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LectSess-B: Lecture Session B

Room: Needham Ballroom 3

Designing a Pseudo-Haptics Study for Virtual Anesthesia Skills Development...1

Bill Kapralos and Alvaro Uribe Quevedo (Ontario Tech University, Canada); Kc Collins (Carleton University, Canada); Celina Da Silva and Eva Hava Peisachovich (York University, Canada); Kamen Kanev (Shizuoka University, Japan); Michael Jenkin (York University, Canada); Adam Dubrowski (Ontario Tech University, Canada); Fahad Alam (Sunnybrook Health Sciences Centre, Canada)

Pseudo-haptics refers to the simulation of haptic sensations without the use of haptic interfaces, using, for example, audiovisual feedback and kinesthetic cues. Given the COVID-19 pandemic and the shift to online learning, there has been a recent interest in pseudo-haptics as it can help facilitate psychomotor skills development away from simulation centers and laboratories. Here we present work-in-progress that describes the study design of a pseudo-haptics for virtual anesthesia skills development. We anticipate this work will provide greater insight to pseudo-haptics and its application to anesthesia-based training.

Presenter bio: Bill Kapralos is an Associate Professor in the Game Development and Interactive Media program at Ontario Tech University. He is also the Technical Lead of the Collaborative Human Immersive Interaction Laboratory (CHISIL), Sunnybrook Health Sciences Centre in Toronto. His current research interests include: immersive technologies, serious gaming, multi-modal virtual environments/simulation/reality, the perception of auditory events, and 3D (spatial) sound generation.

20:20 *Procedural Marine Landscape Synthesis for Swimming Exergame in Virtual Reality...3*

Wanwan Li (University of South Florida, USA)

In this paper, we propose a simulation-based procedural modeling approach to automatically synthesize immersive marine landscapes for swimming exergame in virtual reality. Given arbitrary terrain as input, we transform it into a realistic marine landscape according to a novel simulation-based procedural modeling approach inspired by the geological phenomenon of tectonics. During the tectonic simulation, we apply another constraint that is specifying the water area so as to make the top-down view of our synthesized marine landscape match the shape expected from users. Besides, we apply physics rules to the VR controllers to immersively simulate players' swimming experiences in virtual reality and collected the feedback from the players who virtually swam in our synthesized marine landscapes.

20:40 *User Friendly Minecraft Mod for Early Detection of Alzheimer's Disease in Young Adults...9*

Satoko Ito, Marcel Wira and Ruck Thawonmas (Ritsumeikan University, Japan)

We propose a user-friendly system for early detection of Alzheimer's Disease (AD). The proposed system is an improved version of a state-of-the-art system (SOTA), especially in the "usability/playability" factor of user experience. In recent years, dementia has become a social problem worldwide, and studies on early detection of it have been increasingly focused on. Spatial navigation, in particular, the in-game traveled distance, is considered one of the most critical keys that enable early AD detection. Both systems utilize

the in-game traveled distance and a popular game called Minecraft. A user evaluation was conducted that confirms the proposed system outperforms SOTA in terms of the usability and playability factor and another factor about visual aesthetics, both with statistical significance.

21:00 ***Heart Failure Diagnosis VR Simulator…13***

Byron Perez-Gutierrez (Universidad Militar Nueva Granada, Colombia); Lizeth Vega-Medina (Universidad El Bosque, Colombia); Osmar Perez (Fundación Clínica Shaio, Colombia)

This paper presents a virtual reality (VR) simulator for the treatment of a virtual patient with heart failure condition. The proposed simulator is composed of a VR headset with tracked controls and a virtual environment of the doctor's office and a examination room with the specialized equipment for the diagnosis. The entire flow of the simulation is based on a graph derived from the heart failure guidelines of American Heart Association. A preliminary human factors study demonstrates the potential use and applicability of the prototype for clinical training.

21:20 ***An Analysis of Mobile Gaming Apps' Privacy Policies…16***

Tian Wang (University of Illinois at Urbana-Champaign, USA); Carol Hayes (University of Illinois, USA); Chen Chen and Masooda Bashir (University of Illinois at Urbana-Champaign, USA)

Nowadays, gaming applications become more and more popular among mobile users. The number of gaming app users has significantly increased during the COVID-19 pandemic. Given the amount of user information being collected and shared by these gaming apps, it is service provider's responsibility to implement appropriate privacy policies to protect users' personal data. In this study, we reviewed and analyzed 20 gaming apps' privacy policies to understand types of privacy protections explicitly addressed by gaming apps providers, and if any specific privacy protections are provided to vulnerable groups like children and teenagers. Results from this study are expected to address the missing pieces of privacy protections on current gaming apps' privacy policies and suggest implementations accordingly, as well as raise public awareness on potential privacy risks when sharing personal information with the gaming apps.

