

The Power of Framing: How News Headlines Guide Search Behavior

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Abstract

Search engines play a central role in how people gather information, but subtle cues like headline *framing* may influence not only what users believe but also how they search. While framing effects on judgment are well documented, their impact on subsequent search behavior is less understood. We conducted a controlled experiment where participants issued queries and selected from headlines filtered by specific linguistic frames. Headline framing significantly shaped follow-up queries: conflict and strategy frames disrupted alignment with prior selections, while episodic frames led to more concrete queries than thematic ones. We also observed modest short-term frame persistence that declined over time. These results suggest that even brief exposure to framing can meaningfully alter the direction of users' information-seeking behavior.

1 Introduction

“You can't see or hear frames. They are part of what we cognitive scientists call the “cognitive unconscious”—structures in our brains that we cannot consciously access, but know by their consequences.”

(Lakoff, 2014)

About two-thirds of U.S. adults get news at least occasionally from websites or apps (68%) and from search engines (65%) (Center, 2021). This shift from traditional media to digital platforms has transformed how people access and interpret information. Search engines and social media now act as gatekeepers, shaping public perception by controlling which stories appear most prominently (Goldman, 2005; Introna and Nissenbaum, 2000; Poudel and Weninger, 2024; Poudel et al., 2025).

While the visibility and ranking of news content receive significant attention (Diakopoulos, 2015; Lazer et al., 2018; Robertson et al., 2018), far less is known about how *framing* of headlines

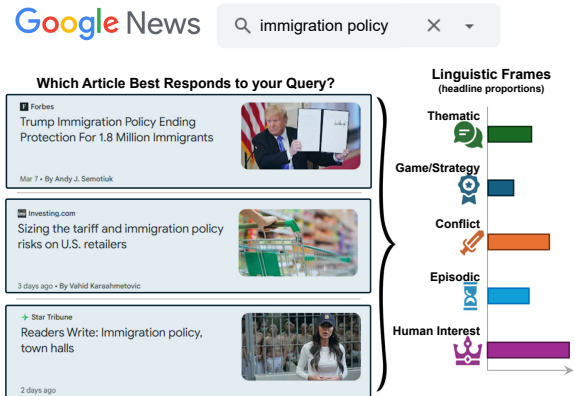


Figure 1: News headlines have linguistic frames. Here we ask: do these headline frames present in search results change search behavior?

within those results influences behavior. Framing, whether through linguistic cues, emphasis, or implied meaning, can shape perceptions, reinforce bias, and steer the course of information seeking (Guo et al., 2025). Algorithmic ranking amplifies certain narratives (Noble, 2018), and exposure to specific frames affects how issues are interpreted (Lecheler and De Vreese, 2012; Liu et al., 2019; Rathje, 2017). Yet how framing within results affects subsequent search behavior remains poorly understood.

Discussions of search engine bias (Mowshowitz and Kawaguchi, 2002) and query reformulation (Boldi et al., 2011) often center around how users revise their queries based on internal goals. But search behavior may also be influenced in other ways like the framing of content in top results (Chen and Décary, 2018) as shown in Fig. 1. Click patterns and term overlap are often used to track engagement (Wang and Zhai, 2008), though this overlooks more subtle semantic shifts that reflect deeper interpretive changes.

Because headlines frequently serve as the first point of contact with a topic (Konnikova, 2014), these frames may exert a lasting influence on how

people explore, understand, and act upon information (Lecheler and De Vreese, 2011).

Framing and Cognitive Mechanisms of Influence

Framing, a concept rooted in psychology (Goffman, 1974), refers to how information is structured to emphasize certain aspects of reality, shaping interpretation, evaluation, and response (Entman, 1993). In the context of news communication, framing can define problems, diagnose causes, make moral judgments, and suggest solutions (De Vreese, 2005). Common cognitive frames (*e.g.*, conflict, human interest, and strategy) shape how issues are perceived and discussed (Neuman et al., 1992; Semetko and Valkenburg, 2000). While these patterns are well documented in traditional media (Gans, 1979; Tuchman, 1978; Cooper, 2002), much less is known about how framing operates within digital platforms and how it influences beliefs and behaviors in interactive settings.

Frames shape how people process information by activating cognitive biases that guide interpretation and decision-making (Tversky and Kahneman, 1981). Three such mechanisms are especially relevant in digital environments:

Recency. People are more likely to recall and act on information they encountered most recently (Tversky and Kahneman, 1974). Frames that dominate the news cycle become disproportionately salient in memory and judgment.

