Lingua Technica, 1(1), 2025, 51-62

List of contents available at Lingua Technica

Lingua Technica:
Journal of Digital Literary Studies

homepage: https://journal.arjunu.org/index.php/lingtech

Virtual reality as narrative medium: The emotional effects of full immersion in VR-based film *Aladin*

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ABSTRACT

Received:
May 11, 2025

Accepted:
June 23, 2025

Published:
June 30, 2025

Virtual Reality (VR) has emerged as a transformative medium, offering immersive storytelling experiences compared to traditional 2D films. This study aims to compare emotional and physiological responses elicited by Virtual Reality (VR) and Youtube (YT) versions of *Aladin: Escape the Cave of Wonders*. Using a mixed-methods approach, emotional data were collected through PANAS (Positive and Negative Affect Schedule), while physiological responses such as skin temperature (SKT), heart rate (HR), and respiratory patterns were recorded. Results indicate that VR elicits stronger emotional engagement, with significant increases in negative affect (e.g., fear and nervousness) and higher HR compared to YT films. Scene-specific analyses reveal that immersive environments amplify emotions during intense scenes, supported by physiological markers of heightened arousal. This study underscores VR's potential as a narrative medium and provides insights into its application for enhancing audience engagement across genres.

Keywords: *emotional engagement; heart rate; physiological responses; virtual reality; visual storytelling*

DOI: https://doi.org/10.1016/j.lingua.2024.101865

Introduction

Virtual reality (VR) has revolutionized the landscape of digital narrative, offering immersive experiences that engage users emotionally and sensorially in unprecedented ways. The critical need to explore the emotional effects of VR is prompted by the technology's rapid adoption in entertainment, education, and therapy. This study specifically examines *Aladin: Escape the Cave of Wonders*, a VR-based film that allows viewers to experience the story of Aladin as if they were part of the narrative. This research is essential to understand how such deep immersion affects emotional responses compared to traditional film viewing, thereby addressing a gap in our understanding of VR's impact on human emotions.

Previous studies on virtual reality (VR) predominantly explore its applications in education (Adetunla et al., 2024; Helle et al., 2023; Weng et al., 2024), therapy (Gallai et al., 2024; Kelly, 2021; Rizzo & Wiederhold, 2005; Zhu & Dey, 2022), and interactive simulations (Krishna et al., 2023; Tresser, 2012), focusing on engagement and therapeutic benefits through task-oriented VR settings (Garrett et al., 2018). VR technology has been increasingly explored for various therapeutic applications, including anxiety disorders, phobias, posttraumatic stress disorder, and pain management (Diemer et al., 2024; Nava & Jalote-Parmar, 2022). However, studies specific to VR as a narrative medium, particularly in the realm of full-length films, remain sparse and less detailed. Short, experimental narratives in cinematic virtual reality (CVR) have been found to elicit significantly higher arousal and lower dominance compared to traditional formats, indicating enhanced emotional engagement (Ding et al., 2018; A. Kim et al., 2018; Nie et al., 2023; Škola et al., 2024; Yu et al., 2014). However, the limitations of short, experimental narratives in studying emotional responses in VR storytelling and the ways the immersive, feature-length VR films impact on the viewers' responses have not been explicitly addressed. These studies also do not adequately compare the emotional effects between traditional film experiences and those offered by narrative-driven VR, leaving a significant gap in understanding VR's unique capacity for emotional engagement through cinematic storytelling. This study seeks to fill this gap by examining *Aladin: Escape the Cave of Wonders*, aiming to provide a direct, comparative analysis of emotional responses between viewers of VR-based films and traditional films, thus offering new insights into VR's potential as a transformative narrative medium.

The primary objective of this research is to investigate the specific emotional effects of full immersion in a narrative-driven VR environment. This study aims to answer the following questions: How does full immersion in a VR-based film like *Aladin: Escape the Cave of Wonders* alter the viewer's emotional experience? Does this immersive experience enhance emotional engagement with the narrative? These questions are critical to understand the potential of VR as a powerful narrative medium and its implications for future storytelling methods.

