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Advancing the Field of Health Games

A Progress Report on Health Games Research

INTRODUCTION

In September 2007, the Robert Wood Johnson Foundation (RWJF) launched an $8.25 million national program called Health Games Research: Advancing Effectiveness of Interactive Games for Health *to advance the innovation, design and effectiveness of health games and game technologies. Current funding runs through June 2012.*

The national program grew out of an initial RWJF investment, starting in 2004 and continuing into 2012, that funds the annual Games for Health Conference, as part of a project called Games for Health. The conference brings together researchers, medical professionals and game developers interested in developing health games and game technologies. The Games for Health project, directed by Ben Sawyer who is president of a game design firm, Digitalmill, supports the field by convening meetings and conferences and provides leadership to the health games industry.

The Health Games Research *national program is directed by Debra Lieberman, Ph.D., a communication researcher who specializes in the research and design of health games at the University of California, Santa Barbara.* Health Games Research *has funded 21 research projects nationwide and gives its grantees technical support for their research and assistance with dissemination of their findings. It also conducts research, develops resources for researchers and game developers, and provides scientific leadership to the health games field.*

Digitalmill's Sawyer and his staff advise Health Games Research *when there are questions about game genres, software and technology, or the games industry.* Health Games Research *staff give Sawyer information about current research in the field and how to interpret research findings, as he develops the program for the annual Games for Health Conference.*

WHAT PROBLEM IS THIS PROGRAM ADDRESSING?

Interactive health games are engaging, fun, challenging, and experiential—and have the potential to change attitudes and behaviors that can improve players' health. "Previous studies and clinical trials have shown that well-designed interactive games can

significantly improve players' health-related knowledge, skills, attitudes, behaviors and outcomes," said Lieberman.

The Need for Effective Health Game Design

But there was a need to identify the elements of effective health game design and to show which games and game features work best, depending on the health topic and the target population. Beyond that, the field needed to know how and why certain health games work, and for whom, so that the most effective design strategies could be used in future games.

The RWJF-supported Games for Health project helped identify this need. Games for Health has been bringing researchers, medical professionals and game developers together to share information about the impact that games and game technology can have on health and health care since 2004, through the annual Games for Health Conference and other meetings. Discussions at these conferences and meetings revealed the need for "… a much larger bastion of research about health games and better support from the research community," said Sawyer of Digitalmill. "People were mostly doing stuff on their own or getting small bits and pieces of grants."

"There was a strong need for outstanding quantitative research to help game designers create better games. The field was moving fast and unfortunately a lot of the work being done to design and implement health games was not evidence-based," said Lieberman.

Establishing an evidence base for health games is crucial, according to Paul Tarini, M.A., RWJF senior program officer. "Unless you demonstrate the efficacy of games, doctors and other providers are unlikely to use them as therapeutic interventions," he said.

WHAT IS THIS PROGRAM ABOUT?

Health Games Research conducts and supports research to discover evidence that can be used to improve the design and effectiveness of health games. The Games for Health project builds the field through meetings and social networking, to serve health professionals, researchers, game developers and others involved in the creation and implementation of health games. The two organizations—the national program office at the University of California, Santa Barbara, and Digitalmill—have different areas of expertise and a different focus, but at times they work together to help promote and build the health games field.

Developing Principles of Health Game Design

Health Games Research provides grants to researchers to study interactive games that focus on improving:

- Physical activity ("exergames" that require physical exertion in order to play and mobile games that involve moving from one geolocation to another or that help players track their workouts)
- Physical therapy and cognitive skill development
- Prevention behaviors and healthy lifestyle habits
- Self-care
- Self-management of chronic diseases
- Adherence to one's recommended treatment plan

The health games that their 21 grantees are studying use digital technology, ranging from traditional console video games to games played on the Web and on mobile phones to the use of exertion interfaces (e.g., dance pads) and emerging game technologies such as robots, sensors and medical devices.

The aim of the research is to develop principles of effective health game design based on theory and evidence about processes of learning and health behavior change with interactive games. RWJF's Tarini gives some examples of the kinds of questions being asked: "If you want to get somebody to participate in a weight loss game, how do you design the game? Do you play in tandem with another person; do you have to be in the room physically or online? Do you use an avatar as a competitor? We expect this research to help the next generation of games be better and more effective."