21:40 ***Prototyping a Spatial Skills AR Authoring Tool for Partially Sighted, Blind, and Sighted Individuals…22***

Erin Lee, Mitali Kamat and Lucas Temor (OCAD U, Canada); Chris Schiafone (OCADU, Canada); Lillian Fan (Ontario Tech University, Canada); Jessie Liu (University of Toronto, Canada); Peter Coppin (OCAD U, Canada); Alvaro Uribe Quevedo (Ontario Tech University, Canada); Ali Syed and Robert Ingino (Sensetech, Canada); Teresa Lee (OCAD U, Canada); David Rojas (University of Toornto, Canada); Sharman Perera and Adam Dubrowski (Ontario Tech University, Canada); Mahadeo A. Sukhai (Canadian National Institute for the Blind, Canada)

Spatial skills are critical for understanding the relations among objects and people, playing an important role in how we interact with the world. Spatial relationships are built through interactions with physical

objects; however, in computational/online environments, these change to bi-dimensional media and computer-assisted design comprised of 3D representations viewable through a flat screen. Such a traditional 2D and 3D approach presents challenges to partially sighted, blind, and sighted individuals alike due to the spatial immersion and interaction limitations. This paper presents the prototyping of a co-design Augmented Reality (AR) authoring tool by recruiting inclusive emerging affordances of consumer-level AR technologies within the context of current e-learning provisions in subject matters including inclusive design, engineering design, and game hardware design, and health sciences. This work has been inspired by the COVID-19 pandemic that has shown the need to level the field in inclusive design for teaching a subject typically oriented to the sighted. Our prototype allows users to create e-learning content for visualization, interaction, collaboration, and inclusive learning.

22:00 ***Cricothyroidotomy Simulator: A Makerspace and Augmented Reality Approach...28***

Silas Franco dos Reis Alves, Mithusa Sivanathan, Julia Micallef, Bruno Gino, Marvin Mnaymneh, Adam Dubrowski and Alvaro Uribe Quevedo (Ontario Tech University, Canada)

A cricothyroidotomy opens the cricothyroid membrane in its midline, allowing it to communicate with the external environment. Cricothyroidotomy is a complex procedure and involves quick motor, psychological, and decision-making skills, especially in the pandemic context. This procedure requires dozens of hours of training, and simulators are useful tools for teaching advanced airway management techniques to healthcare professionals. However, upper Airway Simulators are expensive and may present limited functionality for cutting fake skin, ligaments, and membranes, thus introducing limited experiential learning to trainees. Furthermore, the COVID-19 pandemic required shifting in-laboratory practices to experiential learning that could take place remotely, thus sparking interest in makerspace technologies for creating cost-effective simulators. This paper presents the prototyping of a cricothyroidotomy simulator through a Design Thinking approach to ideate a cost-effective solution that contains all 3D printed structures properly representing the real anatomical parts needed for the procedure. Additionally, we propose an augmentation of the 3D printed model employing Augmented Reality (AR) with the purpose of enhancing how information about the procedure can be accessed without relying on traditional instruction materials. Our preliminary results have led to a makerspace cricothyrotomy simulator that has been used in training sessions in conferences and workshops and the prototyping of an AR complementary tool.

LectSess-D: Lecture Session D

Room: Needham Ballroom 3

Co-Located Mixed Reality for Teaching Equine Radiology Techniques to Veterinary Students...32

Xuanhui Xu, David Kilroy, Antonella Puggioni and Abraham Campbell (University College Dublin, Ireland)

Radiology and diagnostic imaging techniques are important in the diagnosis of conditions in both humans and animals. It is essential that students understand how to use the imaging equipment for diagnosis and that they use this equipment in a safe manner. However, the X-ray equipment requires costs for maintenance and the practical tutorials are limited by class size and the availability of qualified staff. The

availability of large animals (such as horses and cows) is limited in most institutions, whereas the students can role-play the projections as patients in Human Medicine Education~\cite{o20213d}. It is challenging even to teach the use of basic equipment including x-ray machines, ultrasonography and endoscopy, not to mention performing an MRI or CT scan. Moreover, for radiation safety reasons, only qualified staff can take radiographic images on live animals while the student is only allowed to restrain the animal and observe the procedure. Although radiographic image acquisition practice is important for students to learn the techniques such as exposure and beam centering, the current clinical lab setup cannot fulfill the current learning demands.

