



DIGITAL OUT-OF-HOME AND BRAND RECALL IN CITIES. A Scopus Literature Review.

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KEYWORDS	ANSTRACT
<i>Digital Out-of-Home</i> <i>Digital out-of-home</i> <i>advertising</i> <i>DOOH</i> <i>Out-of-home</i> <i>advertising</i> <i>Digital advertising</i> <i>Brand Recall</i> <i>Recall</i> <i>Brand</i> <i>Cities</i>	<i>In a dynamic context in which consumers are hyperconnected and simultaneously exposed to multiple stimuli across the urban landscape, brands face the challenge of remaining memorable. This study aimed to establish the relationship between digital out-of-home (DOOH) advertising and brand recall in cities. Sixty-five articles indexed in the Scopus database were analysed using the PRISMA method. The findings show that the most prominent technologies and techniques in DOOH include programmatic automation, digital signage, extended reality and the Internet of Things (IoT), offering advantages such as real-time dynamic creative optimisation (DCO), advanced segmentation, omnichannel integration, less intrusive content and the seamless integration of advertisements into their surroundings, thereby increasing conversion and engagement. DOOH enhances the recognisability of a place by strengthening its image and increasing its value, with positive experiences, visual stimuli, strategic location and the way advertising pieces are displayed emerging as decisive factors. DOOH represents a technological evolution in out-of-home advertising and constitutes a strategy for consolidating more conscious and memorable connections with cities.</i>

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1. Introduction

Digital out-of-home (DOOH) advertising has become one of the communication platforms gaining increasing traction, particularly among urban residents, owing to its dynamic nature and omnipresence in city streets. This growth is also attributable to its ability to adapt content to the context and personalise messages in real time, as well as to reach wider audiences and enable more accurate measurement (García Carrizo, 2017). In a highly competitive environment, recall is a fundamental asset for long-term success. However, before developing advertising initiatives, it is essential to establish and strengthen identity within cities. At the global level, various studies have explored how digital out-of-home (DOOH) advertising influences user experience and levels of recall. Key motivating factors include useful information, entertainment and perceived benefits, together with interactivity and system quality. These factors are essential for encouraging residents to accept this type of advertising and fostering a positive experience. Moreover, interaction has been shown to play a central role in connecting these motivators with users' experiences (Mposi et al., 2025). As regards DOOH formats, their implementation varies by region.

In Asia, large screens in brightly lit spaces and interactive street-level displays are particularly prominent. In Europe, by contrast, smaller and more discreet devices are preferred in an effort to preserve the harmony of public spaces and integrate advertising more seamlessly into the urban environment. The focus is on close-range interaction, including through touch, thereby creating a sense of intimacy and drawing on advanced technologies such as the Internet of Things. Current research on brand recall, meanwhile, presents a complex and multifaceted landscape, with a convergence of approaches from cognitive psychology, neuromarketing and the sociology of consumption (Breves and Schramm, 2019; Boerman et al., 2015). Key trends include advertising personalisation and entertainment content, such as advergames and product placement, as well as the use of immersive technologies such as artificial intelligence and extended reality (Hernández and Minor, 2014; Del Vecchio et al., 2024). In the United States, studies focusing on recall predominate, particularly those analysing advertising on television and in video games. There are also theoretical studies of out-of-home displays based on the Internet of Things (IoT), as well as research on product sponsorship and product logos aimed at university students and runners. Other studies address the emotional connection between brands and consumers and employees. Finally, research has examined the effects on customers of dark patterns, placements and naming (Brasel and Gip, 2014; Leng et al., 2021; Rabanal-Chávez et al., 2022; Boerman et al., 2015; Smith et al., 2016; Lee and Davis, 2014; Del Vecchio et al., 2023; Campbell et al., 2020; Davtyan et al., 2016; Lee and Baack, 2014).

In Latin America, large-format and interactive street advertising is prioritised because it stands out amid advertising saturation, thereby contributing to its acceptance. Theoretical studies have addressed out-of-home advertising and neuroscience, as well as its role in smart cities. Research has also examined reactions to out-of-home technologies among passers-by and customers, together with vandalism affecting advertising pieces and displays Baungratz and Casarin, 202; Breva-Franch and Camacho, 2016; Nuñez, 2023; Baungratz and Casarin, 2024; Sanz, 2016. There is likewise growing interest in the analysis of brand recall, although a substantial research gap remains compared with developed countries. Similarities can be observed in the factors considered influential, although greater emphasis is placed on the importance of sociocultural aspects. There is also a prevalence of case studies and an emerging body of research on sensory branding and recall among specific groups, such as adolescents (Mena and Arbaiza, 2024; Sandoval et al., 2018; Gamarra et al., 2023; Calderón et al., 2018). Research conducted in Peru has analysed artistic murals for a personal care product in relation to consumer perception. It has also examined external brand management and brand recall through social media (Condemarín-Seminario et al., 2024; Florian and Flores, 2021). The information available in the sources provided is limited regarding studies directly addressing brand recall. Nevertheless, there is a focus on related areas involving historical corpora, research and sustainable tourism (Gamarra et al., 2023; Mena and Arbaiza, 2024).

1.1. Theoretical Framework

1.1.1 Digital Out-of-Home (DOOH)

Digital out-of-home advertising, known as DOOH (Digital Out-of-Home), is understood as an ever-expanding range of interactive screens incorporated into open spaces for persuasive purposes. This

medium is often regarded as a form of out-of-home communication 2.0 (García, 2023; Felisberto & Casarín, 2024) and encompasses a wide variety of formats that differ in size, location and technological sophistication. Recall, meanwhile, is understood as the user's ability to bring a brand from memory after receiving certain information associated with a product or its characteristics, the context in which it is used, the product category or the needs it fulfils, thereby implying unaided knowledge. This process occurs after recognition (Keller, 1993). In this sense, brand identification is defined as consumers' ability to bring a product or service to mind during the decision-making process. Brand recall refers specifically to unaided brand knowledge (Bohara et al., 2022; Sandoval et al., 2016).

1.1.2 Types of DOOH

Among the most common formats are digital billboards, which are typically located alongside roads or high-traffic routes and at intersections. These have evolved to incorporate large LED screens. Another common format is integrated into street furniture, such as bus shelters and MUPs. In some cases, these structures serve several functions: on the one hand, they display advertising and, on the other, they are decorative or provide useful information for citizens. DOOH technology also encompasses so-called digital advertising displays, known as the "fifth screen", which feature in innovative formats, including building façade wraps and specially designed coverings. These not only provide advertising space but also help improve the city's image by concealing older façades during renovation work (Lou et al., 2020; Perez, 2022; Chiquito and Yance, 2019; Felisberto and Casarín, 2024; García, 2023; Pedro & Camáñez, 2023).

A significant development is the introduction of 3D digital billboards using anamorphic illusion technology to create effects of depth. Mobile displays have also been developed that adapt to different architectural contexts. DIGITALISATION has enabled the incorporation of dynamic and audiovisual content, as well as more sophisticated capabilities such as touch sensors, augmented reality and contactless NFC. These technologies provide a level of interactivity that was previously impossible with traditional media (García, 2023; Mršić, 2023; Baungratz and Casarín, 2024; Felisberto and Casarín, 2024).

1.1.3 Brand Recall

Recall is understood as the user's ability to bring a brand to mind after receiving specific information associated with a product or its characteristics. These include the context of use, the product category or the needs it fulfils, implying unaided knowledge. This process occurs after recognition (Keller, 1993; Gamarra and Olórtégui, 2023). In terms of measurement, brand recall reflects the position a brand occupies in consumers' minds. Furthermore, the context in which the brand is experienced helps establish a connection with the user, which may generate positive behaviour towards it and lead consumers to prefer it as a result of direct experience or an indirect relationship (Odar et al., 2022; Ortega-Ruiz & Velandia-Morales, 2011). In this sense, brand knowledge is defined as consumers' ability to recall or recognise a product or service during the decision-making process; brand recall specifically refers to unaided brand knowledge (Bohara et al., 2022; Sandoval et al., 2016).

