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Does Augmented Reality Augment the Experience? A Qualitative Analysis of Enjoyment for Sports Spectators

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This study examined users' attitudes and opinions of using augmented reality technology in comparison to other non-augmented reality technologies. Broadly, there were differences between users when using different devices. These differences help shed light onto the process of implementation of such new technologies in various sports settings, from arenas and stadiums to at-home viewership. From the results of this study, it is likely that this technology may not lead to better fan experience, but instead might leave them feeling frustrated and potentially isolated. Particularly given the expense of technology like Google Glass, this study suggests such technology should be implemented selectively and carefully. Additionally, the effects of using Google Glass in stadiums and arenas may not simply be on the users, but also on those seated around them, who may be bothered by the deliberate actions of those wearing such augmented reality devices. Notably, this may shift as the devices become more prevalent.

Keywords: Augmented reality, sports, audiences, information seeking, experiment

Increasingly, new and innovative communication technologies have had a drastic impact on live sports spectator experience. In many cases, these implementations are done simply to keep pace with the mediated, at-home spectator experience, where fans have endless access to information through a variety of technologies. In particular, sports producers have looked to implement augmented reality devices, such as Google Glass, as part of the live spectator experience. However, it is unclear whether this technology will create a better fan experience. This study will attempt to better understand this quandary. Specifically, this study examines users' attitudes and opinions of using augmented reality technology in comparison to other non-augmented reality technologies in sports spectatorship. To do so, the emotions, behaviors, and thoughts of spectators were recorded as open-ended responses, then examined for common themes using grounded theory, inductive approach.

Consumption of Sports Media

Sports content producers and sports organizations consistently compete for revenue and market advantage (Rein et al., 2006). As a result, the sports media market often looks for ways to engage their fans and satisfy consumers. One way that sporting events are being enhanced is through augmented reality (Heimbold, 2015). Specifically, sports teams have

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begun to implement Google Glass, an innovative computing device that is worn as eyewear, in creating unique, interactive stadium experiences for fans (Dwoskin, 2014). While such projects are new and have been fairly limited, they do represent an important means of maintaining a sporting public increasingly expecting to have constant engagement with information while watching a sporting event. Sports organizations have looked towards Google Glass to offer unique spectator experiences, often taking them closer into the sports action and giving them unique fan experiences (Cohen, 2014). Many teams across several sports have used the technology to give their fans a better stadium and arena experience (Kulp, 2014). To state plainly, sports organizations are looking for ways to enhance fan engagement by using new technology; Google Glass is one means of doing this. A recent study suggests that augmented reality can be an effective way to reach and entertain audiences provided that the augmented reality engenders feelings of competence and autonomy, two components of Ryan and Deci's(2000) self-determination theory (blinded for review).

Augmented reality has been defined in a handful of ways, but researchers suggest broad definitions with fewer limitations are most useful (Wu, Lee, Chang, & Liang, 2013). As such, a useful definition of augmented reality is "a situation in which a real-world context is dynamically overlaid with coherent location or context-sensitive virtual information" (Klopfer & Squire, 2008, p. 205). Essentially, it's where the physical world and the digital world are displayed simultaneously (Klopfer & Sheldon, 2010). For example, augmented reality at sporting events like golf and tennis can show spectators the length of food lines, scores/statistics, or player information just by pointing the device in the appropriate direction (Lester, 2009). The idea is that the viewer can watch a sporting event through an augmented reality device, and relevant information will be displayed on top of it (Sporttechie.com, 2012). This information is typically presented as a digital overlay to the actual environment. In doing so, the device presents information to the spectator without requiring him or her to take his or her eyes off of the action. This should enhance engagement with the event and the social experience surrounding the game.

Regardless of the advancements made at the arena, some fans may choose to stay home for a highly engaged sporting experience instead of paying to watch the game in person, where access to technological amenities, such as wi-fi and ability to use computers, are more readily available (McCarthy, 2014). Indeed, the term "couchgating" has been used to describe the act of watching sporting events with all of the amenities of home. Thus, sports producers increasingly have been compelled to create a worthwhile experience for fans in the arena (Hammond, 2014). Integration of new media technology such as augmented reality may be one way in which the spectator's experience can be enhanced at the stadium to combat the increasing easy propensity of trading a stadium seat for a living room couch.

