OXFORD

Interacting with Computers, 2025, 1–16
https://doi.org/10.1093/iwc/iwaf026
Article

A cinematographic approach to web design

Mauro Coccoli [1,*] and Livio Gatta[2]

[1]DIBRIS, University of Genoa, Genoa, Italy
[2]Naples, Italy
*Corresponding author: Mauro Coccoli, DIBRIS, University of Genoa, viale Causa, 13 - 16145 Italy. Email: mauro.coccoli@unige.it

Abstract

In this paper, we present a novel web design paradigm inspired by creative techniques from other visual arts, with a particular focus on cinema as a unique source of inspiration. In filmmaking, deliberate choices regarding the placing and moving elements within a frame, lighting and color schemes are made to evoke specific emotions in the audience. Similarly, web design employs specific patterns, layouts, and diverse visual elements to capture and engage the attention of Internet users. Drawing from cinematography, we have identified several elements that can be integrated into web design to foster innovative solutions and enhance the effectiveness of websites.

RESEARCH HIGHLIGHTS

- A novel approach to Web design.
- Using cinematographic techniques in Web design.
- A mix of computer science with arts and humanities.

Keywords: *human-centered computing; human computer interaction; interaction design; World wide web; Arts and humanities*

On the World Wide Web, an eye-catching and effective user interface comprises various design elements such as text, images, graphics, typography, layout, and composition, all working together to create a unique effect. Web designers must skillfully balance clients' requirements and users' preferences, while addressing important issues related to accessibility, usability, and other technical constraints. Ultimately, the success of a website design depends on the end users' appreciation, which is mainly based on emotional aspects (Douneva *et al.*, 2016). Recent studies indicate that aesthetics, including a clear content organization and a consistent color palette, are the most common criterion for evaluating the quality and reliability of websites is (Park *et al.*, 2004). Additionally, it has been found that average users assess a web page in approximately 50 ms, primarily based on visual information (Lindgaard *et al.*, 2006). However, many web developers often neglect the design opting for standard systems, templates, and layouts over originality. This approach negatively impacts the overall quality of their websites, particularly in terms of customization and distinctiveness (Diaper and Waelend, 2000). In 2020, a group of computer scientists conducted a study on the general conformity of web pages from 2004 to 2018. Their research involved analyzing ten thousand of websites using artificial intelligence (AI) tools specifically programmed to detect differences in color palettes, layouts, and other aesthetics attributes. They found that differences consistently decreased from 2010 to 2016, primarily in terms of layout and composition. The authors of this study suggest that this trend is largely due to the widespread use of common open-source libraries and frameworks by developers when building modern websites (Goree *et al.*, 2021). Interaction design expert Professor Müller (2018) argues that, although modern technology allows web designers to experiment with a wide variety of graphic solutions, the most common aesthetics seen on today's websites are simply containers within containers stacked on top of each other.

In fact, today the web is filled with similar websites (e.g., e-commerce, service subscription, public information, news, magazines, etc.) and encourages the rise of automated systems for rapid website creation, updates, and maintenance. Among these systems, themes and templates are perhaps the most overused. While the immediate benefits of using such packages may seem obvious, some argue that templates are often designed by graphic professionals with little or no marketing expertise. Consequently, template-based websites could pose a serious threat to commercial success, as they are not designed to effectively guiding users towards conversions (Ahuja and Webster, 2001). Furthermore, a website designed to maximize conversions should present content in a way that aligns the website's goals and direct users' attention to areas specifically designed to persuade them to stay longer on the site (Mullin, 2020).

Received: May 18, 2023. **Revised:** August 14, 2024. **Accepted:** March 9, 2025

This is where the art of web design comes into play. According to the Interaction Design Foundation[1], web design "refers to the design of websites that are displayed on the Internet. It usually refers to the user experience aspects of website development rather than software development," while web designers are those who work "on the appearance, layout, and, in some cases, content of a website." To expand on these definitions, we can state that designing a website is not just a graphic task but involves a series of studies, including prospective users' profiles and competitor analysis (Miller, 2011; Monteiro and Spiekermann, 2012; Sklar, 2011). This preliminary phase of discovery and exploration paves the way for effective design, as it allows designers to understand the needs of both the client and the prospective users. Therefore, the choice of design elements such as, e.g., layout, color palette, typography, and other visual cues should reflect and reinforce the identity and goals of a website (Beaird and George, 2014). In contrast, themes and templates are inherently content agnostic (Müller, 2018). The overemphasis on the functional aspects of websites may originate from a specific approach to web design that gained popularity in the 90's largely due to the influence of the work on Human Computer Interaction made by Jakob Nielsen. In fact, according to Nielsen, websites should primarily be viewed from a user-oriented perspective, where design serves merely as a tool to grant users access to content. In contrast, designer David Siegel proposed a different approach to web design, emphasizing aesthetics, emotions, and entertainment (Siegel, 1996).

Hence, we need a new methodology for web design to solve these issues. We propose borrowing design principles from the most engaging visual communication medium: cinema, the 7th art. Specifically, adopting a cinematographic approach to web design will enable web designers to leverage graphic principles and composition rules, as well as employ effective visual techniques used by filmmakers to capture and control viewers' attention and emotions.

The remainder of the paper is organized as follows: section "Historical background of cinema and its language" provides a brief overview of cinema history and language, introducing techniques filmmakers use to capture and maintain audience attention. Section "The role of emotions in surfing the web" recalls the basic principle that users' attention is the most valuable asset on the web, similar to other media, and explores how emotions influence web surfing. Building on this wave, Section "A cinematographic approach to web design" presents our cinematographic approach to web design, detailing the shift from text-based to visual storytelling-driven websites and comparing web design to filmmaking. Section "Applying cinematography techniques to web design" offers practical tips for implementing this approach, reviewing techniques used by film directors and their potential application in web design. Finally, Section "Examples" illustrates examples of how the cinema techniques can be used in the web design process. Section "Conclusions" concludes with insights into the proposed method.

1 Historical background of cinema and its language

Before the advent of cinema, the photographic process, which began in the early 1830, enabled the reproduction of still images. By the late XIX century, cinema introduced moving images, was made possible by technological advancements in films and cameras. The first cinema cameras were invented by Thomas Alva Edison in 1893 and the Lumière brothers in 1895 (Bordwell *et al.*, 2010), thanks to the improvements in chemistry, optics, and mechanics, and the efforts of passionate artists and scientists across Europe and the United States of America (Bordwell *et al.*, 2010).

Early films were short, silent, black-and-white recordings of everyday actions. However, from the early XX century, this new form of entertainment gained popularity, and many authors and filmmakers began experimenting with various techniques to enhance the narrative experience. Continuous technological progress has given rise to innovative filmmaking techniques, altering the way academics and critiques perceive this contemporary art. According to modern cinema theory, films are primarily communication acts between filmmakers and their audience, who construct the meaning behind films by mentally rearranging the inner narrative elements. Thus, viewers recognize and validate the filmmakers' intentions (Carmona, 2017). Filmmakers, in turn, rely on various theoretical and practical tools to ensure that their audio-visual narrative elements consistently elicit the same attention focus of attention and emotional responses from viewers. Specifically, according to philosopher Carroll, 1985, filmmakers shape viewers' perception through:

(i) indexing—directing viewers' attention with camera movements; (ii) bracketing—framing the scene through the camera lens to highlight meaningful narrative elements; (iii) scaling—adjust the size of objects through camera movements, based on their plot relevance. The Tyranny of Film theory also argues that filmmakers manipulate viewers' attention with external, regardless of the scenes. This was demonstrated in an experiment where two groups of volunteers, one familiar with the plot and one not, watched the same movie scene while their eye movements and fixation times were recorded using eye-tracking devices. The results showed that gaze directions were similar in both groups and occurred simultaneously for each individual watching the same scene. This phenomenon, termed Attention Synchrony (Loschky *et al.*, 2015) indicates a correlation between spectators' perceptions and the techniques filmmakers use to exert a powerful influence over viewers' attention and psychological states.

Another study yielded similar results while exploring whether filmmakers can influence their audience's emotions. The research involved 500 hr of film screenings and 43 volunteers, whose emotional responses were monitored using wearable and integrated biometric measurement tools. The collected data revealed that, although the film's musical score plays a crucial role in eliciting or intensifying viewers' emotional reactions, filmmaking strategies and techniques (such as e.g., camera movement, cut pacing, and amount of motion within the frame) can also prompt different individuals to experience the same emotions while watching the same scene, with a correspondence rate of approximately 90% in most cases (Rothwell, 2007).

Based on this evidence, we have drawn a correlation between the spectators' perceptions and the techniques employed by filmmakers. Film theory and reputed manuals for aspiring directors often discuss specific filmmaking techniques in relation to the potential or desired impressions they can create on viewers. For instance, certain camera movements can emphasize the mysterious or unsettling tone of a scene, while a rapid change in lens focus can both direct the viewer's attention and evoke surprise or astonishment (Brown, 2016; Monteiro and Spiekermann, 2012).

Summarizing, filmmakers have developed various techniques to intentionally manipulate viewers' attention and emotions, and we observe that web designers share similar objectives. Therefore,

[1] https://www.interaction-design.org

it may not be worthwhile to explore whether and how well-established cinematographic techniques can be applied to web design, with the goal of capturing users' attention, an invaluable resource in the digital era.

