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A Novel Approach to Assessing and Treating Traumatic Brain Injury

BY CYNTHIA MWENJA, PhD

Nicole Cruse, assistant professor of Communication Disorders at Sacred Heart University, researches effective treatments for people who have traumatic brain injuries (TBI). Her goal is always to translate her research findings into meaningful treatments for this population. Her admirable projects include social media research and the establishment of a TBI support group, but one current project is truly revolutionary: Cruse aims to create an entirely new way of assessing TBI clients, through their interactions with a purpose-built video game app.

“Atypical” Path to Communication Disorders Research

Unlike most of her peers in communication disorders, Cruse earned a bachelor’s degree in English classical literature, then continued her studies with a master’s degree in literature, with linguistics electives. In one linguistics class, the professor showed a video of patients with aphasia—defined by Oxford Languages as “loss of ability to understand or express speech.” Cruse had always been deeply invested in storytelling, and she had not known that people could suddenly lose the ability to tell a story—to participate in this very human way of showing who they are.

Cruse remembers being “consumed” by this new realization; she couldn’t let it go. To better understand people with aphasia, she decided to transition to a second master’s degree in linguistics, with a cognitive science certificate. She was subsequently accepted to the University of Connecticut’s IGERT Fellowship program funded by the NSF, where she would earn a Ph.D. in Speech Language and Hearing Sciences with a

concentration in cognitive neuroscience and neurogenic disorders. She persevered and loved the challenges, ultimately changing her research agenda from aphasia to TBI, which was her advisor’s focus.

Traumatic Brain Injury

Cruse says that individuals with TBI often have trouble navigating the world, and they can also experience issues with telling stories. Even though they can talk, they may struggle to communicate meaning; they can be easily derailed and have trouble finding their way back to the point they had been trying to make. These issues can cause problems communicating with family members or with others in the workplace, so people with even mild TBI can have trouble maintaining jobs or relationships. Around 97 percent of people with TBI have executive dysfunction, as well, which causes them to struggle with structuring their days and adapting to unplanned circumstances. If a stressful event happens, people with TBI can have challenges prioritizing what will be helpful to address the issue in the moment. Because so many of the

challenges that this population faces have to do with communication, helping them communicate better is a big part of their treatment, Cruse states.

As Ciara Leydon, chair and professor of Communication Disorders at Sacred Heart, points out, TBI can affect any part of the brain. As a result, this population has complex needs and many possible deficits. Leydon also notes that Cruse approaches TBI treatment from the standpoint of cognitive neuroscience; her insights offer a different and complementary approach within a department focused on functional communication. Leydon admires the way that Cruse uses cognitive science to think about how people are actually functioning in the real world, calling this move an “uncommon bridge.”

Translational Research

Cruse feels strongly about the importance of translational research; she doesn’t want to answer questions that won’t help real people. In one collaborative project, Cruse is working with a colleague who is a clinical



speech pathologist to develop a support group for people with TBI. Leydon affirms that this sort of translational work aligns with the department's mission to serve the community. Further, the initiative offers communication disorders students opportunities to develop their skills working in the group setting, while clients will receive this effective and needed service in Sacred Heart's clinic, which is free of charge. Leydon also notes that involvement with the clients in the group will offer Cruse insights to inform all of her projects.

In another project which yielded helpful real-world data, Cruse worked with graduate student Helena Sabo last fall to conduct a detailed analysis of over 4,000 posts in a TBI caregivers' group. As Sabo points out, this analysis is helping them to understand what information and support that people are looking for; the results will help the researchers know what information to provide to people with TBI and how best to make an impact on their care.

This term, Sabo, Cruse, and graduate assistant Iva Barun are assessing the standardized tests which are used to analyze executive function in TBI clients. The tests currently in use have been around since the 1980s and can be badly outdated—some tests have the client working with clock faces and images of rotary phones. As Sabo states, functional activities—such as checking the weather to choose appropriate clothing—are not addressed in current assessment instruments. Other issues can crop up when the traditional tests are administered, Sabo points out. For example, some clients are unable to draw; that limitation nullifies some tests. Sabo still believes the current tests are reliable and give valid results, and they do offer insights into a client's executive and cognitive function. Seeing a client perform on this sort of test, however, is very different from seeing them function in real-life situations.

