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Roundtable Discussion

Using What's Learned in the Game for Use in Real Life

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A player can learn many things from playing a game for health. Some of these learnings were deliberately designed for the player to use in his or her real life, outside of any game. The effective ways to enable players to generalize what they learn in the game to their real lives (and thereby benefit from playing the game) are not clear. We have convened a group of expert health game designers and researchers to discuss this important issue.

Tom Baranowski: ***Let's get started: What design procedure(s) have you used in your videogames to maximize the likelihood that a player will apply in his or her real life what he or she learned in the game? And have these procedures been effective?***

Deborah Thompson: Before a new behavior can be applied, the target audience must understand what is being asked of them (comprehension), and they must be able to perform the action or behavior (knowledge, competence). Therefore, as part of videogame development, we typically convene an expert panel composed of members of the intended target audience and conduct extensive formative research to ensure they understand what we are asking them to do and that they can do what we are asking them to do. Essentially, we partner with the expert panel to create the videogame. In addition, during the development phase, we vet problems and solutions with the expert panel to ensure the problems addressed in the videogame are realistic (i.e., they are problems faced by target audience members when they attempt to engage in the desired behavior) and, equally important, that the solutions offered are realistic and appealing to the target audience (i.e., solutions they would or could actually use if they faced this problem). The expert panel also helps construct the characters. This is important because the characters (i.e., protagonists) are typically designed to serve as models; thus, they must be perceived as likeable and believable. As part of the videogame narrative, the characters face problems achieving the desired behavior; then, using a coping style, they model how to overcome the problems using solutions vetted by the expert panel. In addition, players set goals in the videogame to perform the behavior in the ''real world'' and then report goal attainment in the videogame.

We believe this approach has been effective. In a recent online videogame designed to increase fruit–vegetable consumption in 4th and 5th graders (''Squire's Quest! II: Saving the Kingdom of Fivealot''),[1] we used these procedures to develop the videogame. To guide game design decisions, we used a complex theoretical framework (i.e., social cognitive theory,[2] self-determination theory,[3] behavioral inoculation theory,[4] elaboration likelihood model,[5] and maintenance theory[6]) and integrated a variety of self-regulatory behavioral procedures into the structure of the videogame (e.g., goal setting, self-monitoring, goal review, problem solving, decision making, and skill development). We believe this approach ensured the videogame emphasized key aspects of behavior change that influence the children's real lives by enhancing behavior-specific knowledge, skills (competence), motivation, and self-efficacy regarding fruit–vegetable consumption. For example, as part of gameplay, children set goals to eat fruit and vegetables and make fruit–vegetable recipes in the ''real world.'' Prior to setting a goal to prepare a recipe, they viewed a clip of how to prepare the recipe as part of gameplay. The rationale for this was that we believed by giving them choice over which recipe clip to watch, watching it be prepared, and then setting a goal to prepare it at home, this would help them build the foundation they needed to successfully prepare tasty, appealing fruits and vegetables in real life, thus increasing the likelihood they would eat the recipes they prepared, which, in turn, would increase the likelihood they would more eat more fruits and vegetables. Preliminary analyses indicated children reported meeting most of their fruits and vegetables and recipe goals. Most played all 10 episodes of the videogame, and the attrition

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rate at the end of the study (approximately 6 months after baseline) was low. Qualitative research conducted at immediate post-intervention indicated children enjoyed the game and that they were able to provide realistic solutions to common problems children face when attempting to eat more fruits and vegetables.

Lynn Fiellin: In designing and developing our game, ''PlayForward: Elm City Stories,'' a National Institutes of Health–funded interactive two-dimensional game developed for the iPad® (Apple®, Cupertino, CA) and focused on teaching knowledge and skills around risk reduction and human immunodeficiency virus (HIV) prevention in young teens, we engaged the community and our target audience in every step. This strategy, which incorporates substantial input from our players, increases the authenticity and ''realness'' of the game. We also employed a number of techniques to increase the likelihood that actions and behaviors learned in the game would translate to real life. Specifically, we employed the game mechanic of skill-based minigames to focus on specific behavior change goals. For example, our ''Refusal'' minigame is about having the player practice skills that translate to real life. Based on well-established strategies for a stepwise approach to refusing unwanted behaviors,[7] the ''Refusal'' minigame incorporates evidence-based mechanisms for establishing behaviors that have a high likelihood of persisting in real life.

We also used other mechanics such as creating visual representations of social networks, allowing the player to visually see how proximity and friend choices can influence their decisions. The use of visual techniques to represent risk-taking and its consequences allows players to experience risk in concrete ways and impacts all of the important components of behavior change, necessary in order for behaviors to stick.

