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Television Directors' Visual Focus on Sport Games: An Eye-Tracking Study

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Abstract: With the advent of digital media, live television sports broadcast became an important training for future sports communication professionals. Sports TV directors will usually direct all broadcast sports visual contents, in the training of student (future) sports TV directors, they must first have solid background knowledge of the sports itself, be familiar with sports TV directing and their sports onscreen visual focus should be the most important aspect of all. The current study is an exploratory and pioneering eye-tracking study in sports communication that combined sports TV directing with eye-tracking methodology, examining the visual focus of sport TV directors on volleyball games, with a Cognitive Load theoretical framework. It attempts to fill the gap in the sports communication and education literature, comparing and analyzing the differences between senior and junior students with sports TV directing experiences, examining their visual focus of the *Business Enterprise Volleyball Games.* Results found that (1) Visual focus differences were found among senior and junior student sport TV directors. The eyes of senior students, with more than two years of sports and games training, scanned at a faster speed than junior students; (2) Visual focus of senior students were more detailed as they focused on sports athletes' movement and close-up shots; (3) Panoramic shots of sports games allows TV directors to have an overall visual pace and a better interpretation of the game. Application of the cognitive load theory can further explain the differences in visual focus among the senior and junior students. The more sports expertise, familiarity with the players they have in their long term memory, the more onsite performance and observation they would have in handling the complexity of the game. Results of the current study served as a benchmark for future research and contributed to the education and training of sport communicators.

Keywords: Sports TV Director, Eye Tracking, Visual Focus, Cognitive Load, Sportscast

1. Introduction

In the age of Web media and a proliferation of digital sports media, the training of sports media director, who are responsible for the overall look, pacing and presentation of all broadcast sports content and games, is fundamental in sports communication education. In the training of student sports TV directors, the visual focus on the different aspects of live games are crucial in the future presentation of sports broadcast. Since the visual focus of sports TV director is crucial to any sports broadcast, the purpose of the current eye-tracking study examined the visual focus of student sports TV director, using an Eye-Tracker, with a Cognitive Load Theory theoretical framework.

Cognitive Load Theory (CLT), formulated by John Sweller, an Australian educational psychologist, is a theory that focuses the load on working memory during instruction, treating schemas, or combinations of elements, as the cognitive structures that make up an individual's knowledge base. (Sweller, Van Merrienboer & Paas, 1998) CLT has become an influential theory in the fields of educational psychology and instructional design over the past two decades. Six out of ten most cited research articles were concerned with CLT (Ozcinar, 2009). In a study examining the research productivity in the top five educational psychology journals 2003-2008, found CLT was the central theory applied in the four out of the top 20 most productive researchers' journal research (Jones, Fong, Torres, Yoo, Decker, & Robinson, 2010).

With the advent of computer and the Web, CLT related studies into animation and multimedia instruction, found that under many conditions animations are not more effective than pages in a book (Tversky, Morrison & Betrancourt, 2002), and

multimedia design can be negatively impacted by split-attention (Ayres & Sweller, 2005) or redundancy (Chandler & Sweller, 1996).

CLT is best applied in the area of instructional design of cognitively complex or technically challenging material, some people have difficulty learning material of this nature, such as animated and multimedia instruction cognitive load theory has many implications in the design of learning materials which must, if they are to be effective, keep cognitive load of learners at a minimum during the learning process. Consistent with previous CLT research (Sweller and Chandler, 1994), in a research examining the impact of cueing on cognitive load and comprehension of animations which depicted a dynamic process in a neurobiology domain, Amadieu, Marine, and Laimay (2011) found no significant effects for low element interactivity materials, other than improvements of test scores over learning repetitions. For high element interactivity materials, there was a significant interaction in that the cuing group improved scores over repetitions, but the non-cued group did not. No significant differences were found on the mental effort measure; however, a combined difficulty scale did reveal results. There was an interaction that showed that the cued group found the materials less difficult over the repetitions. Hence, support can be found that the cued group experienced less cognitive load over the period of trials. Researchers argued that searching and extracting relevant elements within an animation could be considered an additional task and therefore can be considered as extraneous cognitive load and helpful to learning. The results generally support this position.

CLT is concerned with the learning of complex cognitive tasks, in which learners are often overwhelmed by the number of interactive information elements that need to be processed simultaneously before meaningful learning commence. According to Sweller (1988), long term memory (LTM) viewed as the central structure of human cognition, are sophisticated structures that permit us to perceive, think, and solve problems, storing previously acquired information, rather than a group of rote learned facts. It was also confirmed that prior knowledge could help learners to reduce the uncertainty or confusion about learners to process the connection between concepts and context (Amadieu, Salmeron, Cegarra, Paubel, Lemarie and Chevalier, 2015).

