Effects of Virtual Reality Technology in Disaster News Coverage based on MAIN Model

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Abstract. This article used data from an experiment based on a survey (*N*=40) to examine the effects of virtual reality (VR) disaster news by comparing it with that of non-VR disaster news (traditional text news) mainly from two aspects - audience knowledge gain and risk perception through presence based on the MAIN model. Results of ANOVA revealed that subjects in the VR condition showed lower knowledge gain about the disaster compared to the text condition through presence with controlling the initial knowledge amount about this disaster by a preliminary test. Moreover, subjects in the VR condition showed greater extend of risk perception compared to the text condition corresponded through presence. Therefore, this study concluded that audiences exposed to VR news coverage gain less knowledge about the disaster but have a greater degree of risk perception compared to those exposed to text news coverage under the influence of the extent of presence.

Keywords: VR disaster news, knowledge gain, risk perception, experiment, MAIN model.

1 Introduction

Virtual reality (VR) is a realistic three-dimensional virtual system generated by computer simulation [1], which is gradually being used in news production and presentation in this multi-media era. Industrially, there are three forms of VR News: panoramic picture, panoramic video, and headsets-based news [2, 3]. But generally, panoramic video is the most commonly seen and accessible form for ordinary audiences, which this study will focus on.

In recent years, the VR system is increasingly used in disaster news coverage, which has received widespread attention and many scholarly controversies about the effect on the audience. Some studies suggested that VR is always beneficial in disaster news due to the presence and immersion created by its 360° scene experience [3]. While others have found that it is not always effective in terms of information acquisition [4, 5].

To investigate the effect of VR on audiences of disaster news, this study compares VR and text news in terms of aspects as follows: Presence is the biggest feature of VR environment compared with the text format, and the presence can be explained by related heuristics such as being-there, realism and interaction in the Modality-Agency-Interactivity-Navigability (MAIN) model. Moreover, there are two elements in disaster news, the objective knowledge of the facts about the disaster [6] and the subjective perception of risk towards the disaster [3, 7], which have been conceptualized as knowledge gain and risk perception in this study.

Thus, this research utilizes panoramic video news materials (Landslide) selected from CCTV.com to examine the effect of VR news on knowledge gain and risk perception through the presence in disaster news coverage with the comparison between text news based on the MAIN model.

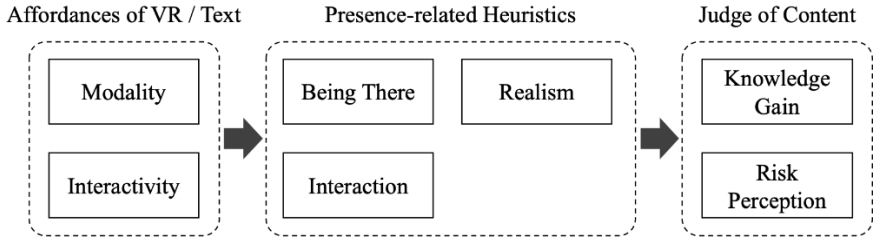

Fig. 1. Theoretical Framework based on MAIN model

2 Literature Review

2.1 MAIN Model

The MAIN model is an approach to understand the effects of different communication technology affordances on audiences' judgment of content through heuristics. Modality refers to the means by which information is conveyed, and interactivity is the degree to which individuals can act and control the mediated presentation [2]. In a VR environment, modality means the vividness of the mediated environment in terms of being-there and realism heuristics, and interactivity shows the ability that users can change the form and content depending on their own will which can be explained by interaction heuristics [2]. The three heuristics mentioned above are all presence-related. Being-there heuristic likely provides sensory immersion, and it can be explained by "I am part of the action, therefore I am present" and "self-location" in an external, physical space. The interaction heuristic means that a medium enables user action with content. And realism can be explained by "it is so real that I am present" (i.e., seeing is believing) [8, 9].

Therefore, the VR format is more realistic and vivid to present the event scene, and more flexible according to the audience's mouse movement interaction than that of text format. Disaster news involves more scene descriptions and pictures, so disaster news in VR format will show a more sense of presence in both aspects than disaster news in text form. Therefore, we propose:

H1: Audiences exposed to VR disaster news coverage experience a higher sense of being there (*H1a*), realism (*H1b*), and interaction (*H1c*) compared to text disaster news coverage.