1.1.4 Levels of City Brand Recall

The concept of city recall comprises different levels. The first and lowest is aided recall, in which individuals recall a list of names within a category that they have previously heard, highlighting the importance of prior awareness. At a higher level is unaided recall, in which no assistance is provided to identify the name of a particular place. The brand of a specific city is retrieved from memory when general information is provided, such as the category to which it belongs, the needs it satisfies or the relevant context (Gamarra et al., 2023; Florian and Flores, 2021). A higher level is top-of-mind awareness, which occurs when individuals spontaneously mention the name of a city first and without any form of assistance, reflecting a high level of salience. The city thereby occupies a position ahead of its competitors within the same segment, consolidating a stronger position in memory. As a result, it gains a significant competitive advantage and frequently displaces other cities in terms of preference (Gamarra et al., 2023). The highest level of recall is city brand dominance, in which residents recall and name only one city, directly associating it with the relevant category (Keller et al., 2008). It is not the only city within that category, but rather the one that is recalled exclusively (Alet, 2011; Jiménez, 2004). This dominance is evident when the name of the city becomes more widely recognised than the category itself, to the point that it becomes firmly established in people's minds.

1.2. Objectives

1.2.1 General Objective:

The main objective of this study is to establish the relationship between Digital Out-of-Home (DOOH) advertising and brand recall in cities.

1.2.2 Specific Objectives:

- To establish the characteristics of DOOH advertising and brand recall.
- To identify the types of DOOH advertising and levels of brand recall.
- To identify the advantages of DOOH for city recall.
- To identify solutions to the problems associated with implementing Digital Out-of-Home advertising to enhance city recall.

2. Methodology

This study adopts a qualitative approach based on a systematic literature review (SLR). A four-stage procedure was conducted (identification, screening, selection and analysis of the literature) owing to its structured and rigorous nature, which promotes replicability and reduces bias. In this regard, Manterola et al. (2013) state that the purpose of a systematic review is to conduct a comprehensive and detailed examination of the available evidence on a specific topic. This is carried out through a standardised protocol that facilitates the identification of reliable and valid data, which are then used to assess the quality and robustness of scientific knowledge. Its systematic nature reduces bias and helps to organise the information (Samnanni et al., 2017).

This study followed the PRISMA guidelines, which, according to Moher et al. (2009), are represented in a diagram illustrating the process of including and excluding previous studies from the analysis (Page et al., 2021). Scopus was the scientific database consulted, from which 75 publications were selected, with priority given to studies published over the last decade in order to ensure the inclusion of the most up-to-date approaches (see Figure 1).

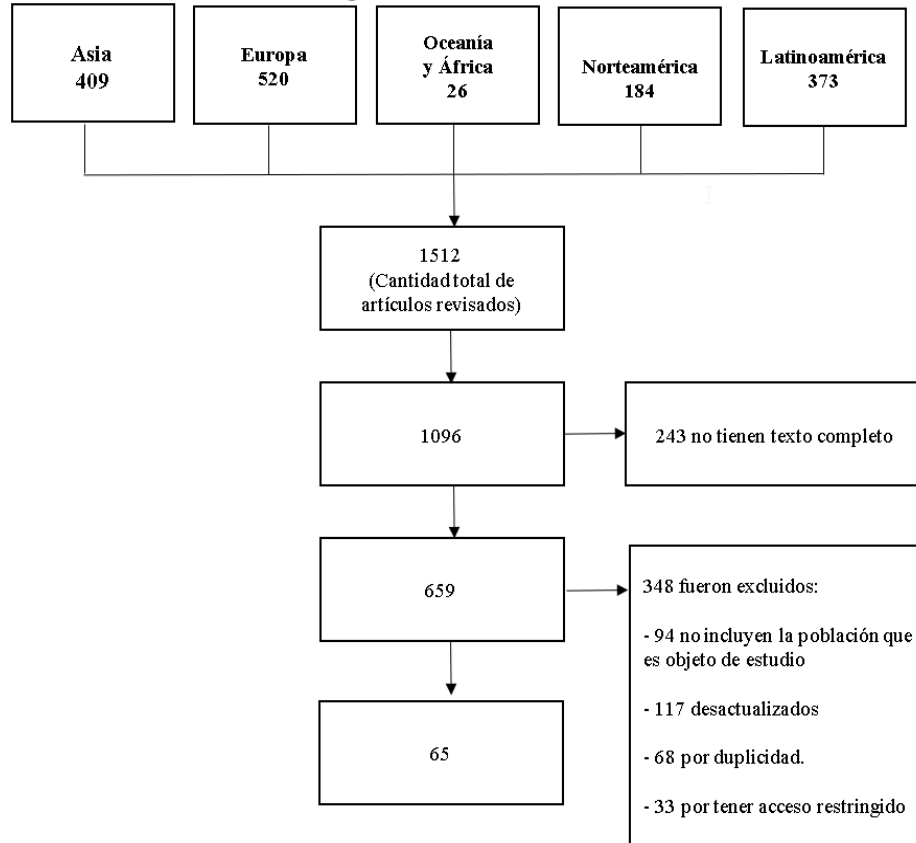
2.1. Information Search and Identification of Studies

Studies addressing the relationship between Digital Out-of-Home advertising and brand recall in cities between 2014 and 2025 were selected and examined thematically. Incomplete studies were excluded, and different elements and subtopics were identified through the systematic review, taking into account the relevance of data on factors affecting safety in online video games.

2.2. Selection of Publications

Initially, 1,512 publications were analysed, and those unrelated to cybersecurity were excluded. The process concluded with the selection of 65 sources for the systematic review.

2.3. Selection

Figure 1. Selected articles

Source: Scopus database, 2014–2025

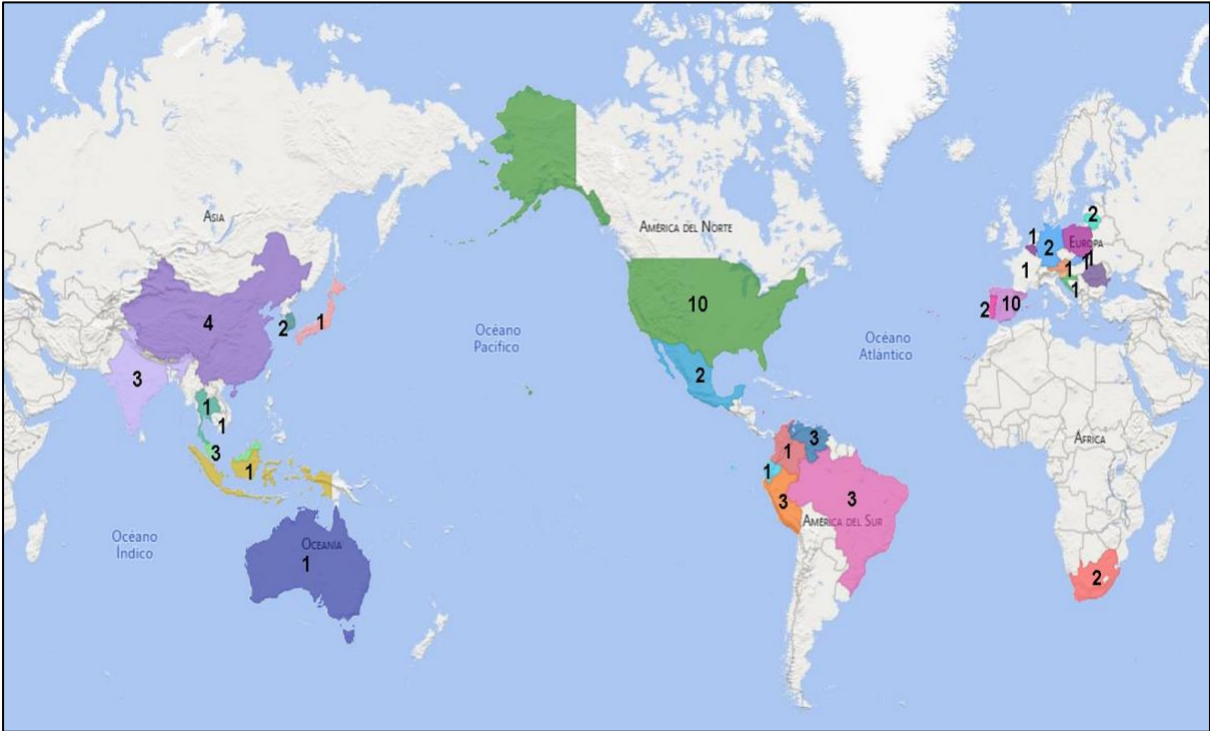
The search for scientific articles in the database yielded a total of 1,512 articles indexed in Scopus between 2014 and 2025, distributed as follows: 409 studies from Asia; 520 from Europe; 26 from Oceania and Africa; 184 from North America; and 373 from Latin America. Once the total number of articles had been established, all those for which the full text was unavailable were excluded, amounting to 243 articles and resulting in 659 papers. Subsequently, the inclusion and exclusion criteria were applied, leading to the selection of a final total of 65 studies on which the present research was based.