Availability. Individuals rely on easily accessible information when forming judgments (Tversky and Kahneman, 1974; Kahneman, 2011). Repeated exposure to specific frames can cause them to feel representative, even when alternative perspectives exist.

Priming. Early exposure to particular language or narratives shapes how users interpret subsequent information (Bargh et al., 1996). For example, describing an event as a “crisis” rather than a “dispute” primes users to expect urgency and instability.

Through digital media’s rapid and repetitive cycles, these effects are amplified. Framing becomes more than a feature of individual stories—it shapes the broader narrative environment in which public discourse unfolds.

Do Headline Frames Affect Search Behavior?

The present work examines how the framing of search engine results influences user behavior, particularly in shaping subsequent queries and altering

the trajectory of information seeking. Drawing on framing theory and cognitive mechanisms, we investigate how repeated exposure to framed content may guide what users search for next, how they interpret what they encounter, and how their mental models evolve over time. Specifically, we formulate the following hypotheses:

H1 Framing Influences Search Behavior. (*Priming & Availability*) Framing will shape follow-up queries by activating certain concepts and interpretations.

H2 Frame Exposure Leads to Short-Term Persistence. (*Priming & Availability*) Exposure to a particular narrative frame increases the likelihood that subsequent queries retrieve similarly framed headlines.

H3 Framing Effects Accumulate Over Time. (*Recency*) If framing effects persist, users will increasingly retrieve headlines matching the initial frame in later rounds.

We also explore how individual differences may moderate framing effects:

E1 Framing Effects Interact with Demographics. (*Cognitive Availability*) Frequent news seekers may show stronger frame persistence across queries.

E2 Political Orientation Influences Frame Selection. (*Motivated Reasoning*) Participants with stronger ideological views may respond more to frames that align with their beliefs.

Findings in Brief Our results show that framing meaningfully shapes the trajectory of user queries (supporting H1). Exposure to conflict and game/strategy frames reduces semantic alignment with clicked headlines, suggesting a shift toward emotionally or ideologically salient interpretations. We also observe short-term frame persistence: users tend to submit follow-up queries that retrieve similarly framed content (supporting H2), though this effect does not compound over time (no support for H3).

Exploratory findings suggest that frequent news seekers and politically liberal users may be more sensitive to framing effects (tentative support for E1 and E2). Overall, these results reveal subtle but consistent ways headline framing can influence search behavior after minimal exposure. All data

Table 1: Framing Categories in News Headlines

Frame	Description	# Headlines
Game/Strategy	Emphasizes tactics, strategy, or competition in political or institutional contexts.	42,171
Conflict	Highlights polarization, disputes, or antagonism between individuals or groups.	28,367
Thematic	Focuses on systemic issues, policies, or trends with broader social relevance.	56,627
Episodic	Focuses on specific events, incidents, or individuals without broader context.	10,698
Human Interest	Centers on emotional appeals or personal stories that elicit empathy or drama.	16,593
Other	Does not clearly fit into the above categories or lacks identifiable framing.	3,371

and analysis scripts are available at <https://doi.org/10.7910/DVN/1MUI68>.

2 Related Work and Background

Framing plays a central role in shaping how individuals interpret and act on information in digital environments. Prior work has established that: (1) headlines serve as powerful framing devices, shaping perception through linguistic and structural cues; (2) these frames influence user behavior by engaging cognitive biases that guide attention, memory, and decision-making; and (3) framing can be systematically analyzed in search contexts using established taxonomies from political communication and media studies.

2.1 Headlines as Framing Devices

Headlines are powerful framing tools, often the first (and sometimes only) text users read when scanning the news (Konnikova, 2014). Readers act as “shoppers of headlines,” forming impressions based on brief linguistic cues (English, 1944). Headlines do more than summarize; they signal salience, shape interpretation, and prime cognitive associations (Papacharissi, 2018).

This effect is well documented. During the 2009 H1N1 outbreak, headlines emphasized risk, conflict, and strategy over factual content (Kee et al., 2010). More recent computational work shows that structural features in headlines can even guide algorithmic inference. For example, stock movements have been predicted using only the emotional framing of financial news headlines (Bhat and Jain, 2024).

2.2 Framing and User Behavior

Headline framing engages core cognitive mechanisms that shape how people process, recall, and act on information. Psychological theories emphasize the role of heuristics *e.g.*, availability, recency, and priming, when navigating online information environments.

