

Videogames for Emotion Regulation: A Systematic Review

Daniela Villani, PhD,¹ Claudia Carissoli, PhD Candidate,¹ Stefano Triberti, PhD,¹ Antonella Marchetti, PhD,² Gabriella Gilli, PhD,¹ and Giuseppe Riva, PhD^{1,3}

Abstract

Introduction: Emotion regulation (ER) supports multiple individual functions and promotes mental health and wellbeing. Among the tools that may be used to help people in managing their affective states, videogames are reaching attention and are showing positive effects. Yet, little is known about their effectiveness.

Objective: This study aims to assess the amount and quality of studies investigating the effects and modalities of the use of videogames for ER.

Materials and Methods: A systematic literature search according to PRISMA guidelines was performed. Subsequently, according to expert advice other few studies have been added.

Results: Twenty-three studies met the inclusion criteria and were included in the review; they can be categorized into three groups, namely (1) cross-sectional and qualitative studies, (2) experimental studies investigating the effects of videogame experience on ER and (3) ER intervention with serious games.

Discussion: Discussion of the reviewed studies highlights that frequent gaming with commercial games offers more opportunities for ER improvement (related to gameplay and enjoyment of fictional properties) than limited-time experiences, such as those supported by bespoke serious games. This research area is still in its infancy and findings need to be interpreted with caution; furthermore, future reviews are encouraged to include clinical populations.

Conclusion: Videogames offer several opportunities for ER and a challenge for educational and psychological interventions.

Keywords: Emotion regulation, Videogames, Serious games, Systematic review, Mental health

Introduction

FROM THE EARLY 1990s, there has been exponential growth in research on emotion regulation (ER) in the field of psychology. ER consists in “the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one’s goals.”^{1(p27–28)} One of the most widely used model aimed to describe ER is the so-called “process model” of ER^{2,3} that distinguishes among different strategies mostly classified by the time at which they intervene in the emotion generation process (namely *antecedent-focused* and *response-focused* processes). In this article we consider a broad conception of ER that entails the regulation of all emotionally charged states, including mood and positive or negative effect. This is coherent with Koole’s

classification⁴ of ER strategies that also includes their functions, namely the fact that people aim to achieve certain psychological outcomes by regulating their emotions. Specifically outcomes are related to the satisfaction of hedonic needs (possible ER strategies to reach this aim are thinking pleasurable or relaxing thoughts), facilitation of specific goals and tasks (e.g., effortful distraction and cognitive reappraisal), and maintenance of the integrity of their overall personality system (e.g., mindfulness training and relaxation exercises).

The literature shows that effective ER leads to several important outcomes, such as mental health,⁵ subjective and psychological wellbeing,⁶ and relationship satisfaction.⁷ On the contrary, a great deal of research highlighted the role of emotion dysregulation in certain forms of psychopathology⁸ and maladaptive behaviors.⁹ Furthermore, recent research

¹Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy.

²Research Unit on Theory of Mind, Department of Psychology, Università Cattolica del Sacro Cuore, Milan, Italy.

³Applied Technology for NeuroPsychology Lab, Istituto Auxologico Italiano, Milan, Italy.

suggests the importance of considering person–situation interactionist models that recognize individual differences and emphasize the importance of flexibility in ER.¹⁰ Through the learning of new and effective ways of regulating their emotions individuals can enhance their emotional lives and protect themselves from the risk of psychopathologies, thus interventions targeting the empowerment of such skill are increasing.

Today new methods and tools to help individuals in managing their affective states are available, including virtual computer-generated settings aimed to manipulate the affective experience^{11,12} and to train specific ER strategies.^{13–15} Among the virtual mediated experiences, videogames are becoming increasingly popular within people's entertainment activities and are attracting the interest of researchers about their opportunities for positive individual functioning. This is consistent with other studies investigating the role of traditional media, which highlighted how different forms of human art and expression have relationships with consumers' social and emotional abilities.^{16–18}

Overcoming the typical “good–bad” dichotomy in videogame research, interest is growing toward a deep understanding of the effects of videogames on the development of several abilities, such as cognitive^{19,20} and social ones.^{21,22} To examine the potential positive and negative outcomes of gaming, it is important to go beyond a “cause and effect” approach and to consider a comprehensive gamer-centered approach. Research has recently explored the positive effects of videogames on players' wellbeing,^{23,24} in terms of inducing positive emotions,²⁵ improving mood and decreasing stress,²⁶ contributing to emotional stability,²⁷ and promoting engaging, self-actualizing experiences such as psychological flow.^{28,29} Nevertheless, the effects of videogames in terms of ER are gaining attention, but have not yet received systematic in-depth analysis in literature.

Even if videogames may not address the complexity of the human emotional experience, several aspects of videogames are interesting for the promotion of ER. Following the psychological taxonomy of videogames' characteristics proposed by King et al.,³⁰ it is possible to recognize at least three main opportunities. The first is related to manipulation and control features, including various functions in a videogame that directly relate to the player's sense of mastery and control over the game, such as being able to save progress to correct mistakes, and the ability to simultaneously manage numerous resources. The controlled exposure to negative emotional stimuli may trigger and train reappraisal abilities, which is a key aspect to mature ER. Such property is certainly typical of videogames in which emotional stimuli are repeated and controlled by the player's activity.^{24,31} Furthermore, specific positive effects can emerge also by negative emotions experienced while playing games, such as frustration related to gameplay difficulty or sadness and fear related to tragic or horror contents.³² This is related to the interactivity of videogames, which has been labeled as the “art of failure” because it moves the player to constantly manage to overcome obstacles within the game instances.³³ Thanks to their interactive nature, videogames allow the player to deal continuously and directly with what generates the emotional response and to recover from failure.