Bringing Key Players Together

The convening part of the effort is the Games for Health project. It addresses the needs of researchers, medical professionals and game developers to meet and interact, says Sawyer, who oversees the annual conference, other meetings and the use of social media to keep the community in touch. It also works to increase the visibility of the health games field.

"It's hard to accelerate work if people are sitting in offices and communicating by e-mail," Sawyer says. "Holding meetings is one of the easiest ways to coordinate people in a community. The meetings also galvanize participants and show that the health games field has breadth and depth."

To coordinate efforts to build the health games field, RWJF funded *Health Games Research* and the Games for Health project together.

WHAT HAS THIS PROGRAM ACCOMPLISHED TO DATE?

Supporting a Large Collection of Health Games Research

In 2008 and 2009, *Health Games Research* awarded 21 grants totaling $4 million to support research on health games.

Some projects look at how existing consumer games—including "Dance Dance Revolution," Wii Fit games, and "Crazy Taxi"—can be repurposed to achieve health goals. Others are designing and testing new health games or game prototypes, using mobile technologies, GPS systems, accelerometers, robots, social networks, cameras, alternate reality, virtual worlds, the Web and traditional game consoles.

"These research projects comprise the largest single collection of people doing research in games for health anywhere on the planet," Tarini says.

"The program has formed a thriving community of health games researchers," says Lieberman. "It's coalesced individual academic projects into a community of researchers who are looking at this space from slightly different angles," adds Muki Hansteen-Izora, senior researcher and strategist at the Digital Health Group at Intel Corporation, in Portland, Ore. Hansteen-Izora is a member of the national advisory committee for *Health Games Research*.

Some of the funded projects are expanding the ways that games can be used to improve health, noted Tarini. "There's a dance game for patients with Parkinson's to help them maintain mobility. There's a game to help adult alcoholics practice relapse prevention, and a game to help autistic youngsters recognize faces and emotional expressions. There are a lot of creative applications of games."

Examples of Research Projects

Current *Health Games Research* projects include these examples.

- **Dance Video Game Training and Falling in Parkinson's Disease**. Researchers at Long Island University, Brookville, N.Y., are comparing the use of the dance pad video game "Dance Dance Revolution" to two traditional treatments that help people with Parkinson's disease reduce their risk of falling: rhythmic stepping with music and treadmill training with music. Brain imaging using MRI shows how the brain responds to the three treatments.

- **BloomingLife: The Skeleton Chase.** This alternate reality game is designed to promote physical activity and a healthy lifestyle among college freshmen. It involves an interactive fictional story—a mystery that takes eight weeks to solve—unfolding across a variety of media (e-mail, websites, phone calls from fictional characters and physiological monitoring) and real-world physical and mental challenges that players must surmount to gather clues.

  Researchers at Indiana University, Bloomington are studying the relative advantages of competitive and collaborative versions of this game.

- **Lit to Quit: A Game Intervention for Nicotine Smokers.** Researchers at Columbia University's Teachers College, New York, are developing and evaluating a smoking cessation game to be played on a mobile platform (initially, on the iPod Touch and iPhone).

  The player breathes into the mobile device's microphone to control the game, which uses sound, color, images, challenges and feedback to get the player to breathe in such a way that game playing will mimic the stimulant and relaxant effects of smoking. The idea is to get smokers who are trying to quit to reach for this five-minute game instead of a cigarette. Survey responses and EEGs of the brain while the study participant is smoking versus playing will indicate whether the game serves as a gratifying substitute for smoking a cigarette.

- **Practicing Relapse Prevention in Artificial-Reality Environments: A Game-Based Therapy Maintenance Tool.** People diagnosed with alcohol abuse or dependence who have successfully completed rehabilitation can play games to practice skills that will help them prevent relapse. Researchers at the University of Central Florida, Orlando, Fla., are developing the role-playing games to be integrated into a life management multiplayer simulation video game.

  They are also comparing the behavioral and health impacts of relapse prevention treatment conducted with and without access to the role-playing games.

