Handbook of Research on ICTs for Human–Centered Healthcare and Social Care Services

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Chapter 3
Playing for Better or for Worse?:
Health and Social Outcomes with Electronic Gaming

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ABSTRACT

Of the many of Information and Communication Technology (ICT) products, electronic games are considered as having great potential for improving health and social outcomes. This chapter considers the factors that may be involved in facilitating health and social outcomes and also those factors that might be considered risk factors by reviewing studies that have shown both positive and detrimental effects on people's physical and mental health. The authors also debate some research questions that remain unanswered and suggest guidelines for practitioners, researchers, and game designers.

INTRODUCTION

Electronic or digital games (i.e., video and computer games) are today some of the most popular of the various entertainment products among children, teenagers, and adults. The NPD Group (2011)—a global market research company—estimated the 2010 sales of all electronic game software (e.g., new physical electronic games, game rentals, digital downloads, subscriptions, mobile gaming) to be between $15.4 and $15.6 billion. Several market studies and surveys conducted in 2010 in the United States (US) and Europe reported that more than half of the population from these

regions is a gamer. For example, the Entertainment Software Association (ESA, 2010) reported that 67% of American households play electronic games, with 49% of players aged 18-49 years. In Europe, the Game Vision European Market Study prepared the last report for the Interactive Software Federation of Europe (ISFE, 2010) on the attitudes and buying habits of European consumers. The ISFE reported that in 2010 around 95.2 million of Europeans were gamers, based on estimates from data collected from individuals between 16-49 years of age from 18 European countries. The game systems are diverse (e.g., broadband Internet, consoles, computers, interactive TVs, mobile phones, Smart Phones, iPhones) providing users different modes of play and a variety of social contexts. Players can play alone or in groups, offline or online, and with real or virtual partners.

Electronic games are also no longer seen as merely entertainment. Their impact and effects on users are so broad that they have actually entered into our modern culture, gaining the attention of policy makers, researchers, educators, health care providers, caregivers, and parents. For example, the majority of parents in the US and in European countries now believe that electronic games have positive outcomes for their children (ESA, 2010; ISFE, 2010) and, compared to previous years, there is now more agreement that games can also help to keep users mentally and physically fit and that games are a valuable mechanism for spending time with the family (ISFE, 2010), which also shows the cultural acceptance of interactive gaming.

Based on existing literature, this paper will present a review of research on the overall effects of electronic games for health and social outcomes. We shall focus on published studies that showed positive and also negative consequences of gaming on people's physical and mental health. Finally, we shall debate research questions that remain unanswered and suggest some guidelines for practitioners and researchers in this field.

GENERAL OVERVIEW OF RESEARCH

Many studies have reported both negative and positive effects of playing with electronic games.

Detrimental effects on health that have been reported include concerns related to the overuse or even addictive use of electronic games (e.g., withdrawal, social isolation, depression, bad sleeping habits, waking-time tiredness, obesity, musculoskeletal disorders, visual problems, palmar hidradenitis). The content of video games has also been a matter of concern, especially regarding the cognitive, emotional, and behavioral effects of playing games that are considered morally objectionable because of their explicit violent or misogynistic messages. The increased belief in the power of games to influence individuals has also contributed to the use of this new entertainment as a mass medium to deliver all sorts of message, ranging from simple advertisement of brands to those involving religious and political issues.

There has also been a substantial interest in the educational, training, and preventive health uses of this interactive technology. Besides the use of available commercial games to provide cognitive distraction for pain and anxiety management, efforts have also been made in designing games for health-educational purposes. The benefits of these type of "serious games" have been reported in a wide range of areas, including physiotherapy, rehabilitation, health promotion, risk behavior prevention, development of cognitive, social and communication skills, and treatment of clinical disorders.

In order to include the broadest range of gaming experiences and outcomes, in this chapter we shall consider the following distinct (but interrelated) dimensions to address the specific effects of electronic games on users' health and social outcomes (as suggested by Gentile et al., 2009): the game structure, the mechanisms of game play, the amount of play, the context in which gaming takes place, and the game content.

We shall discuss how electronic games can affect these outcomes for each dimension separately, although these dimensions are intertwined in both gaming experience and outcomes provided.

MAJOR DIMENSIONS OF GAMING AND EFFECTS

The Game Structure

A brief analysis of the *game structure* and the *central game characteristics* is relevant for a better understanding of the popularity of games among all age ranges and to explain their effects on learning and the development of specific skills.

First of all, gaming is considered by the majority of users as entertainment. According to the ISFE (2010), the main motivations of Europeans for playing games were "fun" (61%), "relaxation" (53%), and "a positive way to pass time" (53%). This playful characteristic provides the intrinsic motivation for their use, that is, the interest in participating in the game activity by itself because of its compelling nature. Nevertheless, extrinsic motivation, in which players engage in the game activity as a means towards another outcome, also plays an important role in enjoyment (Garris, Ahlers, & Driskell, 2002). For example, external reinforcement is usually obtained when players reach the goals set by the games. Leaning is also considered an extrinsic motive, although the survey reported by the ISFE (2010) showed that "learning new things" was the least selected reason for playing.