CLT previously applied to multimedia learning, can also be applied to the current eye-tracking study on the visual focus of sports games. These structures of sport rules and camera shot types, known as schemas, are what permit TV directors to treat multiple elements during the sport games as a single element, cognitive structures that make up the director's knowledge base. Schemas are acquired over a lifetime of learning, and may have other schemas contained within themselves. It consisted of an effectively unlimited long-term memory (LTM) interacting with a working memory (WM) that is very limited in both capacity and duration.

Schemas and the extent of knowledge held in LTM determined the level of performance by a TV director in a given game. Thus, the difference between an expert and a novice sports TV director is that, novice sport directors still lack the acquired schemas of an expert. Learning requires a change in the schematic structures of long term memory and is demonstrated by performance that progresses from clumsy, error-prone, slow and difficult to smooth and effortless.

The change in performance occurs because as the learner becomes increasingly familiar with the material, the cognitive characteristics associated with the material are altered so that it can be handled more efficiently by working memory. To be able to make accurate judgments during the game, therefore, TV directors should be able to follow the game, to guide the camera person, relying on their instant understanding and observation, which includes recognizing different players' faces, the game rules, instant game scores or data. The extent of knowledge held in LTM determines the level of performance by an individual in a given area. Accordingly, how the large store of knowledge held in LTM is best acquired provides the central concern of CLT.

In a research examining instructional animation, De Koning, Tabbers, Rikers, and Paas (2011) examined the effects of presentation speed on attention cueing with cognitive load theory as the theoretical framework. They found that guiding learners' attention in animations by cueing does not necessarily improve conceptual understanding. Mayer and Moreno (2003) presented the cognitive theory of multimedia learning in explaining how people process information among sensory memory, working memory and long-term memory (shown as Figure 1). Prior knowledge would integrate with audio and visual metal models during the WM procedures in the multimedia presentation.

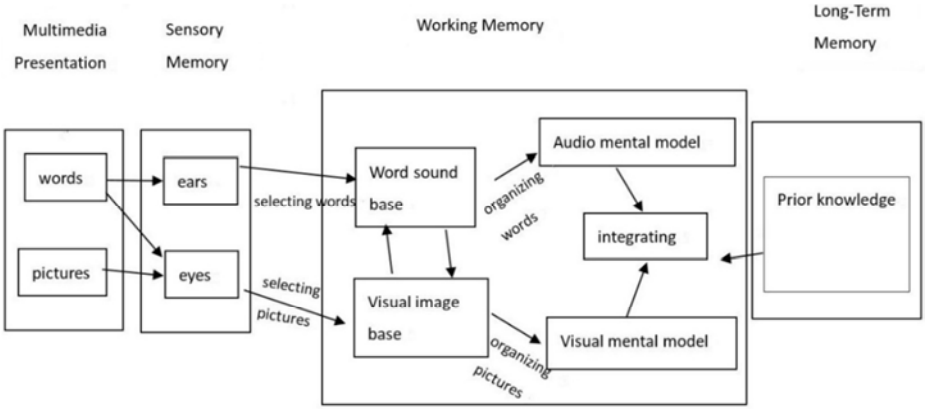

Figure 1. *Cognitive theory of multimedia learning (Mayer & Moreno, 2003, p. 44).*

No prior research, however, has applied cognitive load theory in the study of sportscast. It is also important to know how TV directors perceive and process the visual and audio inputs during the games. To what extent, they can integrate the prior knowledge of sports and players and different camera shot types on the site.

Eye tracking is the process of measuring the point of gaze or the motion of an eye, with an eye-tracker, a device for measuring eye positions and eye movement. Studying the visual focus of student sports TV directors allow us to examine and compare how prior knowledge of sports would affect TV director's performance in directing a game between the senior and junior sports TV directors.

The following three main research questions guided the current eye-tracking exploratory research on the visual focus of TV sport directors:

1. What are the differences between senior and junior sports TV directors in tracking video frames on the mixer?
2. How can different camera frames affect the visual focus and choice of sports TV directors?
3. What types of camera shot would draw sport TV directors' visual focus and attention?