- **Breath Biofeedback Video Game for Children with Cystic Fibrosis.** Researchers at the University of Vermont, Burlington, are studying whether a biofeedback video game that uses a breath controller and game software can improve cystic fibrosis patients' use of inhaled medicines and breathing exercises, and can increase awareness of their breathing status. The research team developed this game in collaboration with patients.

"We have helped stimulate and coach a community of investigators with the right tools to investigate questions about health games," says J. Leighton Read, M.D., venture partner at Alloy Ventures, Palo Alto, Calif., and chair of the *Health Games Research* national advisory committee.

In addition to awarding grants and supporting grantees, the *Health Games Research* national program provides resources and scientific leadership to a wide variety of constituents in health care, health promotion, media and technology, the games industry, education, government, and business, as well as to academic researchers. For example, it disseminates information about new developments and research findings in the health games field through the program's website, social networking, press interviews, research publications and presentations. The website includes a searchable database listing many hundreds of health games, research publications, resources, organizations, events and more.

Convening the Health Games Community

The Games for Health project has been working to build the field as well. About 400 researchers, medical professionals and game developers attended the 6th Annual Games for Health Conference (May 2010 in Boston). Attendance has increased from 200 in 2005 to 400 in 2010, Sawyer says.

Sawyer has also held three regional meetings, each with about 100 participants, and three summer retreats, each with about 10–12 participants. The regional meetings are designed to boost health games work and partnerships in that region. At the summer retreats, participants discuss how to help develop and disseminate specific topics, such as "exergaming," rehabilitation and nutrition, to a broader audience in the gaming industry as well as identify leaders who can move these fields forward.

"The convening and gathering function has been fantastic," Hansteen-Izora says. "There was not a place for folks looking at gaming and technology more broadly in the health care space to convene together as a community of practice, to formulate that community. It allows people to partner and collaborate in a way that they haven't done before."

For example, a game called "Elude," which helps family members understand what it is like to struggle with depression, is the result of a collaboration formed at an annual conference. Doris C. Rusch, the director of the MIT GAMBIT Game Lab, gave a presentation about a game she was building to help family members understand addiction. A Harvard psychiatrist in the audience, T. Atilla Ceranoglu, M.D., approached her afterward and they worked together to create "Elude." "It's highly unlikely that they would have collaborated without the conference," says Sawyer.

Recent annual conferences have focused attention on new areas in health games, such as the need to develop special interfaces for people with disabilities and the special design issues related to games for rehabilitation. Since 2008, the annual conference has included a games accessibility day on the day before the annual Games for Health Conference.

Identifying Leaders

Sawyer is also working to develop leaders in the health games field. He says he looks for people who actively participate in the conferences and are willing to help others. By giving them opportunities to organize tracks at conferences and post articles and other resources on the Games for Health website, he is informally elevating them as leaders.

WHAT CHALLENGES HAS THE PROGRAM EXPERIENCED?

One challenge, says Hansteen-Izora, is to attract the large game developers like Nintendo, Sony and Electronic Arts to fully participate in developing health games.

"It's still largely an academic community and a health community and less of the large games community," he says. "Without having those who are really skilled in designing games that are fun and competitive the potential is limited. Ultimately, they will have less impact on health issues unless they take what developers of the game industry have learned about how you make a good game and keep people engaged in playing for a long time."

Limited funding for game development in *Health Games Research*—just 25 percent of each grant's budget—is another challenge. The reasoning is that the funded projects should focus on studying health games, not developing them, "It was controversial that the program limited money for game development," Lieberman says. "But there are already several outstanding commercial games to study, and grantees are also creating innovative new games to test in their research even with small amounts of funding. The bottom line is that we needed more well-designed and robust research studies in our field and it was important not to cut corners in research support."

WHAT HAVE WE LEARNED SO FAR?

Creating a Market for Health Games

Creating a market for health games means drawing in the large game developers and businesses. "If you don't have the business people and the game developers at the table it's going to be harder to turn this into a market and actually get health games companies to build products for this space," Hansteen-Izora says. "The thinking was ‘if we support enough research that demonstrates that it's efficacious, it will take off. Game developers will take off with it, health organizations will use it, and consumers will feel confident using it.' Right now this work is mostly with academic health researchers."