The second aspect is related to narrative and identity features that refer to the role of storytelling as a means of

immersing the player in the videogame and to the ways the player can take on another identity in the game. Indeed, games can feature a wide range of emotional stimuli most of them integrated within complex and thought-provoking narratives. For example, role-playing games (RPG) allow gamers to select and modify several character features so that playing is associated with the ability to move fluidly among different opportunities for emotional experiences, reappraising them and learning new ways of dealing with negative emotions or disturbing events.²⁴ Customization features make possible the creation of a complexity of emotional narratives that are specifically tailored to an individual's own personality and desires³⁴ such as, acting as a good or evil person or taking choices different from real life. Furthermore, a player's avatar represents a powerful resource for self-representation and identity play³⁵ and the embodied experience of using an avatar can influence the individual's self-perception,^{36–38} the enactment of ER strategies and even the person's behavior.^{39–41} As Gaetan et al.^{42(p344)} write, avatars constitute an extraordinary tool for learning and improving ER: “the avatar's evolution in the virtual environment may help mediate adolescents' problematic emotional experiences to give them meaning and enable their appropriation. As such, videogames may act as a medium for projecting and experiencing one's emotional life by staging the emotional self.”

The third aspect is related to feedback/reward features that refer to the many ways players are reinforced for skillful play. For example, meta-game rewards, such as points or awards gained upon completion of game milestones, are designed to give players an overall assessment of their mastery over the game itself. According to this approach, games with biofeedback have been recently developed and tested and the main goal was to increase the quality of interaction by modifying the game in real time. This is the case of games such as *Nevermind* and *Deep* created to support ER training by encouraging specific patterns of physiological self-regulation.^{43–45}

These are some of the aspects specific to videogame technology that could possibly be related to improvements in ER abilities; however, the literature on this topic seems to be still fragmented regarding theoretical approaches, methods, and results. Starting from this background, the present review aims to analyze the state of the art of research on videogames for ER.

This review is restricted to healthy individuals and encompasses all phases of the life span because having clinical disorders related to ER may confound the outcomes that can be different for promotional/preventive interventions compared with treatment ones.

Materials and Methods

Selection of articles

Articles were extracted in June 2017 using two academic search engines (PsycINFO & Scopus) and other articles were suggested by experts in the field. This systematic review was conducted according to PRISMA, a protocol to perform systematic reviews.⁴⁶ Only articles published in peer-reviewed journals and conferences, written in English were extracted. Keywords were “emotion regulation” and “videogames.” The authors decided to include “positive affect” as a synonym of positive emotion and “management,”

“coping” as synonym of regulation, and to include “mood” as a key word. Also “serious game” word was included, because videogames designed for educational purposes are often labeled in this way in the literature. The search terms were truncated in efforts to include all variations of the word. The following combinatory keyword was used across all selected search engines: *emot*®ulat*& video game or videogame, emot*®ulat*&serious game; emot*&manag*&video game or videogame, emot*&manag*&serious game; emot*&cop*&video game or videogame, emot*&cop*&serious game; positive&affect&video game or videogame, positive&affect&serious game; positive&emotion&video game or videogame, positive&emotion&serious game; mood&video game or videogame, mood&serious game.*

In the first round, the titles and abstracts returned (*n* = 531, after elimination of 87 duplicates) were screened to exclude: (1) not original research articles (opinions, editorials, and reviews excluded) and (2) studies not focused on ER.

A full-text analysis of the remaining 58 publications was independently performed by three authors (D.V., C.C., S.T.) and each article was assessed based on reliability of its content (background; research method; research results, analysis, and discussions). This step allowed to exclude 35 further publications due to the following reasons: (1) the target was constituted by clinical population (with a specific clinical diagnosis) (*n* = 23); (2) videogames and/or serious games were cited in the text, but not involved in the study (*n* = 12).

Through this screening, twenty-three articles were retained to obtain the final sample. The same coding scheme was used to analyze the retrieved contributions. Table 1 provides a summary of studies’ characteristics (year of publication, sample size, age, gender, and outcome) and each

contribution was coded according to the following thematic categories: authors and year, research purpose, design, type of game, measures, and findings relevant for ER (Table 2).

Figure 1 contains the PRISMA diagram of the article search, retrieval, and coding process.⁴⁷

Results

The reviewed studies can be categorized in three main groups, depending on their methodological approaches and on the use of commercial or bespoke games.

Cross-sectional and qualitative studies

This first group investigated videogaming activity in everyday life and its relationship with a number of constructs, some of them being of interest for ER. In other words, these studies deepened the relationship between ER and commercial videogame play, without experimental settings involving a specific videogame. These studies were mostly cross-sectional research (i.e., employing questionnaires and large samples) and two qualitative studies using focused interviews. For example, Gaetan et al.⁴² conducted a survey to explore videogame playing and its relationships with emotional functioning features, such as ER, emotion intensity, emotion expression, and alexithymia. Authors found that regular gamers regulated their emotions more than irregular gamers did, but also felt emotions more intensely and expressed their emotions less often. Moreover, regular gamers were less prone to be emotionally reactive (alexithymia). Accordingly, another cross-sectional research about videogames and various aspects of psychosocial functioning⁴⁸ found that frequent videogame playing was

TABLE 1. STUDIES’ CHARACTERISTICS

<i>Characteristic</i>	<i>References</i>	<i>Count</i>	<i>%</i>
Year of publication		23	100.0
2007–2010	1–7	7	30.4
2011–2014	8–15	8	34.8
2015–June 2017	16–23	8	34.8
Sample size			
0–50	13, 14, 22	3	13.0
51–100	5, 11, 12, 15,16,17,18	7	30.4
101–200	2, 6,7,9,10, 19, 20, 21, 23	9	39.1
>201	1, 3, 4,8	4	17.4
Mean age (years)			
<10	23	1	4.3
10–20	8, 16, 17, 18, 19, 20, 21	7	30.4
20–30	1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15, 22	15	65.2
Gender			
Both male and female	1, 2, 4–13, 15–23	21	91.3
Male only	3, 14	2	8.7
Outcome			
Emotion regulation	3, 8, 12, 14, 16, 17, 18, 19	8	34.8
Mood repair	2, 6, 7, 9, 10, 11, 13, 15,	8	34.8
Stress relief	1, 4, 5, 22, 23	5	21.7
Anxiety prevention	20, 21	2	8.7