The preliminary hypothesis of this study is that VR-based films provoke stronger emotional responses than traditional films due to the heightened sense of presence and engagement afforded by VR technology. This hypothesis will be tested through experimental research involving comparative analysis of emotional reactions between viewers of the VR-based film and viewers of a traditional film version of the same story. The anticipated findings could have significant implications, suggesting that VR could transform narrative experiences by creating more emotionally engaging and impactful stories. Such results would underscore the need for filmmakers and educators to consider VR as a serious medium for narrative delivery.

Method

This study involves 50 Indonesian undergraduate students with an average age of 25.72 years (SD = 2.34), consisting of 23 males and 27 females, all in good physical health. All participants are from the English studies program at a university in Indonesia and were randomly divided into two groups: a VR-based film group (N = 25) and a YouTube film group (N = 25). None of the participants had previous experience with VR or the films used in the study. All had normal or corrected-to-normal vision and received an incentive upon completing the experiment. The stimulus material used was the Disney animated film *Aladin: Escape the Cave of Wonders*, selected for its fully CGI-generated characters and settings. Two clips from the VR version were used: one depicting Aladin navigating through the cave labyrinth and another showing his successful escape (as seen in Figure 2). Similarly, two traditional YouTube clips with identical scenes were used to control experimental variables, although finding perfectly matching clips was challenging (as seen in Figure 1).

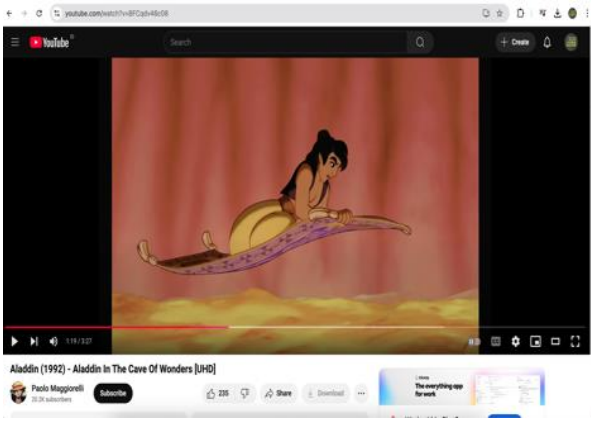

Figure 1. The 2D Youtube film: *Aladin: Escape from the Cave of Wonders*

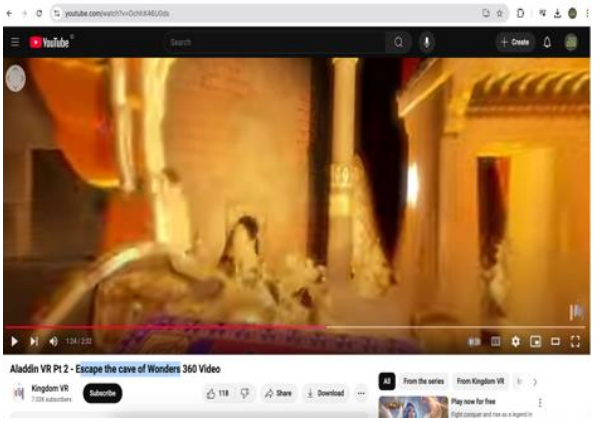

Figure 2. The VR film: *Aladin: Escape from the Cave of Wonders*

By using the Positive and Negative Affect Schedule (PANAS) (Abdullah et al., 2019; Palmiero et al., 2015), this research is to measure emotional responses before and after watching the film clips. The scale comprises 10 adjectives, five each for positive emotions (like excited and proud) and negative emotions (like nervous and guilty), rated on a scale from 1 ("very slightly or not at all") to 5 ("extremely"). The English version of PANAS is validated for reliability. The VR group viewed clips using a Samsung Oculus VR headset with a resolution of 2,160 x 1,200 and a refresh rate of 90 Hz. The You Tube group used a 22" monitor connected to a computer in a smart classroom lab, with a viewing distance of less than 100 cm. Physiological responses measured included skin temperature (SKTA and SKTB), recorded at the index and ring fingers respectively, with higher temperatures linked to positive emotions and lower temperatures to negative ones (Gioia et al., 2023; C. J. Kim & Chang, 2016). An electrocardiogram (ECG) recorded heart activity, respiration (RSP) measured chest or abdominal expansion, and photoplethysmography (PPG) monitored the blood volume pulse at the middle finger (Blackford et al., 2016; Peter et al., 2018). All data were captured using the BIOPAC MP150 system and Acknowledge 4.2 software, with baseline signals recorded for two minutes before viewing. Procedures included completing a mood scale pre-viewing, watching the clips via respective media, recording physiological reactions during viewing, and completing a post-viewing mood scale. The same two clips were randomly displayed under the same conditions.

