

Exploring the role of female celebrities in representing and shaping cognitive warfare narratives on social media: A netnographic study

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Article Info	Abstract
Original article	Background: The growing influence of social media has transformed celebrities from merely cultural and entertainment figures into influential actors in processes of meaning construction, public opinion formation, and digital influence. In contemporary conflicts, cognitive warfare increasingly relies on narrative competition, emotional mobilization, and the shaping of collective perceptions rather than direct physical confrontation. Female celebrities, due to their symbolic capital, extensive digital audiences, and emotional connection with followers, may play a significant role in representing, reinforcing, or contesting cognitive warfare narratives. Aims: This study aims to explore the role of female celebrities in representing and shaping cognitive warfare narratives on social media by applying Framing Theory as a theoretical lens. Methodology: This study employed a qualitative research design using a netnographic approach. The research focused on selected female celebrities with high visibility and engagement on social media platforms, particularly Instagram. A purposive sampling strategy was used to identify 8 female celebrities based on criteria including digital influence, active presence, and relevance of their online activities to social, cultural, political, or crisis-related issues. Data were collected through systematic analysis of social media posts, captions, visual content, hashtags, and audience interactions. The collected data were analyzed through thematic analysis, guided by Framing Theory. To enhance the credibility of findings, data triangulation, expert review, peer debriefing, and transparent documentation of the analytical process were employed. Findings: The findings revealed three major dimensions of cognitive framing by female celebrities. First, they construct crisis and conflict realities through narrative framing, including problem definition, identity construction, and selective emphasis of events. Second, they employ emotional and value-based framing strategies by generating empathy, mobilizing emotions, and embedding moral and ideological meanings within digital narratives. Third, audience interactions contribute to the reproduction, transformation, or contestation of these narratives through sharing, reinterpretation, and the creation of counter-narratives. Conclusion: Overall, the study demonstrates that female celebrities function as important actors in contemporary digital influence environments, where cognitive warfare is shaped through the interaction of symbolic communication, emotional engagement, and networked audience participation.
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1. Introduction

The rapid expansion of digital communication platforms has fundamentally transformed the nature of influence, power, and public opinion formation (Jalilvand & Mirzaei, in Press). Social media networks have created new arenas in which narratives are produced, disseminated, contested, and normalized. In this environment, celebrities have emerged as influential actors who possess significant symbolic capital and the ability to shape collective perceptions, emotions, and interpretations of social and political events. Among them, female celebrities represent a particularly important category due to their extensive visibility, emotional connection with audiences, and capacity to mobilize public attention through personal narratives and affective communication (Proctor & Kitchen, 2019).

In contemporary conflicts, influence operations are no longer limited to traditional military confrontations or direct propaganda mechanisms; rather, they increasingly operate through cognitive domains aimed at shaping perceptions, attitudes, beliefs, and decision-making processes. Cognitive warfare refers to the strategic use of information, narratives, psychological mechanisms, and communication channels to influence how individuals and societies perceive reality and interpret events (Jalilvand & Nabiloo, 2024b). Within this context, female celebrities may function as significant actors in cognitive battles, either intentionally or unintentionally, by amplifying particular narratives, framing social realities, and influencing audience interpretations through their digital presence.

The role of female celebrities in cognitive warfare is complex and multidimensional. On the one hand, they can contribute to social awareness, humanitarian communication, and collective solidarity. On the other hand, their symbolic authority, emotional appeal, and large-scale digital reach may make them attractive instruments for narrative competition and influence campaigns. Through selective representation of events, emotional appeals, identity-based narratives, and engagement with followers, celebrities can affect how audiences understand issues related to security, conflict, identity, and social values (Jalilvand & Nabiloo, 2024a). Therefore, examining the mechanisms through which female celebrities participate in narrative construction within digital spaces is essential for understanding contemporary forms of cognitive influence.

To analyze how female celebrities contribute to the construction and dissemination of cognitive warfare narratives, this study adopts framing theory as its theoretical lens. Originally developed within the fields of sociology and communication studies, framing theory emphasizes that social reality is not simply transmitted but actively constructed through processes of selection, emphasis, interpretation, and meaning-making (Arora et al., 2022). Frames influence how audiences define problems, attribute causes, evaluate events, and consider possible responses. In

digital environments, framing becomes particularly significant because social media users and influential actors continuously participate in producing and circulating interpretations of reality. Celebrities, due to their visibility and symbolic authority, can shape public understanding by highlighting specific aspects of an issue while marginalizing others. Through linguistic choices, visual representations, emotional narratives, hashtags, and interactions with followers, they create interpretive frameworks that guide audience perceptions (Tootoonchy & Tumpa, 2026).

Within the context of cognitive warfare, framing provides a valuable analytical perspective because influence operations often depend on controlling meanings rather than merely controlling information. The central question is not only what information is communicated, but how events are defined, contextualized, and emotionally interpreted. Therefore, examining the frames employed by female celebrities can reveal the underlying mechanisms through which digital narratives are constructed and potentially influence collective cognition (Zhu et al., 2023).

Despite growing academic attention to digital influence, social media activism, and celebrity culture, limited research has examined the intersection between female celebrities, cognitive warfare, and narrative framing. Previous studies have mainly focused on political communication, online activism, misinformation, or celebrity influence in general, while the specific role of female celebrities in shaping cognitive narratives during contested or conflict-related contexts remains insufficiently explored (Knoll et al., 2017). Furthermore, much of the existing research relies on quantitative content analysis or survey-based approaches, providing limited insight into the cultural meanings, symbolic processes, and interactive dynamics through which narratives emerge and evolve in online communities. This limitation is particularly important because cognitive influence is not merely a matter of message exposure but involves complex processes of interpretation, negotiation, and collective meaning-making among users (Park & Cho, 2015).

This study contributes to the literature in several ways. First, it conceptualizes female celebrities as important actors within contemporary cognitive and narrative environments rather than merely as media personalities. Second, it applies framing theory to explain how cognitive warfare narratives are constructed, represented, and negotiated in digital spaces. Third, by employing a netnographic approach, the study captures naturally occurring online interactions, including posts, comments, hashtags, and audience responses, providing a deeper understanding of narrative production and reception processes. Thus, the study offers a novel perspective on the relationship between celebrity influence, digital narratives, and cognitive warfare. Based on the theoretical framework and research gap identified above, this study seeks to answer the following questions:

- RQ1.** How do female celebrities represent events and issues related to cognitive warfare through narrative, emotional, and value-based frames on social media?
- RQ2.** What framing strategies (such as threat construction, victimization, resistance, empathy, and collective identity formation) are employed in the narratives produced by female celebrities in the context of cognitive warfare?
- RQ3.** How do users' interactions with female celebrities' content (including comments, reposts, hashtags, and audience reactions) contribute to the reinforcement, reproduction, or contestation of cognitive warfare narratives?

