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Perception of VFX across Diverse Media Formats: A Systematic Review

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Abstract

Objective: This systematic literature review aims to comprehensively synthesize the existing evidence on Perception of VFX across Diverse Media Formats using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. The primary objectives were to what is the nature of human perception of Visual Effects (VFX) and how are human cognitive and perceptual dimensions triggered by Visual Effects (VFX) across various media formats and systematically evaluate the quality of relevant studies.

Methods: Following PRISMA guidelines, a thorough search of electronic databases, IEEE Xplore, Scope, Taylor & Francis Online and ACM Digital Library, was conducted to identify articles published up to 31 Oct 2023. The inclusion criteria encompassed English and Journal. An independent reviewers screened articles for eligibility and discrepancies were resolved through consensus. Data extraction, quality assessment and synthesis were performed systematically.

Results: A total of 14 studies met the inclusion criteria and were included in the review. The studies were characterized by title related to VFX with any type of study design, participant demographics. And the findings of this review presented in a narrative synthesis.

Discussion: In summary, the studies reveal that Visual Human becomes more human-like, VFX reduces conflicts between virtual and physical objects and there are various emphasis effects in different scenarios. Together, these findings deepen our understanding of Visual Effects and enhance our insight into how viewers experience them.

Conclusion: This systematic literature review provides a comprehensive overview of the current state of knowledge on perception of VFX across diverse media formats. The existing body of research on CGI, 3D and composition within the realm of Visual Effects is notably sparse and the term "Visual Effects" has been applied broadly across various domains. This broad application has complicated the systematic review process, making it challenging to discern specific areas of focus. Recommendations for future research are outlined, emphasizing the need for exploration of Trompe l'oeil perception and narrow down the media. Adherence to PRISMA guidelines enhances the transparency and rigor of this review.

Keywords: VFX • Visual effects • CGI • Human perception

Introduction

Visual Effects (VFX) technical grown quickly in the whole world [1], Visual Effects could be another best optional choice for the post-production process in Digital Media. Visual Effects was widely used in animation, advertising, games and film. The term "visual effect" refers to any imagery produced, changed, or improved for a movie or other moving media that cannot be achieved through live-action moving. It has also been expanded to include virtual production, which is the act of taking pictures and instantly composing them into a scene [2].

In the overview of Jeffrey Okun VES and Zwerman VESS [2], the process of making a movie, commercial, or television show was divided into three main stages: pre-production, production and post-production. Pre-production involves all the planning, building and preparation. Production involves filming the live action on a set or location. Last, post-production involves all the finishing touches like editing, sound, music, colour grading and Visual Effects. Therefore, Filmmaking has been transformed by the advent of Visual Effects technology in recent decades. Students will become future filmmakers and professionals in the industry if their perception and use of VFX are understood.

Perception, according to OpenStax (n.d.), [3] is how we arrange, analyse and experience sensory information. Each person has their own way of perceiving things and this influences how we organize sensory data. This organization happens through sorting and making sense of sensory info, allowing us to recognize patterns, distinguish objects and understand our surroundings. Efron R [4] pointed out that perception is the main way humans understand the world around them. Studying perception is important for philosophy and science because all our conceptual knowledge comes from this basic form of awareness.

Qiong Ou simplifies [5] the perception process into three stages: selection, organization and interpretation. In the first step, humans turn environmental signals into meaningful experiences. Next, they organize this information by spotting patterns or categories. Finally, in the interpretation stage, individuals assign personal meanings to categorized information, creating stimuli. Different people give diverse meanings to the same information. Every incident will add a new stimulus to increase a personal experience, when the people meet the environmental signals again the stimulus will be triggered. Humans will throughout sight, hearing, taste, touch and smell to produce the perception process.

Other than that, before conducting this article, there was some knowledge good to know about Systematic Reviews. A systematic review, also called a research synthesis, provides an unbiased, comprehensive overview of many relevant studies [6-9]. Essentially, Systematic Review is the process of summarizing and synthesizing existing evidence on a given topic. A systematic

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method for searching, selecting, evaluating and analysing relevant studies is used in this formal and transparent literature review.

The purpose of this systematic review aims to synthesize existing research literature, examining methodologies, identifying key findings and discerning patterns in how individuals perceive and interact with VFX across diverse media formats. The goal is to enhance our understanding of the nuanced aspects of VFX perception and inform future research directions. Using a systematic review method, which is more prevalent in the literature, this study selected relevant topics from databases guided by a review question. Based on the results of a previous theoretical study, the research question for this study was formulated.