Presenter bio: Dr. Abraham Campbell is an Assistant Professor for University College Dublin(UCD) Ireland, who is current teaching as part of Beijing-Dublin International College, a joint initiative between UCD and BJUT.
Abraham coordinates UCD's VR lab which examines the use of Augmented Reality and Virtual Reality to explore tele-presence applications to allow true distance learning. He is a funded investigator for the CONSUS SFI centre and a collaborator on the EU funded AHA - AdHd Augmented project.

20:20 *An Adaptive Hint System for Puzzle Games: A Multimodal-Based Approach...38*

Hao He, Yulin Zhu and Wei Cai (The Chinese University of Hong Kong, Shenzhen, China)

For a puzzle game, the embedded hint system is a vital medium to improve the quality of the gameplay. A well-designed hint system can help balance the difficulty of the puzzle game and offer the player a better game experience. However, according to the questionnaire-based survey and the industrial investigation we made for puzzle games, two significant problems with the current hint systems are discovered: a) Most hint systems are rule-based. Many players consider that the timing of the hints cannot match the actual states of their game flows. b) In addition, the presentation modes of the hints are sometimes too abstract or too straightforward to follow and even leak the upcoming puzzles. Hence, to improve the game experience for the players when involved in puzzle games, we design and develop a multimodal-based adaptive hint system to help players get through the puzzles more smoothly with timely hints that are presented in proper modes. To test the system's effectiveness and usefulness, we conducted a control experiment based on three puzzle games, with a control group playing the original games and an experimental group playing the games with the multimodal-based adaptive hint system. The experimental results showed that our system has a significant effect in helping players improve their game experience and balance the difficulty of the game.

20:40 *Using Selective Simulation to Create Digital Therapeutics for Educating Social Skills to Children with High-Functioning Autism Spectrum Disorder...44*

Bryan Woosung Kim (Rensselaer Polytechnic Institute & MeDKit, USA)

Several digital therapeutics are using gamification to reduce the cost of developing new medicine and reach out to more people. Due to their likability toward games, many children, especially those with mental disorders, are the main audience for education and healthcare digital therapeutics. Ironically, such merits do not stand out due to the poor usage of gamification. Disregarding children's cognitive development when designing digital therapeutics for children creates skeptical views toward using digital therapeutics as an educational or a healthcare tool. This paper explores a new design position for digital therapeutics, a selective simulation, and testing it out by simulating an elementary school's social environment that focuses on empathic conversation through recognizing a character's emotion and situation that trains

the Theory of Mind to High-functioning Autism Spectrum Disorder (HFASD) children. This paper aims to use selective simulation to create a simulated social interaction digital playground for HFASD children to explore familiar and recurring social interactions and foster understanding of other people's situations and emotions.

LectSess-E: Lecture Session E

Room: Garrison 1

As the End Drew near: Exploring Volumetric Video in Videogames...48

Cindy Poremba and Maxwell Lander (OCAD University, Canada)

VVV: Volumetric Video in Videogames is a research-creation project aiming to advance experimental development using volumetric video in expressive videogames. It aims to push deeper into interaction design paradigms for hybrid image forms like volumetric video, and offer a viable channel for engaging captured content in videogames. As the End Drew Near is the first experimental game prototype designed for VVV.

Presenter bio: Cindy Poremba is a digital media researcher, gamemaker and curator. They are an Associate Professor (Digital Futures) at OCAD University (Toronto, CA) and Co-Director of OCAD's game:play Lab. Dr. Poremba has presented internationally at conferences, festivals and invited lectures, on topics relating to game art and curation, capture in postmedia practices, and interactive documentary. Cindy also organizes non-traditional exhibitions as an independent curator, and their award-winning game and "New Arcade" work has been featured in both international game and digital art exhibitions.

20:20 ***Understanding the Challenges of Team-Based Live Streaming for First-Person Shooter Games...51***

Jiaye Li and Minghao Li (The Chinese University of Hong Kong, ShenZhen, China); Zikai Alex Wen (The Hong Kong University of Science and Technology (Guangzhou), China); Wei Cai (The Chinese University of Hong Kong, Shenzhen, China)

First-person Shooter (FPS) game tournaments take place across the globe. Instead of buying tickets to attend FPS game events, many people watch competitions online. However, live streaming might miss critical game highlight moments, including kills and tactics. Our work identifies how and why the live streaming team fails to capture highlights while streaming, which is named as Jarring Observation. We summarized five typical Jarring Observations and identified three major causes behind this phenomenon through a field study of Game For Peace, a popular FPS game. Furthermore, we explored how to prevent Jarring Observation. Based on the field study, we interviewed two streaming teams for Game For Peace to conclude three suggestions on avoiding Jarring Observation. Our work provides insights for streaming system researchers and developers to improve the streaming system to offer live audiences smoother entertaining experiences.