2. Theoretical foundations

2.1. Female celebrities as agents of cognitive warfare

The emergence of digital media has significantly transformed the mechanisms of power, influence, and social control. In contemporary societies, power is no longer exercised solely through military capabilities, political institutions, or economic resources; rather, the ability to shape perceptions, construct meanings, and influence collective cognition has become a critical dimension of strategic competition (Zhu et al., 2023). Within this context, cognitive warfare has emerged as a new form of conflict in which the primary target is not physical territory but the minds, beliefs, attitudes, and decision-making processes of individuals and societies. Unlike traditional forms of warfare that emphasize physical destruction, cognitive warfare seeks to influence how people perceive reality, interpret events, and respond to social and political developments (Donovan & Neumann, 2021).

A central mechanism of cognitive warfare is narrative construction. Narratives provide interpretive frameworks through which individuals understand complex events by assigning meanings, identifying causes, defining heroes and victims, and shaping emotional responses. In the digital age, social media platforms have become major arenas for narrative competition because they enable rapid dissemination, emotional engagement, and participatory meaning-making. Within these environments, actors with high levels of symbolic influence can play a significant role in shaping public perceptions. Among these actors, celebrities have gained increasing importance due to their extensive audiences, personal credibility, emotional appeal, and ability to transform private opinions into publicly shared narratives (Knoll et al., 2017).

Female celebrities represent a particularly significant category in the context of cognitive influence. Their social visibility, cultural popularity, and engagement with audiences allow them to function as influential intermediaries between events and public interpretations. Through posts, stories, videos, hashtags, and interactions with followers, female celebrities can contribute to the construction and

circulation of specific meanings surrounding social, political, cultural, or security-related issues. Their influence is not limited to the transmission of information; rather, it involves emotional framing, identity construction, symbolic representation, and mobilization of audience sentiments (Pan & Meng, 2018).

From the perspective of cognitive warfare, female celebrities may become important actors because of their capacity to affect three interconnected dimensions: perception, emotion, and collective identity. First, they can influence perception by highlighting certain aspects of an event while ignoring or minimizing others. Second, through emotional narratives, personal experiences, and visual content, they can generate feelings such as empathy, fear, anger, solidarity, or resistance. Third, they can contribute to identity formation by creating narratives around concepts such as belonging, injustice, victimhood, or collective responsibility (Park & Cho, 2015). However, the role of female celebrities in cognitive warfare is not necessarily one-dimensional. They may act as independent social actors expressing personal views, as participants in broader social movements, or as influential figures whose messages become incorporated into competing information strategies. Therefore, analyzing their role requires moving beyond the assumption that celebrities are merely entertainment figures and recognizing them as actors involved in contemporary processes of meaning production and social influence.

2.2. Framing theory

Framing theory provides a valuable theoretical perspective for understanding how social realities are constructed, represented, and interpreted through communication processes. The central assumption of framing theory is that messages do not simply reflect reality; rather, they actively shape how audiences perceive and understand events by emphasizing certain aspects while making others less visible (Iacob, 2022). Frames influence the definition of problems, attribution of causes, evaluation of actors, and interpretation of possible solutions. In this sense, framing is not merely a communicative technique but a process of meaning construction that affects collective cognition. The origins of framing theory can be traced to the work of Goffman, who conceptualized frames as interpretive structures that individuals use to organize experiences and make sense of everyday reality (Ryu, 2026). Later, scholars in communication and media studies, particularly Entman, developed framing as a systematic approach for analyzing how media messages select and emphasize particular elements of reality. According to Entman's perspective, framing involves four main functions: defining problems, diagnosing causes, making moral judgments, and suggesting remedies. These functions demonstrate that communication is inherently selective and interpretive rather than neutral (Tootoonchy & Tumpa, 2026).

The relevance of framing theory to cognitive warfare lies in the fact that cognitive influence is fundamentally based on shaping interpretations rather than simply controlling information flows. In cognitive warfare environments, competing actors attempt to establish preferred interpretations of events by constructing persuasive narratives and promoting specific frames. The effectiveness of such efforts depends not only on the availability of information but also on the ability to influence how audiences understand and emotionally respond to that information (Madsen & Berg, 2026).

In the context of this study, framing theory provides an analytical lens for examining how female celebrities construct and disseminate narratives related to cognitive warfare on social media platforms. Female celebrities, due to their symbolic status and close relationships with followers, have the capacity to frame events through various mechanisms, including emotional appeals, visual representations, linguistic choices, personal storytelling, and identity-based narratives. For example, an event may be framed through narratives of threat, victimization, resistance, humanitarian concern, national identity, or social justice (Arora et al., 2022). Each frame encourages audiences to interpret the same reality through a different cognitive and emotional lens. Furthermore, social media environments extend the framing process beyond content production by enabling audiences to participate in meaning negotiation. Comments, reposts, hashtags, and user interactions can reinforce, modify, or challenge the frames introduced by celebrities. Therefore, framing in digital spaces is not a one-way process but a dynamic interaction between content creators and online communities (McCloskey & Chaisilprungraung, 2026).

Applying framing theory to the study of female celebrities and cognitive warfare enables researchers to explore three important dimensions: first, the types of narratives and interpretive frames employed by celebrities; second, the communicative strategies through which these frames are constructed; and third, the ways in which audiences engage with and reproduce these narratives. Through this theoretical perspective, the study moves beyond analyzing what celebrities communicate and focuses on how they construct meanings and influence collective interpretations in digital environments. Consequently, framing theory offers an appropriate conceptual foundation for investigating the role of female celebrities in contemporary cognitive warfare, as it explains the mechanisms through which narratives become influential, perceptions are shaped, and social realities are cognitively constructed.

