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Virtual Reality For Social Impact: Exploring The Potential Of A 360-Degree VR Documentary 'The Hidden' Based On Bonded Laborers In India

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Abstract—Virtual Reality (VR) has emerged as a promising tool to create immersive experiences for social impact. This study examines the capacity of virtual reality (VR) as a means of creating social change. It does so by analysing a 360-degree VR documentary called "The Hidden," which specifically addresses the problem of bonded labour in India. Bonded labour, a contemporary manifestation of slavery, involves coercing individuals into working to repay debts that can persist for multiple generations. The documentary seeks to enhance awareness and elicit empathy towards this matter. The study utilises a combination of qualitative and quantitative methodologies to investigate the influence of "The Hidden" on the audience's views and their inclination to combat bonded labour. A total of ninety-six individuals used Oculus Quest 2 VR headsets to watch the documentary and subsequently engaged in interviews to discuss their encounters. The data underwent analysis using linear regression to discover any noteworthy trends in the replies. The results indicate that virtual reality (VR) has the potential to greatly amplify viewers' emotional involvement and facilitate societal transformation by offering immersive, direct encounters with crucial social matters.

Keywords—immersive media, societal influence, societal transformation, virtual reality.

1. Introduction

The rapid development of virtual reality (VR) technology has revolutionised how we view and interact with digital information. Entertainment, gaming, education, and even healthcare have all found uses for this immersive technology, and its potential for positive social change is largely unrealised. The primary objective of this research is to investigate how far a 360-degree virtual reality video called "The Hidden" may go in bringing attention to the plight of bonded labourers in India, illuminating their sufferings, and calling for reform. Debt bondage, another name for bonded labour, is a modern form of slavery that affects millions of individuals worldwide, but disproportionately so in developing nations. This societal problem, in which people are compelled to work under exploitative conditions to repay debts, is a problem in India, one of the world's largest economies. Legislative frameworks have been put in place, and international attempts have been made to end bonded labour, yet the practice still exists.

For many years, classic documentaries have been used to educate audiences and motivate them to take action. On the other hand, the immersive and participatory aspect of VR presents a once-in-a-lifetime opportunity to connect with people on a more profound, emotional level. A 360-degree virtual reality video about bonded labourers has the potential to inspire viewers to take action by immersing them in their experiences. Virtual reality is being used in "The Hidden" to help bring awareness to bonded labourers in India. Viewers will be transported to the villages and slums where these workers live through a gripping tale and engaging storytelling techniques. They'll see firsthand the problematic working

conditions, hardships, and effects on their personal lives and loved ones. The documentary aims to dispel prejudice, dispel myths, and encourage audience empathy by offering a thorough and genuine depiction of their challenges.

The present research aims to investigate the possible influence of "The Hidden" by investigating its efficiency in raising consciousness, encouraging empathy, and stimulating societal transformation. To assess how the documentary affected its viewers' perceptions of bonded labour and their willingness to take action, it will use a mixed-methods approach, incorporating qualitative and quantitative data. Data from people who watched the VR documentary was gathered through surveys, in-depth interviews, and focus groups. The results of this study add to the existing body of knowledge on the application of virtual reality for social impact and illuminate the potential of immersive storytelling in dealing with complex social problems. The study helps to learn more about how helpful virtual reality documentaries are for lobbying and social change by analyzing participant feedback. Findings from this study can aid filmmakers, activists, and organizations interested in using virtual reality to promote positive social change in the future.

In addition, this study aims to investigate how a 360-degree virtual reality documentary, "The Hidden," might help bring attention to the problem of bonded labour in India and have a positive social impact. The documentary uses immersive storytelling techniques to encourage empathy, dispel preconceived notions, and motivate viewers to take action. This study intends to aid in the fight to end bonded labour and other types of modern-day slavery by providing a more thorough knowledge of how virtual reality technology can be used for social activism. In specific industries in India, such as agriculture, brick kilns, and construction, bonded labour is a significant problem. People are often pushed into the bonded labour system because they have taken out debts at high interest rates and cannot afford to make monthly payments. Workers are usually from lower castes or indigenous tribes, making them especially susceptible to exploitation because of poverty, a lack of education, and limited access to economic possibilities.

The Bonded Labour System (Abolition) Act of 1976 is one such law that was passed in India to prohibit bonded labour, although it has not been consistently enforced. Not all governments have acted as quickly as others to solve the problem. In addition, the public and policymakers alike require more information and exposure to the topic. In India, many NGOs and civil society organisations are fighting bonded labour by advocating reform, rescuing victims, and providing them with support through empowerment initiatives. However, much more must be done to protect the human rights and dignity of all Indian employees and address the underlying causes of bonded labour.

