fast games" where the players are required to respond to a game challenge within a very limited amount of time. Slow games can be played occasionally and do not require undivided player attention.

In contrast to a generalized dietary intervention, LunchTime promotes lifestyle and/or attitude change in line with an individual's health goal. It helps users to learn how to make good decisions that are consistent with their health goal when eating out. The result from the evaluation of LunchTime shows that the game facilitates learning and reflection and promotes desirable dietary attitude change.

Our main contributions are as follows: First, we propose an approach for developing a persuasive game for dietary interventions (goal-based approach), which allows the player to move from goal to solution. Second, we formulate the slow-casual game technique that combines both casual and slow attributes to induce learning, reflection, attitude and/or behavior change. Third, we model two recognized determinants of well-being (away-from-home foods and portion sizes) into dietary interventions. Fourth, we design, implement, and evaluate LunchTime to demonstrate the feasibility of our proposed technique for sustained learning, reflection, and attitude change.

2 Related work

In this section, we present an overview of behavior-change theories. This is followed by a discussion of related research on persuasive technology for human well-being. We conclude with a brief overview of persuasive games with emphasis on the genres of casual and *slow-casual* games.

2.1 Overview of theories

Persuasive technology is fundamentally about inducing behavior and/or attitude change using computers [5]. Developing effective persuasive technology for behavior change requires in-depth and practical understanding of human behavior theories, so that designers of persuasive interventions do not have to guess at which ad-hoc approaches will succeed [8]. The most effective persuasive interventions for behavior change usually occur when the intervention is behaviorally focused and theory driven [9]. Therefore, to design technologies that will successfully motivate behavior change, persuasive researchers rely on behavioral theories from psychology and social science to inform their design decisions. Among these theories, the Transtheoretical Model [10], Goal Setting Theory [11], and Reinforcement theory [12] have been widely studied and successfully applied in many health-related interventions. Other important, but rarely used theories of behavior change are the Social Learning Theory [13] and the Knowledge–Attitude–Behavior Model [14]. In this section, we present an overview of these theories, which inform our work.

2.1.1 The transtheoretical model

The Transtheoretical Model (TTM) is the most frequently used model for health-related behavior interventions (e.g., [3, 7]; see [6] for a detailed review of TTM for dietary behavior change). The model identifies five stages that an individual progresses through to modify their behavior. The stages include *Precontemplation* (the individual is unaware of the problem and has no intent to change), *Contemplation* (the individual is aware and is thinking about taking action), *Preparation* (the individual has intent to change and is initiating behavior modification), *Action* (the individual performs the desired behavior), and *Maintenance* (the individual has consistently performed the target behavior for more than 6 months and works to prevent relapse). Once an individual's behavioral stage is determined, interventions can be used to help facilitate progression into the next stage in the TTM.

Despite the wide adoption and successful application of the TTM in many behavior change interventions including

dietary and physical activity interventions [6, 10], the TTM has some limitations that stem from its simplistic and narrow focus on observable behaviors, its assumed linear progression, and its inability to account for social and economic factors that can affect behavior [15].

2.1.2 Goal setting theory

The Goal setting theory [11] describes how individuals respond to different types of goals, and how setting goals can motivate behavior change. It suggests that, under certain conditions, setting-specific goals lead to higher performance than could be achieved with no goals or vague and non-quantifiable goals (e.g., "do your best."). For effective application of goal setting theory, the goal should: be important to the individual; be set by the individual alone or in collaboration with an expert (never without his/her consent); be feasible, tangible, reliable, specific, challenging and yet realistic, have a time target for completion; and have feedback that is easy to gauge [11]. Goal setting theory is commonly used to drive the design of healthy lifestyle interventions that encourages individuals to be physically active and/ or eat well. In such settings, it has been successfully applied in some technologies aimed at behavior change, for example, [4, 9]. The common critiques of goal setting are that goals can lead to a narrow focus and overemphasis on some aspect of performance that neglects important non-goal areas (e.g., quantity over quality). It can also lead to unethical behavior, and distorted risk preference [16].

