Health Impacts of Stereoscopic Film Projection: A Study on South Indian Viewers

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Abstract

Films are considered as a mass communication tool, as technology has developed, it has also made a change in the film industry providing stereoscopic films. These movies attract a wide range of audience due to their perception of depth in the visuals which creates much more interest in them. Hollywood movies stay the primary foundations for a high ratio of stereoscopic movies, yet stereoscopic movies find a greater space in every movie industry in recent times. In 3D movies, the stereographic depth of visuals plays an integral part to provide an impact on the audience, which may lead to certain health issues. The audience experiences these issues because of the difficulty which they face, to get adjusted to the stereographic depth of the visuals.
Keywords: stereoscopic film projection, 3dfilms, health impacts, stereo blindness.

Introduction

Stereographic movies are one of the most popular, well-liked technology for viewing movies. It's leading and trending as it's not cramped only for entertainment purpose. As it has been deployed and availed in medical science to brush up and upgrade precision in surgeries. It is also used in the primary education system for filtered and uncomplicated studying methods. As it is public eyed and approved 3D movies are released very often. Even though 3D movies are interesting and desired taste of visual entertainment sometimes the viewers may experience some visual discomfort irksome viewing experience.

According to W. J. Tam, F. Speranza, S. Yano, K. Shimono, and H. Ono (2011), watching 3D movies can cause visual fatigue and visual discomfort.'

Stereoscopic visuals can only be viewed through a 3D glass with polarization filters, which allows different images to both eyes. Thus, our brain fuses these two images to give us a perception of depth. During this process, many of the viewers may find difficulty in adjusting with the stereographic visual depth which may lead to Headache, Nausea or Vomiting, Dizziness, difficulty in focusing and visually induced motion sickness.

Research problem

The main problem identified was that the audience of a particular category faces several problems while watching 3D movies. Research have been conducted to find the health problems which are faced by the audience, but there is no such research conducted which made them aware of the reasons for the health difficulty.

Objectives
- To analyse the problems faced by the audience and the period which they take to get adjusted with the stereographic visual depth.
- To analyse the awareness level of the audience towards the health issues

Hypothesis
1. The age category of 40 and above faces most of the problems.
2. The awareness of people on these health issues is very poor.

Methodology
This study mainly focuses on creating awareness among the audience of stereoscopic 3D (S3D) movies and analyses the age group of the audiences who experience the problems. This study includes a quantitative study of the feedback of these viewers. The quantitative method is based on numerical analysis of data collected through questionnaires.

This study was conducted among people of Kerala and Tamil Nadu, above the age groups of 13 who watch 3D movies. A questionnaire containing 20 questions was distributed among 470 participants and their responses were collected. Stratified random sampling was used in this study to categorize the samples by their age group.

Literature review
Angelo G. Solimini's (2013) 'Are There Side Effects to Watching 3D Movies? A prospective crossover Observational Study on Visually Induced Motion Sickness'. 54.8% of the total samples reported some kind of sickness after the exposure to the 3D movies and 14.1% of the total sample showed sickness after their exposure to the 2D movies. So that the symptom intensity was 8.8 times higher than the baseline.

Jenny C A Read and Iwo Bohr 'User experience while viewing stereoscopic 3D television'.
Around 14% of the total samples from the age of 4 to 82 years, experienced adverse effects due to viewing Stereo 3D. They have also found out that women are slightly more likely to report this affects more than men.

Brendan Rooney and Eilis Hennessy (2013) 'Actually in the cinema: A field study comparing real 3D and 2D movie patrons' attention, emotion and film satisfaction' Audience is more satisfied with the stereoscopic atmosphere as they are getting less distracted and they experience a higher level of perceptual realism as compared to the 2D movies.

EunJoung Cho, Kwan Min Lee, Sung Min Cho, Yang Hyun Choi (2014) 'Effects of stereoscopic movies: The positions of stereoscopic objects and the viewing conditions' The feeling of dizziness while watching stereoscopic movies are influenced by the position of stereoscopic objects and the viewer's seat location. They also found out that viewers wearing corrective glasses in addition to the 3D glasses increases eye fatigue in viewers.

FabrizioBracco, Beatrice Hosseini Nia, Carlo Chiorri, Gianni Vercelli, Donald Glowinski (2013) 'Investigating Visual Discomfort With 3D Displays: The Stereoscopic Discomfort Scale'. "One of the main problems of 3D movies is the depth of field and the blurring of background elements. This allows the viewers to engage in the situation, but if they want to focus on other background elements, they are unnaturally blurred, since the focusing is decided by the director and forces the viewers to focus on the areas of interest. Besides, the physiological effects of visual discomfort could have psychological drawbacks like a decrease in motivation to watch the movie or a general irritation due to the eye strain".