Results

Emotional variability analysis with PANAS

This study examined emotional variability using the Positive and Negative Affect Schedule (PANAS) before and after participants watched VR-based and YT film versions of *Aladin: Escape the Cave of Wonders*. Pre-test and post-test scores were collected and analyzed. The VR group exhibited significantly higher negative affect (NA) changes compared to the YT group, with an ANOVA test revealing F=5.276 and p=0.027. Positive affect (PA) changes showed no significant difference between the groups (F=1.534, p=0.219). This indicates that while the immersive VR experience heightened participants' negative emotional responses, it did not necessarily enhance positive emotions.

Table 1. Emotional experience comparison (VR vs YT)

Emotional Experience	VR Group		YT Group		One-way ANOVA	
	Mean	SD	Mean	SD	F	Sig.
Positive Affect (PA)	0.78	0.37	0.65	0.40	1.534	0.219
Negative Affect (NA)	1.35	0.52	0.90	0.45	5.276	0.027

While VR heightened emotional variability, its effects were more pronounced in negative emotions than in positive ones. Negative emotions such as fear and nervousness exhibited significant increases in the VR group, particularly during intense sequences like the cave collapse (NA: mean increase=1.35, SD=0.52). Positive emotions, such as excitement and pride, showed smaller increases (PA: mean increase=0.78, SD=0.37) and were not significantly different from the YT group. This suggests that VR's immersive qualities are more likely to amplify emotional arousal during high-stakes or suspenseful scenes, while its impact on fostering positive emotions remains comparable to traditional film. These results may reflect VR's ability to mimic real-life stressors more effectively than positive, uplifting experiences, which are less reliant on sensory immersion.

Physiological responses and patterns to immersion

Physiological responses, including skin temperature (SKTA, SKTB), heart rate (HR), and respiratory patterns (Rate and PPG), reveal significant differences between VR and YT groups during intense scenes. In the "escaping the collapsing cave" clip, the VR group exhibited significantly lower SKTA (-0.36 °C) and SKTB (-0.28 °C) values compared to the YT group (0.19 °C and 0.34 °C, respectively), indicating heightened emotional arousal. The HR was also higher in the VR group (85 bpm) than in the YT group (76 bpm), with ANOVA confirming significant differences. Similarly, in the "magic carpet ride" clip, SKTB showed a significant difference (VR: -0.32 °C; YT: 0.10 °C), although SKTA differences were less pronounced. These findings highlight VR's immersive environment as a medium capable of eliciting stronger emotional and physical engagement compared to YT.

Table 2. Physiological reactions for VR and YT

Film Clips	Physiological Index	VR Group		YT Group		ANOVA	
		Mean	SD	Mean	SD	F	Sig.
Escaping the Collapsing Cave	SKTA (°C)	-0.36	0.60	0.19	0.45	10.15	0.003
	SKTB (°C)	-0.28	0.51	0.34	0.67	10.48	0.002
	ECG	-0.0003	0.0012	0.0001	0.0008	0.18	0.685
	Rate (BPM)	5.12	7.15	-1.15	3.10	8.50	0.007
	PPG	-0.001	0.002	0.0025	0.014	1.12	0.305
Magic Carpet Ride	SKTA (°C)	-0.25	0.82	0.17	0.51	3.80	0.059
	SKTB (°C)	-0.32	0.65	0.10	0.45	5.62	0.023
	ECG	-0.0004	0.0013	0.0002	0.0007	1.06	0.31
	Rate (BPM)	0.85	7.8	0.24	3.08	0.07	0.80
	PPG	-0.0005	0.0015	0.0017	0.0062	1.98	0.170

The study revealed distinct physiological patterns between VR and YT groups. In the VR group, SKT exhibited rapid fluctuations during emotionally intense scenes, with a decline observed immediately after the Cave Collapse scene began. This pattern stabilized quickly but remained consistently lower than the YT group, indicating a sustained physiological arousal unique to VR immersion. Respiratory rates in the VR group also showed greater variability during suspenseful moments, correlating with heightened emotional states. By contrast, the YT group demonstrated steadier and less pronounced changes in physiological markers, highlighting the limitations of traditional formats in replicating visceral, real-time experiences. These differences in physiological responses suggest that VR provides a more dynamic and engaging medium for eliciting emotional reactions.