2.2 Knowledge Gain

A variety of literature has studied the effect of VR news on knowledge gain but got different findings. Positive findings argue that the most eye-catching advantage of VR news is enabling audiences to "visit" the news spot and feel all the information in the spot intuitively which allows audiences to gain knowledge about the news more efficiently [10].

Meanwhile, numerous studies hold negative points and showed that VR News is not conducive to viewers accessing critical information. The vivid and interactive character of VR technologies may interfere with knowledge gain [5]. Moreover, the VR version results in lower cued recall of disaster news stories than that in a text version [2].

Actually, according to the limited capacity model of information processing [11], when people immerse themselves in a big scene of VR environment, which means the presence extent in VR news format, they are more proactive and selective than ever before. This situation leads them to over-focus on certain information and consume too much energy and compels them to exhaust the limited capacity of the human information processing system [2], resulting in missing some valuable information. Thus, the following hypothesis is proposed:

H2: Audiences exposed to VR news coverage gain less knowledge about the disaster compared to those exposed to text news coverage which is influenced by the differential of presence extent of these two news formats.

2.3 Risk Perception

There is plenty of evidence to suggest that VR news is more conducive to subjective perception change. For instance, Sundar et al. [2] found that subjects who experienced the stories using VR and 360° video outperformed those who read the same stories using text with pictures in terms of the feelings of empathy, and the reason is that VR News leads to a higher sense of presence which could make a higher level of emotional arousal.

As expected, there are similar conclusions in disaster news. Research has shown that audiences who experienced the greater spatial presence and perceptual realism while watching this news story via VR format performed increased judgments of the severity of hurricanes [12]. In addition, Jason et al. [13] found that the audience felt more dangerous and injury in the scene of pediatric mass casualty incidents created by VR technology. Thus, the following hypothesis is proposed:

H3: Audiences exposed to VR news coverage have a greater degree of risk perception about the disaster compared to those exposed to text news coverage which is influenced by the differential of presence extent of these two news formats.

Here, this study also used the approach of structural equation modeling to integrate the hypotheses (Fig.2).

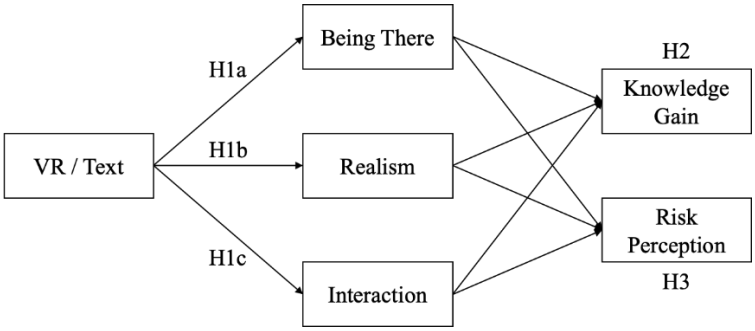

Fig. 2. Structural equation modeling analysis framework

3 Method

3.1 Subjects

This study employed 40 students that enrolled in new media courses at a university located in southern China whose initial knowledge score about the selected disaster news in preliminary test was zero (i.e., never heard about this disaster). And the subjects were divided into two groups, 20 watched VR news and 20 read text news, with demographics equally distributed.

3.2 Stimulus

The news used as stimulus were selected from the VR channel of CCTV.com. It's about the Fugui Mountain mudslide in Sichuan province, China. Contents of VR (https://bit.ly/3kb86pr) and text news (https://bit.ly/2ZWvi3j) were the same.

3.3 Procedure

All subjects of two groups were asked to watch the VR news and read the text news respectively, and subsequently fill in a questionnaire to get their situation on dependent variables. To reduce the interference of subjects' memory on the experiment, questions in preliminary test and formal questionnaire were essentially the same, but different in wording.

3.4 Measurement

Knowledge Gain. Knowledge gain was measured by 6 questions about objective facts on the disaster. For example, when did the landslide happen? As of 2 p.m. June 25, how many corpses have been discovered? One point is awarded for each correct answer.

Risk Perception. The measurement of risk perception consists of four dimensions: psychology, economics, life, and social stability. Psychological perceived risk refers to how disaster news affects our perception of a disaster [14–16]. Economic perceived risk refers to the perception of financial loss caused by a disaster. Perceived risk to social stability refers to the degree to which we think disasters will affect social stability. Life perceived risk can be measured from two dimensions: quality of life and life safety [17] (Cronbach α= .89).