Research questions

1. What is the nature of human perception of Visual Effects (VFX)?
2. How human cognitive and perceptual dimensions are triggered by Visual Effects (VFX) across various media formats?

Methods

Protocol and registration

Aligned with the review objectives, a comprehensive review protocol was developed to meticulously direct the literature search process, encompassing key details such as specific search terms, identified databases and established screening criteria. Employing a systematic approach based on recognized guidelines for systematic literature reviews, a thorough search will be conducted across relevant academic databases [7].

Eligibility criteria

This article had to meet a few criteria. Firstly, the criteria included the keywords 'VFX' or 'Visual Effect' and 'Perception.' Secondly, the criteria for the paper specified the use of the English language and a timeline from 2019 to 2022, constituting a five-year range. Lastly, the paper needed to meet the criteria of being in the Journal or Article type and in the final publication stage with free access Table 1 displays all the criteria in tabular form."

Information sources

The extensive literature search was conducted using the databases IEEE Xplore, Scope, Taylor & Francis Online and ACM Digital Library. Referring to the citations in Table 1, a total of 272 papers were identified in the results of the database search related to the review title.

Search strategy

Since there are four different databases, each required a distinct search strategy. The details of each search strategy have been recorded in Table 2. The search day was on 31 Oct 2023.

Screening

After The PRISMA flow diagram that show below was the process of screening of this extensive literature. The Figure 1 was showed the PRISMA flow diagram that this the extensive literature search conduct.

Data extraction

The study selection process entailed a meticulous assessment of each record by a singular reviewer. The authors identified each paper through a comprehensive reading process, providing a robust justification for its inclusion. This involved a thorough scrutiny of the title, abstract and full text, ensuring a careful determination of whether the paper met the predefined criteria for inclusion or exclusion in the research [8].

Subsequent to this rigorous selection process, a structured data table was formulated, capturing key characteristics of the identified papers. These characteristics included the Title, Authors, Publication Year, Origin, Type of research, Approach, Data collection methods, Analysis methods, Purpose and Findings. The creation of this table served to enhance the transparency of the study, offering a clear and organized representation of the essential information extracted from each selected paper.

Table 1. Eligibility criteria.

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2019-2023	<2019
Literature type	Journal (Article)	Conference, Book, Review
Publication Stage	Final	In Press

Table 2. Search string.

IEEE Xplore	("Perception"or "Insight") and ("VFX" or "Visual Effects" or "CGI" or "Computer-Generated Imagery" or "Digital Visual Effects" or "DVFx")
Scope	TITLE-ABS-KEY ((“Perception" or "Insight") and (“VFX" or "Visual Effects" or "CGI" or "Computer-Generated Imagery" or "Digital Visual Effects" or "DVFx")) and PUBYEAR>2018 and PUBYEAR<2024 and (LIMIT-to (DOCTYPE, "ar")) and (LIMIT-to (LANGUAGE, "English")) and (LIMIT-to (SRCTYPE, "j")) and (LIMIT-to (OA, "all")) and (LIMIT-to (SUBJAREA, "COMP") or LIMIT-to (SUBJAREA , "ARTS"))
Taylor & Francis Online	[[All: "Perception"] or [All: "Insight"]] and [[All: "VFx"] or [All: "Visual Effects"] or [All: "cgi"] or [All: "Computer-Generated Imagery"] or [All: "Digital Visual Effects"] or [All: "Dvfx"]] and [All Subjects: Computer Science] and [Article Type: Article] and [Publication Date: (01/01/2019 to 31/12/2023)]
ACM Digital Library	[[All: "Perception"] or [All: "Insight"]] and [[All: "vfx"] or [All: "Visual Effects"] or [All: "CGI"] or [All: "Computer-Generated Imagery"] or [All: "Digital Visual Effects"] or [All: "Dvfx"]] and [E-Publication Date: (01/01/2019 to 31/12/2023)]