Preliminary qualitative data collected after 6 weeks of gameplay revealed that when asked how they would describe ''PlayForward'' to others, players use descriptors such as ''fun,'' ''interesting,'' ''cool,'' and ''inspiring,'' with 85 percent reporting that they would recommend the game to a friend. They cited improving decision-making skills, future awareness, and increasing knowledge about sex, drugs, and alcohol as reasons for recommendation. They also reported ''PlayForward'' as relatable and transferrable to their own lives. To date, we also have preliminary data on knowledge acquired and have found that the group that played ''PlayForward'' had statistically significantly higher levels of knowledge after gameplay as compared with the control group. In addition, in examining the data from the iPad software, we can document that exposure to the game is highly correlated with performance on the computer-based standardized assessments we collected. We have not yet examined the behavioral data but hope that a compelling, engaging game grown from the target population input will lead to behaviors learned in a game translate to real life.

Deborah Thompson: The children who played our videogame had similar reactions based on qualitative interviews we conducted at Post 1. This is very interesting to me, considering the topics (fruit–vegetable consumption versus HIV refusal skills), audiences (approximately 9–11 year olds versus young teens), and formats (online versus iPad) were so different. I think this speaks to the importance of conducting extensive formative research with the target audience during development of the videogame. Partnering with them during development helps ensure the videogame resonates with the target audience (i.e., it's something they WANT to play versus something they HAVE to play).

Geri Gay: We developed ''Time to Eat,'' an iPhone® (Apple) virtual pet care game that promoted healthy eating behaviors in seventh and eighth graders. We worked with artists, graphic designers, and developmental psychologists to design age-appropriate pets and interfaces, and we tested prototypes of the game with children before deployment. In this game, children's real-world eating behaviors impacted the well-being of their virtual pet. Children used the iPhones to upload pictures of their meals within the game interface, and the healthiness (or unhealthiness) of their food was rated by members of our research team who had been trained by nutritionists. When children ate healthy meals or snacks, their virtual pets became happier looking, but when they ate unhealthy food or skipped meals, their virtual pets became sadder looking. This reinforced the link between the gameplay and real-world behavior, maximizing the likelihood that the children would engage in these behaviors. Furthermore, this approach was effective, as we saw that children who played the game ate a healthy breakfast over twice as often as children in the control group.

Tom Baranowski: ***What research would be useful to you to refine your approach to encouraging players to use in their real lives what they learn in your games?***

Deborah Thompson: The concept of ''transfer of learning'' is an important issue in education,[8–10] from which we can learn. In addition, I believe more targeted, single-focus research is needed to determine how to make serious videogames fun and relevant to the target audience. And, of course, we need to continue to conduct formative research during development to ensure the videogame is relevant, appealing, and developmentally appropriate for its intended audience. Other issues that need to be investigated are what theories or theoretical frameworks best guide transfer of learning in regard to health behaviors, behavioral procedures that most effectively promote transfer of knowledge and skill to the real world, and identification of procedures that reinforce and promote continued transfer of learning in the real world (i.e., behavioral maintenance).

Lynn Fiellin: Further research developing systems and strategies to examine game-generated data would pave the way for refining new approaches for players to translate what they do in a game to their real lives. Studies are needed that use different techniques for evaluating knowledge and behaviors learned in gameplay and what reinforcing factors are involved that motivate players to use this knowledge and skills in their real life and see the resulting benefits.

Geri Gay: Mobile technologies provide exciting opportunities for games to promote healthy living, as smartphones and other devices such as smartwatches are portable enough to be used throughout the day. These devices can then be used to collect data for ecological momentary assessment, send encouragements or recommendations to users, or serve as an ambient display regarding healthy behaviors. More research is needed, however, on the most effective way to make use of these technological features to promote behavior change. How frequently should a behavior change game send reminders to players, for example, and does that change depending on how long an individual has been playing the game? Additionally, does the type of device matter? Do players react and respond differently to information presented on ambient displays like smartwatches than they do when information is sought out within the context of a mobile game? Understanding how to best make use of these technologies can help us better design mobile games that seamlessly connect one's real life actions with virtual gameplay.

Another area in which further research would be useful is more deeply exploring the interplay between physiological sensors and game interfaces. For instance, we're looking at how a hand-held galvanic skin response sensor can be used as an input for a stress management game. It's often counterintuitive to think of games, especially competitive ones, as a tool to decrease arousal. However, we're working with a game developer who uses these arousal inputs to design games intended to promote relaxation, and we believe that learning to control arousal and stress in this way could more effectively promote transference of these behaviors to real-world situations.

Deborah Thompson: Geri, going back to a point you made earlier, I agree that an area that needs to be more fully researched is related to feedback—How do we use the data that can be collected via technology to help individuals more effectively modify their behavior? What types of data are most helpful, what is the best way to provide that information back to the individual, how frequently should feedback be provided, what types of feedback are most likely to lead to transfer of learning, etc. In my opinion, there are lots of important questions that need to be answered related to this key area of research.