20:40 ***Evaluating the Performance of Object-Oriented and Data-Oriented Design with Multi-Threading in Game Development...57***

David Wingqvist, Filip Wickström and Suejb Memeti (Blekinge Institute of

Technology, Sweden)

The frame rate of a game is important for both the end-user and the developer, and for a game to be considered playable, the minimum requirement of 60 fps should be maintained. With respect to the programming design/paradigm/model, the current industry standard is to use Object-Oriented Design (OOD). While the demand for efficient game applications is increasing, applications that are developed using object-oriented design are struggling to efficiently utilize the available computing resources and consequently meet the minimum frame-rate requirements. A design pattern that may be able to cope with the current and future requirements of resource-intensive games and applications is the Data-Oriented Design (DOD), which focuses on utilizing the CPU memory efficiently. The main difference between OOD and DOD is related to the way data is organized and accessed. While DOD is able to efficiently utilize the cache memory, programming applications using the data-oriented design is perceived as much more complex compared to programming applications using object-oriented design.

In this paper, we will first develop a simple game application using both object-oriented and data-oriented design. Thereafter, we evaluate the performance of both implementations with respect to the overall execution time, CPU and memory utilization. Furthermore, we will develop the corresponding multi-threading versions to explore how the memory is utilized when multiple cores access data from shared cache memory. The results from the empirical evaluation show that the sections of the code that used DOD were significantly faster than the corresponding parts implemented using OOD for both single-threaded and multi-threaded applications. The maximum observed speedup of 13.25 times demonstrates that games and applications developed using DOD can utilize the available resources more efficiently at the cost of increased programming effort.

21:00 *The Effect of In-Game Advertising on Non-Immersive Game Experience...63*

Panagiotis Vasilogamvros and Vlasios Kasapakis (University of the Aegean, Greece)

Virtual Reality (VR) games, either in their Immersive or Non-Immersive form, are the cornerstone of the entertainment industry. Integrating advertisements inside game content is one of the most profitable ways of games monetization. In-game advertisements are either integrated into a game's content as diegetic game elements or as non-diegetic, simply placed in designated game-world areas to solely demonstrate a product or brand. This work presents preliminary evaluation results on the impact diegetic and non-diegetic in-game advertisements have on the non-immersive game experience.

21:20 *Scrum and Remote Work in Video Game Projects: Improving Communication, Trust and Efficiency...66*

Levika-Herve Nankap and Bruno Bouchard (University of Quebec at Chicoutimi, Canada); Yannick Francillette (University du Quebec à Chicoutimi & LIARA, Canada); Gilles Action (Imbeau, Canada)

In a rapidly expanding video games industry, companies have to manage complex development projects with interdisciplinary teams. Nowadays, these teams often produce in remote working (at least partially) with the Scrum framework. However, this framework is not adapted to the virtual team context. Moreover, key issues about communication and trust between team members are not well addressed by the original framework tools. In this paper, we show our Com-Scrum model extending the original Scrum framework to take into account the context of remote work. We also propose to exploit a text mining approaches to

automatically detect in real-time the problems of communication and trust between team members. This tool uses data from the team activities in the chat platform to extract the and apply a quantitative analysis of multiple metrics to infer communication health status of team in order to give feedback.

21:40 *What Features Influence Impact Feel? A Study of Impact Feedback in Action Games...68*

Zhonghao Lin and Haihan Duan (The Chinese University of Hong Kong, Shenzhen, China); Zikai Alex Wen (The Hong Kong University of Science and Technology (Guangzhou), China); Wei Cai (The Chinese University of Hong Kong, Shenzhen, China)

How to make the hits feel satisfying is a long-term problem for action game designers. However, there is neither a word explicitly defining this subtle feeling nor research that figures out how detailed features influence the impact of hits. Hence, we propose the word impact feel, a sub-genre of game feel, to describe the tasty feeling when receiving juicy impact feedback. By collecting game comments from the Steam platform, we train a Natural Language Processing (NLP) model to rank popular action games with their performance on impact feel. We present a 19-features framework of impact feedback design and examine it on the top 8 and last 8 games. As a result, we figure out that hit stop, sound coherence, and camera control can strongly influence players' impact feel. As long as the designer messes up one of these three features, players' impact feel will be ruined. Our result can be used as the evaluation metric for further study.