2.4. Analysis

Subsequently, the factors and subtopics were defined using the model proposed by Braun and Clarke (2006), which comprises several phases. The selected literature was reviewed in order to understand the relationship between digital out-of-home (DOOH) advertising and city recall. Finally, a set of dimensions was generated. Redundant subcategories and codes were removed with the assistance of specialists in the field.

The following is a list of the 65 studies retrieved from the Scopus database, classified by country, year of publication and field of study.

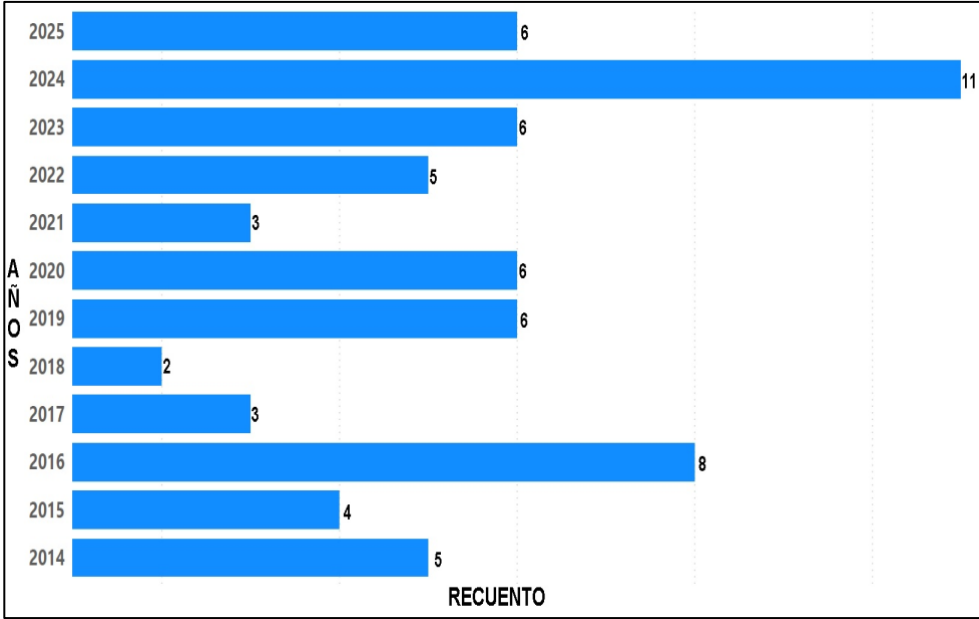
Figure 2: Publication of articles by country



Source: Scopus database, 2014–2025

Figure 2 shows a broad geographical distribution of scientific output related to the topic analysed. Within the database, the United States and Spain stand out with 10 studies each, followed by China with 4, and Brazil, Peru, Venezuela and Malaysia with 3 studies each. South Africa and Australia are also represented, demonstrating international interest in understanding the relationship between DOOH and recall, with particular emphasis on artificial intelligence, sustainability, new narratives and neuromarketing, among other areas. This geographical diversity shows that the phenomenon is not confined to a single context but constitutes a growing global field of research. Moreover, the presence of multiple studies from European (22), Latin American (13), North American (10) and Asian (16) countries indicates a balanced representation of both developed and emerging economies. This panorama enriches the academic discussion by incorporating diverse commercial, cultural and social realities.

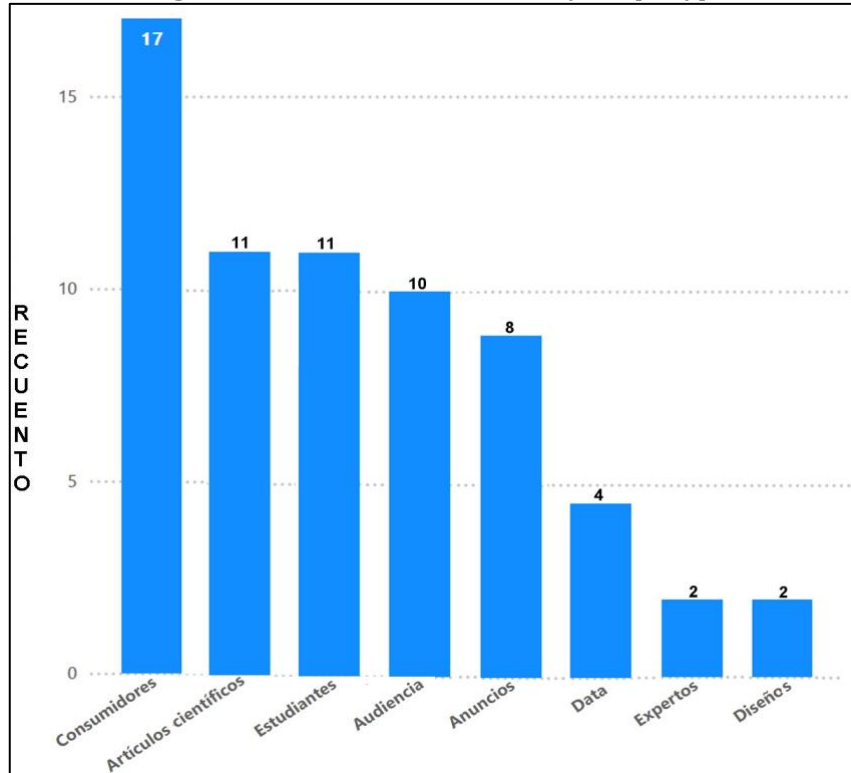
Figure 3: Publication of studies by year



Source: Scopus database, 2014–2025

Figure 3, which shows the evolution of publications over time, reveals a sustained increase in research output in recent years, reaching its highest point in 2024 with 11 publications. This upward trend suggests that the topic has gained relevance within the fields of marketing and communication, particularly in contexts where consumer experience and brand recall are associated with emotional and narrative factors. Earlier years show a smaller number of studies, indicating that academic interest in this approach is relatively recent. Therefore, the concentration of publications between 2022 and 2024 supports the relevance and topicality of the subject addressed in the present study.