One central characteristic of gaming is its interactivity, which provides players with a sense of control and a strong engagement with the environment. In a pioneering work about the use of electronic games with educational purposes, Malone and Lepper (1987) underlined what they considered to be the central game features that favor the intrinsic motivation for the use of electronic games: fantasy, challenge, curiosity, and control. For example, research has shown that fantasy tends to be positively associated with learning outcomes (Gunter, Kenny, & Vick, 2008). Following this reasoning, several authors suggested that these primary factors should be applied in the design of electronic games intended to promote learning and health gains (Garris, et al., 2002; Lieberman, 2001). Rules and goals are also central features in gaming experience (Garris, et al., 2002). Players must learn the game rules in order to be efficient players, and this usually requires practice. The process of discovering the rules during the course of a game may maintain the player's curiosity and fascination. As players move from one level to another, the performance tends to increase, as does the perception of control and the experience of engagement with the game environment (Grodal, 2000), which in turn may provide players a rewarding experience and a sense of accomplishment. As the game unfolds, players also learn that the problems can be solvable, which usually requires the development of appropriate strategies and persistence when faced with obstacles. According to Garris and colleagues (2002), this repeated cycle between players' judgment, behavior, and the feedback provided can also contribute to an increase on internal locus of control, that is, the perception that the consequences are related to their own efforts, and to an increase in self-efficacy, that is, individuals' beliefs on their own competence and mastery. These in turn may affect their self-esteem. In addition, these features may also allow the development of problem-solving skills, as they require planning, hypothesizing, experimentation, and decision-making. These skills are required in our daily lives and games may thus facilitate players' ability to cope with everyday tasks.

Based on the assumption that the majority of users view gaming as an entertaining activity, many commercially available electronic games have been used in health care for pain and stress

management, as a means of distracting patients from critical clinical periods that usually evoke anxiety associated with intrusive interventions (e.g., children undergoing surgery) (Patel et al., 2006) or from the side effects of treatments such as radiotherapy or chemotherapy in cancer patients (Kato, Cole, Bradlyn, & Pollock, 2008; Redd et al., 1987; Vasterling, Jenkins, Tope, & Burish, 1993). The reasoning behind this outcome is that playing games is an engaging activity that will consume a lot of cognitive resources and attention, thereby distracting patients.

In the design of electronic games it is thus extremely important to take into account the characteristics that allow users to use this medium in a ludic, appealing, and engaging way for health purposes.

The Mechanisms within the Gaming Activity

Another key dimension that we should take into account for the effects of games on users is *the mechanisms within the gaming activity*. Most games require many perceptual, cognitive, and motor skills. Players usually need to perform tasks that require visuospatial abilities such as spatial representation skills, because they require fast tracking of multiple features, rapid allocation and disengagement of attention, and comparison of visual forms. Games also require working and long-term memory. They may also facilitate executive control (Boot, Kramer, Simons, Fabiani, & Gratton, 2008). The combination of these successful skills are key factors for performing other complex skills such as mental rotation (Spence & Feng, 2010).

The development of these abilities is important for cognitive/perceptual training. Research in this area shows their positive effects for individuals with cognitive impairment (e.g., brain injuries, autism spectrum disorders) (see Durkin, 2010) and for elderly populations (Goldstein et al., 1997).

Other psychomotor abilities include the development of eye-hand coordination, such as the improvement of players' left and right coordination, laterality (i.e., the awareness of both sides of the body and the selection of a dominant side), and directionality (i.e., the notion of right/left in space).

With practice, these cognitive and visuomotor abilities can be transferred to other situations that require similar skills (Boot, et al., 2008; Ferguson, Cruz, & Rueda, 2008; Green & Bavelier, 2003; Spence & Feng, 2010), demonstrating that it is possible to learn, develop, and train these motor and cognitive skills while playing electronic games.

Exergaming is another good example of a new generation of console games that require visuomotor skills, as exergaming combines gaming with physical activity. Exergames were (presumably) created to promote physical activity and they therefore provide an alternative to a sedentary lifestyle and can overcome and minimize physical inactivity and obesity in youth (Daley, 2009). Based on these principles, exergames have also been introduced in public places such as hospitals and schools (Song, Peng, & Lee, 2011). Increased public interest in this innovative new phenomenon has contributed to the large sales of these games and associated specific devices, such as foot operated pads and motion sensitive controllers (Sinclair, Hingston, & Masek, 2007).

One of the most popular exergame has been Dance Dance Revolution (DDR). This action game was first released in arcades and then developed for the major home electronic consoles. The different zones of its pad must be stepped on according to the dance steps displayed on the screen. Other types of devices that track motion were also developed for the home console market, the most popular being digital camera devices such, as the Sony's EyeToy, and Nintendo's Wiimote controller, which contains motion sensors.