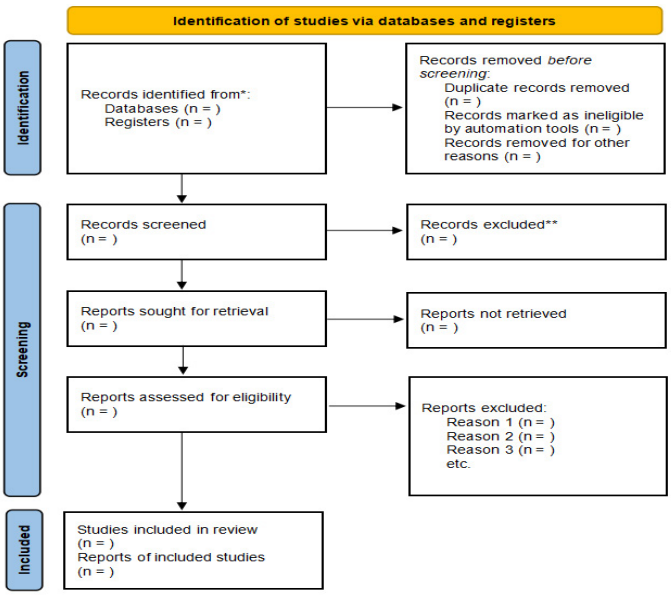

Figure 1. The prisma flow diagram.

Quality appraisal

To bolster transparency and credibility, a single reviewer conducted this process, providing a firm foundation for the research. Emphasis was placed on clear and concise reporting, particularly regarding study design and methodological rigor, setting a high standard for the entire process.

A standardized approach to quality appraisal was employed, facilitating consistent judgments on various aspects of study quality. This ensured a thorough synthesis and interpretation of findings. By prioritizing studies with higher methodological quality, the research aimed to uphold the overall integrity of the conclusions while minimizing the impact of lower quality studies [9].

Results

Study selection

Following the PRISMA flow Figure 2, in the initial stage of identification, a total of 272 papers were identified. Subsequently, 3 duplicate records were removed. During the title and abstract screening, 243 records were excluded based on relevance criteria. Additionally, full-text articles for 11 papers could not be retrieved. Following a thorough review, 14 papers were deemed eligible and included in the final synthesis of studies.

Study characteristics

After thoroughly reviewing all included studies, a detailed Data Extraction table was created to summarize every single study's key findings. This table, synthesizing the extracted data, will be seamlessly integrated into the Study Characteristics section, enhancing clarity and organization.

To facilitate easy reference and maintain a clean presentation, the Data Extraction Tables 3 and 4 will be included in the Appendices. This strategic placement ensures that readers can access detailed study characteristics while maintaining the flow of the main text [10-23].

Data synthesis

As the table is now complete, the subsequent step becomes more manageable. Before initiating the synthesis, it's essential to bear in mind that this systematic review aimed to analyse existing research on how individuals perceive and interact with Visual Effects (VFX) in various media formats. The examination encompassed diverse methodologies, identification of key findings and observation of patterns, all with the goal of understanding how individuals engage with VFX across different media contexts.

To simplify the discussion, the data will be categorized by the media aspect explored in each paper. The studied media included Image, video, Augmented Reality (AR) and Virtual Reality (VR). While most papers delved into Visual Effects (VFX), their focus was on specific media contexts. Each paper conducted a study on how people perceive VFX within that media. Notably, many papers used still images as a popular medium for their research.

This review places a crucial focus on perception, given that the majority of the papers centre around the author's and participants' visual experiences, considering most media is visually oriented. However, there's a noteworthy exception in a particular paper by Sato Y, et al. [14]. In this study, the authors explored the sense of touch by designing three types of texture-form Visual Effects, engaging participants in a unique way. The study utilized a novel pseudo-haptic feedback framework, enabling users to feel the tactile texture of objects without relying on haptic devices.

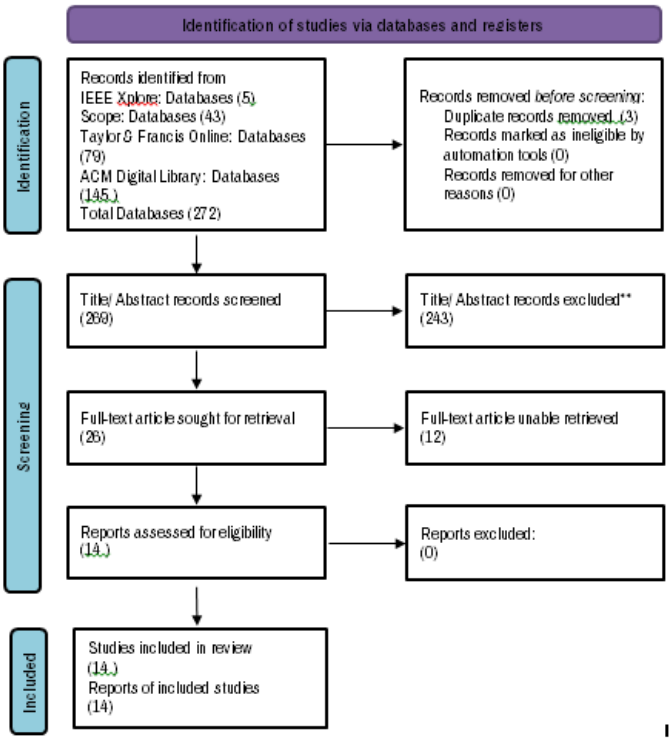

Figure 2. The prisma flow diagram of the review.

