Advancements & Applications of Augmented Reality

Henry North

Southern Polytechnic State University

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There have been numerous advancements in recent years in the usage of augmented reality for various fields of study. This technology presents a new facet to the ways in which people learn and interact with one another. The focuses of this paper will be the interactions between augmented reality and education, augmented reality and the environment and augmented reality and social interactions.

Matt Dunleavy (2014) analyzed augmented reality from an instructive standpoint, noting how the main source of augmented reality games and systems was found in devices such as smartphones and tablets. Dunleavy states that the educational usage of augmented reality technology is divided into three instructional design principles, "enable and then challenge… [,] drive by gamified story… [and] see the unseen (2014, pg. 29)." Dunleavy then mentions that while the principles of augmented reality are beneficial as a teaching method, they are only one method and should be used in tandem with other methods that would work better for certain situations. According to Dunleavy, these principles should also be studied a bit further to increase not only the knowledge of how to work with augmented reality, but also how to increase the spread of knowledge gained through the use of such tools.

In discussing the differences of virtual reality from augmented reality, Fan Kang and Cunchen Tang (2014) explain the expansive use of augmented reality in fields other than education, such as in medicine and the military. They list off points where virtual reality is used as an assistive tool in education, but also explain the issues that come with

using virtual systems. It was suggested that virtual reality teaching methods be overlaid with those of augmented reality systems. AR systems currently offer a better teaching environment based in the real world, rather than a fictional setting, with less of the cost and resources needed for VR systems. Kang and Tang claim that virtual reality will be the star once it is more fully developed, but this won't come until after the reign of augmented reality. However, these claims may not hold true when it comes to certain uses of augmented reality.

Joseph R. Keebler et al. (2014) takes a focused look on an augmented reality system used to help people learn to play the guitar, the Fretlight. They compare it to traditional methods for learning how to play instruments that split the teaching tools into internal and external teaching styles. They argue that the Fretlight is able to combine those tools into one form, teaching in both the internal and external methods simultaneously, even though it is an external cognitive tool. Tools such as the Fretlight will be able to lower any barriers to learning how to use a musical instrument.

Delving further into the medical uses of augmented reality systems that were mentioned earlier, Ming-Kuan Tsai, Pei-Hsun Emma Liu and Nie-Jia Yau (2013) explain how they are using augmented reality technologies to increase the speed at which people evacuate to shelters during a nuclear incident. After an incident in 2011 that affected nuclear power plants in Japan, there have been studies made to maximize public safety from radiation. Originally using a pen and paper approach to teaching, the switch to electronic maps and augmented maps were used when pen and paper proved less efficient.

After an experiment run later that year, it was shown that the evacuation trainees who used the AR-maps made it to the shelters quicker than the trainees using electronic maps. The technology is still undergoing testing, because some issues were discovered, such as the mobile device dropping the map and having to identify the trainee's position again before continuing to work; however, it has been proven that augmented reality systems seem to be the best method of training for this situation.

Michele Florentino et al. (2013) detail the uses of augmented reality on headsets in the industrial world. Florentino et al. state that using overlaid headsets "is very useful to support complex maintenance or assembly processes where most of personnel time is spent retrieving technical task instructions, localizing parts, and operating on them in the right order (2013, pg. 171)." However, the current technology still has too many issues to overcome before it can be properly used, such as outside forces interfering with the viewing ability of the information on the augmented reality headsets. Different experiments with color of the HUD, text styles used and the backgrounds that the HUD will have to be displayed on as well as how it is presented on the headset are being tested to ensure that such a technology can actually be usable in future iterations.

In the similar field of assembly, Lei Hou et al. (2013) are finding ways using augmented reality to speed up the assembly process, transitioning from traditional pen and paper methods to virtual reality into augmented reality. Virtual reality was the first step taken in revolutionizing the assembly business, using virtual prototypes to identify any problems or issues that couldn't originally be identified using older methods; however,

virtual systems have issues with translating over to real world problems that can occur during the assembly process. Like with what Fan Kang and Cunchen Tang was dealing with in a previously mentioned research topic, augmented reality systems are being implemented to overcome the real world boundaries that virtual reality systems cannot handle. Hou et al.'s proposed solution is an animated augmented reality system that "provides information about components to be mounted and outputs to be assembled step-by-step so that an assembler can monitor their progress and ensure they do not damage components that have already been installed (2013, pg. 441)." Results from testing the animated AR system proved that the system increased the productivity and effectiveness of the assembly process, even to the point of allowing novices in the business to be able to be more efficient with their assembly skill.