2. Method

2.1. Subjects

Subjects for the research were college students, ages 20-22, majoring in Sports Information and Communication, from a public sports university from central Taiwan, trained to be television sportscast directors. All participants volunteered to participate in the current eye-tracking experimental research.

Two groups of 12 student TV sports directors were recruited for the study (ten females and two males); the Senior Group (the expert group) was five senior student TV sports directors with more than two years of actual participation in the TV sports broadcast of volleyball games. The Junior Group (novice group) was seven students with less than two years of training and participation in sports broadcast.

2.2. Experimental Stimulus Materials

Footages of *The Enterprise Volleyball Games 2014-2015* in Taiwan were randomly selected and edited into a 60 seconds clip, to be used in the eye-tracking research. The volleyball game footages consisted of real time volleyball game showing different scenes of panorama shot, full shot, medium show, close-up, slow motion replay and score bar (shown as Figure 2). During the play, eye moments were monitored and recorded by the eye tracker.

Four different camera angles were presented to subjects. Camera 1 presents High full panorama shot; Camera 2 presents another angle of panorama shot; Camera 3 presents Pan/ left-right full shot of players, and Camera 4 presents Medium-Shot and Close-Up of athletes shown on the mixer. In a sports broadcast, sport TV directors should visually scan all cameras angles and select the different camera shots, thus the visual focus of sport TV director is crucial in the pacing and presentation of the sports games to millions of sports audiences

Figure 2. *Four different camera angles were presented to subjects.*

2.3. Experimental Design

The current study is the first research that attempts to fill the gap in the literature examining the cognitive load by eye tracking devices. The research design for the current study did not include cueing or instructions for subjects, as prior

research in multimedia learning, cueing or prior instructions in guiding learners' attention in animations does not necessarily improve learners conceptual understanding (De Koning et al., 2011).

Before the actual experiment began, all subjects were asked one by one to sit in front of eye tracking equipment. Each participant was confirmed to be in a right position with the subject's head and seat height of comfort. Subsequently, five-point eye calibration is to confirm the fixation of the subject eye movement and screen coordinates. The five-point calibration is in the center, upper left, upper right, lower left, lower right of the monitor, and the reader should be steady gaze this dot one by one, until the research was completed.

These steps were used as the exercise phase and for the subjects to be familiar with eye movement without any head movement (their heads moving away from the detecting area unconsciously). Then, the formal experiment followed, eye tracking equipment presented the edited video clips of volleyball, to collect each subject's eye trajectories and attention maps.

The study used *Tobii EyeX Controller*, with an infrared detector measuring eye movements of a subject, at a sampling rate of 50HZ, incorporated with ANALYSIS ONE eye movement analysis software. All participants' eye movement trajectories, hot zone maps, and visual data of the interest area were recorded for analysis.

The following analysis would base on the following variables:

(1) The length of directing experiences (i.e. Senior vs. Junior) of each subject would be independent variable; (2) The dependent variables as measured using the *Tobii EyeX Controller*, are the frequency and duration of scanning different frames and attention to different camera shots (close-up, medium-shots, full-shots, panoramic shots).

3. Results

After the data was recorded by eye tracker *Tobii EyeX Controller*, 12 participants' raw data accuracy rate was verified for validity evaluation. There were two subjects being removed from further analysis due to errors. The accuracy rate of one subject detected by the eye tracker was below 60 percent. The other subject had lost its focus during the experimental stage without showing the trajectories efficiently. Thus, 10 subjects' (6 junior and 4 senior directors) eye-tracking records were being further analyzed.

An overall understanding on the performance between junior and senior directors was provided by the descriptive statistics and one-way ANOVA test is used to identify the significant level of experimental factors.

First, the frequency of tracking different frames on the video mixer, it was found that the average number of senior directors is 35 times, comparing to the junior director with 23.5 on scanning through the mixer screen in 60 seconds (shown as Figure 1.). The ANOVA test reveals significantly different at the 10% level between them in the frequency of observing frames on the mixer screen ($F_{(1,8)}$=3.759, p=.089 <.1).

Table 1. *ANOVA test on frequency of tracking different frames on video mixer.*

Groups	Scanning Times	F value	p Value
Junior (n=6)	23.5	3.759	.089*
Senior (n=4)	35		

*p<.10

Furthermore, it is also important to examine the differences in observing the camera signals sending onto four frames, and one frame with score bar shown on the director's mixer. It was found that the junior and senior directors have no statistical difference in watching the frames of camera 1 and camera 2. For camera one, the scanning frequency of junior directors is average of 3.67, comparing to senior directors with 5.2 times. Camera two, junior is 3.17 and senior is 5.25 times (shown as Table 2).

