GENERATOR
at Sheridan

Leveraging AI for Improved Elder Care: Innovative Digital Companions for a Changing Demographic

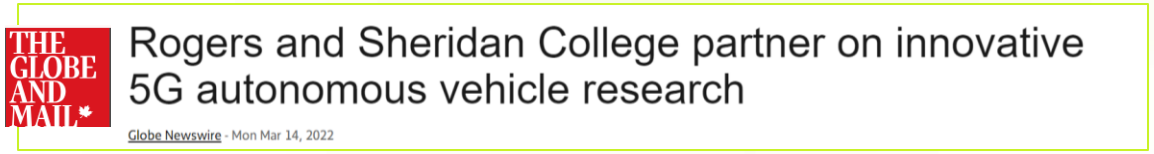
Stephan Kozak & Lia Tsotsos
Sheridan College

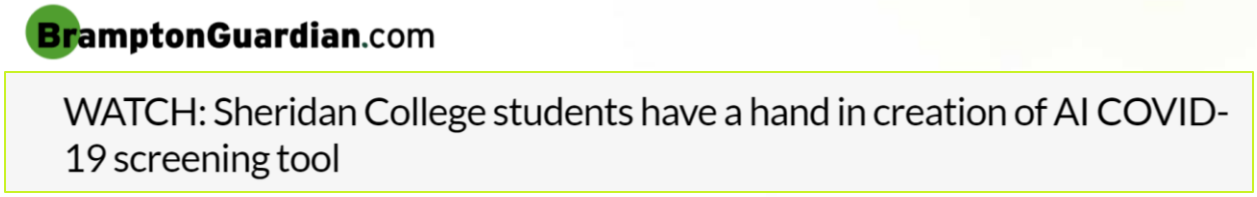
May 16, 2024
Polytechnic Showcase

About Generator at Sheridan

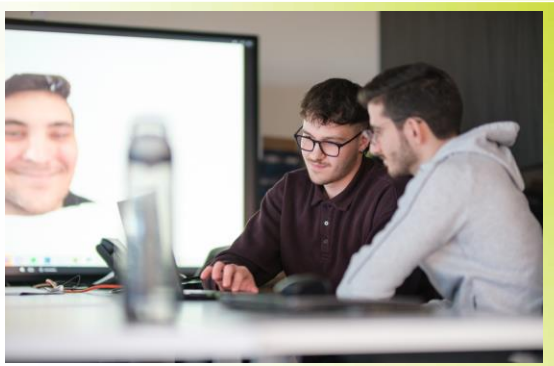
Generator at Sheridan is where purpose and passion unite the extraordinary research, innovation and entrepreneurship undertaken across Sheridan to drive meaningful impact for an everchanging world.

- We provide the expertise and talent through our faculty, staff and students on RIE development and activities to help organizations address key challenges to become more productive, competitive and impactful.
- In addition to faculty-led research, Sheridan also boasts five renowned Research and Entrepreneurship Centres that provide innovation supports to community, industry and government partners.



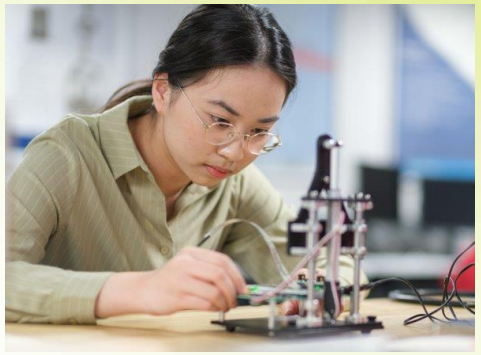


Research and Entrepreneurship Centres



The Centre for Applied AI

The Centre for Elder Research



The Centre for Intelligent Manufacturing

Screen Industries Research and Training Centre

EDGE

Centre for Elder Research

The Centre for Elder Research conducts leading-edge research in the field of aging by examining innovative ways to enhance the well-being of older adults and the environments that support them.

sheridancollege.ca/elder-research

Areas of expertise

Our team has nearly 50 years of cumulative experience in these areas:

- Population aging.
- Social determinants of health.
- Co-design and community implementation.
- Universal and accessible design.
- Age-related physical, sensory and cognitive changes.
- Evaluation, training, education and outreach.
- Creative use of the arts to enhance well-being.
- Scalable technologies to promote and support healthy aging.