Presence. The measurement of presence-related heuristics, including being-there (Cronbach α= .84), realism (Cronbach α= .71), and interaction (Cronbach α= .93) referenced a study of Sundar [2].

4 Results

Presence-related Heuristics. Table 1 shows that subjects experience a significant different degree of being-there and realism heuristic between VR and text disaster news coverage. For interaction, there was no significant difference. Thus, H1a and H1b were supported, and H1c was rejected.

Knowledge Gain and Risk Perception. Results of ANOVA (Table 1) shows that there was a significant difference in knowledge gain about disaster and risk perception of audience between VR and text news formats. Subjects in the VR condition showed lower knowledge gain about the disaster compared to the text condition. What's more, subjects in the VR condition showed a greater extent of risk perception compared to that in the text condition corresponded.

Table 1. Result of ANOVA including heuristics, knowledge gain, and risk perception

Dependent variables	VR news		Text news		Indicator	
	M	*SD*	*M*	*SD*	*F*	η^2
Heuristics						
Being-there	4.25	1.15	3.50	1.38	3.51†	0.09
Interaction	3.18	1.37	3.05	1.33	0.10	0.00
Realism	5.13	0.96	4.48	1.10	3.95*	0.09
Knowledge gain	1.65	1.09	2.35	1.63	2.55†	0.06
Risk perception	6.43	0.43	4.99	1.31	21.80***	0.37

†p <. 10, *p < .05, **p < .01, ***p < .001

Accordingly, VR and text news formats have an impact on knowledge gain and risk perception through presence, including being-there, realism based on the results of structural equation modeling analysis (Table 2). Results show that the degree of presence including being-there and realism of new coverage have a negative effect on knowledge gain. Therefore, hypothesis 2 was supported. Moreover, the degree of presence including being-there and realism has a positive effect on the extent of risk perception. Therefore, hypothesis 3 was supported.

Table 2. Result of path analysis for each variable

Path	β	SE
VR / Text → Being There	0.44***	0.35
VR / Text → Realism	0.32†	0.39
VR / Text → Interaction	-0.04	0.38
Being There → Knowledge Gain	-0.63	0.45
Realism → Knowledge Gain	0.13	0.17
Interaction → Knowledge Gain	0.51	0.42
Being there → Risk Perception	1.22***	0.23
Realism → Risk Perception	0.20*	0.07
Interaction → Risk Perception	-0.69**	0.16

†p <. 10, *p < .05, **p < .01, ***p < .001. Model fit: χ^2/df = 1.13, p = .10, CFI = .99, GFI = .99, RMSEA = .06

5 Discussion and Conclusion

This research examined the effects of the VR system on knowledge gain and risk perception in disaster news coverage through presence based on the MAIN model. Specifically, VR disaster news can make the audience more aware of the risk and severity of the disaster because of its presence, but it is not a format to acquire information about disaster. Firstly, the conclusion on knowledge gain resonates with some previous studies [18] which found that the VR system could have a negative impact on knowledge gain. However, this is different from the research of Suh & Lee [19] and Chang et al [10]. It is probably caused by the difference of topics [5] that those two studies are about education and advertising. Secondly, the conclusion on the risk perception of this study is also in line with the literature. For instance, Chen and Li [20] stated that VR news has realistic audio-visual effects and the reality becomes more expressive via VR news, which makes audiences have more real and natural reactions in disaster news.

Therefore, it would be better to use text format if it is an explosive disaster that sought to make the public aware of the event itself in time. Meanwhile, the VR format is superior when it comes to environmental monitoring, improving risk awareness, and arousing charitable acts.

Limitations of the study should also be pointed out. Although this article tried to exhaust the control variables, it cannot fully control the subjects' curiosity and personal

media literacy, such as some subjects searching for news stories out of curiosity within an hour of the interval, or someone is easier to be aroused by emotions brought by VR. Future research can take into account the role of some moderating variables, such as topics, specific forms of VR news, countries and regions, etc. Last but not least, the study mainly took 360-degree panoramic video and pictures as the research objects. Future research can compare these two forms of VR News, VR News that requires professional headsets and traditional news to analyze the effects of VR News and traditional news in more detail.

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