In summary, sports consumers have options when choosing how to experience sports entertainment. Many choose to stay home instead of going to the arena because of the technological conveniences. As a result, to compete, sports media organizations have begun to implement more technology at the arenas. This *should* make the arena experience more appealing and thus more profitable. However, whether or not this is the case has not been thoroughly explored. One area of scholarship that may underline this phenomenon is information seeking. Perhaps by applying information seeking to the at-home versus in-arena experience will shed light on this query.

Information Seeking

According to Case (2012, p. 5), information seeking is "a conscious effort to acquire information in response to a need or gap in your knowledge." In other words, when a person feels that he or she needs to address a lack of knowledge, he or she will purposefully engage in tasks that will address that lack of knowledge. Information seeking can include a variety of behaviors, such as reading a book, asking a colleague questions, or searching the Internet.

"Dozens" of information seeking models have been put forth over the years (Case, 2012, p. 135). Wilson (1999) describes a process in which a user has an information need which leads to demands on information systems, after which the information seeking succeeds or fails. If it succeeds, the information is used. If it fails, the process reaches a dead end. A second Wilson model is suggested, but it is cyclical. In the second model, information need is impacted by intervening variables such as psychological variables and source characteristics. This then leads to the type of information seeking behavior (passive or active) and, ultimately, information use.

In another model (Krikelas, 1983), an environment creates information needs, and the user then decides if those needs are immediate or can be delayed. If immediate, the seeker then chooses a preferred information source. Many of these sources can be external, such as the Internet. Meanwhile, Ellis (1989) describes a series of activities related to information seeking. These activities include, but are not limited to the following: the initial search for information, chaining of information to find needed information, browsing for information or a more casual scanning of information, and assessing information.

In summary, many models of information seeking have been put forth. Differences between the models tend to manifest in terms of passive exposure to information versus proactive seeking of information, some of the models are loops while others are not; and some of the models are testable while others are not (Case, 2012). We believe that for our purposes, a model of information seeking in sports viewership should be proactive, a loop, and testable. The model should be proactive because a majority of the information seeking that takes place while watching a sporting event is likely proactive. That is, audience members will decide whether or not they want to seek information. The model should be a loop because of the considerable benefits of such a design (Goetz, 2011; Hattie & Timperley, 2007; Ramaprasad, 1983). In other words, feedback loops are noted for their effectiveness in a variety of domains. Finally, a testable model is important to examine its veracity.

Broadly there is an increase in media literacy and digital competency for all media consumers, including sports consumers (Prensky, 2001). As a result, entertainment platforms must adapt and evolve to accommodate these advances information seeking techniques. This study aims to explore that process.

Google Glass and Other Information Seeking Technology

In the current study, we identify a handful of elements from previous models of information seeking that we believe may be critical during sports viewership – namelyintervening variables such as psychological variables and source characteristics (Wilson, 1999) as well as environmental prompts and immediate needs for information (Krikelas, 1983). These appear to be the most relevant during sports viewership.

Notably, younger generations have identified the Internet as the main resource for information seeking (Gray, Klein, Noyce, Sesselberg, & Cantrill, 2005). Accordingly, sports

venues should make the Internet as accessible as possible to appeal to younger audiences and allow for information seeking. However, the Internet is not necessary for information-seeking tasks. For generations, sports fans have looked to traditional print publications – a program or media guide – for supplementary information about a game, team, or other relevant facts. These programs have served a multitude of functions for sports teams, including providing fans a chance to gain more information than they would by simply watching the contest (Favorito, 2012). Likewise, smartphones may be the most ubiquitous means of sports fans seeking additional information. Many fans at sporting events can be found using their phones, likely to supplement their viewing experience. In short, there are many ways in which audiences can seek information at sporting events, and one avenue may or may not be superior to another. This is important to note as installing and implementing major changes to technology in an arena is a considerable and expensive undertaking. These advances may not provide any actual benefit despite the high cost.