2 The role of emotions in surfing the web

In the modern digital market, users' attention is of paramount importance and numerous studies have been conducted over the years to investigate how web pages should be designed to ethically leverage the ways people's minds allocate attention to visual cues and processes information while browsing the Web. It is worth mentioning Pete Faraday's work on salient visual elements in web pages and how they can help predict users' eye movement to design better interfaces. Although often contradicted by empirical data, Faraday's framework, which was based on a hierarchy of six eye-guiding features (i.e., (i) motion, (ii) size, (iii) images, (iv) color, (v) text style, and (vi) position), sparked interest and debate among professionals, aiming to improve designers' awareness on the consequences of specific graphical choices on user's reactions (Faraday, 2000; Still, 2018). Related to Faraday's research, Human Factors and Experimental Psychology student Rebecca Anne Grier not only demonstrated a discrepancy between the scan path of web pages anticipated by Faraday and those observed in a realistic environment but also highlighted the far greater importance of the "position" eye-guiding feature opposed to that proposed by the original model (Grier, 2004). Other significant findings have emerged from an experiment highlighting that web users' attention allocation may depend not only on the elements that make up a web page but also on its overall layout. Multimedia content tends to be fixated on more frequently and for longer durations on web pages lacking a clear and perceivable layout (Sutcliffe and Namoune, 2008). Additionally, other data support the idea that the well-known F-shape scan pattern, commonly used by web users to "read" content on text-based pages, may be not as relevant on graphically intensive pages where text does not follow a definite layout and where users' eye movements are primarily influenced by animations and their execution order.

Moreover, in 2016, a team of researchers from the Department of Computer Science at City University of Hong Kong developed a design model utilizing data from eye-tracking technology and interviews with industry professionals Sutcliffe and Namoune, 2012. This model aims to create or enhance web pages to effectively guide the user's gaze along a predetermined path set by the designer. The study's results indicated that, despite the model's reliance on simple adjustments to web page elements (i.e., position, color and size of text, buttons, and images), professionals took longer to edit web pages manually than when using the model. They also found the task to be challenging or very challenging in some cases (Pang *et al.*, 2016). This feedback demonstrates that guiding web users' attention cannot be achieved solely thorough a designer's experience and expertise; it requires specific training based on tested and formalized data.

However, the aforementioned research on the impact that specific design choices on users' emotions, seem to have fallen short in identifying clear methods that designers can use to create web pages that both engage readers (thus providing a good user experience) and elicit appropriate psychological responses according to the specific web page's goal. Instead, researchers have often focused on the negative effects of poor design and low usability on users' psychology and behavior, emphasizing the functional aspects of web design (Lim *et al.*, 2014). This body of literature, closely linked to the functionalist approach to web design initiated by Jakob Nielsen in the '90s, centers on the idea that websites should avoid frustrating users and that good design's primary task is to make navigation simple, enjoyable, and fast (Lokman and Noor, 2006). However, it does not address whether and how specific emotions (even those typically considered as negative such as, e.g., fear, stress, or anxiety) can or should be stimulated by the website. For example, consider an e-commerce site for very expensive jewels, aiming to appeal to customers through concepts like greed, power, and selfishness: how could these ideas be effectively conveyed thorough web design? Similarly, consider a nonprofit informational website designed to raise awareness about sensitive topics like, e.g., health or global warming while also evoking relevant stress and anguish. We question whether a well-ordered layout and some images would suffice to achieve this legitimate goal or if web designers should employ more effective graphic principles and tools to evoke emotions with their work.

To counterbalance the focus on web design solely dedicated to functional aspects tied to navigation, a new approach emerged in the 2000s based on the concept of Kansei Engineering. This approach was founded by Professor Emeritus Mitsuo Nagamachi at Hiroshima University and is defined as the "translating technology of a consumer's feeling of the product into the physical design elements" (Nagamachi, 1999). The idea of Kansei Engineering originated from recognizing that the increased abundance of goods available to customers made them more sophisticated and aware of the psychological and emotional implications brought using a piece of industrial design. Kansei Engineering aimed to shift from a product-based industry to a consumer-based one by developing various models to adapt product design to people's needs (Nagamachi, 1999). In the context of web design, there is extensive exploring the application of Kansei principles (Kaushalya *et al.*, 2020) but only a few studies have attempted to create practical models and guidelines based on actual data. Among the most notable studies is the work by Lokman, Nagamachi and Noor between 2006 and 2009, which led to the development of the ExpertKansei-Web project, a visual-based tool for designing Kansei websites, particularly e-commerce sites, leverages databases of Kansei words, web design elements and data related to associated sensations and feelings. It allows designers to interact with an interface where they can select the Kansei words they want their product to be associated with, thereby determining the design characteristics needed to elicit specific user responses (Lokman *et al.*, 2009). In 2012, a study applied Kansei Engineering to university digital portals demonstrating that this web design approach can enhance the visual appeal of a web page compared to others of the same type and that this is likely to be more appreciated than its original version (Song *et al.*, 2012). Overall, the Kansei Engineering approach to web design have proven effective in helping professionals develop web pages that users trust and enjoy when tested in a controlled environment. However, some limitations of this methodology are evident: determining design elements and their relevance in eliciting users' emotions while surveying volunteers' responses to the collected data can be time-consuming and costly for small or medium-sized projects or teams. Additionally, the data are dependent on the type of website being developed, meaning that results from previous experiences may not always be reusable by an experienced web designer when addressing different types of projects. Finally, although there are good examples of literature on this topic are available, there seem to be no comprehensive resource for inexperienced web designers that serves as a ready-to-use material or, at the very least, a coherent source of knowledge for studying and acquiring professional skills.

3 A cinematographic approach to web design

As discussed, creating websites that effectively capture users' attention while tuning their mood is a complex task. Without resource-intensive inquiries and surveys to test design and stylistic choices, web designers lack solid referential works to address design problems beyond the functional and programming aspects of web pages. Even when consulting the available literature, professionals often confront themselves with papers and guidelines with diverse or conflicting outcomes.

Given this situation and considered that the cited works are based on comparisons between web pages and other design products (such as newspapers, magazines and posters in Faraday's work and industrial goods in Nagamachi's insights into Kansei Engineering), we aim to evaluate the contribution that cinema can offer to web design. We explore how web designers can adopt the mindset and techniques of film directors to develop a deeper understanding of the real effects their design choices have on end users. Consequently, we outline the features of a cinematographic approach to web design, which involves planning the development of hypertext media similarly to how movies are made, utilizing the theoretical and practical tools that experienced directors employ to transform a script into a compelling piece of visual storytelling.

In this respect, we emphasize that the aim of this newly proposed method is not to transform websites into movies or to overcrowd web pages with animations and videos, nor to draw improper parallels between two very different sensory experiences (i.e., browsing the web vs. watching a movie). However, considering web pages as visual storytelling products may not entirely incorrect. Since the early '90s, there has been a dramatic shift in the content and aesthetics of hypermedia documents, moving from text-only websites to multimedia-based ones, which significantly influences users' interactions. In modern web portals, the relevance of text has been steadily decreasing for various reasons. Notably, recent studies indicate that web users are likely to read on average, only 20% of the verbal information on a web page (Nielsen, 2008; Weinreich *et al.*, 2008).

In addition, multimedia contents have repeatedly proven to be an effective alternative for conveying information that might otherwise be lost if expressed solely through text. For example, in e-learning environments, several studies have shown how students exposed to concepts presented in the form of text paired with graphics and images achieve better results compared to those who rely solely on textbooks (Clark and Mayer, 2008). Similarly, in the context of e-commerce portals, images can play a determinant role in influencing users' actions and purchases (Prakash *et al.*, 2014). However, it is not just about images. Recent studies on e-commerce websites have highlighted that while pastel and neutral colors can have a calming and soothing effect on users, making them more comfortable with the page and less likely to leave it, the use of more saturated and brighter foreground colors can excite potential consumers, evoke positive emotions, and encourage them to complete a purchase (Kuo *et al.*, 2022; Pelet, 2015). Naturally, the mere presence of these visual and graphic elements is not sufficient to convey a coherent message to the viewer; such elements must be organized within an implicit or perceivable structure (Cao *et al.*, 2015). Furthermore, the overall meaning of the graphic content on a web page can be reinforced if it develops throughout a narrative arc that follows the user navigation path, incorporating storytelling components such as, e.g., character identity, plot progression, and emotions (J and Beyond e., 2018).

Upon closer inspection, it may not be incorrect to assert that since the '90s, web designers have increasingly needed a broader range of skills to perform their job effectively; one of these being the ability to use multimedia and graphic elements for purposes beyond mere aesthetics.

Given this transformation, we observe that the roles of web designer and film director are now closer than ever, and the processes of web design and film production share many common aspects, as highlighted by the relevant literature. Some even suggests that movies, like websites and applications, might be considered the result of a human-centered-design approach where every choice made to visually tell a story must be carefully weighed for its potential impact on the viewer's mind (Saunders, 2019; Scherer, 2019).

To be more precise, we emphasize that although websites and movies are distinct forms of modern communication, both revolve around a core message intended for the audience. In the web environment, this message is provided by the client and relates to site's subject (e.g., a product, a service, or public information). In cinema, the core topic of a movie is depicted from the script proposed by the screenwriter. Both mediums require careful consideration of how to utilize resources to transform text content into compelling visual art.

On movie sets, it is the director's responsibility to coordinate the people on stage and manage the camera movements to capture the action. Each scene may be filmed multiple times, often out of sequence, due to constraints such as staff or set availability and the need to provide editors with sufficient material (Bordwell *et al.*, 2010). Similarly, web designers do not create a website on the first attempt. Instead, they use sketches and visual approximations to explore all design possibilities within the available resources. At this stage, the focus is not on final aesthetic details but on envisioning the most suitable layouts, shapes and navigation structures to help users achieve their tasks and convey the website's intended feeling (Mathis, 2016). A more advanced yet preparatory step involves creating a wireframe, which accurately depicts the structure of the future web interface and identifies the types of elements it should include (Bank, 2014). Additionally, a detailed wireframe can consider potential interface animations triggered by specific user actions.