Most studies in this area evaluated children's physical activity levels while the children were playing these active games. Mhurchu and col-

leagues (2008), for example, exposed a group of children to active games for 12 weeks. They found that those children spent more time in physical activities and less in playing other electronic games, and decreased their waist circumferences, compared to controls that received no intervention. The authors interpreted these results as indicating that regularly playing active games may lead to improvements in children's physical activity levels. Other studies have analyzed the impact of exergaming on energy expenditure, body movements, and enjoyment (Graves et al., 2010; Graves, Stratton, Ridgers, & Cable, 2008). One study (Graves, et al., 2008) showed that adolescents playing the Wii Sports games for 15 minutes expended more energy than when they played sedentary games. However, the energy expenditure was not as much as when actually playing the real sport, and was less than the recommended amount of daily physical activity for the target age group. More recently, Graves and colleagues (2010) showed that exergaming with the Wii Fit aerobic games were considered by adolescents and adults as more enjoyable than brisk walking on a treadmill. Results on physiological indexes showed that energy expenditure and heart rate were greater than when playing other handheld passive electronic games, but lower than when doing treadmill exercises. Again, the authors highlighted that cardiorespiratory fitness provided by the Wii Fit was below the recommended level for physical fitness and did not recommend active Wii games as substitutes for real sports. The physical benefits associated with the DDR simulation game were also studied (Tan, Aziz, Chua, & Teh, 2002; Unnithan, Houser, & Fernhall, 2006). In general, the intensity and energy cost of the dance simulation game were positive but under the guidelines of the American College of Sports Medicine for cardiorespiratory fitness.

Although the research in this field is still in the early stages, the findings are encouraging in terms of the expenditure of energy and the enhancement of psychosocial health, having the advantage of being a home activity when outdoor activities are not possible or are difficult for specific disorders. Nevertheless, based on these results, these games should not be regarded as a substitute for actual sports and physical activities in people who are able to exercise on a regularly basis. In addition, players should be attentive to their own level of prior health fitness and to take this into account when deciding the duration, intensity, and frequency of gaming (Sinclair, et al., 2007).

There are several other special situations in which playing games as exercise might be useful for heath purposes. For example, electronic games have been introduced in physiotherapy and occupational therapy programs because they tend to motive and engage patients to do the exercises that are needed for a better recovery. Because electronic games are considered fun and engaging, players' may channel their attention towards practicing skills for extended periods of time, and this ability to capture and retain their attention might be an important factor when individuals need to perform physical exercises considered boring.

A number of different input devices have also been developed for individuals with motor and cognitive impairments (e.g., head trackers; switch inputs; eye, mouth, one-handed, or brain wave controllers) (see Yuan, Folmer, & Harris, 2011). Various reports have been published regarding the successful use of interactive games among several groups of clinical patients, including some undergoing movement rehabilitation for arm injuries (Szer, 1983) and hand strengthening (King, 1993), with conditions such as Erb-Duchenne Palsy (Krichevets, Sirotkina, Yevsevicheva, & Zeldin, 1995), with traumatic brain injuries or excised cerebral tumors (Betker, Szturm, Moussavi, & Nett, 2006; Sietsema, Nelson, Mulder, Mervauscheidel, & White, 1993), burn victims (Adriaenssens, Eggermont, Pyck, Boeckx, & Gilles, 1988), and children with Duchene Muscular Dystrophy undergoing respiratory muscle training

(Vilozni et al., 1994). In conjunction with physical rehabilitation, other authors also emphasize their role in cognitive and perceptual-motor disorders such as stroke rehabilitation (Broeren, Rydmark, & Sunnerhagen, 2004).

Individuals with spinal cord injuries and diseases and those with multiple sclerosis have also benefitted from the cardiovascular fitness resulting from using interactive games while doing their therapeutic exercises. O'Connor and colleagues (2000), for example, designed a manual wheelchair interface, called Game(Wheels), in which patients were able to play commercially available racing games while driving their own wheelchairs. The results from 35 patients revealed that this system was able to increase the motivation for doing physical exercise and helped them to achieve the health fitness goals of the training program.

Another initiative to merge physical health equipment with electronic games was the combination of games with ergometric devices. GameCycle, for instance, was developed with the financial support of the US National Institutes of Health, to allow users to do exercises while controlling the movements of several commercial racing games. Two studies using this type of equipment were conducted with mobility impaired patients, including adolescents with spina bifida (Widman, McDonald, & Abresch, 2006), and wheelchair athletes (Fitzgerald & Cooper, 2004). Both studies showed an increase in exercise training, although Widman and colleagues' study (2006) reported that the use of this system was more effective in patients who were less physically fit. Nevertheless, these are important initiatives that should continue, in order to promote positive health outcomes in individuals with impairments.

Unfortunately, there are also economic constraints. The high cost involved in designing such specific devices for impaired individuals can limit the games' accessibility. In fact, Yuan and colleagues (2011) highlighted the high number of individuals with disabilities who are unable to play because the majority of commercial games lack the indispensable features to accommodate their physical needs.

The Amount of Play

Another key dimension for the effects that games provide is the *amount of time* individuals occupy with this activity. The amount of time is also relatively independent of the other dimensions, but should be considered a serious concern, given the potential displacement effects on social-psychological well-being and physical health of users.