Geri Gay: That's a great point about the relationship between feedback and transference; I completely agree that better understanding this relationship would lead to more effective games for health. This would also dovetail nicely with Lynn's comment about better utilizing game-generated data, as improved strategies for making use of that rich source of data would be helpful in terms of more deeply exploring the role of feedback in these types of games.

Tom Baranowski: ***At this time in game design, it appears that enabling participants to use in their real lives what they learned in the game requires a multicomponent strategy, including a theoretical model of what is necessary to change behavior (in the real world), anticipating what the players need to know, skill at performing and motivation to perform those behaviors (in the real world), and formative research with representatives of the target group to ensure that all materials and procedures are understandable and easily performed. Exaggerated, intuitively obvious visual representations of the effects of decisions made in the game were also reported. Hypothesis testing research (highly focused) on aspects of these approaches in other settings, with the same and other behaviors and populations, is necessary to confirm these are the critical game design ingredients for transfer of learning from game to real life. In addition, the discussants indicated a need for research on (a) measurement of what is really learned in games, (b) "reinforcing factors" for using in real life what is learned in the game, (c) the use of ecological momentary assessment methods for prompting behavior change in the real world, and (d) tying biofeedback-type sensors into gameplay. Much challenging research remains to be conducted to clarify the factors influencing transfer of learning from games to real life. The*** **Games for Health Journal** ***would be highly receptive to considering reports of this research for publication.***

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Brief Biosketches

Lynn E. Fiellin, MD, is an Associate Professor of Medicine in the Section of General Internal Medicine at the Yale University School of Medicine. Her research is focused in the area of HIV and substance abuse prevention and treatment. She has received funding from the Robert Wood Johnson Foundation, the Health Resources and Services Administration, the National Institute on Drug Abuse, and the National Institute on Alcohol Abuse and Alcoholism for her work. Most recently, she has been awarded a 5-year grant from the Eunice Kennedy Shriver National Institute of Child Health and Human Development to develop and test an interactive videogame for the purpose of risk reduction and HIV prevention in at-risk young teens. With this project she created the play2PREVENT™ Lab at Yale University, a program focused on forging collaborations and partnerships among researchers, educators, videogame designers/developers, community-based organizations, and others with the goal being to develop innovative effective and targeted interventions and educational materials for risk reduction and prevention in youth and young adults.

Geri Gay, PhD, is the Kenneth J. Bissett Professor of Communication at Cornell University and a Stephen H. Weiss Presidential Fellow. She is also a member of the Faculty of Computer and Information Science and the director of the Interaction Design Lab at Cornell University. Her research focuses on social and technical issues in the design of interactive communication technologies. Specifically, she is interested in social navigation, affective computing, social networking, mobile computing, and design theory. Currently, she receives funding from the National Science Foundation, Google, the National Institutes of Health, the U.S. Department of Agriculture, and private donations.

Deborah I. Thompson, PhD, RD, is a USDA/ARS Research Nutritionist with a faculty appointment as Associate Professor of Pediatrics at the USDA/ARS Children's Nutrition Research Center, Baylor College of Medicine. Her primary research interest is the prevention of obesity and related diseases, such as type 2 diabetes, among children and adolescents. Her research, which promotes healthy nutrition and physical activity behaviors, can be placed into three categories: Theory and measurement, health message design, and intervention research focusing on the use of digital media to promote behavior change. Examples of her research include the evaluation of an online program promoting healthy nutrition and physical activity to African American girls, development and validation of a model of youth physical activity behavior, a study to assess the feasibility of self-representational avatars on physical activity, and a pilot study to assess the feasibility of using text messages to promote physical activity to teenagers. She was also Principal Investigator of a 10-episode online videogame funded by the Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health, to increase fruit–vegetable consumption among 4th and 5th graders. Dr. Thompson is a member of the Editorial Board for the peer-reviewed journal *Games for Health: Research, Development, and Clinical Applications*, and she is on the Board of Associate Editors for *Health Behavior & Policy Review*. Dr. Thompson is co-editor of a special issue on serious videogames published in the *Journal of Diabetes Science and Technology*. Her professional memberships include the International Society of Behavioral Nutrition and Physical Activity, Society for Behavioral Medicine, the Academy of Nutrition and Dietetics, and the American College of Sports Medicine. Dr. Thompson has a Master of Science with an emphasis in nutrition from the University of North Carolina at Greensboro and a PhD in Curriculum & Instruction, Human Performance, and Health Promotion from the University of New Orleans. She completed a postdoctoral fellowship in youth behavior change at Baylor College of Medicine. Dr. Thompson is a Fellow of the Post Graduate Course on Physical Activity and Health and the Dannon Academic Mid-Career Nutrition Leadership Institute.