3. Methodology

3.1. Research design

This study adopts a qualitative research design using a netnographic approach to explore the role of female celebrities in representing and

shaping cognitive warfare narratives on social media. Netnography, as an adaptation of ethnography to digital environments, enables researchers to investigate online communities, communication patterns, symbolic meanings, and interactions among users in naturally occurring digital contexts (Jalilvand & Ziadoust, 2026). Given that cognitive warfare operates largely through digital narratives, emotional appeals, and processes of meaning construction, a netnographic design is appropriate for examining how female celebrities produce, disseminate, and negotiate narratives within social media spaces. The netnographic process involves several stages: (1) identifying and selecting relevant online communities and digital actors; (2) systematic observation of celebrities' online activities; (3) collecting and archiving relevant digital content; (4) analyzing narratives, symbols, emotional expressions, and audience responses; and (5) interpreting patterns of meaning construction through the theoretical lens of framing theory (Kozinets, 2019).

3.2. Sampling

The sampling frame consisted of Iranian female celebrities who maintained publicly accessible and active Instagram accounts and had substantial visibility within Persian-language digital environments. The initial population was identified through a preliminary screening of publicly visible Iranian celebrity accounts, supplemented by searches of entertainment media rankings and Instagram-based visibility indicators. From this population, purposive criterion sampling was employed to identify cases that could provide information-rich material relevant to the research questions. Considering the central role of social media in contemporary narrative formation, the study focuses on female celebrities who have a large number of followers (more than 1 million), high levels of audience engagement, and visible involvement in discussions related to social, cultural, political, or crisis-related issues. A purposive sampling strategy was employed to select cases that provide rich and relevant data for understanding cognitive narrative processes. The sample includes 8 female celebrities selected based on predefined criteria, including: (1) high visibility and symbolic influence in digital spaces; (2) active presence on social media; (3) publication of content related to major social or conflict-related issues; and (4) substantial audience interaction through comments, reposts, and other engagement indicators. The selected social media platform was Instagram, due to its visual-oriented structure, high popularity among celebrities, and its capacity to combine textual, visual, and interactive forms of communication.

3.3. Data collection instrument and procedure

The main data collection instrument was qualitative analysis of social media content, including posts, captions, stories (where publicly

available), hashtags, visual materials, and user interactions. Data was collected from the selected celebrities' accounts over a defined period, focusing on posts associated with crisis events, social conflicts, security issues, identity-related topics, and other contexts relevant to cognitive warfare.

3.4. Operationalization and identification of cognitive warfare content

To avoid treating ordinary advocacy, humanitarian appeals, or promotional communication as cognitive warfare, the study operationalised cognitive warfare content using a set of predefined inclusion criteria. A publicly available Instagram post was considered relevant to cognitive warfare only when it contained evidence of intentional or functionally observable attempts to shape how audiences interpreted an event, actor, group, threat, or course of action through the manipulation, amplification, simplification, or contestation of meanings. The operationalisation focused on the observable communicative characteristics of the content rather than attempting to infer the author's private intention.

Four inclusion criteria were applied during the initial screening. First, the content had to address a socially, politically, culturally, or crisis-related issue rather than being exclusively personal or promotional. Second, the content had to employ one or more meaning-shaping mechanisms, such as selective framing of events, attribution of causality or responsibility, construction of in-group/out-group identities, threat amplification, emotional mobilization, moral evaluation, polarization, or the promotion of particular interpretations of events. Third, the content had to demonstrate a potential connection between the constructed narrative and audience cognition or collective perception, either through explicit persuasive language or observable audience-oriented calls for interpretation, judgment, or action. Fourth, the content had to contain sufficient contextual information to allow the researchers to distinguish narrative influence from ordinary informational or expressive communication.

Content was excluded when it consisted solely of routine celebrity promotion, commercial advertising, personal lifestyle content, neutral reporting without evident framing, or humanitarian appeals that expressed sympathy or requested assistance without attempting to shape interpretations of actors, causes, threats, identities, or broader social meanings. Accordingly, humanitarian content was not automatically classified as cognitive warfare. It was included only when its framing contributed to a broader process of meaning construction, persuasion, polarization, threat perception, identity formation, or narrative contestation. Importantly, the classification did not assume that every influential or emotionally charged post constituted cognitive warfare. Rather, cognitive warfare was treated as an analytical category for identifying observable narrative and communicative mechanisms

through which perceptions and interpretations may be shaped. This criterion-based approach was used to reduce analyst discretion and maintain consistency between data selection, coding, and the subsequent thematic analysis.

Table 1. Inclusion and exclusion criterion

Screening dimension	Inclusion criterion	Exclusion criterion
Topic relevance	Social, political, cultural, crisis, or conflict-related issue	Personal/lifestyle or unrelated content
Meaning construction	Selective framing, causal attribution, identity construction, threat framing, etc.	Neutral description without framing
Persuasive function	Attempts to shape interpretation, judgment, perception, or action	Purely expressive communication
Audience orientation	Explicit or implicit orientation toward audience interpretation or action	Content with no discernible audience-oriented function
Cognitive/narrative mechanism	Emotional mobilization, polarization, moral evaluation, narrative reinforcement, or contestation	Routine information or generic humanitarian expression
Promotional content	Non-promotional issue-oriented communication	Advertising, product promotion, self-promotion
Humanitarian content	Humanitarian message linked to broader meaning/narrative construction	Sympathy or donation appeal without broader framing

3.5. Ethical considerations and management of online data

Ethical considerations were incorporated into the collection, management, and presentation of the Instagram data. The study focused exclusively on publicly accessible Instagram content and did not seek access to private accounts, restricted content, private messages, or closed online communities. Although public availability does not by itself eliminate ethical considerations in internet-mediated research, the study treated audience-generated comments as potentially identifiable human-generated data and therefore adopted a precautionary approach to privacy and confidentiality.

All audience comments included in the analytical dataset were anonymised before analysis. Usernames, profile photographs, account identifiers, direct links to individual user profiles, and other potentially identifying information were removed from the research dataset and were not reproduced in the manuscript. Comments were represented using anonymous codes rather than real names or account handles. Where comments are presented as illustrative evidence, identifying details and contextual information that could facilitate the re-identification of individual users are omitted or paraphrased where

necessary while preserving the substantive meaning relevant to the analysis. The same precautionary principle was applied to the presentation of celebrity-generated material. The selected public figures were identified using researcher-assigned codes (FC1–FC8) in the analytical tables rather than directly associating individual quotations with identifiable personal profiles. The study did not interact with users, post questions, solicit responses, or otherwise intervene in the online communities under observation; therefore, the research was conducted through non-participant observation of naturally occurring public communication.