Thus, both the web designer's wireframes and the director's collection of movie frames serve as foundational materials for shaping the final form of their respective works. In cinema, this phase is executed by editing professionals who, in collaboration with the director, arrange all recorded scenes according to the script's plot. They control the pacing of the movie and the juxtaposition of different frames to harness the power of visual storytelling, enhancing viewers' comprehension and engagement. Similarly, mock-ups created by web designers aim to achieve the same goals regarding users' understanding of the web interface and its functionalities. Icons, images, text formatting, links, and other graphical elements are meticulously selected and utilized to produce realistic previews of the website to be coded. This process helps identify design solutions that need adjustments to align perfectly with the project's overall requirements (Cao *et al.*, 2018).

In general, web designers and film directors can be seen as problem solvers of modern visual communication (Beaird and George, 2014; Bordwell *et al.*, 2010). However, there have been limited studies or literature examples drawing analogies between the two professions or the tools and strategies used to produce their respective works. Among the few, the "Onscreen drafting" technique developed by American editing expert Karen Pearlman is noteworthy. By examining how modern design products are

created (that is, through an iterative approach that progresses from rough drafts to more refined versions, interspersed with testing and evaluation sessions), she argued that more visually effective movies could be achieved if scripts were immediately converted into "moving sketches" or drafts. These drafts could be scenes shot using inexpensive and easy-to-manage devices such as cell phones or low-cost cameras. The material collected and analyzed to identify possible flaws in the script, which can then be fixed or revised, would provide a more solid foundation for creating refined scenes using advanced film production tools (Pearlman, 2012).

However, web design practitioners appear more reluctant to consider movies as a source of inspiration or as a prompt for innovative approaches to their work. Instead, studies have shown that designers seeking reference models primarily look within their own domain, such as other websites, particularly those of reputable brands. Other sources include magazines and textbooks, which some researchers prefer for being more organized and less distracting than their digital counterparts (Herring *et al.*, 2009).

Surprisingly, movies are never mentioned in these papers, neither by their authors nor by the subjects involved. Despite the many common traits between web designers and film directors, and the fact that most web sites are based on the visual storytelling paradigm, web designers do not draw on resources from cinema theory and shooting techniques. Given the lack of literature on this subject, the next section presents a selection of techniques used by directors for shooting and envisions their possible implementation in a web design environment.

4 Applying cinematography techniques to web design

In this section, we present a brief review of common shooting techniques that we believe can be effectively applied to web design. We have identified five macro areas for which we propose descriptions: (i) camera (see Table 1), (ii) lens (see Table 2), (iii) lighting (see Table 3), (iv) colors (see Table 4), and (v) framing and staging (see Table 5). For each area, a short description is provided along with the results in terms of visual effect. More detailed descriptions of these techniques can be found in the works of Bordwell (2013), Brower (2007), Brown (2016), and Mercado (2013). We then explore how these techniques can be used in the design and development of engaging web pages. Additionally, we offer some hints for web programmers on the Cascading Style Sheets (CSS) instructions needed to render these effects in HyperText Markup Language (HTML). Furthermore, we include pictures showing how we implemented the proposed solutions into sample web pages, along with the relevant links to the CodePen playground[2] where interested readers can inspect details of the HTML, CSS, and JavaScript codes.

4.1 Camera

A camera is far more than a simple device for capturing images of the outside world. Its placement on set and its movements during filming play a crucial role in shaping the meaning of scenes and conveying specific information to the audience. In the following, we present a list of techniques, each accompanied by a brief description and its visual effect (Table 1).

[2] http://codepen.io

4.2 Camera techniques in web design

The filmmaking techniques listed above involve various degrees of camera movement. These visual effects help directors convey different meanings to viewers, characterized by changes in the size and perspective of the framed subjects and background. To achieve similar effect on websites, designers and developers can alter the size and position of interface elements. It is worth noting that, due to the absence of a moving point of view within a web page (unless sophisticated computer graphic technologies are used), the perspective changes caused by a moving camera must be simulated by moving elements within the viewport. Additionally, to mimic the idea that a tangible reality exists beyond the camera frame, web page elements can be hidden beyond the screen boundaries. Figure 1 illustrates the push-in and pull-out effects and the relevant code snippets[3] are available on CodePen. Figure 2 demonstrates the application of the tracking effect, with corresponding code snippets[4] also available on CodePen. Figure 3 shows an example of the dolly zoom effect and the relevant code snippets[5] are available on CodePen.

4.3 Lens

Just like the human eye, a camera lens gathers light from the external world and projects it onto the surface of a film or on an electronic sensor, creating a flat image of the three-dimensional world (Bordwell, 2013). However, unlike human eyes, camera lenses come in various shapes and with different features, the most important being their focal length. The greater the focal length, the narrower the field of view and the perceivable depth of the scene. Conversely, the shorter the focal length, the wider the field of view and the more accentuated the perspective relations among the elements in the scene (Ascher and Pincus, 2007). Another aspect of camera lens considered while filming is depth of field, which is related to the lens type, the amount of light allowed into it, and the distance between the lens and the subject. For our purposes, depth of field can be thought of as the portion of the image perceived as sharp by the human eye, surrounded by a blurred out-of-focus zone (Ascher and Pincus, 2007). In the following, we present a selection of techniques, each with a brief description and its effect on viewers (Table 2).

4.4 Lens techniques in web design

Most of the filmmaking techniques listed above involve some change in the focus of the shooting lens, allowing directors to draw viewers' attention or enhance film comprehension by skillfully dividing the screen into sharp and blurred areas. To achieve a similar effect in web design, the sharpness of an on-screen element can be altered using appropriate CSS instructions. Regarding size transformations affecting zoomed elements, the same techniques used to emulate camera movements still apply. Their implementation is even simplified, as the intended scaling effect would be applied to all elements within the viewport without altering their perspective relations.

Figure 4 shows an example of the rack-focus effect application. The relevant code snippets[6] are made available on CodePen.

4.5 Lighting

While in daily life light and shadow are often seen as merely opposing conditions, in filmmaking, they are powerful tools for

[3] https://codepen.io/wbdsgn-92/pen/ZErqWyK
[4] https://codepen.io/wbdsgn-92/pen/WNMagrK
[5] https://codepen.io/wbdsgn-92/pen/ZErqYaY
[6] https://codepen.io/wbdsgn-92/pen/JjpmYXV

TABLE 1. Camera techniques and their visual effect.

Technique	How it works	Visual effect
Pan short for Panoramic	This camera movement consists of turning the camera around its vertical axis to follow a moving character or to give viewers more information about the scene through a horizontal scan.	While often employed to keep a moving object or character in its own position within the frame, the Pan has also a more subtle and meaningful purpose directly related to storytelling, that is, making the viewer aware of the spatial and temporal continuity of the actions occurring in the same scene.
Boom shot also known as crane shot	A boom shot is a vertical movement of the camera, which allows heights out of reach of human arms.	Due to its ascending or descending route, it is commonly employed to get wide shots of an outdoor scene or to present a smooth transition from a wide view of a place to a more detailed one (and *vice versa*). Moreover, the metaphorical implications of this vertical movement may also be exploited to convey viewers more subtle meanings about a character's transformation.
Push-in	A push-in consists in a camera movement toward the main subject of a scene (being it an actor or an object).	Since the visual effect of a push-in consists in a relative increase of the framed subject's size while its surroundings are pushed aside out of the frame boundaries, invariantly it informs viewers that something important is occurring on the screen and that they should pay keener attention.
Pull-out	As counterpart of the push-in technique, the pull-out consists of a camera movement that increases the distance between the framed subject and the lens.	Since the pull-out moves away the camera from the subject of the shot, it decreases its relative size in the frame while making the background or other near subjects fill up the screen. Through this technique, directors make viewers aware of what is happening outside the frame, but they can also use it to isolate the subject from its surroundings and make it look weak, lonely, or detached.
Tracking	The term tracking may express different meanings, representing a simple camera movement that follows the framed subject from the side, from behind or from the front.	This technique can serve many different purposes based on the camera movement direction and the distance from the followed subject, but generally it is used to involve viewers in all the evident or subtle transformations a subject undergoes moving from point A to point B (a change in behavior, posture, or appearance) or to highlight its relations with the surrounding scene.
Canted shot	Also known as dutch shot, this technique is the result of a camera rotation, which makes the horizon level and the vertical lines diagonal with respect to the frame.	The resulting tilted appearance of the image makes this shot be perceived by viewers as unnatural and unsettling, a sensation whose intensity is directly reflected by the camera rotation degree. Being the visual effect of a canted shot so evident and powerful, directors are urged to make use of it sparingly and mostly to highlight tense scenes and revelatory moments.
Dolly zoom	Also known as the vertigo effect, due to its first use in the homonymous movie by Alfred Hitchcock, a Dolly zoom is a complex technique consisting in a camera movement paired with a simultaneous zoom in the opposing direction.	This powerful technique gives a dramatic change in the perspective of the image background paired with a stable size of the subject(s) standing in the foreground and is mostly employed to make a subject's inner turmoil, distress or sudden disconcert visible to the viewers.

shaping environments, objects, and characters, conveying specific ideas and information to viewers. Typically, lighting on set comes from artificial sources that can be adjusted. In the following, we present a selection of techniques, each with a brief description and its effect on viewers (Table 3).

4.6 Lighting techniques in web design

All the filmmaking techniques mentioned above involve arranging light sources on set to create an illumination that tells a story through the contrast between bright and dark areas of the image. On the web, even without a real light source, users can be tricked into believing that the elements within the viewport are arranged in a three-dimensional space where shadows are cast. To achieve this, different CSS instructions can be used depending on the object involved. For example, for text we can apply shadow effects, allowing letters to cast their own shadows in any color and in any direction. Similarly, shadows can be applied to box elements.

4.7 Colors

From a physics perspective, colors are the visible result of the interaction between light's electromagnetic waves and our eyes. In modern filmmaking, digital colors are typically produced using

TABLE 2. Lens techniques and their visual effect.

