



10.3389/fpsyg.2013.01010 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baniqued P. Furthermore, playing a commercial computer cognitive training program results in significant improvement in visuospatial learning, and focused attention in healthy older adults (Peretz et al., 2011). Besides being useful tools for the training of cognitive processes, various studies have demonstrated that video games offer a variety of positive emotion-triggering situations (e.g., Ryan et al., 2009; McGonigal, 2011), that may be of benefit during training of emotional skills, including self-regulation habits (Gabbiadini and Greitemeyer, 2017). Enhancing spatial attention and working memory in younger and older adults. 10.1038/mp.2013.120 [PubMed] [CrossRef] [Google Scholar]Lampit A., Hallock H., Valenzuela M. A possible explanation of this tendency could be linked to the fact that many studies have enlisted college students as participants, for a matter of simplicity of recruitment 10.1177/0956797616650300 [PubMed] [CrossRef] [Google Scholar]Looi C. 78, 309-316. L., Lee H., Voss M. L., Carvalho C. (Cham: Springer; ), 229-239. Behav. Working memory. Psychophysiology 49, 1558-1570. A., Thomason M. 7, 76-93. Since early findings in this research field have reported evidences supporting an enhanced performance in spatial relations after video game training in elders (e.g., Maillot et al., 2012) and children (Subrahmanyam and Greenfield, 1994), future studies should deeply verify the possible usefulness of video games as training of such cognitive skill in adults specifically. As for task-switching/multitasking, in spite of high effect sizes suggesting the effectiveness of video game trainings in such sense, it is once again important to underline the limited number of considered studies (three). N., Metzler J. Advances in Intelligent Systems and Computing, Vol. T., Basak C., et al.. B. 6:1721. 10.1037/a0037556 [PubMed] [CrossRef] [Google Scholar]Boot W. In particular, in this systematic review papers were coded with respect to: Video Game Variables: The game category (whether the game was commercial or non-commercial); the games; simulation games; simulation games; simulation games; simulation games; simulation games; simulation games; borror game (console, PC/laptop, or mobile gaming). 10.1159/000323950 [PubMed] [CrossRef] [Google Scholar]Rebok G. A., Stenton R., Dajani S., Burns A. Cogn. Calif.), 38, 25–32. Negatives include limited weapons and monsters and environments that could use some work. L., Fan F. L., Rebok G. Pathological video-game use among youth ages 8 to 18. In addition, video game characteristics (e.g., genre, platform) in relation with trained skills should be further investigated in the future, in order to create specific and effective training programs. To summarize, the present systematic review gives evidences of benefits of video game trainings on cognitive and emotional skills in relation to the healthy adult population, especially on young adults. Penguin Books. Violent video game effects on aggression, empathy, and prosocial behavior in Eastern and Western countries: a meta-analytic review. The search string was: [("Video Games" OR "Computer Games" OR "Interactive Gaming")] AND [("Cognition") OR ("Cognitive") OR ("Emotion") OR ("Em ("Emotion Regulation")] AND ["Training"]. To avoid the risk of bias, PRISMA recommendations for systematic literature analysis have been strictly followed (Moher et al., 2009). D., Bersted K., Smetter J. 10.1037/bul0000130 [PubMed] [CrossRef] [Google Scholar]Blacker K. Playing shooter and driving videogames improves top-down guidance in visual search. M., Gross A. 6,237-248. (1971). It features hundreds of quests for players to complete to achieve this goal. (1987). Sci. 10.1038/nature09042 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Parong J., Mayer R. Cyberpsychol. The effects of videogame playing on the response selection processing of elderly adults. Aging 38, 220-236 Story immersion of videogames for youth health promotion: a review of literature. U., Ratcliff R., Wagenmakers E. M., Buske-Kirschbaumb A., Kirschbaumb A., Ki Przybylski A. 71, 17-22. In contrast, no improvement was observed after training with other commercial games (one exergame and several action games), probably because of the limited number of participants (Dominiak and Wiemeyer, 2016). Five studies tested video games as tools for training emotional skills (Table 2). The fact that not only ad hoc non-commercial games, but also commercial video games can be useful for training cognitive and emotional capacities, if confirmed, appears to be very interesting, as it opens the possibility to use commercial titles for the training of cognitive and emotional abilities in the adult population. Child Psychol. L., Nelson R. Biobehav. C., Patterson M. 18, 653-677. Neurosci. Acad. E., Fiorella L., MacNamara A., Homer B. 6:22003. 10.1016/j.actpsy.2012.11.009 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Secer I., Satyen L. Currently entertaining players with its third incarnation, the game drops players into a world filled with different cultures battling a host of angry gods for supremacy. 15, 13-32. 5:409. On the contrary, no positive effects on episodic memory have been reported after training with puzzle games (Baniqued et al., 2014). This seems to be linked to the need for evidences of wellcontrolled studies, differently from previous studies in which less strong methods (e.g., survey, correlational design) were used. 10.1111/j.1469-8986.2012.01474.x [PubMed] [CrossRef] [Google Scholar]McGonigal J. Regarding cognition, authors identified five domain-specific subcategories, following the classification proposed by Kueider et al. Adding to the kid appeal, it only takes a couple of hours to play through the full game, on average. 10.3389/fnhum.2014.00169 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Nouchi R., Taki Y., Takeuchi H., Hashizume H., Nozawa T., Kambara T., et al.. The game pushes players to use memory and logic skills to protect a colony of humans from hordes of monsters. Online games training aging brains: limited transfer to cognitive control functions. The number of hours spent playing the different video games different video games different video games different video games training aging brains: limited transfer to cognitive control functions. The number of hours spent playing the different video games differ on aggression: is it more than just the violence? Methods 1, 170-177. Since the duration and intensity of training has been reported to be a relevant variable, as it has a rather important impact on the accessibility and feasibility of the training itself (Hempel et al., 2004), future studies should address in detail such aspects of the training, for instance comparing the effectiveness of shorter trainings to longer ones in order to identify the minimum number of sessions to obtain an effective program. Finally, regarding the training outcome, based on this review, video games appear to hold promise for improving both cognitive and emotional skills in the healthy adult population. Rev. 6:221. 10.1371/journal.pone.0036169 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Boyle E. Strength Cond. Moreover, playing exergames at a self-selected intensity has been reported to positively influence emotional responses (enjoyment, changes in positive and negative affects) (Naugle et al., 2014). head-down: effects of precision on cue effectiveness and display signaling, in 45th Annual Meeting of the Human Factors and Ergonomics Society (St. Paul, MN: ), 1-6. PLoS ONE 8:e58546. 8, 22-23. This fact is rather curious, because the video games' intrinsic characteristics of being motivating, engaging, and easily accessible (Granic et al., 2014), make computer games potentially useful tools in order to better the individuals' emotion regulation. K., Falcone M., McConnell M., Bernardo L., Parthasarathi T., et al. A. As for emotional training, only 1 study adopted a non-commercial video games, while a variety of commercial video games were used (1 horror game, 1 action game, 1 puzzle game, and 1 exergame). Considering the retrieved studies, games delivered via PC or laptop were the most popular in all categories (20 studies), followed by mobile (8 studies) and console (7 studies). 10.2196/games.5888 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Maillot P., Perrot A., Hartley A. 10.1111/j.1467-9280.2009.02340.x [PubMed] [CrossRef] [Google Scholar]Gomes E. 10.3758/s13423-015-0912-6 [PubMed] [CrossRef] [Google Scholar]Jaeggi S. 37, 216-228. 10.1016/j.bbr.2012.03.043 [PubMed] [CrossRef] [Google Scholar]Levin K. 37, 7390-7402. Concerning other forms of memory, a positive effect of an adventure game-based training on mnemonic discrimination was reported in one study (Clemenson and Stark 2015), while improvements in short term memory skills have been noticed after a brain training program (Nouchi et al., 2013). 10.1519/JSC.0b013e31829999c3 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Nikolaidis A., Voss M. From what emerged from this systematic review, an enhancement of mental spatial rotation abilities was reported after training with commercial exergames and driving-racing games, with a greater advance for women (Cherney et al., 2014), while no improvement was observed after training with other commercial games (one exergame and several action games) (Dominiak and Wiemeyer, 2016). J., Curby K. C., Lindenberger U., Gallinat J. 11:e1001756. Despite the generally high values, it is currently impossible to compare them with results emerged from other systematic reviews or meta-analyses concerning the same topic, as the few works around the subject do not provide any information about effect sizes (e.g., Villani et al., 2018). Annu. Training spatial skills in men and women. In particular, improvements in visual and spatial working memory have been observed after training with an action game (e.g., Blacker et al., 2016). 