Reference numbers: 1, Wood et al.⁵³; 2, Russell Newton⁵⁶; 3, Wack and Tantleff-Dunn⁴⁸; 4, Reinecke⁴⁹; 5, Hussain and Griffiths⁵¹; 6, Ferguson and Rueda⁵⁷; 7, Russoniello et al.²⁰; 8, Seo et al.⁵⁴; 9, Reinecke et al.⁶⁰; 10, Bowman and Tamburini⁶²; 11, Bowman and Tamburini⁶³; 12, Astor et al.⁷¹; 13, Rieger et al.⁵⁸; 14, Lobel et al.⁵⁵; 15, Rieger et al.⁵⁹; 16, Cejudo and Latorre⁶⁷; 17, Rodríguez et al.⁶⁵; 18, Vara et al.⁶⁶; 19, Gaetan et al.⁴²; 20, Scholten et al.⁶⁹; 21, Schoneveld et al.⁷⁰; 22, Kuo et al.⁵²; 23 Hinkley et al.⁵⁰

TABLE 2. DESCRIPTION OF THE STUDIES INCLUDED IN THIS REVIEW

No.	Authors (Year)	Title	Research purpose	Design	Type of game	Measures/themes	Findings relevant for ER
1	Wood et al. (2007) ⁵⁵	Experiences of Time Loss among Video-game Players: An Empirical Study	Examining experiences of time loss among gamers	Quantitative and qualitative data collected through an online survey.	Commercial	Content analysis on data coming from answers to open-ended questions (gamers' views, experiences, and strategies in relation to time loss while playing videogames).	Time loss is typical among gamers and is often associated to positive outcomes, such as relax and temporarily escape from reality, but it can cause negative outcomes as guilty feelings about wasted time, and social conflict.
2	Russell and Newton (2008) ⁵⁶	Short-Term Psychological Effects of Interactive Videogame Technology Exercise on Mood and Attention	Investigating the short-term psychological effects of interactive videogame exercise and comparing effects on mood with traditional forms of exercise.	Experimental study. Participants were divided in three 30-min conditions: (1) interactive videogame cycle ergometer exercise, (2) regular cycle ergometer exercise, or (3) a videogame-only control condition.	Commercial	1 Positive affect and negative affect schedule; 2 Heart Rate	The interactive videogame exercise condition did not result in greater mood benefits compared with other conditions.
3	Wack and Tantleff-Dunn (2009) ⁴⁸	Relationships Between Electronic Game Play, Obesity, and Psychosocial Functioning in Young Men	Investigating relationship between frequency of videogame play, obesity, academic performance, and motivations to play.	Cross-sectional/correlational research.	Commercial	Timeline Follow-Back technique to estimate game play frequency, types of games played, and length of play in a retrospective daily diary format	Significant positive correlation between frequency of play and self-reported frequency of playing when participants are bored, lonely, or stressed. Gaming among college-aged men may provide a healthy source of relaxation and coping.
4	Reinecke (2009) ⁴⁹	Games and recovery: The use of video and computer games to recuperate from stress and strain	Investigating the use of video and computer games for recovery purposes.	Cross-sectional/correlational research.	Commercial	1 Questions about general use of video and computer games and playing computer games for recovery purposes; 2 The Recovery Experience Questionnaire; 3 The Need for Recovery Scale; 4 The Daily Stress Inventory; 5 Four subscales (active coping, planning, self-distraction, and denial) of the brief COPE inventory.	Persons who associated stronger recovery experiences with gameplay used video and computer games more often after stressful and exhausting situations. Participants with emotion-focused coping style showed a higher tendency to use games for recovery than participants with problem-focused coping style.

(continued)

TABLE 2. (CONTINUED)

<i>Authors (Year)</i>	<i>Title</i>	<i>Research purpose</i>	<i>Design</i>	<i>Type of game</i>	<i>Measures/themes</i>	<i>Findings relevant for ER</i>
5	Hussain and Griffiths (2009) ⁵¹ Gamers: A Qualitative Analysis	Exploring the attitudes, experiences, and feelings of online gamers.	Qualitative research	Commercial	Thematic analysis on the interview transcripts regarding attitudes, experiences, and feelings of participants about online gaming (integration into day-to-day lives, excessive play, addiction, psychosocial impact, alleviation of negative feelings and mood states, dissociation and time loss).	Gamers used MMORPGs to alleviate negative feelings and to relieve everyday stresses and annoyances.
6	Ferguson and Rueda (2010) ⁵⁷ The Hitman Study. Violent Video-game Exposure Effects on Aggressive Behavior, Hostile Feelings, and Depression	Examining violent video-game effects on aggressive behavior, hostile feelings, and depression.	Experimental study. Participants were given a frustration task and then randomized to play no game, a nonviolent game, a violent game with good versus evil theme (i.e., playing as a good character taking on evil), or a violent game in which they played as a "bad guy."	Commercial	1 Videogame Habits; 2 The State Hostility Scale; 3 The Beck Depression Inventory-II	Short-term randomized exposure to violent videogames does not increase neither decrease hostile feelings nor depression. By contrast, long-term exposure to violent videogames is associated with reduced hostile feelings and depression following a stressful task. Violent games may provide a particularly good medium by which the impact of real-life frustrations on depressed mood and hostile feelings may be reduced.
7	Russoniello et al. (2009) ²⁶ The Effectiveness of Determining whether Casual Video-games in Improving Mood and Decreasing Stress	Determining whether casual videogames could improve mood and/or decrease stress in players, using valid and reliable psychological and physiological measures.	Experimental study. Participants choose and played one of three videogames proposed, whereas control group surfed in internet looking for articles related to health for twenty minutes. During these activities, physiological signals of both groups were recorded.	Commercial	1 Profile of Mood States; 2 Physiological signals: EEG; HRV	Playing a casual videogame coherent with participant's choice can improve mood and decrease stress.