Technique	How it works	Visual effect
Zoom-in	Generally speaking, a zoom consists of a change in the focal length of the camera lens; more specifically, a zoom-in is accomplished when the length increases.	Just like with a push-in, zooming-in on a subject makes it fill up the frame while less space is dedicated to the surroundings but, unlike a camera movement, the zoom-in increases the size of all the shot elements indistinctly, maintaining their perspective relations.
Zoom-out	Zoom-out is the contrary to a zoom-in and it is achieved by decreasing the focal length.	Just like with a pull-out, zooming-out from a subject makes it less prominent and allows viewers to discover what lays beyond the frame boundaries but, unlike a camera movement, the zoom-out decreases the size of all the shot elements indistinctly, maintaining their perspective relations.
Rack focus	The rack focus technique exploits the depth of field of a lens, in that allows the camera operator to shift from one focus plane to another altering the way viewers perceive the whole image.	Visually, this technique always causes two image planes to exchange their focus, bringing the one that was sharp to be blurred and *vice versa*. This, invariably, makes viewers' attention to be drawn to the element in the frame that gains detail and sharpness and is usually employed by directors to show something earlier hidden or hardly discernible or to stress the plot-related relevance of an element within the composition.
Deep focus	Allows directors to keep sharp and visible all the elements that are framed by the camera, from the nearest to the farthest image plane.	Letting viewers embrace with their eyes the whole screen, directors use Deep focus to involve the audience in the action and to make them aware of all the framed subjects' movements and attitudes.
Shallow depth of field	As opposed to deep focus, a shallow depth of field allows directors to create a separation between sharp and blurred areas within the frame, even dynamically changing the focus during the shot and deciding which of the image's plan shall be distinctively visible to the viewers.	Semantically, employing a shallow depth of field invariably makes viewers more aware of what happens on the sharp side of the screen, and it is therefore suggested when aiming at isolating a particular subject from its surroundings and drawing attention on it.

TABLE 3. Lighting techniques and their visual effect.

Technique	How it works	Visual effect
High-key	In terms of lighting design, high-key lighting refers to the overall illumination setup of a scene that allows to have low contrast differences between brighter and darker areas and is obtained employing a background source of light paired with one coming from the side.	This kind of illumination is commonly looked for when filming comedies or romantic movies due to the cheerful tone it can give to the scene and is characterized by lights and shadows blending seamlessly into one another.
Low-key	As opposed to high-key lighting, Low-key lighting is obtained lessening or eliminating fill light sources altogether while employing other sources of hard light directly hitting the framed subject to create bright areas with well-defined edges.	Typical in thrillers and horror movies, low-key lighting is commonly used when looking for a mysterious atmosphere in which shadows play a great role in defining characters and environments.

the RGB model and are often considered as the HSB combination of three components: hue (the actual color, such as red, green, blue, etc.), saturation (the percentage of white within the color) and black (the percentage of black within the color). Numerous studies demonstrated how colors affect the human mind (Elliot and Aarts, 2011; Rubin and Katz, 1946). Specifically, in cinema, a long legacy of studies by color consultant and former professor at the School of Visual Arts in New York Patricia Bellantoni has highlighted how colors can be a powerful and sophisticated tool for communication. They allow directors to intentionally influence a viewer's mind and emotional state. In her seminal work "If It's Purple, Someone's Gonna Die," Bellantoni (2012) explored how the main colors of the RGB model are employed in filmmaking and showed how directors carefully plan chromatic choices based on the specific meaning or emotion they intend to convey to the audience. Table 4 reports the effects of each color on humans from a psychological perspective, according to Bellantoni (2012).

4.8 Color techniques in web design

It is undeniable that colors play a fundamental role in user experience. They are ubiquitous on any website, used to characterize it based on the chromatic features of the brand that owns the product or service advertised online. Colors are also commonly employed to highlight interactive graphic elements such as links and buttons. However, most of the official literature on this topic focuses on how colors should be managed by designers and developers to avoid hindering navigation and legibility or causing distress to visually impaired users. This is the goal of the

TABLE 4. Color techniques and their psychological effect.

Color	Psychological effect
Red	Red is probably the color most renowned for its impact on the viewer; due to the connection with blood and fire it is often considered powerful, aggressive, or sexually appealing, but it can also hint to much more than that: warmer reds, for example, are elegant and mature and can suggest inclusiveness and protection or wisdom and authority. Furthermore, unlike what has been observed when studying other colors, red seems to have the power to influence people's physiological state making their heart rate increase and their senses keener. All these qualities make red the perfect choice for attention-grabbing visual elements or for backgrounds aiming to soothe or alert the viewer, but caution must be called for in order not to overwhelm the eye with too many predominant visual stimuli.
Orange	Although orange is usually associated with pleasurable sensations, on the color wheel it stands between red and yellow and, therefore, borrows from them a double power on the viewer's mind. On the one hand, like red, it might suggest nonanalytical concepts like freedom, love, and spontaneity and, on the other hand, like yellow, it can play as a warning to the viewer when spotted in context not usually associated with it. This happens, for example, when orange is used to paint skies or waters, evoking images of pollution and toxicity.
Yellow	When heavily saturated, yellow is mostly perceived as an aggressive color able to produce anxiety in the viewer. Bright yellow is the color of the sun and that of the heated iron and therefore associated with a type of energy hard to restrain. Especially when paired with black, this color calls for attention and awareness: it is not a fortuity that this combination of colors is globally used for warning or danger signages and that many venomous creatures bear the mark of a black-yellow patterned skin. On the contrary, a more desaturated yellow is considered elegant, almost a visual metaphor of innocence that soothes the viewer and solicits reflection and nostalgia.
Green	Although commonly associated with nature itself, green suffers a strong duality in that it is able to evoke images of lush forests and healthy gardens as well as of grimy swamps and stale water. When bright and saturated, the color is called acid green and its name bears along with it the idea of poison and danger; when darkened, on the other hand, green becomes less intimidating and gains back the natural look of plants and leaves but when too much desaturated and shifted toward more greyish tones it can be easily turned in an omen of death and decay.
Blue	Statistically, blue is more often associated with the idea of winter, melancholy, and detachment. A study from Bellantoni (2012) reveals how people exposed to blue become rapidly calm, reflective, and lethargic but it shows also how this reaction may be overturned even with slight modifications in the color composition: a green-tinted blue, for example, induces people to be more socially active and talkative whereas the so-called electric blue fills them with energy and volition. Paler blues tinted with grey, on the other hand, are quintessentially powerless and subdued, unable to stand out from the background or to evoke sentiments other than modesty and discretion.
Purple	Among all the colors investigated by Bellantoni (2012), purple seems to be the most enigmatic one, hard to categorize due to its scarcity in the real world and its consequently loose association with material things throughout the different cultures and societies. As such, this color is mostly seen as a mark of something elusive or intangible, evoking mystical thoughts that forebode profound transformation of its wearer (creature and object alike) or of the context in which it shows itself; at times, this transformation can even lead to death (the end of the body) or to disillusionment (the end of an idea), revealing the existence of a second reality in which all that have been earlier taken for granted is suddenly questioned or undermined.

Web Content Accessibility Guidelines (WCAG), which specifically instruct designers and developers to "make it easier for users to see and hear content including separating foreground from background" and to "make text content readable and understandable." They urge the adoption of color combinations with a high contrast ratio to spare users from excessive and unnecessary eye strain (The World Wide Web Consortium (W3C), 2021). Regarding the emotional and psychological implications of color combinations, few studies, mostly related to e-commerce websites (Pelet, 2015), have highlighted how web user experience can be not only enhanced but even deliberately manipulated through chromatic visual stimuli. These stimuli can induce specific emotional states that lead to a higher engagement in the navigation process and higher conversion rates.

4.9 Framing and staging

Even before the shooting phase begins, directors must decide where to position their cameras and how to arrange their set to have actors positioned as the script requires. Framing is the act of determining what part of the visible world will be shown to the viewer and what will be excluded from the camera frame's boundaries. To do this, directors not only determine the camera location but also its height, angle, and level with respect to the horizon, thus affecting the way viewers perceive a shot and interpret its subtext (Bordwell, 2013; Brown, 2016). However, framing alone is not enough to produce the visual effects directors seek when highlighting the spatial and conceptual relations between elements in the scene. To achieve this goal, actors and objects are arranged in front of the cameras through staging: a series of planned movements and repositioning coordinated with the filming cameras, which may involve interactions between actors or between actors and environment (Bordwell, 2013). In the following, we present a selection of techniques, each with a brief description and its effect on viewers (Table 5).