10.1016/S0306-4530(02)00146-4 [PubMed] [CrossRef] [Google Scholar]Kueider A. Moreover, in this review we based our choice of categories on a specific model (Connolly et al., 2012; Kueider et al., 2012; Boyle et al., 2016), however the level of specificity and distinctiveness of different categories is an ongoing discussion in the scientific world, both in relation with the outcomes of cognitive and emotive trainings, and with analyzing video games 10.1017/S1041610213002482 [PubMed] [CrossRef] [Google Scholar]Van Muijden J., Band G. [Google Scholar]Wang P. 10.1037/a0034857 [PubMed] [CrossRef] [Google Scholar]Cao M., Wang J. What emerged from the studies included in this review appears to be in line with previous evidences concerning the possibility to effectively use video games to enhance the memory skills of young and older populations, in particular regarding visual and spatial working memory (e.g., Wilms et al., 2013; Toril et al., 2014). E., Ebmeier K. Photo Courtesy: CasarsaGuru/E+/Getty Images Online gaming offers a great way to pass the time (particularly when we're all quarantined), plus it helps build manual dexterity skills and potentially enhances problem-solving abilities, depending on the games chosen. 7:907. After the application of the inclusion criteria, 35 papers were finally included and described on the basis of important previous works, which provide a useful framework for organizing the research along key variables (Connolly et al., 2012; Kueider et al., 2012; Boyle et al., 2016). With respect to video game variables, starting from the games' category, efficacy was demonstrated not only for non-commercial video games or commercial brain-training programs, but for commercial off-theshelf video games as well. (2008). PCMag gave it a "Good" rating, praising its easy learning curve and cross-compatibility with game consoles. Two authors (Federica Pallavicini, Ambra Ferrari) independently selected paper abstracts and titles, analyzed the full papers that met the inclusion criteria, and resolved any disagreements through consensus selected paper abstracts and titles. A few years later, in 1989, Space Fortress, the first non-commercial computer game designed by cognitive psychologists as a training and research tool (Donchin, 1989) was considered so successful that it was added to the training program of the Israeli Air Force. Uncovering the association between strategy video games and self-regulation: a correlational study. (2006). Only one study did not report any benefit of commercial video games over these particular skills (van Ravenzwaaij et al., 2014). Memory (4 studies): Effective trainings of visual working memory have been carried out with an action game (Blacker et al., 2014). Memory (4 studies): Effective trainings of visual working memory have been carried out with an action game (Blacker et al., 2014). Serious games and gamification for mental health: current status and promising directions. Platforms of delivery represent important information about video game training, primarily because they are the way in which the training itself can be accessed (Aker et al., 2016). Variables Related to the Study: The sample included in the study (sample size, mean age, or age range); the research design used (categorized as a Randomized Controlled Trial or Quasi Experimental); the measures used for the assessment of outcomes (self-report questionnaires, cognitive tests, fMRI, physiological data, etc.); the duration of training (duration, intensity, and the total amount of sessions); the effects size of each training outcome, reporting partial-eta squared ( $\eta$ 2), with values closer to 1.0 indicating a stronger effect size, and Cohen's d, applying the conversion formula when reported by the study in terms of partial-eta squared ( $\eta$ 2) (Cohen, 1998); where not reported in the study, standardized Cohen's d effect sizes were derived following a computation formula: the one described in Dunlap et al. Nature 465, 775-778. 10.1016/j.actpsy.2012.11.003 [PubMed] [CrossRef] [Google Scholar]Wu S., Spence I. M., Vaslow J. S., et al.. A serious videogame as an additional therapy tool for training emotional regulation and impulsivity control in severe gambling disorder. Short- and long-term benefits of cognitive training. F., Mendonca J. (1998). Aging 33, 267-268. Psychiatry 19, 265-271. PLoS ONE 7:e36169. Hum. Aging 27, 589-600. (2005). Statistical Power Analysis for the Behavioral Sciences. PLoS ONE 7:e40588. 52, 59-82. 10.3389/fpsyg.2016.00907 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Wilms I. 16, 55-62. This game requires Adobe Flash Player to play, and it's available as a mobile app as well as an online game. As for emotional training, 2 video games were delivered via PC, 2 via console, and 1 via mobile. The mean number of participants included in the emerged studies was 54.4 (cognition: M = 56.1; emotion: M = 42.8), ranging between 5 (Chandra et al., 2016) and 209 (Baniqued et al., 2013). Comput. K., Kramer A. [PMC free article] [PubMed] [Google Scholar]Dennis-Tiwary T. 18, 654-660. 10.1037/a0026268 [PubMed] [CrossRef] [Google Scholar]Mathewson K. [Google Scholar]Moher D., Liberati A., Tetzlaff J., Altman D. Gen. PLoS ONE 10:e0134467. 57, 1735-1739. Analyzing playability in multi-platform games: a case study of the Fruit Ninja Game, in Design, User Experience, and Usability: Novel User Experiences. 142, 74-86. Soc. Psychol. M., Scholes L., Johnson D., Katsikitis M., Carras M. Using biofeedback while immersed in a stressful videogame increases the effectiveness of stress management skills in soldiers. A., Shibuya A., Ihori N., Swing E. 10.1016/j.chb.2014.046 [CrossRef] [Google Scholar]Oei A. W., Lee H., Cosman J. Combining brain stimulation and video game to promote long-term transfer of learning and cognitive enhancement. Aging 29, 706-716. Viol. 27 1092-1108. 10.3758/s13414-013-0440-2 [PubMed] [CrossRef] [Google Scholar]Yeh M., Wickens C. The game has a 4.5-star rating on TechRadar, partially due to fun combat scenarios and the vibrant gaming environment. 78, 34-43. Psychoneuroendocrinology 29, 83-98. Mot. 10.1016/j.brainres.2013.02.019 [PubMed] [CrossRef] [Google Scholar]Ball K., Berch D. Bull. L., Garcia Caraballo N. Adapt. Meta-analysis of action video game impact on perceptual, attentional, and cognitive skills. The studies included in this review provide evidences suggesting that non-commercial video games (Dennis and O'Toole, 2014; Dennis-Tiwary et al., 2016) and commercial video games (exergames and horror games) can be effective in inducing positive emotions and in reducing individual levels of stress in healthy adults (Bouchard et al., 2012; Naugle et al., 2012; Naugle et al., 2014). Secondly, one of the biggest unresolved issues appears to be the generalizability of improvements: up to now, only short-term effects and specific improvements have been recorded in most studies (e.g., Hardy et al., 2015; Tárrega et al., 2015). Photo Courtesy: @FNBRLeaks/Twitter League of Legends to appeal to fans of the popular World of Warcraft online game. 10.1162/jocn\_a\_01159 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Rosenthal R., DiMatteo M. Action video game training for healthy adults: a meta-analytic study. 10.1016/j.procs.2016.04.074 [CrossRef] [Google Scholar]Cherney I. The samples' mean age, instead, was 24.2 (cognition: M = 27.7). In general, 28 studies included in the review have used a quasiexperimental design. 8, 47-89. Empirical evidences were identified for all the training outcomes (i.e., cognition: multiple domain, processing speed and RTs, memory, task-switching/multitasking, mental spatial rotation; emotion). Effect sizes (Cohen's d) for cognitive training, in general, ranged from 0.06 to 3.43: in particular from 0.141 to 3.43 for processing and RTs, 0.06 to 1.82 for memory, 0.54 to 1.91 for task-switching/multitasking, and 0.3 to 3.2 for mental spatial rotation (Table S1). Factors Ergon. One of these top free online games may offer the perfect solution. E., Lanphear A. T. The possibility to train processing speed and RTs with video games, especially with action video games, represents one of the largest interests of video game and cognitive training literature in spite of mixed results about its effectiveness (e.g., Dye et al., 2009; Wang et al., 2016), therefore further investigation is surely needed. The same results, in fact, were not obtained if participants were asked to play for only 1 h over two sessions (Parong et al., 2017). S., Bavelier D. Future studies are therefore necessary in order to better investigate the role of video games in such sense. Regarding mental spatial rotation, even though the effect sizes are averagely high, only two studies have been included in this review, therefore results should be considered in the context of such numerical limitation. F., et al.. On the one hand, the effects of the so-called inverted U curve of neuroplasticity and cognitive performance starts to be evident during the adult age, especially the middle-age (Cao et al., 2014; Zhao et al., 2015). Video game training enhances cognition of older adults: a meta-analytic study. Putting brain training to the test. E., Tipton E., Green C. H., Dai Z. 10.1093/geronb/62.special\_issue\_1.53 [PubMed] [CrossRef] [Google Scholar]Rolle C. D., Dan R., Schard J. Neurol. The effectiveness of casual video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding cognitive training, 18 video games in improving mood and decreasing stress. 