Screen Industries Research and Training Centre

The Screen Industries Research and Training Centre drives creative and technological advances within the screen industries (film, television, interactive digital media including gaming and virtual/augmented reality); and innovative application of screen-industry technologies within the performing arts and other sectors.

sirtcentre.com

Areas of expertise

Software, CG, Animation & VFX, Virtual Production

- Mixed Reality (MR, Virtual and Augmented Reality)
- Artificial Intelligence (AI)
- Rendering Development (Real-time, Online, Neural rendering)
- Virtual Production, Visual Effects
- Web development, WebGL
- Mobile development
- Animation (2d/ 3d/ 4d)
- Generative AI
- real-time, linear, procedural animation, automation
- Character Creation - digital Doubles, virtual humans
- In-Camera Visual Effects (nDisplay in Unreal Engine)
- Motion Capture - multimodal (Body, Facial, Hands)
- Real-time Compositing
- Reality Capture (Object and Human Scanning)

Project: Key Collaborators

CER

- Specialists in aging and the associated cognitive challenges.
- In-depth knowledge of health and wellness for older adults.
- Designing and implementing studies focused on the aging population.
- Provides insights into user needs, ensures research protocols align with project needs, and leads pilot evaluation of AI solutions.

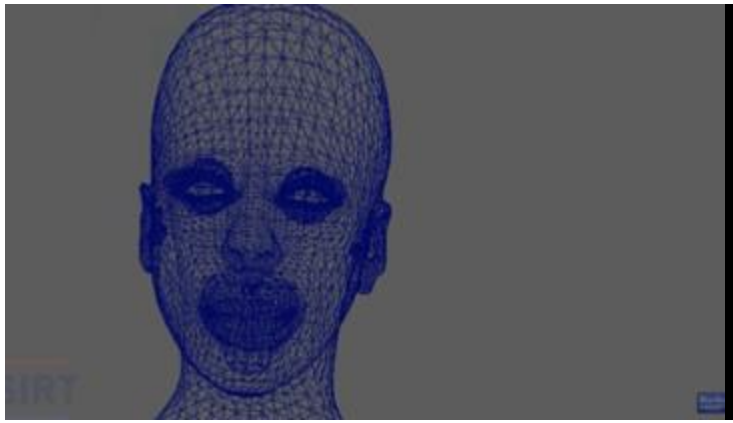
SIRT

- Specialist in the development of real-time interactive characters and virtual humans.
- Applies advanced ML techniques to enhance AI character performance.
- Experienced in creating immersive experiences that engage users.
- Technical development of AI characters, focusing on optimizing pipeline to create real-time performance and user interaction.

Reimagine AI

- Leader in creating AI characters with personality and interactive functionalities.
- Experience in integrating AI into mobile platforms.
- Combines artistic vision with technological innovation to create engaging digital companions.
- Oversaw the development of AI characters, ensuring they meet the functional and emotional needs of the elderly and their caregivers.

Virtual Humans: An Evolution

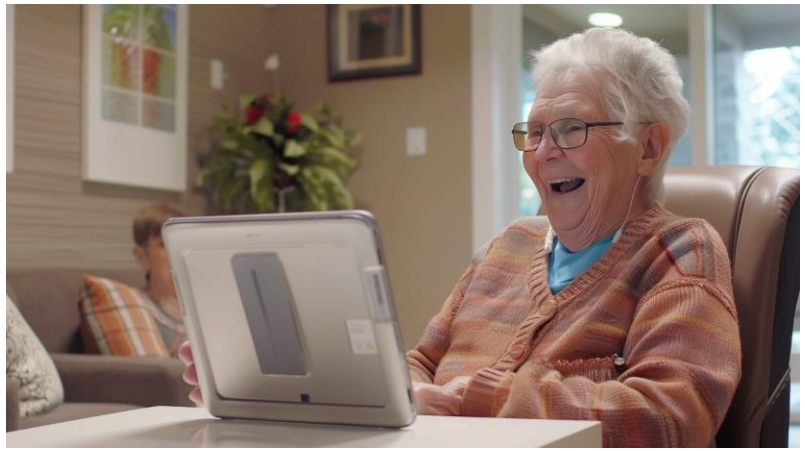


Virtual Humans for Real-time Animation

Digital Doubles for Real-time Production

4D Digital Human Libraires

Case Study: AI Memory Care



The Challenge

- Projections estimate that over 25% of Canadians will be seniors by 2050
- Traditional caregiving struggles to provide consistent and personalized companionship, especially for individuals facing memory loss or cognitive decline.

The Research

- Mobile-based AI companions that offer empathetic support, reduce loneliness, and enhance mental stimulation.
- Testing these digital characters in real world environments ensures effective adaptation to user needs.

The Expected Impact

- Supports care partners by offering consistent, low-cost assistance, and may relieve some daily challenges.
- Provides older adults with much-needed companionship, reducing the impact of cognitive decline on quality of life.