2.1.3 Reinforcement theory

Reinforcement theory emphasizes the linkage between individual behavior and specific outcome [12]. Basically, the theory proposes two main types of reinforcement: positive reinforcement (rewards) and negative reinforcement (punishments). A large number of studies have examined the effect of rewards and punishments as a motivator or a deterrent from performing a specific behavior; an overview of these studies can be found in [17]. Punishment is less successful as a behavior-change mechanism because the use of punishment either lowers interest or encourages the abandonment of the primary task. Reward is a widely adopted approach; a number of successful behavior change interventions have been developed based on incentive mechanisms (e.g., [9], see [17] for a review). However, one controversial issue has been on the effect of rewards (e.g., money) on motivation to change behavior and their potential to redirect the intention of a particular activity. So, although rewards seem to have positive effects on the development of new behavior

patterns, the effectiveness of this approach on long-term behavior change is still unclear [18].

The common critiques of reinforcement theory are that it ignores individuality, restricts freedom of choice, and ignores the possibility of other types of motivators [19].

2.1.4 Social learning theory

Social learning theory [13] focuses on learning that occurs within a social context. Its main premise is that people learn from one another. Learning in a social context can occur in several ways, including observational learning, learning by imitation, and modeling. Another important tenet of social learning is that a significant component of learning arises from interaction or dialog with others. Thus, learning is socially construed and occurs through interaction between individuals, between individuals and groups, and between different groups [20]. Social learning research therefore examines conversations within the communities of learners.

Despite that social learning theory has rarely been applied in persuasive research, it has the potential to promote behavior change. Critics of social learning theory argue that it does not take into account individual differences or the social context [21].

2.1.5 Knowledge–attitude–behavior (KAB) model

KAB stresses the importance of knowledge as a prerequisite for intentional performance of health-related behavior. An acquisition of new knowledge leads to changes in attitude, which in turn leads to improved dietary behavior [14]. Research has distinguished between various types of knowledge. "Awareness knowledge" is a type of knowledge that captures people's attention, increases awareness, and enhances motivation, whereas "how-to" knowledge is the type people need when they are already motivated [22]. In other words, motivational knowledge enhances motivation to take action and instrumental knowledge is needed by people in order to act on their motivation [22]. This suggests that persuasive systems designed to impact health-related knowledge can target both motivated and unmotivated people.

While each of these traditional behavior theories is important, they complement each other rather than being mutually exclusive.

2.2 Persuasive technology for well-being

In all persuasive technologies, motivation is an essential element that leads to initiation of behavior change actions, continuation of the actions, and maintenance of the behavior over time. In this section, we review the state-of-

the-art in persuasive technology research under three different categories based on the primary form of motivation: social influence (social competition, collaboration, and comparison) [3, 4], learning and reflection [7, 23], and game-like approaches [7, 24, 25]. We emphasize game-like approaches and more specifically, the genre of casual games. We conclude the section with an overview of *slow-casual* games.

2.2.1 Social influence

Systems that use social influence as a motivator typically focus on sharing information about one's physical activity with one's social groups such as friends, coworkers, and family. In these systems, social competition, collaboration, and social comparison are often an explicit design goal or a consequence of how the systems are used [23]. Chick Clique [3] and Houston [4] are examples of systems in this category. Chick Clique uses a mobile phone and pedometer to help teenage girls track and share their step counts with their friends. Houston, similar to Chick Clique, encourages groups of users to track and share their step counts as recorded in a pedometer via their mobile phone. In general, social influence is often based on a number of theories including social learning theory (e.g., in collaborative systems), TTM, and Reinforcement theory. TTM can be used to determine the stage of change of each group member to avoid unintended upward or downward comparison depending on the desired change. Awarding of points, ranking, recognition, and praise can be used to directly reinforce behavior in line with reinforcement theory.

2.2.2 Reflection and learning

The difficulties associated with making people change their behavior using an approach that causes immediate performance of the behavior led to a search for an alternative way of effecting behavior change. For example, persuasive approaches based on tracking of behavior might require that the user continuously uses the application to enact the desired behavior. It remains to be seen for how long the users will use these applications. It will not be realistic to expect that users will use these applications for their lifetime. For instance, in the evaluation of the HealthyEdge persuasive application [26], the participants expressed discomfort that they experienced when they attached the device to their body. Therefore, a number of studies have looked at emphasizing reflective thinking about health as an approach to behavior and attitude change that indirectly impacts the behavior [7, 18, 23]. The work based on this approach uses both personal prompt and group discussion as a mechanism to trigger reflective thinking. For example,

the participants in the evaluation of a persuasive game [7] reported how playing the game prompted group discussions (in line with social learning theory) that facilitated reflection about healthy eating. Playing the game increased the consciousness of the players toward what they eat, which also led to increased personal reflection about their diets. The increasing interest in reflective approaches to behavior change is due to its potential to intrinsically motivate and thereby results in a long-term behavior change [18]. This approach is supported by a research finding that critical reflection is a key to transformative learning [27]. The reflection and learning approach is mainly based on the KAB Model and Social Learning theory.