84, 115-122. Regarding Broken: Why Games Make Us Better and How They Can Change the World. (Amst). Regarding non-commercial video games, training with an ad hoc non-commercial video games, training with an ad hoc non-commercial video games, training with an ad hoc non-commercial video game has been shown to help trait-anxious adult people handle emotional and physiological responses to stressors (Dennis and O'Toole, 2014), as well as improve behavioral performance in an anxiety-related stress task among female participants (Dennis-Tiwary et al., 2016). Information about the selected studies on video games for emotional training. StudySampleAgeStudy designConditionsTime spent playingMeasuresMain outcomesEffect sizesBailey and West, 20133118-45 years oldRandomized controlled trialThreeconditions:- Action video game group - Non-action video game group - No contact control groupTen sessions (1 h each) across 10 consecutive daysPre and post training: - The Emotion Search Task while ERPs (Event Related Potentials) are recordedPlaying an action game resulted in a change in the affective information processing, with an the an increase in the amplitude of the ERPs over the right frontal and posterior regions that was similar for angry, happy, and neutral faces- For the post-test than for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the pre ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the main effect of occasion was not significant ( $\eta 2 = 0.44$ ); for the no-contact and non-action group, the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); for the no-contact and non-action group ( $\eta 2 = 0.44$ ); f 0.17)Bouchard et al., 20124124.9 ± 3.9 years oldRandomized Controlled TrialTwo conditions: - Video game group - Training-as-usual control groupThree sessions of 30-min (one per day for 3 days)Pre and post training:- Concentration of salivary cortisol and heart rate- Perceived sense to control stressDecrease of stress level after the training with the video game- When comparing efficacy of the ImPACT program on the main measure of stress, there was a significant difference in cortisol response ( $\eta 2 = 0.17$ ) documenting that the program was effective in better controlling stress than training as usual- The ImPACT program had a significant difference in cortisol response ( $\eta 2 = 0.17$ ) documenting that the program was effective in better controlling stress than training as usual- The ImPACT program had a significant positive impact on stress levels measured thought heart rate ( $\eta 2 = 0.11$ ) during the apprehension phases- Significant interaction Time × condition on self-reported perceived stress ( $\eta 2 = 0.31$ ), with ImPACT program contributing for the greater decreaseDennis and O'Toole, 20147817-50 years oldRandomized Controlled TrialFour conditions: - Video game group short training - Active control group short training - Video game group long training - Active control group long training condition)Pre and post training condition and 25 for the short training condition)Pre and post training condition)Pre and post training condition and 25 for the short training condition)Pre and post training condition and 25 for the short tr strategy for ABMT— a gamified mobile app — shows transfer of benefits to independent, untrained lab-based measures of anxiety and stress reactivity after a single session of training. Of course, the cost of playing some online games can quickly add up, particularly if you opt for the more elaborate RPGs that often require monthly fees and in-game purchases that are necessary to succeed. 10.1016/j.paid.2016.07.041 [CrossRef] [Google Scholar]Garrett M. In particular, it has been observed that training with action games (Green et al., 2014), FPS games (Colzato et al., 2013; Hutchinson et al., 2016), adventure (Li et al., 2016), and puzzle games (Stroud and Whitbourne, 2015) can enhance these skills in healthy adults. non-threat ( $\eta 2 = 0.11$ ): post-training N2 amplitudes to threat vs. 10.1093/geronj/42.1.82 [PubMed] [CrossRef] [Google Scholar]Clemenson G. J., Ventura M., Ke F. 18, 46–57. The search string was: [("Video Games" OR "Interactive Gaming")] AND [("Cognition") OR ("Cognitive") OR ("Emotion") OR ("Emotion Regulation")] AND ["Training"]. Results: Thirty-five studies met the inclusion criteria and were further classified into the different analysis of effect modifiers. 77, 105–117. Nonetheless, numerous studies have included self-administered psychological questionnaires (e.g., Nouchi et al., 2013), physiological measures (e.g., Naugle et al., 2014), EEG-based assessments measures (e.g., Kable et al., 2017), which seem to be more reliable in assessing change over time, therefore an openness to such ways of assessment is desirable in a perspective of empirical evidence. The length of the training programs proposed by studies included in this systematic review resulted to be rather heterogeneous, both in the number of sessions and in the number of sessions and in the number of session (e.g., Colzato et al., 2013; Cherney et al. 2014) to a maximum of 60 sessions (Kühn et al., 2014), and with gameplay time ranging from 10 min to 50 h (Green et al., 2012; Chandra et al., 2016). A., Hainey T., Connolly T. 28, 984-994. 10.1038/srep22003 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Lu A. S. DUXU 2016, Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics, Vol. An indication of mean age or age range has been provided in order to identify studies conducted on young vs. Moreover, it was reported that video game training with an adventure game can augment gray matter in brain areas crucial for spatial navigation and visual working memory, along with evidence for behavioral changes of navigation strategy (Kühn et al., 2014). 10.1038/sj.ebd.6400473 [PubMed] [CrossRef] [Google Scholar]Li L., Chen R., Chen J. Photo Courtesy: @GolfWYF/Twitter Runescape As the world's most popular MMO (massively multiplayer online) role-playing game, Runescape has been around for quite some time. Selling points: what cognitive abilities are tapped by casual video games? Toward an understanding of flow in video games. Curr. The game allows you to play with friends in the same world, or you can make all new ones. Psychiatr. The use of video games for such purpose, because of their own nature of requiring complex planning and strategizing, appears to be rather significant, as it could potentially allow training or rehabilitation of these cognitive skills (e.g., Boot et al., 2008). 5:260. 10.1016/j.compedu.2014.08.013 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/01924788.2014.935908 [CrossRef] [Google Scholar]Stanmore E., Stubbs B., Vancampfort D., de Bruin E. 10.1080/019 Scholar]Shanahan M. A systematic literature review of empirical evidence on computer games and serious games. In addition, it has been reported that combinations between the neurological stage of the participants and the precise features of each video game produce unique results in a matter of benefits on mental skills (Ball et al., 2002; van Muijden et al., 2012). B., Helmers K. It will be important for future studies to continue using this type of experimental design, which is considered as the most reliable empirical design in order to prove a treatment's effectiveness, minimizing the important for future studies to continue using this type of experimental design, which is considered as the most reliable empirical design in order to prove a treatment's effectiveness, minimizing the impact of confounding variables (Levin, 2007). The measures of outcome of the training adopted in the studies included in this systematic review predictably have largely been constituted by cognitive tests (e.g., Blacker et al., 2014). W., Lee H., Vo L. 40, 1992-2004. F. B., Voss M. (2016), adapting it to the specificity of this review and its area of interest. Furthermore, playing commercial puzzle games improved task-switching ability (Oei and Patterson 2014). Mental spatial rotation (2 studies): Enhancement of mental spatial rotation abilities was reported after training with commercial exergames and driving-racing games, with a greater advance for women (Cherney et al., 2014). Future studies will be fundamental in order to explore the potentiality of video games as emotional training tools, and to identify the most effective game genres for this purpose, examining potentially interesting genres that have not been investigated yet (e.g., affective gaming, virtual reality-based gaming). As with all literature reviews, the current review does not claim to be comprehensive, but summarizes the current review does not claim to be comprehensive, but summarizes the current review. emotional training in the adult population based on specific key words used in the search string, the database included and the time period of the review. A., Boot W. 26, 435-446. 10.3389/fpsyg.2014.00409 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Boyle E. 10.1371/journal.pone.0040588 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [CrossRef] [Google Scholar]Kühn S., Gleich T., Lorenz R. S., Sugarman M. Effect of video game practice on spatial skills in girls and boys. middle-aged adults. 