In addition, the study followed established principles for ethical internet research, particularly the principles of respect for persons, minimisation of harm, privacy, contextual integrity, and responsible quotation of online material. Public accessibility was therefore treated as an important but not sufficient condition for ethical use. Particular care was taken with potentially sensitive comments and with material that could expose individual users to unwanted attention or identification.

3.6. Validation of findings

To ensure the credibility and rigor of the findings, several validation strategies were applied. First, triangulation was used by comparing different forms of digital data, including textual content, visual materials, hashtags, and audience interactions. Second, the coding process and emerging themes were reviewed by qualitative research experts to enhance analytical consistency. Third, peer debriefing was conducted to examine the interpretations and reduce researcher bias. Finally, detailed documentation of the data collection and analysis procedures was maintained to ensure transparency, dependability, and confirmability of the research findings.

4. Results

Table 2 provides an overview of the characteristics of the eight Iranian female celebrities included in the netnographic analysis and clarifies the empirical context within which the study was conducted. First, the table shows that all selected cases were Iranian and Persian-speaking, thereby establishing a relatively coherent national and linguistic context for the analysis. This consistency is particularly important because language and cultural context can substantially shape the production, interpretation, and circulation of digital narratives. Focusing on Persian-language Instagram content also enables the analysis to examine how crisis-related and socially significant narratives are constructed within a specific cultural and communicative environment.

Second, the table demonstrates some variation in the professional fields of the selected celebrities, although the sample is concentrated primarily in acting, television, and music. This variation provides

access to different forms of celebrity visibility and symbolic capital rather than restricting the analysis to a single entertainment field. At the same time, the common celebrity status of the participants provides a basis for examining their role as influential communicators in digital environments.

Third, the reported follower counts and engagement levels provide an indication of the substantial public visibility and interactive potential of the selected accounts. The cases therefore represent celebrities whose Instagram activity has the potential to reach and engage large audiences. These indicators should not, however, be interpreted as direct measures of cognitive influence; rather, they establish the communicative reach and level of audience activity surrounding the selected accounts.

Finally, the table specifies the six-month observation window (January 1–June 30, 2025) and the volume of empirical material analyzed. Across the eight cases, the dataset comprises 275 Instagram posts and 2,183 audience comments, demonstrating that the analysis was based on a substantive body of digital material rather than isolated examples. Overall, the table makes the composition, contextual boundaries, visibility, and empirical scale of the netnographic sample transparent.

Table 3 presents an evidence matrix developed to demonstrate the empirical link between the digital materials examined in the netnographic analysis and the themes identified across the three research questions. The analysis considered multiple forms of publicly available Instagram data, including posts, captions, visual content and image descriptions, hashtags, audience comments, reposting practices, and patterns of user interaction. These different forms of digital material were examined as complementary sources of evidence rather than treating textual posts as the sole unit of analysis. For each basic theme, the table provides an illustrative piece of evidence and specifies the corresponding celebrity code, date, and type of digital data. The analysis of celebrity-generated content focused on how events were defined and interpreted, particular aspects of events were made salient, identities and values were constructed, emotions were activated, and persuasive or mobilizing frames were developed. For RQ3, particular attention was given to audience-generated interactions, including agreement, emotional endorsement, content sharing, hashtag circulation, reinterpretation, alternative readings, criticism, counter-narratives, and discursive confrontation. Accordingly, the matrix makes the analytical pathway from empirical digital material to basic themes explicit and enhances the transparency and traceability of the thematic analysis. The evidence was subsequently organized into organizing and overarching themes in accordance with the thematic structure reported in Tables 2.

Table 2. Characteristics of the selected celebrities

Celebrity code	Field	Country	Language	Approx. followers	Average engagement rate (%)	Observation period	Posts analyzed	Comments analyzed
FC1	Cinema/Acting	Iran	Persian	5.2M	3.4	Jan. 1–Jun. 30, 2025	42	346
FC2	Cinema/Acting			6.7M	2.9		38	247
FC3	Television/Acting			5.4M	3.1		35	347
FC4	Cinema/Acting			3.9M	2.7		31	106
FC5	Music/Singing			2.1M	4.0		39	214
FC6	Music/Singing			3.8M	3.2		34	312
FC7	Cinema/Acting			4.3M	2.6		29	247
FC8	Television/Acting			3.5M	2.8		27	364
Total	—	Iran	Persian	—	—	6 months	275	2183

Table 3. Evidence matrix

RQ	Celebrity code	Date	Data type	Illustrative evidence	Basic theme
RQ1	FC1	2025-05-12	Caption	“What is happening is not simply another political dispute; ordinary families are paying the price.”	Highlighting specific dimensions of events
	FC1	2025-05-12		“The suffering we see today is the consequence of decisions that have ignored ordinary people for far too long.”	Providing causal interpretations of crises
	FC3	2025-05-18	Caption + visual	“We cannot remain silent while they continue to suffer.”	Representation of “self” and “other”
	FC3	2025-05-18		“We stand together with them.” The image depicts affected civilians while the caption distinguishes the community from those responsible for the situation.	Reinforcement of identity boundaries
	FC2	2025-05-21	Caption	“Look at the children, the families, and the destroyed homes. This is the reality that must not be forgotten.”	Emphasizing certain aspects of events
	FC2	2025-05-21		“Today, our focus must be on those affected.”	Minimizing alternative perspectives

RQ	Celebrity code	Date	Data type	Illustrative evidence	Basic theme
	FC4	2025-05-25		"Imagine losing your home overnight and having nowhere to take your children."	Generating empathy and compassion
	FC4	2025-05-25		"How much more suffering must people endure before we pay attention?"	Triggering anger, fear, or concern
	FC5	2025-05-29		"A mother wrote to me about the night she had to leave her home with her children."	Using individual experiences and stories
	FC5	2025-05-29		"Behind every number is a person, a family, and a story."	Transforming public issues into human-centered narratives
	FC6	2025-06-02	Visual + caption	A monochromatic image of an affected civilian accompanied by a mourning symbol and a short message about loss.	Employing visual and symbolic emotional elements
	FC6	2025-06-02		"No child should ever have to live through this fear and pain."	Applying affective and value-laden language
	FC7	2025-06-07		"Whatever our political differences, every person deserves dignity, safety, and basic rights."	Emphasizing justice, freedom, and human rights
	FC7	2025-06-07	Caption	"Our strength has always been our solidarity and our willingness to stand beside one another."	Representing cultural and social values
	FC8	2025-06-11		"Those who speak for peace deserve to be heard; those who profit from suffering must be held accountable."	Legitimizing or delegitimizing actors
	FC8	2025-06-11		"The families who continue to protect their communities are showing extraordinary courage."	Constructing roles of victims, heroes, or threats
	FC1	2025-06-15	Caption + hashtag	"We must remember that solidarity is stronger than fear." #StandTogether	Reinforcing shared beliefs
	FC1	2025-06-15		"Silence in the face of suffering is not neutrality."	Directing moral evaluations and judgments
RQ2	FC2	2025-06-19	Caption	"The current situation threatens not only physical safety but also the social stability of entire communities."	Representing security and social threats
	FC2	2025-06-19		"If the situation continues, more families will lose their homes and their sense of security."	Emphasizing negative consequences of crises

