Abstracts of Sample Research Studies
in Virtual and Augmented Reality (2011-2016)
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Overview:

The design, development and empirical research on wearable-computer systems is not new as seen by the work of Steven Mann at the University of Toronto. Current wearable virtual and augmented reality products are available from companies such as Facebook, Google, Valve Corporation, Apple, Microsoft and Meta. Microsoft and Case Western Reserve University and the Cleveland Clinic commenced product research and evaluation in 2015 with the goal of revolutionizing medical anatomy instruction. What makes the HoloLens AR product different is Microsoft's objective. It is clearly focused on not only being the next computer that you "wear", but on the next computer for the enterprise

My research interest in this area started in an AI course during my Master's Program when I saw a very early system at George Mason University. As we move from creating *E-Learning objects* to *H-Learning objects* to enhance student-centered and inquiry-based learning, R & D contributes to decisions about product features, creation, evaluation and assessment. The following is a small sampling of empirical research studies conducted during 2011-2016. These studies investigate user-experience, human-computer interaction, disabilities, collaboration and classroom management, cost-effectiveness, long-term health and psychological issues of device usage. Understanding and applying this research is important for the effective design of Educational Virtual Environments (EVE).

Sample Studies:

3D Collaboration Method over HoloLens™ and Skype™ End Points
URL: http://dl.acm.org/citation.cfm?id=2814350 (*ImmersiveME '15 Proceedings of the 3rd International Workshop on Immersive Media Experiences, ACM Digital Library, 2015*)

Abstract:

This paper describes a new Augmented Reality (AR) system called HoloLens developed by Microsoft, and the interaction model for supporting collaboration in this space with other users. Whereas traditional AR collaboration is between two or more head-mounted displays (HMD) users, we describe collaboration between a single HMD user and others who join the space by hitching on the view of the HMD user. The remote companions participate remotely through Skype-enabled devices such as tablets or PC's. The interaction is novel in the use of a 3D space with digital objects where the interaction by remote parties can be achieved asynchronously and reflected back to the primary user. We describe additional collaboration scenarios possible with this arrangement.

A proposed use of Virtual and Augmented Reality for supporting inquiry based learning

URL:
http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=7359628&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D7359628 (*Interactive Mobile Communication Technologies and Learning (IMCL), 2015.*)

Abstract:

The research proposed in this paper will embrace the possibilities that eLearning tools can bring to Science education. A number of Virtual and Augmented Reality (VR and AR) devices are appearing on the market for research and development. The plan is to develop an Augmented Reality learning object, a software that will enable students to interact with learning resources and scenarios and allow them to experience inquiry-based learning (IBL) in science education.

An Exploration of Intended Use of Augmented Reality Smart Glasses

URL:
http://www.sba.oakland.edu/Faculty/Fliedner/mwdsi/Annual%20Conference%20Information/Valparaiso%202016/MWDSI%202016%20CONFERENCE%20PROCEEDINGS.pdf#page=98 (*Midwest DSI Annual Conference, Valparaiso University, Indiana, 2016*)

Abstract:

Numerous market research studies and an inspection of recent press releases among leading IT companies indicate that a new form of wearable device might soon influence the technology landscape: Augmented Reality Smart Glasses, that is, digital eye glasses that integrate virtual information in one's view-field. Yet, little is known about this nascent technology. In this research, we draw upon prior technology acceptance research and present the results of a large-scale cross-sectional study among 1,682 US-consumers. The study identifies Usefulness, Ease of Use, Entertainment, Design, and Public Privacy Issues as antecedents to usage intention. However, the strength of these effects differs between usage contexts (at home, in public, at work). Implications for Scholars, Managers, and Policy Makers are discussed.

Augmented reality persistent annotation

URL: https://www.ideals.illinois.edu/handle/2142/90635 (*Illinois Digital Environment for Access to Learning and Scholarship, University of Illinois, 2016*)

Abstract:

We present a novel augmented reality annotation system that can create persistent annotation in any environment. The environment is either meshed in real time or loaded from previously scanned model. The model remains invisible while providing reference to real world geometry. Annotations are persistent across multiple sessions and devices. Annotations can also be color-coded and filtered. Our interface has annotation indicators and a radar map to help users quickly locate annotations. Multiple devices can work under a synchronized network to facilitate collaborative annotation tasks. We also conducted a user

study to evaluate our system. Results have shown both quantitatively and qualitatively that our system improves productivity for annotation tasks. (Graduate Dissertation Thesis, University of Illinois, 2016).