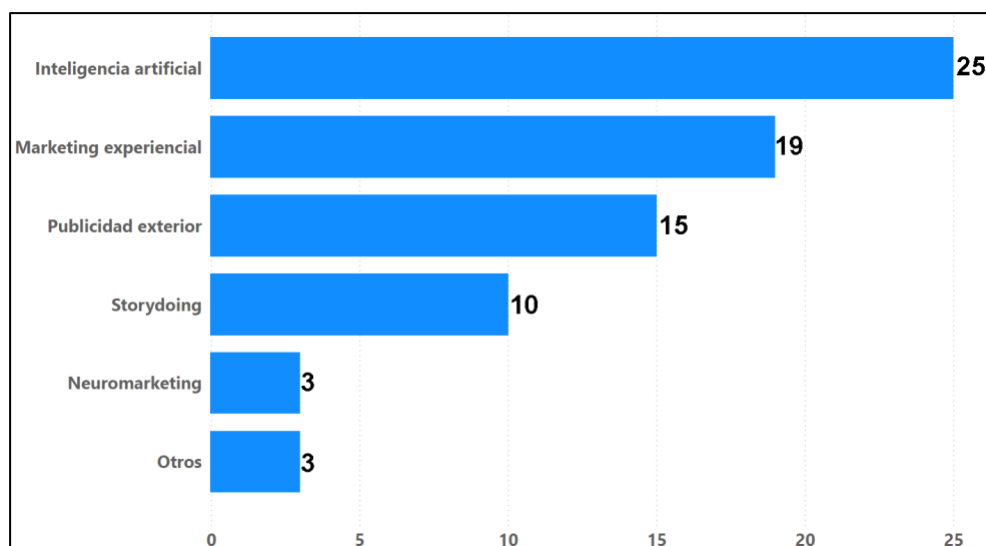
Figure 4: Table of research studies by sample type



Source: Scopus database, 2014–2025

Figure 4 refers to the samples used in the selected articles. Seventeen studies analyse consumers, confirming an orientation towards actual customer behaviour. Secondly, scientific sources and students were each examined in 11 studies, revealing a tendency towards theoretical or experimental analyses in academic settings. There is also considerable attention to audiences exposed to out-of-home communication in cities (10), including passers-by, runners, workers, *gamers* and cinema-goers, among others. This suggests that some population segments remain relatively underexplored. Finally, fewer studies focus on historical, customer and telephone data, expert perspectives and business-oriented research designs.

Figure 5: Publication of studies by topic



Source: Scopus database, 2016–2025

Figure 4 refers to the samples used in the selected articles. Seventeen studies analyse consumers, confirming an orientation towards actual customer behaviour. Secondly, scientific sources and students were each examined in 11 studies, revealing a tendency towards theoretical or experimental analyses in academic settings. Attention is also given to audiences exposed to out-of-home communication in cities (10), including passers-by, runners, workers, gamers and cinema-goers, among others. This suggests that certain population segments remain relatively underexplored. Finally, a smaller number of studies focus on historical, customer and telephone data, expert perspectives and business-oriented research designs.

Table 1. Samples in selected articles

Authors	Topic	Number
Chiquito and Yance (2019), Felisberto and Casarin (2024), Huang et al. (2020), Lou et al. (2020), Marx et al. (2025), Mposi et al. (2025), Roslan and Fadzil (2025), Roux et al. (2024), Seo et al. (2024), Tan Y-F et al. (2024), Wang et al. (2020)	Digital out-of-home advertising	11
Abad et al. (2016), Brasel and Gip (2014), Breves and Schramm (2019), Hernandez and Minor (2014), Herrawing and Poels (2015), Leng et al. (2021), Mena and Arbaiza (2024), Vashisht and Royne (2016), Xu et al. (2024)	Digital advertising, advergames and recall	9
Calderón et al. (2018), Campbell et al. (2020), Del Vecchio et al. (2023), Fidelis et al. (2017), Kilijaneek and Ozga (2022), Lee and Davis (2014), Naderer et al. (2021), Wu and Song (2020)	Emotional connection, narratives and recall	8
Baungratz and Casarin (2024), Breva-Franch et al. (2023), Carrizo (2017), Cuc and Secan (2024), Palomo-Domínguez and Zemlickien (2022), Rao et al. (2025), Widyo and Raras (2023)	Sustainability in digital out-of-home advertising	7
Baumann et al. (2015), Davtyan et al. (2016), Florian and Flores (2021), Kakei (2019), Lee and Baack (2014), Natarajan et al. (2018)	Management, location and recall	6

Fuentes-Santos et al. (2025), Kwon (2024), Leo (2023), Nuñez (2023), Rabanal-Chávez et al. (2022), Urban et al. (2020)	AI and advertising in cities	6
Biscaia et al. (2014), Boerman et al. (2015), Erfgen et al. (2015), Piątkowska and Gocłowska (2016), Smith et al. (2016), Tan and Pyun (2019)	Sponsorship and recall	6
Baungratz and Casarin (2022), Lyu et al. (2025), Othman et al. (2020), Sanz (2016)	Other studies on out-of-home advertising	4
Breva-Franch and Camacho (2016), Fondevila-Gascón et al. (2019)	Neuromarketing	2

Source: Selected articles from the Scopus database

Table 1 presents the distribution of the indexed articles retrieved from Scopus, showing that digital out-of-home advertising accounts for eleven studies, making it the most prominent line of research. In second place are studies related to digital experiences, advergames and brand recall, with nine publications, while research exploring the relationship between emotions, narratives and recall comprises eight contributions. This is followed by sustainability in out-of-home advertising media, with seven publications, while three further approaches each comprise six articles: the management and strategic placement of messages, artificial intelligence applied to cities, and the relationship between sponsorship and brand recall. At a more specific level, other approaches to out-of-home advertising account for four studies. Finally, neuromarketing appears as an emerging line of research, with only two contributions. These findings provide an overview of the areas that have received the greatest academic attention and those that represent opportunities for further research.

3. Results and Discussion

The general aim of this study was to analyse the role of out-of-home advertising in residents' recall within urban contexts.

3.1. Elements Influencing Digital Out-of-Home Advertising

For a brand to remain in people's minds after they encounter digital advertising in the street (DOOH), several key elements need to be combined intelligently and creatively. In this sense, DOOH functions as a dynamic canvas within the urban environment, and the key to ensuring that people remember a brand lies in overcoming the threshold of attention associated with moving through the city. One essential factor is therefore the creativity of the message. An advertisement needs to be sufficiently ingenious to enhance brand memorisation. In digital out-of-home advertising, people place considerable value on novelty, as seeing something they have never encountered before is the main element that captures attention in advertisements (Breva & Mut, 2016; Zuza & Ahtik, 2022; Yi-Fan et al., 2024).

Regarding the visual aspects that favour perception and memory, elements that stand out from their surroundings are particularly important, whether because of their shape or use of colour. The intensity of tones also plays a role, especially when colours are vivid, distinctive or unusual, as does the size of graphic elements. Although colour might appear to be the most decisive factor, some studies show that novelty is the main element capturing attention, even more so than contrast and chromatic intensity. Nevertheless, colour retains a fundamental role, as it remains the attribute most strongly associated with brand recognition and exerts a considerable influence on purchasing decisions. Active interaction and dynamism are vital in DOOH advertising; digital screens are therefore perceived as modern and cutting-edge, and their ability to display dynamic, interactive and up-to-date content enables them to attract attention more effectively. People perceive DOOH advertising as having greater impact, offering more creative and innovative content and being easier to remember. This interaction may occur through touch or QR codes, generating a stronger emotional connection between the brand and its audience (Fondevila-Gascón et al., 2023; García, 2023). In addition, the use of animation and audiovisual elements creates a more immersive and engaging experience. Movement in advertisements has been shown to increase attention, memorability and purchase intention. Even the animation of certain graphic

elements can improve visibility and, consequently, the effectiveness of a poster (Zuza & Ahtik, 2022). Other, more traditional factors also remain important for brand recall, including the material dimensions of the advertisement, such as billboard size, physical presence and ability to attract attention. It is also important that visibility should not be obstructed by other elements. Brand familiarity among consumers likewise increases the likelihood of recognition and memorisation (Pedro & Camáñez, 2023; Chiquito & Yance, 2019; Breva & Mut, 2016).