10.1371/journal.pone.0055518 [PMC free article] [PubMed] [CrossRef] [CrossRef] [CrossRef] [ action video games. 144, 77-110. 10.1007/s10802-006-9037-8 [PubMed] [CrossRef] [Google Scholar]Shepard R. As for emotional training, the minimum time spent playing was of 25 min (Dennis and O'Toole, 2014; Dennis-Tiwary et al., 2016), and the maximum was 10 h (Bailey and West, 2013). The measures of the training outcome adopted in this systematic review predictably have largely been constituted by cognitive training (e.g., Bailey and West, 2013). Effects of cognitive training interventions with older adults: a randomized controlled trial. 392, eds Chung P., Soltoggio A., Dawson C., Meng Q., Pain M. [PMC free article] [PubMed] [Google Scholar]Adachi P. Meta-analysis of experiments with matched groups or repeated measures designs. M., Ballesteros S. C., Langbaum J. Finally, the follow-up effect of video games training was not specifically addressed in this review, since a very limited number of studies provided follow-up tests. The present systematic review provides several directions for future studies in this research field. [Google Scholar]Colzato L. Even better, you can play in quarantine with your friends! Golf with Your Friends supports and enhances hand-eye coordination, with players banking golf balls off obstacles and around corners to reach the holes in the fewest possible shots. It is nonetheless important to highlight the fact that, in this systematic review and in previous literature, the efficacy (or the ineffectiveness) of each training seems to differ on the basis of the specific game genre, as well as of the sample characteristics (e.g., Baniqued et al., 2013; Oei and Patterson, 2015; Chandra et al., 2016). Literature, nonetheless, still presents mixed results, not always positive (e.g., Green et al., 2012), and for this reason future studies providing an in-depth analysis are still necessary. Finally, regarding video games for the training of emotional skills, effect sizes ranged from 0.201 to 3.01. HPA axis responses to laboratory psychosocial stress in healthy elderly adults, younger adults, and children: impact of age and gender. L. First of all, further studies are needed to better examine the video games effects on cognitive and emotional skills, especially in middle age adults, population which has been investigated in a limited number of studies. Video game experience and its influence on visual attention parameters: an investigation using the framework of the Theory of Visual Attention (TVA). 20, 594-602. 10.1007/s00426-013-0514-8 [PubMed] [CrossRef] [Google Scholar]Connolly T. U.S.A. 108, 10081-10086. (2010). Lastly, a non-commercial game, Space Fortress, was proven to be effective as a training for visual working memory (Lee et al., 2012), and alpha and delta EEG oscillations during game play of this particular video game were shown to predict learning and improvements in such cognitive skill, while no similar effects were found on task-switching/multitasking skills (Mathewson et al., 2012). Processing speed and reaction times (8 studies): Studies reported that action games (Green et al., 2012; Wang et al., 2012). 2014), FPS games (Colzato et al., 2013; Hutchinson et al., 2016), adventure (Li et al., 2016), and puzzle games (Stroud and Whitbourne, 2015) can be considered effective training tools for processing speed and RTs. Moreover, in a study comparing the effectiveness of various genres of commercial video games, action and driving-racing games were proven to decrease RTs and processing speed more effectively than a puzzle game (Wu and Spence, 2013). P., Hommel B. FP and AF write the first draft of the paper. Clin. L., Bushman B. In particular, the mean number of sessions was 10.1, ranging from 1 to 60 sessions, while the mean number of hours played was 13.5, ranging between 10 min and 50 h. S., Teixeira-Carvalho E. In particular, training with a commercial horror video game combined with arousal reduction strategies (e.g., exposure to stressful scenarios, traditional biofeedback techniques) has shown efficacy in increasing resilience to stress in soldiers, as observed through analyses of salivary cortisol level conducted along the training (Bouchard et al., 2012). E. Available online at: P., Reales J. W., Carlson M. L., Kranz M. The hunt for good monster-themed games to play free online has increased significantly since the release of the successful Monster Hunter series. Amer. F., Simons D. J., von Cramon D. Cognitive training with casual video games: points to consider. N., Evans A., He Y., et al.. [Google Scholar]Castel A. 10.3389/fpsyg.2015.01721 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Thalheimer W., Cook S. (2015). All the authors read and approve the final version of the manuscript. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. Achtman R. This distribution is valid for both commercial and non-commercial games, which seems to be a rather interesting fact and various reasons behind this consistency of distribution can be hypothesized. W., Caulfield M. h 10.1146/annurev.psych.52.1.59 [PubMed] [CrossRef] [Google Scholar]Russoniello C. On the contrary, only one meta-analysis results to be focused on the adult population, and it is restricted to examining the effects of training with a particular genre of games) on cognitive skills of healthy adults. Objectives: This systematic review was aimed to identify research evidences about the impact on cognitive [i.e., processing and reaction times (RTs), memory, task-switching/multitasking, and mental spatial rotation] and emotional skills of video games training in the healthy adult population. Methods: A multi-component analysis of variables related to the study, the video games, and the outcomes of the training was made on the basis of important previous works. Meta-analysis: recent developments in quantitative methods for literature reviews. V., Barrett D. Aging 30, 515-520. 10.2466/23.25.PMS.119c12z0 [PubMed] [CrossRef] [Google Scholar] Hardy J. Effects of action video game training on visual working memory. As for emotional training, four studies followed a RCT design (e.g., Bouchard et al., 2012), while 1 a quasi-experimental design (Naugle et al., 2014). The length of the trainings proposed by studies included in this systematic review resulted to be rather heterogeneous, both in the number of sessions and in the number of weeks. 7, 85-99. 10.1016/0193-3973(94)90004-3 [CrossRef] [Google Scholar]Tárrega S., Castro-Carreras L., Fernández-Aranda F., Granero R., Giner-Bartolomé C., Aymamí N., et al.. Percept. B Aging Neuropsychol. The effects of an action video game on visual and affective information processing. Pers. (1994). Age-related changes in the topological organization of the white matter structural connectome across the human lifespan. Some characters are only available through purchasing, but players can enjoy the game without buying extra characters if desired. Proc. Appl. Neurobiol. Spatial working memory, as well as RTs, improved after training with a simulation game (Rolle et al., 2017). This could mean increasing adherence to training, keeping the trainee engaged with an effective feedback system (Cowley et al., 2008), and enhancing the accessibility of training programs in terms of costs and ease of access to treatment, since it would be sufficient to simply have a console or another gaming device. As for the distribution of game genre considering only commercial games, in the emotional training sector no genre prevalence is recorded, while in cognitive training games. Intensive video gaming improves encoding speed to visual short-term memory in young male adults. The majority of the retrieved studies used commercial video games, and action games in particular, which resulted to be the most commonly used, closely followed by puzzle games. (2013). Computerized cognitive training with older adults: a systematic review. 35, 16116-16125. Such result should not be considered surprising, as previous literature indicates action games as the class of video games which has been scientifically assessed for the longest time (e.g., Adachi and Willoughby, 2011), similarly to puzzle games (e.g., Carvalho et al., 2010). Results showed that the delivery platform of choice for more than half of the included studies was the PC, distantly followed by games delivered via consoles or via mobile. 62 Spec No 1, 53-61. P. 10.1089/g4h.2017.0108 [PubMed] [CrossRef] [Google Scholar]Wang D. 9747, ed Marcus A. Atten. E., Scott A., Boada R., Willcutt E. Gerontol. The large number of papers (1,423) identified using our search terms confirmed that there has been a surge of interest in the use of games for the aforementioned specific population, following the tendency already registered about elders (e.g., Lampit et al., 2014), and young people (e.g., Gomes et al., 2015). Across all these training programs, the effect sizes' range (Cohen's d) was 0.201-3.01 (M = 0.897). FP and AF examined and write the description of the studies included. From that moment on, numerous video games have been developed with the specific purpose of changing patterns of behavior, and are often defined in literature as "serious games" (Zyda, 2005) as they use gaming features as the primary medium for serious games" (Zyda, 2005) as they use gaming features as the primary medium for serious games" (Zyda, 2005) as they use gaming features as the primary medium for serious games (Fleming et al., 2016). investigated the potentiality of various video games, both commercial and non-commercial, mainly in relation with cognitive skills of seniors. (1989). Here, we propose the above categorization, which resembles the present commercial classification as much as possible, defining ten different genres of commercial video games. Photo Courtesy: @Dauntless\_comm/Twitter Little Big Snake is a skills game that enhances manual dexterity and puzzle solving skills. Beach. Gamification of cognitive assessment and cognitive training: a systematic review of applications and efficacy. Science 171, 701-703. Mol. PLoS Med. M., Mayer R. 10.1037/a0018251 [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired Our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired Our Minds. 