2.2.3 Game-based persuasion

Games have the capability to change players' behaviors and/or attitude. Research has shown the potential of violent games to make players aggressive [28]. Other researchers discovered that health games could raise players' consciousness and cause them to reflect on unhealthy behaviors [7]. Similarly, games have been found to cause an attitude change. A smoking cessation game decreased players' positive beliefs about smoking and their temptation to smoke, while increasing their negative beliefs about smoking, intention to quit, and resistance to smoke craving [29]. In general, persuasive health games can be categorized into three types: exergames, serious games, and casual games.

Exergames is the name used for games that induce behavior change by encouraging physical activity and fitness by playing the games. Exergames use players' energy expenditure from physical activities as input to drive the game [25]. In these games, various exertion interfaces (such as electronic dance pads, bicycles, motion platforms, and motion-tracking cameras) allow the player to control the game through his/her actions, instead of using traditional electronic game input interfaces (e.g., keyboards, mouse). A well-known example is the dance simulation game, Dance Dance Revolution (DDR) [25]. DDR uses a sensor-enabled dance floor with a video interface to provide stimulating exercise as a social activity. Moreover, DDR requires the player to dance to a variety of songs. Some other forms of *exergames* are more ubiquitous as they extend beyond the physical activity arena (e.g., room or gym) into the players' daily lives, tracking the players' daily physical activity and energy expenditure [7]. A typical example is Neat-o-game [24].

Serious game is a term used to describe games that are driven by educational purposes. Serious games for health are designed to entertain, educate, and train players, while attempting to modify some aspect of a player's health behavior [30]. Various serious games have been developed to impact on health behavior in many domains. Research

has shown that educational health games effectively help players develop healthier eating habits, better manage chronic diseases, and increase their health-related knowledge [7]. Lunch crunch makes players fill lunch trays with fruits and vegetables and trash unhealthy food as a way of impacting knowledge about healthy and unhealthy foods [31]. "Escape from Diab" [32] is a serious videogame adventure on healthy eating and exercise, with the goal of preventing kids from becoming obese and developing type 2 diabetes and other related illnesses. "Trigger happy" [33] is another educational game designed to teach and warn players about the risk of "triggers" that can lead to poor eating choices when dieting. Serious games focus on all fields of life, but the impacts are more evident in the health field.

In recent years, *casual games* have become increasingly popular and important because of their simple play style. Casual games differ from serious games in that they typically offer short, less complex gameplay sessions, are easy to learn and play, and allow play on ordinary devices like personal computers and mobile phones (unlike exergames, which require additional equipment [25]). While serious games require a minimum of 20 min to complete a session, casual games take between 1 and 10 min to complete a session and can easily be stopped and restarted [7]. These attributes make casual games suitable for different kinds of gamers (avid and casual) and attract a wider audience than traditional games [34]. A relevant example of a casual game is OrderUP!—a health-related role-playing game, where a player acts as a maître d'hôtel with the role of recommending a healthier food option to the customers. The players gain points by serving customers quickly and by recommending the healthiest food options (each customer must be served within six seconds or they will leave and players will lose points). Evaluation of OrderUP! showed that playing the game made players reflect over their dietary options but the players desired some feedback on why a particular choice was not the best [7].

Most games reinforce behavior by rewarding the player (e.g., happy fish as in Fish 'n' Step) in line with the Reinforcement theory. Generally, all games described in the literature so far treat players as a homogenous group regardless of their health goals. Such a generalization assumes a one-goal-fits-all approach in contrast to adaptive approaches where recommendations are tailored to individual goals. We explore how games can be used to educate players in line with their health goals and provide insightful feedback that goes beyond the level of information to knowledge.