Previous studies have shown that the amount of time that players spend gaming tends to be positively associated with withdrawal and social isolation (Griffiths, 2008; Horzum, 2011; Wolfling, Thalemann, & Grusser-Sinopoli, 2008), perceived stress, depression, sleep disturbances, waking-time tiredness (Oka, Suzuki, & Inoue, 2008; Punamaki, Wallenius, Nygard, Saarni, & Rimpela, 2007), reduced academic achievement (Gentile, Lynch, Linder, & Walsh, 2004; Sharif & Sargent, 2006) and tends to be negatively associated with social skills development (Griffiths, 2010). However, because most of these studies used correlational research methods, it is not possible to draw causal conclusions. Furthermore, many of the problems outlined are not exclusively due to the amount of play, and for this reason research on the effects of gaming should consider other strong predictors for these outcomes.

Gaming has also been associated with reduced physical activity and sedentariness, which may lead to overweight and obesity (Carvalhal, Padez, Moreira, & Rosado, 2007; Vandewater, Shim, & Caplovitz, 2004). Excessive and prolonged exposure is also associated with musculoskeletal disorders, visual problems, and palmar hidradenitis (e.g., Kasraee, Masouye, & Piguet, 2009). Other adverse physical effects have been mentioned in the literature (e.g., neck pain, enuresis, encopresis, wrist pain, elbow pain), but most of them were

quite rare and are only temporary, as most players tend to recover over two or more weeks after cessation of the gaming activity (Gunter, 1998).

Because of all these problems, some concerns have been raised about "video game addiction" (Griffiths, 2008; Horzum, 2011; Wolfling, et al., 2008), with many authors advocating the inclusion of this phenomenon as a specific disorder in the next edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V), which is expected to be released in 2013. However, according to an official statement made by the American Psychiatric Association (APA, 2007), the upcoming DSM-V will neither consider video game addiction nor the broader category of Internet addiction as clinical diagnoses, due to insufficient scientific evidence on these specific issues. Instead, according to a new release from APA (2011), gambling will be included as a disorder in the new category of behavioral addiction. Video game and Internet addition will potentially be added in an appendix of DSM-V to encourage further research and more consistent data (APA, 2007).

Nevertheless, these concerns indicate a need for continuing research in this field and for closer attention to the amount of time spent playing and its effects. Control against the overuse of gaming in children and adolescents is still recommended by several Health Organizations. The American Academy of Pediatrics (AAP, 2001), for example, recommends that the total amount of time children and adolescents dedicate to media entertainment, which includes television viewing, computer, and video games, should not exceed two hours per day.

The Context of Game Play

The *context of game play* is another major dimension of gaming that should be taken into account. It seems undeniable nowadays that electronic games play an important social role (Cole & Griffiths, 2007). Online games with multiplayer options have fostered new types of relations and new forms of social interactions, contributing to the development of online communities. According to the ISFE survey (2010), 71% of European gamers in 2010 played online games in the preceding three months. The interaction among players in online gaming is an extremely relevant feature for the enjoyment of play, which may contribute to the development and maintenance of lifelong friendship, as well as providing an opportunity for more open self-expression than in real life (Cole & Griffiths, 2007).

Nevertheless, even for games that do not have multiplayer options, social groups tend to form and develop around this cultural phenomenon. Players may create networks and develop specific languages for sharing game-related information on how to solve the challenges, thereby creating opportunities for collaborative learning environments (Papastergiou, 2008-2009). Greenfield (1996) views electronic games as a cultural artifact in terms of their massive penetration in our culture. In her opinion this mass medium has the potential to be a cultural instrument of cognitive socialization, by enabling players to exchange ideas and be exposed to different approaches and ways to solve complex problems. Through the games players can show to others and especially to themselves what they are capable of, which can also lead to increased self-esteem. Therefore the social culture of gaming extends beyond the game itself, and it appears that these social factors play an extremely relevant role in players' enjoyment (Cole & Griffiths, 2007). Nevertheless, individuals may also prefer to play alone. The option to game in private could also be relevant for acquiring knowledge on certain sensitive topics, such as sexuality or drug consumption, or even for developing gaming skills.

The Game Content: Health Edutainment or Miseducation?

Finally, we should consider one of the major dimensions that has been most studied in this field of research: the *message* that is conveyed in electronic games.

One of the most prevalent predictions regarding the effects of game content is their potential capacity to teach the message conveyed by the game. The idea of combining entertainment with education, also referred to as "edutainment", lies in the premise that learning will be facilitated when introduced within a medium that is regarded as entertaining and "fun".

An array of theoretical approaches have been developed to explain the processes involved in the edutainment effects of gaming and the influence of the knowledge acquired on cognition, affect, attitudes, and behaviors of individuals.

Although it is beyond the scope of this article to review all the theoretical approaches, it is relevant to highlight that social cognitive learning theories, such as the Social Cognitive Theory (Bandura, 1986) and the General Learning Model (GLM, Buckley & Anderson, 2006; Gentile, et al., 2009) support that playing games enhances the chance for learning and may affect attitudes and behaviors outside of the game.

