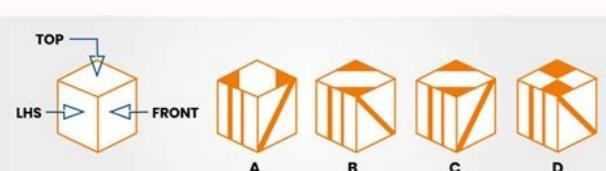


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In the past 10 years, there has been substantial interest in the idea that playing videogames may serve to improve certain cognitive functions. A recent meta-analysis (Powers et al., 2013) provided a quantitative summary of the numerous studies in which a videogame-playing group was compared against a control group that did not receive the videogame treatment of interest. As is typically done in meta-analyses, Powers et al. (2013) used broad operational definitions of cognitive outcomes, such as combining together various outcome measures of executive function, which included multitasking, inhibition, task-switching, short-term/working memory, and intelligence. Overall, videogame training effects on executive functions was statistically significant ( $d = 0.16$ ), although the effect would be classified as small according to Cohen (1992). Notably, transfer to intelligence was not significant,  $d = 0.06$ , and inhibition was the only executive function that was significantly improved by videogame training, and the other hand, tests of spatial imagery, such as mental rotation tasks, exhibited stronger meta-analytic effects,  $d = 0.43$ . Our current work investigates specifically the effect of videogame training on spatial ability transfer outcomes, given recent research that argues these spatial ability tests may be most sensitive to cognitive training (Colom et al., 2013). Basak et al. (2008) provide an illustrative example of almost ideal intelligence transfer results, as a function of a video game training. In their study, older adults in the training group played a videogame (Rise of Nations) during 15 sessions. Raven Advanced Progressive Matrices, a matrix reasoning test commonly used to measure fluid or nonverbal intelligence, was among the battery of tests administered during pre-test and post-test transfer sessions. As seen in Figure 1A, the training group improved on Raven scores from pre- to post-test,  $d = 0.19$ , while the control group did not. This pattern of results is quite different from the Raven interaction pattern shown by Basak et al. (2008). The pre-test Raven IQ mean score for the videogame and documentary sessions, all participants completed a cognitive test battery that consisted of nine cognitive tests, including Raven standard progressive matrices. Raw scores from Raven were converted to IQ scores, van Muijden et al. (2012) concluded that modest improvements of inductive reasoning can also be achieved by means of playing cognitive training games (p. 10). The group AÀ session interaction on Raven was significant ( $F_{(1,20)} = 0.068$ ), and is displayed in Figure 1B. However, this pattern is quite different from the Raven interaction pattern shown by Basak et al. (2008). The pre-test Raven IQ mean score for the videogame group was 120.1 and the post-test mean score was 119.4, an increase of 3.0 IQ points. The pre-test Raven IQ mean score for the documentary group was 120.1 and the post-test mean score was 116.8, a decrease of 3.3 IQ points. Although the between-groups comparison of the pre-test scores reported by van Muijden et al. (2012) was not significant ( $F_{(1,20)} > 0.056$ ), the effect size for the pre-test scores indicated a small-to-medium difference (Cohen's  $d = 0.38$ ), van Muijden et al. (2012) conducted subsequent simple main effect analyses to examine the pre- to post-test change within each group separately. Within the videogame group only, the pre- to post-test Raven increase was considered marginally significant ( $p = 0.05$ ), whereas the pre- to post-test Raven decrease for the documentary group was not significant ( $p > 0.10$ ). Critically, however, there was also a large difference in the group sample sizes ( $n = 53$  and  $n = 19$  for the videogame training group and the documentary control group, respectively). The sample size difference is extremely important as it is a emarexExE id oppurg i arit isrevit etnemafacifingis onare no elatmen enoizator id. 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