The notable papers in this review were by Sharma M and Vemuri K [15] their findings centered on VFX and perception, aligning with the review's objective Sharma M and Vemuri K [15] employed CGI in movie clips for experimental and observational purposes. The paper suggested that as human-likeness increased, eeriness scores deviated from the Uncanny Valley theory. Additionally, it found that increasing human-likeness led to a divergence in eeriness scores from the Uncanny Valley theory.

On the other hand Kim H, et al. [10] conducted experiments using AR. The paper discovered that VFX made conflicts between virtual and physical objects less noticeable. This positive impact helped maintain Virtual Human's social and co-presence in conflicts between virtual and physical aspects, ultimately improving the Virtual Human's physical abilities in response to conflicts with physical objects.

Another noteworthy study worth mentioning is by Mairena A, et al. [11], which explored the emphasis technique. The paper evaluated the perceived prominence of twelve emphasis effects in scenarios with varying distractor amounts, distractor types and visualization types and backgrounds. The findings demonstrated that, although there are commonalities among various effects, the perceived prominence varies in different contexts.

This paper contributes to the overall understanding of Visual Effects (VFX) perception across various media contexts. The findings from these papers highlight the factors triggering audience perception of VFX, including the Uncanny Valley theory, trompe l'oeil perception, realism, aesthetic appeal, quality, conflicts and distractors. These elements are interconnected and influence each other when VFX are presented in the media.

Discussion

In this section, we scrutinize the findings obtained from data collected through PRISMA, focusing on previous studies to identify relevant research on the perception of Visual Effects (VFX). The main objective of our study is to unravel the intricacies of human perception regarding Visual Effects (VFX) and explore how Visual Effects trigger human cognitive and perceptual dimensions across diverse media formats.

As indicated in the previous data synthesis, the findings from those papers are extensive, making it challenging to pinpoint common themes or characteristics. This difficulty arises from the versatility of applying Visual Effects (VFX) to various media. A pivotal discovery in this study stems from Ferretti G [16], highlighting that Visual Effects (VFX) consistently grapple with the Uncanny Valley theory, with implications for both realism and human aesthetics. Moreover, the exploration of trompe l'oeil perception presents an uncharted territory that holds potential for further innovation in Visual Effects (VFX).

From the compilation of studies that consistently offer valuable insights for addressing the research questions in this study, we discern that understanding the nature of human perception of Visual Effects (VFX) involves considering both human vision and experience. The exploration of human cognitive and perceptual dimensions, influenced by Visual Effects (VFX), is elucidated through the application of theories and frameworks employed in previous studies.

Understanding the overall study results boils down to how the research responds and adapts Sharma M and Vemuri K [15] found that Visual Human becomes more human-like and eeriness scores differ from the Uncanny Valley theory [10] added to this by stating that VFX makes conflicts between virtual and physical objects less noticeable. In addition, Mairena A, et al. [11] discussed emphasis perception in various conditions, even showcasing twelve

Table 3. Data extraction.