(continued)

TABLE 2. (CONTINUED)

<i>Authors (Year)</i>	<i>Title</i>	<i>Research purpose</i>	<i>Design</i>	<i>Type of game</i>	<i>Measures/themes</i>	<i>Findings relevant for ER</i>
8 Seo et al. (2012) ⁵⁴	Emotional Competence and Online Game Use in Adolescents	Exploring the relationships between emotional competence and online game play in adolescents.	Cross-sectional research	Commercial	1 Internet game addiction self-test scale; 2 Intensity and Time Affect Survey revised; 3 Emotional expressiveness scale; 4 EI Questionnaire for adolescents.	Emotional competence is negatively correlated with excessive online gameplay; all variables of emotional competence were significantly lower in high-risk users if compared with general users.
9 Reinecke et al. (2012) ⁶⁰	Characterizing Mood Management as Need Satisfaction: The Effects of Intrinsic Needs on Selective Exposure and Mood Repair	This study attempted to (1) extend traditional mood management theory research by investigating the influence of the intrinsic needs for competence and autonomy on selective exposure to videogames and (2) test the influence of satisfying these needs on resultant mood repair.	Experimental study. Participants were familiarized with three versions of a computer game that systematically differed in user demand (high, medium, and low) and randomly assigned to one of two false-feedback conditions (positive vs. negative feedback). Finally, participants were instructed to play the computer game again, choosing one of the three user demand conditions they had already played.	Commercial	1 Player Experience of Need Satisfaction Scale; 2 Adapted version of the Affect Grid; 3 Four items from the interest/enjoyment subset of Intrinsic Motivation Inventory (IMI); 4 User Demand using four items of the NASA TLX.	Thwarted intrinsic needs significantly predict the choice of videogames with different levels of user demand and the satisfaction of these needs predicts enjoyment. Mood management can result from mood repair through need satisfaction.
10 Bowman and Tamborini (2012) ⁶²	Task demand and mood repair: The potential of computer games	Examining the effects of increased task demand on mood repair for bored and stressed individuals.	In a 2 (mood state) × 4 (task demand) between-subjects experimental design, participants were randomly assigned to mood conditions and asked to play a flight simulator computer game programmed to vary in task demand.	Commercial	1 Behavioral measure of task demand and the NASA TLX; 2 Adapted version of the Affect Grid; 3 GaPS scale	Increasing the amount of control an individual has over a mediated environment—such as increasing the number of control inputs a user has in a computer game—significantly increases that medium's intervention potential. This increase in intervention potential results in an enhanced ability for that medium to relieve boredom and stress, and too much task demand can have a detrimental effect on mood repair.

(continued)

TABLE 2. (CONTINUED)

<i>Authors No. (Year)</i>	<i>Title</i>	<i>Research purpose</i>	<i>Design</i>	<i>Type of game</i>	<i>Measures/themes</i>	<i>Findings relevant for ER</i>
11 Bowman and Tambor- ini (2013) ⁶³	“In the Mood to Game”: Selective exposure and mood management processes in computer game play	Examining selective exposure processes expected to result in mood repair	A 2 × 3 experimental study: induced participant mood (boredom, stress) and computer game task demand (low, moderate, or high).	Commercial	1 the NASA TLX; 2 Adapted version of the Affect Grid; 3 GaPS scale	Stressed individuals choosing the moderate task demand condition experienced greater mood repair than bored individuals making the same selection. Bored individuals experienced more mood repair than stressed individuals when choosing the highest task demand level.
12 Astor et al. (2013) ⁷¹	Integrating Biosignals into Information Systems: A NeuroIS Tool for Improving ER	Improving decision makers’ awareness of their emotional state and their skills for effective ER, using a biofeedback game-labeled <i>Auction Game</i> .	Two between-subjects laboratory interventions with and without biofeedback.	Bespoke	1 ECG Measurements; 2 ERQ	NeuroIS can help traders to increase emotional awareness and to improve ER: it provides a learning environment in which ER can be practiced and rewarded.
13 Rieger et al. (2014) ⁵⁸	The winner takes it all: The effect of in-game success and need satisfaction on mood repair and enjoyment	Investigating how in-game success as a prerequisite for satisfying the need for competence and autonomy positively influences mood repair and game enjoyment.	Experimental study. Participants were frustrated through a highly stressing math task and then played a videogame (Mario Kart) to examine the role of in-game success and need satisfaction on mood repair and enjoyment.	Commercial	Adjective scale to assess differential aspects of mood (SES Questionnaire).	Mood repair was predicted by in-game success (ranking), whereas enjoyment is mainly driven by need satisfaction (autonomy and competence).
14 Lobel et al. (2014) ⁵⁵	Stressful Gaming, Interoceptive Awareness, and ER Tendencies: A Novel Approach	Presenting a method for measuring the interoceptive awareness of negative affect during stressful videogame play, and investigating whether individual differences in this ability relate to ER strategies.	Proficient videogame players played a session of Starcraft II in the laboratory. Players’ physiological and subjective states of in-game negative arousal were measured consecutively.	Commercial	1 Five subscales of the COPE; 2 the Ruminative Response Scale (RRS); 3 the ERQ; 4 Heart Rate;	Player’s interoceptive awareness of in-game negative affect may be specifically related to problem-focused strategies that are relevant to in-game success.
15 Rieger et al. (2014) ⁵⁹	Eating ghosts: The underlying mechanisms of mood repair through interactive and non-interactive media	Analyzing how effectively negative moods were regulated after a computer game, after a gameplay video, and without media consumption (control group).	The current study realized a 3 Condition: Game Playing interactive vs. Gameplay video noninteractive vs. Control × 3 (Time: Baseline vs. t1 vs. t2) design with the last as repeated measurement factor.	Commercial	1 Adjective scale to assess differential aspects of mood (SES Questionnaire); 2 Perceived effort ad hoc scale; 3 Involvement subscale of the Measurements, Effects, Conditions Spatial Presence Questionnaire; 4 Electrodermal activity.	Computer games led to a higher degree of mood repair and that this repair was a function of task demand as well as arousal characteristics.

