Responding to Administrative Priorities

Video Games, Engineering, and Spatial Cognition,

***Capsule*:** There exists a gender disparity in spatial attention and cognition, an important aspect of engineering and mathematical sciences. Research shows that action video games increase spatial attention and mental rotation, with women benefiting more than men and closing this gap.

Summary: A common observation is that there are gender differences in spatial cognition; however, the gender variability in the capacities to support spatial cognition is not known. As stated by one study authors Feng and colleagues, determining the variability in spatial cognition capacity, and determining whether these differences may be modified, is of scientific consequence. Improvements in performance on a variety of high-level spatial tasks have been associated with playing video games, and in particular popular first person shooter (FPS) games. As these types of games are typically more attractive to males, this group may be realizing benefits from this improved spatial attention that is not present in female counterparts. While females also play video games, they are primarily alternative types of games not shown to give the same benefit.

This was shown in a report in *Psychological Science*, where group differences in spatial attention were explored for groups in different genders, video-game playing experience, and field of study. The results of a quantification study of the spatial aptitude showed that (1) independent of gender, those students qualified as "experienced" FPS video game players were much superior in mental rotation tasks and spatial cognition tests, and (2) after a 10 hr training session to those not qualified as "experienced" game players, both genders improved, with females making a markedly larger improvement "such that prior gender differences were reduced or virtually eliminated."

Implications in Engineering Education: Although the results of this study can benefit engineering and engineering education indirectly, integrating this concept directly into a teaching environment requires some creativity. Realistic implementation of FPS video games in coursework is unlikely; however, alternative types interactive games that combine the spatial relation benefits of a 3-D immersive environment more directly with engineering objectives and problem solving during gameplay could be a good tool. While current games are dominated by the former, and examples of the latter exist (SimCity being an excellent example of forcing user to plan a city ecosystem/ infrastructure), games seamlessly integrating the two have yet to appear commercially. Some examples of research pursuits on engineering centric video games include efforts by collaborators at Valparaiso University (www.timeengineers.com) integrating civil and mechanical engineering into a time travel storyline, a collaborative effort from Purdue university integrating chemical engineering into a dramatic storyline (See ACS Meeting news), and a racing game utilizing numerical method in mechanical engineering at Northern Illinois. In the instance that this continues to become a focus of video game developers, as the engineering community hopes will be part of a more broad effort of engineering and commercial media, educators may begin to capitalize on the benefits of this study.

References: Feng, J., Spence, I., and Pratt, J. (2005) "Playing an action video game reduces gender differences in spatial cognition" Psychological Science 18: 850-854

Rovner, S. (2006) "Video Game aims to engage students" ACS Meeting News, 84: 76-77
http://pubs.acs.org/cen/education/84/8415education.html

Example of Northern Illinois Numerical Methods Driving Game
http://www.youtube.com/watch?v=LYGwaI-haOM

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