ShakeTime! A Persuasive Robotic Game

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Abstract

This paper describes a robotic game intended to persuade players to consume healthy food for an extended period of time. Peer pressure, competitiveness and deception are used as persuasive techniques. The game implied that the only factor for determining who won or lost was the players' response time. However, results were changed imperceptibly during game play to promote engagement and a longer interaction time. The ethics of deception in human-robot interactions is a topic worth discussion.

Introduction

It seems natural to move in dimensionality from persuasive computer applications (Fogg 2002; Gram-Hansen 2009) to influential robotics. Shinozawa et al. (2005) study the difference in effect of a robot's recommendation versus on–screen agent influence. According to their experimental results, geometrical consistency between interaction environment and an embodied social agent is recommended. Meaning that for a 3D environment, robots should be preferred over two–dimensional interactive devices, such as computer screens.

Engagement has increasingly gained importance within the field of human-robot interaction. Kidd and Breazeal (2006) propose the creation of a sociable robot system for weight maintenance as a motivating tool for changes in behavior. Short et al. (2010) find greater level of social engagement and greater attributions of mental state when a robot clearly cheats humans in "rock-paper-scissors".

This paper describes a robotic game system that attempts to modify players' eating behaviors and attitudes towards healthy food consumption. The system was developed to explore persuasive techniques in the context of an interactive gaming experience. Ideally, the robot is engaging enough to motivate people into eating healthy food they might even dislike, while simultaneously encouraging social interaction between players.

This work uses deception as a persuasive technique, though deception has unclear ethical implications in robotics. When is it acceptable for robots to lie?

Game Design

A multiplayer robotic game was designed with a food motif in mind. The goal is getting people together to eat healthy food. In practice, players should become so immersed in the game that they are distracted and more likely to ignore the discomfort of eating food they do not necessarily enjoy.

The main body of the robot consists of a turntable, concealing electronic components from players, as can be seen in Figure 1. The turntable holds a quasi–anthropomorphic corkscrew "robot representative", and vibrating plastic fruits on top of it. A monitor is placed behind the robot to give visual support to human–robot communication during games. Messages are shown on the screen in simple format to keep players from being distracted with the secondary interface.

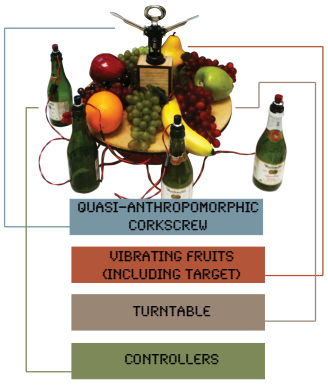

Figure 1: Robotic game system

The main objective during a round of the game is detecting the vibration of a specific "target" fruit. The first of 4 players to react by pressing a button is the supposed winner. The fastest player gets to consume one type of food, while the rest of the gamers eat another. The reason for playing with two distinct types of food is differentiating winners and losers. The food that the winners receive should be considered preferable by all players, while also being healthy. The other type should not taste as good as the first one, since this is what players get to eat when they lose. The size of these portions greatly affect how long rounds take and the pace of the overall game. Small bite–sized portions are recommended.

Game Flow

A round of the game consists of the following steps:

1. The robotic system waits for players to be ready to start the round.
2. A target is chosen, so that players know what to look for during the round.
3. A randomly–selected time starts and the robot tries to distract players by vibrating non–target fruits.
4. Distractions stop and the target fruit vibrates.
5. The robot records players' responses to the target.
6. The round ends and either a player is the winner of the round, or everybody loses if nobody responds to the target within a short period of time.

A special case occurs when a player pushes his or her button before the target fruit starts vibrating. In this situation the round ends, only this player is declared to be the loser, and he or she is obligated to eat.

The obligation to eat different types of food is strongly supported by peer pressure from players and competitiveness. In some sense the robot is granted authority from the group. We hypothesized that a single–player mode would likely not be successful since the robot may not possess the necessary authority to convince a player to repeatedly punish him or herself.

Persuasion

The robotic system conceals its use of deception by taking advantage of paradigms maintaining the goodness and reliability of electronic systems. This is particularly true for certain tasks where electronic devices are considered more accurate than human perception.

Deception and competition are commonly used in online social networks (Weiksner, Fogg, and Liu 2008), as the robot does to cause the users to become more absorbed with the experience. These patterns of persuasion (Fogg 2002) are key for an immersing gaming experience with relatively long interaction time.

Whenever a round of the game ends, the robotic system chooses the winner using one of the following strategies:

Telling the truth: The robot declares the winner as accurately as possible. The winner of the round is the first player that responds to the robotic stimulus, given hardware and programming limitations for accuracy.

Balancing: The robot attempts to make imperceptible changes in the results whenever more than one player responds quickly and almost at the same time. Results are changed with the intent to balance winning and losing, so that all players win and lose the same number of times and get to eat both types of food. There is always a chance that players will become true winners, if there is a perceptible gap between the first and subsequent responses. In this case the robot tells the truth to avoid suspicion.

Conclusions and Future Work

This paper described a robotic game intended to persuade players to consume healthy food for an extended period of time. In the future, the logic of the robot could be modified to favor alternative behaviors. For example, the person who has won least recently could be chosen as the next winner.

Even though the robot was designed to promote social interaction, it might create an imperfect social environment. In the ideal case players will be encouraged to talk and physically interact with one another, whereas in this game one can conceivably only interact with the robot and the food. In spite of the suboptimal case, players are still technically interacting with the rest of the group, because the robot's actions are guided by the past and present players' input. Interestingly, after rounds of informal testing, the robot became a conversation piece between players. The balancing mode was a source of significant discussion.

The system is currently being tested to gain greater insight about the effect of deception in the field of human–robot interaction. There are many unanswered ethical questions related to robotic applications that involve deception. Would you have children play with the described robot if you knew or discovered it was lying? Determining how and when to change the behaviors of robots to suit the conditions and humans around them is extremely important. Strategies to encourage engagement are key to the success of games such as the one presented, and possibly a much larger branch of the future of robotics.

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