Literature review

Enslaving somebody to work for another is as old as human history; it was common in many ancient societies. Various civilizations used distinct methods to uphold the institution of slavery. For instance, Aristotle supported slavery by asserting that it was both ordained by the gods and advantageous to mankind, authorised by the laws of nature, and validated by the practicalities of social life. The right of conquerors to enslave the defeated was the driving force behind the institution of slavery. The frequent sale of debtors by creditors contributed to the perpetuation of slavery. The exploration of virtual reality (VR) technology and its applications has extended to several domains, encompassing education, entertainment, and social influence (Adams & Jang, 2020). Numerous studies have examined how immersive and captivating VR experiences can foster empathy for significant social issues and raise awareness of them. This literature review analyses the use of virtual reality (VR) for social impact, with a specific focus on evaluating the efficacy of VR films for raising awareness and motivating action against bonded labour in India. Bonded labour, a contemporary manifestation of slavery, continues to exist despite legal endeavours aimed at its eradication. The Bonded Labour System (Abolition) Act of 1976 in India was enacted to eradicate this practice. However, it continues to persist as a result of socio-economic causes. Historical viewpoints show that debt bondage has changed over time. These perspectives also offer information about the socio-cultural factors that sustain debt bondage, such as the caste system and economic exploitation (Kulshrestha, 2021).

Virtual reality (VR) has been recognised as a potent tool for fostering empathy and raising awareness. Research has demonstrated that immersive virtual reality (VR) experiences have a notable effect on the emotional and cognitive involvement of viewers, resulting in heightened empathy and comprehension

(Ahn, Bailenson, & Park, 2014; Bailenson & Blascovich, 2011). VR documentaries are beneficial in depicting societal concerns by offering a unique first-person perspective that is not possible with traditional media (Delmas & Pekovic, 2017).

The Efficacy of Virtual Reality Documentaries

Studies of virtual reality documentaries suggest that they can significantly increase awareness and inspire action. Virtual reality documentaries have the potential to increase viewers' empathy and willingness to support social concerns, according to a study by Adams and Jang (2020). In a similar vein, Lee and Han (2019) emphasised the capacity of virtual reality (VR) to impact the attitudes and behaviours of viewers regarding environmental and social concerns. The immersive quality of virtual reality enables viewers to directly feel issues, resulting in a stronger emotional bond and a higher inclination to participate in advocacy efforts (Gentile et al., 2017). The Bonded Labour System (Abolition) Act of 1976 provides a legal definition of bound work, which is against the law. "Bonded labour" means any labour or service rendered under the bonded labour system, as defined in the Bonded Labour Abolition Act. In ancient India, forced labour was frequently used. It all starts with our land issue, which drives the Indian economy. The poor peasants and farmers had to obey the landlords, who owned most of the land. They were forced to work for little or no pay because they had no other options. Not only did they have to perform manual labour for their creditor in place of the repayment of an advance, debt, or interest thereon; debt bondage also led to forced labour. The workers were forever enslaved because they could never repay the debt (Kulshrestha, A., 2021).

Hindu belief in castes is another possible cause of the rise of bonded labour. Because they lacked sufficient resources, lower cast members occasionally had to rely on higher cast members for food and other necessities. The debtor was so cash-strapped that they had nothing to put up as collateral. As a result of this arrangement between the creditor and the debtor, the debtor agreed to provide services for the creditor in consideration of the payment of his outstanding debt. There are still areas of the country where the practice of bonded labor— in which the borrower and his heirs or successors are obligated to serve the lender for inadequate or no remuneration, remains legal. Frequently, generations must toil in servitude to pay off a debt that a distant ancestor started. The bond cannot be realised under any reasonable contract or arrangement, and the loan interest rates are excessive. The system suggests that fundamental civil rights are violated and that the dignity of human labour is destroyed when people are suffocated in the oppressive web of bonded labour (Banerjee, 2020).

In modern slavery, bonded labour (debt bondage or peonage) occurs when an individual incurs insurmountable debt to their employer or creditor. Therefore, their employer or creditor binds them to demeaning, exploitative, and dangerous jobs, for which they receive little to no compensation and find it difficult to escape. The human rights of bonded workers are often violated, and they are regularly subjected to physical and psychological abuse. Although it has been made illegal in several nations, including India, this practice still exists in some areas.

The government of India has taken various steps to end slavery and bonded labour in the country. The government passed the Bonded Labour System (Abolition) Act in 1976 to help people who were forced into slavery get out of it and get access to justice. Its goal was to eliminate forced labour and give people hurt by this exploitative system legal protection. Also, the government started the National Child Labour Project (NCLP), which aimed to help former child workers get back into society by giving them chances to go to school and learn a trade. The NCLP wanted to break the circle of child labour and give these kids a chance at a better future by focusing on their rehabilitation and development.