In the medical and military spectrum, augmented reality is being used to increase the skill at which lives are saved after being injured by improvised explosive devices. Kenneth L. Wilson et al. (2013) took a study that showed that the skillset of combat medics was not at a level that they should be, with the average scores on a combat medic skills test being significantly lower than the score needed to pass the test. The study showed that the teaching methods were not sticking as effectively as they needed to, so they turned to augmented reality systems to assist in the educational sessions to prevent tension pneumothorax, the second most preventable cause of death on the battlefield. A study using premed students who had no armed combat background was done using a lecture and an AR headset that showed them the correct procedures on how to treat tension pneumothorax. The students using the AR headset had a higher success rate than those who just tried to

remember what was learned during the lecture. This study has shown that AR systems increased the capabilities of people to successfully do invasive surgery without fatal results, noting that the system allowed for any critical information to be readily available, so nothing would be forgotten or screwed up.

Tobias Langlotz, Jens Grubert and Raphael Grasset (2013) have not had as much luck in finding positive results in their augmented reality research. They discuss the matter of AR browsers on mobile devices: whether they are usual application that more of the general public should use or if they will fail to shine due to similar location-based services which get the job done just as easily. Some of the issues that augmented reality browsers suffer from include a lack of the same infrastructure brought about by Web 2.0, problems with how quickly AR applications drain a phone's battery life, and also how the information that can accessed through an AR application is normally geocentric and is not easily accessible outside of its prime location. In order to progressively get better, these are some of the hurdles that augmented reality browsers are going to have to get over or else they lose the chance to become a successful use of AR technology.

Michael Tscholl and Robb Lindgren (2014) have used augmented reality in a form that not only elicits an educational connection, but also involves the development of informal social interactions. Using an experimental augmented reality device called MEteor, Tscholl and Lindgren were able to conduct an experiment that focused on parents guiding their children through problem solving techniques in a public setting where the parent could only talk to the child, which allowed for the child to develop their cognitive abilities on

their own. This research using augmented reality was based on previous studies that stated that exhibits in science centers and museums had a way of creating informal social interaction and learning capabilities.

Augmented reality is not only a great tool for teaching, but it is also a cognition builder that can increase the level of someone's memory. It has applications in numerous fields that range from a fun gaming activity to assisting in saving one's life. As technology continues to advance, the applications of augmented reality in everyday life should also increase, which should prove to generally increase the cognitive abilities of the general populace as well as improve on other skills such as social interactions.

References Cited

Dunleavy, M. (2014). Design Principles for Augmented Reality Learning. *Techtrends: Linking Research & Practice To Improve Learning*, *58*(1), 28-34. Retrieved from http://proxygsu-sct1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=tfh&AN=92774887&site=eds-live&scope=site

Fan, K., & Cunchen, T. (2014). The Application of Augmented Reality Technology in Teaching Education. *Journal Of Chemical & Pharmaceutical Research*, *6*(5), 1446-1449. Retrieved from http://proxygsu-sct1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=96377760&site=eds-live&scope=site

Keebler, J. R., Wiltshire, T. J., Smith, D. C., Fiore, S. M., Bedwell, J. S., Nijs, L., & ... Seago, A. (2014). Shifting the paradigm of music instruction: implications of embodiment stemming from an augmented reality guitar learning system. *Frontiers In Psychology*, 51-19. doi:10.3389/fpsyg.2014.00471

Ming-Kuan, T., Pei-Hsun Emma, L., & Nie-Jia, Y. (2013). Using electronic maps and augmented reality-based training materials as escape guidelines for nuclear accidents: An explorative case study in Taiwan. *British Journal Of Educational Technology*, *44*(1), E18-E21. doi:10.1111/j.1467-8535.2012.01325.x

Fiorentino, M. (2013). Augmented Reality Text Style Readability with See-Through Head-Mounted Displays in Industrial Context. *Presence: Teleoperators & Virtual Environments*, *22*(2), 171-190. Retrieved from http://proxygsu-sct1.galileo.usg.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cph&AN=90405371&site=eds-live&scope=site

Hou, L., Wang, X., Bernold, L., & Love, P. D. (2013). Using Animated Augmented Reality to Cognitively Guide Assembly. *Journal Of Computing In Civil Engineering*, *27*(5), 439-451. doi:10.1061/(ASCE)CP.1943-5487.0000184

Wilson, K. L., Doswell, J. T., Fashola, O. S., Debeatham, W., Darko, N., Walker, T. M., & ... Weaver, W. L. (2013). Using Augmented Reality as a Clinical Support Tool to Assist Combat Medics in the Treatment of Tension Pneumothoraces. *Military Medicine*, *178*(9), 981-985. doi:10.7205/MILMED-D-13-00074

Langlotz, T., Grubert, J., & Grasset, R. (2013). Augmented Reality Browsers: Essential Products or Only Gadgets?. *Communications Of The ACM*, *56*(11), 34-36. doi:10.1145/2527190

Tscholl, M., & Lindgren, R. (2014). Empowering Digital Interactions with Real World Conversation. *Techtrends: Linking Research & Practice To Improve Learning*, *58*(1), 56-63. doi:10.1007/s11528-013-0721-6