Virtual Humans: Innovation

Prosody and Phonetics in Speech Generation

- Refine how virtual humans speak to make interactions more natural.
- focus on intonation, stress, and rhythm of speech (prosody), and the articulation of sounds (phonetics)

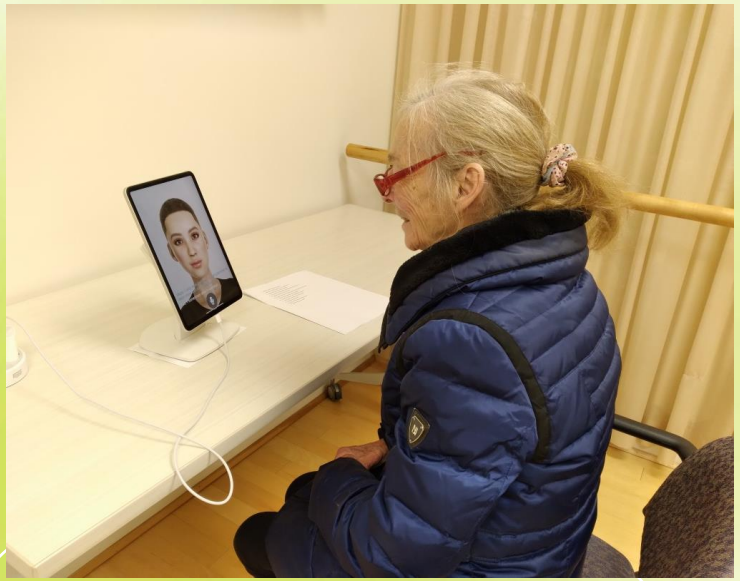
Contextual and Emotional Relevance

- Ensure that AI responses are contextually appropriate and emotionally attuned to the user's state.
- Integrate sensors and algorithms that analyze user's vocal tones, facial expressions, and spoken words to gauge emotional
- Sentiment analysis, emotion recognition technologies

Specific Conversational Actions

- Enable AI to perform actions relevant to the conversation, such as reminders or emotional support
- Action prediction models, contextual understanding frameworks.

User testing: Methods



The Goal

- Observe how older adults of varying levels of cognition interacted with the virtual human character
- Collect specific user feedback
- Evaluate the implementation and feasibility of virtual humans as a tool to support formal and informal care partners

The Participants

- Cognitively well, community dwelling (n=14)
- Cognitively well, living independently in a retirement home (n=7)
- Diagnosed with mild cognitive impairment or a more severe form/stage of dementia; living in, or attending the adult day programming at, a private respite facility (n=4)
- Ages ranged from 60-100 (mean=79), 6 males/19 females

The Task(s)

- Participants were invited to engage in conversation with the virtual human character while being observed by a facilitator and/or staff person
- Question/dialogue prompts were provided, and the facilitator was able to troubleshoot in real-time as required
- Formal observations and user feedback were collected during each session

User testing: Results

- Participants engaged with the virtual human for 11-15 minutes
- 88% of the conversations appeared to be an even balance between the human and the virtual human
- 52% of participants displayed a cheerful demeanor, suggesting enjoyment; 12% were frowning or expressing frustration/disinterest
- Mostly positive feedback to the virtual character's appearance, voice, etc.
- Perceptions of value of this type of engagement were mixed; 29% said 'yes, they saw value', 43% said 'no', 24% were unsure
- Formal feedback could not be collected from participants with dementia; it was viewed as too intrusive and disruptive and staff often had to engage alongside the participants to keep the sessions on track

Participant Feedback

One participant sent an email to the moderator the day after their AI session and shared these thoughts:

I wonder if it would be useful to prime participants with an idea of how to regard “Maya”.
Obviously, “she” is a AI program, but is it an AI program pretending to be a real person,
or an AI program responding as an AI program?
For instance, in the one case I might ask “Have you ever been to Mexico?”
and in the other, “How much do you know about Mexico?”

Right now, I don’t think I’d ever want a “conversation” with an AI program,
but I’m quite happy to ask a program for information or to do something.
On the other hand, if I was suffering from dementia, it’s possible I might want a conversation,
but responses like “AI’s don’t take vacations” might confuse me.

The bottom line

Great potential, but there is still a ways to go…

- Initial engagement and interest was high, suggesting willingness to explore the technology and consider its utility
- Interest for the cognitively well individuals dropped off when the virtual human couldn't engage in more in-depth dialogues; individuals with dementia struggled to get into a conversational rhythm independently
  - This raises questions about how much respite this technology might offer for care partners, or how supportive it might be in promotion social engagement
- This field has much potential and plenty of room to grow…

GENERATOR
at Sheridan

Get in touch

CER


lia.tsotsos@sheridancollege.ca


elder.research@sheridancollege.ca


sheridancollege.ca/elder-research


@sheridan_elder


Sheridan Centre for Elder Research

SIRT


stephan.kozak@sheridancollege.c


sirt@sheridancollege.ca


sirtcentre.com


@sirtcentre


SIRT Centre


SIRT Centre

SIRT Centre