The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was made to stop people from being forced to work in rural places. By ensuring that they have at least 100 days of paid work each year, this law guards against taking advantage of rural families. MGNREGA hopes to improve rural towns and stop bonded labour by giving these people a safety net. The government set up the Rescue and Rehabilitation of Bonded Labor Scheme in 2016 because they knew it was essential to get people out of bondage and help them get back on their feet. This plan aims to find slaves, set them free, and help them get back on their feet. Through this programme, efforts are made to free people and help them get back into society by giving them the tools and chances they need for a new start.

Manual scavenging is a common type of forced work in India. It is dangerous and demeaning work. The government's plan to clean up the country, Swachh Bharat Abhiyan, aims to solve this problem. By promoting cleanliness and sanitation, the program hopes to reduce people's need to pick up trash by hand and make it easier for marginalised communities to live in general. The National Human Rights Commission (NHRC) has been crucial in trying to protect the rights and respect of slaves. The NHRC has been a leader in fighting for these people's rights and ensuring they are treated respectfully and decently. The NHRC works to make systemic changes, raise awareness, and ensure that the rules that protect the rights of bonded labourers in India are followed.

According to Anti-Slavery International 2020, over 40 million people are held captive in modern slavery systems worldwide. The majority of those involved in bonded labour are located in South Asia (Kubasiewicz et al., 2023). Migrant labourers, casual labourers, contract workers, bonded workers, and farm workers are the most popular forms of employment in India. Rural and urban areas have sections of unorganised enterprises that employ bonded labour, such as brick kilns, stone quarries, coal mining, agricultural labour, domestic servitude, the circus, and sexual slavery.

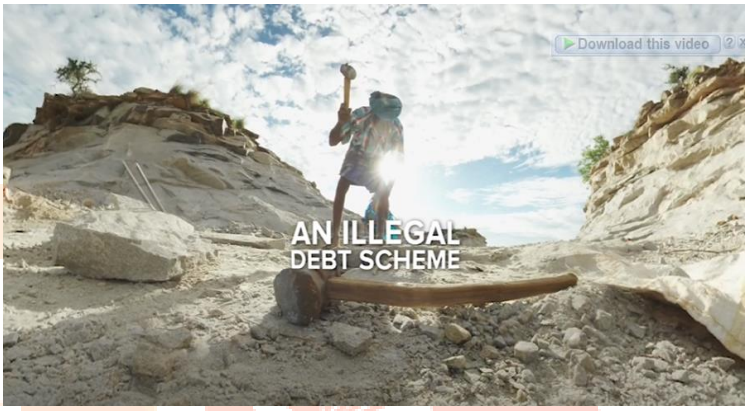

Figure (1) shows the QR code for the short video of the documentary and a screenshot of “The Hidden," a 360-degree VR documentary. Source Credit: Within VR

“Caste-based occupations and bonded labour are essential elements to the Indian brick-kiln industry," as John (2018) puts it, and without them, the industry's projected annual output of 700–800 million bricks would be unthinkable. Debt bondage is widespread in India's brick-kiln industry despite the passage of the Bonded Labour System (Abolition) Act in 1976 (Anti-Slavery International, 2017). The Minimum Wage Act (1948), which allows local governments to set minimum pay for various skill levels, industries, and job categories within their constituency, is one of the several laws legally regulating the brick-lining business in India. However, experts widely acknowledge the subpar enforcement of these regulations (Kubasiewicz et al., 2023). India is home to many non-governmental organisations (NGOs) that focus on issues such as education, health, poverty reduction, women's empowerment, child welfare, and environmental protection, among many others.

Research Problem

According to the 2021 Global Slavery Index, 8 million people in India are victims of modern slavery, such as debt bondage or forced labour. This research aims to determine whether or not the 360-degree virtual reality documentary "The Hidden" is impactful in raising public consciousness about bonded labour in India and inspiring its viewers to take action to end this practice. This amounts to almost 60% of the global total of modern-day slaves. This estimate might be low, though, because bonded labour is frequently either not reported or acknowledged by the authorities in India.

Research Objectives

1) To explore the perceptual impact of "The Hidden", a 360-degree virtual reality (VR) documentary, on raising awareness about the issue of bonded labour in India.
2) To find out how the selected documentary motivates viewers to actively engage in addressing the problem in real life. such as by participating in advocacy campaigns, supporting relevant

organisations, promoting awareness within their social networks, or making ethical consumption choices.

Research Questions

1) How can VR be used to create an immersive and engaging experience for viewers in a documentary about bonded labour?
2) What are the elements with which VR documentaries raise awareness about the issue of bonded labour in India?
3) What are the challenges and opportunities of using VR for social impact?
4) How actively are the viewers addressing these issues in their real lives?

