Do we know what really works? A systematic review about using video games for cognitive training

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INTRODUCTION

Applied games (i.e., serious games with gamified environments) aim to promote the learning of new contents and skills, as well as to facilitate behaviour change. Use of games is more and more supported by health professionals, game-designers and patients, who tend to consider conventional cognitive training strategies as rather monotonous. The autonomous motivation to learn and repeat non-habitual actions is maintained when positive emotions (e.g., having fun, feeling curious) are associated with learning and repetitive tasks. This makes video games a powerful resource for cognitive self-control training. However, the evidence about what makes video games effective in promoting general or specific cognitive functions is still scarce.

This project aimed to summarize and integrate existing knowledge about which video games’ elements are being used and their effectiveness in promoting attention and working memory.

RESULTS

From the 2777 initially identified papers, 155 were considered eligible for narrative synthesis (methodological appreciation and evidence summary) (Figure 1). Figure 2 summaries some data regarding games purposes and elements and regarding study design. As can be seen, cognitive training is the most prevalent purpose of the selected video games. Most part of papers do not mention if the video game includes a narrative nor if it includes an Avatar or a Character (for enhancing players’ identification/immersion with the game). Randomized controlled trial is the most common design for studying video game effects (in terms of its health promotion effect or in terms of cognitive assessment or training effect).

Table 1 presents the narrative synthesis of 10 selected papers concerning the association between video games and cognitive outcomes (attention and working memory). For this table, only papers with a detailed description of game elements were included (n=10). In these papers, video games were studied either in terms of their effectiveness for cognitive training or in terms of their adequacy for cognitive assessment/evaluation.

Collected data suggest poorly detailed description of video games and lack of consensus definition of game elements (e.g., avatar vs. character) or technological borders (virtual-environments vs. reality). Key-aspects of user-experience such as fun, enjoyment and usability only rarely are evaluated. Cognitive endpoints are usually considered as dependent variables of the whole gaming experience, but without adequate understanding of which specific game-elements have effect. Far transcurrence of cognitive competences is seldom assessed and effectiveness evaluation tends to be done for short-term follow-up periods.

DISCUSSION

Both methodological limitations and lack of information about video games’ properties/characteristics hinder a proper assessment of the effectiveness of video games in promoting cognitive functions. The trend on using videogames to promote cognitive function justifies and urges for a thorough evaluation of the impact of different game-elements, enabling game’s personalization to individuals’ clinical condition.

METHODS

A systematic review was conducted following PRISMA guidelines. Consulted electronic databases were PubMed, ScIELO and PsycARTICLES. The search in ScIELO and PubMed was performed on January 24th, 2017 and was restricted to studies published between 2007-2017 and within last 10 years, respectively. PsycARTICLES search was conducted on January 26th-29th, 2017, targeting articles published from January 1st, 2006 to December 31st, 2016. Additional inclusion criteria (common to all databases) were: studies with humans and English-language written papers.

Search keywords (both free-text and Mesh terms) formed two blocks and were combined pairwise. Block 1: cognitive outcomes (cognitive function, cognitive performance, processing speed, attention, executive function, executive system, working memory, inhibitory capacity, cognitive flexibility, planning, decision making, visual memory, verbal memory). Block 2: game/element-game elements (game, video game, videogame, online videogame, online game, applied game, serious game, entertainment, rehabilitation, exergames, gamification, virtual reality exposure therapy, virtual reality, virtual environment, 3D-environments, virtual gardening, virtual kitchen, virtual supermarket, real-life simulation game, sports game, role-play game, puzzle game, dance-rhythm game, adventure game, endless running games, strategy games, game elements, videogame level, game level, level of play, game controller, controller, multitask, interaction mode, multiplayer, leaderboard, scoreboard, first-person shooter, self-representation, narration, narrative context, team, time pressure, parallel communication systems). Additional articles were manually recruited through an exhaustive search in relevant-field journals.

An initial screening for eligibility, based on title and abstract analysis, was done independently by two or, in case of disagreement, three team members. Considering the high number of identified/eligible studies, the analysis for this poster was limited to those having attention and working memory as cognitive outcomes and having detailed information about game elements.

REFERENCES