2.2.4 Slow technologies

The design of a game determines how we play, understand, and assimilate the message conveyed by the game. According to Hallna et al. [35], one of the major characteristics of any computing technology intended to initiate reflection is that such technology is slow. Slow technologies not only promote a moment of reflection but also lead to mental rest. The proponents argue that technology should be slow because learning takes time; it also takes time to understand why it works the way it works (reflection); applying the knowledge also takes time (action); and it equally takes time to find out the consequence of using it (maintenance) [35]. In games, slowness can be introduced by removing or relaxing the time constraint, which often requires players to respond to a game challenge within a limited time span. Most computer games are 'fast' as time constraint is used as a game mechanic to add additional challenge and fun to the game. In fast games, a player's performance is partly dependent on how fast he/she is able to respond to the challenges [7]. This makes the game more suitable for certain groups of people (e.g., experts with better gaming skills and knowledge). Moreover, fast games might lead to sub-optimal in-game decisions and increase the tendency of myopic behavior as players contend with many challenges including the restricted time. It might be hard to measure the actual performance in isolation (of time restriction). Therefore, we argue that 'fast games' might be appropriate for certain games (e.g., entertainment games) and not for others (e.g., games for learning and reflection). Learning and reflection requires that players be given enough time to think about their every step within the game before making it. The slow attribute that ensures that players have enough time to think about their choices and steps in the game makes it fit for learning, reflection, and attitude or behavior change. It ensures that in-game action is solely dependent on a player's actions.

Persuasive researchers have shown the potential of casual games in behavior change [7]; however, the capability of slow-casual games to effect behavior change has not been explored.

2.3 Summary of theories and previous work

In summary, numerous health behavior-change theories exist. *TTM* is particularly useful as it identifies both the five major stages that individuals advance naturally as they change their behaviors and the characterized processes of change through which people can transit toward a healthier lifestyle. However, behavior can be determined by other factors including social and cognitive factors, and other theories focusing on these factors can augment the TTM. The *Social learning theory* is a perfect complement of TTM as TTM advocates learning at all stages of behavior change. Moreover, learning provides the necessary knowledge (as proposed by the KAB model) needed to expose the bad behavior and cause some kind of

discomfort. *The goal setting theory*, though widely applied to drive the design of persuasive interventions, is only applicable for an individual who is already contemplating or motivated to change. It can hardly be used as a key motivator in many behavior change interventions. Although using *rewards* as a motivator has been a controversial issue, their adoption in game-like applications (e.g., points) appears to be an acceptable and successful approach, and a significant motivator.

The use of game-like applications (particularly exergames and serious games) to induce behavior changes has been well explored. However, there is a recent increasing interest in the use of *casual games* to effect behavior change, especially through reflection and learning. Research has shown that educational casual games can also be effective for both children and adults as they induce behavior change using learning and reflection [7]. However, we argue that the attributes of *intentional slowness* (i.e., a slow game) are necessary for educational games that are designed to motivate behavior change through learning and reflection. We suggest the term *slow-casual games* to describe games that are developed based on the combined attributes of slow and casual games to effect behavior change. These attributes ensure that the game will attract a broader audience and facilitate reflective thinking [35].

3 LunchTime game design

LunchTime is an interactive multiplayer slow-casual game. The player's objective is to choose the healthiest food possible in line with their health goal. The initial design is a cross platform application that can run on any web-enabled device (e.g., Android, iOS, and desktop). Unlike most other research in this domain, this approach aims to effect behavior change using a combination of a goal-based approach, feedback, social influence, and rewarding mechanisms built into a slow-casual game. In this section, we describe the game's design and rules briefly; this will be followed by a description of the system architecture.

3.1 LunchTime game play

LunchTime is a role-playing multiplayer game where a group of friends visit a selected restaurant as customers. They are presented with the restaurant menu, and their goal is to choose the food that is best for their chosen health goal. We chose this approach because various health organizations (e.g., American Diabetes Association) have indicated the need to contextualize learning how to make the healthiest possible choices when eating at restaurants, and recent work shows that role-playing games are a good

approach to facilitate learning about a particular subject [7].