Cruse points to other limitations of the standard tests: they are done in quiet, controlled settings, and they can have a
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high level of error due to the subjectivity of the reporter. Speech language pathologists also often have big caseloads, and they may only have time to conduct an assessment when a patient is not at their best. What clients want to know from their assessment results is whether they can go back to work, but the current assessments don't really answer questions about what people can do in the real world, Cruse says. To really test executive function, an assessment needs to be replicable and also include some of the uncertainty that people experience in everyday situations.

A Novel Assessment Approach

To Cruse, the solution for replicable, realistic assessment became obvious. "Why not use video games?" she remembers thinking. This approach hasn't been used for TBI assessment—Leydon calls it "completely novel"—but people can do everything in video games that they can do in real life. Sabo notes that the goal of communication

disorder therapy is always functionality, and she appreciates the true functionality that an assessment game can support. It took some time for Cruse to find individuals in computer science who were interested in making games that would do this type of translational work. Once she located people with expertise in computer science who were willing to work with her across disciplinary lines, Cruse developed two versions of the game; she then connected with Jordan Tewell, assistant professor of Computer Science and Engineering at Sacred Heart.

Last summer, Tewell had been looking at fellow faculty profiles, and he saw that Cruse was doing work with video games. He saw a good opportunity for his engineering students to work with a professor in a different discipline to develop a "serious game"—a type of video game that is used in the medical industry, often to train professionals. He approached Cruse to propose a

collaboration. "I can help you develop your dream game," he told her. Right now, Cruse and Tewell are co-teaching a class of seven students who are working on developing Cruse's game for course credit. Like Leydon, Tewell uses the word "novel" to describe Cruse's idea—he confirms that he and his students researched the field, and "there's nothing like it out there."

Tewell states that the collaboration has been a good experience, though he notes that learning to talk to someone from a different academic background can pose challenges. To bridge the gaps, Cruse created a glossary for the computer science students so that they could understand the terms she uses. She also works directly with the students in weekly meetings so that she can provide feedback on their work. Tewell appreciates that collaborations like this can get students thinking about jobs they may not be aware of, such as the overlap among the medical field, computer



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science, and game design. Sabo also values the collaboration between disciplines and sees this project as potentially life changing. “[This is] great research that can change the face of medicine,” she says.

Cruse says the game will provide better, more efficient assessment for individuals with TBI, and those assessments will be easier, cost less, and take less time. Once the game is fully developed and rigorously tested, clients will download it as an app, and then they can be assigned specific assessments within the game by their clinician. For example, they might be asked to find items at the grocery store within a given budget; such a task would assess their memory, attention, and decision-making skills. The game-development class is creating content for a grocery store, a dry cleaner, and other common spaces where people might run errands. Through observing how clients interact with the game’s scenarios, researchers can

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get real-time information. They can also compare the client’s performance over time to get meaningful long-term data.

Leydon states that Cruse has identified a true need in the community as well as the scientific field to better assess and treat TBI. She points out that the key aspect with gaming is that it can provide dynamic assessment in which the clinicians can “watch processes that people will need to use in their everyday lives.” The observers can see the client solve a problem and make sure that it was a good solution.

After the game is developed, Cruse says, the next step is to gather a focus group to get feedback. Once the game has been fully vetted by focus groups and beta-testers, then the collaborators must prove its validity through rigorous testing. When the game works and is reliable, it could potentially be adapted for other populations, too. After Cruse’s game is released, it will help clinicians to better personalize not only assessment but treatment, as well. Additionally, since speech language pathology treatment is not covered by insurance after the allotted time runs out, this game can provide a vital, low-cost resource for clients on an ongoing basis.

Cruse’s inspiration to revolutionize TBI assessment and treatment through a video game is truly remarkable, and her ability to work across disciplinary lines to bring her vision to reality is inspiring. Cruse’s commitment to translating her clinical insights to real-world practice will have long-lasting, positive affects for people with TBI.



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ABOUT THE AUTHOR: Dr. Cynthia Mwenja teaches Composition and Rhetoric at the University of Montevallo.

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