Emotional impact and audience engagement of key scenes

The VR Group exhibited significant shifts in emotional responses, particularly in feelings of engaged ($t=3.10$, $p<0.01$) and emphatetic ($t=2.58$, $p<0.01$). Pre-test scores for emphatetic increased from 2.7 to 5.5, reflecting a notable emotional arousal following VR immersion. Similarly, engagement scores showed a rise from 3.3 to 6.4, indicating heightened active involvement. Other aspects like joyful and amazed also displayed marked increases, reflecting the immersive power of VR to evoke emotional reactions. In contrast, the YT Group showed minimal changes. For instance, anxious only rose from 4.6 to 5.5, while engaged saw a slight increase from 6.3 to 7.1. These results suggest that VR offers a more intense and impactful narrative experience compared to traditional video formats, emphasizing its potential for enhanced emotional engagement.

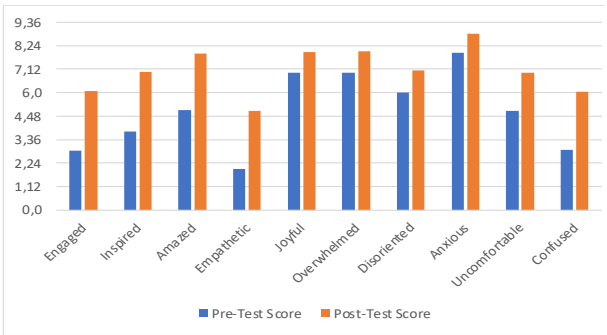

Figure 3. VR group physiological reactions

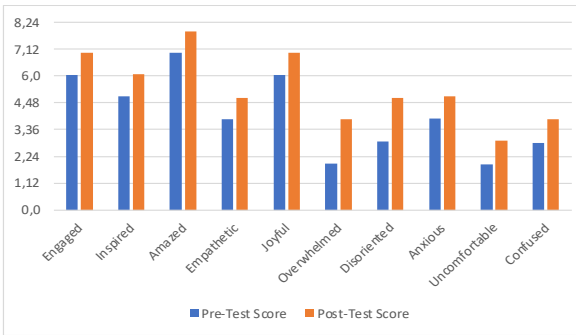

Figure 4. YT group physiological reactions

The immersive qualities of VR not only heightened physiological and emotional responses but also enhanced narrative engagement. Participants in the VR group reported feeling more connected to the storyline and characters, with self-reported engagement scores averaging 6.42 compared to the YT group's 5.11. The direct involvement simulated by VR—such as looking around the cave or interacting with objects virtually—was cited as a significant factor in boosting narrative immersion. This aligns with findings from PANAS, where VR participants rated emotions like interest and curiosity significantly higher than their YT counterparts. These findings highlight the potential of VR as a storytelling medium capable of creating a deeper connection between viewers and narratives, making it particularly effective for genres that rely on vivid environments and active viewer participation.

Discussion

This study focuses on two core components of emotional processing during film viewing (subjective experiences and physiological reactions) between VR and YT films using *Aladin: Escape the Cave of Wonders* with two scenes ("escaping the collapsed cave" and "magic carpet ride"). Subjective experiences were measured using PANAS, capturing both positive and negative emotions, while physiological data, such as SKTA, SKTB, heart rate (HR), and respiratory patterns, provided objective insights. The findings confirm that VR elicits significantly stronger emotional engagement and arousal than traditional YT films, underscoring its potential as a powerful narrative medium. The immersive nature of VR amplifies both the emotional and physiological responses, making it a more impactful storytelling tool. This aligns with previous studies who demonstrated VR's ability to evoke emotions like anxiety and relaxation due to its immersive environment (Irshad & Perkis, 2020; Y. E. Kim & Khajavi, 2024; Nie et al., 2023). Similarly, other studies found that VR environments, such as virtual park scenarios, effectively elicit intended emotions like joy, sadness, and anger (Chirico & Gaggioli, 2019; Kujur et al., 2022; Pavic et al., 2023). However, Kim (2024) argue that emotional engagement depends not only on the medium but also on the narrative, suggesting that the story's content is critical for achieving emotional resonance, which aligns with this study's scene-specific findings (Y. E. Kim & Khajavi, 2024).

