BACKGROUND

Game-Based Cognitive Interventions for Older Adults
- Age-related decline in cognitive abilities is a well-established phenomenon (Salthouse, 2004)
- There is growing evidence for the successful use of video games as cognitive interventions for older adults (e.g. Basak, Boot, Voss, & Kramer, 2008; Stern, Blumen, Rich, Richards, Herzberg, & Gopher, 2011; Whitlock, McLaughlin, & Allaire, 2012), especially in the area of executive function
- However, not all game-based interventions have shown cognitive benefits (e.g. Ackerman, Kanfer, & Calderwood, 2010; Owen et al., 2010)

Variable Priority Training
- Variable priority training (VPT) is a type of emphasis change protocol that requires the manipulation of attention allocation policies in concurrent task performance (Gopher, 2007)
- VPT requires flexibly distributing one’s attention during the performance of complex or dual tasks, where different subcomponents of the whole task are emphasized on different trials
- Cognitive training for older adults that incorporates VPT appears to be more effective in improving executive control (Kramer, Larish, Weber, & Bardell, 1999; Stern et al., 2011) although one study of younger adults found no special transfer of training with VPT (Boot et al., 2010)

We examined the characteristics of three games used for cognitive training with older adults, one unsuccessful (Big Brain Academy) and two successful (Rise of Nations and World of Warcraft), and suggest that differences in the success of these games may be due at least in part to the degree in which they emphasize flexible allocation of attention and task switching through implicit variable priority training.

IMPLICIT VPT IN GAMES

Rise of Nations:
- Real-time strategy game controlled via mouse and keyboard
- Shown in one study to improve executive control in older adults (Basak, Boot, Voss, & Kramer, 2008)
- Players’ goal is to defeat enemy nations by engaging in a number of subtasks, like monitoring resource income or controlling military units
- The relative importance of each subtask varies throughout the game, but any given subtask is never performed in isolation
- Our examination of gameplay in Rise of Nations revealed two major phases of play, economy-focused and battle-focused, that simulated explicit VPT instructions

Economy-focused phase has a greater emphasis on subtasks of monitoring resource income, building, and allocating citizens
- Example: Monitoring resource income subtask (Figure 2; upper left). The player has an income level for each resource and a maximum income capacity for each resource; both change in response to player decisions within the game. Because the current income of a resource may never exceed its maximum income capacity, the player must constantly monitor resource income and change strategy based on income

Battle-focused phase has a greater emphasis on subtasks of resupplying army, monitoring army composition, and controlling individual military units
- Example: Controlling military units (Figure 2; bottom left). The player engages in battle by issuing commands, like hold position, to military units

World of Warcraft:
- 3D role-playing game controlled via mouse and keyboard
- Shown in one study to improve executive control in older adults (Whitlock, McLaughlin, & Allaire, 2010)
- Our examination of gameplay World of Warcraft revealed a similar pattern of implicit VPT cued by indicators within the game
- Example: Health monitoring subtask. During battle the player must increase attention allocated to monitoring his current health and the health of his target, as indicated by a bar display in the upper left of the game interface (Figure 4).

CONCLUSIONS & FUTURE DIRECTIONS

Variable priority training appears to be an important component in cognitive interventions for older adults, including those using video games
- Improved attentional flexibility and control gained through VPT (e.g. Rise of Nations or World of Warcraft) may contribute to gains in other controlled processes, like spatial ability, that may not be improved through simple practice of the process in isolation (e.g. in Big Brain Academy)
- Designers of game-based interventions to improve the cognitive abilities of older adults should be aware how VPT may contribute to improvement in executive function, and consequently may improve other cognitive abilities as well

Future directions:
- The relative importance of explicit vs. implicit VPT in cognitive training tasks
- Age differences in benefit from VPT in cognitive training

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