Creating a Business Model for Health Games

The business model for health games is also unclear. "The business model for consumer games is that you go to a store and buy it," says Tarini. "It's not clear how that's going to work for particular chronic diseases. Are you going to get enough per unit sales? Will it be distributed through your health insurance company? How that works is not clear."

Creating Shared Platforms and Infrastructure

Similarly, there is a need to think strategically and create shared platforms and infrastructure so that people can build health games faster and with less expense, says Sawyer. For example, the infrastructure for a game that tracks calories used in playing the game or provides constantly updated nutrition data could be shared with other game developers.

"The next time someone comes up with an idea for a game, we could attach a half a million dollars worth of infrastructure. That will give them features they won't have to spend money on," says Sawyer.

Other Lessons Learned

1. **Games can be used for a broad range of conditions.** "We never thought of cystic fibrosis or Parkinson's or suggesting a game to practice relapse prevention skills," says Tarini. "People are really creative."

2. **There is a lively academic health games community.** "We have validated the fact that this is a lively community of skilled social scientists who are interested in health games and want to work on it," Read says. "We don't have to pull hard to find people with the right skills to work on this problem. As the data come in, we will have a number of much more nuanced beliefs about which tools work better in which settings."

3. **Games** are **powerful environments for changing health behaviors.** "When well-designed, games can influence many of the factors that are known to lead to health behavior change," according to Lieberman. "Games are experiential and they provide immersive adventures with immediate performance feedback. Game players can gain, for example, deeper understanding of their susceptibility to health problems and how to prevent them, while at the same time they can rehearse health-related skills and share their progress with others. Experiences like these can increase players' health-related self-confidence, motivation, social support, knowledge and skill, all of which predict better behaviors and outcomes."

WHAT DOES THE FUTURE HOLD?

Moving the Field Forward Through Research Results

Researchers will complete their studies in 2011 and will, with the help of the *Health Games Research* national program, disseminate their findings to a wide range of constituents. This should help move the health games field forward, says Tarini.

Lieberman is guest co-editing a special issue of the *Journal of Diabetes Science and Technology* (July 2011) focused on games for diabetes, obesity and healthy lifestyles. Nine *Health Games Research* grantees have submitted articles for the issue.

The national program will publicize and disseminate the results of all 21 research projects, with a focus on the evidence-based health game design principles that each project has discovered and tested. Publicity and dissemination activities will include press releases, conference presentations, publications, and posting findings on the program's website and on social networks.

Considering Health Games for Social Media

Since *Health Games Research* began, there has been an upsurge of games on social media, such as "FarmVille" on Facebook. "People interested in health promotion are going to have to meet the targets of their interventions where they live. Increasingly, where they live is in social media. That's where they are playing games," says Read.

Social media games are different than other types of games, adds Hansteen-Izora. "A lot of social games are not long, sophisticated, interactive, 3-D experiences like the Xbox. They are short and social. You do them with your friends and share scores."

Hansteen-Izora also noted that social media games are a good model for health games. The social aspect of these games is well suited to health behavior change and these games are easier to build than other types of games.

Advancing the Health Games Field

Games for Health and *Health Games Research* are working with RWJF's Pioneer Portfolio to identify current and future needs of the health games field and strategies for advancing the field as new opportunities and challenges begin to appear.

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BIBLIOGRAPHY

(Current as of date of the report; as provided by the grantee organization; not verified by RWJF; items not available from RWJF.)

Article

Journal Articles

Lieberman DA, Bates CH and So J. "Young Children's Learning With Digital Media." *Computers in the Schools*, 26(4): 271–283, 2009.

Lieberman DA, Fisk MC and Biely E. "Digital Games for Young Children Ages Three to Six: From Research to Design." *Computers in the Schools*, 26(4): 299–313, 2009.

Book or Chapter

Chapters

Lieberman DA. "Designing Serious Games for Learning and Health in Informal and Formal Settings." In *Serious Games: Mechanisms and Effects*, Ritterfeld U, Cody M and Vorderer P (eds). New York: Routledge, 2009.

Lieberman DA. "Digital Games for Health Behavior Change: Research, Design, and Future Directions." In *Interactive Health Communication Applications: Promising Strategies for Health Behavior Change*, Noar SM and Harrigton NG (eds). New York: Routledge, in press.