Methodology

The present study adopts a mixed-methods approach, wherein a self-administered online questionnaire was used to collect data from the samples on the quantitative side. Along with this, an in-depth interview was done with the samples on the qualitative side to cross-validate the answers. The pre-experimental design, also known as the one-shot case design, was used in this study. In contrast, the samples in the experimental group were given a chance to watch “The Hidden", a 360-degree documentary using Meta Quest 2 virtual reality stand-alone headsets. Since the present study adopted a pre-experimental research design, no pre-test was conducted. The documentary was preloaded on the headset to avoid buffering issues because of internet issues. The samples were from multimedia journalism and advertising backgrounds considered for this study. Students enrolled in multimedia journalism and advertising programs are expected to have a basic understanding of media content and technology, equipping them to effectively analyse and interact with virtual reality documentaries. Due to their experience, they are capable of offering well-informed input about the efficacy of virtual reality as a medium for increasing awareness and promoting social change.

"The Hidden," an innovative 360-degree film produced in collaboration with filmmaker Lindsay Branham and the International Justice Mission, is the latest initiative from the Oculus VR for Good Creators Lab. According to Branham, there is an overwhelming number of people currently enslaved, surpassing any previous period. Branham intended to use virtual reality (VR) to personally bring these staggering statistics to life, given that more than 20 million people are subject to indentured or forced labour. By focussing on a specific case, she highlights the story of a family of nine who were enslaved for a decade in exchange for the absurd sum of USD 70. (The Oculus Team, 2019).

Research Design

We conducted the study in a completely soundproofed setup to ensure a noise-free environment. All participants in the experimental group were required to perform simple physical warm-up exercises to prevent nausea, headaches, and unnecessary eye strain. Before the samples watched the 360-degree documentary on Meta Quest 2, the researcher thought asking them to warm up was crucial. 96 students participated in the study with their consent. 10% of all the samples taken for the survey were considered for the interview. Samples in the experimental group were asked to respond to the open-ended questions asked during the interview. The interviews lasted 10 minutes each, and qualitative responses were collected in audio form. The transcripts were further analysed.

The present study adopted a convenience sampling technique for the two main factors, such as accessibility and feasibility. Although convenience sampling may create biases, it is justified in this case because of the study's exploratory character, its special emphasis on students with relevant backgrounds, and practical limitations. The constraints are recognised, and measures are implemented to minimise their influence. Generally, pre-experimental designs have limited resources and time. Convenience sampling has led researchers to access nearby subjects or instances quickly. This ease is invaluable when logistical or practical constraints restrict more elaborate sample methods. Also, pre-experimental designs focus on a specific group or case rather than generalise about a population. Convenience sampling lets researchers get data from this group or case without substantial recruitment or complicated sample procedures. Due to the exploratory nature of this study and the constraints of limited resources and time, convenience sampling was a pragmatic decision. The use of this method facilitated the gathering of data in a limited time, ensuring that the study could go on without any notable interruptions. Selecting participants with

similar educational backgrounds helps control for variability in media literacy and technological proficiency. This homogeneity allows for a clearer analysis of the VR documentary's impact, reducing confounding variables related to participants' familiarity with media and technology.

As an initial exploration into the impact of VR documentaries on social issues, this sample provides a valuable pilot test. Insights gained from this group can inform larger, more diverse studies in the future, helping to refine research questions and methodologies. The manipulation of data under the pre-experimental study has been classified as finding the effect of an independent variable on a dependent variable. The table below shows the list of variables used in the present study.

Dependent Variables	Independent Variables
Perception of the viewer	The pain of bonded labourers
Willingness to take action	Immersiveness/Involvement
Attitude	Social Impact

Table (1): List of variables used

When the dependent variable (the outcome) and one or more independent variables (the predictors) have a linear relationship, linear regression is frequently applied to analyse the data. In this case, the use of immersive technologies like virtual reality headsets affects the viewer's perception of the virtual reality documentary they are watching.

Statistical Analysis

An attempt was made to identify a certain measure's internal attributes using an exploratory factor analysis (EFA) technique. It was checked with Bartlett's test of sphericity and Kaiser-Meyer-Olkin's (KMO) measure of sampling adequacy to see if the items were significantly correlated and shared enough variance to make the test worthwhile. The number of factors was determined based on a few criteria, including the Kaiser criterion (eigenvalues greater than 1), scree plot analysis, factors interpretation, and parallel analysis. The fit of the model was assessed using the Tucker-Lewis Index (TLI) and the root-mean-square error of approximation (RMSEA), where TLI > 0.90 and RMSEA < 0.06 indicated a good fit. The measure's internal consistency was assessed using Cronbach's alpha and McDonald's omega coefficients, and the interpretation followed the guidelines outlined by Robert DeVellis. Finally, correlations were analysed.

