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ORAL PRESENTATIONS

July 29th (Timezone: GMT-3)

09:00 - 09:15: Opening Session

10:00 - 11:00: Oral Session 1: AI & Conversational Agents in Health**Paper 5311: Modular Low-Code Architecture for Trustworthy Conversational Agents with Governance and Clinical System Integration**

José Trajano Mendes Neto, Francisco Milton Mendes Neto, Cláudia Leite Rolim Moreira

KEYWORDS: CONVERSATIONAL AGENTS, DIGITAL HEALTH, LOW-CODE PLATFORMS, CLINICAL INFORMATION SYSTEMS.

Abstract: The rapid adoption of large language models (LLMs) has accelerated the use of conversational agents in digital health. However, in regulated and safety-critical environments, challenges related to trust, governance, and controlled integration with clinical information systems continue to limit their practical deployment. In particular, reliance on model-level behavior alone is insufficient to ensure operational safety and compliance. This paper proposes a modular architectural pattern for governed orchestration of LLM-based conversational agents in healthcare. The approach integrates (i) explicit separation between institutional knowledge, structured clinical data, and session-level context, (ii) a configurable governance layer that decouples prompts, model parameters, and operational constraints from workflow implementation, and (iii) controlled interaction with clinical systems through rule-based, tool-restricted operations. The architecture was implemented using a low-code orchestration platform and evaluated in a test healthcare environment through controlled scenario-based testing. The evaluation included repeated execution of operational scenarios, inspection of workflow logs, and analysis of system behavior. Observations indicate consistent enforcement of architectural constraints, absence of unsupported data generation in tested scenarios, and response latency ranging from 5 to 10 seconds depending on the type of request. The results suggest that embedding governance and control mechanisms at the architectural level can improve transparency, traceability, and operational reliability of conversational agents in healthcare. The proposed approach highlights the importance of system-level design in supporting trustworthy AI beyond model-centric optimization.

Paper 8309: Medical General-Purpose LLMs for Virtual Patient Simulation? Comparative Evaluation OSCE-Aligned Scenarios

Abdulrahman Aloraini

KEYWORDS: VIRTUAL PATIENTS, LARGE LANGUAGE MODELS, MEDICAL EDUCATION, OSCE, CLINICAL SIMULATION

Abstract: Selecting a Large Language Model (LLM) for virtual patient (VP) simulations remains an open question in medical education. Many LLMs have been trained on clinical data, but whether they can convincingly behave like a patient has not been thoroughly studied. We report the first systematic comparison of eight open-source LLMs (four medical-specialized, four general-purpose) on this task. Using a full factorial design, we generated 576 unique simulated conversations and scored them with a dual framework: seven practical deployment metrics plus six literature-derived metrics grounded in the RIAS communication coding system and the CARE empathy scale, all validated by three blinded clinicians. When grouped by category, general-purpose LLMs performed better on both automated and human evaluations. The top four individual models (a mix of medical and general-purpose) earned statistically equivalent human ratings, all above 4.6/5, while the bottom two, both medical, suffered from poor fine-tuning. What predicted simulation quality was base model architecture and fine-tuning quality, not whether the model carried a “medical” label. Model choice was the dominant source of performance variance ($ICC = 0.074$ for scenario), while clinical scenario accounted for under 8%. Practical and literature-based metrics captured overlapping but partially distinct constructs (Spearman $\rho = 0.619$), with individual model rankings shifting substantially between frameworks, indicating that conversational fluency and socio-emotional depth require separate evaluation. These findings suggest that medical educators should prioritize well-constructed, instruction-tuned LLMs rather than restricting selection to medical-specific models.

Paper 3961: Always On: Qualitative Study Agents 24/7 Tool for Relief within Fragmented Caregiving Routines

Beatriz Jardim Peres, Lilian Motti, Teresa Alvadia, Elvio Rúbio Gouveia

KEYWORDS: INFORMAL CAREGIVERS, AI-AGENT, DAILY ROUTINES, EMOTIONAL STATES

Abstract: Informal caregivers provide essential long-term support for family members, yet they frequently experience severe time constraints and emotional strain that existing support services cannot always accommodate. This paper investigates how an AI-based agent functions as an accessible tool to be integrated into the fragmented daily routines of informal caregivers for emotional support. Through a qualitative study with 10 participants, we find that the system's primary value lies in its on-demand availability, allowing users to find immediate relief at home during brief breaks or in moments of acute anxiety. Our findings identify the AI-based agent as a non-judgmental interface providing security and reduced cognitive load. While time constraints remain, the results suggest the AI-based agent can act as a critical 24/7 complement to traditional support, filling the gap when other resources are unavailable. Ultimately, this research highlights how automated agents can provide a sustained supportive presence and emotional relief within the caregiver's everyday environment.

Paper 2444: Teaching Dragons How Humans Fly Investigating the Learning Teaching Effect Using Teachable Virtual Agents with Primary School Students

Marius Griebhammer, Richard Schörner, Linda Graf, Maic Masuch

KEYWORDS: LEARNING BY TEACHING, TEACHABLE AGENTS, VIRTUAL AGENTS, VIRTUAL REALITY, VR, LEARNING, MOTIVATION

Abstract: Learning by teaching is an established learning approach across a wide range of age groups, particularly in primary and secondary education, that has also proven effective in interactions with virtual teachable agents. However, most prior work has focused on 2D screen-based environments, leaving the role of immersive technologies like Virtual Reality (VR) largely unexplored. Therefore, we developed a VR application in which children teach a virtual dragon about flying in hot air balloons. In a between-subjects study with primary school students (N = 57), we investigate whether learning by teaching in VR offers advantages over a comparable PC-based version, and a conventional learning method (control condition). We evaluated short- and long-term learning outcomes, intrinsic motivation, and relatedness to the respective agent. Across both learning outcomes, as well as motivational measures, no significant differences emerged between the groups. We discuss possible explanations, including the degree of interactivity achievable with the agent, and highlight both the potential and the practical challenges of immersive learning by teaching applications for young learners.

11:15 - 12:30: Oral Session 2: AI & Technological Healthcare Solutions**Paper 7040: Adaptive System for StepMania Students using Large Language Models**

Samuel Alves Tavares, Rita Maria Silva Julia, Marcelo Zanchetta do Nascimento

KEYWORDS: EXERGAMES, SERIOUS GAMES, ADAPTIVE LEARNING, LARGE LANGUAGE MODELS, PROCEDURAL CONTENT GENERATION, MOTOR COORDINATION, STEPMANIA.

Abstract: Physical inactivity among youth has reached critical levels worldwide, making tools that promote motor development through engaging activities increasingly important. Exergames, electronic games that integrate physical movement with virtual environments, offer a promising approach, yet their effectiveness may be limited when difficulty levels do not adapt to individual performance. This work proposes an adaptive system for the rhythm game StepMania 5 that leverages large language models (LLMs) to generate personalized dance-pad levels based on individual player performance. The system extracts per-note timing accuracy and per-track hit statistics from replay data and transmits these metrics to an LLM, along with pedagogical instructions, for adaptive chart generation. A pilot quasi-experimental study with 12 third-grade students (8 years old) using dance pads compared an experimental group ($n = 6$) receiving AI-adapted levels against a control group ($n = 6$) playing fixed charts over multiple sessions. Both groups performed the same original chart in their final session to ensure comparable evaluation. The experimental group achieved significantly lower timing deviations ($p = .041$, $r = -0.722$) and showed a trend toward higher accuracy ($p = .093$, $r = 0.611$). Session-level analysis revealed that, while the first session timing offset did not differ significantly between groups ($p = .132$), last session offsets diverged markedly ($p = .004$, $r = -0.944$), with the experimental group also exhibiting substantially lower outcome variance. These findings provide evidence that LLM-based adaptive chart generation can support personalized motor coordination development through exergame-based learning.

Paper 3873: Evaluating the Safety Local LLM-Generated Exercise Prescriptions Against Clinical Guidelines

Augusto M. P. de Mendonça, Filipe Pessoa Sousa, Igor Machado Coelho

KEYWORDS: LARGE LANGUAGE MODELS, EXERCISE PRESCRIPTION, CLINICAL SAFETY, PATIENT SAFETY, PUBLIC HEALTH INFORMATICS

Abstract: Large language models are increasingly employed as fitness coaching tools, yet their ability to generate clinically safe exercise plans, particularly for individuals with chronic conditions, remains largely unexplored. Based on a complementary literature search, this work presents the first fully deterministic audit of exercise plans generated by four local open-source LLMs running entirely on consumer-grade hardware via Ollama, without commercial API dependencies. A total of 288 plans spanning eight patient profiles and three prompt authority framings were evaluated against 15 criteria grounded in ACSM, WHO, ADA, and AHA clinical guidelines. The experiments reveal a safety–calibration paradox: all models achieve high safety scores yet systematically fail at age-stratified intensity calibration, a limitation that persists regardless of model size or clinical specialization. Furthermore, prompt authority framing significantly modulates both safety alignment and refusal behavior. These findings suggest that local LLMs can produce structurally complete exercise plans at lower cost than commercial alternatives, but require complementary rule-based intensity verification before deployment in clinical or digital health settings. All source code and datasets are publicly available.

Paper 2902: AI-Based Performance Evaluation Serious Games for Motor Rehabilitation: Preliminary Mapping Study

Paulo C. M. Santos, Rummenigge R. Dantas

KEYWORDS: SERIOUS GAMES, MOTOR REHABILITATION, ARTIFICIAL INTELLIGENCE, EVALUATION

Abstract: The growing demand for accessible rehabilitation solutions has motivated the integration of Artificial Intelligence (AI) into serious games as an alternative to traditional physiotherapy. However, it remains unclear how AI has been systematically employed to evaluate user performance in such applications. This paper presents a preliminary mapping study examining 40 publications (2020–2026), extracted from Scopus, IEEE Xplore, PubMed and ACM Digital Library, analyzing five dimensions: clinical context, AI mechanisms, collected data, evaluation metrics, and main limitations. Results show that the majority of studies (67.5%) employ context-specific or hybrid AI approaches with no single gold standard, while computer vision is the most prevalent data source (n=18), reflecting a trend toward low-cost, non-invasive home-based solutions. Physical rehabilitation and neurology account for 40% of the studied contexts. Despite a notable growth in publications from 2023 onward, the field remains predominantly at a proof-of-concept stage, constrained by small sample sizes, absent standardization protocols and a persistent gap between technical accuracy and clinical effectiveness. These findings highlight the need for large-scale RCTs, domain-specific datasets and ethical frameworks for biometric data governance in future research.

Paper 1426: The Role Software Engineering the Development Serious Games for Health: Systematic Literature Review

Bruna M. Barbosa, Carlos Henrique R. Souza, Halleff H. Reis Santos, Luciana O. Berretta, Sérgio T. Carvalho

KEYWORDS: SOFTWARE ENGINEERING, SERIOUS GAMES, HEALTH, REQUIREMENTS ENGINEERING, SYSTEMATIC REVIEW.

Abstract: The development of Serious Games for Health faces the complex challenge of aligning playful engagement with scientific fidelity. This paper investigates, through a Systematic Literature Review (SLR), which Software Engineering practices, methods, and models researchers use to guarantee and validate the coherence between game mechanics and proposed health objectives. From an initial set of 2,170 records, the review selected 8 primary studies that met the inclusion criteria. The results show that all selected approaches adapt agile methodologies, frequently complemented by visual artifacts to bridge communication gaps. Moreover, 87.5% of the studies (7 out of 8) explicitly address the translation of therapeutic requirements, indicating effectiveness when formal frameworks map clinical protocols directly to game mechanics. Overall, the findings demonstrate that representing clinical protocols as software rules and involving health experts as active co-designers ensure traceability, therapeutic efficacy, and safety of digital interventions.

Paper 7572: IoT Solution Towards Smart Diabetic Foot Monitoring Using Machine Learning

Silvio Soares Carreiro, Valéria Lelli, Paulo Fernandes Rodrigues, Maria Luiza Felipe Carolino, Donnavan Souza de Carvalho, Fabiana Gomes Marinho

KEYWORDS: DIABETIC FOOT, INTERNET OF THINGS, MACHINE LEARNING, DATASETS

Abstract: Internet of Things (IoT) solutions are widely used to monitor patients' vital signs, using sensors attached or implanted in various parts of their bodies to track physiological states, such as pulse rate, body temperature, and other vital indicators. Specifically in diabetic foot care systems, wearable devices (e.g., smart insoles and socks) are used to assist in the prevention and treatment of diabetic foot disease at all stages, from early detection of ulcers to advanced care. Furthermore, incorporating machine learning techniques into such solutions can support data-driven analysis and assist in clinical decision-making. Key challenges include the scarcity of standardized annotated data for training models, the high cost and maintenance of smart wearable devices, and network complexity that may disrupt daily activities. To address these challenges, this paper presents a structured IoT- based system architecture for smart diabetic foot monitoring, integrating sensing, communication, and cloud processing into a functional prototype, including the evaluation of relevant datasets and machine learning algorithms.

14:00 - 15:30: Oral Session 3: Exergames, Active Living & Play**Paper 5517: GestRunner: A Persuasive Gesture-Based Game for Mitigating Sedentary Behaviors in Workplaces**

Grace Ataguba, Kuldeep Gajera, Gerry Chan, Oladapo Oyeboode, Luv Patel, Rita Orji

KEYWORDS: SEDENTARY BEHAVIOR; GESTURE-BASED INTERACTION; PERSUASIVE GAMES, OCCUPATIONAL HEALTH

Abstract: Prolonged sedentary behavior in desk-based environments is linked to cardiometabolic and musculoskeletal risks. Although upper-body micro-exercises are recommended to interrupt sitting, adherence remains low due to workflow constraints. Most digital interventions emphasize standing or step-based activity, leaving a gap for workstation-compatible upper-limb solutions. This paper presents GestRunner, a gesture-controlled serious game that embeds upper-body micro-movements into gameplay using real-time hand tracking. We map implemented gesture patterns to evidence-based seated exercises, including arm circles, overhead presses, push-like motions, and dynamic stretching. In future work, we will conduct a biomechanical correspondence analysis to evaluate the feasibility of these mappings within workstation constraints. While physiological outcomes were not measured, the proposed framework demonstrates the potential of persuasive gesture-based interaction to integrate light-intensity upper-body activity into sedentary digital environments and provides a foundation for future comparative validation.