Location is crucial, as strategic and symbolic placements influence advertising effectiveness. Positioning an advertisement close to the point where the product will be consumed can significantly increase sales. The prestige a brand gains from appearing on a large billboard, which is known to be costly and beyond the reach of many businesses, can itself strengthen the brand's image (García, 2023; Chiquito & Yance, 2019). Integration with other communication strategies is also key. When an advertisement captures attention in a striking way, it has considerable viral potential; if members of the public record and share it on social media, its reach and advertising effectiveness are multiplied (Pedro & Camáñez, 2023; Sanz). In other words, out-of-home advertising can become an urban spectacle designed to be amplified through digital media. In addition, incorporating urban art into advertising, for example in the form of murals, can create a positive impression of the brand and strengthen connections with consumers by evoking pleasant emotions and memories (Condemarín-Seminario et al., 2024). Brands that use this technique, often together with technologies such as artificial intelligence to personalise messages in real time, project an image of modernity and innovation and enhance their reputation (García, 2023; Mršić, 2023).

3.2. Characteristics of DOOH Advertising and City Recall

The main difference between out-of-home (OOH) advertising and digital out-of-home (DOOH) advertising lies in their nature. While the former is static, DOOH is characterised by its dynamic nature. Although both are located in public spaces outside the home, they operate according to different principles. OOH encompasses all traditional physical formats, such as billboards printed on paper or vinyl, advertising on vehicles and taxis (transit advertising), and posters incorporated into street furniture such as bus stops or kiosks. Once a campaign has begun, its message remains unchanged and may stay in place for weeks or months (Cuc and Secan, 2024; García, 2023; Lara, 2024; Palomo-Domínguez and Zemlickiene, 2022).

Advanced digital advertisements, by contrast, introduce substantial changes to the physical medium. Printed materials are replaced by interactive screens, such as LED billboards or advanced multimedia displays. This shift towards technology gives DOOH its dynamic character, enabling the display of content such as videos, animations and audio. The ability to show movement captures attention far more effectively; indeed, various studies indicate that an animated display can be twice as visible as a static one and hold viewers' attention for considerably longer. This digital format offers a degree of flexibility that static formats cannot provide. DOOH advertising content can be updated remotely and adapted in real time to contextual factors such as the time of day, weather conditions or specific events taking place. Whereas a traditional billboard displays a single message, a digital screen can rotate multiple messages within a shorter period, maximising the use of space and enabling advertisers to adjust their campaigns as they progress (Yi-Fan et al., 2024; Mršić, 2023; Zuza & Ahtik, 2022; Lou et al., 2020).

A traditional billboard displays a single message, whereas a digital screen can rotate multiple messages within a shorter period, maximising the use of space and enabling advertisers to adjust their campaigns as they progress. In short, the most significant difference lies in interactivity and intelligent targeting. Traditional digital advertising could incorporate simple multimedia elements, including a QR code. DOOH, by contrast, integrates advanced technologies such as touchscreens, augmented reality (AR) and motion sensors. More importantly, it is supported by artificial intelligence (AI) and recognition software, always used anonymously (Mršić, 2023; Zuza and Ahtik, 2022; Lara, 2024). These technologies can collect demographic data on the audience present, such as age and gender, in order to personalise the advertisement displayed at that precise moment. This development is reshaping the business model, shifting from renting advertising space to targeting audiences with specific profiles in a manner very similar to online advertising. It also makes it possible to measure campaign effectiveness using specific metrics and optimise return on investment, something that is very difficult to achieve with conventional OOH advertising (Cuc and Secan, 2024; García, 2023; Yi-Fan et al., 2024; Roux et al., 2024; Fuentes and Bustos, 2022; Hyun-Woo et al., 2023).

Recall and recognition, meanwhile, are concepts analysed in order to establish the effect of brand management on memory. Although the two terms are related, they differ significantly. Their relationship stems from the fact that recall involves two phases: information retrieval and a sense of familiarity. Recognition, by contrast, is based solely on familiarity-based judgements. Recall is a more complex process than recognition because of its broader nature and the greater amount of information involved (Davtyan et al., 2016). Brand recall measures consumers' ability to bring a brand to mind within a specific context (Bauerova and Koprivova, 2025).

3.3 Types of DOOH Advertising and Levels of Brand Recall in Cities

Among the most common formats are digital billboards, which are typically located alongside roads or high-traffic routes and at intersections. These have even evolved to incorporate large LED screens. Another very common format is integrated into street furniture, such as bus shelters and MUPs. In some cases, these structures serve several functions: on the one hand, they display advertising and, on the other, they are decorative or provide useful information for citizens. DOOH technology also encompasses so-called multimedia displays, known as the "fifth screen", which feature in innovative formats, including building façade wraps and specially designed coverings. These not only provide advertising space but also help improve the city's image by concealing older façades during renovation work (Lou et al., 2020; Perez, 2022; Chiquito and Yance, 2019; Pedro and Camáñez, 2023).

A significant development is the introduction of 3D digital billboards using anamorphic illusion technology to create effects of depth. Mobile displays have also been developed that adapt to different architectural contexts. Digitalisation has enabled the incorporation of dynamic and audiovisual content, as well as more sophisticated capabilities such as touch sensors, augmented reality and contactless NFC. These technologies provide a level of interactivity that was previously impossible with traditional media (García, 2023; Mršić, 2023; Baungratz and Casarín, 2024; Felisberto and Casarín, 2024). Brand recall, meanwhile, comprises different levels and processes. The first and most basic is recognition based on an aided-recall test. At this level, individuals are presented with a list of product names within specific categories and identify those they have previously heard of, reflecting an initial level of brand awareness. At a more complex level is unaided recall, which is used to identify brands.

This process is defined as an individual's ability to retrieve a specific product or service from memory when provided with general information, such as the product category, the needs it satisfies or the context in which it is used. The highest level is top-of-mind awareness, which occurs when an individual spontaneously mentions a brand first and without any form of assistance, reflecting a high degree of salience. This level places the product ahead of its competitors within the same category, consolidating a particularly strong position in memory. As a result, the brand gains a significant competitive advantage, displacing others during the purchase decision-making process (Gamarra et al., 2023; Florian and Flores, 2021).

3.4. Advantages of DOOH for City Recall.

DOOH has grown rapidly and now surpasses traditional channels in terms of impact, creativity and innovation, as it is perceived as less intrusive and more effective in encouraging purchase behaviour. One factor that enhances its effectiveness is the novelty effect, which captures public attention and creates a memorable experience (García, 2023; Marx et al., 2025). In other words, these digital initiatives do more than simply convey an advertisement: they create engaging interactions that strengthen the connection between cities and their residents. Another advantage is that out-of-home advertising transforms streets into promotional spaces while simultaneously revitalising the urban environment. In doing so, it can project a cultural identity through female representation, diversity and the participation of women muralists. These designed walls generate an emotional connection with consumers, strengthening their sense of belonging and leaving a positive impression of the brand. Like well-designed DOOH advertising, this disruptive strategy demonstrates that art and culture can be powerful allies in creating memorable advertising experiences (Condemarín-Seminario et al., 2024).