Findings

Virtual reality technology has become increasingly utilised to create awareness about problems with the issue of bonded labour in India. In a study, participants experienced a range of emotions, such as surprise, shock, and sadness upon discovering the existence of bonded labour in the country. By employing reality, participants could connect with the workers on a level that evoked empathy and a strong desire to help. Moreover, some individuals reported that the documentary impacted their emotions, evoking astonishment, despair, empathy, and grief. Scenes portraying cramped living conditions and impoverished surroundings as children engaged in labour or unable to attend school left an indelible impression on viewers' minds. The denial of education and the burden placed on these victims highlighted the realities they faced. After watching the documentary, many viewers felt both compassionate and accountable for taking action. The findings of this study indicate that virtual reality technology can effectively raise awareness regarding issues while fostering empathy among those who engage with it.

Researchers have found that using virtual reality technology to depict the lives of historically marginalised workers profoundly impacts viewers. The immersive nature of the VR experience allows the viewers to feel as if they are physically present in the environment, which leads to increased comprehension and empathy for the employees. Combining a compelling narrative with an immersive experience lets viewers

empathise with the labourers' struggles on a deeper level, making them more invested in taking action. Through the use of 360-degree views and proximity to the subjects, the VR experience enhances the emotional impact of the sequences by creating a sense of empathy and personal connection among the viewers. Many viewers have remarked that they felt as if they were in the shelters, experiencing the cramped spaces and witnessing the living conditions of the labourers firsthand, which emphasises the need for action to combat social injustices.

Their understanding and compassion for the employees grew due to the nature of the VR experiences, which made them feel like they were present in that environment. When combined with a narrative, this immersive experience allowed viewers to connect with the challenges faced by the workers on a personal level. People who watched it mentioned feeling like they were inside the shelters, experiencing the cramped living conditions, and witnessing firsthand the circumstances these labourers face. These sequences had an impact by creating a sense of empathy and closeness through 360-degree perspectives and proximity to the individuals. The lives of enslaved workers were brought to light, emphasizing the need for action through this immersive encounter.

The documentary brought attention to the living and working conditions, exploitation, and lack of rights that slave labourers endure. It deeply affected viewers, especially considering the number of individuals affected, including children. The immersive experience made the issue feel immediate and real, leaving viewers curious to learn more about the problem and how it can be resolved. The documentary effectively raised awareness fostered empathy and inspired people to take action, against this form of slavery. Throughout the film, the theme of liberation and freedom resonated with the audience in a way. The documentary offered a fresh perspective and a deeper understanding of the issue by being informative and comprehensive. It also sheds light on the need for collective action and the urgency of addressing the issue, discussing various systematic problems such as low conviction rates, social bias, and inadequate enforcement of laws and regulations. The documentary helped the viewers comprehend the actual issue, understand the pain and struggles of the victims, and effectively convey the severity of the issue by emphasising the imperative need for awareness and action.

VR documentaries are considered to be an effective tool for educating viewers about sensitive issues like forced labour, and the responses clearly show that the technology can evoke emotional connection, change preconceived notions, and motivate individuals to be change-bearers. The viewers felt that VR technology has the potential to humanise the issues by presenting the stories and experiences of the victims. At the same time, some viewers felt that the documentary

Virtual reality (VR) documentaries are an effective tool for educating viewers about forced labour and evoking empathy. Viewers' responses demonstrate VR technology's capability to establish emotional connections, challenge preconceived notions, and motivate individuals to become change agents. Most viewers indicated that the VR documentary enhanced their comprehension and perception of bonded labour. They praised the documentary for its ability to humanise the issue of forced labour by presenting the stories and experiences of victims. However, some viewers felt that the documentary lacked in-depth data and information about the issue of indentured labour, which would have contributed to a more complete understanding. Others specified that the cost of a VR headset could be a barrier to the accessibility of VR technology. Additionally, the VR format offered a more immersive and genuine experience, allowing viewers to empathise with the plight of the enslaved workers. VR documentaries and immersive experiences offer a novel approach to storytelling, enhancing comprehension of indentured labour and its effects. VR technology can be used for advocacy, campaigning, and fundraising, effectively engaging policymakers and the general public. Furthermore, VR can be utilised in academia and focus groups to investigate and comprehend complex social issues such as indentured labour.

Students can receive training in new behaviours in a real-world, contextualised learning environment thanks to virtual reality (VR) technology. There were no notable differences in the VR condition, according to the results of an experimental trial with repeated measures, except for a minor increase in happy emotions for the control group. Students are nevertheless adamant that virtual reality instruction can enhance their academic performance and abilities. Virtual reality education has been well accepted, and there is hope that it may eventually replace traditional classroom settings in university settings.