At the beginning of a game session, a group member selects a restaurant to be visited by the group. The system can also assign a restaurant randomly from a list. Each group member has chosen a health goal from five health goal options (manage weight, manage diabetes, manage blood pressure, build muscle, and general well-being). Providing different health goals is a unique and important characteristic of this application (in line with the Goal Setting theory) and offers two advantages. First, while the importance of a role-playing game in learning using the one-goal-fits-all approach has been established [7], our goal-oriented approach tailors the application to each individual's health need. This is close to reality, where a group of friends order different food in accordance with their health or body needs. Therefore, the goal-based approach helps individuals learn to manage their choices in line with their health goals. Second, including five basic health goals in the system allows it to accommodate a broader audience with varying health goals. It is also important to point out that, as opposed to many persuasive applications for well-being, which target only preventative healthcare, LunchTime is for people who are aiming at both preventative healthcare (e.g., general well-being) and disease management (e.g., manage diabetes). These five health goals are not exhaustive; they are only used to examine the effect of tailoring persuasive applications based on health goals.

A game session is made up of ten rounds, and during each round, players are presented with three randomly chosen meal options. The meal options are the same for all the players in a group. Each player must decide which among the presented meal choices is the best in terms of their health goal. The choice of randomly selecting three meal choices for each game is to encourage reflection on each individual choice. Presenting more than three choices at a time may overwhelm the player and undermine the casualness of the game. As a design alternative, we contemplated on using a sequential algorithm for the meal selection; after brainstorming and consultations, we concluded that a random pick is better as it eliminates the problem of mastering the different combinations of options in the game and also depicts the fact that there is no generally best or worst choice in away-from-home food. A meal option that is the best in one round might be the worst in another round depending on the *health value* (caloric value, sodium content, trans fat, saturated fat, cholesterol, and portion size) of the other options presented alongside.

In this initial stage, the LunchTime restaurant database contains sample restaurants from several fast food chains in Canada. Each restaurant is associated with its menu, and each menu item with the nutritional information of each

dish. Our goal is to include foods that our participants commonly have access to when they visit each restaurant. We derived the health value of the dishes from the restaurants' nutritional information, and this initial prototype focus is on people who are managing weight. Basically, for people who are interested in managing their weight, the caloric content (provided in the restaurant menu) is the major determinant of the food value [36]. The health value for the remaining health goals will be determined with the help of a dietician, bearing in mind that the dietary need for people with different health goals varies. The research focus is on health conditions that are lifestyle related; therefore, we are more concerned about people who want to manage type-2 diabetes. Using each restaurant's menu in deriving the health value of food is important because although many restaurants serve similar dishes, their health value differs considerably. For example, a MacDonald's medium hamburger and a KFC medium hamburger are similar in both taste and name but have different health values. Using LunchTime, we bring out the salient point that some foods might be similar both in name and taste but their nutrition content, which determines their health value, might differ considerably from one restaurant to another. We bring the player's attention to the fact that content of the food matters more than the name.

For every choice made in the game, points are awarded to the players (10 points for best choice, 5 for the second best choice, and 2 for the worst choice). Players aim to make and accumulate the highest possible score (by making the best choice consistent with their health goal) to win the game. There is a winner at the end of each round and an overall winner at the end of 10 rounds.

At the beginning of each day (7 am), players are presented with the challenge for the day (a game round). Players receive an update both on their mobile phone and via email informing them that the challenge for the day has been posted. The challenge does not expire until 12 h later (7 pm), which marks the end of a game round. The end of a game round is followed by feedback containing the individual player's points for the round and a comparison of the three choices in terms of their health value related to each individual's health goal. The cumulative result and feedback comes at the end of each game session (after 10 days). The idea of presenting just a single challenge in a day follows directly from the intentional slow aspect of the game. As a design alternative, we thought of designing a casual game where players are given a few seconds or minutes to play and finish one session at a time, but instead adopted the slow-casual approach because it allows the players to reflect, consult friends, and possibly research on the food choices in relation to their health goal before making a choice. Thus, our game is both reflective and educational.

3.2 Social aspect of LunchTime

Although LunchTime can be adapted for different groups of users, the target audience of this initial prototype is the University of Saskatchewan community. There is a high concentration of restaurants around the Campus and there is an increasing reliance of the University population on the services of these restaurants. In fact, there has been a recent move by a number of Canadian school administrators to ban the sale of fast food in schools because of the growing number of students who prefer the dishes from fast food restaurants to healthy meals [38]. Based on this fact, the university community is indeed well suited for the LunchTime application.

The individual points obtained in each game round are displayed on the leader board, visible to all group members. The competition and comparison of results motivates players to continue playing.

To play the game, an individual creates an account with username and password or signs up with an existing Facebook username. There is also a profile page for each individual, which contains some personal information and allows players to invite friends to play the game. The invite friend option allows the player to invite Facebook friends. We decided to link the application to Facebook to increase the social experience, make it easier to invite friends, and reach a broader audience.