Perhaps one of the most notable innovations and adaptations for supplementing a viewing experience was Google Glass, wearable computing technology (worn as eyewear) that allowed users to see a screen in their peripheral field of vision while commanding the device largely through voice commands. The Glass serves as a form of augmented reality, enhancing the actual live experience of the user by merging the physical and virtual worlds for the user (Kumar, 2012). While Google Glass (or other similar wearable technology) has not reached large scale production/distribution, this technology has created the groundwork for subsequent similar (and likely improved) devices (Metz, 2014). Regardless, Google Glass represented a new means by which information could be intuitively and seamlessly searched for and received, even if a consumer version has not been released (Metz, 2014). This sort of technology has obvious and clear potential in the landscape of sports spectatorship, where items like media guides and smartphones do not share this augmented perspective, but rather would pull the spectator's attention from the live action. While both media guides and smart devices are likely a more familiar and ubiquitous means of finding information for sports spectators (and certainly represent the more common second "screen"), Google Glass and devices like it could perhaps provide a different and even more complimentary experience while watching a sporting event.

As such, it may be compelling to implement Google Glass in arenas, but we suggest research be done to assess the benefits engendered from doing so. We explore if there are fundamental differences in information seeking tasks as related to psychological variables, source characteristics, environmental prompts, and immediate needs when using Google Glass, a smartphone, or a media guide. Consequently, we arrive at the following research question:

RQ1: How does augmented reality technology differ from other technology (smartphone and media guide) in terms of information seeking?

Beyond general pragmatics, it is also unclear whether augmented reality devices such as Google Glass will truly provide a "better" experience for sports spectators than either mobile smartphones or even traditional media guides. While the technological allure and potential of Google Glass are impressive and even intoxicating to sports producers, all of whom desperately seek ways to further engage their fans, it is unknown if sports fans will have a better sports experience through the use of this emerging technology.

As such, we arrive at two more research questions:

RQ2: How can augmented reality be effectively implemented?

RQ3: What advantages and disadvantages does the use of augmented reality engender?

Method

This study examined user responses after using different technologies during information seeking tasks while spectating a sporting event. Participants watched a sporting event while using one of three devices (media guide, smartphone, augmented reality (Google Glass) to seek information. Data was collected as part of a larger dataset used for a separate study.

Sixty-five ($N = 65$) people were recruited at a northeastern university. The majority of participants were men (54.00%), Caucasian (90.80%), and born between the years of 1989 and 1994 (92.30%). Participants were evenly and randomly distributed across devices. Twenty-two individuals in the sample used the media guide. Twenty-two individuals in the sample used smartphones. Twenty-one individuals in the sample used augmented reality.

Participants watched a 10-minute clip of a college basketball game. This footage was selected because data collection took place during basketball season. Also, the teams in the game were from California and Oregon, two teams that the participants (at a northeastern university) would not likely have much knowledge of or prior attitudes toward. The footage was also shown in a theater setting to more accurately facilitate the feel of watching a sporting event with other fans. Participants watched the footage in groups of five. When participants entered the theater, they were given brief instructions and tutorials for their device.

The information-seeking tasks were designed to represent information that a person might look up while watching a sporting event. Tasks included "Look up the California Men's basketball head coach," "look up what year Haas Pavilion (the venue where the game was being played) was renovated," and "look up the California Men's basketball schedule this season." Every two minutes, participants were given new information seeking task. After receiving a task, the participants used a California Men's Basketball media guide, their smartphone, or a pair of Google Glass to find the information. Whether or not participants found the information, they continued watching the game. They were not asked to write this down or report it at the time.

Afterward, participants left the theater area and were escorted to a lab setting where they responded to a short questionnaire. In this questionnaire, participants responded to the following open-ended questions: "When not performing tasks asked of you, what did you do?" "What were your overall impressions of performing the tasks?" "Explain how you felt during this. What thoughts did you have?" "Would you like to watch a game in this fashion? Why or why not?"

Given the lack of theoretical and empirical research regarding this technology as well as its novelty, we felt exploratory analysis and a grounded theory approach was most beneficial. We were interested to see the qualitative differences between user responses to these tasks while using different technologies. All responses were read in their entirety and analyzed for common ideas. These ideas were then organized into themes and were placed into clusters to discover patterns within the responses.

Results and Discussion

Analysis of the responses revealed the following themes: effort, attitudes toward the device, and socializing. In other words, the comments seemed to reflect varying degrees of effort required for the tasks/devices, specific attitudes toward the tasks/devices, and how performing these tasks/using these devices impacted the users' views of themselves and one another socially.