Paper 3399: Effort, recovery, and engagement: heart rate–based study the Cardia Game should not used

John Henry, Marlene Cristina Neves Rosa, Connah Kendrick

KEYWORDS: EXERGAME DESIGN, HEART RATE MONITORING, PHYSIOLOGICAL MONITORING, PHYSICAL ACTIVITY ENGAGEMENT.

Abstract: Integrating heart rate (HR) feedback into game mechanics offers a promising strategy to promote engaging and well-paced physical activity. This study investigates the physiological demand, temporal HR dynamics, and user acceptability of the Cardia Game, an exergame in which player movement is directly driven by real-time HR during a monster-chase mechanic. Twenty participants completed gameplay sessions with continuous HR monitoring. HR data and gameplay logs were synchronised using timestamp alignment, and values were normalised (HR z) to enable relative comparisons. Functional demand was analysed across game activities, post-transition time windows (5–10 s, 10–20 s, 20–30 s), and in relation to threat proximity. Running phases produced sustained moderate- to-high effort (median HR $z = 0.56$), whereas final jump activities generated short high-intensity peaks (median HR $z = 1.10$). Early jump phases functioned as relative recovery periods. HR responses increased within 10–20 s following transitions and stabilised around 20–30 s. A strong association between threat proximity and HR response (median Spearman $\rho = -0.88$) indicated effective coupling between game mechanics and physiological arousal. Participants reported high usability and enjoyment. These findings support the potential of HR-driven exergames for motivating and physiologically structured physical activity.

Paper 8610: A Wireless Digital Pneumotachograph for Respiratory Exergames

Leonardo Cordeiro da Silva Santos, Marcelo da Silva Hounsell

KEYWORDS: EMBEDDED SYSTEMS, EXERGAMES, RESPIRATORY THERAPY, SENSING, SERIOUS GAMES, SIGNAL PROCESSING.

Abstract: This paper details improvements to a previously validated device, named “PITACO,” used as an incentive spirometer for exergame-based respiratory therapy. The new device reduces costs compared to its predecessor by employing a more accessible differential pressure sensor and low-cost 3D printing. It maintains compatibility with existing exergames through Bluetooth Serial Port Profile, ESP32, and FreeRTOS technologies. Furthermore, it eliminates manufacturing risks associated with burning plastics and using sharp objects inherent to the original design. To validate this device, sequential tests were performed using the game “I Blue It.” Results showed high similarity and low variation between both devices, consolidating the new “PITACO 2.0” as a superior substitute to its predecessor.

Paper 8469: Neural Networks Learning Play Truco through Reinforcement Learning

Thales Bueno Pasqual, Glauco A. P. Caurin, Daniel V. Magalhães

KEYWORDS: NEURAL NETWORKS, REINFORCEMENT LEARNING, CARD GAMES

Abstract: This work utilizes a Neural Network with a single hidden layer employing the Rectified Linear Unit (ReLU) activation function to make decisions in the popular Brazilian card game Truco (São Paulo version). The Inputs represent the game state from the perspective of a single player, and the Outputs represent the decision-making actions (play a card or place a bet). The Artificial Intelligence is trained through Reinforcement Learning using the game's own scores as rewards (transformed into negative values for punishment). The ADAM algorithm was used for network optimization, and the Bellman equation was employed to define the estimated gains of desired actions, using different strategies for comparative purposes. The training was conducted with matches played in pairs, involving 4 agents (2x2), where all learn from each other's experiences, however utilizing different approaches regarding the exploitation/exploration trade-off during training. To verify the effectiveness of the AIs, a round-robin tournament was held, including an untrained player (random decisions), using the same AI within each pair, to calculate the win rate among the AIs. The result showed success for most strategies, yet all of them provided valuable insights.

Paper 3238: The Discursive Topic Integration Framework: Designing Health Topics into Play

Marcelo Simão de Vasconcellos, Cláudio Manuel Rodrigues, Roberto da Rosa Faller, Cátia Oliveira, Flávia Garcia de Carvalho

KEYWORDS: GAMES FOR HEALTH, DISCURSIVE DESIGN, EMOTIONAL DESIGN, PUBLIC HEALTH, SERIOUS GAMES, GAME STUDIES.

Abstract: Games for health increasingly address topics that are socially embedded, emotionally charged, and structurally complex, including menstrual health, domestic safety, and ethnic-racial health inequalities. These themes extend beyond information delivery and involve lived vulnerability, stigma, responsibility, and collective negotiation. When translated into playable systems, such dimensions can introduce friction that destabilizes engagement. This paper presents the Discursive Topic Integration Framework as a structured approach for analyzing and designing the integration of health-related discursive topics into games while sustaining emotional receptivity and playability. The framework identifies five interrelated design dimensions: topic depiction, emotional climate, emotional anchors, topic delivery, and exposure timing. Drawing on three case studies, it examines how sensitive health issues are translated into playable experiences. By reconceptualizing the magic circle as a permeable design heuristic rather than a rigid boundary, the framework contributes a conceptual lens and a structured vocabulary to support the analysis and design of experientially grounded games for health.

16:00 - 17:30: Oral Session 4: Virtual Reality, Mixed Reality & Serious Games**Paper 2989: Pain Perception Immersive Virtual Reality and Mixed Reality with the Cold Pressor Task***Maxim Kuznetsov, Aviv Elor, Sri Kurniawan***KEYWORDS: VIRTUAL REALITY, MIXED REALITY, PAIN, CROSSOVER DESIGN, PRESENCE, SERIOUS GAMES**

Abstract: Immersive virtual reality (VR) has shown promise as an effective non-pharmacological analgesic, theorized to primarily work through presence-mediated distraction. Recent developments have enabled consumer access to immersive mixed reality (MR), which grounds virtual elements in the user's real surroundings. As MR becomes increasingly available on consumer headsets, and as AR glasses capable of similar digital overlays approach mainstream adoption, understanding the therapeutic efficacy of these blended-reality experiences relative to VR is essential for informing their use in therapeutic contexts such as pain management. This study conducted an exploratory comparison of MR and VR during the cold pressor task (CPT), employing a randomized crossover design with a counterbalanced condition order and a washout period. Using a Meta Quest 3, 25 participants completed the CPT while interacting with an identical game in either VR or MR mode. Pain tolerance, measured as time to hand withdrawal, was analyzed using survival analysis and a linear mixed model, supplemented by electrodermal activity and validated questionnaires. Results suggest that VR elicited significantly greater presence than MR, while pain tolerance did not differ significantly between conditions, though VR showed a small but consistent trend towards higher pain tolerance. These findings support the validity of the experimental design and are consistent with a presence-mediated distraction hypothesis, though the non-significant pain outcome limits causal interpretation. Exploratory analyses suggested a possible temporal pattern, with VR's relative advantage increasing after the initial shock of the ice bath before leveling off. Lastly, this work establishes a methodological foundation for comparing analgesic efficacy between VR and MR, though the study was underpowered to detect the observed effect size and adequately powered replications are needed to confirm these findings.

Paper 8443: Investigating Different Modalities Behavioral Approach Tests for Spider Phobia Virtual Reality

Florian Grensing, Vanessa Schmücker, Anne Hildebrand, Tim Klucken, Maria Maleshkova

KEYWORDS: ARACHNOPHOBIA, BAT, PHYSIOLOGICAL DATA, PRESENCE, PHOBIA, PSYCHOLOGY, SPECIFIC PHOBIA, VIRTUAL REALITY

Abstract: Behavioral approach tests (BAT) are a common means of assessing specific phobias. In these tests, participants move towards an anxiety-inducing stimulus as close as they are willing to, with the final distance indicating the severity of the anxiety. In this work, we aim to evaluate a virtual reality implementation of the BAT. For this purpose, four different BATs were designed, consisting of two approach methods, both replicated in vivo and in vitro. Evaluation of these BATs is done by using a standardized presence questionnaire, application-specific questions, as well as physiological reactions of the participants. Since the study focuses on the fear of spiders, a real and virtual spider is chosen as anxiety-inducing stimulus. Our results show that the developed VR BAT perform within established presence norms, while the different modalities influenced participants' subjective impressions. Furthermore, the standardized structure of the VR environment ensured a consistent experience regarding the anxiety-inducing stimulus. This differs from the observation in the real-world setting, where the behavior of the spider might differ between individuals and also between sessions. This highlights one of the key advantages of virtual reality, which is the complete control of the stimulus and environment. Correlations between presence and physiological signals were found. Particularly, tonic electrodermal activity levels are more stable with increased presence. However, more research into this is required, as the effects of anxiety on the physiological signals make the correlations difficult to interpret. The evaluation has revealed, which design choices are particularly promising for increasing presence in VR applications, and some which should be avoided. Overall, these results indicate that our VR-based implementation is a promising tool for assessing avoidance behavior for individuals with spider phobia.

Paper 1612: Towards Affordable Vibrotactile System for Haptic Feedback Serious Games with Vision-based Hand Tracking

Edwin Daniel Ona, Johnny J. Yepez-Figueroa, Hugo Alonso-Cámara, Alberto Jardón

KEYWORDS: VIBROTACTILE FEEDBACK, HAND RECOGNITION, GAMES FOR HEALTH, HAPTIC

Abstract: Hand tracking is a crucial feature when developing serious games for health, enabling natural interaction with virtual environments. However, systems oriented to complement this interaction by means of haptic feedback usually reduce the comfort and effectiveness in hand tracking. This paper presents the development and preliminary evaluation of an affordable, thimble-like device designed to provide vibrotactile feedback during natural hand interactions with serious games. The design includes slim 3D-printed flexible holders to attach the thimbles to the middle phalanges. However, the vibrotactile system operates on the fingertips and triggers whenever the user interacts with virtual objects. Unlike glove-based haptic systems, this minimalist design does not cover the hand. Thus, the proposed design aims to minimize the occlusions in hand tracking based on vision sensors, such as the Leap Motion Controller (LMC) or the embedded VR-headset hand recognition. The system's functionality was preliminarily validated through a usability trial with healthy participants comparing the influence in hand recognition using the proposed device and a commercial haptic glove. The influence of vibrotactile systems was quantified by the times the hand disappear in virtual environment. Results suggest that the thimble-like design is comfortable and does not alter the hand's morphology to affect vision-based hand recognition systems.

Paper 5666: Life Play: Serious Game Immersive Virtual Reality for Activities Daily Living Training Hospitalized Adults

Aléxia C.S. do Nascimento, Victor Sassi, Thiago Porcino, Mauro Felipe Felix, Esteban Clua, Mônica Rodrigues da Cruz

KEYWORDS: VIRTUAL REALITY; SERIOUS GAMES; REHABILITATION; USABILITY; PATIENT SAFETY; HOSPITALIZED PATIENTS.

Abstract: Prolonged hospitalization and immobility are associated with functional decline, reduced independence in Activities of Daily Living (ADLs), and increased morbidity. Conventional rehabilitation approaches often face challenges related to patient engagement, especially among individuals with psychological or motivational barriers. This study presents the development and validation of Life in Play, an immersive Virtual Reality (VR) serious game designed to support ADL training in hospitalized adult patients. A methodological pilot study was conducted in a hospital ward using a Meta Quest 3 headset, evaluating usability, safety, and acceptability. Usability was assessed using the System Usability Scale (SUS) with 33 physical therapists, yielding a mean score of 82.0 (± 8.0), indicating excellent usability. Acceptability and intrinsic motivation were measured using the IMI-TEQ-Br, yielding high Interest/Pleasure (6.33 ± 0.12) and low Pressure/Tension (2.95 ± 0.87), while safety was monitored through hemodynamic parameters and the Simulator Sickness Questionnaire (SSQ), which had a score of 16.52. Five patients completed the intervention. Most sessions were asymptomatic or presented only mild oculomotor symptoms, with one participant discontinuing due to claustrophobia. Repeated exposure resulted in reduced SSQ scores, and correlations were observed between hemodynamic parameters, BORG scale, and SSQ. Overall, the findings suggest that the VR system is usable, safe, and well accepted in the hospital setting, supporting its feasibility as an adjunct tool for ADL rehabilitation.

Paper 5950: Nurse Against Time: Serious Game Proof-of-Concept Promote Break-Taking Through Time–Energy–Morale Trade-offs

Stephane Gobron, Jun Keschubay, Marco Pedrotti

KEYWORDS: SERIOUS GAME; NURSES; FATIGUE; WORKLOAD; REST BREAKS; SELF-CARE; NURSING EDUCATION; TASK MANAGEMENT.

Abstract: Background: Nursing work is characterized by time pressure, repeated interruptions, and fatigue, which can contribute to performance degradation and adverse outcomes. Beyond explicit recommendations, break-taking often fails in practice due to workload and cultural factors. Objective: We present Nurse Against Time, a proof-of-concept 2D side-view serious game (SG) designed to promote break-taking implicitly through gameplay consequences. Methods: The player completes patient-care tasks within a limited shift time while managing two personal resources—Energy and Morale. Rest actions consume time but restore resources; insufficient self-care increases the likelihood of mistakes, which can extend task execution and precipitate failure. We conducted a formative evaluation using a short questionnaire after supervised play sessions (n=10; four nursing, four engineering, two other). Results: Participants reported high engagement (mean 83%) and strong visual adequacy (mean 90%), with moderate perceived realism (mean 73%). Most rated the pacing as appropriate (7/10) while 3/10 found it too slow. Energy/time mechanics were considered clear by 8/10 participants and somewhat clear by 2/10. Eight participants stated the game helped them understand nursing challenges. Conclusion: The proof-of-concept demonstrates the feasibility of using an implicit, consequence-driven design to encourage self-care behavior in a nursing context, motivating future work on onboarding, debriefing, instrumentation, and larger-scale evaluation with nursing students.

July 30th (Timezone: GMT-3)**09:00 - 10:00: Oral Session 5: Rehabilitation & Stroke Care****Paper 4586: Collaborative Rehabilitation-Exercise Serious Game for People with Stroke and their Caregivers: Pilot Study**

Elizabeth D. Vasquez, Jonathan Siskind, Marion S. Buckwalter, Maarten G. Lansberg, Sean Follmer, Allison M. Okamura

KEYWORDS: EXERGAME, REHABILITATION, STROKE.