Augmented reality smart glasses: an investigation of technology acceptance drivers

URL: http://www.inderscienceonline.com/doi/abs/10.1504/IJTMKT.2016.075690 (*International Journal of Technology Marketing, 2016*)

Abstract:

Microsoft HoloLens and Google Glass (Project Aura) are two examples of a new stream of wearable technology devices called Augmented Reality Smart Glasses that might substantially influence media usage in the near future. In this study, the authors draw upon prior technology acceptance research and propose an exploratory model of antecedents to smart glasses adoption. An empirical study reveals the importance of various drivers such as functional benefits, ease of use, individual difference variables, brand attitudes, and social norms. Although smart glasses are worn in a similar manner to fashion accessories and capture various personal information, self-presentation benefits and potential privacy concerns seem less likely to influence smart glasses adoption. The findings provide pre-market knowledge about smart glasses that can help scholars and managers understand this new technology.

Bringing user experience empirical data to gesture-control and somatic interaction in virtual reality videogames: an exploratory study with a multimodal interaction prototype

URL: https://repositorioaberto.uab.pt/handle/10400.2/4755 (*Paper presented at SciTecIn15 - Science and Technology Interaction Conference in Coimbra , 12-13 November 2015*)

Abstract:

With the emergence of new low-cost gestural interaction devices various studies have been developed on multi-modal human-computer interaction to improve user experience. We present an exploratory study which analyzed the user experience with a multimodal interaction game prototype. As a result, we propose a set of preliminary recommendations for combined use of such devices and present implications for advancing the multimodal field in human-computer interaction

Does Perceived Health Risk Influence Smartglasses Usage?

URL: http://link.springer.com/chapter/10.1007/978-3-319-30376-5_2 (*Drivers of Wearable Device Usage, Progress in IS, Springer Link, 2016.*)

Abstract:

The World Health Organization has warned populations about illnesses that can develop due to radiation. Since smartglasses, which are worn on the head right next to the brain, can emit radiation, their usage might be hindered by the Perceived Health Risks people associate with such devices. In this article, we empirically evaluate the topic by studying the influence of Perceived Health Risk on smartglasses usage. After collecting 109 completed online questionnaires about one specific pair of smartglasses, Microsoft HoloLens, and applying a structural equation modeling approach, our findings indicate that smartglasses

are at least partly hedonic technologies whose usage is influenced by Perceived Enjoyment. Furthermore, although we could not confirm a direct negative influence of Perceived Health Risk on the Behavioral Intention to Use smartglasses, we confirmed an indirect negative influence of Perceived Health Risk on Behavioral Intention to Use through Perceived Enjoyment. These findings suggest that smartglasses manufacturers need to emphasize the hedonic benefits of their devices as well as address people's potential negative perceptions of these devices in terms of their health.

Educational virtual environments: A ten-year review of empirical research (1999–2009)
URL: http://www.sciencedirect.com/science/article/pii/S0360131510003052 (*Computers and Education, 2011*.)

Abstract:

This study is a ten-year critical review of empirical research on the educational applications of Virtual Reality (VR). Results show that although the majority of the 53 reviewed articles refer to science and mathematics, researchers from social sciences also seem to appreciate the educational value of VR and incorporate their learning goals in Educational Virtual Environments (EVEs). Although VR supports multisensory interaction channels, visual representations predominate. Few are the studies that incorporate intuitive interactivity, indicating a research trend in this direction. Few are the settings that use immersive EVEs reporting positive results on users' attitudes and learning outcomes, indicating that there is a need for further research on the capabilities of such systems. Features of VR that contribute to learning such as first order experiences, natural semantics, size, transduction, reification, autonomy and presence are exploited according to the educational context and content. Presence seems to play an important role in learning and it is a subject needing further and intensive studies. Constructivism seems to be the theoretical model the majority of the EVEs are based on. The studies present real world, authentic tasks that enable context and content dependent knowledge construction. They also provide multiple representations of reality by representing the natural complexity of the world. Findings show that collaboration and social negotiation are not only limited to the participants of an EVE, but exist between participants and avatars, offering a new dimension to computer assisted learning. Little can yet be concluded regarding the retention of the knowledge acquired in EVEs. Longitudinal studies are necessary, and we believe that the main outcome of this study is the future research perspectives it brings to light.