Effort

First, those using their smartphones indicated that they exerted much less effort while watching the game and performing the information seeking tasks. Specifically, more than half of those who used the augmented reality technology said they "tried to watch the game" when not performing a search. Similarly, just under half of those who used the media guide said they "tried to keep up with the game" when not performing a search. Conversely, almost none of those using smartphones left a response that indicated effort. Instead of "trying to watch the game," those using smartphones just "watched the game" when not performing search tasks. From this, we conclude that those using the smartphone were required to use much less effort. This conclusion is further supported by the pattern that those using the augmented reality technology and the media guide gave much more elaborate responses describing their experiences during the game (media guide users wrote a total of 1741 words, Google Glass users wrote a total of 1634 words, and smartphone users wrote a total of 1359 words). For example, an augmented reality user said, "I tried to watch the game, but the Google glasses kept most of my attention because it was my first experience with them," and a media guide user said he or she "tried to watch the game and skim the pages of the guide to prepare for the next task." Those using smartphones gave little description outside of the fact that they were simply "watching the game."

From this data, we concluded that those using their smartphones were under less of a cognitive burden than those using the media guide or augmented reality. A person's ability to cognitively process information, such as a sporting event, could be depleted when another stimulus requires cognitive resources (Sweller, 1988). Using the media guide and Google Glass was challenging and therefore left fewer cognitive resources than using the smartphone. Indeed, reduction of cognitive resources can impede the decision-making processes (Drolet & Luce, 2004), and other noteworthy outcomes (Lamble, Kauranen, Laakso, & Summala, 1999; Ward & Mann, 2000). Cognitive resources are required for a person to stay focused on a goal (Hattie & Timperley, 2007; Kluger & DeNisi, 1996), even when that goal is watching a sporting event. And this reduction of cognitive resources makes creating entertainment media challenging (Mayer & Moreno, 2003). In other words, competing for attention in a crowded media landscape is difficult.

Consequently, we suggest that the cognitive burden stands in the way of enjoying a sporting event because it reduces feelings of competence. Self-determination theory argues that competence, or a feeling of mastery and effectiveness, is an intrinsic psychological need that individuals aim to gratify (Ryan& Deci, 2000). The gratification of competence needs can lead to greater degrees of enjoyment (Ryan, Rigby, & Przybylski, 2006; Tamborini, Bowman, Eden, & Grizzard, 2010). That is, when entertainment media encourages feelings of competence, that person will enjoy the game more than they would if he or she did not feel as competent. The same should be accurate for viewing sports and attracting viewers to those events. Based on this argument, sporting events should focus on creating feelings of competence during information seeking tasks for their audience members. In turn, audience members will enjoy the event more and be more likely to pay to consume that content.

Attitudes Toward the Task/Tech

Each group (smartphone, media guide, and augmented reality) had at least some users who found the tasks "easy" or "simple." For example, one using Google Glass said it was "easy once I got the hang of it." One using the smartphone said the tasks"were easy." One using the media guide said, "they were not hard tasks to perform." While these attitudes

appeared to be uniform when the tasks were viewed as "easy," the negative attitudes associated with the tasks were disparate based on what technology people were using. Many using the augmented reality and media guide did *not* perceive the tasks to be "easy." When they did not find the tasks to be "easy," those using augmented reality said that Google Glass was "difficult" to operate. For example, some users said that the device did not pick up their speech when performing searches, or they noted their inability to use the Glass effectively. Those using the media guide who did not find the tasks "easy" said that the tasks were "tedious" or a "waste of time." Few of the smartphone users indicated that the tasks were anything but "easy." However, the tasks were viewed as "boring" and "trivial," not difficult. We interpret this to mean that the smartphone tasks were *too* easy and did not provide enough of a challenge to gratify the users or to justify a distraction from the game. A flow state is a pleasurable state of enjoyment that some enter when they are engaged and immersed in an activity (Csikszentmihalyi, 1990).

Typically, a flow state can be entered when the users' skills and the challenge of the task are matched properly. If the task is too difficult, the user will become frustrated. If the task is too easy, the user will become bored(Sherry, 2004). We believe this reflects the pattern we found in our study based on what technology was used such that the matching of skill to challenge was critical to enjoyment. Importantly, some of the Google Glass users indicated an excitement for using the device despite the enhanced difficulty. One user said that the experience was "new and interesting." Neither smartphone users nor media guide users indicated this degree of novelty.