Bandura's Social Leaning and Cognitive Theory (Bandura, 1977, 1986), for example, emphasizes the importance of observing the actions of others for learning, as well as the observed consequences that those actions have on others. With electronic games, players not only observe the action of the game characters, but can assume the role of a character, and can choose and/or create their own avatar, that is, their own on-screen representation. For example, in several experimental studies, Yee and colleagues (Yee & Bailenson, 2007; Yee, Bailenson, & Ducheneaut, 2009) manipulated the appearance of the participants' avatars (e.g., attractiveness, height) and studied their attitudes and behaviors towards another avatar and also to potential real partners. It was found that simply observing their own avatar's appearance affected players' behaviors and attitudes toward others. The authors termed this the Proteus Effect, because in Greek mythology the god Proteus was capable of several self-representations.

In an effort to integrate social-cognitive and learning approaches, the GLM predicts that playing electronic games will affect players in both the short- and the long-term. Regarding short-term effects, playing games may affect the internal state of the individual in terms of cognitions, feelings, and physiological arousal. These factors, in turn, can interact with one other and affect behavioral outcomes that can be reinforced through classical and operant mechanisms. In the authors' view, gaming will therefore provide users "a continuous cycle of learning and reinforcement" (Gentile, et al., 2009, p.754), and this is one of the reasons why the content portrayed is extremely relevant for the outcomes.

Common Harmful Effects of Game Content

The majority of research has focused on the harmful effects of playing games with violent content. In addition to violent content, other concerns, some of which also tend to be included in violent games, are displays of hateful, racist, or misogynistic and stereotypical messages (Everett, 2005; Mou & Peng, 2009).

As previously stated, the game structural features and the mechanisms within the game activity are not totally independent of the game content. For example, in violent games players will repeatedly actively participate in, rehearse, and practice acts of violence to achieve the goals. In these games, players are constantly rewarded for the violence they commit (in contrast, players are "punished" when they do not act violently against their opponents). Violent games also tend to foster identification with one or more aggressive character, and some games allow players to

use external devices such as light guns. The time spend playing these games is also relevant in terms of both short- and long-term effects, as gaming experience can be a moderator of the relationship between playing and several target variables.

Research in this area has consistently reported that playing violent games contributes towards priming aggressive thoughts, activates negative emotions such as anger, enhances the likelihood of aggressive behaviors, decreases prosocial behaviors, and leads to emotional desensitization towards other human beings (Anderson et al., 2010; Arriaga, Gaspar, & Esteves, 2011; Arriaga, Monteiro, & Esteves, 2011), as predicted by the GLM. This has been found in studies using different methodological approaches. Because of the strong evidence relating exposure to violence and negative outcomes, many government health agencies and professional health associations from several countries not only made clear statement regarding the negative effects of exposure to violence in youth (see Anderson, et al., 2010) but have also promoted legislative proposals and other actions to protect children from the unsuitable and harmful content in gaming (e.g., Commission from the European Union, 2008).

Along the same line of reasoning, research on playing games that promote the prosocial messages, have begun to show positive effects on social psychological outcomes such as empathy and prosocial behaviors (Gentile, et al., 2009; Sestir & Bartholow, 2010).

The Benefits of Serious Games for Improving Health and Social Outcomes

The increased interest during the last two decades in developing the so-called "serious games" is also relevant. These are games that have been designed mostly for (although not limited to) training and educational purposes in order to positively impact peoples' health and social outcomes. To accomplish these goals, tailored health games have been developed taking into account some of the features that are believed to increase the motivation and the learning processes of players. Playing games may of course by itself not be sufficient for learning and therefore, to facilitate learning, serious games should be theory-based and centered on the needs of the target users within an instructional context.

Lieberman (2001) has outlined several main characteristics that games should have in order to improve health care awareness and behavior: attractive and efficacious role-models displaying adequate self-care behaviors, behaviors that are as customizable as possible, two or more player options in order to allow the interexchange of opinions with other individuals (e.g., friends, caregivers), unlimited opportunities to rehearse self-care and prevention skills within a safe environment, immediate and constant informative feedback about players' choices and inputs, and both positive and negative consequences of the player choices.

The literature on the effects of electronic games for health and social issues have shown positive results in promoting knowledge acquisition about health and self-care, with relevant results for social and health awareness promotion, risk prevention, and development of positive attitudes. Self-efficacy is also a major outcome of experiencing success in making the appropriate choices (Lieberman, 2001). With regard to the adoption of recommended health behaviors the findings have, however, been less consistent (Kato, 2010; Papastergiou, 2009). In fact, empirical studies have shown that having information about a particular health topic is less related to appropriate behavior than expected (e.g., Prochaska & Velicer, 1997).

We shall briefly review the literature regarding studies that analyzed the effectiveness of games specifically tailored for the improvement of health and social outcomes including health awareness, education, and promotion; preventive behaviors; dietary habits; adherence to medical treatment plans; and chronic disease self-management.