Abstract: Motivation to perform movement therapy and care-giver burnout are major challenges to post-stroke life. Serious games have been shown to support therapeutic tasks in people with stroke, but there are few activities that simultaneously support informal caregiver health, which is also impacted post-stroke. Here, we present a collaborative, mutually beneficial, serious game designed to support therapy for persons with stroke and also exercise for their informal caregivers. One player performs rehabilitative wrist movements – useful to people with stroke – and the other performs a seated march exercise – useful to informal caregivers – via pedals or a keyboard to control their avatar. We present a pilot study with 6 healthy dyads to evaluate how exercise-based input of one player, the Pseudo Caregiver (PCG), impacts motivation and emotional experience in both the PCG and Pseudo Person with Stroke (PPS). While not statistically significant, we find that PCGs Interest subscale scores trended higher when using a pedal (the exercised-based input) compared to a keyboard, regardless of game play mode. PPSs' positive affect scale scores and Competence subscale scores trended higher when their partner played collaboratively with a pedal compared to a keyboard. These trends encourage future work toward incorporating an exercise-based device, such as a pedal, to enhance the emotional and motivational experience of rehabilitative serious games for people with different movement ability levels.

Paper 5614: Mobile Serious Game Tech for Accessible Stroke Rehabilitation

Marija Markovic, Carina Arnberger, Selina Breuer, Christoph Aigner, Thomas Grechenig, René Baranyi

KEYWORDS: REHABILITATION, STROKE, SERIOUS GAMES, MHEALTH

Abstract: Stroke is one of the leading causes of long-term disability, also containing cognitive and motor impairments that could also affect the independent daily living and functioning of people suffering from it. There are a few challenges, including attention deficits and memory problems. These could also affect information processing or learning. This work presents the analysis, design, and prototypical implementation of a smartphone-based serious game for attention training support, grounded in the Attention Process Training (APT) framework. Developed with domain experts and in consultation with a neurological expert, and evaluated with test participants, the solution includes a prototype and the underlying requirements for an accessible mobile serious game, demonstrating the potential of such a game-based interaction to support sustained cognitive training. The paper further discusses core design decisions, implementation considerations, and future development needs. Overall, the implementation shows that cognitive rehabilitation support via smartphones and serious games is feasible and offers a promising supplementary approach for attention training after stroke.

Paper 2960: Proposed Improvements for IoT-Based Interactive Environment for Lower Limb Physical Rehabilitation

Leonardo C. G. Manzke, Juan R. Stefani, Rafael L. Melo, Maria E. M. Almeida, Érico M. H. do Armaral, Julio S. Domingues Júnior

KEYWORDS: SERIOUS GAME, HEALTH TECHNOLOGY, EMBEDDED SYSTEMS, INTERNET-OF-THINGS.

Abstract: This paper introduces Victus Exergame, an IoT- integrated environment developed to support the rehabilitation of patients who have suffered the loss of a lower limb due to an amputation procedure. The system combines a low-cost embedded architecture using a NodeMCU ESP32 for the acquisition of heart rate, electromyography (EMG), and cycling speed with a serious game that leverages gamification to enhance patient engagement. Furthermore, a Progressive Web App (PWA) enables clinical data visualization and longitudinal session comparison. Data are transmitted via Bluetooth and stored in cloud-based repositories for continuous performance monitoring. Experimental validation was conducted with three amputee patients and four physiotherapists. Results indicated increased engagement during rehabilitation sessions and improved consistency in pedaling performance. System acceptance, evaluated through the Technology Acceptance Model (TAM), yielded mean scores above 4.0, demonstrating high perceived usefulness and ease of use. These findings underscore the technical feasibility and clinical potential of Victus Exergame as a scalable, cost-effective serious game solution for physical rehabilitation.

Paper 3049: Development Serious Game Incorporating Motion Capture for Physiotherapeutic Rehabilitation Individuals with Fibromyalgia

Maria Victória Brito Valentim, Luis Guilherme Silva Rodrigues, Juliana da Costa Feitosa, José Remo Ferreira Brega

KEYWORDS: DIGITAL GAMES, SERIOUS GAMES, MOTION CAPTURE, FIBROMYALGIA

Abstract: Fibromyalgia is a syndrome characterized by musculoskeletal pain that causes significant discomfort and compromises the quality of life of those who live with it. Among the treatments used to alleviate its symptoms, kinesiotherapy stands out, employing physical activities as a form of rehabilitation and treatment. The use of serious games in the rehabilitation of musculoskeletal disorders assists healthcare professionals in the application of specific exercises, while also enabling the integration and analysis of data generated during therapy sessions to improve treatment. These games further promote adherence and accessibility of medical instructions, in addition to reducing costs and improving clinical outcomes. In this context, the present work aimed to develop a serious game, named FibroQuest, which uses motion capture as a tool to support the physiotherapeutic treatment of fibromyalgia. By employing modern technologies such as MediaPipe Pose and Unity3D in its development, the game demonstrates the potential applications of these technologies in serious games, contributing to the improvement of the quality of life of people living with fibromyalgia.

11:00 - 12:15: Oral Session 6: Healthcare Training & Simulation**Paper 8368: Towards Physiology-Based Serious Game Scenarios for Pre-Hospital Care: Cyanide Intoxication Model***Benedikt Paul, Julia Hofmann***KEYWORDS: SERIOUS GAMES, PHYSIOLOGICAL MODELING, VIRTUAL PATIENTS, SIMULATION-BASED TRAINING, MEDICAL EDUCATION AND TRAINING, GAME-BASED LEARNING**

Abstract: Pre-hospital casualty care training increasingly relies on simulation-based approaches. While high-fidelity mannequin systems provide realism, they require instructor resources and are thus difficult to scale. Serious games offer a scalable alternative through interactive, scenario-based training, but existing pre-hospital treatment simulators commonly rely on fixed scripts that constrain decision-making. This work presents a deliberately simplified, physiology-driven approach to patient simulation in which scenario progression emerges from an underlying physiological patient model, with trainee actions determining outcomes rather than scripted branches. As proof of concept, a lightweight and transparent physiological model of cyanide intoxication is introduced that captures key aspects of poisoning progression relevant to emergency response. Using cyanide intoxication as a test case, we demonstrate how chemical exposure models can be integrated into serious games to enable action-dependent symptom development and outcome variability. The proposed approach supports that transparent, low-complexity physiology models might provide sufficient fidelity for scenario variability while remaining controllable for instructional design in pre-hospital emergency care games. The contribution is limited to model formulation and initial validation; educational outcome evaluation is left for future work.

Paper 3937: IMERSIVA: Virtual Reality System for High Impact Teaching Strategies

Felipe Cassiano Barbosa, Ana Gabriela da Silva Bezerra, Rodrigo Lages Barbosa, Daniel Rebouças Jaguaribe, Joel Sotero da Cunha Neto, Belmondo Rodrigues Aragão Junior

KEYWORDS: ARTIFICIAL INTELLIGENCE, HIGH IMPACT TEACHING STRATEGIES, LANGUAGE LEARNING, SERIOUS GAMES, VIRTUAL REALITY

Abstract: This paper presents "Imersiva," an integrated system designed to enhance English language conversation practice through the synergy of Virtual Reality (VR), Generative Artificial Intelligence (AI), and real-time pedagogical monitoring. While traditional methods often struggle with student anxiety and lack of immersion, "Imersiva" utilizes a service-oriented architecture to connect VR scenarios, such as a fruit market and a restaurant, with Large Language Models (LLMs) like Gemini 2.5 flash and GPT-5 mini. The system enables authentic, low-anxiety interactions with virtual agents while providing educators with a web-based dashboard for classroom orchestration. Preliminary results from usability and efficacy tests conducted with 15 participants, using a pre-test and post-test methodology, demonstrate significant improvements in conversational confidence and engagement. Evaluation through the System Usability Scale (SUS) yielded high scores, confirming the platform's intuitive design and its potential as a high-impact teaching tool. These findings suggest that the integration of immersive XR environments and intelligent conversational agents can effectively bridge the gap in oral practice within the educational sphere.

Paper 132: Play and Learn: Gamified Feedback for Ultrasound-Guided Catheter Insertion Training Virtual Reality

Mohammad Raihanul Bashar, Alejro Olivares Hernez, Yahia Zine, Anil Ufuk Batmaz

KEYWORDS: VIRTUAL REALITY, GAMIFICATION, SIMULATION, MEDICAL TRAINING, ULTRASOUND-GUIDED CATHETER INSERTION

Abstract: VR is widely used in procedural medical training, but many simulators prioritize realism over formative feedback. We developed a gamified VR simulator for ultrasound-guided peripheral IV catheter insertion, using aligned visual and auditory feedback such as progress indicators, guidance, and rewards. In studies with novices (N=24) and clinicians (N=12), gamification reduced task time, improved usability, and lowered workload. Qualitative results showed clearer goals and greater confidence for novices, and improved pacing for experts. Overall, gamification can provide effective formative feedback in VR medical training.

Paper 6505: Co-Designing an Educational Vaccine Serious Game for People with Dementia and Caregivers

Winnie Sun, Alvaro Quevedo, Sarah Pistritto, Sandra Omlin, Farzana Rahman, Nitha Reno, Robert Ingino, Amer Burhan

KEYWORDS: VACCINE EDUCATION, VIRTUAL REALITY, AUGMENTED REALITY, MOTION CAPTURE TECHNOLOGY, EXERGAMING, DEMENTIA CARE, CO- DESIGNING, INFLUENCE VACCINE

Abstract: The aim of this project is to develop an educational vaccine serious game for people with dementia (PWD) and their caregivers using co-design approaches. The objectives are to explore the potential educational benefits of vaccine education (focus on influenza, COVID-19 and pneumonia) for PWD and caregivers using virtual reality (VR) and iPad tablet technology, while examining the acceptability, and usability for the end-users. This study adopted a mixed methods approach to guide the co- designing of the vaccine education prototype and explore its acceptability and usability with 19 participants (composed of health care professionals (HCP), and caregivers) recruited from a Senior Community Centre and Regional Long-Term Care Division in Ontario Canada. Preliminary prototypes were developed including an iPad tablet game (non-VR version Bingo Style) and a VR headset-based game (VR version Jukebox Style). Usability testing using the System Usability Scale (SUS) yielded an average score of 83.24 (n=17), indicating high perceived usability. Qualitative feedback emphasized the importance of simplifying user navigation, enhancing educational onboarding, and offering diverse technology formats. These findings underscore the value of co-design in developing accessible educational tools and inform future iterations of the vaccine serious gaming to better meet the needs of PWD and their caregivers.

Paper 263: Design and Implementation Immersive Learning System for Scam Prevention Education

Inioluwa Kola-Adelakin, Hongmei Chi

KEYWORDS: VIRTUAL REALITY, SCAM PREVENTION, PIG-BUTCHERING, SEXTORTION, SERIOUS GAMES, SOCIAL ENGINEERING, IMMERSIVE LEARNING

Abstract: Cybercrimes including pig-butchering investment schemes, romance fraud, and sextortion are increasing in both prevalence and sophistication, disproportionately targeting vulnerable populations such as university students and older adults. Traditional awareness programs rely largely on passive information delivery and often fail to build practical resistance skills. This paper presents the design and preliminary evaluation of an immersive virtual reality (VR)-based training system for scam prevention education. Developed using the Godot game engine and using Meta Quest 2, the system features interactive, branching dialogue scenarios that simulate realistic romance scam encounters. Users make decisions at critical points, receive immediate feedback, and view dynamic risk visualizations that reflect the consequences of their choices: green (safe), gray (neutral), and red (high-risk). A pilot study (N = 10) using pre- and post-surveys and gameplay analytics demonstrated improved recognition of scam indicators, stronger identification of emotional manipulation and suspicious financial requests, and increased confidence in safe online interactions. Decision-path analysis further showed progressive selection of safer responses over repeated gameplay. These preliminary findings suggest that immersive, decision-based VR training can enhance digital resilience and reduce susceptibility to online fraud. Index Terms—Virtual Reality, Scam Prevention, Pig- Butchering, Sextortion, Serious Games, Social Engineering, Immersive learning

13:45 - 15:00: Oral Session 7: Cognitive Health, Well-being & UX**Paper 6091: “Beacon Hope”: Usability and Immersion Evaluation AI-Enhanced Serious Game for Anxiety and Depression**

Sarah Chameroy, Marcelo Melo, Julia Tannus, Danilo Rocha, Bruno De Paula, Gwladys Rubayita, Eduardo Naves

KEYWORDS: SERIOUS GAMES, MENTAL HEALTH, ARTIFICIAL INTELLIGENCE, GESTURE RECOGNITION, USABILITY EVALUATION.

Abstract: Anxiety and depression affect over 970 million people worldwide (2022), yet conventional treatments face challenges including high dropout rates (20-60%), limited accessibility, and stigma. While serious games show promise as complementary interventions, most existing solutions require specialized hardware, limiting widespread adoption. This paper presents “Beacon of Hope,” an accessible AI-enhanced serious game that leverages contactless gesture recognition (MediaPipe) and speech interaction (Web Speech API) to deliver evidence-based therapeutic techniques without specialized equipment. The game implements three mini-games targeting diaphragmatic breathing, cognitive restructuring through positive affirmations, and emotional regulation. A preliminary usability and immersion evaluation with ten healthy young adults (aged 20-27) employed the System Usability Scale (SUS) and EGameFlow immersion subscale. Results demonstrated excellent usability (SUS: 85.8/100) and medium immersion (EGameFlow: 4.93/7), with particularly strong cognitive engagement facilitating temporary detachment from worries ($M = 5.70/7$). Qualitative feedback identified specific refinement opportunities for breathing pacing and tutorial clarity. The findings validate the feasibility of AI-powered natural interactions for mental health interventions, supporting accessible, stigma-free complementary approaches that reduce technological barriers while maintaining evidence-based therapeutic content.

Paper 9350: Gamified Interventions for Procrastination: Exploratory Study the GAP Framework Designing Systems for Mental Health

Milena Batalha Pereira, Herick Henrique Cardouzo, Tadeu Moreira de Classe

KEYWORDS: PROCRASTINATION, GAMIFICATION, MENTAL HEALTH, INFORMATION SYSTEMS, EXPLORATORY STUDY.