22:00 *Balancing the Performance of a FightingICE Agent Using Reinforcement Learning and Skilled Experience Catalogue...74*

Akash Cherukuri (Indian Institute of Technology, Bombay, India); Frank G Glavin (National University of Ireland, Galway, Ireland)

Dynamic Difficulty Adjustment (DDA) is the process of changing the challenge offered dynamically based on the player's performance, as opposed to the player manually choosing the difficulty from a set of options. This helps in alleviating player frustration by having the opponents' skill match that of the player's. In this work, we propose a novel application of a DDA technique called Skilled Experience Catalogue (SEC) which has previously been used with success in First Person Shooter games. This approach uses experiential milestones of the learning process of an agent trained using Reinforcement Learning (RL). We have designed and implemented a custom SEC on top of the FightingICE platform that is used in the Fighting Game Artificial Intelligence (FTGAI) competition. We deployed our SEC agent against three fixed-strategy opponents and showed that we could successfully balance the game-play in two out of the three opponents over 150 games against each. Balancing was not achieved against the third opponent since the RL agent could not reach the required skill level after its initial training.

22:20 *A Visual Programming Interface for Experimenting with Volumetric Video...80*

Andrew Hogue (Ontario Tech University, Canada); Cindy Poremba and Veronika Szkudlarek (OCAD University, Canada); Nick Fox-Gieg (York University, Canada); Alvaro Quevedo, Colin Orian and Jakob Anderson (Ontario Tech University, Canada)

Volumetric video is an emerging form of digital media that remains restrictive and less accessible for artists and creators. This is largely due to the prevalence of high-end expensive commercial systems and the lack of free/open-source development tools allowing for algorithmic experimentation. Although volumetric video is gaining momentum in various fields (e.g., education, training, entertainment), the technology presents a disruption for artists and creators. This paper presents a new visual programming interface named VolNodes, designed for maximum flexibility to process volumetric data focused on the needs of independent digital media creators. Results indicate that VolNodes is highly flexible and capable of leveraging existing algorithms/scripts/executables within a dataflow-centric pipeline.

22:40 ***3D Hexglyph Maps: An Immersive Analytics Technique Combining Hexbin Maps with Space-Time Cubes for Visualizing eSports Data...86***

Robin Horst and Lukas Wehenkel (RheinMain University of Applied Sciences, Germany); Ralf Dörner (Hochschule Rheinmain - University of Applied Sciences, Germany)

Displaying multivariate tempo-spatial data such as from competitive strategy games can support people in the challenging task of analyzing them. Within the Immersive Analytics discipline, technologies such as Virtual Reality (VR) and Augmented Reality are utilized for rendering such complex data and extending the tool set of analysts. In this paper, we introduce 3D Hexglyph Maps -- a visualization technique drawing from both the Space-Time Cube and the Hexbin Map techniques for use in VR. We illustrate how we applied our glyph-based technique for analyzing trajectorial match data of the prominent Electronic Sports game League of Legends and discuss identified potential and limitations. The results of our user study show that our technique performed well concerning the completion rates, that our participants needed a short period before efficiently understanding the visualization by means of the completion times, and that an increase of the players whose data are visualized leads to a slight deceleration of the analysis process.

Monday, November 28

Monday, November 28 10:15 - 12:00 (America/Barbados)

LectSess-A: Lecture Session A

Room: Garrison 1

10:15 ***Win Prediction from the Snowball Effect Perspectives...92***

Chanhyeok Jung and Huy Kang Kim (Korea University, Korea (South))

The global E-sports market has been growing steadily. In particular, "League of Legends" holds large international competitions every year, and professional leagues are held in each region. This paper conducted a study to predict advantageous teams in real-time using the time series data of League of Legends. A dataset was built by collecting game data with the API provided by Riot Games. Existing win-loss prediction studies using time series data have a limitation in that they learn as the final win-loss team without considering the flow of the game. To compensate for this, we propose a method of classifying

advantageous real-time teams based on global gold indicators and learning with time series models. We trained LSTM, GRU, and RNN models using 76 features that subdivided the collected in-game data by position. As a result, our experiments show that all three models achieve an accuracy of more than 91%.

10:35 *Developing a VR Socially Assistive Robot Simulator Employing Game Development Tools…98*

Silas Franco dos Reis Alves and Alvaro Uribe Quevedo (Ontario Tech University, Canada); Delun Chen (University of British Columbia, Canada); Jon Morris (JDQ Systems, Canada)

Long-term care facilities (LTCFs) face challenges due to the personalized care required by people with developmental disabilities. The COVID-19 pandemic exacerbated the issues associated with limited staff who are overworked. Such a scenario also disrupted the research and development of socially assistive robots (SARs) as access to care facilities and the elderly was restricted. The restriction sparked creative thinking and innovation aimed at addressing the challenges introduced by the pandemic. Such is the case for developing Aether, a SAR designed to monitor falls and engage in playful activities with users. This paper presents the use of game technologies to develop a Virtual reality digital twin simulator for overcoming the lack of access to LTCFs and the elderly by creating synthetic data that simulates the robot's behavior, interactions with the environment, and virtual avatars, before its deployment. Our approach additionally allows overcoming the limitation with traditional datasets for training machine learning where depicted people and actions are not representative of the elderly population. Our preliminary results indicate that combining DTs and VR expedites robot development. We tested and compared the robot navigation, person detection, and inspection behavior while observing COVID-19 restrictions.

