Research In Focus: A Weekly Digest of New Research from the NIDILRR Community

Serious Games Can Be Fun *and* Educational. Make Sure Everyone Can Play!

"Serious games" are computer or video games that use entertainment to train or educate the players. The games are developed and used to encourage skill development, improve health or cognitive function, or communicate messages of public safety or policy. These types of games could also help older adults to improve memory and cognition, or provide specific therapy following stroke or other health conditions. However, age-related changes like vision or hearing loss can make these games harder to play. One study looked at how developers can find a balance between making games accessible to players with disabilities and ensuring that players still get the intended benefits of game play.

Researchers at the NIDILRR-funded Rehabilitation Engineering Research Center on Technologies to Support Successful Aging with a Disability tested a game called Food for Thought to see how age-related visual disabilities might affect the player's experience. Food for Thought is designed to help players build multi-tasking skills by requiring them to move virtual ingredients simultaneously between four kitchen stations - cooking, chopping, mixing, and spicing - with a time limit in each station. Food that sits too long in any one station may end up "overdone." As players progress through the game, they are introduced to "minigames," short tasks in the game like slicing bread or sorting apples, to make it more challenging. Like similar games, Food for Thought uses many visual cues like symbols, indicators, color changes, and animated graphics.

Participants in this study included players ages 65 and older, some with age-related visual disabilities. While Food for Thought was designed with older players in mind, with large, clickable targets and bright, high-contrast colors, the researchers observed that those with visual disabilities had certain difficulties during game play. The authors described a player who was color-blind and could not see the timer change colors, missing the chance to save the food and win the level. Players with color-blindness or age-related changes in color perception may have had difficulty distinguishing color-coded features.

In part of the game, players move food out of the cooking station when a timer turns green, meaning "ready," but before it turns red, meaning "overdone." To further explore the effects on gameplay from visual impairments such as color-blindness, macular degeneration, and glaucoma, the authors reviewed results of a follow-up study of the same game that used younger players without disabilities but wearing blinders or glasses to simulate visual disabilities. That follow-up study by McClellan & Williams (2014) identified several issues that could limit visual access to games. Players with glaucoma and macular degeneration may have experienced difficulty in seeing portions of the screen where game play took place. Players with macular degeneration tend to have occlusions or "blind spots", thus may not have been able to see images or action in the center of their vision. These players may have been using the periphery of their vision to see the action, missing any alerts in the center. Players with glaucoma may

also have experienced difficulty seeing the full screen, particularly the periphery was difficult to see. For these players, action or indicators on the edge of the screen may have been missed.

Based on the results of the initial pilot test and the follow-up study, the authors had several recommendations to improve the accessibility of the game:

- The authors suggested designers add another indicator besides color, such as sound (a rising tone) or motion (an animation) to alert players that an ingredient is ready to move to the next station.
- The authors suggested allowing players to move important elements like alert graphics to other visible areas to accommodate blind spots or other visual blocks.
- The authors suggested a flashlight or spotlight function that reveals or magnifies a portion of the screen at a time to accommodate players with a smaller field of focus. This function would also make the game competitive, if a player with vision loss chose to play against an opponent who can see the full screen.

While these changes may make playing the game easier for those with visual disabilities, the authors noted that developers may want to test whether players are still getting the original therapeutic or educational benefit of the game.

In this study, the game was tested by older adults with visual disabilities and a follow-up study tested it with younger adults wearing blinders or glasses to mimic visual disabilities. The authors suggested that, while the blinders or glasses may promote understanding and empathy in game designers and developers without visual disabilities, designs should still be tested with actual users across a variety of accessibility needs. The authors also suggested developing a sheet of questions developers can keep in mind starting at the earliest stages of game development such as what are alternate ways to display game information? Or can sound or vibration be added to visual cues, like a buzzing alarm or shaking a controller?

For the future, the authors suggested developing a guide for game designers and developers that describes disabilities and how their symptoms might interact with game play, and offering evidence-based ways to make games more accessible to all users. For serious games, integrating designs to balance accessibility with the intended purpose of the game may be more challenging but still possible.

To learn more:

Includification from the Able Gamers Foundation offers game accessibility guidelines, written by developers and gamers with disabilities. http://www.includification.com/

Usability.gov has information on conducting usability testing with representative users. http://www.usability.gov/how-to-and-tools/methods/usability-testing.html

To learn more about this study

Gomez-Gurley, K., A. Collins McLaughlin, M. G. Coleman, J. C. Allaire. (2015) Accessibility in serious games for adults aging with disability (abstract). Lecture Notes in

Computer Science. This article is available from the NARIC collection under accession number J58752.

Food for Thought is still in development at Georgia Tech. Learn more about the game: http://www.techsage.gatech.edu/node/17