Abstract: Procrastination is a pervasive behavioral pattern that extends beyond productivity loss, posing significant risks to mental and physical health, including heightened stress, anxiety, depressive symptoms, sleep disturbances, and reduced overall well-being. Despite its prevalence and harmful consequences, effective and accessible interventions remain challenging to design, particularly due to the multifaceted nature of procrastinatory behavior. In this context, gamification has emerged as a promising complementary approach to support self-regulation and motivation when thoughtfully designed. This paper presents an exploratory study of the Gamification Against Procrastination (GAP) Framework, a design-oriented artifact intended to support the development of personalized gamified information systems targeting procrastination. The study investigates the framework's conceptual clarity, flexibility, and perceived utility through a qualitative focus group involving postgraduate students. The findings indicate that participants recognized procrastination as a heterogeneous phenomenon and perceived the framework as a cognitive scaffold that supports reflective design reasoning rather than a prescriptive model. Results also highlight the importance of personalization, the risks of generic gamification strategies, and the framework's potential to foster metacognitive awareness about procrastination. These insights provide initial validation of the GAP Framework and inform directions for its refinement and future empirical evaluation.

Paper 2374: Usability and User Experience Social Serious Game System: Evidence from Multi-Center Study

Marta Mondellini, Maria Rosa Miccoli, Lucia Cavallasca, Selen Naz Saritas, Sara Arlati, Clementina Misuraca, Emilia Biffi, Alessia Pesenti, Roberta Nossa, Eleonora Guanziroli, Franco Molteni, Alessro Antonietti, Marco Sacco

KEYWORDS: VIRTUAL REALITY, PHYSICAL ACTIVITY, REHABILITATION, MOTIVATION, DUAL-TASK.

Abstract: Social Bike is a system that combines a cycle- ergometer with three non-immersive Serious Games. It is de- signed to combine physical and cognitive exercise, individually or socially, and to promote a more active lifestyle. In this work, we present a multi-center evaluation focused on the system's usability and user experience, conducted in three clinical centers, a school, and a research institute, involving both patients with rehabilitation needs and healthy users (N=87). The study combines quantitative and qualitative measures. Each participant completed two 10-minute cycling sessions with the system: one in individual mode and one in social mode. Furthermore, a subsam- ple of patients (N=6) used the system for 2 weeks and reported feedback on motivation, sense of inclusion, and game experience after this period. Social Bike was perceived as usable by both healthy participants and patients (tot SUS mean = 77.86 ± 12.5), but patients reported significantly higher usability ($U = 397.5$, $p = 0.002$). Qualitative data confirmed the value of the social mode in supporting motivation and engagement and suggested targeted improvements to the interface and game balance. Longitudinal exploratory analysis indicated good stability in patient motivation to use the system (Median = 6 in t0 and t1 single mode; Median = 5.88 in t0 and t1 social mode) and a stable sense of inclusion This work was funded by Fondazione Cariplo and Regione Lombardia (Project n. 2021-0612 – Active3). The project was also partially funded by the Italian Ministry of Health (Ricerca Corrente 2025/2026 to E. Biffi). (Median = 4 in t0 and t1, both game modes). These results provide preliminary evidence on the system's applicability in clinical and non-clinical settings.

Paper 4780: Active Mind: Serious-Game Platform for Cognitive Stimulation Major Neurocognitive Disorder due Alzheimer's Disease

Germano Pessoa Ciarlini Teixeira, Juliana A. De Figueiredo, Maria Andréia Formico Rodrigues

KEYWORDS: SERIOUS GAMES, DEMENTIA, ALZHEIMER'S DISEASE, COGNITIVE STIMULATION, CO-PARTICIPATION, DIGITAL HEALTH.

Abstract: This paper presents Active Mind, a tablet-based serious-game platform for cognitive stimulation in Major Neurocognitive Disorder (MND) due to Alzheimer's disease (AD). The platform adopts a co-participation model in which a patient plays alongside a caregiver, family member, or healthcare professional, aiming to sustain motivation and social inclusion through reminiscence-oriented content (music and images), dementia-oriented UX, and lightweight session metrics. We describe two mini-games—Vinyl Recall (music-memory excerpt completion) and Memory Mosaic (image-based jigsaw puzzles with optional URL-loaded personalization)—and report formative qualitative evidence from a Neurology specialist review and a target-user video-based pilot with an older adult living with AD. Findings provide actionable directions for difficulty calibration, personalization, pacing, and decision-point support in future iterations.

Paper 2132: LetterShip: a serious mobile game for teaching children to read

Natalia Logvinova, Ekaterina Uvarova, Andrey Sannikov, Svetlana Dorofeeva, Elena Sergeeva, Anatoly Kazakov, Yury Zontov, Yury Vishnyakov, Olga Dragoy

KEYWORDS: READING, DEVELOPMENTAL DYSLEXIA, SERIOUS GAMES, ADAPTIVE LEARNING, LITERACY, EDUCATIONAL TECHNOLOGY

Abstract: Reading is a complex cognitive process essential for academic success and cultural access. Difficulties in reading can severely impact literacy and well-being. However, most serious games designed to help children at risk focus narrowly on phonological skills, neglecting visual and higher-order linguistic components. This paper introduces LetterShip, a serious game designed to provide comprehensive reading support by addressing the wide spectrum of processes underlying reading. The game features a two-stage architecture: Stage One builds foundational skills through visual, auditory, and multimodal training; Stage Two progresses from words to sentences, incorporating vocabulary, morphology, and syntax. A dynamic adaptive algorithm personalizes difficulty in real time based on the player's performance, while all linguistic stimuli are systematically calibrated using psycholinguistic parameters. LetterShip provides a reading tool designed to be accessible without a prior diagnosis for typical learners and children with or at risk for dyslexia.

July 31st (Timezone: GMT-3)

09:45 - 11:15: Poster Session & Coffee Break (poster list below)

11:15 - 12:30: Oral Session 8: Neurodivergence, Specialized Care & Public Health**Paper 6970: Design and Evaluation Mobile Assistive Robot Simulator for Therapy Continuity ASD Care**

Pedro Castelo Branco Moreira, Elaine F. Rangel Seixas, João Vitor Carvalho Cecim, Flavio Seixas, Débora C. Muchaluat-Saade, Marcelo Marques da Rocha

KEYWORDS: ASD, SARS - SOCIALLY ASSISTIVE ROBOTS, SERIOUS GAMES, MOBILE HEALTH, ASSISTIVE TECHNOLOGIES, INCLUSIVE TECHNOLOGIES

Abstract: This paper presents XXX Virtual, a mobile application designed to replicate the interactive functionalities of the XXX socially assistive robot. XXX Virtual enables the execution of serious games, initially implemented for the physical robot and now accessible on smartphones and tablets. The main goal is to ensure the continuity of therapy for children with ASD, even without access to the physical robot. The system was developed using a modular architecture integrating a lightweight simulator with a Unity-based front-end and a RESTful API to orchestrate speech, emotion, and multimodal interaction in real time. A usability evaluation was conducted using the System Usability Scale (SUS) and custom functionality-specific questions at two points: first with 16 participants, then with 55 participants after some improvements. Results indicate an improvement in usability perception, from a mean SUS score of 88.9 to 92.5 after adjustments, indicating excellent perceived usability, with high ratings for key features such as speech output, LED control, and emotion recognition. XXX Virtual demonstrates strong potential as a low-cost, scalable alternative to treatment continuity when physical robotic platforms are not accessible in therapeutic settings.

Paper 6687: A modular mobile surveillance app for vector-borne disease monitoring: Use across two contrasting international deployments

Paul Reynolds, Ava Sullivan, Aisha Aldosery, Jailson Correia, Bárbara Rachelli Farias Teixeira, José Marcos Pereira Júnior, Domingos Lugo, Bruna R. Figueira Ornelas de Gouveia, Tiago Massoni, Patty Kostkova

KEYWORDS: MOBILE APPLICATION, DIGITAL DISEASE SURVEILLANCE, VECTOR-BORNE DISEASES, HEALTH SYSTEMS STRENGTHENING

Abstract: Mosquito-borne diseases such as dengue, Zika, and chikungunya cause over 700,000 deaths annually and account for more than 17% of all infectious diseases globally. Despite this burden, digital surveillance tools remain either monolithic systems designed for a single national context or bespoke prototypes that cannot transfer across jurisdictions. This paper presents a modular, multi-user mobile surveillance architecture in which municipalities configure their deployment by activating components – ovitrap management, property inspection, laboratory workflows, and a manager dashboard – from a shared platform. We validate this architecture through two contrasting deployments: Madeira Island, Portugal and Cabedelo, Brazil. Cabedelo operated without the Laboratory module and Madeira without the Property module, demonstrating how the modules are independently deployable. These results informed the establishment of the Vector-Borne Disease Digital Surveillance Network of Networks (NoN), launched March 2025 with WHO and Brazil's Ministry of Health, targeting expansion across multiple Brazilian municipalities.

Paper 405: Heuristic Evaluation of SAAF: A Persuasive System for Environmental Civic Engagement in Saudi Arabia

Vedsai Vangapandu, Oladapo Oyeboode, Chinenye Ndulue

KEYWORDS: PERSUASIVE SYSTEMS DESIGN, HEURISTIC EVALUATION, GAMIFICATION, SAUDI VISION 2030, PRO-ENVIRONMENTAL BEHAVIOUR, CLEAN PARKS, CIVIC ENGAGEMENT, USER EXPERIENCE (UX), SAUDI GREEN INITIATIVE, ENVIRONMENTAL SUSTAINABILITY.

Abstract: Environmental sustainability has become a cornerstone of national strategic planning, yet individual participation in waste management remains a significant behavioural challenge. This paper evaluates SAAF, a mobile application designed to foster pro-environmental behaviour in Saudi Arabian parks using the Persuasive Systems Design (PSD) framework. We conducted a heuristic evaluation with five experts to assess the perceived persuasiveness, clarity, and trust of eight distinct system features. Quantitative analysis using one-sample t- tests revealed that Self-Monitoring and Verified Points were significantly persuasive, while traditional competitive leaderboards were found to be less effective. Qualitative findings suggest a strong cultural preference for collaborative social support over individual competition, reflecting the collectivist nature of the Saudi population. These results provide critical insights for developers and policymakers into how persuasive technologies can be culturally tuned to support the Saudi Green Initiative and Vision 2030 sustainability targets.

Paper 8701: A Model for Evaluating Games in Public Health: Sustainability, Effectiveness, and Equity (SEQ)

Marcelo Simão de Vasconcellos, Cláudio Manuel Rodrigues, Flávia Garcia de Carvalho, Cátia Oliveira, Roberto da Rosa Faller

KEYWORDS: GAMES, PUBLIC HEALTH, SUS, HEALTH POLICY, EVALUATION FRAMEWORK.

Abstract: Games have demonstrated growing potential in the health field; however, their adoption as public health policy instruments requires structured frameworks capable of assessing their suitability within complex health systems. This study proposes a preliminary analytical model for evaluating game-based projects intended for incorporation into the Brazilian Unified Health System (SUS). Grounded in SUS doctrinal and organizational principles, the SEQ model articulates three complementary axes, Sustainability, Effectiveness, and Equity, each assessed through a five-level ordinal scale ranging from “Does not meet” to “Meets and innovates.” Rather than focusing on the intrinsic qualities of games, the model evaluates their institutional viability, real-world effectiveness, and capacity to reduce health inequalities. The axes are conceptually expanded into multidimensional criteria and illustrated through three fictional case examples. Although preliminary, the SEQ model offers a structured analytical tool to support reflection, comparison, and decision-making regarding the incorporation of games into public health policies.

Poster Session Papers**Paper 3019: Gamification as the Critical Layer: A Gamified mHealth Platform for Adults with Intellectual Disabilities Integrating UDL and CRPD Frameworks***Han-Chun Huang and Ru-Xin Zheng***KEYWORDS: SERIOUS GAMES, GAMIFICATION, INTELLECTUAL DISABILITY, MHEALTH, UNIVERSAL DESIGN FOR LEARNING, CRPD, EASY READ**

Abstract: Serious games show promise for individuals with intellectual disabilities, yet research remains limited regarding when gamification becomes essential versus optional. This study examines whether gamification functions as a critical threshold for learning effectiveness in this population. We developed a gamified mHealth platform with QR code-based access, integrating Universal Design for Learning (UDL) principles with CRPD accessibility requirements through three cumulative layers: AI-generated Easy Read content (Representation), mHealth interactive delivery (Action & Expression), and gamification features including real-time leaderboards and point systems (Engagement). Thirty-six adults with mild-to-moderate intellectual disabilities participated across three conditions: paper-based Easy Read only (n=15), mHealth platform without gamification (n=21, 101 session-pairs), and gamified mHealth platform (n=21, 32 session-pairs). Conditions B and C involved the same participants across an 8-session independent living skills curriculum, enabling within-subject comparison. Results demonstrated that gamification was the critical differentiator: paper-based delivery showed limited improvement (1/8 sessions significant), mHealth delivery without gamification showed no significant gains ($p=.199$, $d=0.13$), while adding gamification produced significant improvement ($p=.002$, $d=0.59$). Between-condition comparison confirmed gamification effects ($p=.037$, $d=0.43$). These findings suggest that for adults with intellectual disabilities, gamification is not merely an enhancement but a necessary threshold for effective learning. Serious game designers targeting this population should prioritize engagement mechanics as essential rather than optional features.

Paper 9305: A Hybrid Pelvic Floor Training Platform: A High-Fidelity Physical Simulator with a Complementary VR Serious Game Module

Verlaine Alves Alencar Lira, Herbert Lima Santos da Rocha, Arthur Cavalcante E Silva, Daniel Almeida Chagas, Leonardo Gonçalves Marques, Emanuele Verçosa Linhares, Ana Cristina de Oliveira Monteiro Moreira and Maria Andréia Formico Rodrigues

KEYWORDS: SIMULATION, HEALTHCARE, PELVIC FLOOR, EDUCATIONAL TECHNOLOGY, TRAINING

Abstract: Pelvic floor dysfunctions affect millions of women worldwide, with training for muscle assessment being critical to treatment success. This paper presents a high-fidelity, anatomically accurate simulator developed for training healthcare professionals in functional pelvic floor evaluation. The simulator reproduces realistic vaginal muscle contractions with adjustable pressure levels based on validated scales. Developed using a project-cycle methodology with interdisciplinary input, the device combines physical hardware, silicone-based anatomy, and a microcontroller-driven control panel with mobile app integration. Preliminary tests showed promising results regarding usability, realism, and pedagogical value. An initial game-based VR prototype was also designed.