Emotionally charged or dramatized frames can drive offline behavior (Brader, 2005; Gross and D’ambrosio, 2004). During political unrest, vivid online narratives increase protest participation even when internet access itself does not explain mobilization (Ruijgrok, 2017). In search environments, subtle phrasing differences can shift beliefs without awareness—a phenomenon known as the Search Engine Manipulation Effect (SEME) (Epstein and Robertson, 2015). Public health research shows similar patterns: fentanyl-related queries closely track overdose deaths (Arendt, 2021).

Across these domains, framing activates interpretive frameworks that steer attention, guide further search, and anchor memory. Even brief exposure to framed headlines can exert lasting influence on user behavior.

2.3 Operationalizing Frames in Search Results

We categorize headlines using six common frame types drawn from the political communication and media framing literature (see Table 1). This taxonomy provides a structured lens for investigating how headline framing influences user behavior across diverse news content (Baden, 2019).

While alternative framing taxonomies exist and may be more suitable for specific contexts (Sullivan, 2023), the selected categories are among the most prevalent in news coverage (De Vreese, 2005). Headlines are not easily reducible to a single frame (Semetko and Valkenburg, 2000), making frame selection especially important. The six frames we adopt are frequently observed in U.S. and European media and have been foundational in framing research (Brants and Neijens, 1998; Dijk, 1988; Neuman et al., 1992; Lawrence, 2000).

3 Experimental Design

We designed a between-subjects randomized controlled experiment (illustrated in Fig. 2) where participants were assigned to one of six experimental conditions, each corresponding to a specific news

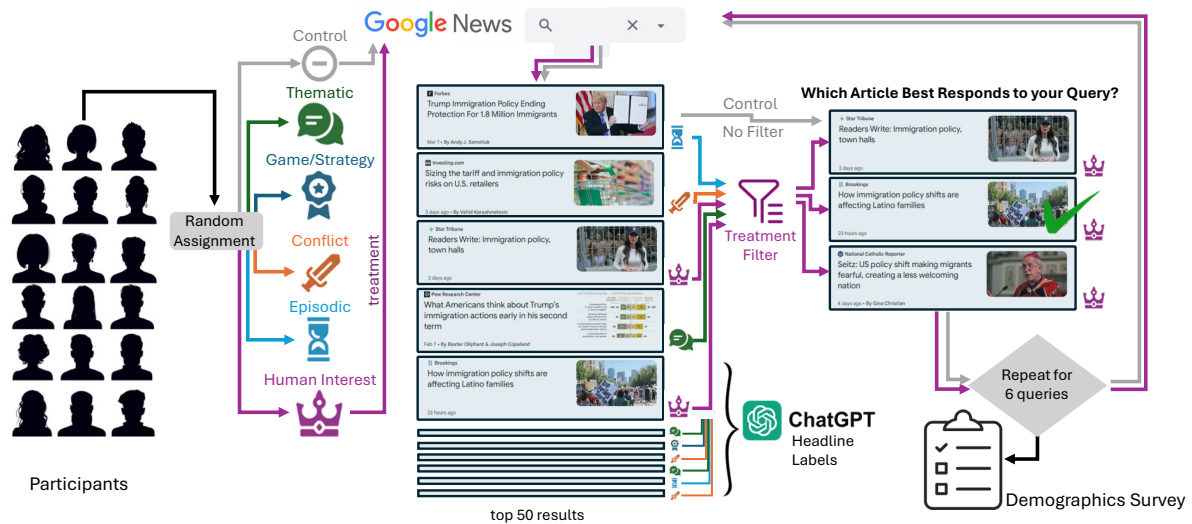


Figure 2: Experimental workflow illustrating the framing intervention and query reformulation loop. Participants were randomly assigned to one of six conditions (control or one of five framing treatments: conflict, game/strategy, human interest, episodic, or thematic). In each of six rounds, participants entered a news-related search query, viewed a subset of Google News headlines filtered according to their assigned frame, and selected one headline to read after a brief delay. We observed how exposure to specific frames influenced follow-up queries and their results. We measured changes in query content using semantic similarity, frame match rate, and linguistic characteristics such as concreteness and emotional valence.

frame or a control group. The study examined how exposure to framed search results affected users' subsequent queries and selection behavior over multiple rounds of interaction.

Procedure Participants were randomly assigned to one of six frame conditions corresponding to journalistic frames: Game/Strategy, Conflict, Thematic, Episodic, Human Interest, and a control group. Each participant was asked to enter an initial news-related query into a custom web form that resembled a Google News search interface. The interface clearly indicated that it was part of an experiment and was not intended to deceive participants into believing it was a real search engine.