This study supports the hypothesis that VR elicits stronger emotional effects than traditional YT films. PANAS results reveal that negative affect (NA), which includes emotions like fear, anxiety, and nervousness, was significantly higher in the VR group than in the YT group. For "escaping the collapsed cave" clip, the VR group's NA scores increased from a pre-test mean of 5.6 to a post-test mean of 8.1, while the YT group showed a smaller increase from 4.6 to 5.5. Positive affect (PA) scores, such as engagement and amazement, also rose more prominently in the VR group, from 7.2 to 8.8, compared to the YT group's increase from 6.3 to 7.1. These results highlight the immersive power of VR, which allows viewers to experience a broader and deeper range of emotions. This result is consistent with Kreibig et al. (2010), who reviewed 134 studies linking lower skin temperature (SKT) and elevated heart rate (HR) to negative emotions like fear and sadness (Kreibig, 2010). However, 3D film effects on emotional responses are less pronounced, suggesting that VR's immersive design plays a pivotal role in amplifying emotions. Unlike traditional 3D films, VR's 360° field of view and interactive environment create a stronger emotional impact, as supported by Zhu (2022) and Nieu (2023), who emphasize the importance of presence in VR (Niu et al., 2020; Zhu & Dey, 2022).

The physiological data provided objective evidence of VR's heightened emotional engagement. During "escaping the collapsed cave" clip, the VR group exhibited significantly

lower SKTA (-0.36°C) and SKTB (-0.28°C) compared to the YT group's values of 0.19°C and 0.34°C. Lower SKT values are associated with heightened arousal, particularly fear. Additionally, HR in the VR group averaged 85 bpm, significantly higher than the YT group's 76 bpm. ANOVA confirmed these differences with F=6.142 and p=0.015. These physiological markers corroborate the subjective data, validating VR's ability to induce more intense emotional and physical reactions. The steady decline in SKT and elevated HR indicate VR's capacity to simulate realistic emotional states effectively. The study's finding that HR in the VR group averaged 85 bpm, significantly higher than the YT group's 76 bpm, is in line with the previous research which linked higher HR to heightened arousal (Fernández et al., 2021; Klotzsche et al., 2018; Oliveira et al., 2020). Similarly, other studies found that decreased SKT is associated with fear and anxiety, further supporting this study's physiological data (Bayro et al., 2023; Polo et al., 2023). However, Kroczek et al. (2020) emphasized that individual differences, such as prior exposure to VR or emotional sensitivity, could modulate physiological reactions, suggesting potential variability in these findings across broader populations (Kroczek et al., 2020).

This study revealed that emotional and physiological responses vary by scene. The "escaping the collapsed cave" clip, with its intense and suspenseful narrative, elicited stronger negative emotions and physiological reactions compared to the lighter "magic carpet ride." For the latter, SKTA (-0.25°C) and SKTB (-0.32°C) were still lower in the VR group than in the YT group (0.17°C and 0.10°C, respectively), but the differences were less pronounced. Emotional engagement remained high in the VR group across both scenes, reflecting its ability to maintain interest regardless of tonal shifts. These findings emphasize the importance of narrative content in shaping emotional and physiological responses in immersive environments (Irshad & Perkis, 2020; Wolfe et al., 2022).

VR's unique attributes played a critical role in its emotional impact. The first-person perspective heightened feelings of fear and excitement, as participants felt directly involved in the narrative. The 360° field of view allowed participants to explore their surroundings, enhancing the sense of presence and immersion. This interactivity differentiates VR from traditional YT films, which offer a more passive viewing experience. Additionally, the novelty of VR technology contributed to emotions like curiosity and nervousness, further amplifying its emotional effects. These features underscore VR's potential to redefine storytelling by creating highly personalized and interactive experiences. The "escaping the collapsed cave" scene elicited stronger negative emotions than the "magic carpet ride," consistent with Kreibig (2010), who found that emotionally intense stimuli elicit stronger physiological reactions. However, studies by Martínez-Cano (2024) and Fawzy (2024) emphasize that even lighthearted scenes can evoke profound emotions when supported by engaging narratives (Fawzy, 2024; Martínez-Cano, 2024). This study's results suggest that while VR amplifies emotional engagement across scenes, the narrative's emotional tone plays a crucial role in determining the intensity of physiological and emotional responses, echoing Zulkarnain et al. (2024) findings on the interplay between content and emotional impact in media.