Title	Authors	Publication Year	Origin	Type of Research	Approach	Data Collection	Analysis Methods	Purpose	Finding
Accepting Human-like Avatars in Social and Professional Roles	Sharma M and Vemuri K [15]	2022	India	Experimental	Experimental and observational methods.	1) Perceptive evaluation of actors in clips.	1) Analysing perceptive evaluation data to examine the divergence of eeriness scores from the Uncanny Valley theory.	The study aims to understand the perceptions and reactions of humans towards digital avatars that closely resemble humans.	1) The key findings suggest that as human-likeness increases, eeriness scores diverge from the Uncanny Valley theory.
						2) Examination of short clips with highly realistic digital avatars.	2) Analysing fixation area and pupil size variation data to infer attention and emotional response.		2) Realistic CGI and motion capture (mocap) technology are proposed as factors that could help overcome the Uncanny Valley.
						3) Recording fixation area and pupil size variation using an eye tracker.	3) Examining proficiency and acceptance scores for roles requiring complex social cognition processes.		3) Visual attention, as inferred from gaze behaviour, is similar for live-action and CGI.
						4) Assessment of acceptance in roles requiring human skill, empathy and cognitive ability.	4) Analysing the transfer of real-life stereotypes of gender roles to digital avatars.		4) Pupil size changes reflect emotions like eeriness when avatars talk or smile.
									5) Proficiency and acceptance scores are lower for roles requiring complex social cognition processes.
									6) Real-life stereotypes of gender roles are transferred to digital avatars.
An implementation framework for transformative gamification services	Tanouri A, Kennedy AM and Veer E	2023	UK	Conceptual and applied	Literature review and conceptualization based on insights from game design, gamification and behaviour change literature.		The analysis method involves synthesizing information from game design, gamification and behaviour change literature to identify different components of transformative gamification.	This research looks at how transformative gamification can impact behaviour. Firstly, they examine the various behavioural changes possible. Then, we break down transformative gamification into its main parts (sensory, hedonic and reflective) and explore how marketing concepts, TSR and gamification literature contribute to behaviour change. Next, they study different play styles to understand how user engagement, gamification components and experiences are linked to behavioural outcomes. Finally, based on a thorough review of literature, they provide a simple framework to help researchers and practitioners design effective transformative gamification services for behaviour change.	1) The study identifies a lack of research on the practical implementation of transformative gamification services.
									2) It emphasizes the need to consider the synergistic effects and behavioral outcomes of combining gamification elements.
									3) The researchers propose an implementation framework for transformative gamification services based on insights from social marketing and transformative service research.
Comparison of gaze accuracy and precision in real-world and virtual Reality	Pastel S, et al. [12]	2020	Germany	Experimental and Comparative	Quantitative and involves experiments	1) eye-tracking devices used in both real-world and virtual reality conditions.	1) Calculating an averaged distance with root mean square between the coordinates of each target and the recorded gaze points for each task.	The purpose of the study is to compare foveal vision, specifically gaze accuracy and precision, between the real world and virtual reality. The goal is to provide insights that can serve as a reference for the development of virtual reality applications in the future.	1) The results of the present study show that regarding the 1 m distance and static visual stimuli equal gaze accuracy between VR and reality could be observed.
						2) The participants performed three eye-movement tasks in sequence: gaze at static targets, tracking a moving target and gaze at targets at different distances.	2) Statistical tests, including p-values, are used to assess significant differences in gaze accuracy and precision between real-world and virtual reality conditions.		2) Large differences were observed in tracking the moving target in virtual reality.

									3) The precision in virtual reality is significantly worse compared to the real world in all tasks with static gaze targets
Do Trompe l'oeils Look Right When Viewed from the Wrong Place?	Ferretti G [16]	2020	UK	Theoretical and Speculative	Theoretical and Philosophical			The purpose of the study is to explore and speculate on the differences between picture perception and ordinary perception, specifically concerning the perception of spatial shifts in trompe l'oeil paintings.	In summary, the main finding appears to be the proposal that trompe l'oeil perception shares similarities with ordinary perception, not only in the illusion of presence but also in the perception of spatial shifts resulting from movement.
Editable Free-Viewpoint Video using a Layered Neural Representation	Zhang J, et al. [20]	2021	China	Experimental and innovatively	Technical and Development		1) The development and evaluation of the proposed layered neural representation (ST-NeRF).	The purpose is to advance the state-of-the-art in free-viewpoint video generation by introducing a novel approach that addresses existing challenges and enables realistic spatial and temporal manipulation in large-scale dynamic scenes.	The proposed approach is successful in generating realistic, editable free-viewpoint videos for dynamic scenes, addressing challenges such as occlusion handling and scene-specific editing
							2) Specific techniques mentioned include scene parsing 4D label map tracking, continuous deform module, object-aware volume rendering, layered loss and motion-aware ray sampling strategy.		
Effects of background colour, polarity and saturation on digital icon status	Yu N and Ouyang Z [18]	2023	China	Experimental	Quantitative	1) Performance measures and eye movement results obtained from 31 participants	1) Assessing task performance and eye movement results to draw conclusions about the effects of icon colour features.	To investigate the effects of icon colour features on user perception and	This research finding revealed several key insights that can inform the design of more efficient, user-friendly and aesthetically pleasing icons and interfaces. Notable conclusions include the advantages of a white background for faster search performance, the benefits of 80% icon saturation for quicker task completion and the nuanced relationship between icon polarity and task completion time, with positive polarity showing advantages in the studied task setting.
Recognition and visual search performance						2) Interacted with icons under different conditions and their responses were recorded.	2) Statistical analysis is likely used to interpret the data, given the experimental nature of the study with multiple independent variables.	Visual search performance under different background colours. There were three independent	
								variables in the study, including background colour (white and black), icon polarity (positive and	
								negative) and icon saturation (60, 80 and 100%).	
Image Synthesis With Efficient Defocus	Chen YC and Chang TS [21]	2020	Taiwan	Applied research	Technical and algorithmic		1) Simulation results to evaluate the proposed perceptual-oriented defocus blur technique.	The study is to address challenges in image synthesis for stereoscopic displays related to depth of field, occluding contour error and computational complexity. The proposed perceptual-oriented defocus blur aims to enhance image quality while reducing the computational load.	The simulation results show that the proposed approach has better quality than the conventional defocus blur methods and achieves similar quality compared to the deep learning based methods but with much lower complexity.
Blur for Stereoscopic Displays							2) Comparison is made with conventional defocus blur methods and deep learning-based methods in terms of quality and computational complexity.		
Key Factors for Evaluating Visual Perception Responses to Social Media Video Communication	Tsai CJ and Shyr WJ [17]	2022	Japan	Exploratory and applied	Mixed-methods approach	1) Expert Consultation Panel: An interview consultation panel of experts and scholars was used to summarize and analyse key factors of visual perception and response evaluation in social media video communication.	1) Statistical analyses such as calculating means (M), modes (Mo) and standard deviations (SD) for responses from the Delphi technique questionnaires.	The purpose of this study was to investigate the key factors for creating a positive visual perception response evaluation for social media video communication. The aim of this study was to determine what factors of light sources impact visual perception to increase the interactions in social media video communication	1) The visual effect of social media users can be increased via the quality of the light source illumination so that the experience of the perception and visual perception of the video user is positively influenced. This study examined the key factors of the quality of light source illumination in evaluating the visual perception responses of social media viewers through the Delphi technique.