This research was approved by the University of Saskatchewan (UofS) ethics board. It has no known risk or privacy issues.

3.3 System architecture and implementation

LunchTime is a cross platform application. The main architecture is based on a client–server system designed and implemented using Java Enterprise technology. As an interactive application, LunchTime uses the Model–View–Controller pattern to separate application components. The system is a 3-tier architecture for enterprise applications comprising the client-tier, the web-tier, and the Enterprise Information System (EIS). The client-tier components were implemented using XHTML, CSS, and JavaScript technologies. The web-tier component was implemented using Java Server Pages and Servlet technologies. The EIS component is a relational database designed using MySQL 6.0.

Some of the key screens of LunchTime include: Login Screen (see Fig. 1), Restaurant Screen, Health Goal Screen (see Fig. 1), Personal Screen, Game Screen (see Fig. 1), and Feedback Screen.

Fig. 1 LunchTime screen shots. *Far left* login screen—this is the first screen presented to the user. It contains the signup for new users and login for returning users. *Middle* Health goal screen-allow player to choose health goal for the game session. *Far right* Game panel screen—it displays the food choices and gives users the opportunity to pick the best food that corresponds to their health goal
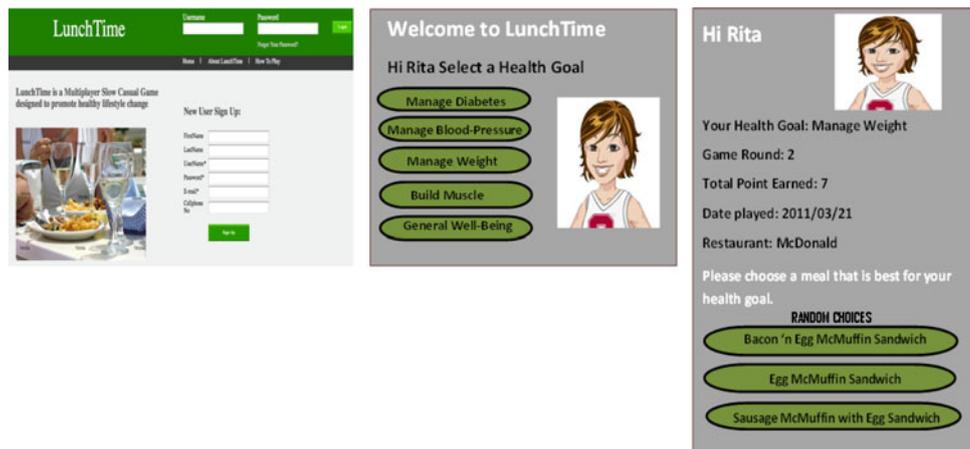
4 Evaluation

We conducted an initial evaluation of LunchTime on six participants (3 males and 3 females). The participants were in the age range of 19–40. Three of the participants have at least a bachelor's degree while the other three possess either a high school diploma or college degree from various disciplines. All the participants owned and used cell phones, computers, and the Internet on daily basis. Two of the participants played games at least once a week, two played at least once a month while the other two do not play games. All the participants that played games except one played on both a computer and a cell phone. All the participants were interested in managing their weight. The only eligibility criterion was that the participants be Internet and phone users.

The preliminary evaluation assessed the effectiveness of LunchTime to help people learn how to make choices consistent with their health goal especially when eating away from home. We examined the capability of Lunch-Time to help players increase or develop a positive attitude toward healthy eating while decreasing their inclination toward unhealthy eating.

Specifically, the preliminary evaluation aimed to answer the following research questions:

- Does playing LunchTime increase players' factual knowledge about a healthy diet?
- Does LunchTime lead to in-game and out-of-game reflection?
- Does it produce a favorable attitude change?
- Does it increase players' desire to learn about a healthy diet?
- What are the motivational feature(s) of the game?

The evaluation consisted of pre- (baseline) and post- (exit) surveys used to determine any change as a result of

playing LunchTime. Surveys were augmented by a semi-structured interview. We also encouraged the participants to record their experiences during the game, the challenges they faced, how they tackled them, and how long it took them to respond to a challenge. Prior to playing the game, we explained our study and the game play to the participants. The baseline survey consisted of questions eliciting the participants' basic demographic information, their frequency of visits to restaurants, whether and how often they played computer or video games, their thoughts about healthy diets and health concerns, their nutrition knowledge, and their attitude toward healthy eating.