10:55 *The Effect of Attention Guidance and the Potential of Cinematic Augmented Reality in Narrative Immersion…102*

Jason Kao (Inland Norway University of Applied Sciences, Norway); Karen Kao (YBL Education Foundation of Management, Taiwan)

This paper discusses issues relate to narrative immersion in cinematic extended reality (CXR). System immersion built by reality technologies forms the fundamental feature of the new medium of storytelling. Attention guidance is widely applied in CXR to maintain the flow of narrative immersion. The authors review several attention guidance approaches and suggest diegetic cue is the preferred method in CXR since it embeds in the scene and less disturbs the storytelling. A framework is proposed in this paper to illustrate pathways of Cinematic Augmented Reality (CAR) and Cinematic Virtual Reality (CVR) to achieve narrative immersion. The authors conclude that CAR has more advantages in fulfilling narrative immersion than CVR due to viewers' reinforced involvement in CAR, suggesting the value of exploring the potential of CAR as a storytelling medium.

Presenter bio: Associate professor in game developments

11:15 *An Assistance System Framework for Virtual Reality Self-Service E-Learning Kiosks…107*

Robin Horst and Ramtin Naraghi-Taghi-Off (RheinMain University of Applied Sciences, Germany); Ralf Dörner (Hochschule Rheinmain - University of Applied

Sciences, Germany)

Digital self-service kiosks are an essential element in various customer-oriented application areas such as self-check-ins at the airport, or self-ordering at fast-food restaurants. Besides, self-service kiosks are also used frequently for educational purposes, for example, to inform visitors at certain exhibits in museums. Furthermore, Virtual Reality (VR) technology has proven to be able to support learning experiences in such cases. However, being used unsupervised and by visitors novel to VR, the experience of these VR self-service E-learning kiosks can suffer greatly besides health- and safety-related challenges. In this paper, we explore the use of assistance systems to support users in the mentioned use-case. We propose a component-based assistance system design for VR. We divide the assistance functions within our system into direct and indirect assistance functions, depending on whether a user may actively trigger them or the functions trigger automatically based on given pre-conditions. We demonstrate the feasibility of our concepts by a reference implementation and discuss the limitations and possibilities of our resulted system. We show that our system meets the users' needs and can proactively support them before potential challenges occur.

11:35 ***Data Analysis and Friendship Prediction for Twitch Streamers...113***

Elham Azizi and Loutfouz Zaman (Ontario Tech University, Canada)

Designing recommendation systems for social networks is a common practice, and live-streaming platforms are not an exception. However, due to data and processing limitations not much work has been done to analyze these networks. In this paper, we analyzed a Twitch network gamers dataset and designed a new recommendation framework based on the specific characteristics of this dataset. The framework consists of three different layers: data, interest, and recommendation layer, each considering specific tasks. The results show the effectiveness of these friendship connection predictions among users.

11:55 ***A System for Giving Presentations with the NAO Robot...119***

Michael Hosein (University of the West Indies, Trinidad and Tobago); Permanand Mohan (The University of The West Indies, Trinidad and Tobago)

In this paper, we describe our work in developing a presentation system to enable the NAO humanoid robot to give prepared presentations to a human audience. The objective is for the robot to deliver the presentation in a manner that is comparable to a good human presenter. We developed a gesture repository consisting of generally accepted effective hand gestures to use during a presentation. We also developed a Presentation Markup Language (PML) which enables a user with relatively little technical knowledge to specify the components of a presentation such as the text of the speech, the hand gestures to use and at which point, and multimedia elements such as images, audio, and video. From the PML, our system generates a program which tells the robot exactly how to deliver the presentation. The robot presentation system has been internally evaluated with hundreds of speech fragments and the speech algorithms have been enhanced to improve synchronization with gestures and multimedia elements. Several presentations have been successfully delivered to audiences in a range of "live" settings. The robot presentation system also caters for non-standard English speeches, enabling the robot to give presentations that can appeal to audiences of different cultural backgrounds.

Presenter bio: Dr. Michael Hosein is currently a lecturer in the Department of Computing and Information Technology Computer Science at The University of the West Indies, where he lectures mainly in the areas of wireless and mobile computing, distributed systems, computer networks, networking technologies, and

computer programming. He teaches the course "Wireless and Mobile Computing" in which wireless apps are developed. He is also involved in app development using Bluetooth.