						2) Delphi Technique Questionnaire: A panel of 12 experts and scholars participated in the Delphi technique, where questionnaires were used to iteratively gather and refine responses.	2) The one-sample Kolmogorov–Smirnov test is used to assess the appropriateness and consistency of the Delphi survey results.		2) key factors for evaluating the visual perception responses to social media visual
									Communication. There were four dimensions, namely: (1) visual perception, (2) emotional
									perception, (3) preference perception and (4) shape perception.
Modifying Texture Perception With Pseudo-Haptic Feedback for a Projected Virtual Hand Interface,	Sato Y, et al. [14]	2020	Japan	Experimental and technical	Technical and innovative	Conducting experiments to assess the effectiveness of the proposed pseudo-haptic feedback framework. Participants are likely involved in interacting with the projected virtual hand interface and providing feedback on their perception of tactile sensations induced by visual effects.	1) Evaluating experimental results to determine the effectiveness of the proposed visual effects in providing users with the intended tactile sensations.	Propose a novel pseudo-haptic feedback framework to provide users with the tactile texture of objects without the use of haptic devices. Designed three types of visual effects that produce unevenness, slipperiness and softness The goal is to propose a novel pseudo-haptic feedback framework that simulates tactile sensations through visual effects.	1) The experimental results indicate that the proposed visual effects can lead users to feel the intended tactile sensation.
							2) Statistical analysis may be employed to assess the significance of the results.		2) Furthermore, the visual effects provide users with tactile sensations with three to five levels of intensity without producing a strange feeling.
Relative Radiation Correction Based on CycleGAN for Visual Perception Improvement in High-Resolution Remote Sensing Images	Yu X, et al. [19]	2021	China	Technical and experimental	Technical and algorithmic	The data collection involves obtaining high-resolution remote sensing images of the same area in different seasons. The images are likely sourced from satellite or aerial platforms. The convolutional neural network is trained and tested on these images for the seasonal relative radiation correction.	1) Measuring the similarity between the relative radiation-corrected images and reference images using a convolutional neural network model.	The purpose of the research or study, as indicated by the title, is to improve the visual perception of high-resolution remote sensing images. This improvement is sought through a specific technique known as Relative Radiation Correction (RRC) based on CycleGAN. The goal is likely to enhance the quality, interpretability and overall visual appeal of the images, making them more useful for applications such as environmental monitoring, land cover classification, or other remote sensing tasks	1) The proposed method using CycleGAN for seasonal relative radiation correction shows significantly better visual effects compared to other methods.
							2) Visual perception distance is assessed and the results are compared with other state-of-the-art methods.		2) The visual perception distance is improved by a certain percentage when transforming images from autumn-winter to spring-summer and vice versa.
							3) Quantitative measures, possibly derived from the convolutional neural network, are used to evaluate the performance of the proposed method.		
The Impacts of Visual Effects on User Perception With a Virtual Human in Augmented Reality Conflict Situations	Kim H, et al. [10]	2021	Korea	Experimental and exploratory.	Experiments	Data collection involves testing different visual effects in three specific conflict situations: (1) VH appearing in a room through a closed door, (2) VH's body overlapping with static real objects and (3) a real moving object passing through the VH. The study likely gathers data on users' responses, attention, social behaviours and perceptions in these situations.	1) Evaluating the impact of visual effects on VH's social/co-presence, physicality and user behaviours in different conflict situations.	To investigate how different visual effects can influence users' perceptions and interactions with virtual humans in augmented reality, particularly in conflict situations. The goal is to understand the implications of using various presentation methods for physical conflicts and to guide future research in this area.	1) The findings indicate that visual effects have varying impacts on VH's social/co-presence and physicality depending on the situations and types of effects.