The participants played the game for 10 days. At the end of the game, participants completed an exit survey. In the exit survey, we repeated most of the questions on nutrition knowledge, attitude toward healthy eating, and health concern (but changed the options to avoid memorability) from the baseline survey to examine whether there was any improvement in their responses after playing the game. The exit survey was followed by an in-person semi-structured interview to know the participants' overall experience with playing LunchTime. During the interview, we asked the participants questions about LunchTime: its features, their experiences during the game, whether they found it fun, and how difficult and how long it took them to respond to a game challenge, whether they had to research or consult with other people to make a choice, and whether Lunch-Time caused them to reflect about their eating habits [7].

5 Results and discussion

At the end of the 10 days evaluation period, we collated and analyzed the responses from the surveys and the interview to answer the research questions on the effectiveness of LunchTime.

5.1 Facilitating learning

Playing LunchTime increased the participants' nutrition knowledge. The participants responded to baseline and exit questions designed to solicit their knowledge about fast food meals. The questions allowed participants to rate the subjective nutrition quality of some selected fast food meals in relation to managing weight. This is in line with *Consciousness Raising* process of behavior change identified by TTM, which occurs when people learn more and increase their knowledge about certain health behaviors [10]. This can be identified by assessing the extent that individuals can recall information from educational materials [7]. The analysis of the baseline and postnutrition knowledge survey shows an increase in nutrition knowledge in the exit survey. The mean score from the baseline survey was 2 ± 0.6 (40 %) compared to the mean score of 4.1 ± 0.5 (82 %) out of 5 from the exit survey. LunchTime facilitated learning because deciding on the comparative health value of randomly generated meal choices sparks some curiosity that made the participants want to know more. The major task of the participant was to choose a meal option from randomly generated choices; they continuously choose foods that they think are the healthiest. A meal that is the best option in one round might turn out to be the worst in another depending on the health value of the other presented options. This made the participants curious and also highlights the subtle point that there is no absolute good or bad choice in away-from-home food. Again, by giving feedback after each round, participants began to see which foods were healthier. Some of the feedback surprised participants as it contradicted their previous assumptions. For instance, according to a participant's report "…the game disproved my assumptions about some food and weight management, that really made me curious and eager to know more…". Moreover, the slow attribute of LunchTime allowed the participants time to research and confirm some of their assumptions even before playing the game. On average, the participants spent 5–12 min to respond to a challenge and most of them reported checking the Internet or discussing the possible answer with their friends after the first day. One participant reported playing the game at the restaurant before placing an order and how he eventually resorted to ordering the meal that was presented as the best choice of the day. Another participant disclosed how he spent 30 min in the game researching on not only the challenge of the day but on his favorite fast food meal choices and their relative health values. This is in line with the *Counter Conditioning* process of behavior change identified by TTM, which involves learning more about healthier behaviors that can substitute for the unhealthy alternatives. Thus, LunchTime helps players not just to learn and think about the healthiness of individual meals presented in the daily challenge but to extend this into their daily meal choices.

5.2 LunchTime and reflection

Playing LunchTime led to both in-game and out-of-game reflection. The feedback and slow attribute of LunchTime are the two main components that trigger reflection. Our study shows that the slow play style allowed the participants time to research on the possible best answers before responding to the challenge. In the course of playing the game, some participants were also motivated to research on their most frequently consumed fast food and their relative health value. As reported by a participant "… I have 4 favorite meal choices whenever I visit Subway; I just discovered that 2 out of the 4 are really not good for my weight! Not bad, I'm still left with 2…" This shows that the game caused the participants to engage in the *Self-reevaluation* process of behavior change identified by TTM [10]. *Self-reevaluation* has to do with realizing and reflecting on how an individual's behaviors affect his/her life. Most participants reported that LunchTime came to their mind when they wanted to make meal choices, causing them to compare their choices with other alternatives in terms of health value, which is an unusual thing to them. This shows some internalization of what has been learned from LunchTime. It is also in line with the *Dramatic Relief* process of behavior change as identified by TTM. *Dramatic Relief* deals with the emotional reactions following the processes of internalizing what has been learned. Moreover, the feedback caused some participants to reflect and even verify the given feedback for correctness. A participant reported how he pondered over a given feedback until he was able to confirm it from another source.