For each submitted query, the top 50 search results were retrieved in real time from Google News using the ScaleSERP API¹. This tool issues queries through clean proxies, minimizing the personalization or adaptive learning on search results. The API used U.S.-based proxies and returned English-language results; all other settings remained at their defaults.

Each headline was then automatically classified into one of the five frame types or labeled as other if no suitable frame was detected (Poudel and Weninger, 2025). Classification was performed using ChatGPT-4o Mini; the full classification

¹<http://scaleserp.com>

prompt is included in the Appendix. Participants in the control condition were shown the top three headlines from the original search results, irrespective of frame. Participants in each treatment group were shown the top three headlines matching their assigned frame condition. If fewer than three matching headlines were available, the remaining results were randomly selected from the rest of the top 50 to ensure that three headlines were always displayed.

Participants were then asked to select one result to read, with a five-second delay before a selection could be made. This delay encouraged participants to review all options rather than clicking immediately. After making a selection, participants were prompted to enter a new query and repeat the process. Each participant completed six rounds in total, with the assigned frame condition held constant throughout. This design allowed us to observe how initial exposure to a particular frame shaped the trajectory of subsequent search behavior over time. We retrieved and classified over 157,000 headlines distributed as shown in Table 1.

Outcome Measures We recorded several aspects of participants' information-seeking behavior throughout the experiment: (1) the sequence of search queries entered, (2) the search results presented in response to each query, and (3) the spe-

cific headlines selected by participants. These behavioral traces allow us to assess changes in search intent, framing exposure, and engagement across repeated interactions. At the conclusion of the task, participants completed a short demographic survey.

Participants We recruited $N = 600$ participants from Prolific using the platform’s “representative sample” feature, which ensures demographic diversity aligned with U.S. census benchmarks. All participants were based in the United States, provided informed consent, and were compensated \$1.20 USD upon completion. The study was approved by the Institutional Review Board at the University of Notre Dame.

The sample included 47% male and 51% female participants (2% preferred not to disclose). Participants resided in rural (15%), suburban (53%), and urban (32%) areas. Educational attainment varied: 15% had a high school diploma, 24% had some college experience, 40% held a college degree, and 22% had a graduate degree. Racial/ethnic composition was 63% White, 15% African American, 10% Latino, and 8% Asian (4% identified with other or multiple categories).

Participants also reported a range of political orientations: 12% identified as very conservative, 24% as somewhat conservative, 24% as moderate, 24% as somewhat liberal, and 16% as very liberal. To assess baseline engagement with news search, participants were asked how frequently they used search engines to find news. Responses indicated that 11% searched a few times per month or less, 25% a few times per week, 17% about once per day, and 45% multiple times per day.

Classification Consistency As stated before, the news headlines were zero-shot classified into frames with ChatGPT-4o Mini. To ensure reliability, the classifications were checked using ChatGPT-4, which assigned identical labels 93.75% of the time with 1,500 headlines, showing strong reliability.

100 headlines were also manually spot-checked, with ChatGPT-4 matching human consensus: $\kappa = 0.69$, $macro - F_1 = 0.74$. Consistent with prior work (Ding et al., 2023; Pavlovic and Poesio, 2024; He et al., 2023) on LLMs and framing, which shows LLMs can match or exceed human consistency on classification tasks.

Table 2: Factors Predicting How Users Reformulate Their Search Queries

Predictor	Effect	Query Influence
(Intercept)	-0.003***	
Previous Query	0.728***	
Retrieved Headlines	0.398***	

*** indicates statistical significance at the 0.001 level. Higher values indicate stronger influence on the wording of the next query.

4 Headlines Affect Follow-Up Queries

Before turning to the effects of news framing, we begin with a foundational question: to what extent do search results shape the evolution of user queries, independent of their original intent? While prior work shows that users revise their queries based on both internal goals and external feedback (Jansen et al., 2009), the degree to which retrieved content nudges users’ thinking in new directions remains unclear.

4.1 Query Evolution and Influence of Results

To measure this influence, we embed queries and their retrieved headlines using a pre-trained Sentence Transformers model (Reimers and Gurevych, 2019) and compute cosine similarity between: (1) a query and its immediate follow-up, and (2) the selected headline and the next query.