Paper 747: Decision support system for weekly exercise planning with multi-criteria decision making and adherence simulation

Filipe Pessoa Sousa, Augusto Magalhães Pinto de Mendonça, Igor Machado Coelho and Cristiane Oliveira de Faria

KEYWORDS: PHYSICAL ACTIVITY RECOMMENDATION, TOPSIS, MULTI-CRITERIA DECISION MAKING, WISDM, ADHERENCE SIMULATION

Abstract: We propose a decision support system for weekly exercise planning that combines accelerometer-derived evidence with multi-criteria decision making. Using the WISDM dataset, we aggregate interpretable subject-activity descriptors and rank exercise-relevant activities with TOPSIS under five criteria: estimated benefit, time cost, exertion proxy, variety, and adherence. Personalization is implemented through beginner, intermediate, and advanced profiles with distinct weight vectors, and execution is simulated through a logistic completion model. Experiments with 50 subjects, 3 profiles, and 5 methods show that TOPSIS provides a consistent balance between benefit and safety. In paired comparisons against Max-benefit, TOPSIS achieved lower weekly risk for 49/50 Beginner subjects, 42/50 Intermediate subjects, and 29/50 Advanced subjects, with no observed losses.

Paper 6783: BreakingBag: Smart Boxing raises Motivation and Resilience in Moderate to High Intensity Bag Training

Lucas Haemmerle, Dominik Peter Hoelbling, Rene Baranyi, Roland Breiteneder, Karl Pinter and Thomas Grechenig

KEYWORDS: SERIOUS GAMES, EXERGAMES, SMART BOXING GLOVE, WEARABLE TECHNOLOGY, GAMIFICATION, MOTIVATION, MARTIAL ARTS, COMBAT SPORTS

Abstract: Physical inactivity and obesity are global health challenges, with lack of motivation to exercise cited as one of the main causes. Serious games are a potential solution, but, especially in the boxing domain, lack biomechanical accuracy and accurate punch force measurement. This short paper presents the design, prototype, and evaluation of a mobile serious game controlled by the “RD Alpha” smart boxing glove. Unlike standard trackers, this system integrates advanced acceleration and force sensors to measure punch statistics. Based on expert interviews (N=4), a reaction-based game concept (“Destroy Blocks”) for Android was developed using the LibGDX framework. A subsequent field study (N=30) comparing martial arts athletes with non-athletes, and gamers with non-gamers, demonstrated high user engagement, with participants rating the overall fun factor highly (4.80 ± 0.41 of 5) and reporting strong motivation to keep playing (4.50 ± 0.63). While potential routine adherence compared favorably to traditional workouts (3.97 ± 0.94), participants criticized an input latency.

Paper 3285: XRMotion: A Collection of Serious Games for Accessible Physical Exercising

Luis Guilherme Silva Rodrigues, Juliana da Costa Feitosa, Alexandre Fonseca Brandão and José Remo Ferreira Brega

KEYWORDS: SERIOUS GAMES, MOTOR REHABILITATION, BODY TRACKING, ACCESSIBILITY, PHYSICAL HEALTH

Abstract: This paper presents XRMotion, a collection of five serious games based on RGB body-tracking designed for motor rehabilitation and physical exercising. The system supports upper- and lower-limb exercises and introduces adaptive interaction mechanisms that compensate movements for reduced mobility, allowing users with limited range of motion to reach all areas of the screen. Therapists can adjust motion sensitivity and required amplitude, enabling personalized training sessions. The proposal focuses on accessibility, portability, and practical deployment in rehabilitation environments.

Paper 9786: MedSim: A Virtual Reality Serious Game for Clinical Anamnesis and Laboratory Decision Training with Structured Feedback

Raquel Albuquerque Quirino, Amanda Lira Andrade Botelho, Flavio de Oliveira Marques, Felipe Cassiano Barbosa, Daniel Rebouças Jaguaribe and Belmondo Rodrigues Aragão Júnior

KEYWORDS: SERIOUS GAMES, VIRTUAL REALITY, GAME-BASED LEARNING, CLINICAL TRAINING, CONTEXTUAL FEEDBACK

Abstract: Serious Virtual Reality (VR) games in healthcare, while promising tools for education, often emphasize procedural skills, offering limited support for diagnostic reasoning. This paper presents MedSim, a VR serious game framework that simulates a complete clinical consultation: anamnesis, physical examination, laboratory testing, and diagnosis. The system employs a modular, data-driven architecture and phase-based progression for scalable scenario configuration and structured assessment. Users interact with virtual patients immersively, while an automated scoring subsystem provides action-linked contextual feedback. By combining immersive interaction with structured evaluation, MedSim is designed to support experiential learning and clinical reasoning development.

Paper 414: KidneyQuest: A Dietitian-Led Gamified mHealth System for CKD Nutrition Self-Management

Hsiao-Wen Chuang, Han-Chun Huang and Yi-Chen Huang

KEYWORDS: CHRONIC KIDNEY DISEASE, GAMIFICATION, GAME-BASED LEARNING, MHEALTH, NUTRITION, QUANTIFIED SELF

Abstract: Chronic kidney disease (CKD) affects over 10% of the global population, yet existing mHealth tools lack personalized tracking and sustained engagement. This extended abstract presents KidneyQuest, a dietitian-led LINE chatbot integrating quantified self-tracking and game-based learning for CKD nutrition self-management. Informed by big data analysis (n=1,573), the system features AI-powered food recognition, a triple traffic light alert system (six food groups, NOVA ultra-processed food classification, potassium), and a 12-week gamified world travel journey with situated nutrition education. Expert validation confirmed high content validity, supporting readiness for clinical evaluation.

Paper 1032: Digital Interventions for Anxiety Reduction in Hospitalized Pediatric Patients: A Scoping Review

Tatiana Losik, Claudia Sevivas, Nicolas A. Morgenstern, Nuno Miguel Feixa Rodrigues, Eva Oliveira

KEYWORDS: SCOPING REVIEW, PEDIATRICS, HOSPITALIZATION, ANXIETY, DIGITAL INTERVENTIONS

Abstract: Background: Hospitalization can be a distressing experience for pediatric patients, often leading to heightened anxiety that negatively impacts both their psychological well-being and recovery process. While various technological interventions have been explored to address anxiety related to single medical procedures, anxiety associated with prolonged hospital stays remains under-researched. Objective: This scoping review aims to map digital interventions used to reduce anxiety in hospitalized pediatric patients and analyze their reported outcomes. Methods: A literature search was conducted in ScienceDirect, IEEE, and PubMed databases, covering studies in English published from 2000 to March 2025. Studies were included if they involved computer-based technological interventions for anxiety reduction in hospitalized pediatric patients (aged under 19 years). Results: A total of 12 studies met all the inclusion criteria. The technological interventions evaluated included virtual reality, augmented reality, video conferencing, digital games, non-interactive multimedia, and social robots. Reported outcomes varied depending on the intervention type and implementation context. Children's engagement with an intervention does not consistently lead to significant reductions in anxiety. Considerable variability in study designs, intervention modalities, and outcome measures limited direct comparisons across studies. Conclusion: The analysis revealed promising results, particularly with virtual reality and other immersive technologies. The review underscores the need for further research on technology-based interventions for anxiety reduction.

Paper 2049: Measurement Framework for Serious Games Addressing Food Loss and Waste (SG-FLW)

Ezequiel Santos, Moisés Moreira, Duarte Duque, Cláudia Sevivas, Vítor Carvalho

KEYWORDS: SERIOUS GAMES, FOOD LOSS AND WASTE, GAMIFICATION, BEHAVIORAL CHANGE, KNOWLEDGE ASSESSMENT, MEASUREMENT FRAMEWORK, EVIDENCE QUALITY, GRADE, SG-FLW

Abstract: Serious games and gamified interventions are increasingly being proposed as tools to reduce household food waste, yet the field lacks standardized methods to assess whether these interventions produce measurable behavioral and environmental impact. Despite the European Union (EU) Waste Framework Directive's call for comparable food waste monitoring, most studies report only knowledge gains or attitudinal shifts. This paper presents SG-FLW, a measurement framework that evaluates the evidence quality of interventions targeting food loss and waste across five dimensions: Baseline measurement, Knowledge & attitudinal assessment, Direct behavioral change, Environmental conversion, and Persistence, each on a 0–3 ordinal scale. We demonstrate the framework through worked coding examples and apply it to thirty-five interventions (seven games, ten serious games, and eighteen gamification studies) drawn from two complementary reviews and targeted search. Results reveal a persistent complementary measurement gap: twenty-five interventions assess knowledge or attitudinal outcomes but rarely measure actual behavior, while the five achieving Moderate certainty through objective behavioral measurement (including waste weighing, audits, and consumption proxies) all neglect cognitive assessment. No study achieves environmental conversion, and only one includes post-intervention follow-up. SG-FLW provides a transparent, reproducible tool aligned with EU reporting standards that can be applied both retrospectively (to evaluate published studies) and prospectively (to guide measurement planning during intervention design). By making measurement gaps visible, the framework directs future research toward stronger evidence of impact.

Paper 4357: A Synthetic Dataset for the Development of AI Methods Applied to Telerehabilitation

Leonel Martins, João Borges, Pedro Morais, João Vilaça, Beatriz Rodrigues, Helena Torres

KEYWORDS: 3D MODELING; COMPUTER VISION; HUMAN POSE ESTIMATION; SYNTHETIC DATA; TELEREHABILITATION

Abstract: Telerehabilitation systems increasingly rely on computer vision and artificial intelligence (AI) to analyze patient movements during remote therapy sessions. However, the development of robust pose estimation models requires large volumes of annotated data, which are difficult, costly, and ethically constrained to acquire in clinical environments, particularly for physiotherapy-specific exercises. This paper presents a modular pipeline for the automatic generation of a synthetic dataset specifically designed to support the training of computer vision-based pose estimation models for telerehabilitation applications. The proposed framework integrates parametric human modeling, custom skeletal rigging, controlled 3D scene construction, and automated multimodal rendering to generate diverse annotated samples. To achieve this, the framework leverages the software MakeHuman for parametric human model generation and the software Blender for skeletal rigging, animation, scene configuration, and rendering. Human models with varying morphological characteristics were positioned in clinically inspired rehabilitation scenarios using an 18-joint skeletal representation designed to balance anatomical relevance and computational efficiency. The resulting synthetic data includes RGB images, depth maps, semantic segmentation masks, and 3D joint coordinates serving as ground truth for supervised learning. Experimental results demonstrate the ability of the pipeline to introduce controlled variability in pose, viewpoint, lighting, and subject morphology, highlighting its potential for scalable and fully annotated dataset generation. Overall, the proposed framework provides a reproducible solution to address data scarcity in AI-driven telerehabilitation and establishes a foundation for rehabilitation-focused pose estimation research.

Paper 9790: Addressing Self-Criticism: The Development of a VR Experience

Eva Oliveira, Diogo Martins, Nuno Rodrigues, Helder Rodrigues, Moisés Moreira, Mara Rodrigues, Miguel Gonçalves and Inês Mendes

KEYWORDS: VIRTUAL REALITY, SELF-CRITICISM, MENTAL HEALTH, COGNITIVE RESTRUCTURING, UNITY.

Abstract: Self-criticism is a pervasive cognitive pattern that undermines mental health and academic functioning in university students. Current VR-based mental health interventions focus predominantly on anxiety disorders through exposure paradigms, relying on fixed, pre-authored content— an approach that places limited emphasis on cognitive restructuring, which must target each individual's specific maladaptive thought patterns. In this paper we present a VR system that enables participants to engage in cognitive restructuring of self-critical personalized thoughts, developed through interdisciplinary collaboration between computer science and clinical psychology. The system pairs a web-based clinical interface—where psychologists configure patient-specific self-critical phrases and compassionate alternatives—with an immersive Unity application for Meta Quest 2, in which users confront their own thoughts through the embodied metaphor of a broken mirror. We describe the system architecture, interaction design, and design rationale based on principles from Cognitive-Behavioural Therapy and Compassion-Focused Therapy. We discuss design implications and outline directions for a planned empirical evaluation with university students

Paper 9863: Pilot Study Virtual Reality and Tablet-Based Multi-Domain Training Healthy Adults Inform Post-Intensive Care Syndrome Rehabilitation

Inês Oliveira, Bruna Reis, Mariana Portela, Sofia Tavares, João Ferreira-Coimbra, Adriana Sampaio, Nicolas A. Morgenstern, Eva Oliveira, António Coelho, Nuno F. Rodrigues

KEYWORDS: VIRTUAL REALITY, POST-INTENSIVE CARE SYNDROME (PICS), SERIOUS GAMES, NEUROREHABILITATION, PILOT, FEASIBILITY, TRAINING.

Abstract: Virtual Reality (VR) is a candidate for Post- Intensive Care Syndrome (PICS) rehabilitation, but the isolate effect remains unquantified. This study evaluates how the gains are driven. Methods: Healthy adults (n = 40) were assigned to: VR Dual-Task (VRCP); VR Cognitive (VRC); Tablet Cognitive (TC); and Tablet Placebo (TP). Protocols involved four sessions; out- comes included Montreal Cognitive Assessment (MoCA) scores, digital performance, and heart rate (HR). Results: VRC and TC showed significant MoCA gains (2.90 ± 0.74 and 2.70 ± 1.77 , $p < 0.001$); TP showed none. VRCP demonstrated a near- perfect cognitive-physical gain correlation ($r=0.985$) with a mean HR of 105.6 bpm. Within the VRC group, lower education levels correlated with higher VR gains ($r=-0.707$). Conclusion: While VR and tablets show clinical parity, VR offers superior multi-domain synergy and performance resolution. VRCP may be the most appropriate model for PICS rehabilitation.

Paper 754: Design and Development Collaborative Serious Game for Hospitalized Children: Translating CBT into Multiplayer Game Mechanics

Joana Alves, Nuno Rodrigues, Eva Oliveira

KEYWORDS: SERIOUS GAMES, COGNITIVE-BEHAVIORAL THERAPY, PEDIATRIC HEALTHCARE, COLLABORATIVE GAMEPLAY, GAME DESIGN, CBT.