5.3 LunchTime and attitude change

The analysis of the pre- and post-survey questions about healthy eating attitude shows that the mean score from the baseline survey was 1.9 ± 0.5 (38 %) compared to the mean score of 4.2 ± 0.5 (84 %) out of 5 from the exit survey. This shows that playing LunchTime led to a positive attitude change toward a healthy diet in line with KAB [14]. According to the KAB model, an increase in knowledge can lead to an intentional change in attitude. The result of our evaluation confirms that an increase in knowledge led to desirable attitude change. It is also in line with previous research that shows that knowledge impacts positively on attitude toward healthy eating [37]. Again, from the semi-structured interview, the participants shared how playing LunchTime led them to research some of their favorite meals. They also reported how they compared

meal choices in the restaurants. A participant actually ordered a meal that was recommended by LunchTime as the best. The participants also showed some behaviors in line with the *Counter conditioning* and *Dramatic Relief* processes of behavior change as identified by TTM. Counter-conditioning happens when people begin to substitute unhealthy ways of acting and thinking with the healthier one, while dramatic relief deals with the emotional reaction experienced by an individual following new knowledge. Most participants reacted to some of the discoveries they made while playing LunchTime. According to a participant "… it was unbelievable to see that tuna sandwich was worse than ham-egg-cheese sandwich. I really like ham but consumed tuna sandwich frequently because I thought fish is lighter!…". Similarly, another participant said "I know I'm overweight, but never bothered, I can't imagine that all of a sudden I started discussing and thinking about what not to eat with my friend". This shows that playing LunchTime motivated a positive change in attitude.

5.4 Keeping players' motivation

The preliminary version of LunchTime included feedback and the leader board. The participants found the feedback useful for facilitating learning; in addition, the scoreboard was reported as being motivating. All the participants reported that they spent approximately a minute in responding to the first day's game challenge and basically used only their personal judgments of the health value of the meals despite the fact that they were allowed to seek help. A surprising feedback and a low score following their response motivated them to research and think about their choices before making them in subsequent game play. The non-gamer participants found LunchTime fun to play while the gamers did not agree. According to one gamer participant "…it's not as fun, I might only play it longer because it makes me do what I wouldn't do ordinarily—get curious and conscious about my meals…". All the participants but one liked the fact that LunchTime is slow, "it allowed me time to look up the choices, and I learn more stuff but it would be nice to allow one to play more than once a day". Participants in most cases went beyond just researching to respond to LunchTime's challenge to learning about some other meals of interest. A participant shared how he discovered that two of his favorite fast food choices are not good for weight management while playing LunchTime. The possibility of researching about other meal choices is high during game play, and this might not be possible with fast games as players have the tendency of forgetting or losing motivation.

The result from this preliminary evaluation will inform how we should iterate on the game design and implementation to better meet our research goals.

The major limitations of this work are the short evaluation period and the small sample size. We are not able to report a significant result from the evaluation. Again, although LunchTime facilitates learning and attitude change, it might be difficult to attract, motivate, and engage players when using a slow design strategy. Other persuasive strategies might be necessary to make slow games fun. A careful consideration of the slow design strategy is therefore necessary for games that aim to entertain and engage players.

6 Conclusion

In this work, we propose a *slow-casual* educational game and a goal-based approach for intrinsically motivating behavior change using learning and reflection. We demonstrated the suitability of our approach in the design, implementation, and evaluation of LunchTime. The preliminary evaluation shows that LunchTime is capable of educating people about healthy eating in line with their health goal. More importantly, it shows that playing LunchTime led to a positive attitude change toward healthy eating. The slow attribute of LunchTime allows players time to think, research, and reflect on their choices. This suggests that intentional slowness is an important attribute to consider in any intervention intending to change behavior using education and reflection. As future work, we will conduct a full-scale evaluation of LunchTime to find out its impact after playing for a long time. The next iteration of LunchTime will also put into consideration some of the insights and the suggestions from this preliminary evaluation. We will consider adapting the slowness to individual's capability. This will allow individuals to spend as much time as needed in the game without any penalty. Also it will allow the number of play times per day to be dependent on individual's motivation, thereby increasing its capability to engage players. We will also consider other ways making LunchTime more fun. Another area of interest for future work is to compare a simple casual game and *slow-casual* game.

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