Finally, most of the media guide users did not want to watch a game in this fashion. They found it "distracting" and "slow." One user said that it "takes away from the game." Smartphone users were similarly distracted and felt like they were not engaged enough with the game. Users felt like they were not "there." Augmented reality users were torn between the major distraction of using the Glass and the untapped benefits of the technology. Many users expressed a desire to use the Glass more and become more proficient with it. In that circumstance, they would like to watch a game in this manner and use the Glass to its full potential. For example, one user said the Glass "seemed much easier than having to pull out my phone."

We believe that the device used helped to dictate the different attitudes. In this fashion, the technology may have been inducing certain specific feelings (Hamm, Schupp, & Weike, 2003). These feelings may have different action tendencies (Shen & Bigsby, 2010) or feelings result in a certain type of behavior. For example, when someone feels happy, he or she wants to share that joy and bond with others. When a person is surprised, he or she wants to figure out what is going on around them. Frustration is similar to anger and can lead to a desire to remove whatever is causing the anger. Those using Google Glass wanted to get rid of the Glass or figure out how to use it to reduce their anger. Those using the media guide were likely experiencing similar emotions. Meanwhile, those using their phones were bored.

In summary, content producers should consider the implications of flow state as well as emotion's action tendencies when implementing certain technologies. If a content producer can encourage a flow state and emotions with desirable action tendencies, the content will be more successful.

Social Aspects

Similarly, those who were using augmented reality were often "frustrated" but also embarrassed by their inability to use the technology and stated that they felt "awkward" using the device. These feelings impeded the users' ability to watch the game. On a few

occasions, responses indicated a degree of excitement or feeling superior to others. One said, "I felt smart by being able to look up and find answers quicker than the other participants who had to look through media guides to find the answers," and another said, "It was cool to use this new technology. I feel like this will redefine the way some people watch sporting events and other shows." Those using the media guide indicated feelings of "irritation" and "discomfort." One user said, "I felt like I was performing a balancing act with the binder on my knee; it was uncomfortable. In a stadium with people right near me, it would be harder." They also felt irritated that they were using an obsolete technology that was not helpful in comparison to a smartphone or Google Glass. Perhaps not coincidentally, those using the Google Glass irritated the participants using the media guide. Smartphone users did not indicate this irritation. Meanwhile, the majority of smartphone users said that this experience of watching the game felt normal if not a little distracting. Thus, there was a certain "normal" feeling when using a smartphone but not with the other items.

Another dimension of SDT is relatedness (Ryan & Deci, 2000), or a sense of feeling connected to the community. It appears that the media guide and Google Glass created a barrier to feeling relatedness, and thus, they were less likely to gratify that psychological need. This was evident in a handful of responses such that the use of anything out of the ordinary (media guide and Google Glass) could be slightly stigmatizing. According to Link and Phelan (2001), certain behaviors can fulfill a stereotype. Once this stereotype is activated, people can become labeled, stigmatized, and discriminated against. Perhaps the media guide and the Google Glass were viewed as objects that could cue stereotypes. Google Glass could be perceived as nerdy or techy. The media guide was antiquated and could be labeled as old or poor. The phone, however, was standard and did not create this discomfort. In terms of emotion, these emotions reflect fear and guilt (Shen & Bigsby, 2010), where one looks for protection and strives to reclaim a self-standard. The Google Glass and media guide users appeared to be engaging in these behaviors because the devices made them uncomfortable among the peer group.

In light of **RQ1**, augmented reality technology differs from other technology (smartphone and media guide) when information seeking. Google Glass was noticeably different than the smartphone but not too much different than the media guide.

As for **RQ2** and **RQ3**, the main barriers to Google Glass were feelings of frustration and social discomfort. Under the guidance of SDT, we suggest that increased feelings of competence and relatedness will aid in increasing the enjoyment of augmented reality technology. Meanwhile, there appeared to be two consistent advantages of augmented reality technology: users liked the novelty, and they saw a lot of potential for the technology. As such, we suggest that sports venues should strongly consider these findings before investing in and installing new technology. Specifically, content producers should ensure that the changes they make encourage a flow state, emotions with beneficial action tendencies, and satisfy the needs of competence and relatedness.

Conclusion

As with any piece of social science research, there were a handful of limitations to this study. First, the study was not conducted at an actual live sporting event. Ideally, this study could be replicated in such a setting. Second, we did not anticipate users to compare themselves to others in their sessions. The results would likely look different had the users watched the game alone, unaware of the others' technology. Lastly, many of the users were completely inexperienced with the Glass. Had they had a bit more training on the device, the results might look quite different.