Quantitative data analysis

The present study went through three study phases in which linear regression was performed. The study estimates that the coefficients of the linear equation, involving one or more independent variables, best predict the value of the dependent variable. The study underwent exploratory factor analysis, in which 22 items were subjected to analysis. The study took 3 attempts, in which different items were removed at each stage for data accuracy.

Bartlett's Test of Sphericity and Kaiser-Meyer Olkin's (KMO) values were derived as good values, whereas Bartlett's Test of Sphericity tested 0.856 and KMO was valued at 0.000. The data indicates that there is a significant correlation between the variables. The data provided represents the findings of a factor analysis carried out on a dataset consisting of 22 items from a survey or questionnaire related to "VR, for Social Impact". The goal of the factor analysis was to uncover underlying patterns or factors within these items. The Kaiser Meyer-Olkin (KMO) measure of sampling adequacy consistently showed values indicating that the data was suitable for factor analysis. Furthermore, Bartlett's Test of Sphericity produced results in all analyses supporting the suitability of the correlation matrix for factorisation.

In each of the four-factor analyses performed, different numbers of components were identified. The amount of variance explained also varied across analyses. Initially, cumulative variances ranging from 39% to 41% were accounted for, while rotated analyses resulted in variances between 23% and 24%. The extracted components underwent rotation using the Varimax method with Kaiser normalization. The component loadings and transformation matrices offer insights into how the original items relate to the identified components. This analysis provides information for researchers or practitioners aiming to comprehend the structure of the dataset and potentially reduce variable complexity for further investigation.

Factor Analysis Setup: Multiple factor analyses were conducted, varying the selection of variables by eliminating one at a time. The variables involved in this study include Item1, Item2, Item3, Item5, Item6, Item7, Item8, Item9, Item10, Item11, Item12, Item13, Item14, Item15, Item16, Item17, Item18, Item19, Item20, and Item22.

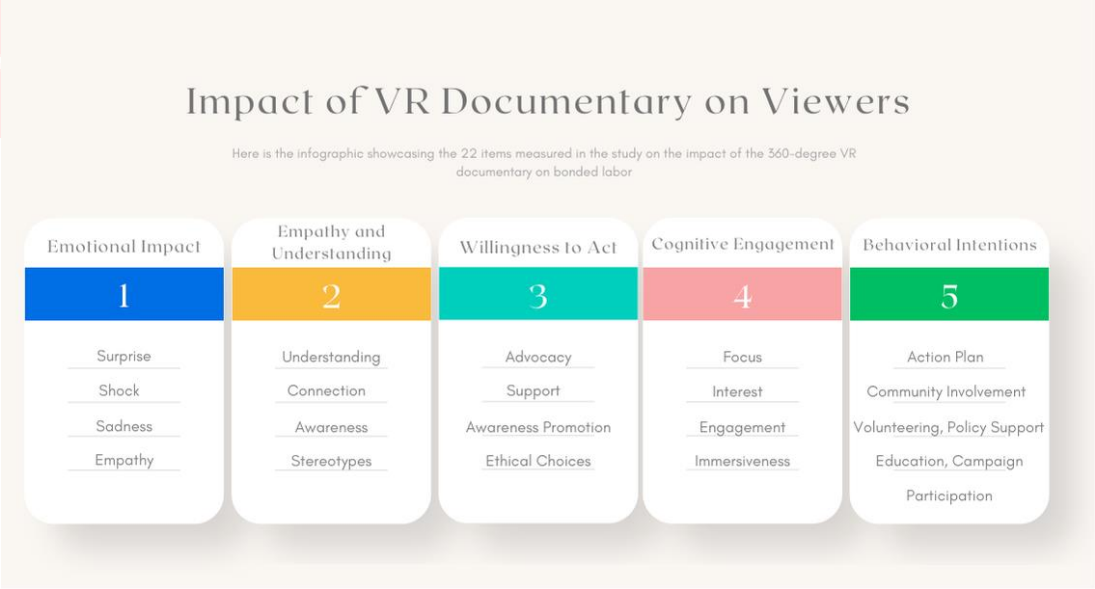

Figure 2: Items and the variables which were subjected for analysis

KMO and Bartletts Test: These tests are used to evaluate the adequacy of the sample and the correlation pattern in the data. In all instances examined here, KMO values exceeded 0.80, suggesting that the data was suitable for factor analysis. Bartlett's test yielded results ($p < 0.05$) indicating that there were non-zero correlations between variables.

Communalities These values indicate how much of each variable's variance is accounted for by the factors extracted. They provide an understanding of how the underlying factors represent the variables.

Total Variance Explained: This value provides insights into how much of the variance in the data is explained by the extracted factors. It presents eigenvalues as indicators of how much variance each factor explains.

Component. Rotated Component Matrix: These matrices illustrate factor loadings for each variable across the components extracted. The factor loadings provide insights into the extent and nature of the connection between the variables and the factors.