							2) Qualitative and quantitative data may be collected and analysed to draw conclusions about the effectiveness of the visual effects.		2) VFX was able to make conflicts between virtual and physical objects less noticeable. This resulted in VFX having a positive impact on maintaining VH's social/ co-presence in physicality conflicts that could adversely affect user perception. Also, the VH's physical ability significantly improved due to VFX in response to conflicts with physical objects.
									3) The study highlights the influence of visual effects on users' attention and social behaviours in the context of AR conflicts.
Visual perception and local features for foreground-backgroundsegmentation	Peng T, et al. [13]	2022	China	Technical and algorithmic	Developing		Evaluating the performance of the proposed top-down segmentation model on the CMU-Cornell iCoseg and BSDS500 databases.	The purpose of the study is to address the limitations of traditional foreground-background segmentation models that rely mainly on low-level features and ignore visual effects. The proposed top-down segmentation model aims to improve segmentation accuracy by combining visual perception with local features.	Demonstrate that Visual perception aims to extract the global impression of an image and local features help improve segmentation performance. It fully considers the contribution of global and local pixels and the experimental results on images are encouraging.
'What lies behind the filter?': Uncovering the motivations for using augmented reality (AR) face filters on social media and their effect on well-being	Javornik A, et al. [23]	2022	UK	Social and behavioural	Sequential mixed-method approach	1) Qualitative data was collected through interviews with 10 participants, exploring their motivations and experiences with AR face filters.	1) Qualitative data from interviews may have been analysed thematically to identify motivations and nuanced insights into self-presentation motives.	The purpose of the study is to understand 'why' people use AR face filters on Instagram (motivations) and 'how' their usage impacts their well-being. The research aims to contribute insights into the complex nature of self-presentation motives and the positive and negative well-being effects associated with AR filter usage.	1) identify nine motivations that can potentially drive AR face filter usage on Instagram.
						2) The quantitative data was collected through a survey involving 536 participants, likely focusing on usage behaviours, motivations and the well-being effects of AR face filter usage.	2) The quantitative data from the survey underwent statistical analysis, identifying significant drivers of usage behaviours and exploring the relationship between motivations and well-being effects.		2) seven of those motivations (e.g. creative content curation, social interactions) are significant drivers of usage behaviours, while two (true self-presentation and silliness) did not have such significant impact.
									3) Nuanced insights into the multi-faceted nature of the self-presentation motives underpinning AR face filter use (ideal self, true self, transformed self).
									4) Show filter usage can have both positive and negative well-being effects dependent on the underlying motivation.
Which emphasis technique to use? Perception of emphasis techniques with varying distractors, backgrounds and visualization types	Mairena A, et al. [11]	2021	Canada	Empirical and experimental	Empirical studies	Data collection is conducted through crowdsourced studies, involving participants who evaluate emphasis perception in different conditions. The study varies effect magnitude, distractor number and type, background and visualization type. Participants' responses and perceptions are collected and analysed.	1) Examining the results of crowdsourced studies to understand perceptual commonalities of emphasis and identify limitations in perceptibility for certain effects.	1) to improve visualization effectiveness in the real world; their studies improve understanding of how visual cues are detected as emphasis effects, offering insights into their perceived visual prominence.	1) Through a series of crowd-sourced studies, they evaluated perceived prominence of twelve emphasis effects in scenarios that varied distractor amounts, distractor types and visualization types and backgrounds.
							2) A model of emphasis predictability is developed based on simple scatterplots, providing a tool for extending predictions to other viewing conditions.	2) The purpose of the study is to go beyond the limitations of computational saliency models and provide a more comprehensive understanding of emphasis perception. By evaluating a wider range of conditions, the research aims to offer insights into how viewers perceive emphasis in realistic visualization settings, providing valuable information for designers.	2) The studies showed that while commonalities exist among various effects, perceived prominence varies in different contexts.