Glass in Class? Examining the Pedagogical Applications and Complications of Google Glass in Secondary and Higher Education Classrooms
URL: https://www.editlib.org/p/150238 (*Proceedings of Society for Information Technology & Teacher Education International Conference 2015*.)

Abstract:

The Google Glass Explorer Program put this unique wearable technology into the hands of educators. As the device made its way into the classroom, pedagogical opportunities were discovered at the same time that potential pitfalls were exposed. While the medical field has championed Glass's value to surgeons and medical students alike, the K-20 educational arena has been mute by comparison. This paper reports

on the experiences of educators using Glass in a pilot study in secondary and higher education, and explains how a planned follow-up study, as well as the work of other researchers, could build on that pilot. It also makes recommendations for collaborative studies based on Google's reluctance to support educational research.

Glass Vision 3D: Digital Discovery for the Deaf

URL: http://link.springer.com/article/10.1007/s11528-016-0090-z (*Tech Trends, Springer US, 2015*)

Abstract:

Glass Vision 3D was a grant-funded project focused on developing and researching a Google Glass app that would allowed young Deaf children to look at the QR code of an object in the classroom and see an augmented reality projection that displays an American Sign Language (ASL) related video. Twenty-five objects and videos were prepared and tested by a focus group. Their suggestions were incorporated into a pilot test at a residential school for the Deaf. Four fifth grade students participated in a usability study. Results were mixed with researchers observing successful use of Google Glass by all participants along with enthusiastic engagement, but also recording a lengthy learning curve and hardware issues that distracted from the learning process. Wearable augmented reality is still in its infancy, but potential was demonstrated.

H-learning in the distance learning paradigm

URL: http://ieeexplore.ieee.org/xpl/login.jsp?tp=&arnumber=7317422&url=http%3A%2F%2Fieeexplore.ieee.org%2Fxpls%2Fabs_all.jsp%3Farnumber%3D7317422 (*Internet Technologies and Applications, 2015*)

Abstract:

Recent development in 3D holographic technology have brought new opportunities to address the limitations of computer-based e-/m-learning learning. Through which a teacher's hologram can address the limitations of e-/m-learning. This research will attempt to identify cost effective and feasible solutions to educate by using holographic learning (h-learning) in developing and third world countries. In particular, this research aims to test available internet resources to project teacher's hologram in under-developed countries and evaluate the impact and effectiveness of h-learning.

Impact of time on task on ADHD patient's performances in a virtual classroom

URL: : http://www.ejpn-journal.com/article/S1090-3798(12)00010-4/abstract (*European Paediatric Neurology Society., 2012Elsevier Inc.*)

Abstract:

Use of virtual reality tool is interesting for the evaluation of Attention Deficit/Hyperactivity Disorder (ADHD) patients. The virtual environment offers the opportunity to administer controlled task like the typical neuropsychological tools, but in an environment much more like standard classroom. Previous studies showed that a virtual classroom was able to distinguish performances of children with and

without ADHD, but the evolution of performances over time has not been explored. The aim of this work was to study time on task effects on performances of ADHD children compared to controls in a virtual classroom (VC).

Learning with Wearable Technologies: A Case of Google Glass
URL: http://link.springer.com/chapter/10.1007/978-3-319-25684-9_25 (*Communications in Computer and Information Science, 2015*)

The purpose of this study is to determine how wearable are used in education. Different types of wearable technologies, such as smart watches, fitness trackers, smart glasses, HoloLens or even smart clothing are gradually changing the structure of global consumer market. These changes inevitably lead to transformation of educational spaces. This paper presents a review of scientific literature for the last three years (2013-2015) in the field of using Google Glass as a teaching and learning tool. We have analysed over thirty papers in reviewed journals, proceedings of conferences and scholarly web sources. In recent years, there has been an increasing amount of literature on the use wearable technologies in education. Wearable devices are used by explorers, librarians and educators at workplaces, university libraries, laboratories and classrooms. Learning with wearables is one of the most widespread trends in medical or especially surgical education. Wearable computers are actively used by library staff and assist to library patrons at universities. Some of the pilot projects in learning with wearables help students to study anatomy, physics and other discipline through application prototypes. Overall, some sources indicate that learning with wearable technologies has big perspectives while other ones show several examples of low efficiency in using wearable technologies in education.

