Designing Serious Video Games for Health Behavior Change: Current Status and Future Directions

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Abstract

Serious video games for health are designed to entertain while changing a specific health behavior. This article identifies behavioral principles that can guide the development of serious video games focused on changing a variety of health behaviors, including those attempting to decrease risk of obesity and type 2 diabetes. Guidelines discussed include how to develop video games that provide a solid foundation for behavior change by enhancing a player's knowledge and skill, ways in which personal mastery experiences can be incorporated into a video game environment, using game characters and avatars to promote observational learning, creating personalized experiences through tailoring, and the importance of achieving a balance between "fun-ness" and "seriousness." The article concludes with suggestions for future research needed to inform this rapidly growing field.

J Diabetes Sci Technol 2012;6(4):807-811

Introduction

Videogames are a popular form of entertainment among both adults and youth.[1,2] They appeal to a wide range of individuals, regardless of age and gender, including parents.[1,2] As such, they have both broad reach and appeal, making them a potentially powerful channel for reaching large numbers of both adults and youth with health-enhancing messages. In addition to serving as a source of entertainment,[1,2] video games can provide an extensive range of player experiences delivered or supported by digital technology. Video games all have certain basic features in common that define them as "video games." For example, regardless of type, video games are guided by rules, promote challenge, and give feedback.[3]

Serious video games are a special type of video game that attempts to entertain while achieving change of some type, such as change in the player's attitudes, beliefs, risk perceptions, knowledge, or skills, which may ultimately change behavior. Thus serious video games have dual, and seemingly disparate, goals of "fun-ness" and "seriousness."[4]

Serious video games for health are a special type of serious video game that is specifically designed to entertain while changing health behavior.[5] Changing health behavior, such as diet and physical activity, can be a daunting task. Health behaviors are typically influenced by multiple competing factors, making them resistant to change.[6]

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Serious video games for health are more likely to be effective if they target factors that are closely and causally related to the behavior of interest.[6] Behavioral science offers insight into how to design serious video games for health that achieve the dual goals of entertaining (i.e., "fun-ness") while promoting health behavior change (i.e., "seriousness").[5,7] Five behavioral science concepts that can guide game design decisions are presented here:

1. *Knowledge and skill provide the foundation for behavior change.*[8] Basic knowledge of the health behavior (i.e., How many servings of vegetables do I need each day?) and how to manage one's behavior (i.e., How do I overcome problems that keep me from meeting my goal?) provide a necessary, but not sufficient, foundation for behavior change.[8] Skills that enable an individual to act on this knowledge are also needed to establish a strong foundation for health behavior change. For example, when youth attempt to increase vegetable consumption, they need to be skilled in preparing developmentally appropriate vegetable recipes, making substitutions when desired vegetables are unavailable, and asking and negotiating with a parent to have their favorite vegetables at home.[9] They also need to be able to set realistic goals,[10] self-monitor,[8] and solve problems,[11] which are important skills that enable one to self-regulate their behavior. Obtaining knowledge and enhancing skill can easily be integrated into a video game. For example, *Escape from Diab* and *Nanoswarm: Invasion from Innerspace*, two epic serious video games designed to reduce risk of type 2 diabetes and obesity by promoting healthy diet and physical activity behaviors[12] achieved this through character dialogue, character modeling, and mini games embedded in game play.[5,7] *Bronkie the Bronchiasaurus* (an asthma self-care game in which players manage the character's asthma, avoid asthma triggers as a way to learn by doing, and make choices for the character and observe the consequences[13]) and *Re-Mission* (a video game for adolescent and young adult cancer patients who play by operating a nanobot within the body of a young person with cancer, destroy cancer cells, and manage side effects related to cancer treatment)[14] both demonstrated knowledge gains among players. Knowledge and skill gains among adults have also been observed, particularly with game-based simulations.[15]