This study examined users' attitudes and opinions of using augmented reality technology in comparison to other non-augmented reality technologies. Broadly, there were differences between users when using different devices. These differences could help shed light onto the process of implementation of such new technologies in various sports settings, from arenas and stadiums to at-home viewership. From the results of this study, likely, this technology may not lead to better fan experience but instead might leave them feeling frustrated and potentially isolated. While there could be a novelty factor of the technology that could appeal to some fans, it appears more likely that sports fans could suffer emotional stress, certainly not an intention of any team or stadium owner. Particularly given the expense of technology like Google Glass, this study suggests such technology should be implemented selectively and carefully. Additionally, the effects of using Google Glass in stadiums and arenas may not simply be on the users, but also on those seated around them, who may be bothered by the deliberate actions of those wearing such augmented reality devices. Notably, this may shift as the devices become more prevalent.

Conversely, continued efforts to best utilize smartphones in stadiums and arenas could help sustain a better fan experience and, in turn, help combat the increased urge of fans to watch from home instead of attending in person. From the results of this study, it is likely that fans can enjoy a live sporting event while also engaging with their smartphones, something that seems less likely with Google Glass or a traditional print media guide. Investing in increased arena and stadium wife capabilities may be a smart move in sustaining live attendance, especially as it allows sports producers to engage with their fans in a way that does not negatively impact the live spectating experience.

However, such interaction should be deliberate and well considered. While this study indicated that sports fans might currently have a better experience with a smartphone than Google Glass, fans could become bored with some of the tasks performed on a smartphone. So for example, if teams tried to engage fans with trivia questions, contests, or other interactive activities through their smartphones to enhance the live spectating experience, it is important these tasks are not perceived as overly simple or tedious, but rather provide adequate challenge and engagement. In other words, this study indicates it is not enough for teams to simply engage fans through smartphones, but rather to engage them in a way that truly interests them. As such, the device is not necessarily driving the differences but the psychological states thereof.

While this study suggests that smartphones may be the most logical way for teams to engage fans at arenas and stadiums, that does not inherently mean that augmented reality devices such as Google Glass could not be used to enhance the live fan experience. Fans must first gain a general sense of competency with the technology. As Google Glass never truly found any widespread distribution (and is currently being further developed) and hardly left a beta phase of development, it seems unlikely a cross-section of fans would have that same competency they would have on a smartphone or even a print media guide. Perhaps if fans were allowed to use this technology throughout many games or a season, this sense of competency might increase. As such, augmented reality devices could potentially be used for regular game attendees (perhaps season ticket holders) as opposed to the entire fan base at a stadium or arena. Additionally, allowing blocks of fans to use this technology (as opposed to having them spread sparingly throughout the stadium or arena) might reduce feelings of social discomfort. In other words, creating an "enhanced technology" section of a stadium or arena – much like a family section or club seating section – could be a smarter way of implementing this new technology effectively into the live spectating experience.

We provide preliminary evidence that feelings of competence and relatedness are key ingredients for augmented reality technology (in this case Google Glass) to succeed in sports spectatorship and this reflects previous research (blinded for review). By identifying these shortcomings and advantages, we hope that this study will impact applications of such devices as well as spark future research on the topic. Further, we hope that continued research on this topic will allow sports producers (teams, leagues, stadiums, arenas, and others) to create a more fulfilling experience for sports fans, helping to preserve the vitality of live sports spectatorship in what has become an increasingly mediated sports landscape.

References

Case, D. O. (2012). *Looking for information: A survey of research on information seeking, needs, and behavior*. Emerald Group Publishing.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper Collins.

Drolet, A., & Luce, M. (2004). The rationalizing effects of cognitive load on emotion-based trade-off avoidance. *Journal of Consumer Research, 31*(1), 63-77.

Dwoskin, E. (2014). Google Glass Turns Its Lens on Sports. *wsj.com.* http://blogs.wsj.com/digits/2014/01/22/google-glass-turns-its-lens-on-sports/

Ellis, D. (1989). A behavioral approach to information retrieval system design.*Journal of documentation, 45*(3), 171-212.

Favorito, J. (2012). *Sports Publicity: A Practical Approach* (2nd ed.). New York, NY: Routledge.