4.10 Framing and staging techniques in web design

All the filmmaking techniques listed above involve a synergy between camera placement and the routes actors and objects follow on the set. To maintain control over what is visible on the screen, directors not only plan all camera positions in advance but also conceive the perfect image composition to convey implicit meanings through the arrangement of characters and props. Among the most common rules of thumb and graphic principles employed to achieve this goal, and shared with web design practices, are the rule of thirds, symmetry/asymmetry and balance/unbalance principles (Brown, 2016). Designers and developers can take advantage of these principles by considering how the

TABLE 5. Framing and staging techniques and their visual effect

Technique	How it works	Visual effect
Macro shot	Exaggeratedly magnifying the framed subject standing at a very short distance from the camera, Macro shots can make visible what would be indiscernible to the naked eye, being it often the detailed texture of an object's surface.	Visually stressing a particular aspect of their subjects, usually detaching it from its context, macro shots almost compel viewers to focus all their attention on it and can be used by directors to film abstract sequences whose interpretation is linked to other scenes of the same movie or totally left to viewers' imagination.
Close-up	Typically used when framing human subjects, close-ups bring on the screen a character from the top of the head to somewhere little under her shoulders.	Often aiming to highlight a character's involvement in the action occurring on the screen, close-ups bring the audience closer to the fictional world of the movie and generates empathy and other emotional responses deeply connected to human behavior and sociality.
Extreme close-up	Like macro shots, extreme close-ups bring on the screen-magnified details of a subject, which, although visible to the naked eye, would go unnoticed if not pointedly stressed.	Following the so-called Hitchcock Rule, stating that the relative size of an element on screen should always reflect its narrative weight with respect to the plot, directors often use Extreme close-ups to focus viewers' attention on small details of paramount importance in terms of film narration.
Medium shot	Spanning from medium close-up to medium long shot, medium shots are classified looking at how much of the human body is included in the frame, from the knees up to the head. Naturally, the more body parts are included in the shot, the less the surroundings of the framed character find space within the screen.	While close-ups focus viewers' attention on the character's emotions expressed through facial expressions, medium shots shift the focus on body language and gestures, highlighting the spatial relations between the characters and their context.
Long shot	Long shots usually frame a character or multiple characters from head to feet, enabling directors to showcase them including extended portions of the surrounding area in the shot too.	Due to the distance between camera and framed subjects, long shots are not suited for conveying emotional information that rely on facial features but are perfect instead for displaying how characters relate themselves with other elements included in the frame or how the background can influence the action-taking place on the screen.

size of any on-screen element can enhance users involvement in the navigation process or elicit emotional responses that might lead to conversions. In particular, designers should carefully consider how the properties of multimedia content could affect the users once on screen: Does the content depict a single subject or many? Is the subject's expression visible and what emotion does it communicates? In which context must the content be placed, and what is the right subject/background ratio for the case at hand? Designers and developers are not necessarily constrained by the original appearance of multimedia content. Thorough CSS, they can enlarge or reduce the size of an image, transforming a medium shot into a close-up, a close- up into an extreme close-up. Additionally, content other than images or videos, such as text and graphic elements, can be transformed using suited CSS instructions. For example, what is typically a simple text line could be converted into a screen-filling geometrical shape that hovers in the background, symbolizing an idea that the designer might not have been able to express otherwise.

5 Examples

In the following, we discuss two small projects to illustrate how film techniques can be applied to web design. Specifically, we consider two different types of websites, i.e., informative and e-commerce. To enhance user experience, the pages must be emotionally engaging, which is where the cinematographic approach comes into play. The examples are depicted with an initial wireframe and a mockup, and include the description of the main filming techniques used.

5.1 Naples underground

The first example pertains to some pages on an informational website about the hidden beauties of Naples, in Italy, showcasing a variety of underground attractions dating back to medieval and Roman times. The Naples Underground site aims to attract tourists with stories related to the local folklore. Specifically, the page focuses on the culture, beliefs, religiosity, and superstitions of Neapolitans, as well as the city's urban structure, characterized by leaning buildings and alleys cluttered with vehicles and people. Based on these cultural elements, we identified three topics for storytelling: (i) The vertical development of the city in a descending movement that reveals the underground historical ruins open to the public; (ii) the same descending movement is also read as the metaphor of a slow transition from reason to the beliefs and superstitions typical of Neapolitan folk culture; and (iii) the narrow spaces distinctive of the historic center. Accordingly, we have designed the following pages as scenes.

5.2 Scene 1, shot 1

The first shot (Figure 5) in the opening scene is a full-screen background image with a daytime view of the Bay of Naples. The colors are clear and vibrant, and the high-key lighting flattens the shadows of the panorama giving the viewer an illusory feeling of serenity. This effect is used to create a contrast with the tones that will be employed in the next shot. The extreme long shot, framed with a wide-angle lens, captures the most important elements of the landscape immediately. Mount Vesuvius towers following the line of the left third of the image. The deep focus ensures a sharp

FIGURE 1. Push-in and pull-out: Moving the slider up and down will produce the effect of bringing the viewer closer or farer from the item displayed and its background while changing the focus of the latter.

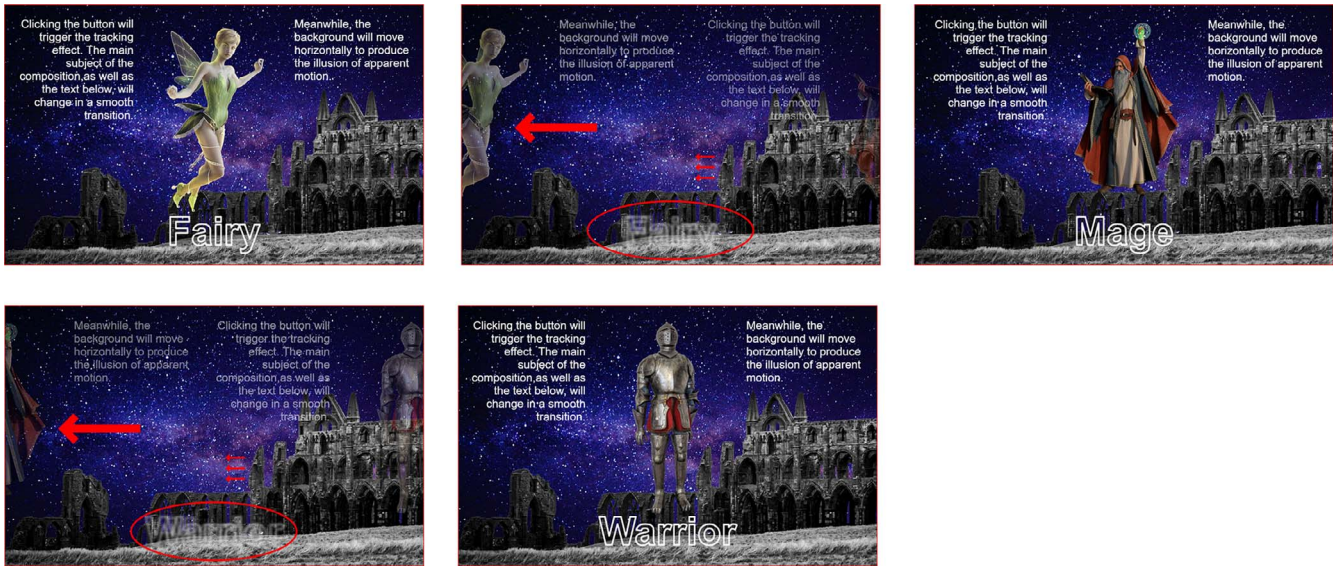

FIGURE 2. Lateral tracking: The tracking effect is triggered by a click. The main subject of the composition, and the text below as well, will change in a smooth transition. Meanwhile, the background will move horizontally to produce the illusion of an apparent motion.

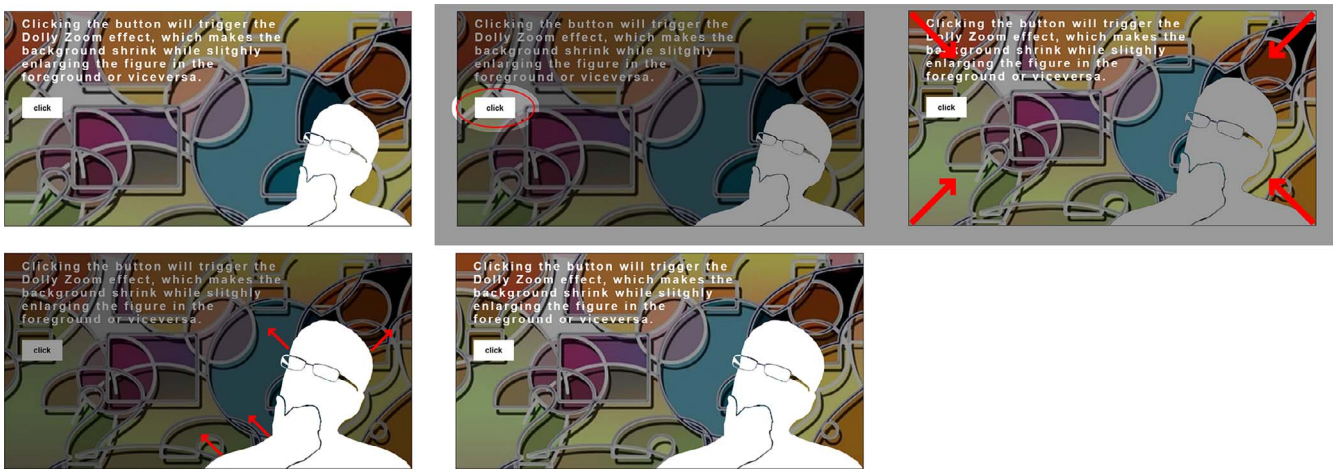

FIGURE 3. Dolly-zoom effect: Clicking the button will trigger the Dolly Zoom effect, which makes the background shrink while slightly enlarging the figure in the foreground or vice versa.

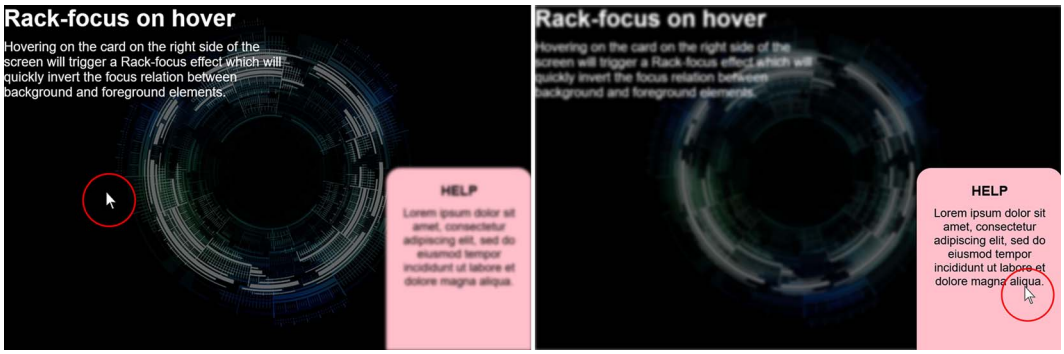

FIGURE 4. Rack-focus on hover: Hovering on the card on the right side of the screen will trigger a rack-focus effect, which will quickly invert the focus relation between background and foreground elements.