Lieberman DA. "Designing Digital Games, Social Networks, and Mobile Technologies to Motivate and Support Health Behavior Change." In *Public Communication Campaigns*, 4th Edition, Rice RE and Atkin, C. (eds). Thousand Oaks, CA: Sage Publications, in preparation.

Communication & Promotion

Grantee Websites

www.gamesforhealth.org. The website for Games for Health includes information on upcoming convenings, articles on health games and other resources.

www.healthgamesresearch.org. The website for *Health Games Research* includes information about grantee research projects, news about colleagues, Research Briefs, and an extensive online searchable database listing games, publications, resources, organizations and other information. Santa Barbara, CA: University of California, Santa Barbara.

Meeting or Conference

Presentations

D.A. Lieberman, "Active Play Video Games: Future Directions for Research, Design, and Implementation," at the American Heart Association and Nintendo conference, The Power of Play: Innovations in Getting Active, January 2011, San Francisco.

D.A Lieberman, "Can Playing Digital Games Improve Our Health?" at TEDxAmericanRiviera, October 2010, Santa Barbara, CA. Video available online.

D.A. Lieberman, "Motivations and Rewards in Serious Games: Impacts on Player Engagement, Learning, and Behavior Change," at the Meaningful Play biannual conference, October 2010, East Lansing, MI.

M.C. Fisk and E. Biely, "Video Game Violence: Is There a Role for it in Meaningful Play?" roundtable discussion at the Meaningful Play biannual conference, October 2010, East Lansing, MI.

D.A. Lieberman, "Health Games: New Developments in Research and Design," at Teachers College, Columbia University, September 2010, New York.

D.A. Lieberman, "Health Games Research National Program," at SciFoo Camp, August 2010, Mountain View, CA.

D.A. Lieberman, "How Can Video Games Improve Science and Health?" at SciFoo Camp, August 2010, Mountain View, CA.

D.A. Lieberman, "Kids, Games, and Interactivity," to 50 producers of children's learning games and social networks, June, 2010, Walt Disney Company, Burbank, CA.

D.A. Lieberman, "Nutrition Games: Current Practices and Future Directions," (via Skype) at a symposium on the design and implementation of nutrition video games, sponsored by Games for Health, June, 2010, Portland, ME.

D.A. Lieberman, "Beyond ‘Catch the Fruit': A Short Survey of Nutrition Games," at the annual Games for Health Conference, May 2010, Boston.

D.A. Lieberman and P. Tarini, "How Digital Games Improve Health Behaviors and Outcomes: Research Evidence on Effectiveness" at the National Institutes of Health, April 29, 2010, Rockville, MD.

D.A. Lieberman and P. Tarini, "Using Digital Games to Improve Health Outcomes: Advancing the Field" at the Office of Disease Prevention and Health Promotion (ODPHP), April 28, 2010, Rockville, MD.

D.A. Lieberman, "Digital Media for Learning and Health Behavior Change," at the conference called Digital Media & Communication Technologies in Adolescent Drug Abuse Treatment, National Institute on Drug Abuse, April 26, 2010, Bethesda, MD.

D.A. Lieberman, "Health Games: From Research to Design," at the Kentucky Conference on Health Communication, April 22, 2010, Lexington, KY.

D.A. Lieberman, "Ten Ways Video Games Can Improve Our Health," sponsored by the Center for Film, Television, and New Media, UCSB, April 15, 2010, Santa Barbara, CA. Video available online. Audio podcast available online.

D.A. Lieberman, "Lifestyle Improvement Game to Delay Alzheimer's Onset and Support Treatment," at the annual grantee meeting for the Everyday Technologies for Alzheimer's Care (ETAC) program, sponsored by the Alzheimer's Association and Intel, September 2009, Portland, OR.

D.A. Lieberman, "Narratives in New Media: Recent Research Findings," (via Skype) at the Power of Narratives conference, Centers for Disease Control, July 2009, Atlanta.

D.A. Lieberman, "The Coming Age of Sensor-Based Health Games," at the annual meeting of the Games for Health Conference, June 2009, Boston.

D.A. Lieberman, "Game Changer: Investing in Digital Play to Advance Children's Learning and Health," panel presentation at a symposium and congressional summit sponsored by the Joan Ganz Cooney Center at Sesame Workshop, June 2009, Washington.