Examples of games that have been designed for health prevention include some target topics such as skin cancer awareness (Hewitt, Denman, Hayes, Pearson, & Wallbanks, 2001; Hornung et al., 2000), injury prevention (Coles, Strickland, Padgett, & Bellmoff, 2007; Goodman, Bradley, Paras, Williamson, & Bizzochi, 2006), sexually transmitted diseases prevention (Thomas, Cahill, & Santilli, 1997), teenage pregnancy prevention (Paperny & Starn, 1989), promotion of anti-smoking attitudes (Lieberman, 1997), dietary and nutrition concerns awareness, and encouragement of healthy food consumption (Baranowski et al., 2003).

Coles et al. (2007), for example, showed how an electronic game was an effective method to develop fire and street safety skills in high-risk children with learning difficulties, while Hornung and colleagues (2000) and Hewitt and colleagues (2001) showed the benefits of a game to teach how skin cancer could be developed, leading to more positive attitudes regarding sun-protection. Lieberman (1997) designed a specific game, named "Rex Ronan," to teach children the hazards of smoking and to promote anti-smoking attitudes. This game was highly appealing to preadolescents and teenagers when it could be played at home; a further study with preadolescents that played the game at home over a week also showed an increase in preadolescents' knowledge about the effects of smoking on the body and in their intention to not smoke (Tingen, Grimling, Bennett, Gibson, & Renew, 1997).

Games that simulate social dilemmas have also been effective with young people, especially when the topics represent their personal concerns. Besides positive social awareness promotion, users can learn the consequences of their actions and alternative ways for solving their personal problems. For example, Oakley (1994) developed the game "Smack" to increase the awareness of teenagers about the negative consequences of drug use. The results indicate that this game is more effective for users whose attitudes were already negative regarding drug use.

Electronic games have also been used as a psychotherapeutic tool for the evaluation and treatment of several emotional disorders (Ceranoglu, 2010). Resnick (1986), for example, has developed a game entitled "Busted", aimed at reducing antisocial behaviour in offenders by developing their interpersonal skills and raising their awareness about the consequences of aggression for the victims. The effectiveness of this game tool was supported by the positive results obtained in a preliminary evaluation in two high school classrooms. Another illustration was the use of a simulation game to develop moral reasoning in junior and senior high-school students (Sherer, 1998). The results with a small youth sample was an increase in the levels of three out of six indices of moral development (moral stages, punishment, and post-transgressional reactions), compared to a control group. Bosworth and colleagues (2000) also analyzed the impact of a computer-based intervention (SMART Talk) on anger-management and conflict-resolution. The intervention showed a decrease in users' positive beliefs regarding the use of violence and an increased intention to use non-violent strategies. More recently, Brezinka (2008) reported the development and use of game called "Treasure Hunt" to support cognitive-behavioural treatment of children aged 9-13 years. The author emphasize that this game was not designed to be a substitute for the therapist; instead, it could be introduced as part of the psycho-educational treatment for children's homework assignments and as a rehearsal of cognitive and behavioral skills. To our knowledge the efficacy of the game was, however, not examined.

The effectiveness of electronic games as a tool for the development of social communication and interpersonal skills has also been studied in children with development disorders such as autism spectrum disorder (e.g., Silver & Oakes, 2001; Tanaka et al., 2010). For example, Takana and colleagues (2010) showed very promising results with the use of an interactive game entitled "Let's Face It!", obtaining measurable improvements in the face emotion recognition skills of these chil-

dren. According to the authors the game also has the advantage of being cost-free and customized to each child's specific learning needs.

Interactive games have also shown relevant positive effects in chronic disease management: helping patients to develop problem solving skills related to the disease and goal setting in a cost-effective and easily distributed way, while allowing users to cope with certain embarrassing aspects of their condition in a private way. Bartholomew and colleagues (2000), for example, on the basis of Bandura's social cognitive theory, designed an adventure game to enhance children and adolescents' asthma self-management skills. The results showed the game's efficacy as a teaching tool for promoting knowledge, asthma management-related behaviors, and reducing hospitalizations. With a similar aim, Yawn and colleagues (2000) used an adventure game to teach children about their asthma symptoms. This game was considered highly motivational for children and effective in improving their asthma-related knowledge. Lieberman also developed games to increase awareness and management of diseases such as asthma ("Bronkie the Bronchiasaurus") and diabetes ("Packy and Marlo"). Brown and colleagues (1997) showed that "Packy and Marlo" was efficacious for diabetes self-management: positively affecting the social support of children and decreasing the number of urgent hospital visits. Recently, a new game was designed for mobile phones to deliver diabetes education (DeShazo, Harris, Turner, & Prattt, 2010). Opinions based on a sample of eight individuals with diabetes who played the game for 10-30 minutes revealed that mobile games can engage players and could be a new way to deliver relevant educational content.

"Re-Mission" was recently designed for cancer patients (Kato, et al., 2008). The results examined in a randomized trial of 375 patients, aged between 16 and 29 years, showed relevant psychological outcomes (improvements in cancer-related knowledge, quality of life, cancer specific self-efficacy) and medical treatment adherence (e.g., high levels of chemotherapy adherence and taking antibiotics more consistently), compared to those in the control group.