BenanDemir (2015) 'Effects of Stereoscopic Motion Picture: Short-Term Memory, Perceptual Realism and Emotional Arousal': This research explores how the audience is able to retain the information and to find the difference within the emotional arousal which the format sustain. The samples were selected according to the knowledge in English which could be more helpful to understand the documentary shown. They found that the 3D is much more helpful in creating an impact on the audience, but they find more realistic and much more expensive.

Angelo G Solimini, Alice Mannocci, Domitilla Di Thiene and Giuseppe La Torre (2012) 'A survey of visually induced symptoms and associated factors in spectators of three-dimensional stereoscopic movies': from 953 samples, 539(60.4%) samples reported symptoms during the movie, 392(43%) right after the movie and 139(15.3%) within 2 hours right after the movie.

A.M. Baranowski, K. Keller, J. Neumann, H. Hecht (2016) 'Genre-dependent effects of 3D film on presence, motion sickness, and protagonist perception': According to this research, Horror films made more arousal and presence than other action films and documentaries. They also found out that the artificial 3D is indistinguishable in terms of the presence from the directors' 3D and both the 3D was more nauseating than 2D viewing.

Michael Gaebler, FelixBiessmann, Jan-Peter Lamke, Klaus-Robert Müller, Henrik Walter, Stefan Hetzer (2014) 'Stereoscopic depth increases intersubject correlations of brain networks'
They found out that the stereoscopic movies are closer to real-world sensory input and enhance the viewer's engagement with the movie content and showed significantly stronger immersion of the viewers in the 3D relative to the 2D condition.

Monika Pölönen, MarjaSalmimaa (2012) 'Subjective experiences of watching stereoscopic Avatar and U2 3D in a cinema': According to this research, exposure to an S3D movie for more than 165 mins causes some visual stan and sickness related issues.

FilippoSperanza, Wa James Tam, Ron Renaud, NamhoHur 'Effect of Disparity and Motion on Visual Comfort of Stereoscopic Images': The change in disparity magnitude over time might be more important in determining visual comfort than the absolute magnitude of the disparity.

Marc T.M. Lambooij, Wijnand A. IJsselsteijn, Ingrid Heynderickx (2010) 'Visual Discomfort in Stereoscopic Displays: A Review': To achieve a guarantee of visual comfort on stereographic displays it is recommended to keep a limit of one-degree disparity.

Fabrizio Zeri1, Stefano Livi2 (2015) 'Visual discomfort while watching stereoscopic three-dimensional movies at the cinema' majority of the samples experienced external symptom factors like eye burning, eye ache, eye strain, eye irritation and tearing and some of them experienced internal symptom factors like comprised of a blur, double vision, headache, dizziness, and nausea.

Tim Clark (2014) 'A review of the Technology and Consumer Opinion relating to Stereoscopic 3D' Passive separation is the process of separating the right and left images using a pair of polarized filters so that the channel separation is achieved.

FabrizioBracco, Beatrice Hosseini Nia, Carlo Chiorri, Gianni Vercelli, Donald Glowinski (2013) 'Investigating Visual Discomfort With 3D Displays: The Stereoscopic Discomfort Scale'. One of the main problems of 3D movies is the depth of field and the blurring of background elements.

FrantišekMikšíček (2006) 'Causes of Visual Fatigue and Its Improvements in Stereoscopy'
Convergence describes the eye's ability to divert the eye optical axis horizontally in an inward or outward direction.

Martin S. Banks, Jenny C. A. Read, Robert S. Allison, and Simon J. Watt (2013) 'Stereoscopy and the Human Visual System'. Vertical parallax can occur due to the problems such as misalignments of the cameras during filming or misalignments of the images during the presentation and can also be introduced due to some delegate problems like filming with a converged camera.

Marc T.M. Lambooij, Wijnand A. IJsselsteijn, Ingrid Heynderickx (2007) 'Visual Discomfort in Stereoscopic Displays: A Review' Stereopsis is the perception of depth which is constructed based on the difference between two retinal images received by both eyes.

Syed Ali Arsalan Naqvi, NasreenBadruddin, Aamir Saeed Malik, Wan Hazabbah, Baharudin Abdullah (2013) 'Dose 3D produce more symptoms of visually induced motion sickness?' The problem of visual fatigue varies from person to person and often leads to motion sickness. They also state that a percentage of the population who are watching 3D movies are suffering from symptoms such as headache, dizziness, and nausea.