10.3389/fpsyt.2016.00215 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our PubMed] [CrossRef] [Google Scholar]Baddeley A. W., Green C. Joystick Nation: How Videogames Ate Our PubMed] [CrossRef] comprehensive training: a large, online, randomized, active-controlled trial. On the contrary, only one meta-analysis focused on the adult population and it is restricted to examining the effects of training with a particular genre of games) on cognitive skills on healthy adults (Wang et al., 2016). Despite this scarcity of focus on the adult population, the latter represents an extremely interesting and unique group, with very peculiar characteristics from a neurological and psychological point of view if compared to children and elders. 104, 129-136. Playing action video games improves visuomotor control. (2000). 10.1109/MC.2005.297 [CrossRef] [Google Scholar] 10.1126/science.171.3972.701 [PubMed] [CrossRef] [Google Scholar]Shute V. L., Low K. Perform. Colorful graphics further add to the appeal of the game modes that even let players change the size and shape of their balls, GWYF offers a fun solution to boredom. As discussed in section Papers Selected Using our Inclusion Criteria, this set of papers was further screened, obtaining a set of 35 relevant papers, 35 papers were identified (see Table 1). The effects of video game playing on attention, memory, and executive control. A., Jha D., Mittal A. When starting the game, you "buy" a race car, customize it to meet your personal specifications, and then race against other cars to see who gets bragging rights. The concept of the game is similar to Super Smash Bros., and players can pick up mascots from other popular games, such as Halo and Battletoads. 10.1371/journal.pmed.1001756 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Lee H., Voss M. W. 23, 587-592. From this review, it appears that the number of studies conducted about this kind of training is smaller than the amount of studies related to cognitive training. A., Pennington B. Evid. W., Prakash R. A., MacArthur E., Hainey T., Boyle J. M., Klobusicky E., Chein J. Across all cognitive trainings, the effect sizes' (Cohen's d) range was 0.141-3.43 for processing and RTs (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 1.18), 0.06-1.82 for memory (M = 0.667), 0.54-1.91 for task-switching/multitasking (M = 0.667), 0.55-1.91 for task-switching/multitasking (M = 0.6consensus about the little to non-transferability of cognitive training effects to untrained skills (Rebok et al., 2007), a rather high number of retrieved studies aimed at the enhancement of multiple cognitive domains. 10.1176/appi.ajp.161.4.745 [PubMed] [CrossRef] [Google Scholar]Herz J. E., Naugle K. 10.1016/j.brat.2015.12.008 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Dominiak A., Wiemeyer J. D., Merlo M. P., Cortina J. For these reasons, future studies should better investigate differences and analogies between young and middle-aged adults, for instance to identify in which life-span moment a game-based cognitive or emotional treatment would potentially be more effective. Secondly, regarding the experimental design adopted in the studies, results show that in the majority of cases studies were conducted using a RCT design. (2017). For instance, action video game novices assigned to action video game training show faster visual information processing according to one study (Castel et al., 2005), while no improvement has been reported for seniors involved in a brief training of memory as well. [Google Scholar]Anderson C. 36, 3777-3792 10.1002/hbm.22877 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Zyda M. M., Rigby C. Future studies should better investigate especially mobile training, which, because of its potential ubiquity, its low costs, and its potential ubiquity, its low costs, and its potential ubiquity and the studies of the studie sample characteristics, the results of this systematic review showed that the majority of studies have been conducted on young adults (18-35 years). Head-up vs. Photo Courtesy: @StarCraft/Twitter MORE FROM QUESTIONSANSWERED.NET Background: Although several excellent reviews and meta analyses have investigated the effect of video game trainings as tools to enhance well-being, most of them specifically focused on the effects of digital games on brain plasticity or cognitive decline in children and seniors. For whom the bell tolls: neurocognitive individual differences in the acute stress-reduction effects of an attention bias modification game for anxiety. 6:20 10.1145/1371216.1371223 [CrossRef] [Google Scholar]Dennis T. As stated by Finch, the adult age, including both young adults (35-55 years old), plays an important role in the life-span development, and therefore very well deserves to be studied thoroughly (Finch, 2009). Playing Super Mario induces structural brain plasticity: gray matter changes resulting from training with a commercial video game. D., DeSouza S., et al.. Computer based, personalized cognitive stimulation. (2001). Specifically, a multi-component analysis of variables related to the study, video games, and outcomes of training was made on the basis on important previous works (Connolly et al., 2012; Boyle et al., 2012; Bo Analysis (PRISMA) guidelines (Moher et al., 2009). With the objective of providing an overview of the experimental studies that have been conducted to test the benefits of different categories of video games used as training tools of cognitive or emotional domains for the adult population, a computer-based search for relevant publications was performed in several databases. (2002). Q. Impact of visuospatial characteristics of video games on improvements in cognitive abilities. L., Petersen A., Vangkilde S. There is no standard accepted taxonomy of genre, although one of the most adopted is the Herz's system (Herz, 1997), while others studies seem to simply divide action games from any other kind, often defined as casual games as a whole (e.g., Baniqued et al., 2013, 2014). 119, 217-230. J., Sakamoto A., et al., 24, 178-192. For instance, it has been observed that the use of complex strategy video games can enhance cognitive flexibility, particularly in older adults (Stern et al., 2011). 10.1016/j.dcn.2013.11.004 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Carvalho J., Duarte L., Carriço L. B Psychol. Thirdly, new technologies such as mobile devices and online games have traditionally been played, their medium of delivery and the different platforms available. [Google Scholar]Ryan R. In only one case no benefits have been reported over these particular skills after training with commercial video games (i.e., first person shooter games, in which the player shoots at targets while witnessing the scene as through the eyes of the character they are controlling), which also seemed to have positive effects on processing speed, but not on mental spatial rotation skills (Choi and Lane, 2013). 2, 53-66. A., O'Toole L. 18, 321-326. (2004). 10.1371/journal.pone.0134467 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Hempel A., Giesel F. [Google Scholar]Zhao T., Cao M., Niu H., Zuo X. 10.1016/j.actpsy.2005.02.004 [PubMed] [CrossRef] [Google Scholar]Chandra S., Sharma G., Salam A. Human Behav. For instance, puzzle video games such as Tetris, characterized by low cognitive loads and generally short time demands, are capable of positive effects on the players' mood, generating positive emotions and relaxation (Russoniello et al., 2009). From visual simulation to virtual reality to games. Educ. 6:e1000097 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Montani V., De Filippo De Grazia M., Zorzi M. Mental health on the go. W., Richards A., Herzberg G., Gopher D. Finally, in this review, empirical evidences were identified for all the training outcomes, showing the potential effectiveness of video games for the training of both cognitive (i.e., multiple domain, processing speed and RTs, memory, task-switching/multitasking, mental spatial rotation), and emotional skills.FP, AF, and FM conceived the idea of this systematic review. 