Additional Trends in Serious Games

Serious games for improving health outcomes can be contrasted to some advergames. Although the integration of advertising in games is not a recent phenomenon, research in this area is still lacking. Many concerns have, however, been raised. We know from past research that children are the most vulnerable target for commercial exploitation, and for this reason there are government regulations to protect children from advertisements, and self-regulatory organizations that encourage the industry to adopt advertising guidelines (e.g., ESRB, ISFE). However, the increased use of on-line gaming makes this question more relevant, because of less control and regulation in this domain (Grimes, 2008). Some recent studies show that placing a brand in online gaming affects users' cognition, emotions, and behaviors regarding their intentions to consume (Mallinckrodt & Mizerski, 2007; van Reijmersdal, Jansz, Peters, & van Noort, 2010). For example, a recent study conducted by van Reijmersdal and colleagues (2010) indicates that younger children, and particularly those with no previous information about a specific brand, are more willing than older children to use the products integrated in online games, which corroborates prior findings. These results are especially relevant if we consider that some online games advertise unhealthy products, such as junk food or beverages (Thomson, 2010). There are, nonetheless, some interesting initiatives aimed at protecting children, such as the European Union Pledge, created in 2007, which has as its main goal reducing unhealthy advertising to European children under the age of twelve years. According to their last report (EU Pledge, 2010), there has been a significant overall reduction in children's

overall exposure to advertising on Internet, on television, and in print material. But more initiatives such as these are needed.

SOLUTIONS AND RECOMMENDATIONS

To sum up, digital games can have positive and negative health effects; and all game dimensions herein reviewed do matter for the envisioned outcomes.

The few games reviewed in this article were only examples to illustrate some of the findings in this wide field of research. Many other games have been designed for improving health-related outcomes, although most have not been empirically tested. Nevertheless, based on the existing published findings it is possible to conclude that many games addressing mental and physical health have succeeded in providing information that allow a better understanding and knowledge about health issues, in reducing users' anxiety about procedures or treatments, in increasing users' adherence to some medical treatment plans, and in motivating doing physical exercise (Kato, 2010; Papastergiou, 2009). The potential of the simulated environments created and the immediate feedback players receive while playing has also shown benefits for the development of problem-solving and decision-making skills. In comparison to other types of media, the interactivity of games facilitates users' involvement, motivation, satisfaction, and information-seeking regarding health and social issues, thus contributing to individualized knowledge, active learning, and therefore to its efficacy in most of the areas that were covered in this chapter.

Overall, the great advantage of games as a tool to improve knowledge about different health problems and risks and to implement better health behaviors is that games are considered fun by many people. Therefore, gaming is usually a self-rewarding experience associated with high intrinsic motivation. For example, the feedback that comes from achieving positive results in a game (either playing with others or just trying to improve one's own score) can be highly motivating. The player might not even be aware of the capacities or skills being learned while playing. Moreover, extrinsic motivation, associated with reinforcement contingencies, is added to this intrinsic motivation. However, the logic of using games for edutainment purposes relies on an important premise: That playing is fun and engaging. Although this is often true, not all games are that amusing, and there are huge differences between individual game preferences. For example, gender differences have been documented (2010), but also age, level of education (Fox, 2009), and general computer and gaming experience may intervene in users' health outcomes. Furthermore, personality variables also play a role. Some people are more competitive, always striving to improve their scores or to beat competitors, while other get stressed by competition, preferring to play alone, while yet others even dislike gaming. The motivational advantage that games can bring may thus be a disadvantage for some people: gaming may be a threatening or frustrating experience or, in contrast, boring. According to the ISFE Survey (2010), two of the main reasons for not playing games were lack of interest (23% of nongamers perceived games as boring) and the difficulties in understanding games. Part of the challenge in creating healthy games is therefore to keep this "pure fun" feature and to incorporate other game characteristics and mechanics that have proved to be useful for specific health purposes into game design, also taking individual differences into account.

On the other hand, the intrinsic motivation and highly rewarding contingencies can also be associated with one of the major problems: The difficulty in controlling the amount of playing, which can lead to overuse.

Methodological concerns are also relevant. In order to be able to make a conclusion about the benefits and the disadvantages of games we need methodologically sound empirical studies. Unfortunately, such studies are scarce in some areas of this field. This is due, in part, to the fact that this is a new research field. From the practitioner's perspective the main goal is to help the patient. Original interventions were therefore sometimes tested with success, but the resulting publications are only case studies. While case studies have methodological limitations (e.g., few participants, lack of proper control conditions), making it difficult to generalize their results, their positive contribution is in raising interesting possibilities that deserve to be tested. Nevertheless, in order to provide valid evidence that games are effective, more well-designed randomized controlled trials are needed, with adequate sample size and well-chosen control groups.

Another important methodological aspect is the use of valid outcome measures with significant policy and practical implications, that is, not relying solely on self-report measures but instead using other type of measures to validate the effectiveness of games. If the ultimate aim is to change or enhance positive health behaviors, behavioral measures should be used more often. Although the basic idea is that players will transfer the acquired knowledge to real-life contexts and behave according to what was learned, research is still lacking to support these assumptions (e.g., Papastergiou, 2009).