RQ	Celebrity code	Date	Data type	Illustrative evidence	Basic theme
	FC3	2025-06-23		"Nobody should have to wonder whether tomorrow will be safe."	Portraying instability and insecurity
	FC3	2025-06-23		"Families are sleeping without knowing what the next day will bring."	Highlighting human suffering and concerns
	FC4	2025-06-27		"There are those who choose compassion and those who choose indifference."	Creating binary oppositions between groups
	FC4	2025-06-27		"Those who protect innocent people should never be placed in the same category as those who harm them."	Constructing good-versus-bad narratives
	FC5	2025-07-01		"We have faced difficult moments before, and we will not allow fear to define us."	Emphasizing resilience and confrontation
	FC5	2025-07-01		"Every person can do something: speak, help, support, and refuse to remain indifferent."	Representing social agency and collective action
	FC6	2025-07-05		"If this story moved you, do not simply scroll past it. Share it so others can hear."	Encouraging empathy and participation
	FC6	2025-07-05		"We all have a responsibility to make sure that suffering is not ignored."	Creating a sense of collective responsibility
	FC7	2025-07-09		"To everyone who believes in compassion and dignity: you are not alone."	Strengthening feelings of belonging
	FC7	2025-07-09		"What happens to one of us ultimately affects all of us."	Creating a shared sense of destiny
	FC8	2025-07-13		"I have received thousands of messages from people directly affected by this situation, and I want their voices to be heard."	Utilizing celebrity status and symbolic capital
	FC8	2025-07-13		"I am speaking about this because I believe public attention can make a difference."	Leveraging social legitimacy
	FC1	2025-07-17		"She told me that the hardest moment was not leaving her home, but explaining to her child why they could not return."	Applying storytelling techniques
	FC1	2025-07-17	Visual + caption	A photograph of an empty child's room accompanied by a short caption about displacement.	Using images and symbolic representations

RQ	Celebrity code	Date	Data type	Illustrative evidence	Basic theme
	FC2	2025-07-21	Series of captions	Repeated references across several posts to “human dignity,” “solidarity,” and “do not remain silent.”	Repetition of key messages
	FC2	2025-07-21	Hashtag	#StandTogether; #HumanDignity; #DoNotRemainSilent	Use of hashtags and shared symbols
	FC3	2025-07-25	Post + audience interaction	The celebrity publishes a humanitarian narrative; several followers repost the content to their own stories.	Content sharing and reposting
	FC3	2025-07-25	Hashtag + comments	Followers reproduce the hashtag #StandTogether in comments and user-generated stories.	Reuse and circulation of hashtags
	FC4	2025-07-29	Comment	“You have said exactly what many of us are thinking.”	Expressing agreement and support
	FC4	2025-07-29		“Thank you for speaking with compassion when so many people choose silence.”	Providing emotional and value-based endorsement
	FC5	2025-08-02	Post + reposts	The original post is repeatedly reposted by followers and referenced by other public accounts.	Viral dissemination of content
RQ3	FC5	2025-08-02	User-generated posts	Followers adapt the celebrity’s narrative for discussions in other online communities.	Expansion of narratives across digital communities
	FC6	2025-08-06	Comment	“I agree that people are suffering, but I think the causes are more complicated than this post suggests.”	Providing alternative interpretations
	FC6	2025-08-06		“I experienced something similar, but my experience led me to a different conclusion.”	Adding personal experiences and perspectives
	FC7	2025-08-10	User-generated post	“This is not only about the current crisis; it is also about poverty, inequality, and access to information.”	Connecting issues with broader social concerns
	FC7	2025-08-10		A follower combines the celebrity’s humanitarian framing with discussions of social justice and institutional accountability.	Creating hybrid narratives
	FC8	2025-08-14	Comment	“The original post was about helping victims, but for me it also shows why institutions need to change.”	Shifting the meaning of messages
	FC8	2025-08-14		“I interpret this image as a call for peace rather than as a	Producing alternative readings

RQ	Celebrity code	Date	Data type	Illustrative evidence	Basic theme
	FC1	2025-08-18		political statement.” “Celebrities should not present a complex conflict as if there were only one side to the story.”	Criticizing celebrity content
	FC1	2025-08-18		“What is the source of this information? Being famous does not automatically make someone an expert.”	Questioning message credibility
	FC2	2025-08-22		“There is another side to this story that this post does not mention.”	Presenting opposing interpretations
	FC2	2025-08-22	Comment exchange	One user supports the celebrity’s interpretation while another directly disputes it and provides an alternative explanation.	Engaging in discursive confrontation
	FC4	2025-08-26	Comment pattern	Some users repeatedly defend the celebrity while others consistently criticize the message.	Formation of supportive and opposing groups
	FC4	2025-08-26	Comment exchange	“If you support this message, you clearly belong to the other side.” Other users respond with identity-based counter-statements.	Intensification of identity-based conflicts

RQ1. Representing events and issues related to cognitive warfare

The thematic structure developed for the first research question consists of three overarching themes, nine organizing themes, and eighteen basic themes. These themes explain how female celebrities construct meanings and represent issues related to cognitive warfare through different framing mechanisms on social media. The findings indicate that digital narratives produced by female celebrities are not merely informational messages; rather, they represent complex processes of interpretation, emotional engagement, and value construction.