Abstract: Pediatric hospitalization often leads to significant emotional distress, yet access to effective psychological interventions such as Cognitive Behavioral Therapy (CBT) remains limited within hospital wards. To address this gap, a collaborative multiplayer serious game for children aged 7 to 12 was designed and developed in collaboration with a multidisciplinary team. The proposed serious game translates core CBT components, including cognitive restructuring, emotional literacy, and behavioral activation, into nine collaborative game levels supported by real-time voice communication. The game was assessed by psychologists ($N = 3$), and tested with non-hospitalized children ($N = 5$) and hospitalized children ($N = 3$). Psychologists rated the game's compatibility with CBT principles at the maximum score of 5.00. Usability outcomes were excellent, with a System Usability Scale (SUS) score of 100 and a mean GUESS-18 score of 118.6. Additionally, improvements in mood during gameplay were observed in hospitalized children. These findings provide preliminary evidence that the proposed serious game is a therapeutically grounded and engaging digital intervention, although further large-scale studies are required to validate its effectiveness in pediatric hospital settings.

Paper 3289: Adverse Event Reporting in VR-Based Mindfulness Therapies for Chronic Pain: An Ethical Analysis Based on the Four Principles of Clinical Ethics

Moisés Moreira, Estela Vilhena, Anabela Marques, Vítor Carvalho, Duarte Duque

KEYWORDS: UNDERREPORTING, VR, MINDFULNESS, CHRONIC PAIN, SERIOUS GAMES, ADVERSE EFFECTS I.

Abstract: Underreporting of adverse effects is a pervasive issue across medical fields, particularly in virtual reality VR treatments for chronic pain; however, in this narrow emerging domain of VR mindfulness interventions, reporting is relatively stronger overall. This reanalysis assesses quality across eight clinical trials: 3 randomized controlled trials (RCTs); 1 crossover study; and 4 feasibility studies from a prior systematic review. Underreporting occurred in some studies with no adverse effects noted (3/8 studies), while others documented cybersickness nausea dizziness and pain increases with rates varying across trials. Abstracts are sometimes conflicted with full-text details. In RCTs, the adverse effects were present in the abstract, discussion and conclusion sections, as well as a specific dedicated section. This is a good indicator of clear reporting, but even these studies could provide more detail on frequency persistence and raw data. Overall, it is imperative not to overlook the ethical shortcomings of minimizing risks, which can undermine informed consent and safety. We propose standardized physician-monitored follow-up dedicated safety sections raw data sharing and cultural shifts to see reporting of adverse effects without minimizing as a positive practice, ensuring safer VR mindfulness applications for chronic pain management.

Paper 5127: Leveraging Large Language Models for Personalized and Context-Aware Persuasive Health Interventions: A Stress Management Case Study

Fidelia A. Orji, Grace Ataguba, Frank Rudzicz, Rita Orji

KEYWORDS: DIGITAL HEALTH INTERVENTIONS, PERSUASIVE TECHNOLOGY, LARGE LANGUAGE MODELS, PERSONALIZED PERSUASIVE HEALTH INTERVENTION, STRESS MANAGEMENT, PERSUASIVE STRATEGIES, SELF-DETERMINATION THEORY

Abstract: Persuasive technologies hold significant promise for promoting healthy behaviours through personalized digital interventions. Yet developing interventions that dynamically adapt to users' evolving contexts and motivational states remains a key challenge. In this study, we fine-tuned two large language models (LLMs) and evaluated their ability to generate personalized, context-aware stress management recommendations grounded in four persuasive strategies: self-monitoring, commitment & consistency, social comparison, and competition. We evaluated generated recommendations through automatic, quantitative, and qualitative metrics to assess their relevance and contextual alignment. Domain experts independently rated the recommendations and provided structured feedback, which we analyzed thematically to identify key strengths and limitations. Results demonstrate that fine-tuned LLMs have the potential to generate persuasive, contextually aligned health recommendations tailored to individual users' stress profiles and preferred persuasive strategies. These findings advance the design of AI-powered adaptive health systems and offer actionable insights for building persuasive digital interventions that dynamically respond to users' motivational profiles and behavioural contexts.

Paper 2865: Serenify: An AI-Driven Multimodal Digital Coach for Continuous Anxiety and Depression Management

Harsh Maisuri, Josteve Adekanbi, Rita Orji, Oladapo Oyebo

KEYWORDS: DIGITAL COACH, MULTIMODAL AI, PERSUASIVE TECHNOLOGY, ANXIETY AND DEPRESSION MANAGEMENT, MENTAL HEALTH, MOBILE HEALTH (MHEALTH), FACIAL EXPRESSION ANALYSIS, VOICE/SOUND ANALYSIS, TEXT ANALYSIS, KEYSTROKE DYNAMICS, EMOTION RECOGNITION, INTERVENTION DESIGN I.

Abstract: Anxiety and depression are among the most prevalent mental health conditions worldwide, yet current clinical assessment tools rely on retrospective self-report, which is subject to recall bias and limited by infrequent clinical contact. Digital health technologies, including mHealth applications and AI-based emotion-detection systems, have emerged to support continuous monitoring, but most rely on manual mood logging or single- modality sensing, capturing only a partial view of the user's emotional state. To address these limitations, we present Serenify, an AI-driven, multimodal, persuasive mobile application that integrates five passive sensing modalities: facial expression recognition, speech emotion detection, ambient audio classification, text-based emotion inference, and keystroke dynamics analysis. A fusion module aggregates the outputs of dedicated machine learning models into a composite emotional risk level that drives the delivery of personalized wellness interventions. Eight persuasive strategies drawn from the Persuasive Systems Design framework and Goal-Setting Theory are embedded across the application to promote sustained engagement. We evaluated Serenify through an expert evaluation with five Human-Computer Interaction (HCI) experts, using 10 heuristics adapted for persuasive health technologies. The results show an overall mean severity of 0.26 (SD = 0.23), with no rating exceeding cosmetic level, indicating little or no usability problems across the system. Finally, we reflect on our findings to offer three design recommendations for building multimodal persuasive mental health technologies.

Paper 8261: Co-Designing Embodied Telehealth for Physical Rehabilitation Integrated Veteran Care

Aviv Elor, Adrian Parrales, Maxim Kuznetsov, Michael Powell, Ash Robbins, Felicia Skelton, Hilary Touchett

KEYWORDS: VIRTUAL REALITY, EXTENDED REALITY, TELEHEALTH, CO- DESIGN, HEALTHCARE INTEGRATION, ACCESSIBILITY, MOVEMENT CARE

Abstract: Immersive Virtual Reality (VR) rehabilitation shows promise for remote movement care, yet implementation requirements differ across healthcare delivery models. This study presents findings from a stakeholder co-design workshop conducted with United States Veterans Affairs (VA) providers, extending previous work with private practice stakeholders. Through structured usability testing and four-axis framework analysis with VA clinicians paired with design researchers, we examined how integrated healthcare networks shape VR telerehabilitation design requirements. Results reveal that VA providers prioritize accessibility and adaptation as foundational requirements, contrasting with private practice stakeholders who emphasized interface simplicity. Key accessibility priorities included wheelchair and seated avatar modes, adaptive range-of-motion mapping, and alternative input methods for veterans with motor impairments. Comparative analysis demonstrates convergent priorities around onboarding, movement feedback, and clinical assessment tools, while divergent priorities reflect differences in patient populations between healthcare contexts. We propose design recommendations for VR rehabilitation platforms serving integrated healthcare networks, emphasizing accessibility-first design, multimodal guidance, and context-aware configuration. These findings contribute a comparative framework for adapting XR rehabilitation across healthcare delivery models.

Paper 6304: Skill Development Individuals with ASD using Applications: Case Study with Underwater Game

Elaine F. Rangel Seixas, Marina Nunes, Leonardo Siqueira, Ana Beatriz Couto, Felipe Barbosa, Orlando Fernandes, Diana Cavalcanti, Daniela Trevisan, Erica Nogueira, Esteban Clua, Debora Saade

KEYWORDS: ASD, VIRTUAL REALITY, EXTERNAL STIMULI, GAMES

Abstract: Autism Spectrum Disorder (ASD) is a neurodevelopmental condition characterized by deficits in social communication and restricted, repetitive behaviors. Diagnosis requires impairments in social reciprocity, nonverbal communication, and relationship development, along with at least two behavioral features such as rigid routines, stereotyped movements, restricted interests, or atypical sensory responses. Emotional dysregulation, although not a core diagnostic criterion, is common and often includes irritability, anxiety, impulsivity, and difficulties in identifying and expressing emotions (alexithymia). These challenges significantly affect quality of life and highlight the need for personalized interventions. In this paper, we propose a VR-based system designed to regulate stimuli such as calmness, attention, and agitation. The solution was evaluated with professionals working with individuals with ASD. The developed VR game takes place in a submarine environment, leveraging the calming and engaging nature of ocean settings and animals to foster curiosity, empathy, and emotional regulation. The system includes adjustable variables to control stress and calmness levels and, although implemented in an underwater scenario, can be adapted to other contexts.

Paper 766: Spatial Tangible User Interface Prototype for Forceps Assisted Vaginal Delivery

Fabian Gualdron, Alvaro Uribe-Quevedo, Sebastian Hobson, David Rojas

KEYWORDS: SIMULATION, EXTENDED REALITY, FORCEPS, CHILDBIRTH, SPATIAL INTERACTIONS

Abstract: Forceps Assisted Vaginal Delivery (FAVD) commonly relies on mannequin-based simulators that provide valuable anatomical rehearsal; however, integrated quantitative assessment is often limited to instructor observation and debriefing, or to partial objective measures (e.g., force/event logging) rather than detailed forceps kinematics (e.g., trajectory and end pose). Studies indicate a lack the competency to perform the procedure independently, thus leading to an increase in unnecessary cesarean sections, which have immediate negative impacts on maternal, neonatal, and child health. We present the development of an extended reality (XR) FAVD simulator integrating a forceps-compatible 3D printed user interface with virtual feedback for instructional support and performance assessment. We report a preliminary formative evaluation for usability, cognitive load, and performance metrics among two obstetrics instructors. Although this study did not include a comparative control condition (e.g., standard mannequin-only training), the exploratory nature of the collected data provided insights into the design and face validity of the prototype and not training efficacy at this stage. This work contributes a novel XR training system and insights for integrating tangible interaction, performance sensing, and feedback in high-stakes skill training. Beyond obstetrics, this work illustrates how tangible tool integration, spatial alignment, and embedded motion-based feedback can be combined in XR systems to support skill development leveraging 3D printing and open electronics.

Paper 2693: Beyond Standard Controllers: How Expertise Shapes Usability, Cognitive Load, and Presence with Task-Representative Input Devices

Lauren Olivier, Isaac Taylor, Hamed Tadayyon, Fabian Gualdron, Michael Quecano, Alvaro Uribe-Quevedo, Bernadette Murphy, Pejman Mirza-Babaei

KEYWORDS: INPUT DEVICES, USER EXPERIENCE, EXPERTISE

Abstract: Standard controllers remain the most common input devices in virtual reality (VR) applications, whether for entertainment, training, health care or others. Task-representative input devices are gaining momentum for enhancing realism and interaction fidelity. However, the role of VR expertise remains underexplored, despite its potential influence on overall user experience, an issue that becomes increasingly relevant as VR continues to be used in scenarios other than video games. This paper investigates how VR expertise moderates the impact of task-representative alternative input devices (AUIDs) on usability, cognitive load, and presence across six heterogeneous VR applications spanning entertainment and serious-game contexts. We conducted a study with 24 (12 novice and 12 VR experienced) participants who completed onboarding tasks using either standard VR controllers or AUIDs to better approximate real-world tool affordances. Results show that task-representative AUIDs consistently improved usability and presence while reducing cognitive load for novice users. In contrast, experienced users exhibited smaller and more application-dependent effects. These findings suggest that the benefits of increased physical realism are expertise-dependent rather than universal. We argue for an expertise-aware approach to VR interaction design, in which input-device selection considers user experience level.

Paper 8777: Adaptive biofeedback may make children jump higher while exergaming for exercise benefits

Oscar O'Brien, Connah Kendrick, Ben Ives, John Henry

KEYWORDS: ADAPTIVITY, BIOFEEDBACK, EXERGAMES, CHILDREN, PHYSICAL ACTIVITY

Abstract: Exergames present opportunities to increase physical activity amongst the 80% of adolescents who are not meeting daily activity guidelines. A limitation is that many exergames can be operated at an exertion level below the user's ability, in some cases seated with minimal arm movement. In this paper, we introduce an adaptive biofeedback approach to exergame input thresholds which we implement within a novel exergame that is co-designed with 23 children. Thirteen pupils aged 6–7 from two other primary school classes participated in an experiment with the game. The intervention group played the game with adaptive biofeedback, and the control group played the same game without. The intervention group showed a significant trend of increasing vertical jump displacement over 10 minutes, $p < 0.001$, effect size 0.322. Overall, our results suggest an adaptive biofeedback approach to exergame input could reduce the possibility of using exergames with sub-optimal exertion levels, while remaining accessible to children.

Paper 6410: Design and Development Immersive Virtual Reality Application for Psychological Support Dialyzed Patients

Gwladys Rubayita, Bruno de Paula, Julia Tannus, Danilo Rocha, Marcelo Melo, Sarah Chameroy, Eduardo Naves

KEYWORDS: VIRTUAL REALITY, MENTAL HEALTH, HEMODIALYSIS, MINDFULNESS THERAPY, BINAURAL BEATS.

Abstract: Depression and anxiety affect up to 52% of hemodialysis patients, yet most cases remain undiagnosed and untreated. This paper presents the design and preliminary evaluation of an immersive virtual reality mindfulness application specifically designed for use during hemodialysis sessions, when patients remain physically immobilized for 3-4 hours, three to four times weekly, to transform this idle treatment time into therapeutic psychological intervention without imposing additional time burdens. The application integrates naturalistic Alpine environments, alpha-frequency binaural beats, guided meditation, and positive affirmations within a 30-minute experience accessible through head-tracking-only interaction to accommodate patients' restricted movement during dialysis. Preliminary evaluation with eight healthy volunteers in a laptop setting demonstrated excellent usability (System Usability Scale: 91.88/100) and high immersion (EGameFlow: 5.75/7), with particularly strong performance on cognitive immersion dimensions therapeutically relevant for anxiety and depression management, including temporal distortion, sustained attention, and worry reduction. Qualitative feedback identified refinement priorities including narration pacing optimization and environmental visual enhancement. While this study establishes foundational usability and immersion benchmarks using laptop-based testing with non-clinical participants, clinical validation with actual hemodialysis patients using head-mounted displays remains necessary to assess therapeutic efficacy and implementation feasibility in dialysis care contexts.