Research should also investigate the processes that contribute to the effectiveness of interactive games for improving health outcomes. Several mediating factors have been mentioned, some related to the game structure (e.g., degree of interactivity, type and number of rewards, feedback, rules, fantasy, user control, speed, single vs. multiplayer), others related to the users' cognitive involvement (e.g., attention, retention of information, perceived relevance of the topic) and emotional and motivational responses (intrinsic motivation, engagement, frustration, self-efficacy, locus of control), but many of these potential explanations for specific outcomes variables have not been tested. The articulation of the research findings when testing mediator and moderator variables should contribute to test or to develop theoretical frameworks, which in turn could serve as guides for game design as well as for the evaluation of the effectiveness of those games.

FUTURE RESEARCH DIRECTIONS

In general, the attitudes toward the use of digital games for the improvement of health can be over optimistic or very negative. Digital games are not the only solution, as game designers and researchers in this field sometimes seem to believe, but they are also not "just games," as many health professionals believe. When used for educational purposes, games are a tool in addition to other resources. In order to make games a useful tool, their design should be based on theories with sound health-edutainment assumptions. To achieve this goal we need to:

1. **Define the Goals:** What do we want to teach? What are the target outcomes?
2. **Define the Target Audience:** Taking into account individual characteristics and needs. To whom can it be addressed? Age, gender, educational level, game experience, familiarity with the technology, and personality traits tend to be important moderator variables.
3. **Define the Appropriate Game, Strategies, and Message:** Which type of game? Which style of play will the game require? Which features and messages should be included and how should they be integrated?
4. **Define the Settings:** Taking into account the place in which the game will be used and estimate the costs.

5. **Empirically Test the Effects:** Experimental trials with appropriate control conditions and sample size, using valid outcomes variables with relevant policy implications for improving health.

Ideally, all people should have access to digital games, and especially to games that can provide significant positive health and social outcomes. In this chapter we reviewed the literature on how several perceptual, cognitive, and motor skills can be trained and developed by using electronic games. We gave illustrative examples of devices that were developed for impaired individuals. But further steps in game designing and research are required to meet the interests and the health needs of several target groups, including those with cognitive, motor, hearing, and visual impairments. Yuan and colleagues (2011) have reported that a substantial part of the US population (an estimated 2% based on the data from the 2002 US census) is totally incapable of playing digital games, while others have many difficulties in doing so. Another relevant target group is the elderly (Czaja & Lee, 2003). Besides the potential of electronic games for developing cognitive and motor skills, as well as the other already mentioned positive health effects, gaming in these populations could also be used for social reasons, including for increasing their social support networks (Czaja & Lee, 2003). The lack of investment can be related to economic constraints, but these groups could also offer sizeable market opportunities for the digital games industry. The recent technological developments such as Kinetic for Xbox 360 might also be helpful for some individuals with impairments, as they require most natural commands like gestures and voice.

CONCLUSION

Information and Communication Technology has advanced incredibly fast in the last decades and changed our habits, the way we perceive the world, our entertainment preferences, and even our social relations. Our basic psychological mechanisms are still, however, the same. Many mechanisms that are used in game design also rely on some basic principles that have been shown to be powerful in energizing and directing our actions. Nevertheless, several innovative trends are occurring in the game industry, including the possibility for gamers to be the developers of game content, the structure of new open game designs in which content is being constantly added, the new interfaces, and the social changes in gaming experiences. The understanding of what and how games affect our psychosocial and physical health is still embryonic but should develop and keep the track of these new developments. The literature reviewed showed that the games fulfill a number of requirements, the value of which should not be underestimated. On the contrary, electronic games should be considered as tools for health-related outcomes. Despite some research methodological limitations, demanding better controlled experimental studies, the general pattern of research findings in tailored games healthcare is extremely positive. Several issues concerning the interaction between the game (e.g., structure, mechanisms, content) and the user (e.g., individual differences, preferences, experience) still deserve our attention, however. We should also continue to pay close attention to possible overuse, and in particular, to the way children and adolescents manage the set of meanings and emotions that games provide and their effects on actual behaviour in both the short and the long-term. In sum, we should persist in trying to understand how games can be used in a positive way. Instead of playing with our health, let us use games to play for better health and improved social welfare.

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KEY TERMS AND DEFINITIONS

Advergames: A combination of advertising with electronic games. It can be in-game advertising, or games designed around a brand or other topics (e.g., politics, religion).

Avatar: In electronic games, the player's virtual graphical representation of him or herself in the game.

Edutainment: A combination of entertainment with education: any type of entertainment aimed at entertaining and being educative.

Exergames: A combination of exercise with electronic games: an electronic game that includes features for doing physical exercise.

Serious Games: Electronic games whose main purpose is "serious" and not to simply entertain. The primary "serious" purposes can be to teach or train in areas such as education, health care, advertising, politics, etc.

Social Games: Game applications embedded into Websites that usually have the attributes of social networks.