Similarly, a greater sense of spatial presence in digital environments, as occurs in virtual reality (VR), increases enjoyment, which in turn strengthens the intention to recommend and improves attitudes towards the city. In this respect, system quality and interactivity influence the perceived ease of use of DOOH, which has a positive effect on attitudes towards and intentions to engage with the brand. These

formats can therefore generate engaging and memorable user experiences, provided that they are based on quality, interactivity and value-adding content (Marx et al., 2025; Tan Y-F et al., 2024).

3.5. Problems in the Implementation of DOOH in Cities and Solutions

Risks associated with street advertising are evident, as its designs can either enrich the urban experience or, conversely, generate visual pollution. The rapid growth of street advertising has brought significant consequences, including the excessive and disorderly use of open public spaces. It can also contribute to the loss of local identity if it is not managed according to criteria that respect traditions and customs while maintaining a balance with external influences (Baungratz and Casarin, 2024; Baungratz and Casarin, 2022; Garcia Carrizo, 2017). In addition, DOOH can affect road safety, as digital displays, particularly animated ones, may distract drivers and place pedestrians and other road users at risk. The problem therefore lies not only in the number of advertising installations, but also in their direct impact on urban quality of life and public safety (Felisberto and Casarin, 2024). The development of advertising in some large metropolitan areas can be positive, while at the same time creating a dilemma between commercial benefits and the need to preserve urban aesthetics. In such contexts, regulations have not succeeded in curbing the proliferation of illegal billboards that compromise both the appearance and safety of the urban environment (Widyo and Raras, 2023). Firm and responsible regulation is therefore essential to balance economic development with social well-being and the protection of public space.

Accordingly, clear rules should be established to regulate both the content and placement of advertisements, including limits on the number of words used and controls on light intensity (Felisberto and Casarin, 2024). In this context, a sustainable model for DOOH implementation is proposed, based on five fundamental pillars: harmonious integration into the city and adaptation to its context, the creation of shared value, long-term sustainability, reduction of environmental impact, and recognition of its cultural and symbolic importance. In this way, DOOH fulfils not only an advertising function but can also contribute to the identity and reputation of a city, even becoming a landmark that connects with local culture and values (García Carrizo, 2017).

4. Conclusions

The main objective of this study is to establish the relationship between Digital Out-of-Home (DOOH) advertising and brand recall in cities. The analysis of the various sources of information collected made it possible to identify the characteristics, types and advantages of DOOH (Digital Out-of-Home) advertising and city recall, as well as to identify solutions that have emerged in response to difficulties encountered in the implementation of advertising installations in open public spaces. First, the essence of this type of advertising lies in the use of digital screens installed in streets; printed posters are now being replaced by more dynamic technological media capable of generating considerable visual impact.

Unlike traditional formats, digital advertising is characterised by its flexibility, as advertisements can be updated immediately and multiple types of content can be displayed on the same medium. This is further enhanced by the use of artificial intelligence, which makes it possible to segment audiences anonymously and personalise messages in order to establish a closer relationship with residents. Another advantage of DOOH is interactivity. Through touch sensors, augmented reality, NFC or QR codes, passers-by and pedestrians can interact more easily with advertisements, thereby generating a deeper emotional connection and enabling campaign effectiveness to be measured with considerable precision. In other words, this format combines technology, creativity and analysis to provide more dynamic communication adapted to the urban environment.

With regard to recall, this is achieved when a brand remains in people's minds. To achieve this, it is necessary to offer something novel and creative in order to overcome the attention threshold and stimulate memorisation. Through innovation, brands can initially gain visibility and capture users' interest, a key step in enabling subsequent recall. Recall is also influenced by visual elements and the dimensions of the advertisement, including colour, contrast and visibility, as well as by emotional and immersive experiences that attract and influence users. Added to this dynamism is brands' ability to generate immersive and emotional experiences, which also affects recall. Both movement in advertisements and psychological connection are relevant because they engage audiences and evoke positive feelings towards the brand. Context and prestige also influence recall by reinforcing the brand's impact in consumers' minds.

The location of advertisements, particularly when they are situated close to points of consumption, strengthens the connection with users by creating an immediate link between the message and the act of purchase. Reputation and a favourable brand image, meanwhile, strengthen the brand's standing among the public by conveying solidity and exclusivity. Familiarity with the product also facilitates recognition and memorisation, as the more familiar a name or logo is, the more likely it is to remain in consumers' memory. With regard to DOOH formats, an examination of the physical media used has identified a wide variety of formats that are dynamically integrated into the urban landscape. Among the most common are digital billboards, which have evolved to incorporate large LED screens located in high-traffic areas.

Future research should analyse DOOH advertising in cities of different sizes, including small and medium-sized cities, metropolises and megacities. Comparisons should also be made between capital and non-capital cities, as well as between urban and rural contexts. Further research should likewise continue to examine digital out-of-home advertising and formats that rely exclusively on immersive technologies.

References

- Abad, E., Thrasher J., Arillo, E., Pérez, R., Barrientos, I., Kollath, C., Mejía, R. & Sargent, J. (2016). Recall, appeal and willingness to try cigarettes with flavour capsules: assessing the impact of a tobacco product innovation among early adolescents. *Tobacco Control*, 25(2), 113-119. <https://doi.org/10.1136/tobaccocontrol-2015-052805>
- Baumann, C., Hamin, H. & Chong, A. (2015). The role of brand exposure and experience on brand recall—Product durables vis-à-vis FMCG. *Journal of Retailing and Consumer Services*, 23, 21-31. <https://doi.org/10.1016/j.jretconser.2014.11.003>
- Baungratz, L., & Casarin, V. (2024). Reflexões sobre a mídia exterior em paisagens preservadas. *InfoDesign*, 21(2). <https://doi.org/10.51358/id.v21i2.1146>
- Baungratz, L., & Casarin, V. (2022). A mídia exterior na paisagem urbana: estudos recentes. *InfoDesign*, 19(2). <https://doi.org/10.51358/id.v19i2.948>
- Biscaia, R., Correia, A., Ross, S. & Rosado, A. (2014). Sponsorship effectiveness in professional sport: an examination of recall and recognition among football fans. *International Journal of Sports Marketing and Sponsorship*, 16(1), 2-18. <https://doi.org/10.1108/IJSMS-16-01-2014-B002>
- Boerman, S. C., Van Reijmersdal, E. A., & Neijens, P. C. (2015). How audience and disclosure characteristics influence memory of sponsorship disclosures. *International Journal of Advertising*, 34(4), 576-592. <https://doi.org/10.1080/02650487.2015.1009347>
- Brasel, S. & Gips, J. (2014). Enhancing television advertising: same-language subtitles can improve brand recall, verbal memory, and behavioral intent. *Journal of the Academy of Marketing Science*, 42(3), 322-336. <https://doi.org/10.1007/s11747-013-0358-1>
- Breva-Franch, E., Olivares-Delgado, F., & Benlloch Osuna, M. T. (2023). Sustainable outdoor advertising: A professional point of view from Spain, 14(1), 1-7. <https://doi.org/10.34135/communicationtoday.2023.Vol.14.No.1.7>
- Breva-Franch, E., & Camacho, M. M. (2016). El desarrollo de las ciudades desde la publicidad exterior y las neurociencias. Opción: *Revista de Ciencias Humanas y Sociales*, (7), 231-247. <https://www.redalyc.org/comocitar.oa?id=31048480016>
- Breves, P., & Schramm, H. (2019). Good for the feelings, bad for the memory: the impact of 3D versus 2D movies on persuasion knowledge and brand placement effectiveness. *International Journal of Advertising*, 38(8), 1264-1285. <https://doi.org/10.1080/02650487.2019.1622326>
- Calderón, S., Caviedes, S. & Chaparro, R. (2018). Branding sensorial y recordación de marca en adolescentes. Estudio de caso Colombia. *Tendencias en la Investigación Universitaria. Una visión desde Latinoamérica*, 3, 94-121. <https://dialnet.unirioja.es/servlet/articulo?codigo=7785394>
- Campbell, C., Sands, S. & Ferraro, C. (2020). How dark stories boost recall. *Journal of Strategic Marketing*, 31(7), 1279-1295. <https://doi.org/10.1080/0965254X.2020.1755352>
- Chiquito, C. A., & Yance, K. T. (2019). Diseño de un sistema de vallas publicitarias tipo prisma para promocionar productos y servicios en la ciudad de Guayaquil-Ecuador. *Revista Espacios*, 40, 16. <https://www.revistaespacios.com/a19v40n16/19401605.html>
- Condemarín-Seminario, R., Balabarca-Fataccioli, R., & Gallardo-Echenique, E. (2024). Arte y publicidad para transformar el espacio público. *Revista Ibérica de Sistemas e Tecnologías de Informação*, (E66), 13-25. <https://www.risti.xyz/issues/ristie66.pdf>
- Cuc, S.; Secan, C. (2024). Environmental Considerations and Sustainable Solutions for Outdoor Advertising Banners. *Sustainability*, 16, 5366. <https://doi.org/10.3390/su16135366>
- Davtyan, D., Stewart, K. & Cunningham, I. (2016). Comparing brand placements and advertisements on brand recall and recognition. *Journal of Advertising Research*, 56(3), 299-310. <https://doi.org/10.2501/JAR-2016-036>
- Del Vecchio, D. Jones, W. & Lee Baugh. (2023). From easy to known: How fluent brand processing fosters self-brand connection. *Psychology y Marketing*, 41(4), 754-777. <https://doi.org/10.1002/mar.21951>
- Erfgen, C., Zenker, S. & Sattler, H. (2015). The vampire effect: When do celebrity endorsers harm brand recall? *International Journal of Research in Marketing*, 32(2), 155-163. <https://doi.org/10.1016/j.ijresmar.2014.12.002>