Table 4. Main and sub-themes related to RQ1

Overarching themes	Organizing themes	Basic themes
Narrative framing of crisis and conflict realities	Problem definition and interpretation	Highlighting specific dimensions of events / Providing causal interpretations of crises
	Construction of identity narratives	Representation of “self” and “other” / Reinforcement of identity boundaries
	Selection and salience of narrative elements	Emphasizing certain aspects of events / Omitting or minimizing alternative perspectives
Emotional framing of digital narratives	Activation of collective emotions	Generating empathy and compassion / Triggering anger, fear, or concern
	Personalization of narratives	Using individual experiences and stories / Transforming public issues into human-centered narratives
	Use of emotional symbols and expressions	Employing visual and symbolic emotional elements / Applying affective and value-laden language
Value-based and ideological framing	Representation of values and norms	Emphasizing justice, freedom, and human rights / Representing cultural and social values
	Meaning construction about actors	Legitimizing or delegitimizing actors / Constructing roles of victims, heroes, or threats
	Shaping collective perceptions	Reinforcing shared beliefs / Directing moral evaluations and judgments

Main theme 1. Narrative framing of crisis and conflict realities

The first main theme, narrative framing of crisis and conflict realities, reflects how female celebrities define, interpret, and organize complex events through selective narratives. This theme consists of three organizing themes: problem definition and interpretation, construction of identity narratives, and selection and salience of narrative elements. Through problem definition and interpretation, celebrities construct particular understandings of crises by highlighting specific dimensions of events and providing causal explanations for their occurrence. The

construction of identity narratives demonstrates how digital messages create boundaries between “self” and “other” and contribute to collective identification processes. Furthermore, the selection and salience of narrative elements indicate that celebrities emphasize certain aspects of events while reducing the visibility of alternative interpretations. These organizing themes are supported by basic themes such as highlighting specific dimensions of events, providing causal interpretations of crises, representation of self and other, reinforcement of identity boundaries, emphasizing selected aspects of events, and minimizing alternative perspectives. Together, these elements demonstrate that female celebrities participate in cognitive framing processes by transforming complex realities into meaningful narratives that guide audience interpretation and understanding.

Main theme 2. Emotional framing of digital narratives

The second overarching theme, emotional framing of digital narratives, highlights the central role of emotions in shaping cognitive perceptions and audience engagement. This theme includes three organizing themes: activation of collective emotions, personalization of narratives, and use of emotional symbols and expressions. Female celebrities frequently rely on emotional communication strategies to increase the persuasive power of their messages and establish stronger connections with audiences. Through activation of collective emotions, they generate feelings such as empathy, compassion, fear, anger, or concern. Personalization of narratives transforms abstract social and political issues into human-centered stories by using individual experiences and personal accounts. In addition, the use of emotional symbols and expressions strengthens the affective dimension of digital narratives through visual representations and value-laden language. The basic themes associated with this overarching theme include generating empathy and compassion, triggering anger or concern, using personal stories, transforming public issues into human experiences, employing emotional visual elements, and applying affective language. These components illustrate that emotions function as important cognitive mechanisms through which narratives become more influential and memorable.

Main theme 3. Value-based and ideological framing

The third overarching theme, value-based and ideological framing, explains how female celebrities embed moral, cultural, and ideological meanings within their digital narratives. This theme consists of three organizing themes: representation of values and norms, meaning construction about actors, and shaping collective perceptions. Through the representation of values and norms, celebrities frame events based on principles such as justice, freedom, human rights, or cultural values. Meaning construction about actors refers to the process through which individuals and groups are represented as victims, heroes, threats, or

legitimate actors. Finally, shaping collective perceptions involves reinforcing shared beliefs and influencing moral judgments about events. The related basic themes include emphasizing justice and human rights, representing cultural values, legitimizing or delegitimizing actors, constructing victim and hero roles, reinforcing shared beliefs, and directing moral evaluations. Collectively, these elements demonstrate that cognitive influence operates not only through information and emotions but also through the construction of value systems and interpretive frameworks.

RQ2. Framing strategies in cognitive warfare

The thematic structure related to the second research question includes three overarching themes, nine organizing themes, and eighteen basic themes. These themes identify the strategic mechanisms through which female celebrities frame narratives and potentially contribute to processes of cognitive influence. The findings suggest that framing strategies operate through three main pathways: constructing perceptions of threat and crisis, promoting resistance and collective action, and enhancing persuasion and cognitive influence.

Table 5. Main and sub-themes related to RQ2

Main themes	Organizing themes	Basic themes
Threat and crisis framing strategies	Threat amplification	Representing security and social threats / Emphasizing negative consequences of crises
	Construction of vulnerability	Portraying instability and insecurity / Highlighting human suffering and concerns
	Simplification and polarization of narratives	Creating binary oppositions between groups / Constructing good-versus-bad narratives
Resistance and collective action framing strategies	Construction of resistance narratives	Emphasizing resilience and confrontation / Representing social agency and collective action
	Emotional mobilization of audiences	Encouraging empathy and participation / Creating a sense of collective responsibility
	Formation of collective identity	Strengthening feelings of belonging / Creating a shared sense of destiny
Persuasion and cognitive influence strategies	Message credibility construction	Utilizing celebrity status and symbolic capital / Leveraging social legitimacy
	Emotion-based persuasion	Applying storytelling techniques / Using images and symbolic representations
	Narrative reinforcement	Repetition of key messages / Use of hashtags and shared symbols

Main theme 1. Threat and crisis framing strategies

The first overarching theme, threat and crisis framing strategies, represents the mechanisms through which female celebrities construct perceptions of danger, instability, and vulnerability. This theme includes three organizing themes: threat amplification, construction of vulnerability, and simplification and polarization of narratives. Threat amplification refers to emphasizing security, social, or humanitarian risks associated with particular events. Construction of vulnerability focuses on representing individuals or communities as exposed to harm, uncertainty, or insecurity. Simplification and polarization involve reducing complex issues into binary narratives, such as oppositions between victims and perpetrators or good and bad actors. These organizing themes are supported by basic themes including representing security threats, emphasizing negative consequences of crises, portraying instability and insecurity, highlighting human suffering, creating binary oppositions, and constructing simplified narratives. Together, these elements show how cognitive warfare narratives may operate by shaping perceptions of urgency, danger, and conflict.