Paper 269: Shinmamoru: Gamified Digital Well-being Mobile Application for Watchdogging Social Media Use

Christoph Aigner, Milan Kasic, Carina Arnberger, Sylvia Winkler, Thomas Grechenig, Rene Baranyi

KEYWORDS: SERIOUS GAMES, NCD PREVENTION, MENTAL HEALTH, BEHAVIOR CHANGE

Abstract: The rise of social media has contributed to the condition of Problematic Social Media Use (PSMU). PSMU is linked to negative mental health outcomes and can therefore be considered a risk factor for non-communicable diseases (NCDs). To address this issue, this paper explores gamification as a potential intervention for PSMU by presenting the design and evaluation of Shinmamoru, a mobile serious game system for Android. The system includes a background service to monitor social media app usage. When users continue using a social media app, it presents an interruption screen and tracks the time spent. This data then influences game outcomes by either positively or negatively affecting the player's character, depending on their tracked screen time. The study's methodology consisted of several steps: a literature review, conceptual framework development, and an evaluation with 9 participants. A blended approach that combined usability surveys and interviews was used. Results showed the prototype was generally usable, though user engagement varied, and some technical issues were noted. Still, these findings indicate gamified interventions like Shinmamoru can help raise awareness of social media habits and promote healthier behaviors.

Paper 1650: Analysis, Design and Development VR-Based Serious Game Support Mirror Therapy Stroke Rehabilitation

Maximilian Modl, Carina Arnberger, Selina Breuer, Lukas Roehrling, Christoph Aigner, Werner Hoerner, Thomas Grechenig, René Baranyi

KEYWORDS: REHABILITATION, SERIOUS GAMES, STROKE, VIRTUAL REALITY

Abstract: Stroke is one of the leading causes of long-term disability and may also lead to various long-term impairments. While conventional therapy is effective, it is often perceived as monotonous, this is where Virtual Reality (VR) offers a promising additional rehabilitation support specifically for mirror therapy, providing highly immersive and controllable environments that can enhance patient engagement. This research presents a VR- based prototype specifically designed to support stroke rehabilitation through mirror therapy. Semi-structured interviews with four experts in physiotherapy and occupational therapy, along with domain knowledge, yielded 20 identified requirements for such a solution. The resulting prototype consists of a virtual arm model and customizable settings to adapt to patient needs. Finally, the prototype underwent an iterative evaluation process with a therapist. This work presents the feasibility of integrating requirements into an immersive VR serious game to support rehabilitation outcomes.

Paper 2672: Design and assessment serious exergame promote relaxation through slow-paced breathing

Henrique Sant'Anna de Faria, Marcelo da Silva Hounsell

KEYWORDS: MENTAL HEALTH, ACTIVE GAME, BIOFEEDBACK, MIND- FULNESS, RELAXATION.

Abstract: In our society, tasks, uncertainties, and unexpected situations cause stress and anxiety, leading to negative consequences. One possible way to cope with it is by slow-paced breathing and meditation. This paper presents ZenBreath, a serious game that promotes relaxation by capturing and guiding the player's breathing in real time using a device called PITACO. ZenBreath promotes guided conscious breathing and relaxation, in addition to emotion comprehension. The game's design involved seventeen participants, four of whom were professionals in the field of psychology. The game evaluation included twenty-three participants, three of whom were professionals who tested the game in person. The game received overall scores of 4.39 and 3.99 (on a 1 to 5 scale) in an empathic utility assessment tool from players' and experts' perspectives, respectively. The evaluators' feedback highlighted the potential of the game as an auxiliary tool in fighting stress and anxiety.

Paper 5832: Redesign of an Exergame Console for Children with Autism Spectrum Disorder

Andre Bonetto Trindade, Marcelo da Silva Hounsell

KEYWORDS: SERIOUS GAMES, MOTION CAPTURE SYSTEM, INTERACTIVE FLOOR SYSTEMS, HARDWARE DESIGN

Abstract: This paper presents a design science iteration of the T-TEA, an interactive floor console developed as an exergame system for children with autism spectrum disorder. The goal was to redesign the system's hardware architecture to overcome critical barriers identified in its original version, such as complex setup, sensory triggers, and spatial constraints. Following the Design Science Research framework, this iteration was guided by empirical feedback from 60 multidisciplinary experts (including healthcare and technology professionals). Their requirements led to the development of a new physical artifact: a compact, ceiling-mounted all-in-one console. This iteration proposes a transition from a general-purpose prototype to a specialized embedded system aimed at increasing the clinical and educational settings viability of interactive exergames by addressing expert-defined requirements, such as reducing the required space and setup complexity. The results provide a technical blueprint for creating more accessible and sensorially appropriate therapeutic environments for the neurodiverse community.

Paper 200: Depths the Mind VR: Underwater Metaphors and Diegetic Guidance for Mental-Health Awareness

Leonardo G. Marques, Emanuele V. Linhares, Maus Najal Cruz, Maria Andréia F. Rodrigues

KEYWORDS: SERIOUS GAMES, VIRTUAL REALITY, MENTAL HEALTH, AWARENESS, PSYCHOEDUCATION, GENERATIVE AI.

Abstract: Mental-health awareness and literacy remain limited in many contexts, motivating scalable and engaging educational approaches. We present Depths of the Mind VR, an immersive underwater serious game designed to raise mental-health awareness through exploration, metaphorical marine life, and a non-clinical in-world AI guide totem (i.e., a diegetic interactive object), aimed at the general population. The experience represents six mental-health conditions as stylized fish groups whose behaviors and audiovisual cues shift during timed flare-up episodes, making abstract concepts observable through gameplay. During flare-ups, players use a handheld flashlight interaction to activate the AI guide totem, which delivers brief, safety-bounded psychoeducational explanations about the active condition using non-stigmatizing language (no diagnosis or treatment). We describe the game design, comfort-oriented VR cues, and the AI-guide interaction pattern. A preliminary UX evaluation (questionnaire and qualitative feedback based on a playthrough video) indicates strong clarity of the dual-task “cleaning the mind” mechanic and respectful representation, and that audiovisual cues effectively signal flare-up transitions, while highlighting improvement opportunities for future iterations.

Paper 6237: Environment for Physical Rehabilitation People With Amputations Serious Game and IoT Devices.

Vitor da S. Moreira, Brayon L. Silva, Miguel L. Tadeo, Ronaldy da S. Gelos, Maria E. M. Almeida, Julio S. Domingues Júnior

KEYWORDS: SERIOUS GAMES, PHYSICAL REHABILITATION, AM-PUTATION, WEARABLE SENSORS, GAMIFICATION, REMOTE MONITORING, INTERNET-OF-THINGS.

Abstract: Physical rehabilitation after amputation is a critical and continuous process, necessary to prevent muscle atrophy, adaptation to new limitations, and ensure proper prosthetic adaptation. However, conventional therapies often face high dropout rates due to the repetitive and monotonous nature of the exercises, in addition to the scarcity of tools that provide precise quantitative metrics to therapists. This work presents PhysioGames, an integrated Serious Games environment designed to assist in the motor rehabilitation of people with amputation, with a primary focus on upper and lower limbs. The system is composed of a low-cost architecture that integrates a sensor node, using an ESP32, and a platform of adaptive games developed in Godot Engine 4.6. Unlike generic commercial solutions, PhysioGames uses optimized communication protocols (Bluetooth BLE) to guarantee real-time biofeedback and ensure total freedom of movement for the user, integrating the data into a complete Web platform for clinical visualization. The solution was preliminarily evaluated regarding its technical feasibility and acceptance. The results indicate that the system is capable of increasing the adherence rate by patients and assisting the monitoring of sessions by the physiotherapist, demonstrating potential to fill the gap between rigid clinical protocols and patient motivation.

Paper 1096: Bonfires: A Persuasive Video Game for Promoting Healthy Eating Through the Retelling of Greek Mythology

Keanu Burr, Oladapo Oyeboade, Chinenye Ndulue

KEYWORDS: PERSUASIVE GAMES, HEALTHY EATING, NUTRITION, AUTO- RUNNER, BEHAVIOUR CHANGE, SERIOUS GAMES, STORYTELLING.

Abstract: Unhealthy dietary habits are a significant public health concern, worsened by the increasing affordability and accessibility of junk food over nutritious alternatives. This paper presents the design, development, and evaluation of Bonfires, a persuasive auto-runner video game designed to encourage healthy eating. The game integrates persuasive design features within a narrative framework inspired by Greek mythology to foster positive behavioural change. Bonfires was evaluated using the Heuristic Evaluation for Playability (HEP) framework. Results indicate strong performance in usability, playability, and persuasive design elements. The findings suggest that Bonfires has the potential to encourage reflection on dietary choices while providing an engaging gameplay experience.

Paper 4136: Newborn Bathing Virtual Reality: Immersive Approach Neonatal Hygiene Education

Roger Castellar, Logan Miranda, Gabrielle Beltrão, Esteban Clua, Fernanda Góes, Daniela Trevisan

KEYWORDS: VIRTUAL REALITY, SERIOUS GAMES, NEWBORN BATH, NURSING EDUCATION, NEONATAL CARE, GAMIFICATION, EDUCATIONAL TECHNOLOGY, USER EXPERIENCE EVALUATION

Abstract: Newborn Bathing VR is an educational virtual reality game developed to teach and evaluate the newborn bathing procedure in a safe, immersive, and risk-free environment. The system simulates real objects and procedures, allowing users to perform each practical step while receiving automatic feedback based on their actions. The application incorporates gamification elements, which contribute to engagement and deliberate practice. The project was developed in collaboration between the Institute of Computing and the Institute of Humanities and Health at the Universidade Federal Fluminense, ensuring technical accuracy, as well as content and visual validation. The evaluation involved 11 participants and employed objective metrics obtained through automated data collection, as well as subjective data gathered through a user experience questionnaire and open-ended questions. The results indicated good overall acceptance, sufficient ease of use for task completion, and a high level of engagement during the activity. Participants also reported a positive perception of the educational potential of virtual reality, highlighting its practical nature and the realistic simulation of procedures. Overall, the results suggest that Newborn Bathing VR is a promising tool for teaching neonatal care, offering an immersive experience capable of complementing traditional educational methods and supporting the training of students and caregivers.

Paper 1242: Eyes On Track: An AI-Driven Context-Aware Navigation System for Pedestrian Road Safety

Grace Ataguba, Gerry Chan, Sivasubramanian Venkatasubramanian, Somya Agrawal, Oladapo Oyeboode, Japheth Mumo Kimeu, Rita Orji

KEYWORDS: CONTEXT-AWARE NAVIGATION, PERSUASIVE TECHNOLOGY, HAZARD DETECTION, PEDESTRIAN ROAD SAFETY, MACHINE LEARNING, ARTIFICIAL INTELLIGENCE (AI), GLOBAL POSITIONING SYSTEM (GPS).

Abstract: The rapid growth of urban mobility has heightened situational demands on people navigating complex environments, prompting their need to exercise high vigilance during daily movement. While the time available to perceive and respond to hazards is essential during mobility, context-aware navigation systems are increasingly in demand to help people navigate safely and efficiently. Therefore, this study introduces Eyes On Track, a novel mobile application that leverages Global Positioning System (GPS) to track user location and movement triggering ML-based hazard notifications along their route, and activating camera-based gaze check when at pedestrian crossing to confirm attentiveness before proceeding. Its design includes persuasive features rewarding users with points for practising safe navigation choices, and an innovative camera-based awareness check system, utilizing face detection and gaze estimation to ensure users are attentive at pedestrian crossings. This multi-faceted approach creates a dynamic and interactive tool that not only guides users safely through urban environments but also actively encourages and reinforces safe pedestrian practices. As part of the evaluation, we conducted an expert heuristic inspection with 5 human-computer interaction (HCI) experts who rated the application with a mean of 0.18 (SD = 0.2979), signifying that they found it to have little or no design issues. Qualitative feedback further confirmed system usability, with users noting its effectiveness in promoting safe crossing behavior. Overall, Eyes On Track application showed great potential for improving focus, accessibility, and user engagement in real-world use.

Paper 4074: ReflectAI: An AI-Driven Multimodal Journaling App for Promoting Mental Well-being

Judith Kurian, Anjali Rachel Benjamin, Gladwin Irudayaraj, Rita Orji, Oladapo Oyebo

KEYWORDS: EMOTIONAL WELL-BEING, MULTIMODAL EMOTION DETECTION, PERSONALIZED INTERVENTIONS, INTELLIGENT JOURNALING, PERSUASIVE TECHNOLOGY, MOBILE HEALTH APPLICATION, AFFECTIVE COMPUTING, MENTAL HEALTH, HUMAN-COMPUTER INTERACTION, ARTIFICIAL INTELLIGENCE.

Abstract: Emotional well-being is fundamental to mental health, yet many individuals find it difficult to recognize and manage their emotional states in daily life. In 2022, the World Health Organization (WHO) reported that more than 1 billion people are currently living with emotional disorders, with conditions such as anxiety and depression placing a significant burden on both individuals and society. Current digital emotional wellness tools rely on manual self-report mechanisms and offer predefined emotion options for users to choose from, which limit their capacity to support personalized interventions and influence mood change. To address these limitations, this study presents ReflectAI, a mobile application that uses multimodal emotion detection to accurately capture the emotional state of the user and deliver personalized interventions for emotional well-being. ReflectAI captures the emotional state of the user through three input modalities: typed text, voice recordings, and facial images. Each input is then processed by a dedicated artificial intelligence model to predict the emotional state of the user along with a confidence score. Based on the emotions detected, the system delivers four personalized interventions, namely motivational quotes, music recommendations, meditation videos, and breathing exercises, to support mood regulation. To evaluate ReflectAI, an expert evaluation was conducted with 5 Human-Computer Interaction (HCI) experts using 10 heuristics adapted for persuasive health technologies. The results show an overall mean severity of 0.32 (SD = 0.47), with no rating exceeding the cosmetic level, indicating little or no usability problems across the system. The findings are used to inform a set of practical design guidelines for researchers who seek to develop future emotional awareness applications that integrate multimodal emotion detection with personalized intervention delivery to promote emotional well-being.