12:15 *Extended-XRI Body Interfaces for Hyper-Connected Metaverse Environments...125*

Jie Guan and Alexis Morris (OCAD University, Canada)

Hybrid mixed-reality (XR) internet-of-things (IoT) research, here called XRI, aims at a strong integration between physical and virtual objects, environments, and agents wherein IoT edge devices are deployed for sensing, context understanding, networked communication and control of device actuators. Likewise, as augmented reality systems provide an immersive overlay on the environment, and virtual reality provides fully immersive environments, the merger of these domains leads to immersive smart spaces that are hyper-connected, adaptive, and dynamic components that anchor the metaverse to real-world constructs. Enabling the human-in-the-loop to remain engaged and connected across these virtual-physical hybrid environments requires advances in user interaction that are multi-dimensional. This work investigates the potential to transition the user interface to the human-body as an extended-reality avatar with hybrid extended-body interfaces that can interact both with the physical and virtual sides of the metaverse. It contributes: i) an overview of metaverses, XRI, and avatarization concepts, ii) a taxonomy landscape for extended XRI body interfaces, iii) an architecture and potential interactions for XRI body designs, iv) a prototype XRI body implementation based on the architecture, v) a design-science evaluation, toward enabling future design research directions.

Presenter bio: Jie Guan holds a MFA in the Digital Futures program at OCAD University and gained an undergraduate degree in Digital Painting & Expanded Animation at OCAD University. Currently, he engages in extending the Metaverse with the Internet of Things and Extended Reality.

Tuesday, November 29

Tuesday, November 29 9:45 - 10:45 (America/Barbados)

LectSess-C: Lecture Session C

Room: Garrison 1

9:45 *Teaching Emotional Regulation and Awareness Through a Virtual Reality Rhythm Game...131*

Maria Camila Bohorquez and Laura Montenegro Jaramillo (Toronto Metropolitan University formerly Ryerson University, Canada); Richard Lachman (Toronto Metropolitan University Formerly Ryerson-, Canada)

This project explores how a virtual reality and music-based game can be used to teach self-awareness and emotional self-management to teenagers. In partnership with Coschool, an organization in Cali, Columbia that teaches Social Emotional Learning skills to at-risk youth, we developed a series of prototypes that use a culturally specific drumming technique to teach emotional identification and regulation. Using a design thinking methodology, we worked with educators in Columbia to define needs and experiences when addressing these skills, combined this with pertinent literature in emotional education methodologies and

emerging technologies, and developed the game HeartTune. This paper presents the framework, design criteria, and prototype development with pilot-testing feedback from educators in Columbia.

Presenter bio: Dr. Richard Lachman directs the Zone Learning network of incubators for Toronto Metropolitan University, and Reserach Development for The Creative School faculty. He is an Associate Professor, Digital Media in the RTA School of Media, and also serves as a Technology and Creative Consultant for entertainment and software-development projects. Lachman completed his doctorate at UNE in Australia studying software recommendation-engines, did his undergraduate work in Computer Science at MIT, and holds a Master's degree from the MIT Media Lab's "Interactive Cinema" group. He was part of a startup acquired by Mattel, ending as Lead Designer and Lead Engineer for the Petz software with over 3 million units shipped worldwide. His areas of research include digital storytelling, technology ethics digital documentaries, augmented/locative/VR experiences, mixed realities, and collaborative design thinking.

10:05 *A Serious Game for Teaching Data Literacy…137*

Velian Pandeliev (University of Toronto, Canada); Alireza A. Namanloo (Ontario Tech University, Canada); Kelly Lyons (University of Toronto, Canada); Michael Bliemel (Ontario Tech University, Canada); Hossam Ali-Hassan (York University, Canada)

Experiential learning through computer games has been shown to impart a greater level of understanding and increased retention of concepts and relationships than more passive educational pedagogy, enabling students to better transfer lessons learned to the business world. Understanding data, making sense of it, interpreting it, presenting visualizations of it, telling stories with it, and using data to drive decisions are critical skills in today's workforce. In this paper, we present a case study describing the design and development of a serious game to teach data literacy to undergraduate-level university students. The game is modular and expandable, and it supports accessibility, multiple languages, and the use of different real-world scenarios. We describe the design principles we used, present the resulting data literacy game, and discuss our conclusions and future considerations for serious game design.