10.1016/S0926-6410(99)00029-4 [PubMed] [CrossRef] [Google Scholar]Dunlap W. fMRI-based assessments were instead used to measure the outcomes of cognitive training (i.e., Mathewson et al., 2012), and (2) to emotional training (e.g., Bailey and West, 2013). Thirty studies used cognitive domain-specific training programs including memory, task-switching/multitasking and mental spatial rotation. Games Health J. This fast-moving, aggressive game teaches both teamwork skills and logic. Aggres. M., Hampshire A., Grahn J. D., Severson J., et al.. D. Randomised controlled trials. D., Pratt J., Drummond E. Training and maintaining memory abilities in healthy older adults: traditional and novel approaches. The effects of action video game experience on the time course of inhibition of return and the efficiency of visual search. (2014). As far as brain training games are concerned, studies confirmed that this genre of video games can improve task. switching, short-term memory, RTs and processing speed more heavily compared to a puzzle game (Nouchi et al., 2013). D., Stark C. 10.1007/978-3-319-24560-7 31 [CrossRef] [Google Scholar]Kable J. Study design VII. Acta Psychol. Selected papers have to: (a) include empirical evidences on the impact and outcomes of video game based training; (b) have been published during the last 5 years (namely from January 2012 to August 2017), in analogy with several other relevant previous works (i.e., Connolly et al., 2016); (c) include participants within an age range of 18-59 years old; (d) only include samples of healthy participants, i.e., not suffering from any neurological disorder (e.g., traumatic brain injury), or psychiatric disorders according to DSM-5 Axis I (American Psychiatric disorder (e.g., traumatic brain injury), or psychiatric disorder (e.g., traumatic brain in the data extraction pro-forma that was developed by Connolly (Connolly et al., 2012), and subsequently modified by Boyle et al. Rep. Nonetheless, two different studies did not highlight any advantage of puzzle games over other video game genres in enhancing cognitive skills such as mental spatial rotation (Shute et al., 2015), nor for cognitive performance on other domains (e.g., task-switching, visual, and spatial working memory) (Kable et al., 2017). As for the distribution of game genre, action game resulted in brain changes related to the emotion processing of facial expressions, with a reduction in the allocation of attention to happy faces, suggesting that caution should be exercised when using action video games to modify visual processing (Bailey and West, 2013). Contrary to popular belief, which sees male children or teenagers as main targets of the gaming industry, the average player is instead 30 years old, and the entire gaming population is roughly equally divided into male and female players, therefore representing a daily activity for a consistent percentage of the adult population, 2015). Contemp. Action video game training reduces the Simon Effect. 136, 151-173. Y., Jiang L. M., Gray G., Earp J., Ott M., et al. M., Wikstrom E. Washington, DC: APA. Motiv. S., Boot W. The sample, study design, and measures of training outcomes have been included as relevant variables in analogy to what has been done in previous reviews (Boyle et al., 2012; Connolly et al., 2012), to facilitate the access to easily classified and comparable studies among the literature. Rehabil. The power of play: the effects of Portal 2 and Lumosity on cognitive and noncognitive skills. Casual video games as training tools for attentional processes in everyday life. 10.1080/01924780903295796 [CrossRef] [Google Scholar]Gentile D. W., Basak C., Cosman J. The benefits of playing video games. How to Calculate Effect Sizes from Published Research Articles: A Simplified Methodology. Psychon. Dif. As early as in 1987, it was for the first time observed that famous commercial video games (i.e., Donkey Kong e Pac-Man) can have a positive effect on cognitive skills, improving the RTs of older adults (Clark et al., 1987). 10.1037/a0037507 [PubMed] [CrossRef] [Google Scholar]Valkanova V., Rodriguez R. Furthermore, the categorization was included in order to analyze the efficacy of ad hoc developed games, about which an ongoing debate about their effectiveness still persists (e.g., Owen et al., 2010). Topological organization of the human brain functional connectome across the lifespan. (1996) in order to calculate d from dependent ttests; the computation formula by Thalheimer and Cook (2002) for ANOVAs with two distinct groups (df = 1); the calculation formula by Rosenthal and DiMatteo (2001) from  $\chi^2$  (with one degree of freedom); otherwise, in cases where effect sizes could not be calculated because not reported in the study or because the necessary data to derive them through formulas were not present, p-value was reported instead (e.g., Oei and Patterson, 2013; Wang et al., 2014; Chandra et al., 2 experimentalTwo conditions: - Video game group - Traditional physical activity groupThree sessions, 2 exercise activities per session for 20 min eachPre and post training: - Heart rate - Enjoyment - Positive and negative affect scale (PANAS)Wii boxing and Wii tennis elicited the highest levels of enjoyment and produced an increase in positive emotions after game play- Significant effect of Activity on average heart rate (d = 3.01); however, the main effect of Activity for level of enjoyment (d = 1.08); follow-up tests indicated that the participants enjoyed playing Wii tennis significantly more than they did all the other exercise activities except for Wii boxing- Significant Activity × Time interaction (d = 0.74): the post hoc tests showed that positive affect significantly (a) decreased after walking and running on the treadmill, and (b) increased after years activities except for Wii boxing. that have been conducted with the aim to identify research evidences about the impact on cognitive and emotional skills of video games training in the healthy adult population. Diagnostic and Statistical Manual of Mental Disorders, 5th Edn.. Available online at: [Google Scholar]Ferguson C. Individ. J., Whitbourne S. Parietal plasticity after training with a complex video game is associated with individual differences in improvements in an untrained working memory task. 129, 387-398. 10.1016/j.actpsy.2008.09.005 [PubMed] [CrossRef] [Google Scholar]Bouchard S., Bernier F., Boivin E., Morin B., Robillard G. (2016). 10.1111/j.1467-8721.2009.01660.x [PMC free article] [PubMed] [CrossRef] [Google Scholar]Entertainment Software Assotiation (2015). M., Parisi J. Front. 10.3389/fnhum.2012.00221 [PMC free article] [PubMed] [CrossRef] [Google Scholar]van Ravenzwaaij D., Boekel W., Forstmann B. L., Green C. PLoS ONE 10:e0135433. Efficacy has been demonstrated not only for non-commercial video games or commercial braintraining programs, but for commercial video games as well. Regarding training of cognitive skills specifically, among commercial games (7) being the most used, followed by brain training games (5), simulation and driving-racing games), exergames and adventure games (2 games each), and, finally, strategy games and arcade games (1 game for each genre). R., Peixoto-Souza F. 157, 200-214. 59, 661-686. E., Sternberg D. Psychogeriatrics 26, 891-909. 30, 344-360. M., Rich L. The motivational pull of video games: a self-determination theory approach. No effect of commercial cognitive training on brain activity, choice behavior, or cognitive performance. FM supervised the scientific asset. M. A meta-analysis. 78, 670-678. Brain Res. S., Coyle D., Munaf, M. J., Nitka A., Raynes K. 10.1016/j.neurobiolaging.2008.11.011 [PubMed] [CrossRef] [Google Scholar]Fleming T. M., Boyle E. On the other, it is well known that the level of psychological stress perceived by adults is rather high, and it can result in important mental and health disorders (Kudielkaa et al., 2004). Moreover, as the literature states, baseline individual differences regarding age can determine variations in training effectiveness (Jaeggi et al., 2011; Valkanova et al., 2014), and if it is safe to say that video games can have beneficial effects when included in a training (e.g., Baniqued et al., 2014); Toril et al., 2014), such effects might indeed vary based on age-specific aspects which therefore cannot be overlooked (Wang, 2017). Consequently, in the current review, we will describe experimental studies that have been conducted between 2012 and 2017, with the aim to identify research evidences about the impact on cognitive and emotional skills of video games training in the adult population. Different slopes for different folks: alpha and delta EEG power predict subsequent video game learning rate and improvements in cognitive control tasks. 10.1016/j.compedu.2012.03.004 [CrossRef] [Google Scholar]Cowley B., Charles D., Black M., Hickey R. Interesting cases regard Tetris, which resulted to be more effective than a commercial brain training program (i.e., Brain Age) in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving cognitive skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven to be effective in improving skills such as short-term memory and processing speed (Nouchi et al., 2013), and Portal 2, that has proven effectively than a brain training program specifically developed for this purpose (i.e., Lumosity) (Shute et al., 2015). Abnorm. J., Fabiani M., Gratton G. Photo Courtesy: @RuneScape/Twitter The Awesome Adventures of Captain Spirit is a sequel to the popular game Life Is Strange. Secondly, the classification of video game genres was considered because of the fact that, under many points of view, not all video games are equal and their effects strongly depend on specific characteristics of the game itself (Achtman et al., 2008; van Muijden et al., 2012). J., Babkirk S., Denefrio S. non-threat were greater following ABMT vs. E., Basak C., Maclin E. Brain Mapp. B., Leveck M. K. Plasticity of cortical activation related to working memory during training. Training of spatial competencies by means of gesture-controlled sports (ISCSS). As for video games used for cognitive enhancement specifically, a total of 38 commercial video games and 6 non-commercial games have been used as training tools in the studies included in this review. Among the studies included in this review, the genre of commercial games was very varied, with action games (15) being the most used, followed by puzzle games (8), brain training games (5), exergames, and driving-racing games and exergames (2 games for each genre), and, finally, strategy games, and horror games (1 game for each genre), adventure games (3 for each genre), adventure game genre). 