	4) Results from their studies and predictive model improve the understanding of how visual effects operate and how they are experienced by viewers.

Table 4. Quality appraisal.

Title	Study Design	Methodology	Reporting	Comments
Accepting human-like avatars in social and professional roles	4.8	4.8	4.5	Study Design: Strong, well-designed study. Methodology: Solid methodology, addressing key considerations. Reporting: Clear and transparent reporting. Overall Rating: Very high overall quality.
An implementation framework for transformative gamification services	3.2	3	3.6	Study Design: Average Methodology: Average methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
Comparison of gaze accuracy and precision in real-world and virtual Reality	3.8	3.5	3.8	Study Design: Average Methodology: Adequate methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
Do Trompe l'oeils Look Right When Viewed from the Wrong Place?	3.8	3.8	3.8	Study Design: Average Methodology: Adequate methodology. Reporting: Acceptable reporting Overall Rating: Moderate overall quality.
Editable free-viewpoint video using a layered neural representation	4.0	3.8	3.5	Study Design: Good Methodology: Adequate methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
Effects of background colour, polarity and saturation on digital icon status recognition and visual search performance	4.2	4	4.2	Study Design: Great , well-designed study. Methodology: Strong methodology. Reporting: Clear and transparent reporting. Overall Rating: High overall quality.
Image synthesis with efficient defocus blur for stereoscopic displays	3.8	3.5	4.0	Study Design: Good , a potential study. Methodology: Average methodology. Reporting: Clear and transparent reporting. Overall Rating: Moderate overall quality.
Key factors for evaluating visual perception responses to social media video communication	4.5	4.5	4.5	Study Design: Strong, well-designed study. Methodology: Solid methodology, addressing key considerations. Reporting: Clear and transparent reporting. Overall Rating: High overall quality.
Modifying texture perception with pseudo-haptic feedback for a projected virtual hand interface	4	4	3.8	Study Design: Great, a potential study. Methodology: Strong methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
Relative radiation correction based on cyclegan for visual perception improvement in high-resolution remote sensing images	3	3.2	3.2	Study Design: Normal study. Methodology: Average methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
The impacts of visual effects on user perception with a virtual human in augmented reality conflict situations	4.8	4.8	4.8	Study Design: Excellent, strange to the point Methodology: Strong methodology, Reporting: Clear and comprehensive reporting. Overall Rating: Very High overall quality.
Visual perception and local features for foreground-backgroundsegmentation	3.8	3.8	3.5	Study Design: Average Methodology: Adequate methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
'What lies behind the filter?': Uncovering the motivations for using augmented reality (AR) face filters on social media and their effect on well-being	3.5	3.8	3.5	Study Design: Average Methodology: Adequate methodology. Reporting: Acceptable reporting. Overall Rating: Moderate overall quality.
Which emphasis technique to use? Perception of emphasis techniques with varying distractors, backgrounds and visualization types	4.3	4.3	4.5	Study Design: Strong study Methodology: Strong methodology, Reporting: Clear and comprehensive reporting. Overall Rating: High overall quality.

emphasis effects in scenarios with different distractor amounts, types and visual backgrounds. This study enhances our grasp of how Visual Effects work and how viewers experience them.

Limitation

The study does have a couple of limitations. Firstly, there's not much data available because the keyword "Visual Effect" is used in many industries,

making it tough to find the right studies. Just to give you an idea, the Scopus database has a huge 323,825 results for papers with the Visual Effect keyword, but only 161,633 are related to Medicine.

Also, having individual reviewers adds a layer of complexity to the study. It can make the study a bit biased since it relies on each reviewer's knowledge. Plus, the Visual Effects field is closely tied to technology and it's changing really fast. That means our study, being a short investigation, might not catch all the newest developments.

Conclusion

For future directions, it's suggested to narrow down the focus to specific media like Video, Movie, Film, AR, VR and images. This way, the study won't be too broad and delving deeper into each medium will help build a stronger understanding of how people's perception Visual Effects (VFX).

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Conflict of Interest

None.

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