Table 2. *ANOVA tests on frequency of tracking camera frames on video mixer.*

Director	n	Cam 1	F value	*p* value	Cam 2	F value	*p* value	Cam 3	F value	*p* value	Cam 4	F value	*p* value
Junior	6	3.67	1.6	.242	3.17	2.342	.164	3.17	3.83	.086*	4.17	4.35	.07*
Senior	4	5.25			5.25			7.25			8		

*p<.10

However, camera 3 shows the frequency of tracking is about 7.25 times for senior directors, comparing to 3.17 times for junior directors. The ANOVA test revealed significantly different at the 10% level between them in observing frame 3 on the mixer screen ($F_{(1,8)}$=3.83, p=.086<.1). The results also indicated that the statistical difference in watching Camera 4 for junior (4.17 times) and senior (8 times) directors. The ANOVA test reveals significantly different at the 10% level between them ($F_{(1,8)}$=4.35, p=.07<0.1). It was surprising to know that there was only one senior director who was the most experienced student in noticing the frame of score bar on the screen. It shows no statistical difference among all student directors ($F_{(1,8)}$=1.6, p=0.242>0.1). It might be worthwhile to bring this to the training board's attention for preparing the class materials.

4. Conclusions

Since this is an exploratory and pioneering eye-tracking study in sports communication, examining the visual focus of sport TV directors on volleyball games, however, the process of training student sport directors could provide important clues to further development for training courses. The eye-tracking visual focus study confirms that the training of

sports TV directors should begin with a schema of the game, rules and athletes'/players' background information.

When the senior and junior directors were compared, it was found that do perform differently in their visual focus in tracking the monitor mixer screen. The senior sports TV director, they tracked different frames in a relatively quick observation. The junior sports TV directors, however, were quite slow in moving through different frames on the screen. From the perspective of cognitive theory, the intrinsic load can be applied to explain that senior directors are quite familiar with the volleyball players on the field. It is easier to locate them, and to figure out their positions, the camera shifts with the game pace. Seniors might have schemas and complete mind sets of basic operations and interpretation in the field. The junior directors may still be in the process of learning the game rules and get to know the players. At the same time, they also need to learn how to interpret the meaning of camera shot types. The juniors have to experience a large number of messages which need to be processed in his working memory. Thus, it would consume a lot of processing time, due to lack of long-term memory (LTM) in the professional field. This situation could affect junior directors in their response time in the judgment of selecting camera shots.

It was found from Camera 1 and Camera 2, it shows no significant difference among the senior and junior directors. Since these two shots show the panoramic pictures of the volleyball court, it provided the basic information about the game. Therefore, it is primary requirement for a director to know the games very well.

Viewing Camera 3 and Camera 4, however, showed the significant difference among senior and junior directors. The familiarity of a game and players could be applied to explain the differences. For the seniors, the operation of the equipment and observation of the game did not preoccupy their working memory (WM). They, therefore, have extra time to learn more details from the onsite performance of each player. Since Camera 3 and Camera 4 presents full-medium shot and close-up shots, close and detailed visual observation required, seniors with more experienced were supposing to be at ease in figuring out the whole game, it will be more focused on these shots, because it could reveal more emotion and tension of players shown on the screens.

Based on the cognitive load conceptualization of Mayer and Moreno (2003), this study represented the concept of the sport director's cognitive integration in directing a game, as illustrated in Figure 3, the cognitive process of sensory memory, working memory, and long-term memory during Sport TV directing.