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TABLE 2. (CONTINUED)

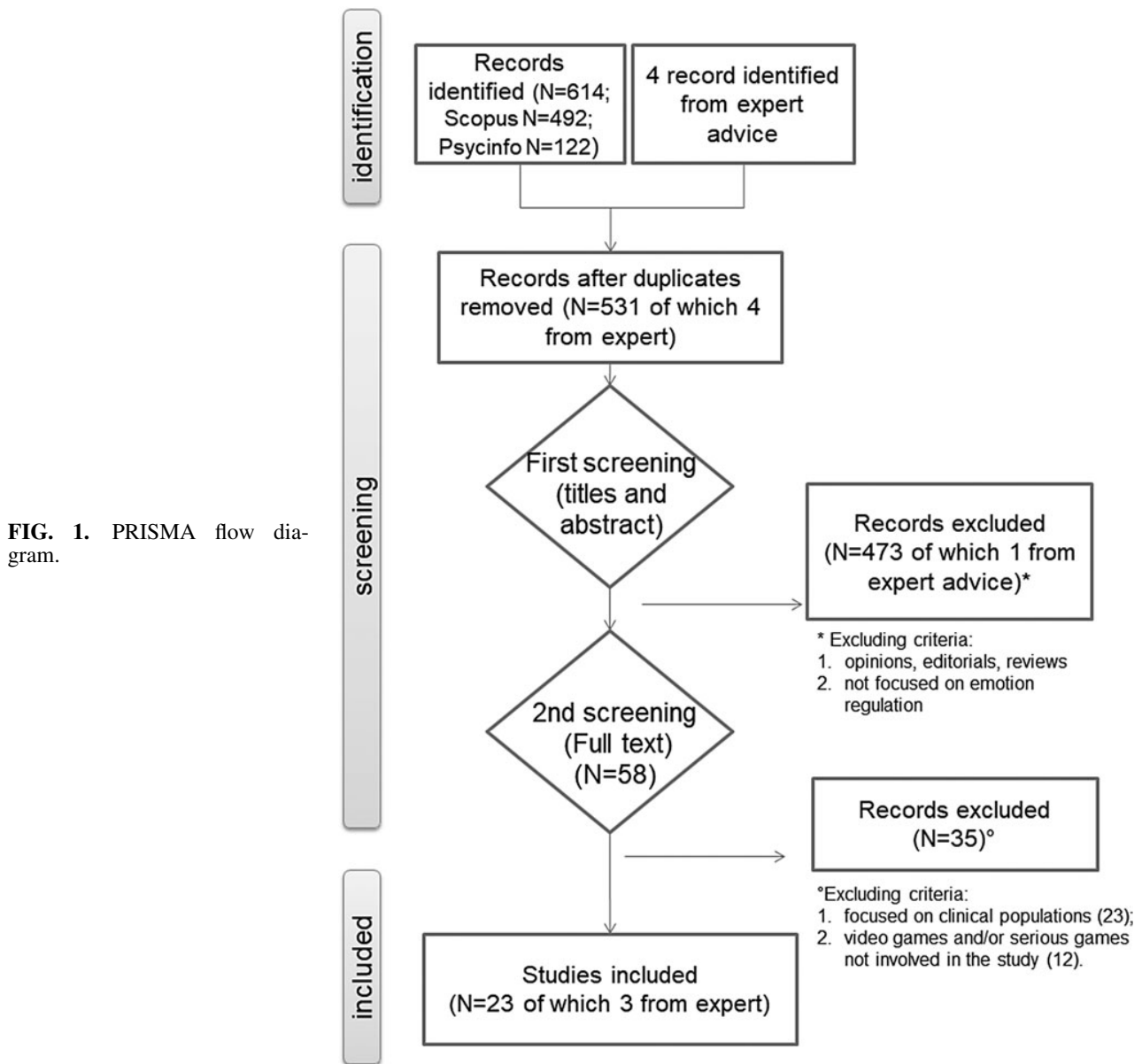
<i>No.</i>	<i>Authors (Year)</i>	<i>Title</i>	<i>Research purpose</i>	<i>Design</i>	<i>Type of game</i>	<i>Measures/themes</i>	<i>Findings relevant for ER</i>
16	Cejudo and Latorre (2015) ⁶⁷	Effects of the Spock videogame on improving EI in adolescents	Assessing the effects of a videogame program (Spock) for improving EI as ability among a sample of adolescents.	Quasiexperimental design, a repeated measure, pretest–posttest design with a control group.	Bespoke	Mayer-Salovey-Caruso EI Test (MSCEIT)	Experimental groups showed an increase in: (1) the global score for ability EI; (2) the score for emotional perceptual facilitation; and (4) the ER score.
17	Rodríguez et al. (2015)	A VR-Based Serious Game for Studying ER in Adolescents	Evaluating the effects of GT System on adolescents' emotions, regulation.	Intervention consisting of two steps: a Frustration Induction Game in which the GT System induces frustration in the user and a training phase during which adaptive ER strategies can be taught.	Bespoke	1 Difficulties in ER Scale (DERS); 2 ECG signals.	The GT-System can effectively train and evaluate ER strategies in adolescents.
18	Vara et al. (2016) ⁶⁶	A game for ER in adolescents: The (body) interface device matters	Evaluating the role of the type of interface device in the efficacy of a serious game that teaches ER strategies.	Experimental study between subjects in which participants played a frustration induction game and then an ER game (a breathing strategy game), using one of three types of devices (computer, smartphone, and RGB-D camera).	Bespoke	1 Visual Analog Scale; 2 Felt Arousal Scale; 3 Ad hoc questionnaire to measure gamers' satisfaction	The type of interface device (and specifically, the participation of the body) is a crucial variable in the efficacy of serious games affecting users' emotional experience.
19	Gaetan et al. (2016) ⁴²	Videogames in adolescence and emotional functioning: ER, emotion intensity, emotion expression, and alexithymia	Investigating the association between videogame playing and some dimensions of emotional functioning.	Regular and irregular gamers are compared in emotional functioning (EI, intensity, expression, and alexithymia)	Commercial	1 ERQ; 2 Affective Intensity Measure; 3 Emotional Expressivity Scale; 4 Bermond-Vorst Alexithymia Questionnaire.	Regular gamers regulated their emotions more than irregular gamers did. They also felt their emotions more intensely. However, regular gamers expressed their emotions less than irregular gamers did. Finally, the regular gamers' alexithymia level was higher than the irregular gamers' level.
20	Scholten et al. (2016) ⁶⁹	A Randomized Controlled Trial to Test the Effectiveness of an Immersive 3D Videogame for Anxiety Prevention among Adolescents	Investigating the feasibility of implementing a videogame intervention ("Dojo") that incorporates CBT principles for supporting youths with externalizing problems.	Experimental study. The experimental group was asked to play Dojo and the control group Rayman. Adolescents played videogame at school after school hours, six times over 3 weeks, with two 1-h sessions per week.	Bespoke	1 Ad hoc questions on game experience and game expectations; 2 SCAS.	Adolescent anxiety symptoms significantly decreased in both conditions. No differences were observed between the two conditions at baseline.