- Felisberto, L., & Casarin, V. (2024). The influence of digital out-of-home media on driver perception and driving: an integrative literature review. *InfoDesign*, 21(3). <https://doi.org/10.51358/id.v21i3.1172>
- Fidelis, B., Oliveira, J., Giraldi, J. & Santos, R. (2017). Sexual appeal in print media advertising: effects on brand recall and fixation time. *Research Journal of Textile and Apparel*, 21(1), 42-58. <https://doi.org/10.1108/RJTA-12-2016-0033>
- Florian, O. & Flores, C. (2021). Modelo de Gestión Comercial para la Recordación de Marca en una Empresa PYME del Sector Calzado: Contexto COVID-19. *Ideas to Overcome and Emerge from the Pandemic Crisis: Proceedings of the 1st LACCEI International Multiconference on Entrepreneurship, Innovation and Regional Development*. 1-10. <https://doi.org/10.18687/LEIRD2021.1.1.10>
- Fondevila-Gascón, J.F, Gutiérrez-Aragón, Ó., Vidal-Portés, E., Pujol, O. (2023). Influencia del neuromarketing en la percepción de carteles publicitarios: factores determinantes en la atención. *Gráfica*, 11(22), 133_143. <https://doi.org/10.5565/rev/grafica.256>
- Fuentes-Santos P., Bustos Díaz J., Martín-Vicario L. & Papaoikonomou E. (2025). Publicidad Programática y Entorno Cookieless: Un Análisis de Contenido en los Medios Españoles. *Estudios sobre el Mensaje Periodístico*, 31(1), 237-251. <https://doi.org/10.5209/emp.97396>
- García Carrizo, J. (2023) City and communication: Effects and functions of digital advertising screens in the Gran Vía of Madrid | Ciudad y comunicación: Efectos y funciones de las pantallas digitales publicitarias en la Gran Vía Madrileña. *Área Abierta*, 23(3), 185-202. <https://revistaprismasocial.es/ps/article/view/1267>
- Hernandez, M. & Minor, M. (2014). False recall of brands in advergames: a cross-country comparison. *Journal of Research in Interactive Marketing*, 9(1), 54-69. <https://doi.org/10.1108/JRIM-11-2013-0075>
- Herrawing, L. & Poels, K. (2015). The impact of social setting on the recall and recognition of in-game advertising. *Computers in Human Behavior*, 53, 544-555. <https://doi.org/10.1016/j.chb.2014.06.012>
- Huang, M., Fang, Z., Weibel, R., Zhang, T., & Huang, H. (2020). Dynamic optimization models for displaying outdoor advertisement at the right time and place. *International Journal of Geographical Information Science*, 35(6), 1179-1204. <https://doi.org/10.1080/13658816.2020.1823396>
- Kakei, S. (2019). A Study of Brand Recall in Thailand. *ABAC Journal*, 39(3), 17-41. <http://doi.org/10.15722/jds.22.10.202410.65>
- Keller, K. (2008). *Strategic brand management: Building, measuring, and managing Brand equity* (3rd ed.). New Jersey: Pearson Education.
- Keller, K. L. (1993). Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. *Journal of Marketing*, 57(1), 1-22. <https://doi.org/10.2307/1252054>
- Kilijanek, A. & Ozga, W. (2022). Impact of various types of provocative advertisements on brand recall and attention engagement: Pilot study report. *Applied Cognitive Psychology*, 36(4), 946-953. <https://doi.org/10.1002/acp.3956>
- Kotler, & Keller. (2012). *Dirección de Marketing*. Cámara Nacional de la Industria Editorial Mexicana.
- Kotler, P. & Keller, K. (2006). *Dirección de Marketing* (12° ed.). Pearson Education.
- Kwon, J. (2024). Development and Utilization of Smart Projected Beam Advertising System for Public Transportation. *Tehnički glasnik*, 18 (1), 108-114. <https://doi.org/10.31803/tg-20230224094437>
- Lee, S. & Baack, D. (2014). Meaning or Sound? The Effects of Brand Name Fluency on Brand Recall and Willingness to Buy. *Journal of Promotion Management*, 20(5), 521-536. <https://doi.org/10.1080/10496491.2014.946203>
- Lee, J. & Davis, L. (2014). Deliver knowledge or touch the mind? The effect of informational and emotional advertisement strategy on fashion sportswear brand attitude and recall. *Journal of Global Fashion Marketing*, 5(2), 135-148. <http://dx.doi.org/10.1080/20932685.2013.878109>
- Leng, H., Rozmand, I., Low, Y. & Phua, Y. (2021). Effect of Social Environment on Brand Recall in Sports Video Games. *International Journal of Gaming and Computer-Mediated Simulations*, 13(1), 1-11. <https://doi.org/10.4018/IJGCMS.20210101.0a1>