4, 1-20. Exp. A., Egan L. 75, 673-686. R., Kramer A. The space fortress game. Concerning non-commercial video games, a mathematics video games, a mathematics video game training was shown to be effective on short-term and visual working memory (Looi et al., 2016). (2012), partially adapted to the results that emerged from the review, specifically: (1) multiple domain, namely trainings focused on more than one cognitive skill, such as trainings including reasoning, episodic memory, and perceptual speed as target skills at the same time; (2) processing speed and reaction times (RTs), i.e., respectively, the ability to quickly process information (Shanahan et al., 2006), and the amount of time needed to process and respond to a stimulus and is critical for handling information (Garrett, 2009); (3) memory, defined as the ability to retain, store, and recall information (Baddeley and Hitch, 1974), including many different types of memory, such as episodic, short-term, visual and spatial working memory; (4) task-switching/multitasking, defined as a whole as attributes of control processes while switching from one task to another (Dove et al., 2000); (5) mental spatial rotation, that is the ability to mentally rotate an object (Shepard and Metzler, 1971). Thanks to the wide availability on the market, the affordable cost and the massive popularity, video games already represent crucial tools as a source of entertainment, and are soon expected to become critical also in another fields, including the mental health panorama (Granic et al., 2014; Jones et al., 201 aggression (e.g., Ferguson, 2007), and addiction (e.g., Gentile, 2009), gradually, scientific studies have also recognized the potential positive impact of video games on people's health (e.g., Anderson et al., 2010; Jones et al., 2014). In recent decades, the field of computer gaming has increasingly developed toward serious purposes, and both commercial and non-commercial video games (i.e., developed ad hoc by researchers for the training of specific individuals' skills) have been tested by several studies. N., Vovtek B., Gazzalev A. M., et al., Videogame training strategy-induced change in brain function during a complex visuomotor task. Age-related cognitive effects of videogame training strategy-induced change in brain function. across the adult life span age-related cognitive effects of videogame. 6:113. Emot. M., Hainey T., Boyle J. Photo Courtesy: @JohanRusch2/Twitter Fortnite Battle Royale drops you into a world with 99 other players, all with the goal of being the last player standing at the end of the battle. 10.1016/j.avb.2010.12.002 [CrossRef] [Google Scholar]Aker Ç., Rizvanoglu K., Inal Y., Yilmaz A. 10.3389/fpsyg.2015.00113 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Oei A. D., Hitch G. Y., Duta M., Brem A.-K., Huber S., Nuerk H.-C., Cohen Kadosh R. 28, 443-451. Databases used in the search were PsycINFO, Web of Science (Web of Knowledge), PubMed, and Scopus. Based Dent. Created by Phantom Games, it pits you against other racers to fan the flames of competition. A., Lawrence N. First of all, the category of the game has been included to explore the effectiveness of several commercial titles, used "as-is" (without modifications), which in previous studies resulted to be effective for the cognitive training (e.g., Green and Bavelier, 2006; Dye et al., 2009). F., Stirbulov R., et al., Am. J. Video games as a tool to train visual skills. Dir. R. Concerning other categories of commercial video games, training with puzzle games was shown to improve task switching skills and inhibitory control, but not visual and spatial working memory, episodic memory differentiation between young and middle-aged adults can be particularly relevant. C., Willoughby T. S., van den Wildenberg W. The effect of active video games on cognitive functioning in clinical and non-clinical populations: a meta-analysis of randomized controlled trials. PLoS ONE 8:e55518. 10.1016/S0079-7421(08)60452-1 [CrossRef] [Google Scholar]Bailey K., West R. J. D., Shatil E., Aharonson V., Birnboim S., Giladi N. Meet. Moreover, strong differences in terms of knowledge and use of video games characterize these two age ranges. The good, the bad and the ugly: a meta-analytic review of positive and negative effects of violent video games. R., Vo L. Hillsdale, NJ: Erlbaum. PT, but only for males (p = 0.02); for the PT condition only, post-training N2 amplitudes to threat vs. Ideally, you want to find free online games that are still a lot of fun to play. Network. 28, 771-780. Psychiatry 161, 745-747. Drag Racer V3 offers some fun, free online games that are still a lot of fun to play. named Chris, which means this is a kid-friendly game that isn't packed with violence like some other adventure games. Psychophys. 10.1016/0001-6918(89)90003-6 [CrossRef] [Google Scholar]Peretz C., Korczyn A. The neurobiology of middleage has arrived. Riot Games also organizes various Esports tournaments, including League of Legends tournaments with prizes in excess of \$1 million for skilled players to compete to win. 8:169. 10.1001/jama.288.18.2271 [PMC free article] [CrossRef] [Google Scholar]Baniqued P. Effects of interactive physical-activity video-game training on physical and cognitive function in older adults. A new adaptive videogame for training attention and executive functions: design principles and initial validation. The long but not the short active training condition on attentional bias ( $\eta 2 = 0.13$ ), and disengagement ( $\eta 2 = 0.19$ ); the effect for vigilance did not reach significance ( $\eta 2 = 0.10$ ) Dennis-Tiwary et al., 20164218-38 years oldRandomized controlled trialTwo conditions: - Video game group - Active control groupOne session (25min of total gameplay with two 10-min breaks)Pre and post training:- State-trait anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during the anxiety inventory (STAI)- Threat bias (Dot-probe task) while recording EEG activity-Trier social stress test (TSST)Improved behavioral performance during test (TSST)Improved behavior

significance for observed behavioral performance ( $\eta 2 = 0.02$ ); there was a significant interaction between training group and gender for observed behavioral performance ( $\eta 2 = 0.13$ ): behavioral performance (@maximilian /Twitter Golf with Your Friends If you enjoy a round or two of putt putt golf, you may be thrilled to hear you can play without braving the elements. 10.1089/cyber.2015.0316 [PubMed] [CrossRef] [Google Scholar]Subrahmanyam K., Greenfield P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement Gaming well: links between videogames and flourishing mental health. Restor. Video game training and reaction time skills in general ranged from 0.06 to 3.43: from 0.141 to 3.43 for processing and RTs, 0.06 to 1.82 for memory, 0.54 to 1.91 for task switching/multitasking, and 0.3 to 3.2 for mental spatial rotation; regarding video games for the training of emotional skills, effect sizes ranged from 0.201 to 3.01. Conclusion: Overall, findings give evidences of benefits of video games training on cognitive and emotional skills in relation to the healthy adult population, especially on young adults. 51, 141-151. (2009). M., Hommel B. Processing speed deficits in attention deficit/hyperactivity disorder and reading disability. Manual dexterity is also needed as you progress through the game. 42, 82-85. C. You get time to build up some protective structures before the competition battle, so get started gathering resources right away. Interestingly, commercial video games have also been tested as a tool to provide interactive Stress Management Training (SMT) programs, mainly used for decreasing levels of perceived stress and negative effects. JMIR Serious Games, 4:e11. 10.1089/g4h.2017.0005 [PubMed] [CrossRef] [Google Scholar]Wang P., Liu H.-H., Zhu X.-T., Meng T., Li H.-J., Zuo X.-N. 10.1073/pnas.1103228108 [PMC free article] [PubMed] [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment through video games improves hippocampal-associated memory. 10.1007/978-3-319-40355-7 22 [CrossRef] [Google Scholar] Jones C. Res. F., Jobe J. 1, 199-204. Virtual environmental enrichment environmental environ on the spatial distribution of visuospatial attention. Nonetheless, numerous studies (19) have included self-administered psychological questionnaires: 14 aimed at cognitive training (e.g., Chandra et al., 2016), and 5 to emotional training (e.g., trainings (e.g., Bouchard et al., 2012). 32, 1465-1478. 10.1016/j.neubiorev.2017.04.011 [PubMed] [CrossRef] [Google Scholar]Stern Y., Blumen H. S., Baranowski T., Thompson D., Buday R. 4:1010. Neuroepidemiology 36, 91-99. Furthermore, individual differences in the post-minus-pre changes in activation of regions implicated in visual working memory during gameplay of an ad hoc developed game (Space Fortress) have been reported to predict performance changes in an untrained working memory task (Nikolaidis et al., 2014). Task-switching/multitasking (3 studies): The cost of dual tasking, as well as the cost of task switching/multitasking (3 studies): The cost of dual tasking, as well as the cost of dual tasking, as well as the cost of task switching/multitasking (3 studies): The cost of dual tasking, as well as the cost of task switching/multitasking (3 studies): The cost of task switching/multit (Montani et al., 2014). D., Firth J. Despite its character limitations, it has an 8.4 rating on IGN, partially due to the fluidity of the fighting moves. 