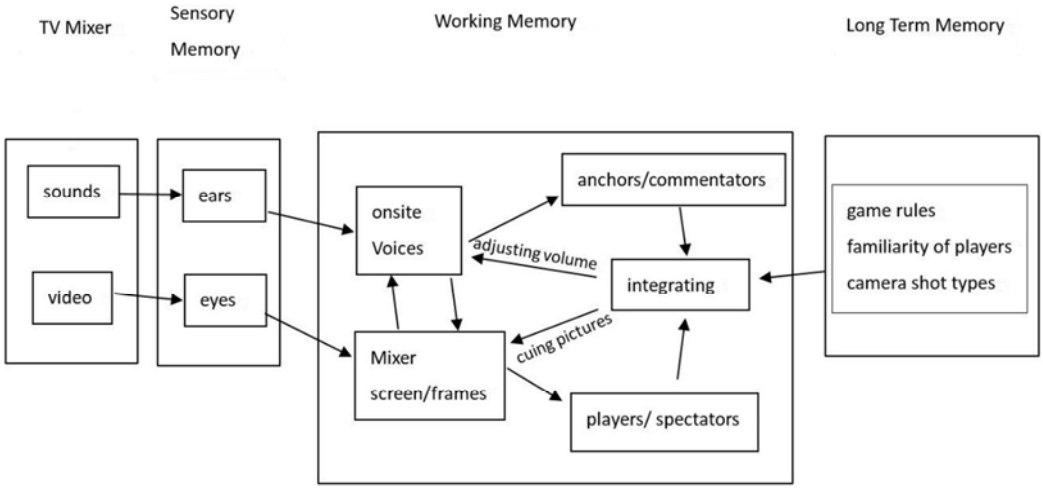

Figure 3. *Applying Cognitive Load Theory to Sport TV Directing.*

Based on the Figure 3, we can further apply cognitive load theory to find out the different levels of knowledge and the process of accumulative learning. It takes time to integrate different sports knowledge, game skills, camera movements for the education and training. For an experienced director, therefore, should be able to locate the players and quickly figure out the attacking and defending positions. The familiarity of the rules of game and camera shot helped them to cultivate spontaneous responses on the game court.

In this study, the junior directors may be too busy to understand the whole process of the game through the panorama view. During the limited time, they tend to ignore the individual players on the screen showing the emotional and physical tension, which is obviously different. That is, for a preliminary inexperienced director, should first know well about the basic knowledge about players, games and operating works on the video mixer.

5. Suggestions and Future Research

There is a huge demand for sports communications professionals to broadcast international sports mega events, such as the Olympic Game to billion sports audiences around the world. The training of sports communication professionals, especially sports TV directors is crucial to the broadcast visual quality of the sports games in enhancing the audience enjoyment of broadcast sports game.

In future, quantitative research as well as qualitative research can be employed hand in hand. In the education and training of sports TV directors, we need to understand the TV

directing style of each director in a sport game; future research can examine the differences of a director's thinking and personalities. The schema, students' prior sports knowledge is also important, it is suggested that future research should examined the schema of sports TV directors, as it would help in the design of the training curriculum that integrate game rules and visual communication skills. Sports TV directors' thoughts behind directing a game and why they cue various cameras should be examined. Research data from quantitative and qualitative research will be helpful in planning our future training and educational materials.

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References

[1] Amadieu, F., Marine, C., & Laimay, C. (2011). The attention-guiding effect and cognitive load in the comprehension of animation. *Computers in Human Behavior*, 27, 36-40.

[2] Amadieu, F., Salmeron, L., Cegarra, J., Paubel, P. V., Lemarie J., & Chevalier A. (2015). Learning from concept mapping and hypertext: An eye tracking study. *Educational Technology & Society*, 18 (4), 100-112.

[3] Ayres, P., & Sweller, J. (2005). The split-attention principle in multimedia learning. In R. E. Mayer (Ed), *The Cambridge handbook of multimedia learning* (pp. 135-146). New York: Cambridge University Press.

[4] Chandler, P., & Sweller, J. (1996). Cognitive load while learning to use a computer program. *Applied Cognitive Psychology*, 10, 151-170.

[5] De Koning, B. B., Tabbers, H. K., Rikers, R. M. J. P., & Paas, F. (2011). Attention cueing in an instructional animation: The role of presentation speed. *Computers in Human Behavior*, 27, 41-45.

[6] Jones, S. J., Fong, C. J., Torres, L. G., Yoo, J. H., Decker, M. L., & Robinson, D. H. (2010). Productivity in educational psychology journals from 2003-2008. *Contemporary Educational Psychology*, 35, 11-16.

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

[8] Ozcinar, Z. (2009). The topic of instructional design in research journals: A citation analysis for the years 1980-2008. *Australasian Journal of Educational Technology*, 25, 559-580.

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

[10] Sweller, J., Van Merrienboer, J., & Paas, F. (1998). Cognitive architecture and instructional design. *Educational Psychology Review*, 10, 251-296.

[11] Sweller, J., & Chandler. P.(1994). Why some material is difficult to learn? *Cognition and Instruction*, 12 (3), 185-233.

[12] Tversky, B., Morrison, J. B., & Betrancourt, M. (2002). Animation: Can it facilitate? *International Journal of Human-Computer Studies*, 57, 247-262.