Matrix for Component Transformation: This matrix displays the coefficients used to transform the variables and obtain the extracted factors. It is tailored to the specific factor extraction and rotation techniques employed.

Extraction. Rotation Method: The researcher utilised Principal Component Analysis (PCA) as our extraction method, with Varimax and Kaiser Normalisation being employed as our rotation methods.

Model Fit Summary

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Saturated model	152	.000	0		
Independence model	32	681.538	120	.000	5.679

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Saturated model	.000	.000	.000
Independence model	561.538	483.236	647.343

FMIN

Model	FMIN	F0	LO 90	HI 90
Saturated model	.000	.000	.000	.000
Independence model	7.174	5.911	5.087	6.814

Table 2: Summary of model fit

The data established here indicates that the model fit of CMIN was acceptable. The baseline value shows 1 which is considered a perfect fit.

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Independence model	.222	.206	.238	.000

AIC

Model	AIC	BCC	BIC	CAIC
Saturated model	304.000	370.256		
Independence model	745.538	759.487		

ECVI

Model	ECVI	LO 90	HI 90	MECVI
Saturated model	3.200	3.200	3.200	3.897
Independence model	7.848	7.024	8.751	7.995

HOELTER

Model	HOELTER .05	HOELTER .01
Independence model	21	23

Table 3: Results of RMSEA

The model fit was acceptable too good. RMSEA= 0.000.

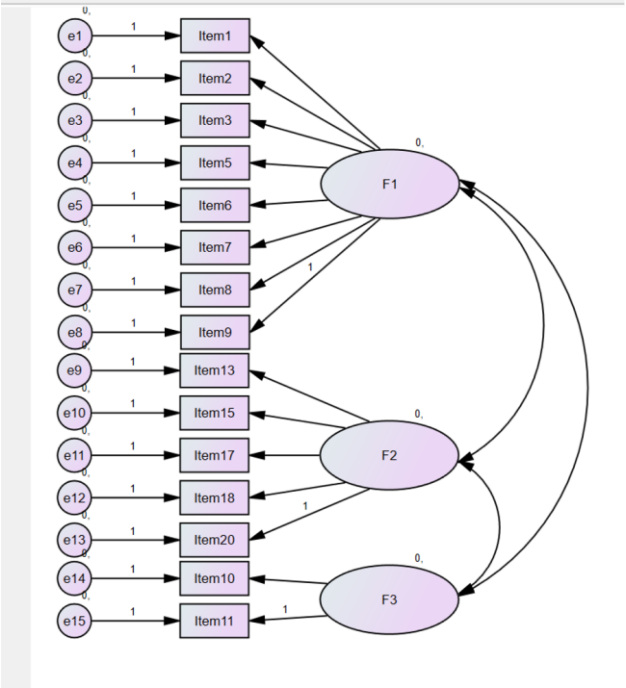

Figure 3: Results of CFA

Three factors were kept for analysis with 15 items. Some items were eliminated at each stage, which was considered a bad fit for the study.

Discussions

The analysis performed at different stages of the study identified varying numbers of components. Initially, the cumulative variance explained ranged between 39% and 41%. After the rotation, the variances were reduced to 23% and 24%. Researchers and practitioners can learn a lot from the factor loadings and transformation matrices that are created through Varimax rotation. They show how the original items are connected to the identified components. It can further help them understand the dataset's structure, reduce variable complexity, and pave the way for further investigation into the relationships between variables in the context of VR for social impact. Overall, the findings from the study are crucial in providing a more nuanced understanding of the relationships between variables in the context of VR for social impact. Researchers and practitioners can leverage the insights gained from the analysis to better comprehend the dataset's structure and reduce the variable complexity for further investigation. By obtaining factor loadings and transformation matrices through Varimax rotation, they can gain valuable insights into how the original items relate to the identified components. This information can be useful in reducing variable complexity and understanding the relationship between variables to make informed decisions in the context of VR for social impact.

According to the data analysis, the model fit was judged satisfactory based on the Comparative Fit Index (CMIN), which has a baseline value of 1, which is ideal and denotes a good fit. This demonstrates that the suggested model accurately represents the underlying data. To further bolster the idea of a superb model fit, the Root Mean Square Error of Approximation (RMSEA) produced an astonishingly low value of 0.000. The RMSEA indicates that there is no error, which highlights the model's accuracy in identifying the relationships in the data. All things considered, these results offer compelling proof that the suggested model is not only reasonable but also demonstrates a high degree of precision and dependability in describing the occurrences that have been seen.