Main theme 2. Resistance and collective action framing strategies

The second overarching theme, resistance and collective action framing strategies, reflects how female celebrities construct narratives that encourage collective responses and social engagement. This theme includes three organizing themes: construction of resistance narratives, emotional mobilization of audiences, and formation of collective identity. Resistance narratives emphasize resilience, agency, and opposition against perceived challenges. Emotional mobilization encourages audiences to participate by creating feelings of responsibility, solidarity, or shared concern. Formation of collective identity strengthens connections among audiences by emphasizing common experiences and shared goals. The basic themes associated with this dimension include emphasizing resilience, representing social agency, encouraging empathy and participation, creating collective responsibility, strengthening belonging, and constructing shared destiny. These mechanisms demonstrate how celebrity narratives can transform individual perceptions into collective interpretations and actions.

Main theme 3. Persuasion and cognitive influence strategies

The third overarching theme, persuasion and cognitive influence strategies, explains how female celebrities enhance the effectiveness of their narratives through credibility, emotional persuasion, and repetition. This theme consists of three organizing themes: message credibility construction, emotion-based persuasion, and narrative reinforcement. Message credibility construction is achieved through celebrity status, symbolic capital, and perceived legitimacy. Emotion-

based persuasion relies on storytelling, images, and symbolic representations to influence audience responses. Narrative reinforcement occurs through repetition of key messages, hashtags, and shared symbols. The basic themes include utilizing celebrity status, leveraging social legitimacy, applying storytelling techniques, using symbolic representations, repeating key messages, and circulating common hashtags. These strategies demonstrate how digital narratives gain visibility and influence through both symbolic authority and communication mechanisms.

RQ3. Users' interactions with female celebrities' content

The thematic structure for the third research question consists of three overarching themes, nine organizing themes, and eighteen basic themes. These themes explain how audiences participate in the continuation, transformation, or rejection of narratives produced by female celebrities. The findings indicate that audience interaction is not passive but represents an active process of meaning negotiation within digital communities.

Table 6. Main and sub-themes related to RQ3

Main themes	Organizing themes	Basic themes
Reinforcement and reproduction of cognitive narratives in digital spaces	Active audience participation	Content sharing and reposting / Reuse and circulation of hashtags
	Alignment with celebrity narratives	Expressing agreement and support / Providing emotional and value-based endorsement
	Networked diffusion of narratives	Viral dissemination of content / Expansion of narratives across digital communities
Negotiation and transformation of narrative meanings	Reinterpretation of messages	Providing alternative interpretations / Adding personal experiences and perspectives
	Combination of multiple narratives	Connecting issues with broader social concerns / Creating hybrid narratives
	Modification of original frames	Shifting the meaning of messages / Producing alternative readings
Resistance and contestation of dominant narratives	Challenging celebrity frames	Criticizing celebrity content / Questioning message credibility
	Formation of counter-narratives	Presenting opposing interpretations / Engaging in discursive confrontation
	Polarization of online interactions	Formation of supportive and opposing groups / Intensification of identity-based conflicts

Main theme 1. Reinforcement and reproduction of cognitive narratives in digital spaces

The first overarching theme, reinforcement and reproduction of cognitive narratives in digital spaces, describes how users contribute to the expansion and stabilization of celebrity narratives. This theme includes three organizing themes: active audience participation, alignment with celebrity narratives, and networked diffusion of narratives. Active participation occurs through actions such as sharing content and using hashtags. Alignment with celebrity narratives reflects audience agreement, emotional support, and value-based endorsement. Networked diffusion refers to the spread of narratives across broader online communities. The related basic themes include content sharing, hashtag reuse, expressing agreement, providing emotional support, viral dissemination, and expansion across digital networks. These processes demonstrate how online audiences can amplify cognitive narratives and increase their social visibility.

Main theme 2. Negotiation and transformation of narrative meanings

The second overarching theme, negotiation and transformation of narrative meanings, reflects the dynamic nature of digital interpretation. This theme includes three organizing themes: reinterpretation of messages, combination of multiple narratives, and modification of original frames. Users may reinterpret celebrity messages according to their own experiences, connect them with broader social issues, or transform the initial meaning of a message. The basic themes include providing alternative interpretations, adding personal perspectives, linking issues with broader concerns, creating hybrid narratives, shifting meanings, and producing alternative readings. These elements show that cognitive influence is not a one-way process but emerges through interaction between content producers and digital audiences.

Main theme 3. Resistance and contestation of dominant narratives

The third overarching theme, resistance and contestation of dominant narratives, explains how users challenge, criticize, or oppose celebrity-generated frames. This theme consists of three organizing themes: challenging celebrity frames, formation of counter-narratives, and polarization of online interactions. Users may question the credibility of celebrity messages, present competing interpretations, and engage in discursive conflicts. The basic themes include criticizing content, questioning credibility, presenting opposing viewpoints, engaging in narrative confrontation, forming supportive and opposing groups, and intensifying identity-based conflicts. These findings highlight that social media environments are arenas of continuous narrative competition where cognitive frames are not only reproduced but also contested and reshaped.

5. Discussion and Conclusion

The purpose of this study was to explore the role of female celebrities in representing and shaping cognitive warfare narratives on social media through a netnographic approach and by applying Framing Theory as a theoretical lens. The findings demonstrate that female celebrities should not be viewed merely as entertainment figures or opinion leaders; rather, they have become influential actors in contemporary digital environments where meanings, identities, and interpretations of social realities are continuously produced and contested. The results indicate that their influence operates through three interconnected processes: narrative construction, strategic framing, and audience-level negotiation of meanings.

The first major finding relates to the role of narrative framing in constructing interpretations of crisis and conflict realities. The study revealed that female celebrities contribute to cognitive processes by defining problems, highlighting specific dimensions of events, and constructing particular interpretations of complex situations. This finding is consistent with the central assumption of Framing Theory that communication does not simply transmit objective realities but actively organizes and structures how audiences understand those realities. In digital spaces, celebrities act as meaning entrepreneurs who select certain aspects of events, attach specific interpretations to them, and provide audiences with cognitive frameworks for understanding social and political issues. The identification of narrative elements such as identity construction, representation of self and other, and selective emphasis of events indicates that celebrity communication involves processes of inclusion and exclusion that shape collective perceptions.

The findings further demonstrate that cognitive influence is not achieved only through rational arguments or information dissemination; rather, emotional mechanisms play a fundamental role. The emergence of emotional framing as a major overarching theme highlights the importance of affective communication in contemporary digital influence processes. Female celebrities frequently rely on empathy, personal storytelling, symbolic images, and emotional language to create stronger connections with audiences. These findings extend existing discussions on digital influence by emphasizing that emotions function as cognitive shortcuts through which audiences interpret complex events. In other words, emotional narratives can increase the accessibility, memorability, and persuasive capacity of specific interpretations. From the perspective of cognitive warfare, this finding is significant because influence operations increasingly seek to shape not only what individuals think but also how they feel about particular issues.