M. Pölönen, T. Järvenpää, and B. Bilcu (2013) 'Stereoscopic 3D entertainment and its effect on viewing comfort: Comparison of children and adults'
This study reports that 5% of viewers of 3D movies experienced nausea and disorientation regardless of the duration of the movie.

Wa James Tam, Senior Member, IEEE, FilippoSperanza, Sumio Yano, Koichi Shimono, and Hiroshi Ono (2011) 'Stereoscopic 3D-TV: Visual Comfort'

Stereoscopic displays exploit the characteristics of the human binocular visual system by re-creating, albeit not in a veridical fashion, the conditions that lead to the perception of the relative depth of objects in the visual scene.

Martin S. Banks, Jenny C. A. Read, Robert S. Allison, and Simon J. Watt (2012) 'Stereoscopy and the Human Visual System'. In stereo displays, small vertical misalignments of the images activate vertical vergence.

Results and Analysis
Table1: Demographic variables (Age, Gender, occupation)
This to measure and analyse the data which has been collected using various statistical tools for different variables. The first part of the analysis begins with the profiling of the samples based on their demographic factors. The total sample size of 447 respondents is collected from all around Kerala and Tamil Nadu, stratified Random sampling and purposive sampling were used to collect the data.

Age	No. of respondents	Percentage of respondent
13-20 Yrs old	97	21.7%
21-30 Yrs old	267	59.7%
31-40 Yrs old	13	2.9%
41-50 Yrs old	30	6.7%
Above 50 Yrs old	40	8.9%

Gender	No. of respondents	Percentage
Male	222	49.7%
Female	224	50.1%
Other	1	0.2%

Occupation	No. of respondents	Percentage
Student	251	56.2%
Working	158	35.3%
Retired	38	8.5%

Table.1 shows, out of 447 respondents, 21.7% are between the age of 13-20 years old, 59.7% are between 21-30 years old, 2.9% are between 31-40 years old, 6.7% are 41-50 years old and the remaining 8.9% are above 50 years of age. around 50.1% out of 447 respondents are female, 49.7% male respondents and 0.2% of respondents from other categories.

Most of the respondents, 251 out of 447 are students. Around 56.2% of the total respondents. 35.3% of respondents are working and the remaining 8.5% of respondents are retired.

PROBLEMS FACED BY THE AUDIENCE AND TIME PERIOD WHICH THEY TAKE TO GET ADJUSTED WITH THE STEREOGRAPHIC VISUAL DEPTH.
Table 2.1: **Their experience of headache while or after watching 3D movies.**

Headache while or after watching 3D movies	No. of respondents	Percentage
Yes	163	36.5%
No	284	63.5%
Total	**447**	**100**

Table 2.1 indicates the headache experienced by the respondents while or after watching 3D movies. Two options were given for this question 'YES' and 'NO'. 284 out of 447 participants (63.5%)

opted for No and the remaining 163 (36.5%) opted for yes. From this we can understand that most of the respondents did not experience headaches while watching a 3D movie.

Table 2.2: Difficulty faced by the audience in adjusting with the 3D visuals.

Difficulty faced	No. of respondents	Percentage
Yes	206	46.1%
No	241	53.9%
Total	**447**	**100**

Table 2.2 indicates the difficulty faced by the respondents to get adjusted with the 3D visuals. Two options were given for this question 'YES' and 'NO'. 241out of 447 respondents (53.9%) opted no and the remaining 206 respondents (46.1%) opted yes. From this, we can understand that most of the people haven't faced any difficulty getting adjusted to the 3D visuals.

Table 2.3: Vertigo/ Dizziness experienced by the audience after a 3D movie

Vertigo/ Dizziness experienced by the audience	No. of respondents	Percentage
Yes	113	25.3%
No	334	74.7%
Total	**447**	**100**

Table 2.3 indicates the experience of vertigo/dizziness after watching a 3D movie. For this question, two options were given this question 'YES' and 'NO'. 334 out of 447 respondents (74.7%) opted that they haven't experienced vertigo/dizziness after watching a 3D movie, remaining 113 respondents (25.3%) opted that they had an experience of vertigo/dizziness after watching a 3D movie. From this we can analyse that most of the respondents haven't experienced vertigo/dizziness after watching a 3D movie.

Table 2.4: Experience of eye strain while watching 3D movies.

Eye strain while watching 3D movies	No. of respondents	Percentage
Yes	223	49.3%
No	224	50.1%
Total	**447**	**100**

Table 2.4 indicates the eye strain experienced by the respondents while watching a 3D movie. Two options were given for this question 'YES' and 'NO'. 224 out of 447 respondents (50.1%) have not experienced eye strain while watching a 3D movie and the remaining 223 respondents (49.9%) experienced eye strain while watching a 3D movie. From this, we can understand that most of the respondents have not experienced eye strain while watching a 3D movie.