FIGURE 5. Naples Underground Scene 1.

image across all planes of the frame, making the viewer feel fully immersed in the scene. Additionally, the height from which the image is captured evokes a sense of dominance over the scenery in the observer.

5.3 Scene 1, shot 2

The second shot in Scene 1 (Figure 5) is just as a transition from the previous shot, achieved by zooming-in on the background image and narrowing its edges. Framing is done with an extreme long shot captured through a wide-angle lens with deep focus. The main differences from Shot 1 are in the colors, lighting, and margins. This shot presents an evening view of the same scene, dominated by shades of blue and purple, which impart a mysterious tone that hints at the content to come. The zoom, combined with the downsizing of the image frame, emphasizes the main elements of the panorama while reducing the visible portion of the sky and partially excluding the outermost mountain profiles. The reduction in visible content and the progressive darkening of the image are intended to convey the mood of the website briefly.

5.4 Scene 2, shot 1

This shot (Figure 6) features a close-up detail of the alleged tomb of Count Vlad III of Wallachia Hagyak (better known in popular culture as Count Dracula) at the monumental complex of Santa Maria la Nova. The framing is a close-up, focusing on a specific detail of the tomb monument. The camera remains static and will not move during the next two shots. The lighting is natural, but a dark layer has been applied to enhance the readability of the overlying text.

5.5 Scene 2, shot 2

This shot (Figure 6) continues Scene 2 with the introduction of a new element that appears with a top-down motion, overlapping the close-up from the previous scene. The focus remains on the bottom plane of the image, and the shallow depth of field renders the foreground elements blurred, making their outlines indistinct. Red, instinctively associated with blood, reinforces the vampire theme. The viewer must wait for the next shot, which features a rack focus, to discern the true nature of this element.

5.6 Scene 2, shot 3

This shot (Figure 6) concludes the scene by shifting focus from the background to the foreground with a rack focus, blurring the marble detail of the tomb to reveal the true nature of the red elements. It becomes clear that these are *cornetti*, traditional amulets linked to Neapolitan culture, used by the superstitious to ward off bad luck and the evil eye. The persistence of the dark background layer gives the shot a low-key lighting effect, making the curtain of scarlet lucky charms stand out sharply against the shaded backdrop.

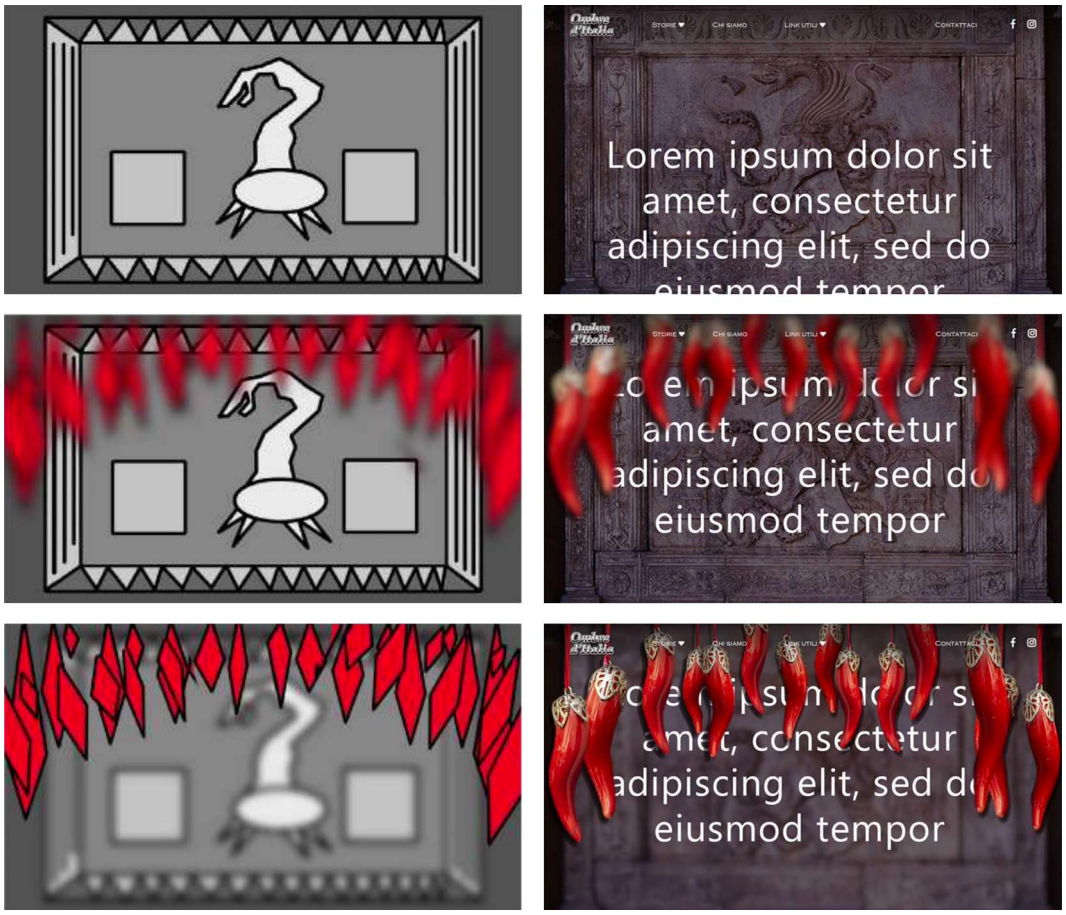

FIGURE 6. Naples Underground Scene 2.

5.7 Scene 3, shot 1

This shot (Figure 7) introduces a new scene with an aerial long shot perpendicular to the ground. The subject is a spiral staircase descending into the tunnels of underground Naples. The shot is slightly right tilted, creating a Dutch angle that gives the image an unsettling effect, foreshadowing the nature of the Underground Naples experience. The color palette is earthy, but the inclusion of yellow and purple, contrasted with large black areas, gives the scene a disturbing characterization.

5.8 Scene 3, shot 2

This shot (Figure 7) concludes Scene 3 with a zoom-in on the staircase featured in the previous shot, coupled with an increased Dutch angle. During the zoom-in towards the bottom of the staircase, the opacity of the image is dynamically modified with a superimposed black layer. The intended effect is to give viewers the illusion of entering the underground levels of the city, where sources of light become increasingly rare.

5.9 Scene 4, shot 1

This shot (Figure 8) introduces the fourth and final scene. The image on the left side of the screen depicts one of the many tunnels of underground Naples, surmounted by brick arches and converging towards a dark passage. To highlight the extent of the image distortion planned for the transition to the next shot, we added the sketched profile of a human halfway through. The framing is once again a long shot with deep focus, ensuring all elements are sharp. The colors are earthy, and the lighting degrades along the Z-axis.

5.10 Scene 4, shot 2

This shot (Figure 8) concludes the fourth scene with a dolly zoom, making the exit of the corridor appear to progressively move away from the observer, despite other perspective clues suggesting the observer is moving closer to the exit. The full-length profile outlined in the shot clarifies the change undergone by the image before and after the effect produced by this cinematographic technique.

5.11 Wine e-commerce

The second example is an e-commerce site of Italian wines, where we present a typical item description page, to learn about the products and proceed with the purchase.

5.12 Scene 1, shot 1

The first shot (Figure 9) shows the screen split into two parts: text on the right and graphics on the left, which will be stacked in the mobile version. In the graphics section, the framing is defined by a long shot with a considerable depth of field (deep focus), making the contours of the wine bottles sharp. This allows users to appreciate not only the aesthetic qualities of the product featured on the web page but also to evaluate its relationship with the surrounding elements. The arrangement of these generic "vino" supporting characters can be traced back to cinematic staging and was carefully planned during the composition of the scene. The bottles are arranged along a diagonal line that descends from the

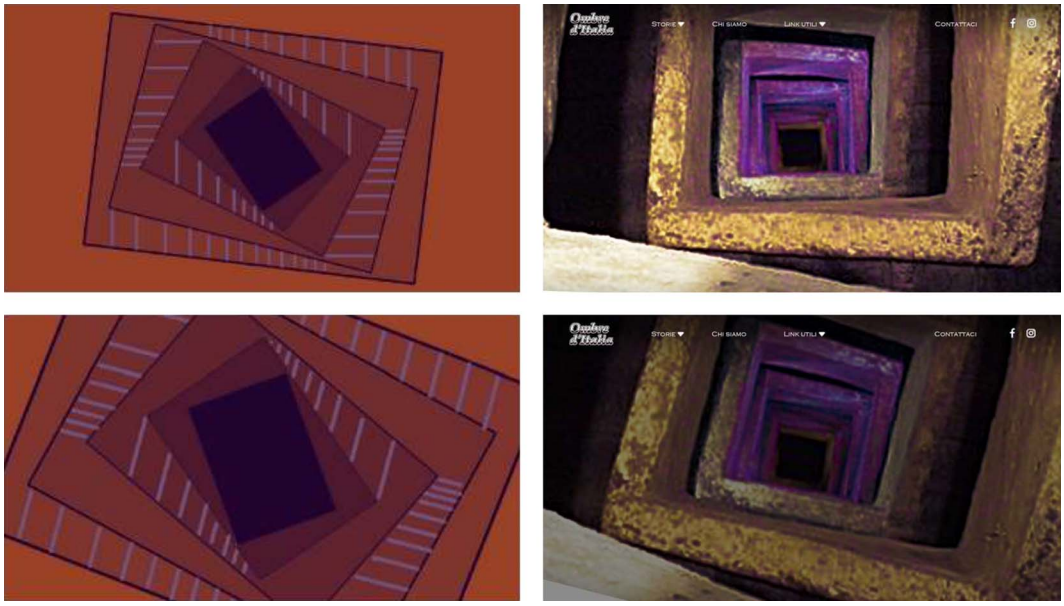

FIGURE 7. Naples Underground Scene 3.