D.A. Lieberman, "Digital Games for Health and Learning," (via Skype) at the annual Healthy Kids Healthy Schools Summit, February 2009, Houston.

D.A. Lieberman, "Using Interactive Games to Improve Health Knowledge, Skills, and Behaviors," at the annual Dust or Magic Conference on New Media Design, November 2008, Lambertville, NJ. Video available online.

D.A. Lieberman, "Health eGames for Preventing and Managing Disease: What the Research Says," at the annual meeting of Physic Ventures, October 2008, San Francisco.

D.A. Lieberman, "Interactive Games for Pediatric Health Education and Behavior Change," at the annual meeting of the Health Care Education Association, September 2008, Tempe, AZ.

M.C. Fisk, "Video Games and More: Research and Development of Interactive Health Games," at the Mid-Year Meeting of the Telemedicine Association, Pediatric Telehealth Colloquium. September 2008, Tampa, FL.

D.A. Lieberman, "Health Games That Work: Examples of Well Designed Health Games and Related Research Findings," at the CDC's national conference on Health Communication, Media, and Marketing, August 2008.

D.A. Lieberman, "The Power of Narratives in New Media," (via Skype) at the Power of Narratives Conference sponsored by the CDC, July 2008, Atlanta.

D.A. Lieberman, "Games and Health Care Improvement: Current Trends," at the annual meeting of the Summit for Behavioral Telehealth, June 2008, Boston.

D.A. Lieberman and B. Bergeron, "Games, Simulations, and Social Media in Behavioral Health and Disease Management," co-directed a multisession post-summit workshop at the annual meeting of the Summit for Behavioral Telehealth, June 2008, Boston.

D.A. Lieberman, "Effects of Narrative, Nurturing, and Game-Play in an Action-Adventure Health Game," at the annual Games for Health Conference, May 2008, Baltimore.

D.A. Lieberman, "Designing Interactive Games to Promote Health Behavior Change," sponsored by the Center for Information Technology and Society, UCSB, October 2007, Santa Barbara, CA. Video available online.

D.A. Lieberman, "Designing Interactive Games for Health Promotion: How, Why, and What the Research Says," at the CDC Health eGames Summit, June 2007.

D.A. Lieberman, "Using Interactive Media to Promote Health Behavior Change: Evidence-Based Methods," at the annual meeting of the Summit for Behavioral Telehealth, June 2007, Boston.

D.A. Lieberman, "Re-Mission as an Intervention for Healthy Lifestyles: Impacts of a Cancer Video Game on Healthy Young Adults," at the annual Games for Health Conference, May 2006, Baltimore.

D.A. Lieberman, "Dance Dance Revolution: The Most Researched Serious Game Ever. Why, and What Have We Learned?" at the Serious Games Summit, Game Developers Conference, October 2005, Washington. Slides available online.

Proceedings

"Games for Health Conference," 2010, Boston. Attended by approximately 400 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Meetup," 2010, Indianapolis. Attended by approximately 75 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Summer Retreat—Nutrition," 2010, Portland, ME. Attended by 10 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Conference," 2009, Boston. Attended by approximately 400 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Meetup," 2009, New York. Attended by approximately 50 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Summer Retreat—Rehab," 2009, Portland, ME. Attended by 12 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Conference," 2008, Baltimore. Attended by approximately 300 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Meetup," 2008, Houston. Attended by approximately 100 researchers, medical professionals, game developers and other people interested in health games.

"Games for Health Summer Retreat—Exergaming," 2008, Portland, ME. Attended by 12 researchers, medical professionals, game developers and other people interested in health games.

Report & White Paper

Reports

Lieberman, D.A. and Donner, A. Using Electronic Games to Empower Healthy Lifestyles, Prevention and Self-Care: Theory and Research Findings. Report written for Physic Ventures, San Francisco, CA.

Watt, J. Social Connection and Anonymity in Health Games. Santa Barbara, CA: Health Games Research, 2010. Available online.

Yee N. The Proteus Effect: How the Avatars We Create and Customize Come to Change Us in Turn. Santa Barbara, CA: Health Games Research, 2009. Available online.