(continued)

TABLE 2. (CONTINUED)

<i>Authors No. (Year)</i>	<i>Title</i>	<i>Research purpose</i>	<i>Design</i>	<i>Type of game</i>	<i>Measures/themes</i>	<i>Findings relevant for ER</i>
21 Schoneveld et al. (2016) ⁷⁰	A neurofeedback video game (MindLight) to prevent anxiety in children: A randomized controlled trial	Evaluating effectiveness of Mindlight, ad hoc game as a prevention tool for children's anxiety.	A controlled study: the experimental group played Mindlight and the control group MAX game (a puzzle platform video-game).	Bespoke	1 Ad hoc questions on game experience and game expectations; 2 SCAS- children and parent versions.	An overall significant reduction in child- and parent-reported anxiety, but the magnitude of improvements did not differ between conditions.
22 Kuo et al. (2016) ⁵²	Brave new World of Warcraft: a conceptual framework for active escapism	Investigating the phenomenon of active escapism.	Qualitative research	Commercial	Participants were asked to describe and recount their experiences with videogames with emphasis on: (1) motivations for seeking out escapism through videogames; (2) the psychological processes occurring when playing videogames; and (3) the consequences of videogame playing behaviors.	Active escapism functions as a coping mechanism when consumers are confronted with external stressors that threaten either their sense of identity or control. While other forms of emotion-focused coping relieve stress through psychological avoidance, active escapism provides the benefits of affirmation and empowerment through projective fantasy (i.e., role play) and presence (i.e., immersion into a mediated reality).
23 Hinkley et al. (2017) ⁵⁰	Does preschool physical activity and electronic media use predict later social and emotional skills at 6–8 years? A cohort study	Investigating the association of 3–5 year-old children's physical activity and electronic media use with their later social-emotional skills (6–8 years).	Children wore ActiGraph GT1M accelerometers and parents completed a survey, including demographics and proxy report of children's electronic media use.	Commercial	1 Electronic media use; 2 Bar-On Emotional Quotient Inventory–Youth Version.	Sedentary electronic games were positively associated with intrapersonal and stress management skills and total emotional quotient. Computer/internet use was inversely associated with interpersonal, and positively associated with stress management skills.

CBT, Cognitive Behavioral Therapy; EEG, ElectroEncephaloGram; ER, emotion regulation; ERQ, Emotion regulation Questionnaire; EI, emotional intelligence; GaPS, game playing skill; GT, GameTeen; HRV, heart rate variability; NASA TLX, NASA-task load index; SCAS, Spence Children's Anxiety Scale; VR, virtual reality.



positively related to relaxation and coping. Reinecke⁴⁹ found that videogames are systematically used to recover from stressful situations: specifically, the tendency to do so was stronger in people with emotion focused than problem focused coping style. Hinkley et al.⁵⁰ performed a longitudinal study to investigate the relationship among electronic media use of children (parent reported) and their social-emotional skills: results showed that videogames' play was positively associated with intrapersonal abilities, stress management skills, and global emotional quotient. Moreover, qualitative research on the topic⁵¹ confirmed that gamers play also to alleviate and manage negative feelings; in terms of "escapism," this could be related to videogames' properties that promote projective fantasy (e.g.: role play) and presence/immersion (e.g.: feeling inside another reality).⁵² In a different context, Wood et al.⁵³ studied the phenomenon of time

loss among videogame players. Indeed, the strong engagement in videogaming often leads to not acknowledging time passing. This experience of full absorption in an activity is enhanced by particular structural characteristics of games, such as their complexity and multiplayer interactions, and not with individual characteristics of gamers, such as their gender or age, or frequency of play. From the point of view of ER, this specific feature of videogame playing is related to both positive (e.g., relaxation, escaping from stressful reality) and negative aspects (e.g., guilty feelings about perceived time waste). However, if ER can benefit from regular videogame play, it could be negatively influenced by *excessive* videogame use: this is what emerged from a cross-sectional research⁵⁴; moreover, sex differences (i.e., females being more able to regulate emotions) disappeared among high-risk gamers.