2. *Personal mastery is key; bring on the avatars!* According to social cognitive theory,[8] an important

way to learn a new skill or behavior is to perform it successfully yourself. Personal performance, however, can be time-consuming, often requiring multiple attempts of trial and error. Serious video games for health offer a solution. Personal mastery experiences can be promoted by setting specific, precise, proximal goals in the video game that have to be achieved in the real world and reported in the game world, subsequently influencing game play. Self-monitoring and goal review in the game world with specific performance-related feedback likely facilitates this process. Additionally, using social cognitive theory as a guiding framework,[8] a video game that supports exploration, provides pertinent knowledge- or skill-based activities the player must master in order to get to the next level, and has the player make choices and observe the consequences (which can be equated to having the player receive performance-specific feedback) will likely enhance feelings of mastery.

In a serious video game for health, there are many different ways to encourage personal mastery. Levels and repeated game play are common techniques in entertainment-oriented video games that can be easily incorporated into a serious video game. Further, simulation games, where players participate in a virtual representation of a "real-world" situation,[15] and role playing games, where players enter a fictional world and assume the role of a character in the game, provide an opportunity to link activities in the virtual world with the real world[16] and could be of particular salience to serious video games for health.

The use of avatars[17] may also be a useful technique for promoting personal mastery. Since players often identify with their avatar,[18] avatars may serve as powerful models, particularly when they are self-representative or bear a strikingly similar appearance to the player.[18] Individuals have consciously performed physical activity when confronted with situations where their actions affected their avatar, especially when the avatar's appearance was similar to theirs.[19]

3. *Show me the way: observational learning facilitates behavior change.* Watching others (called "models") successfully perform a skill or behavior and receive internal (e.g., personal satisfaction or pride at a job well done) or external (e.g., praise or recognition) rewards is an efficient way to learn.[8] Referred to

as "observational learning" or "modeling," this is believed to be the most common way in which new skills are acquired.[8]

Observational learning can be integrated into a serious video game. For example, game characters or avatars can model skills that facilitate behavior change, such as goal setting, problem solving, decision making, and self-monitoring. By modeling a "coping style" (i.e., imperfect performance that gradually improves) versus a "mastery style" (i.e., perfect initial performance),[20,21] game characters or avatars can convey the importance of perseverance and skill refinement. If the game scene or activity is well written, it can be entertaining as well as instructive and convey critical behavior change skills in a natural, nondidactic manner. Watching others perform a behavior is also a way for players to understand the possible effects of their choices on others and to vicariously experience positive and negative consequences of a particular action.[22]

4. *Just for me: the importance of tailoring.* Attracting a player's attention is a critical element of behavior change because it initiates information processing.[23] Maintaining attention is also important because the greater the exposure to behavior change information and related procedures (i.e., program dose[24]), the greater the likelihood of behavior change. Individuals are more likely to pay attention to and process personally relevant messages (i.e., messages perceived as "about me" or "for me") as opposed to more generic ones. Tailoring is the creation of individualized messages crafted to personal characteristics, such as preferences, problems, or goals.[25] Previous research has documented that tailoring enhanced personal relevance[25] and facilitated desirable changes in diet[26] and physical activity[27] behaviors. Thus, to attract and maintain attention, messages and options in the video game, particularly in a serious video game for health, need to be tailored to players' perceptions, expectations, problems, solutions, and situations. Formative research should be conducted throughout development to ensure participants' comprehension and the appeal and personal relevance of the messages, options, and activities included in the game.[5,7] This approach is particularly critical in a serious video game for health, where the intended purpose is to help the player modify a health behavior.

Potential persuasiveness of behavior change messages is influenced by the message source (i.e., in the "real world," this would be an individual; however, in a video game world, the message source would be game characters or avatars). Perceived character trustworthiness, attractiveness, and like-ability enhance their potential persuasiveness.[23] Protagonists (i.e., game characters, avatars) in a serious video game should embody these characteristics for the player, while antagonists should be designed to have the opposite characteristics.