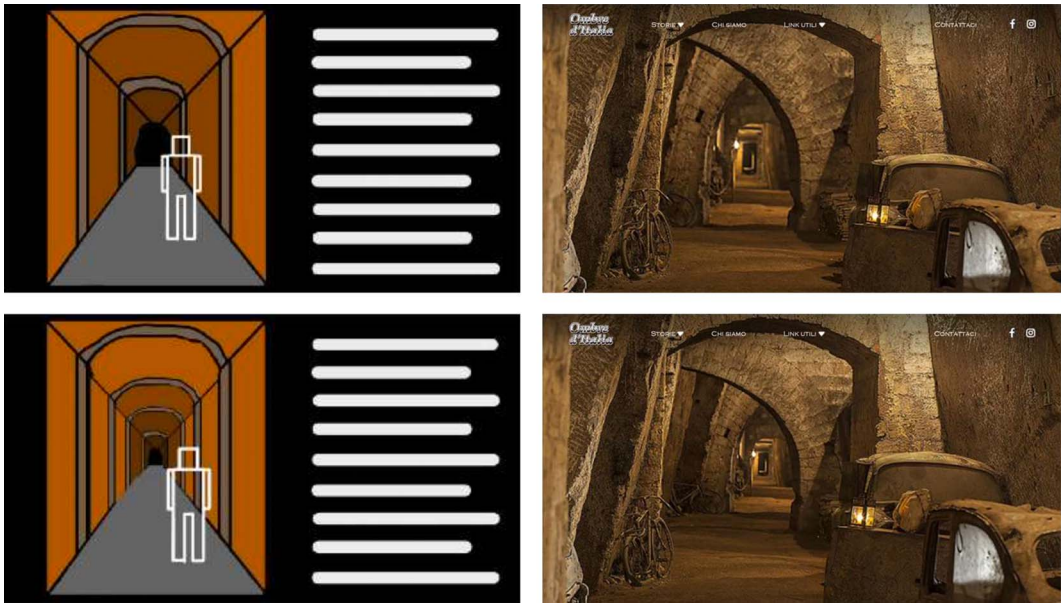

FIGURE 8. Naples Underground Scene 4.

top-left corner of the screen, guiding the user's gaze towards the call-to-action on the right side. Low-key lighting and the contrast between the bright colors of the chosen bottle and the darkness of the others visually highlight its higher quality compared to other products.

5.13 Scene 1, shot 2

The second shot (Figure 9) illustrates a change within the first scene that occurs when scrolling the descriptive text on the right side. This action triggers a push-in camera movement in the image, bringing the lens closer to the chosen bottle and altering the perspective relationships with the surrounding elements. Simultaneously, the camera movement is accompanied by a shallow focus effect, changing the depth of field and blurring the surrounding elements, which are either excluded from view or positioned at the edges of the frame. Additionally, the dramatic increase in dimensions allows users to appreciate the aesthetic qualities of the chosen bottle.

5.14 Scene 1, shot 3

The final scene (Figure 9) is introduced with a more complex shot where staging, color palette, and camera movement work together to create a sense of harmony and elegance. This screen transition is accomplished by rotating the camera, which shifts the bottle toward the left edge of the frame while simultaneously revealing new information on a card that is chromatically linked to the item for sale. The rotation naturally guides the viewer's eye to read additional details and view further images. Unlike the dark, mysterious tones of the previous shots, this scene employs high-key lighting, resulting in an explosion of colors with low-contrast shadows and a brighter, more vibrant background.

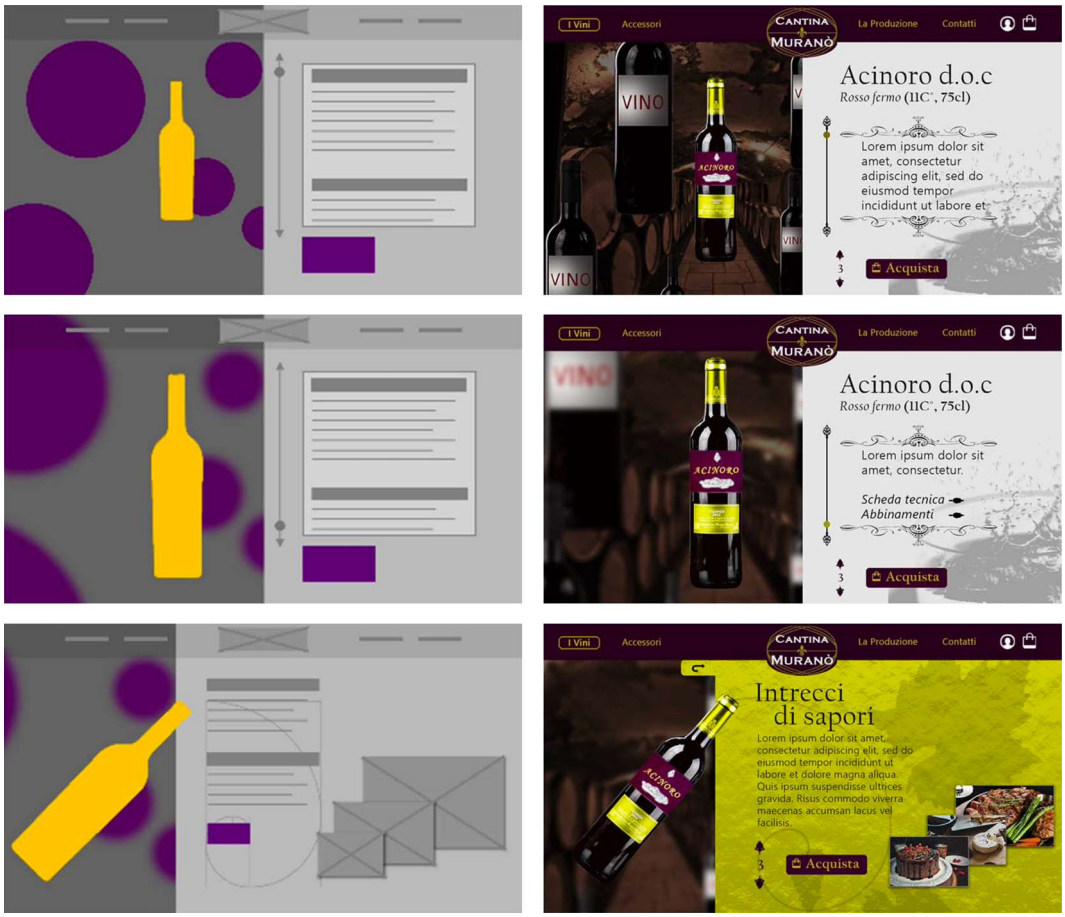

FIGURE 9. Wine e-commerce.

5.15 Evaluation

The techniques listed above were selected from many commonly used in shooting because we believe they have potential application in web design as well. This shortlist was primarily based on our experiences as users, designers, and spectators. Before finalizing our selection, we conducted preliminary tests to verify the suitability and effectiveness of each technique for modern web design solutions. Regarding suitability, we firstly considered the feasibility of implementation in terms of programming and fast execution in a web browser. We developed a collection of client-side code snippets (HTML + CSS + JavaScript). As for the effectiveness in terms of user experience and usability, our preliminary tests were conducted with a small panel, so we cannot provide statistically significant, results. However, the testers generally reacted positively to our novel cinematographic approach to web design, appreciating the aesthetics (e.g., good-looking design and animations) and responsiveness to stimuli (e.g., reaction to colors). Functional requirements, and user expectations also play a crucial role in enhancing user experience and perception of usability. These aspects will be evaluated in future test sessions, with appropriately developed prototypes.

6 Conclusions

The filmmaking techniques presented in this paper (see the section "Applying cinematography techniques to web design") for potential implementation in web development promise to be of powerful tools for modern web designers. We selected these techniques from the many available in the literature (Ascher and Pincus, 2007) because of their proven ability to engage people watching movies.

The cinematographic approach to web design aims to equip designers with both theoretical and practical tools. This enables them to use artistically crafted visual compositions to convey ideas closely related to the website's content thereby capturing users' attention and emotional engagement. This approach gently guides users toward the most relevant interaction points on the interface. Additionally, it is worth noting that the appreciation of colors, images, and animations (that is, the main elements of cinema language) is generally considered socially and culturally independent. This is because the enjoyment and understanding of these nontextual stimuli do not require the acquisition of a specific code to decipher their meaning, making them naturally and universally accessible to all (Carroll, 1985). Therefore, websites that heavily rely on visual storytelling and incorporate techniques from cinema and filmmaking can create more immediate and satisfying web experiences.

Data availability

The data underlying this article are available in the article and in its online supplementary material.

Conflicts of interest

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 paper.

References

Ahuja, J. S. and Webster, J. (2001) Perceived disorientation: an examination of a new measure to assess web design effectiveness. *Interact. Comput.*, **14**, 15–29. https://doi.org/10.1016/S0953-5438(01)00048-0.

Ascher, S. and Pincus, E. (2007) *The Filmmaker's Handbook: a comprehensive guide for the digital age*. Penguin.

Bank, C. (2014) *The guide to wireframing*. UXPIN, Mountain View–EUA.

Beaird, J. and George, J. (2014) The principles of beautiful web design. *SitePoint*.