Paper 4349: PharmaTrac: A mobile application for tracking adverse drug reactions and vital signs

Viral Siddhapura, Oladapo Oyeboode, Gerry Chan, Rita Orji

KEYWORDS: ADVERSE DRUG REACTIONS, DRUG SIDE EFFECTS, MOBILE- HEALTH (MHEALTH) APP, MOBILE APP, MEDICAL DRUGS

Abstract: Recently, healthcare applications have attracted much research attention due to their multiple functionalities to maintain, improve, and manage one's health. However, the possibility of Adverse Drug Reactions (ADRs) is often overlooked. Patients have faith in the reliability of medical systems and believe that prescription drugs are infallible. Despite the existence of several mobile apps for drug information and management, most apps cannot reduce deaths caused by unmonitored vital signs and side effects of drugs. Patients often do not know that a single medication can have multiple names, including chemical and brand names. Monitoring medication side effects is crucial for patient safety and improving quality of life. Timely management of adverse effects encourages compliance with treatment plans and reduces the likelihood of complications, contributing to overall therapeutic success. In this paper, we present the initial design and results of our proposed in-process mobile app, called "PharmaTrac." This app demonstrates how patients can benefit from reporting unexpected drug reactions to their physicians, along with their respective vital signs. The results suggest the importance of vital signs, graphical visualization, chatbot support, and outlining adverse drug effects.

Paper 7912: MoveMates: An AI-Driven Persuasive and Adaptive Technology for Promoting Collaborative Physical Activity

Raj Kamlesh Patel, Josteve Adekanbi, Rita Orji, Oladapo Oyeboode

KEYWORDS: PERSUASIVE TECHNOLOGY, PHYSICAL ACTIVITY, DEEP REINFORCEMENT LEARNING, ARTIFICIAL INTELLIGENCE, COLLABORATIVE FITNESS, MOBILE HEALTH

Abstract: Physical inactivity is a leading contributor to chronic disease, accounting for approximately 3.2 million deaths annually. Research has shown that group-based physical activity improves adherence compared to individual exercise, yet most fitness applications focus on individual tracking and lack support for real-time social collaboration. Those that include social elements typically rely on static models that do not adapt to user behaviour over time, and few integrate persuasive strategies systematically alongside AI-driven personalization. To address these gaps, we present MoveMates, a novel AI-driven collaborative workout application that integrates eight persuasive strategies from the Persuasive Systems Design (PSD) framework and Goal-Setting Theory, a Deep Q-Learning (DQN)-based companion recommendation system, and real-time collaborative workout features to promote sustained physical activity through social engagement. We evaluated MoveMates through an expert evaluation with five Human-Computer Interaction (HCI) experts using 10 well-established heuristics for persuasive health technologies. The evaluation yielded an overall mean severity rating of 0.24 out of 4, with four heuristics receiving perfect scores and no heuristic exceeding 0.80. Qualitative feedback highlighted the value of social collaboration and adaptive recommendations while identifying privacy controls, onboarding efficiency, and offline accessibility as areas for refinement. Based on these findings, we provide three design recommendations for building persuasive, AI-powered collaborative fitness technologies.

Paper 8527: SkinVista: Examining an Augmented Reality and Machine Learning Mobile Application for Suggestive Dermatological Diagnostics in Black African

Olamiposi Olaiya, Gerry Chan, Rotimi Aderibigbe, Omololu Enigbokan, Rita Orji

KEYWORDS: AUGMENTED REALITY (AR), MACHINE LEARNING (ML), DERMATOLOGICAL DIAGNOSTICS, BLACK AFRICAN POPULATIONS, MOBILE HEALTH (MHEALTH)

Abstract: In this research, we present SkinVista, a mobile application integrating augmented reality (AR) and machine learning (ML) to support dermatological awareness and learning for Black African populations. The system addresses diagnostic inequities in darker skin tones through a two-phase design. In Phase I, SkinVista uses AR-guided image capture to help users position the camera appropriately with respect to lighting, distance, and angle, while an ML model provides suggestive feedback on common skin conditions. In Phase II, the system is extended into SkinPop, a persuasive educational game designed to reinforce learning and sustain engagement. SkinVista uses a fine-tuned MobileNetV2 model trained on 960 images per class of eight common skin disease conditions to provide potential diagnoses using AR-assisted image capture. Phase I results showed that the app was usable and informative. Building on these findings, Phase II was developed to increase user engagement and learning using persuasive design principles such as reduction, self-monitoring, praise, and reward, implemented as features within the app. Results showed that all features were perceived to be persuasive and improved knowledge about skin conditions and self-care practices. These results suggest that a combination of AI-assisted diagnostics together with a persuasive game-play intervention can increase accessibility and deliver suggestive, educational guidance for skin-health management among underserved populations.

Paper 9172: Exploring Opportunities for Developing Persuasive Technologies for Coping with Racism

Oluebubechukwu Miracle Okolo, Grace Ataguba, Rita Orji

KEYWORDS: PERSUASIVE TECHNOLOGY, RACISM, COPING, MENTAL HEALTH, INCLUSION, PSD

Abstract: Racism constitutes a chronic psychosocial stressor that negatively affects mental health and well-being. While prior research has explored technologies that offer comfort, validation, and community support, limited work has examined how persuasive systems design (PSD) principles can be intentionally leveraged to scaffold adaptive coping processes. This study investigates how persuasive technologies may be designed to support individuals coping with racism. We conducted a two-phase mixed-methods study. In Phase 1, an online survey (N = 37) explored lived experiences of racism, coping strategies, and perceived design opportunities. Thematic analysis revealed three interconnected themes: (1) reflection and self-awareness, (2) social validation and collective coping, and (3) growth and active coping. These themes informed the development of a Figma-based prototype grounded in Persuasive Systems Design principles, incorporating tailoring, suggestion, rewards, social learning, and credibility support. In Phase 2, a formative pilot study (N = 10) evaluated perceived persuasiveness of the prototype features. Results indicate that interactive and socially grounded components were rated above the neutral midpoint on perceived persuasiveness, while static educational modules were rated lower. Qualitative feedback highlighted the importance of safety, moderation, and expert guidance. We contribute theoretically grounded design insights for developing persuasive technologies aimed at supporting coping with racism, while outlining ethical and practical considerations for future work.

Paper 2072: Low-Cost Monocular Vision-Based System for Upper Limb Rehabilitation Using Serious Games and Real-Time Biomechanical Metrics

Marcelo Policarpo Alves, Rummenigge Rudson Dantas, Junior Petry Machado

KEYWORDS: UPPER LIMB REHABILITATION; MONOCULAR VISION; HUMAN POSE ESTIMATION; SERIOUS GAMES; EXERGAMES; COMPUTER VISION; BIOMECHANICAL METRICS; VIRTUAL REHABILITATION.

Abstract: This paper presents a low-cost semi-immersive virtual rehabilitation system for upper limb motor training, based on monocular vision and real-time human pose estimation. The proposal integrates computer vision techniques, serious games and gamification strategies, with the aim of supporting functional monitoring and making the therapeutic process more interactive, while providing objective biomechanical metrics. Joint angles, movement time, and velocity are extracted in real-time using a conventional RGB webcam and the MediaPipe Pose framework, eliminating the need for depth sensors or proprietary hardware. A preliminary technical validation study was conducted with 10 healthy participants to evaluate angular accuracy, using mean absolute error (MAE) and Pearson's correlation. The results indicated a mean MAE of approximately 1° , with a strong linear correlation ($r \approx 0.99$), suggesting good agreement between the automatic estimates and the reference measurements under controlled conditions. Additionally, a usability study with 5 participants, based on the System Usability Scale (SUS), had a mean score of 70, indicating an acceptable level of usability. The results should be interpreted as initial evidence of feasibility, considering the methodological limitations of the study. Still, the proposed approach has potential as an affordable solution for functional monitoring in virtual rehabilitation and telemonitoring contexts, especially in low-cost scenarios.

Paper 5371: VocalMind: Real-Time Voice Stress Detection with Persuasive, Just-in-Time Interventions

Grace Ataguba, Oladapo Oyeboade, Mona Alhasani, Halleluyah Aworinde, Jagbir Singh, Rita Orji

KEYWORDS: AI, STRESS MANAGEMENT, BEHAVIOUR CHANGE, PERSUASIVE INTERVENTIONS, REAL-TIME, VOICE

Abstract: Stress management technologies are important for mitigating the global burden of stress-related mental health conditions. Traditional approaches (e.g., self-reports and surveys) have failed to timely detect stress and deliver just-in-time interventions in real-time. Also, existing stress technologies have rarely covered real-time unimodal early detection of stress. In this study, we developed VocalMind, a real-time, voice-based stress detection and intervention system that analyzes acoustic features of users' voices to predict momentary stress and delivers just-in-time support through guided breathing exercises and other relevant ones. Our unimodal detection pipeline compares deep learning architectures (RNN-LSTM, CNN, and ANN-MLP) trained on publicly annotated audio datasets. Results showed that the RNN-LSTM achieved the most stable performance (training $\approx 84\%$, validation $\approx 82\%$). Furthermore, the RNN-LSTM model was integrated into the VocalMind system and evaluated in a two-week pilot study with 15 participants. Results from this study showed significant improvements in intention ($t(14)=1.98$, $p<.05$), attitude ($t(14)=2.12$, $p<.05$), and self-efficacy ($t(14)=3.15$, $p<.005$), alongside reduced perceived stress ($t(14)=-1.78$, $p<.05$). Our study presents a framework and actionable recommendations for developing stress management systems in future work.

Paper 9250: Scaffolding Numeracy Through Play: Evaluation Adaptive Math Maze Game for Children with Down Syndrome

Matheus Prado Prandini Faria, Marcelo Zanchetta Do Nascimento, Vinicius Augusto de Souza, Joel Silveira Marques Pereira, Rita Maria Silva Julia

KEYWORDS: SERIOUS GAMES, GENERATIVE ADAPTIVE LEARNING, GAME-BASED LEARNING, INCLUSIVE EDUCATION, DOWN SYNDROME

Abstract: Digital games have significant potential to move beyond entertainment by enabling personalized and inclusive learning experiences for people with intellectual disabilities, particularly in foundational numeracy. However, empirically evaluated serious games specifically targeting counting, addition, and subtraction in children with Down syndrome (DS) remain scarce. This paper presents Maze Revolution, a user-centered serious game designed with an inclusive participatory process and integrated with I-GPLATO, a generative adaptive mechanism for session-level task relevance weighting. The system combines accessibility-driven interface refinements with an adaptive module that adjusts the emphasis on counting, addition, and subtraction based on historical learner performance and contextual features, while preserving pedagogical constraints. It was evaluated in a 12-week within-subject study with 16 children and adolescents with DS, including a hands-on pre-test, adaptive gameplay sessions, a post-test, and a follow-up assessment after a five-week no-intervention interval. Non-parametric analysis showed a statistically significant increase in overall numeracy accuracy from 46.3% to 64.4% ($p = 0.0044$), with pronounced gains in counting and addition and stable performance at follow-up. These findings provide preliminary evidence that an accessible, user-centered adaptive serious game may support individualized numeracy development for learners with heterogeneous cognitive profiles.

Paper 7904: Exploring Digital Card Games Cognitive Tool for Developing Computational Thinking Skills: Theoretical Evaluation Hearthstone

Xinyue Zhou

KEYWORDS: DIGITAL CARD GAMES, COMPUTATIONAL THINKING, COGNITIVE SCIENCE, HEARTHSTONE, SERIOUS GAMES, GAME-BASED LEARNING

Abstract: The integration of digital games into educational environments has shifted the focus from pure entertainment to interactive cognitive skill development. Concurrently, Computational Thinking (CT) has emerged as a fundamental literacy in K-12 education. However, current teaching approaches often narrowly associate CT with explicit coding, creating accessibility barriers for students and educators. This paper proposes a theoretical framework using commercial off-the-shelf Digital Card Games (DCGs) as implicit cognitive tools for developing CT skills. Through a systematic evaluation of the popular DCG Hearthstone, this paper maps core game mechanics like deck building, Mana resource management, and turn-based sequencing directly to established CT dimensions, including decomposition, pattern recognition, abstraction, algorithmic thinking, and evaluation. By analyzing specific gameplay scenarios, this framework shows how DCGs naturally require algorithmic problem-solving in a programming-free environment. Furthermore, this paper outlines a proposed methodological framework for future empirical studies to quantify the effectiveness of DCGs in K-12 CT education. Ultimately, this mapping provides educators and game designers with a foundational model for using existing DCGs to develop computational problem-solving skills.

Paper 4324: Playing Your Way to Fitness: A Competitive–Cooperative Exergame for Motivating Cardio

Diogo Guimarães, Jose Da Silva, Luís Nunes, Salomé Batista, Tomás Vasconcelos, Daniel Pinhão, André Thiago Netto, Thales Wendel Fernandes Vieira, Samuel Ferreira Gomes, José Nóbrega, Paulo Moreira Silva Dantas, Rummenigge Dantas and Hugo Paredes

KEYWORDS: EXERGAMES, GAME-BASED LEARNING, VIRTUAL ENVIRONMENT, CARDIO ADHERENCE, CROWDSOURCED LABEL QUALITY

Abstract: We present a third-person rowing exergame-GWAP that maps real strokes to an avatar boat and embeds brief image-classification microtasks (logs vs. rocks) into micro-dosed races with competitive and cooperative modes. Our research questions examine whether the virtual environment increases engagement and intent (RQ1), how social modes influence motivation and exertion (RQ2), and how game context and exercise state affect in-situ label quality (RQ3). We outline the instrumented prototype (per-user calibration, low-latency pipeline) and a pre-registered randomized crossover pilot using objective, subjective, and behavioural measures. As a work-in-progress poster, this paper focuses on the prototype and evaluation protocol; empirical results will be reported in future phases.

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