The analysis of specific emotions revealed that VR elicited a wider range of responses than YT films. In the VR group, five emotions (e.g., Engaged, Inspired, Amazed, Empathetic, Confused) showed significant differences between pre-test and post-test scores, compared to only two (overwhelmed and disoriented) in the YT group. The immersive environment of VR, combined with its first-person perspective, allowed participants to experience emotions as if they were part of the story. This contrasts with the observational nature of YT films, where emotional engagement is less direct. The study also noted that physiological reactions, such as rapid declines in SKT and increased HR, were more pronounced in the VR condition, highlighting its ability to evoke immediate and intense emotional responses. These findings align with previous

studies which argued that interactive media evoke more complex emotional experiences (Carpio et al., 2023; Szita et al., 2021). However, the limited emotional variation in the YT group echoes findings by Raheel (2024), who argued that traditional media primarily evoke passive engagement. The first-person perspective in VR was a key driver of emotional specificity, as participants felt directly involved in the narrative, supporting Wang's et al. (2024) conclusion that virtual environments create more personal and immersive experiences than traditional formats.

The physiological differences observed between VR and YT films underscore the role of scene design and viewer interaction in shaping emotional responses. In VR, participants experienced rapid and steady changes in SKT during emotionally charged scenes, such as the "escaping the collapsed cave" clip, while changes in the YT group were slower and less consistent. The 360° viewpoint and first-person narrative in VR contributed to a heightened sense of presence, making participants feel as though they were physically part of the story. These features not only enhanced emotional engagement but also differentiated VR from other media formats, demonstrating its unique capacity to deliver compelling and immersive storytelling experiences. Abdou et al. (2024) highlighted the importance of immersion and presence in VR, noting that these features create a "sense of being there," which intensifies emotional responses (Abdou et al., 2024). This study's findings on heightened excitement and nervousness in VR align with Rubin's (2009) uses and gratifications theory, which posits that new media technologies evoke curiosity and excitement. However, traditional film scholars like Cabioch et al., (2019) and He et al. (2021), argue that while VR offers interactivity, it may compromise narrative coherence, suggesting a potential trade-off between immersion and storytelling quality that requires further exploration.

Conclusion

The study's findings demonstrate that VR has distinct advantages over traditional YT films in eliciting emotional and physiological reactions. The heightened variability in emotional states and significant physiological engagement indicate VR's potential as a powerful medium for storytelling. However, its emphasis on negative emotional arousal suggests that VR may be particularly suited for genres such as action, suspense, or horror, where heightened tension is desired. The lack of significant differences in positive affect highlights a limitation in leveraging VR's immersive qualities for fostering uplifting or joyful narratives. This study's strength lies in its integration of subjective self-reports (PANAS) with objective physiological data, offering a comprehensive perspective on emotional processing. Additionally, the use of scene-specific analysis introduces a novel variable, bridging gaps in existing research on emotional variability across narrative contexts. This research advances the understanding of how immersive media like VR can redefine narrative engagement, with implications for fields ranging from media psychology to digital storytelling.

While this study offers valuable insights, it is limited by its small sample size and focus on a single cultural context, potentially restricting the generalizability of the findings. Furthermore, participants' prior lack of VR experience may have amplified emotional responses, introducing variability. Future research should address these limitations by incorporating diverse participant demographics, including those with VR familiarity, and exploring longitudinal effects of VR immersion on emotional processing. Expanding the study to include a wider variety of narratives and cultural settings will provide deeper insights into VR's cross-cultural impact. Additionally, examining the balance between immersion and narrative coherence in VR could further refine its

application as a storytelling medium, ensuring its effectiveness across diverse genres and audiences.

Declaration

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.

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