Experimental studies on videogame experience for ER

This group of studies focused on experimental research of different facets of videogame playing experience, providing results interesting for the topic of ER.

The association between in-game experience—measured both with physiological and subjective measures—and real-world regulation strategies have been explored by a recent study by Lobel et al.⁵⁵ Authors observed a positive relation between in-game interoceptive awareness and the self-reported tendency to actively seek a resolution to negative affect. Specifically, the interoceptive awareness of negative affect during stressful game play appeared uniquely related to regulatory strategies that are more problem focused than emotion focused and that are relevant for in-game success. This result opened the doors to the possibility that specific ER skills may be engaged and even trained during stressful videogame play, as in the case of recent biofeedback-integrated videogames that will be presented within the ER interventions with serious games paragraph.

Other studies investigated how videogames can be used as a resource for mood repair or a well-established function that implies distraction from negative mood and modification of unpleasant arousal states. Russoniello et al.²⁶ in a randomized controlled study tested and confirmed the effect of three popular casual videogames on mood and stress. Specifically, authors used different measures to assess change in mood and stress, and electroencephalography and heart rate variability changes corroborated findings on psychological reports. Even if all three games had different yet complementary mood lifting effects, findings have implications related to the potential development of prescriptive interventions using casual videogames to prevent and treat stress-related disorders. A study with college students recognized that only the interactivity feature of videogame could offer a potential for interventions aimed to elicit affective benefits as interactive videogames resulted not more effective in repairing mood over other forms of exercise.⁵⁶

Another experiment showed that even violent videogames could offer opportunities for mood repair. Ferguson and Rueda⁵⁷ showed that the use of violent videogames reduces depression and hostile feelings in players. Violent games may provide mechanisms through which players can assert control over a virtual environment both by aggressively demonstrating dominance or acting clear goal-directed behavior. Thus, the author concluded that even violent games may provide, at least for some individuals, a particularly good medium to reduce the impact of real-life frustrations on depressed mood and hostile feelings.

Other recent studies deeply understood the mechanisms and opportunities of videogames for mood repair. Rieger et al.^{58,59} explored in a laboratory setting how in-game success, as a prerequisite for satisfying the need for competence and autonomy, positively influences mood repair and game enjoyment. With the same approach, Reinecke et al.⁶⁰ extended traditional mood management theory research by investigating the influence of the intrinsic needs for competence and autonomy on selective exposure to videogames and tested the influence of satisfying these needs on resultant mood repair. Thwarted intrinsic needs significantly predict the choice of videogames with different levels of user demand and the satisfaction of these needs predicted enjoyment. This

result is coherent with recent findings indicating that impedances of player competence satisfaction increase cognitive, affective, and behavioral aspects of aggression.⁶¹

Bowman and Tamborini extended this line of research with two experimental studies.^{62,63} First, they varied the levels of task demand in a computer game to examine mood repair for bored and stressed individuals. Results confirmed that the increasing of the amount of control an individual has over a mediated environment significantly enhances individual's ability to relieve boredom and stress, but too much task demand is detrimental to mood repair. Second, they investigated the effect of experimentally induced noxious mood states on subsequent selective exposure to computer games known to differ in task demand, as well as the resultant mood repair from these task demand selections. Participants preferred moderate task demand to high and low task demand, and this preference was stronger for stressed participants.

ER intervention with serious games

Finally, the last group of studies included interventions specifically focused on the use of videogames to improve affect regulation abilities. All these studies involved the use of videogames created to achieve specific objectives; these bespoke games include serious games or games with specific educational purposes, and games specifically developed to perform experimental studies.

One research group developed and tested a number of videogames specifically devoted to the empowerment of ER abilities in adolescents. This was done because deficits in ER during adolescence may evolve into mental health problems later in life. A virtual multiplatform system (*GameTeen*) based on Ecological Momentary Assessment,⁶⁴ which allows the therapist to monitor the adolescent's emotional status day by day, was implemented and tested. The system contains mood-induction arcade games (joy and frustration) and mini games to train and evaluate ER strategies (for example, a moving feather that helped the player to control his own breath to promote relaxation). In the end, *GameTeen* was evaluated as pleasant, usable, and appeared more effective to teach ER than control, paper-based counterparts. In the context of subsequent evaluations of the same system⁶⁵ both psychophysiological variables (heart rate) and questionnaire data demonstrated that the game could induce frustration, and then promote effective regulation of the previously induced negative emotion. Another study⁶⁶ demonstrated that the use of specific interface devices significantly impacted the effectiveness of the *GameTeen* tool (i.e., personal computer and tablet were more effective than an RGB-D camera). Similar results were obtained by Cejudo and Latorre⁶⁷ while evaluating the effectiveness of the videogame *Spock* in promoting emotional intelligence, namely a complex construct involving the abilities of perceiving, recognizing, generating, and regulating emotions so to sustain wellbeing and intellectual growth.⁶⁸

Scholten et al.⁶⁹ tested *Dojo*, a biofeedback videogame created for anxiety prevention: in this case, anxiety symptoms equally decreased both in the experimental and the control group (playing the commercial videogame *Rayman 2: The Great Escape*, Ubisoft, 1999). Latent growth curve models revealed a steeper decrease of personalized anxiety

symptoms (not of total anxiety symptoms) in the Dojo condition compared with the control condition. Another randomized controlled trial focused on anxiety prevention among children⁷⁰ involving *Mindlight*, a neurofeedback videogame for anxiety prevention, or *Max and the Magic Marker* (Press Play, The Games Company, 2010), a commercial videogame as control. Results revealed reduction in children and parents' reported anxiety, but the magnitude of effects did not differ between conditions.