10:25 *Fostering Learning Motivation of Students with Reading and Spelling Difficulties by an AR-Enhanced Gamified Educational App for Literacy Learning…143*

Jennifer Tiede (University of Würzburg, Germany); Rita Treacy (WordsWorthLearning, Ireland); Silke Grafe (University of Würzburg, Germany); Eleni Mangina (University College Dublin, Ireland)

Students with special educational needs benefit from carefully designed learning approaches that consider both their individual learning requirements and the advances in teaching and learning methods and tools. This paper presents the initial exploratory results from a pilot study on the advancement of literacy skills through an innovative Augmented Reality (AR)-enhanced gamified educational app for students diagnosed with reading / spelling difficulties or dyslexia. A sample of 5 teachers and 23 students worked with the AR app for the duration of a school term and filled in standardized scales on student motivation upon completion of the pilot study. The analysis of the results indicates that both groups of teachers and students found the AR app motivating to a certain degree. However, there were challenges within the pilot implementation that impeded the successful app use and potentially delimited the perceived motivational effects. Conclusions and outlooks of research perspectives for further development highlight the necessity for further research in this important field.

Presenter bio: Dr. Jennifer Tiede is a research fellow at the department of School Pedagogy, University of Würzburg (Germany), where she mainly works in international research projects in the field of media pedagogy. She specializes in research on media-related educational competencies of preservice teachers and teacher educators, in the benefits and challenges of AR and VR in education, in the evaluation of pedagogical interventions on an international level and in game-based learning and gamification.

10:45 *Biology Project Training Tool: Novel Interface to Allow a User to Embody an Octopus for Biology Education...N/A*

Guillaume Carle (ISIMA, France); Mia Siebert (THE OHIO STATE UNIVERSITY, Ireland); Rosie O Reilly and Abraham Campbell (University College Dublin, Ireland)

One of the best ways to gain knowledge is to experience it in the field. Field studies are common technique in all levels of education but when studying biology could we extend this concept to allow a user to become the very life form that they are studying. This short paper argues that it could be possible to use Virtual Reality to allow a user to immerse themselves in a virtual world through a life form other than a humanoid avatar. Empathy for ones avatar has been clearly demonstrated over the last 30 years in VR and can even be true if the avatar is of a non-humanoid shape. The question is to know to what extent the control of a non-humanoid avatar is possible for a human user. This short paper outlines the first attempt at this research developing a virtual reality experience to allow a human user to control an octopus in a virtual world

11:05 *A Gamification Approach for Residential Electricity Demand Decarbonization...149*

Lucio Ciabattoni (Polytechnic University of Marche, Italy); Gabriele Comodi and Enrico Marchegiani (Università Politecnica delle Marche, Italy); Antonio Sabatelli (Revolt SRL, Italy)

Reduction and decarbonization of residential electricity consumption has become a major goal for EU. The use of ICT applications is one of the main drivers to reach this target. In this paper authors introduce a hardware and software solution able to monitor residential electricity consumption, suggest energy management/efficiency actions and products, guide and monitor user progresses towards a virtuous energy behavior. Gamification features (charts, badges, achievements) have been then added to the platform in order to enhance the engagement of users.

Presenter bio: Lucio Ciabattoni, born in San Benedetto del Tronto (AP) on 12 July 1986, he received in 2008 the first level degree in Informatics and Automation Engineering (cum laude) - in 2010 the Master Engineering degree in Industrial Automation Engineering (cum laude) - in 2014 Ph.D. degree in Information Engineering from the Universita' Politecnica Marche, Italy. Founder of the start-up META srl (www.metasistemi.it) in April 2014 and Revolt srl (www.revoltsrl.it) in January 2017. He is currently postdoc researcher at Università Politecnica delle Marche and chair of the Italian Chapter of the IEEE Consumer Electronics Society.

11:25 *Prototyping a VR Sandbox for Scene Customization Without 3D Authoring Skills...151*

Milena Novakovic, Silas Franco dos Reis Alves and Alvaro Uribe Quevedo (Ontario Tech University, Canada); Jon Morris (JDQ Systems, Canada)

Virtual Reality (VR) and simulation continue positioning as suitable tools for fine-tuning processes otherwise impossible in real life. Such is the case of Aether, a mobile service robot for elderly care

developed during the COVID-19 pandemic. Aether's development was negatively impacted due to restrictions placed on accessing long-term care facilities that impeded testing object tracking, elderly tracking, fall detection, and human-robot interactions. Our efforts to maximize Aether's development led us to create a digital twin where the core functionality is replicated to train the machine learning modules to optimize the robot's responses before real-world deployment. However, the digital twin creation requires significant authoring to ensure the virtual environment matches the real one by employing 3D technical artistry skills, which demands a professional knowledgeable in this domain. This paper presents a sandbox prototype for scene customization that allows importing, positioning, scaling, and saving changes for mobile robot simulation. Our preliminary testing of the sandbox has focused on usability to understand how the setting up of the environment is perceived. Preliminary results indicate that the sandbox is usable with improvements pertaining to improving the manipulation of the objects.

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