The qualitative data analysis was undertaken meticulously, utilising a theme analysis technique. Comprehensive interviews were recorded, transcribed, and carefully analysed to find repeating patterns. The discovered themes were emotional effect, empathy and understanding, readiness to act, cognitive engagement, and behavioural intents. Participants had intense emotional responses, including astonishment, disbelief, and sorrow, at the portrayal of bonded labour in the virtual reality documentary "The Hidden." The virtual reality (VR) experience created a strong sense of empathy and a more profound comprehension of the challenges faced by bonded labourers, greatly improving participants' cognitive

involvement. A significant number of individuals have shown a strong commitment to combating bonded labour by actively engaging in lobbying, providing support to organisations, and raising awareness.

Triangulation using quantitative data served to further confirm the conclusions. The quantitative investigation, which utilised linear regression and exploratory factor analysis, revealed a notable association between the immersive virtual reality (VR) experience and alterations in the perceptions and attitudes of the viewers. The VR video had a significant impact on crucial factors such as the perception of bonded labour, the motivation to take action, and the alterations in attitude. The qualitative themes of emotional impact and empathy were shown to be in direct correlation with the quantitative findings of heightened awareness and improved motivation to take action. The validity and reliability of the qualitative findings were ensured through inter-coder reliability and member checking. When combined with the quantitative results, these findings highlighted the effectiveness of VR in driving social change by improving viewers' emotional and cognitive engagement with important social issues.

Conclusion

The examination of both qualitative and quantitative data reveals the substantial influence of the 360-degree virtual reality documentary "The Hidden" on viewers' attitudes, feelings, and behaviours about bonded labour in India. The immersive characteristics of VR technology evoked intense emotional reactions, such as astonishment, dismay, and sorrow, which were identified in the qualitative categories of emotional influence and empathy. Participants showed a greater desire to actively participate in advocating for bonded workers' rights, helping relevant organizations, and raising awareness within their communities as a result of their improved understanding of the situation they face.

Quantitative data analysis showed strong connections between the immersive virtual reality (VR) experience and changes in viewers' perceptions and attitudes, which supported the findings. The documentary noticeably altered variables such as the impression of bonded labour, the motivation to take action, and attitude alterations. The comprehensive research revealed that the virtual reality documentary successfully promoted cognitive engagement and encouraged tangible actions in the real world against bonded labour. The study highlights the potential of virtual reality (VR) as a formidable instrument for social influence, capable of generating immersive and emotionally captivating experiences that raise awareness and motivate individuals to take action. The findings indicate that virtual reality (VR) technology may have a significant impact on lobbying and education by offering a powerful platform to tackle and counter important societal problems. Subsequent investigations should further investigate the enduring consequences of virtual reality (VR) encounters and broaden the range of participants to improve the applicability of the findings.

Declaration of Research Ethics

The present research adhered to the required standards of research ethics, employing informed consent, participants' well-being, data confidentiality, and ethical reporting. Voluntarily, the research was conducted. Participants were appropriately informed of the purposes, procedures, and rights of the research by a clear and concise participant information sheet. Written informed consent was offered to all participants before they took part. Participants were told that they were free to withdraw at any time without negative consequences. The experiment consisted of viewing 360-degree virtual reality (VR) video of bonded labor sensitive content. The experiment was carried out in a quiet, controlled, and supportive setting to safeguard participants' emotional and psychological well-being. Participants were pre-briefed and post-briefed before and after viewing the VR to assess and minimize any potential anxiety. Contact information for mental health services was made available to all participants as a precautionary measure.

Stringent data anonymity and confidentiality maintenance. No identifiers were personally collected; responses were safely stored and examined in aggregate and not transcribed. Stringent access control existed; solely for analysis and transcription were interview audio files utilized. No vulnerable populations were used in the study, and the research adhered to national and institutional standards of ethics for carrying out human subjects research. Institutional review board approval by the affiliated institution was obtained prior to initiation of the study. Realizing the sensitive character of the topic, the research team

worked hard to represent the reality of bonded labor with honesty, empathy, and respect. Everything was done so that the topic and mode of release gave dignity and human rights to the people involved.

Statement of Competing Interests

The authors declare that no non-financial or financial competing interests would have apparently affected the execution, interpretation, or publication of this study. In particular, the authors have no financial interests, having received no money, honoraria, or support from any institution or organization that would gain financially from the study result. There are no commercial or financial interests that would be a conflict of interest.

The authors have no financial relationships, professional interests, advisory, or institutional affiliations—such as commercial, family, or political/religious advocacy—that could create a conflict of interest or bias the study. This study was conducted independently as part of a study project, with all the findings discussed and presented objectively.

We make sure that the manuscript file and data within the submission system do not have any inconsistencies. All the author information, affiliations, title, abstract, keywords, and statements—those pertaining to funding, ethics, and competing interests—are made uniformly in the manuscript as well as the submission platform. Any unintentional differences that may be discovered, we are willing to rectify in accordance with the journal's guidelines.

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