Goetz, T. (2011). Harnessing the power of feedback loops. *Wired*. http://www.wired.com/magazine/2011/06/ff_feedbackloop/

Gray, N. J., Klein, J. D., Noyce, P. R., Sesselberg, T. S., & Cantrill, J. A. (2005). Health information-seeking behavior in adolescence: the place of the internet. *Social science & medicine, 60*(7), 1467-1478.

Hamm, A. O., Schupp, H. T., & Weike, A. I. (2003). Motivational organization of emotions: Autonomic changes, cortical responses, and reflex modulation. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (eds.), *The Handbook of Affective Sciences*. Oxford: Oxford University Press.

Hammond. T. (2014, April). *Stadiums Race to Digitize: How Sports Teams Are Scrambling to Keep Millennials Coming to Games*. TechRepublic.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research, 77*(1), 81-112.

Heimbold, S. (2015). NBC Golf Gains Augmented Reality Advantage with RCS. *TVTechnology.com*. http://www.tvtechnology.com/equipment/0005/nbc-golf-gains-augmented-reality-advantage-with-rcs/276496

Klopfer, E., & Sheldon, J. (2010). Augmenting your own reality: Student authoring of science-based augmented reality games. New Directions for Youth Development, 128,85-94. doi: 10.1002/yd.378

Klopfer, E., & Squire, K. (2008). Environmental detectives: The development of an augmented reality platform for environmental simulations. Educational Technology Research and Development, 56(2), 203-228.

Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin, 119*, 254-284.

Krikelas, J. (1983). Information-Seeking Behavior: Patterns and Concepts.*Drexel library quarterly, 19*(2), 5-20.

Kumar, H. (2012).

Lamble D., Kauranen, T., Laakso, M., & Summala, H. (1999). Cognitive load and detection thresholds in car following situations: Safety implications for using mobile (cellular) telephones while driving. *Accident Analysis and Prevention, 31*,617–623.

Lester (2009). Augmented Reality and the Future of Sport. *Augmentedplanet.com*. http://www.augmentedplanet.com/2009/12/augmented-reality-and-the-future-of-sport/

Link, B. G., & Phelan, J. C. (2001). Conceptualizing stigma. *Annual Review of Sociology*, 363-385.

Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational Psychologist, 38*(1), 43-52.

Metz, R. (2014, November 26). Google Glass is Dead; Long Live Smart Glasses. *MIT Technology Review*. Retrieved fromhttp://www.technologyreview.com.

Prensky, M. (2001). Digital natives, digital immigrants, part 1. *On the horizon*, *9*(5), 1-6.

Ramaprasad, A. (1983). On the definition of feedback. *Behavioral Science*, 28(1).

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary educational psychology, 25*(1), 54-67.

Ryan, R. M., Rigby, C. S., & Przybylski, A. (2006). The motivational pull of video games: A self-determination theory approach. *Motivation and Emotion, 30*, 344-360.

Scherer, K. R. (2003). Introduction: Cognitive components of emotion. In R. J. Davidson, K. R. Scherer, & H. H. Goldsmith (eds.), *The Handbook of Affective Sciences*. Oxford: Oxford University Press, pp. 563-571.

Shen, L., & Bigsby, E. (2010). Behavioral activation/inhibition systems and emotions: A test of valence vs. action tendency hypotheses. *Communication Monographs, 77*, 1-26.

Sherry, J. L. (2004). Flow and media enjoyment. *Communication Theory, 14*, 328-347.

Sporttechie.com (2012). Augmented Reality: Here to Stay In Sports. *Sporttechie.com.* http://www.sporttechie.com/2012/10/17/augmented-reality-here-to-stay-in-sports/

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257-285

Tamborini, R., Bowman, N. D., Eden, A. L., & Grizzard, M. (2010). Defining media enjoyment as the satisfaction of intrinsic needs. *Journal of Communication*, *60*, 758-777.

Ward, A., & Mann, T. (2000). Don't mind if I do: Disinhibited eating under cognitive load. *Journal of Personality and Social Psychology, 78*(4), 753-763

Wilson, T. D. (1999). Models in information behaviour research. *Journal of documentation, 55*(3), 249-270.

Wu, H. K., Lee, S. W. Y., Chang, H. Y., & Liang, J. C. (2013). Current status, opportunities, and challenges of augmented reality in education. *Computers & Education, 62*, 41-49.

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