Reaching for Holograms Assessing the Ergonomic of the Microsoft HoloLens Gesture Know as the "Air Tap"
URL: http://s3.amazonaws.com/academia.edu.documents/39617312/Looker-IDC-Final-V5.pdf?AWSAccessKeyId=AKIAJ56TQJRTWSMTNPEA&Expires=1470684877&Signature=PyucXXgcDayez2PE7Xgb4s9x%2BxI%3D&response-content-disposition=inline%3B%20filename%3DReaching_for_Holograms_Assessing_the_Erg.pdf (*Carleton University, 2015*)

Abstract:

This paper assesses the ergonomics of the air tap, a 3D gesture used to interact with the Hololens™, a head-mounted optical see-through display being developed by Microsoft™. After reviewing ergonomics literature, we found the air tap appeared to be outside of known anthropometric and biomechanical limits and tolerances. Because the Hololens was unavailable for testing at the time of writing, the air tap was evaluated using methods that support general, observational data. The Rapid Entire Body Assessment (REBA), Rapid Upper Body Assessment (RULA) and Novel Ergonomic Postural Assessment (NERPA) methods were used to assess the gesture as observed in four videos.

Smart view: A study on students´ attitude toward employing smart glasses as a medium for e-learning.
URL: http://umu.diva-portal.org/smash/record.jsf?pid=diva2%3A940413&dswid=-831 (*Umeå University, Faculty of Social Sciences, Department of Informatics, 2016.*)

Abstract:

User attitude and their perceptions are increasingly being explored by a variation of methods. This thesis addresses the perception that one might have for employing smart glasses as a potential online educational tool. Furthermore, it explores the challenges that are associated with designing educational apps for smart glasses as a medium for e-learning in general. For addressing and identifying these challenges and exploring user attitude, this thesis employs two different approaches. Firstly, by identifying the current challenges associated with e-learning in literature-related studies and secondly, based on the related literature surrounding the topic of e-learning and augmented reality, this thesis conducts a field study using semi-structured interviews. This study proposes the final conclusion based on the field study and by reviewing identified challenges in literature.

The Potential for Virtual Reality in Education for Students Who Learn Differently
URL: http://www.landmark.edu/institute/read-our-monthly-newsletter/the-potential-for-virtual-reality-in-education-for-students-who-learn-differently/ (Landmark College, Institute for Research and Training, Vermont)

Abstract:

The Landmark College Institute for Research and Training, is exploring some of the innovative new worlds created for virtual reality. Research questions are centered on classroom management and the long-term health and psychological issues that might arise from being in a virtual world for long periods of time.

The Usage of Augmented Reality Smartglasses: The Role of Perceived Substitutability
URL: http://aisel.aisnet.org/amcis2016/ITProj/Presentations/4/ (*Association for Information Systems, 2016*)

Abstract:

Augmented reality smartglasses (ARSG) allow users to place virtual 3D representations of real objects, i.e., holograms, into a user's physical surroundings. For example, users can choose to place a virtual clock on their wall instead of the real physical object. We argue that being able to have fewer physical devices and products by replacing these objects with holograms offers multiple utilitarian and hedonic benefits. More specifically, we postulate that Perceived Substitutability, the extent to which a person believes that ARSG are able to substitute his/her real-life objects with virtual ones, is a positive influence factor of both Perceived Usefulness and Perceived Enjoyment, thus indirectly influencing ARSG usage. After collecting 109 questionnaires about Microsoft HoloLens and applying a SEM approach, our research model is confirmed, suggesting that manufacturers need to emphasize the utilitarian and hedonic benefits of their ARSG as well as promote their device's capability of substituting physical objects.