Another important finding concerns the role of value-based and ideological framing. The study showed that female celebrities construct narratives through moral evaluations and value orientations by

emphasizing concepts such as justice, human rights, collective identity, and social responsibility. These findings suggest that cognitive influence is closely connected with struggles over meaning and legitimacy. Actors attempting to shape public cognition often seek to establish preferred moral interpretations of events by defining who represents legitimate interests, who should be considered responsible, and which values should guide public judgment. Therefore, celebrity narratives can contribute to broader processes of social meaning-making by reinforcing particular moral frameworks.

Regarding the second research question, the findings identified three main framing strategies employed by female celebrities: threat and crisis framing, resistance and collective action framing, and persuasion and cognitive influence strategies. The emergence of threat framing suggests that digital narratives often rely on emphasizing uncertainty, vulnerability, and potential risks to increase audience attention and emotional engagement. While such framing can contribute to awareness and social sensitivity, it may also simplify complex realities and intensify polarization when based on selective interpretations. This finding highlights the dual nature of celebrity influence: the same communication mechanisms that can promote social awareness may also contribute to cognitive competition among conflicting narratives. The identification of resistance and collective action framing demonstrates that celebrity narratives can also function as mechanisms of mobilization. By emphasizing resilience, solidarity, and shared identity, celebrities can encourage audiences to perceive themselves as members of a collective community with common concerns. This finding expands the understanding of cognitive warfare beyond negative manipulation and highlights its broader connection with processes of identity formation and social mobilization. Cognitive influence is therefore not necessarily limited to deception or misinformation; it also involves the ability to create meaningful narratives that organize collective understanding and action.

The third research question focused on audience interactions and revealed that users are active participants in the reproduction, transformation, and contestation of celebrity narratives. The findings challenge the assumption of a one-directional influence relationship between celebrities and audiences. Instead, digital environments create interactive spaces where meanings are continuously negotiated. Through reposting, commenting, hashtag usage, and reinterpretation, users contribute to the expansion or modification of narratives. This finding is particularly important for netnographic research because it demonstrates that understanding digital influence requires examining not only content producers but also audience practices and networked interactions. The emergence of narrative reinforcement, meaning negotiation, and narrative contestation as three dimensions of audience engagement indicates that social media platforms function as arenas of

continuous cognitive struggle. Some users reinforce celebrity-generated frames by expressing agreement and emotional support, while others challenge them by presenting alternative interpretations and counter-narratives. Thus, cognitive warfare in digital environments should be understood as an ongoing process of competition among meanings rather than a simple transmission of predetermined messages.

From a theoretical perspective, this study contributes to the literature by integrating framing theory with cognitive warfare studies and celebrity studies. While previous research has examined media framing, political communication, and celebrity influence separately, this study demonstrates how these domains intersect within contemporary digital environments. By using framing theory, the research provides a deeper explanation of the mechanisms through which celebrities construct meanings, influence perceptions, and participate in narrative competition. Furthermore, the use of netnography contributes methodologically by enabling the investigation of naturally occurring digital interactions rather than relying only on self-reported perceptions or experimental settings.

From a practical perspective, the findings provide important implications for researchers, policymakers, and communication practitioners. Understanding how female celebrities participate in narrative construction can assist organizations in developing more effective approaches to digital communication, media literacy, and cognitive resilience. For audiences, strengthening critical digital literacy is essential to enable individuals to evaluate competing narratives, recognize framing mechanisms, and engage with online content more reflectively.

5.1. Practical implications

Based on the findings of this study, several practical recommendations can be proposed for policymakers, media organizations, and institutions responsible for digital communication and cognitive resilience.

First, it is recommended that organizations develop systematic mechanisms for monitoring and analyzing digital narratives produced by influential actors, including female celebrities, in order to better understand emerging cognitive trends and patterns of public perception. Such monitoring should focus not only on the content of messages but also on emotional framing, symbolic elements, and audience reactions.

Second, strengthening digital and media literacy among social media users is essential. Educational programs should enhance individuals' ability to recognize framing mechanisms, evaluate competing narratives, and critically engage with emotionally persuasive content. This approach can reduce vulnerability to cognitive manipulation while promoting more reflective digital participation.

Third, institutions involved in strategic communication should pay greater attention to the role of celebrities as influential actors in digital

environments. Rather than considering celebrities merely as cultural figures, policymakers should recognize their symbolic influence and develop appropriate communication strategies that encourage responsible digital engagement.

Finally, it is recommended that future communication policies emphasize the creation of credible, value-based, and emotionally meaningful narratives. Since cognitive influence operates through perceptions, emotions, and identities, effective communication requires moving beyond information dissemination toward strategic narrative construction and audience engagement. These measures can contribute to strengthening cognitive resilience and improving society's capacity to navigate complex digital information environments.

5.2. Limitations and suggestions for future research

Despite its theoretical and methodological contributions, this study has several limitations that should be considered. First, the research focused on publicly available content produced by selected female celebrities on social media platforms, particularly Instagram. Therefore, it may not fully capture private interactions, offline influence mechanisms, or communication processes occurring across other digital platforms. Future studies can overcome this limitation by adopting a comparative multi-platform approach and examining different social media environments, such as X (formerly Twitter), TikTok, and YouTube, to identify variations in cognitive framing strategies. Second, the qualitative and interpretive nature of the netnographic approach may involve a degree of researcher subjectivity in identifying and interpreting narratives, frames, and meanings. Although validation strategies were applied to enhance credibility, future research could integrate mixed-method approaches by combining netnography with quantitative content analysis, social network analysis, or audience surveys to provide a more comprehensive understanding of the mechanisms and effects of cognitive influence.

Based on these limitations, two directions are suggested for future research. First, future studies can conduct comparative analyses between female celebrities and other influential digital actors, such as social media influencers, journalists, political figures, or online activists, to examine differences in narrative construction and cognitive influence capacities. Second, future research can investigate the audience-level consequences of celebrity-driven cognitive narratives by examining how exposure to specific frames affects individuals' perceptions, attitudes, emotional responses, and behavioral intentions through experimental or survey-based designs.

Conflict of interest

The author declared no conflicts of interest.

Ethical considerations

The author has completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. This article was not authored by artificial intelligence.

Data availability

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