10.1523/JNEUROSCI.2580-15.2015 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Cohen J. Photo Courtesy: @ArtStationHQ/Twitter Killer Instinct With the Killer Instinct game, you can play as one character for free, but if you want to expand your character options, you have to shell out some cash. 69, 66-78. According to the included studies, the cost of dual tasking and the cost of task-switching decreased after training with a commercial puzzle game (Oei and Patterson, 2014), as well as with a custom-made video game (Montani et al., 2014; Parong et al., 2017). 10.1007/s11126-007-9056-9 [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Stroud M. 10.1523/JNEUROSCI.2832-16.2017 [ [CrossRef] [Google Scholar]Kudielkaa B. Puzzle games, in Proceedings of the 4th International Conference on Fun and Games - FnG'12 (Toulouse: ), 64-72. Action video games do not improve the speed of information processing in simple perceptual tasks. 10.1037/1082-989X.1.2.170 [CrossRef] [Google Scholar]Dye M. Cardiovascular and affective outcomes of active gaming. 143, 1794-1805. (Cham: Springer; ), 243-249. M., Bavin L., Stasiak K., Hermansson-Webb E., Merry S. Do the benefits of chess instruction transfer to academic and cognitive skills? A quasi-experimental design was instead adopted in six studies directed at the evaluation of cognitive trainings based on video games (Mathewson et al., 2012; Montani et al., 2013; Chandra et al., 2015; Chandra et al., 2015; Chandra et al., 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra et al., 2016), but no effect on spatial (Oei and Patterson, 2015; Chandra e reported. placebo training (PT) condition, but only for females (p = 0.02); for the PT condition only, males had better performance compared to females (p = 0.02) - The interaction between Training Group and Gender was significant for N2 amplitudes to threat vs. Prefrontal cortex activation in task switching: an event-related fMRI study. Mind over matter - what do we know about neuroplasticity in adults? Such categorization has been chosen among many others proposed by literature (e.g., Sala and Gobet, 2016; Stanmore et al., 2017; Bediou et al., 2018), because of its particular adaptability to the search results at hand, and because of its effectiveness in defining precise sub-categories of cognitive skills. A large number of papers (1,423) published in the time period between January 2012 and August 2017 was identified. A., Katovich K., Farzin F., et al.. Consonant findings regarding the positive relationship between video game training and benefits on various cognitive skills have been demonstrated by both behavioral studies (e.g., Baniqued et al., 2014) and meta-analytic studies (Toril et al., 2014) regarding both the aforementioned populations. 9, 103-109. Moreover, a training based on an ad hoc developed game lead to significantly better performance on cognitive shifting tests after playing for 2 h over four sessions (i.e., reaching a high level in the game) (Parong et al., 2017). 10.1089/g4h.2011.0012 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Lumsden J., Edwards E. Furthermore, by continuously providing new challenges, either it is switching from one level to another (e.g., Portal 2) or between different avatars (e.g., World of Warcraft), video games demand players to "unlearn" their previous strategies and flexibly adapt to new systems without experiencing frustration and anxiety (Granic et al., 2014). Although several excellent reviews and meta-analyses have investigated the effect of video games training as tools for enhancing individuals well-being, in particular regarding cognitive and emotive enhancement (e.g., Boyle et al., 2016; Lumsden et al., 2016), most of them specifically focused on the effects of digital games on brain plasticity or cognitive training, a minimum of one session (e.g., Colzato et al., 2013; Cherney et al., 2014), and a maximum of 60 sessions (Kühn et al., 2014). Enhancing perceptual and attentional skills requires common demands between the action video games and transfer tasks. The effect of action video game experience on task-switching. Neuropsychol. 10.1037/0096-1523.32.6.1465 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Green C. V., O'Brien K., Parks J. Ther. Learn. 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Information about the video games variables of the selected studies.StudyGroupVideo game categoryDisplayBailey and West, 2013Video game groupUnreal tournament 3Action gameComputerVideo game groupUnreal tournament 3Action gameComputerVideo game groupUnreal tournament 3Action gameComputerAWMR games groupSilversphere, Aengie Quest, Gude Balls, Block DropPuzzle gamesComputerActive control groupAlphattack, Music Catch 2, Crashdown, EnigmataPuzzle gamesComputerActive control groupThe Sims 3Simulation Wii)Nintendo GameCube<sup>™</sup> groupCrazy TaxiDriving-racing gameConsole (Nintendo GameCube)Control groupNoneNoneChoi and Lane, 2013FPS game groupBeGoneAction gameComputerControl puzzle game groupBeGoneAction gameComputerControl groupNoneNoneNoneNoneChoi and Stark 2015Video game groupSuper Mario 3D WorldAdventure gameConsole (Wii U)Active control groupAngry BirdsPuzzle gameConsole (Wii U)Control groupAngry BirdsPuzzle gameConsole (Wii U)Active control gameConsole (Wii U)Active (Wii U control 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K., Riddick C. non-threat were greater for females vs. 142, 108-118. Photo Courtesy: @ 1 1 f e /Twitter Drag Racer V3 Like drag racing games? Brain training game boosts executive functions, working memory and processing speed in the young adults: a randomized controlled trial. Computer (Long. Your snake eats nectar and bugs, but if it touches another snake, then it's game over for your slinky friend. 1504, 35-46. 10.1371/journal.pone.0135433 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Granic I., Lobel A., Engels R. (2018). Photo Courtesy: @edouardcaplain/Twitter Starcraft II The strategy game Starcraft II drops players into different galactic environments, where they take on various challenges to conquer the galaxy. Effect sizes reported in this systematic review are comparable to those reported for video game exercise training improves the clinical control of senior populations (Kueider et al., 2012; Lampit et al., 2014). Active video game exercise training improves the clinical control of senior populations (Kueider et al., 2014). of asthma in children: randomized controlled trial. Efficacy has been demonstrated not only for non-commercial video games, computer games, computer games, computer games, video games as well. Keywords: video games or commercial video games as well. Keywords: video games as well had a transformational impact on how people play and enjoy themselves, as well as on many more aspects of their lives (Yeh et al., 2001; Zyda, 2005; Boyle et al., 2012). (1996). Playing action video games a key to cognitive enhancement. 2015 Essential facts about the computer and video game industry. 10.1016/j.edurev.2016.02.002 [CrossRef] [Google Scholar]Schubert T., Finke K., Redel P., Kluckow S., Müller H., Strobach T. (1997). It's similar to the early versions of snake games, but the graphics are vastly improved. Natl. For instance, a systematic review of a computerized cognitive training with older adults reported a range standardized pre-post training gain from 0.09 to 1.70 after the video game intervention, which appears to be similar to the values emerged from the traditional (0.06-6.32) or computerized (0.19-7.14) trainings for cognitive skills was found on processing speed and RTs, as these cognitive domains presented the larger effect sizes. 34, 584-601. Created by Blizzard Entertainment, the developer of the wildly popular World of Warcraft, the game requires players to set up a Battle.net account to play, but game play is free once you complete that step. 10.1037/a0036923 [PMC free article] [PubMed] [CrossRef] [Google Scholar]Villani D., Carissoli C., Triberti S., Marchetti A., Gilli G., Riva G. F., Yerys B. As it is reported by scientific literature, in fact, the effects of the so-called inverted U curve of neuroplasticity and cognitive performance and of the perceived stress starts to be evident during the middle-age (Cao et al., 2014; Zhao et al., 2015). Skills 119, 82–99. Training-related factors have also been considered, including the duration, intensity, and total amount of training sessions, as well as the effect sizes of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and feasibility of the training outcomes, since they represent useful information about the characteristics and two macro-categories: cognition and emotion. Mental rotation of three-dimensional objects. Boston, MA: Little, Brown, and Co. [Google Scholar]Hutchinson C. A., Skinner S. 10.1177/1541931213571387 [CrossRef] [Google Scholar]Hutchinson C. A., Skinner Scholar empirical evidence of the impacts and outcomes of computer games and serious games. Entertain. 80, 58-67. Cognitive control and the COMT Val158Met polymorphism: genetic modulation of videogame training and transfer to task-switching efficiency.

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