5. *Fun trumps all.* Behavioral science can offer insight into how to design a serious video game to influence health behavior; however, players expect that a video game will be fun and entertaining. Dramatic tension, humor, and challenge are all methods to enhance entertainment;[28] however, this is the purview of entertainment specialists. Therefore, the serious video game design team should be multidisciplinary and include behavioral scientists, content experts, and entertainment specialists. It is essential that the behavior change components and the entertainment features be seamlessly integrated to achieve a balance between fun-ness and seriousness. An entertaining serious video game for health is more likely to motivate a player to continue playing, ultimately providing a greater opportunity for behavior change by increasing exposure to the behavior change components embedded in the game.[29]

Future Directions

Serious video games for health offer a promising platform for reducing risk of developing type 2 diabetes and obesity by promoting healthy diet and physical activity behaviors. However, this field is in its infancy. To reach its full potential, research is needed to elucidate effective design in serious video games. Key research areas are identified here.

Behavioral Focus

What types of health behaviors are the best "fit" for serious video games for health? Are different types of games (i.e., genres) needed to address different health behaviors (i.e., strategy games for adopting healthy nutrition behaviors versus active video games for increasing physical activity)? Does player gender or age influence genre selection in a serious video game for health?

Theoretical Framework

What theories have the highest predictability for the behavior of interest and offer the best guidance for the design of serious video games? How can theories from disparate fields be combined to attain a synergy for creating an effective serious video game for health? Are different theoretical frameworks needed to address different behaviors, or is there a universal theoretical framework that can be used to design serious video games for health? How can a serious video game designer incorporate theory in the storyline and/or game mechanics to increase the chances of achieving health behavior change?

Narrative

What story features contribute most to immersion? How important is immersion to health behavior change? Is there an optimum level of immersion in a serious video game for health? How important are characters, story, and game play features to immersion? In a serious video game for health, which has the greatest effect on behavior change: avatars, characters, or a combination of the two? What is the difference in player appeal and immersion between first-person versus third-person perspectives in serious video games for health? Does this vary by age, gender, or health behavior?

Characters

What characteristics of video game characters are most appealing in a serious video game for health? Do these characteristics vary by player attributes (i.e., player age, gender) or health behavior? What attributes are the most conducive for modeling behavior change?

Avatars

What characteristics of avatars are important when attempting to change health behaviors? In a serious video game for health, how important is player and avatar similarity? Is it more effective for an avatar to possess desired traits or to acquire the traits over time? If individuals identify with their avatar, what are the consequences for the player if the avatar suffers an undesirable outcome resulting from the player's actions (i.e., develops type 2 diabetes, becomes overweight or obese) or suffers no undesirable outcomes after engaging in unhealthy behaviors?

Fun

What constitutes fun in a serious video game? What are the relationships among fun, immersion, and behavior change?

Motivation

What motivates someone to play a serious video game for health? How can that motivation be maintained over time? What effect do competition and rewards in a serious video game for health have on intrinsic motivation? How can serious video games be designed to attract individuals not inclined to play video games?

Fantasy versus Real-World Learning (Transfer)

How can knowledge and skill learned in a virtual world best be transferred to the real world? What is the tipping point between failure, frustration, and feelings of personal mastery?

Behavioral Procedures

What are the optimal ways of incorporating key behavior change procedures (i.e., goal setting, problem solving, decision making, self-monitoring) into a serious video game for health while maintaining the optimal levels of immersion and fun? Are there other behavior change procedures that may be more effective (or equally effective)?

Data Collection

What method of behavioral assessment works best in a serious video game: stealth data collection (i.e., responses or response times to questions from game characters or choices made by the player during game play); overt, out-of-game data collection (i.e., completing questionnaires prior to episode 1 and following conclusion of the final episode); or a combination of the two approaches?

Behavioral Maintenance

Does behavior change resulting from playing a serious video game for health last over time? Are "booster" sessions needed? If yes, what type or types of booster sessions are most effective?

Privacy

How can privacy be protected in a multiplayer game?

Conclusion

Behavioral science can help inform key design decisions faced by the designers of serious video game for health. Future research needs to investigate the most effective ways to achieve the dual goals of fun-ness and seriousness.

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