In a different context, Astor et al.⁷¹ hypothesized that some videogame playing aspects could be useful to promote emotion management in traders and investors, who may be often negatively influenced by emotions when engaged in financial decisions. Authors designed and implemented a serious game-based NeuroIS tool that continuously displayed the player's individual emotional state, through biofeedback, and adapted the gaming environment to the players' physiological responses. Positive results from two laboratory studies showed that biofeedback technology could be used effectively in the design of finance-centered information systems.

Discussion

The present review highlighted a high variety of studies investigating the relationship among videogame playing and ER abilities. A group of studies employed cross-sectional and qualitative research finding consistent results: videogame playing may enhance emotional intelligence and the mastering of ER strategies.^{42,48,54} Nevertheless, *excessive* videogame playing may negatively influence such competences.⁵⁴ This is in line with other studies⁷² showing a curvilinear relationship between videogame playing and mental health outcomes, with "moderate" gamers showing better mental health and psychosocial functioning.

Thanks to the regular game activity, gamers may cope with emotional stimuli that they cannot normally experience in real life. Thus gamers can learn adaptive ER strategies. Additionally, the identification with a character constitutes a critical affordance to enhance emotional skills.⁴²

Exploring gaming motivations, several studies agree on the fact that people usually play videogames to recover from stress and negative emotions.^{49,51,52} This can be regarded as the simplest way videogames can interact with players' emotions and mood, and it is the specific phenomenon investigated by mood repair.^{58,59} According to the mood management perspective,⁷³ people select entertainment for pleasure-seeking (or stress avoidance) purposes. Moreover, the selection of meaningful entertainment experiences is associated with appreciation; thus, games also provide players with experiences that are not only enjoyable but also potentially deeply enriching.⁷⁴

Experimental studies extended the traditional mood management theory research by discovering that not only the selection of videogames coherent with user needs is important but that also the satisfaction of the intrinsic needs for competence and autonomy influences enjoyment and mood repair.^{60,62,63} Furthermore, experimental studies showed that violent games may provide a mechanism through which players can assert control over a virtual environment thus demonstrating dominance and clear goal-directed behavior and reducing negative feelings.⁵⁷

As narrative, interactive, and symbolic media, videogames could represent an affordance for the design of digital interfaces explicitly devoted to the improvement of ER. For this reason, serious games have been developed and tested exactly with this aim and they generally give encouraging results. For example, games designed to improve ER abilities such as GameTeen and Spock succeeded in their aim⁶⁵⁻⁶⁷; similarly, a game to improve emotion management in adult financial experts obtained positive results.⁷¹ However, when serious games designed and developed as ER tools are rigorously evaluated in randomized controlled trials they obtain only partial results.^{69,70} Although encouraging, ER intervention with serious games are characterized by the use of different games, samples, and ER-related techniques. They typically compare the game with no treatment at all, or they compare different devices. Consequently, more effort is required to define specific guidelines for this field of intervention.

This review shows that the use of commercial and bespoke videogames offers different potentialities for ER. Specifically, the continual, passionate yet not-excessive experience with personally relevant videogames represents a concrete resource to experiment with rich emotional states and exercise coping abilities within secure, simulated contexts. This highlights that commercial videogames offer several advantages in terms of interaction, control, and narrative features; however, further research is needed to understand what factors may impact on the ER enhancement process. For example, videogame opportunities are certainly differently distributed and incarnated by different videogame genres (e.g.: RPGs and Adventures are typically more based on narrative than other genres); moreover, videogame players' expectations may influence the videogame experience (for example passionate gamers could expect more emotional intensity or be more positive when dealing with well-known games they already love and respect than with educational products). On the other side, controlled trials with bespoke games (serious games or games developed for experimental purposes) showed that their actual capacity to empower ER is controversial. Indeed, these games were often limited-time experiences and not able to include all the typical complex properties (e.g., avatar identification; sophisticated immersion into narrative) of commercial games.

The principal limitation of the present review is that is represented by its own inclusion/exclusion criteria. To focus on the specific phenomenon of ER as a healthy life skill, the researchers decided to exclude studies involving people suffering from physical or psychological disorders, which could have possibly influenced the results. A recent longitudinal study aimed to understand the effects of videogames on psychosocial development⁷⁵ found that gaming frequency in healthy children was associated with an increase in internalizing problems, such as anxiety and depressive symptoms. This result calls for the need to adopt a bidirectional analysis' perspective between pre-existing psychosocial and clinical characteristics of gamers and positive or negative outcomes. Thus, future reviews may focus on clinical populations, especially involving those disorders related to emotion expression and regulation (e.g., anxiety disorders, autism, etc.), to see whether videogames improving ER may be more or less effective when integrated with psychotherapy.

Conclusion

What emerges from this review is that videogames should not be considered only as entertaining, interactive devices; rather, they are fully suitable to be recognized in their complexity and richness as communicational and narrative media with legitimate application in understanding and influencing ER.

The information reported by the present review of experimental studies constitutes an initial guideline both for designers and professionals. On the one hand, this review gives suggestions for the design of future serious games for emotional/social abilities: bespoke game designers should take advantage of complex fictional properties of videogames. On the other hand, psychological interventions for game-based ER empowerment could consider the possibility of building intervention protocols around commercial games selected on the basis of specific properties. Thus, the challenge for educational and psychological intervention is to exploit the emotional and affective affordances of videogames, so to make use of the rich properties of these simulated experiences, as previously done with other traditional media.^{76,77}

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Address correspondence to:

Daniela Villani, PhD

Department of Psychology

Università Cattolica del Sacro Cuore

Largo Gemelli

Milan 1–20100

Italy

E-mail: daniela.villani@unicatt.it