Table 2.5: Difficulty in focusing or blurred vision right after a 3D movie.

Difficulty in focusing or blurred vision right after a 3D movie	No. of respondents	Percentage
Yes	188	42.1

No	259	57.9
Total	**447**	**100**

Table 2.5 shows the blurred vision and difficulty in focusing experienced by the respondents after watching a 3D movie. Two options were given for this question 'YES' and 'NO'. 259 out of 447 respondents (57.9%) opted that they haven't faced any difficulty and the remaining 188 respondents (42.1%) opted that they had faced difficulty. From this, we can understand that most of the respondents have not faced any issue.

Table 2.6: Time for the viewers to get adjusted to the 3D visuals.

Time taken	No. of respondents	Percentage
1-5 minutes	280	62.6%
5-10 minutes	135	30.2%
10 minutes or more	32	7.2%
Total	**447**	**100**

Table 2.6 shows the time they took to get adjusted to the 3D visuals. Three options were given for this question 1-5 minutes 5-10 minutes 10 minutes or more. 280 out of 447 respondents (62.6%) opted that they only took 1-5 minutes of ie to get adjusted with the visuals, 135 respondents (30.2) took 5-10 minutes to get adjusted with the visuals and the remaining 32 respondents (7.2%) took around 10 minutes and more to get adjusted with the visuals. From this, we can understand that most of the respondents only took less time to get adjusted to the visuals.

AWARENESS LEVEL OF AUDIENCE TOWARDS THE HEALTH ISSUES

Table 3.1: Awareness level of audience towards the health problems created by 3D movies.

Awareness of the participants	No. of respondents	Percentage
Yes	150	33.6%
No	297	66.4%
Total	**447**	**100**

Table 3.11 points out the level of awareness of people towards the health issues created by 3D movies. 'YES' or 'NO' were the two options given for the question. In this around 297 out of 447 respondents (66.4) opted No and the remaining 150 (33.6%) opted yes. This shows that most people are not aware of the health issues created due to 3D movies.

Discussion

This study mainly focuses on the health impacts faced by the viewers, the period which the viewers took to get adapted to the visuals and the age category which faces most of the problems. According to the previous studies done based on this topic, concluded that the youngster incurred visual and motion sickness due to 3D viewing 'Shun-nan Yang, Tawny Schlieski, Brent Selmins, Scott C. Cooper, Rina A. Doherty, Philip J. Corriveau, and James E. Sheedy' (2012). From the comparison of this study, we have got approximately the same results as the young viewers who have faced most of the problems including eye strain and motion sickness. Increased visual discomfort in the viewers was reported when watching stereoscopic 3D on smaller sized display than on a larger display, 'Sang-Hyun Cho, Hang-Bong Kang' (2012) The gap which is analysed with the other studies had concluded are that the visual discomfort and the symptoms which they face can be reduced or avoided by changing the angle of view by changing the seating order and by increasing the distance between the viewer and the screen.

Conclusion

This study is focused on the health impacts which are faced by the people who watch 3D movies. This chapter is a summary of the data collected and the analysis of the data.

This study was done using quantitative analysis, a questionnaire was prepared according to the study which was done before analysis. The questionnaire was distributed among the people in Kerala and Tamil Nadu and around 447 responses were collected.

The results from the survey and analysis show that approximately half of the respondents had experienced eye strain while watching 3D movies. The other results from the analysis, study concludes that most of the people have not faced any health problem while or after watching 3D movies. Even though a minor amount of crowd is still facing problems while and after their exposure to the 3D visuals. According to the first objective the main health issue faced by the viewers, the eyestrain while watching a 3D movie and the difficulty which they face to get adjusted with the 3D visuals depth. According to the data collected around 30.2% of the respondents faced a mild issue of taking a bit of time to get adjusted to the visuals and 7.2% of the respondents took much more time to get adjusted to the visuals.

The results according to the survey indicate that most of the audience is not aware of the health impacts which are created due to the 3D movies. From this, we can understand that there is a lack of awareness of the health impacts due to the exposure of 3D visuals.

This study could not prove the hypothesis of the first objective that the age category above 40 age are more affected with the 3D visuals because the number of the responses which we received from this age category was very low as compared to the respondents from other categories. By this study, we can conclude that the age category which faced most of the problems are between 21-30 And the hypothesis of the second objective has been proven that most people are not aware of the health issues which are created due to the exposure of 3D visuals. Around 66.4% of the respondents are not aware of these problems.

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