- Lyu, D., Manas-Viniegra, L., & Xu, Z. (2025). Visual attention differences toward football stadium's naming rights: an eye tracking study. *Asia Pacific Journal of Marketing and Logistics*, 37(1), 189-209. <https://doi.org/10.2307/1252054>
- Marx, T., Welle, G., & Gier-Reinartz, N. R. (2025). Enhancing virtual reality experiences in grocery retailing: the impact of audio priming on spatial presence and retailer outcomes. *The International Review of Retail, Distribution and Consumer Research*, 1-25. <https://doi.org/10.1080/09593969.2025.2512303>
- Mena, A. & Arbaiza, F. (2024). Más allá del Match: Impacto de la Publicidad en Tinder en la Recordación de Marca en Jóvenes Peruanos. *Revista Ibérica de Sistemas e Tecnologías de Informação*, (E68): 388-397. <https://www.risti.xyz/issues/ristie68.pdf>
- Meng Huang, Zhixiang Fang, Robert Weibel, Tao Zhang & Haosheng Huang. (2021) Dynamic optimization models for displaying outdoor advertisement at the right time and place, *International Journal of Geographical Information Science*, 35:6, 1179-1204, <https://doi.org/10.1080/13658816.2020.1823396>
- Mposi, Z. S., Roux, T., & van Zyl, D. (2025). Content and Process as Motivational Factors in Digital Out-of-Home Media: The Mediating Role of Interaction in User Experience. *Human Behavior and Emerging Technologies*, (1), 8820265. <https://doi.org/10.1155/2024/3984159>
- Naderer, B., Matthes, J. & Binting, S. (2021) It is just a spoof: spoof placements and their impact on conceptual persuasion knowledge, brand memory, and brand evaluation, *International Journal of Advertising*, 40(1), 106-123, <https://doi.org/10.1080/02650487.2020.1793632>
- Natarajan, T., Balasubramaniam, S., Stephen, G., Inbaraj, D. & Kasilingam, D. (2018). The influence of audience characteristics on the effectiveness of brand placement memory. *Journal of Retailing and Consumer Services*, 44, 134-149. <https://doi.org/10.1016/j.jretconser.2018.06.008>
- Núñez-Pacheco, R., López-Pérez, B.-E., & Aguaded, I. (2022). Diseño emocional e inmersión en videojuegos narrativos. El caso de Detroit: Become Human. *Palabra Clave*, 25(4), e2543. <https://doi.org/10.5294/pacla.2022.25.4.3>
- Othman, N. H., Baharuddin, S. A., & Hassan, B. R. A. (2020). Papan iklan luar dan pemilihan sosial: Kajian kes papan iklan di Lebuh raya Elite Expressway E608. *Jurnal Komunikasi*, 36(4), 258-281. <https://doi.org/10.17576/JKMJC-2020-3604-16>
- Palomo-Domínguez, I., & Zemlickienė, V. (2022). Evaluation Expediency of Eco-Friendly Advertising Formats for Different Generation Based on Spanish Advertising Experts. *Sustainability*, 14(3), 1090. <https://doi.org/10.3390/su14031090>
- Pedro, J., & Camañez García, G. (2023). Series de televisión y publicidad exterior: vídeo bajo demanda en la ciudad contemporánea. *Fonseca, Journal of Communication*, 26, 303-326. <https://doi.org/10.14201/fjc.31219>
- Pérez, F. L., & Labandeira, S. T. (2017). La Influencia Del Diseño Exterior Del Establecimiento Comercial En La "Venta Libre" De La Oficina De Farmacia. *Revista Galega de Economía*, 26(2), 59-76. <https://www.redalyc.org/articulo.oa?id=39152751004>
- Piątkowska, M., & Gocłowska, S. (2016). Classification of ambush marketing methods in sport-evidence from the 2012 UEFA European championship. *International Journal of Contemporary Management*, 15 (1), 131. <https://doi.org/10.4467/24498939IJCM.16.007.4840>
- Rabanal-Chávez, E., Campos-Vásquez, N., Pérez-Heredia, C. M., Manturano-Chipana, R. K., & Diaz, M. a. D. (2022). Internet of Things (IoT) – scope, applicability and communication models. Proceedings of the 20th LACCEI International Multi-Conference for Engineering, Education and Technology: "Education, Research and Leadership in Post-pandemic Engineering: Resilient, Inclusive and Sustainable Actions." <https://doi.org/10.18687/laccei2022.1.1.652>
- Rao, A., Nandineni, R. D., Shetty, R. S., Mallaiah, K., & Kamath, G. B. (2025). Enhancing Walkability for Older Adults: The Role of Government Policies and Urban Design. *Infrastructures*, 10(4), 77. <https://doi.org/10.3390/infrastructures10040077>
- Roslan, M. M., & Fadzil, L. M. 6LOWPAN Equipped Streetlight with Digital Displays Redefines Pedestrian Advertising: An Emphasis on Cyber Security. *International Journal of Electrical and Electronics Engineering*. 12(5):353-374. <https://doi.org/10.14445/23488379/IJEEE-V12I5P127>
- Roux, A. T., Wannenburger, E., & Manetje, T. V. (2024). The Environment and Features of Digital Place-Based Media at Minibus Taxi Ranks as Nontraditional Advertising Media. *Advances in Human-Computer Interaction*, (1), 3984159. <https://doi.org/10.1155/2024/3984159>

- Sanz, R. B. (2016). Publicidad exterior, vandalismo y contrapublicidad. Algunos casos para el análisis. *Opción*, 32(11), 34-53. <https://www.redalyc.org/pdf/310/31048902004.pdf>
- Solís, F. M. (2016). La metáfora visual, elemento comunicador de las marcas en la publicidad exterior. *Prisma Social*, (17), 116-139. <https://revistaprismasocial.es/ps/article/view/1279>
- Seo, HW., Kim, SH., Ryu, SG. et al. Development of an offline OOH advertising recommendation system using negative sampling and deep interest network. *Multimed Tools Appl* 83, 11943–11955 (2024). <https://doi.org/10.1007/s11042-023-16083-5>
- Smith, W., Pitts, R., Mack, R. & Smith, J. (2016). Don't be one more logo on the back of the T-shirt: Optimizing sponsorship recall. *Journal of Convention & Event Tourism*, 17(2), 75-94. <http://dx.doi.org/10.1080/15470148.2015.1059782>
- Suárez-Carballo, F., Galindo-Rubio, F., y Martín-Sanromán, J. R. (2024). Estrategias visuales de los carteles cinematográficos en las principales plataformas de Video On Demand (VOD) en España. *Revista Mediterránea de Comunicación*, 15(1), 201-216. <https://www.doi.org/10.14198/MEDCOM.25490>
- Tan Y-F, Leow M-C and Ong L-Y (2024). Evaluation of the extended TAM for digital signage augmented roadshow (DiSAR) using PLS-SEM. *Front. Comput. Sci.* 6:1449908. <https://doi.org/10.3389/fcomp.2024.1449908>
- Tan, S. & Pyun, D. (2019). The Effectiveness of Sponsorship of the F1 Singapore Grand Prix: Recall and Recognition. *International Journal of Asian Business and Information Management*, 9(1), <https://doi.org/10.4018/IJABIM.2018010101>
- Urban, M., Avilés, D. J. V., Bojović, M., & Urban, K. (2020). Artificial, cheap, fake: Free associations as a research method for outdoor billboard advertising and visual pollution. *Human Affairs*, 30(2), 253-268. <https://doi.org/10.1515/humaff-2020-0023>
- Vashisht, D. & Royne, M. B. (2016). Advergame speed influence and brand recall: The moderating effects of brand placement strength and gamers' persuasion knowledge. *Computers in Human Behavior*, 63 (4), 162-169. <https://doi.org/10.1016/j.chb.2016.05.022>
- Wang, J.L., Li, H.L. & Shan, S. (2020). Computer vision-based OOH audience measurement system. In *Proceedings of the 20th International Conference on Electronic Business*, 468-473. ICEB'20, Hong Kong SAR, China, December 5-8.
- Widyo Harsanto, P., & Raras Satuti, K. (2023). Impact of Advertisements on Public Spaces and Environmental Aesthetics: Insights from Indonesia. *Journal of the International Society for the Study of Vernacular Settlements*, 10(9), 210-227. <http://digilib.isi.ac.id/id/eprint/15249>
- Xu, Z., Cao, Y. & Matsuoka, H. (2024). The effects of different billboard advertisement language on TV sports audiences' recognition, recall and search intention of the sponsor signage. *Asia Pacific Journal of Marketing and Logistics*, 36(8), 1801-1820. <https://doi.org/10.1108/APJML-09-2023-0842>
- Zuza, L., & Ahtik, J. (2022). *Analysis and design of animated posters*. GRID-2022.