Bellantoni, P. (2012) *If it's Purple, Someone's Gonna Die: The Power of Color in Visual Storytelling*. CRC Press.

Bordwell, D. (2013) *Film art: an introduction*. McGraw Hill.

Bordwell, D., Thompson, K., Smith, J. (2010). *Film art: an introduction*. (Volume 9). McGraw-Hill.

Brower, K. H. (2007). *Cinematic storytelling: the 100 most powerful film conventions every filmmaker must know, by Jennifer Sijll Van*. Michael Wiese Productions, Studio City, CA, 2005.

Brown, B. (2016) *Cinematography theory and practice: image making for cinematographers & directors*. Taylor & Francis.

Cao, J., Stryjewski, K., Ellis, M. and Zieba, K. (2015) *Web UI design for the human eye: principles of visual consistency* (pp. 24–27). UX Pin, Estados Unidos.

Cao, J., Knach, N., & Ellis, M. (2018). *The guide to Mockups*. UXPin.

Carmona, C. R. (2017) The role and purpose of film narration. *Journal of Science and Technology of the Arts*, **9**, 7–16. https://doi.org/10.7559/citarj.v9i2.247.

Carroll, N. (1985) The power of movies. *Daedalus*, **114**, 79–103. https://www.jstor.org/stable/20025011.

Clark, R. C. and Mayer, R. E. (2008) Learning by viewing versus learning by doing: evidence-based guidelines for principled learning environments. *Perform. Improv.*, **47**, 5–13. https://doi.org/10.1002/pfi.20028.

Diaper, D. and Waelend, P. (2000) World wide web working whilst ignoring graphics: good news for web page designers. *Interact. Comput.*, **13**, 163–181. https://doi.org/10.1016/S0953-5438(00)00036-9.

Douneva, M., Jaron, R. and Thielsch, M. T. (2016) Effects of different website designs on first impressions, aesthetic judgements and memory performance after short presentation. *Interact. Comput.*, **28**, 552–567. https://doi.org/10.1093/iwc/iwv033.

Elliot, A. J. and Aarts, H. (2011) Perception of the color red enhances the force and velocity of motor output. *Emotion*, **11**, 445–449. https://doi.org/10.1037/a0022599.

Faraday, P. (2000) Visually critiquing web pages. In Correia, N., Chambel, T. and Davenport, G. (Eds.), *Multimedia '99. Eurographics*. Springer, Vienna. https://doi.org/10.1007/978-3-7091-6771-7_17.

Goree, S., Doosti, B., Crandall, D., & Su, N. M. (2021). Investigating the homogenization of web design: a mixed-methods approach. In *Proceedings of the 2021 CHI conference on human factors in computing systems* (pp. 1–14).

Grier, R. A. (2004) *Visual attention and web design*. University of Cincinnati.

Herring, S. R., Chang, C. C., Krantzler, J., & Bailey, B. P. (2009). Getting inspired! Understanding how and why examples are used in creative design practice. In *proceedings of the SIGCHI conference on human factors in computing systems* (pp. 87–96).

J and Beyond e. V. (2018). Once upon a time. how to create powerful visual storytelling on the web. Available at the URL https://www.youtube.com/watch?v=mBxMgUXkVNg (Date accessed May, 2023).

Kaushalya, P., Charles, J., Lekamge, L., & Kulathunga, K. (2020). Kansei engineering approaches for web interface designing: a systematic literature review. In *Proceedings of the ICACT 2020. International conference on advances in computing and technology* (pp. 100–102).

Kuo, L., Chang, T. and Lai, C. C. (2022) Multimedia webpage visual design and color emotion test. *Multimed. Tools Appl.*, **81**, 2621–2636. https://doi.org/10.1007/s11042-021-11684-4.

Lim, Y. M., Ayesh, A., & Stacey, M. (2014). The effects of menu design on users' emotions, search performance and mouse behaviour. In *Proceedings of the 2014 IEEE 13th international conference on cognitive informatics and cognitive computing* (pp. 541–549).

Lindgaard, G., Fernandes, G., Dudek, C. and Brown, J. (2006) Attention web designers: you have 50 milliseconds to make a good first impression! *Behav. Inform. Technol.*, **25**, 115–126. https://doi.org/10.1080/01449290500330448.

Lokman, A. M., & Noor, N. L. M. (2006). Kansei engineering concept in e-commerce website. In *Proceedings of the international conference on Kansei engineering and intelligent systems* (pp. 117–124).

Lokman, A. M., Noor, N. L. M., & Nagamachi, M. (2009). Expertkansei-web: a tool to design kansei website. In *Proceedings of the international conference on Enterprise information systems* (pp. 894–905).

Loschky, L. C., Larson, A. M., Magliano, J. P. and Smith, T. J. (2015) What would jaws do? The tyranny of film and the relationship between gaze and higher-level narrative film comprehension. *PLoS One*, **10**, e0142474. https://doi.org/10.1371/journal.pone.0142474.

Mathis, L. (2016) *Designed for use: create usable interfaces for applications and the web*. Pragmatic Bookshelf.

Mercado, G. (2013) *The filmmaker's Eye: learning (and breaking) the rules of cinematic composition*. Routledge.

Miller, B. D. (2011) *Above the fold: understanding the principles of successful web site design*. Simon and Schuster.

Monteiro, M. and Spiekermann, E. (2012) *Design is a Job*. A Book Apart.

Müller, B. (2018). Why do all websites look the same? Available at the URL https://borism.medium.com/on-the-visual-weariness-of-the-web-8af1c969ce73 (Date accessed May, 2023).

Mullin, S. (2020). Why you should think twice before using website templates. Available at the URL https://cxl.com/blog/website-templates (Date accessed May, 2023).

Nagamachi, M. (1999) Kansei engineering: the implication and applications to product development. In *IEEE SMC'99 Conference Proceedings. 1999 IEEE International Conference on Systems, Man, and Cybernetics (Cat. No. 99CH37028)*, Vol. 6, (pp. 273–278). IEEE. https://doi.org/10.1109/ICSMC.1999.816563.

Nielsen, J. (2008). How little do users read? Available at the URL https://www.nngroup.com/articles/how-little-do-users-read (Date accessed May, 2023).

Pang, X., Cao, Y., Lau, R. W. H. and Chan, A. B. (2016) Directing user attention via visual flow on web designs. *ACM Trans. Graph.*, **35**, 1–11. https://doi.org/10.1145/2980179.2982422.

Park, S. E., Choi, D. and Kim, J. (2004) Critical factors for the aesthetic fidelity of web pages: empirical studies with professional web designers and users. *Interact. Comput.*, **16**, 351–376. https://doi.org/10.1016/j.intcom.2003.07.001.

Pearlman, K. (2012). Opportunity for filmmakers: onscreen drafts. Available at the URL http://www.karenpearlman.net/karenpearlmannet/opportunity-for-filmmakers-onscreen-drafts (Date accessed May, 2023).

Pelet, J. E. (2015) Investigating the importance of website color contrast in e- and m-commerce. In *Encyclopedia of Information Science and Technology* (Third), (pp. 2329–2338). IGI Global Scientific Publishing.

Prakash, A., Bhutani, M. and Bhardwaj, G. (2014) The impact of marketing strategies on customer and long-term growth. *Global Journal of Finance and Management*, **6**, 293–296.

Rothwell, S. (2007) *Detection and analysis of emotional highlights in film*(Doctoral dissertation,. Dublin City University.

Rubin, H. E. and Katz, E. (1946) Auroratone films for the treatment of psychotic depressions in an army general hospital. *J. Clin. Psychol.*, **2**, 333–340. https://doi.org/10.1002/1097-4679(194610)2:4<333::AID-JCLP2270020405>3.0.CO;2-P.

Saunders, J. E. (2019). Public communication for hcde 210: how the human centered design process parallels the filmmaking process, and other inter- disciplinary implications. Available at the URL https://medium.com/@jes1053/public-communication-for-hcde-210-how-the-human-centered-design-process-parallels-the-filmmaking-698abdf6ee20 (Date accessed May, 2023).

Scherer, H. (2019). For a human-centered design. Available at the URL https://www.hailey scherer.com/writing/2018/7/10/for-a-human-centered-design (Date accessed May, 2023).

Siegel, D. (1996) *Creating Killer Websites*. Hayden Books, Indianapolis.

Sklar, J. (2011) *Principles of web design: the web technologies series*. Cengage Learning.

Song, Z., Howard, T. J., Achiche, S. and Özkil, A. G. (2012) Kansei engineering and web site design. In *International Design Engineering Technical Conferences and Computers and Information in Engineering Conference* (pp. 591–601). American Society of Mechanical Engineers.

Still, J. D. (2018) Web page visual hierarchy: examining faraday's guidelines for entry points. *Comput. Hum. Behav.*, **84**, 352–359. https://doi.org/10.1016/j.chb.2018.03.014.

Sutcliffe, A. and Namoune, A. (2008) Getting the message across: visual attention, aesthetic design and what users remember. In *proceedings of the 7th ACM conference on designing interactive systems* (pp. 11–20). Association for Computing Machinery, New York.

Sutcliffe, A. G. and Namoune, A. (2012) Predicting user attention in complex web pages. *Behav. Inform. Technol.*, **31**, 679–695. https://doi.org/10.1080/0144929X.2012.692101.

The World Wide Web Consortium (W3C) (2021). Web content accessibility guidelines (wcag) 2.2. Available at the URL https://www.w3.org/TR/2021/WD-WCAG22-20210521 (Date accessed May, 2023).

Weinreich, H., Obendorf, H., Herder, E. and Mayer, M. (2008) Not quite the average: an empirical study of web use. *ACM Trans. Web*, **2**, 1–31. https://doi.org/10.1145/1326561.1326566.

Interacting with Computers, 2025, 1–16
https://doi.org/10.1093/iwc/iwaf026
Article