As shown in Table 2, both the prior query and the retrieved headline significantly influence how users reformulate their next query. To interpret the relative magnitude of these effects, we compute the *influence ratio* from the normalized effect sizes: approximately **65%** of the semantic direction of the next query is attributable to the user’s own previous query, while **35%** reflects the influence of the selected headline. This ratio highlights how even brief exposure to retrieved content can subtly steer user intent.

In other words, search results are not just a reflection of user goals; it is a site of influence, where platform-generated content feeds back into the query stream. This dynamic reveals a quiet but consequential loop: users shape their results, but results also shape users.

Quasi-Control Comparison To test whether retrieved headlines causally influence query reformulation, we conducted a difference-in-differences analysis comparing real query-headline pairs to a quasi-control condition with randomly shuffled headlines. This preserved headline and query distributions while breaking their alignment. Follow-

up queries in the real condition were significantly more semantically aligned with retrieved headlines than in the shuffled control (+0.036 cosine similarity; $p < .001$). This reinforces the interpretation that retrieved content, rather than internal goals alone, drives semantic shifts in query reformulation.

Decay Effects Across Query Turns We next examined whether this influence persists over time. Semantic similarity between queries and prior headlines declined with each additional query round ($\beta = -0.0048$, $p < .001$), suggesting that framing effects are strongest immediately and fade with continued interaction.

4.2 Summary

This preliminary analysis supports the view that search results meaningfully guide the direction of user search behavior. While users' prior queries exert the strongest influence, retrieved headlines also shape future information-seeking, especially in the immediate next turn. This sets the stage for our core framing analysis by demonstrating that users are indeed responsive to the content of what they see.

5 Framing Effects

5.1 Framing Influences Search Behavior

Building on our preliminary finding that search results influence the trajectory of user queries, we now examine how specific types of framing shape user behavior. In particular, we hypothesize that **H1: Framing conditions increase the presence of their respective frames in subsequent queries compared to the control condition.**

Participants were randomly assigned to one of five frame-based treatment conditions (conflict, episodic, thematic, game/strategy, or human interest) or a control group with no frame filtering. Starting from their second query (*i.e.*, after the initial query, which preceded treatment), we measured how participants responded to framed results over five rounds of search.

5.1.1 Frames Influence Follow-up Queries

We first tested whether concentrated exposure to framed headlines changes the follow-up queries. To do this, we computed the cosine similarity between the headline a user selected and their *next* query. We then fit a linear mixed-effects model

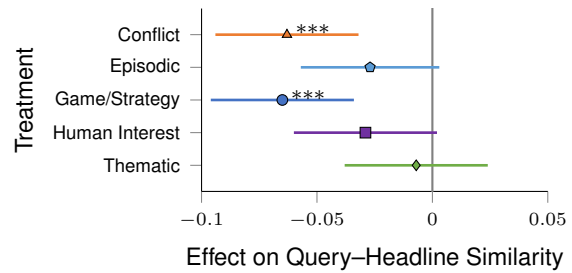


Figure 3: Estimated effects of each framing condition on query-headline similarity, relative to the control group. Points represent regression coefficients from the additive mixed-effects model. Horizontal lines show 95% confidence intervals.

predicting similarity as a function of framing condition (relative to a control group) with random intercepts for each participant.

Figure 3 shows the estimated effects of each frame condition on query-headline similarity. Participants exposed to *Conflict* and *Game/Strategy* frames submitted queries that were significantly less aligned with their selected headlines compared to those in the control group. The *Human Interest* and *Episodic* frames also showed negative trends, though their effects did not reach conventional levels of significance. The *Thematic* condition was indistinguishable from control.

These results show some support for H1: certain frames, particularly those emphasizing conflict or strategic dynamics, disrupt alignment between what users read and how they continue searching. This may reflect how these frames shift attention toward emotionally or ideologically salient aspects of the news.

5.1.2 Framing Shapes the Language of Follow-Up Queries

Beyond semantic alignment, we also investigated whether framing influences the linguistic character of follow-up queries. Specifically, their level of concreteness and emotional content.

For concreteness, we computed a concreteness score for each query using a psycholinguistic dictionary that assigns word-level ratings based on imageability and specificity (Brysbaert et al., 2014). A one-way ANOVA revealed a marginal overall effect of frame condition on query concreteness ($F(5, 2272) = 2.10$, $p = .063$). Post-hoc comparisons indicated that participants in the *Episodic* condition wrote significantly more concrete queries than those in the *Thematic* condition ($p = .037$), consistent with the idea that episodic frames emphasize

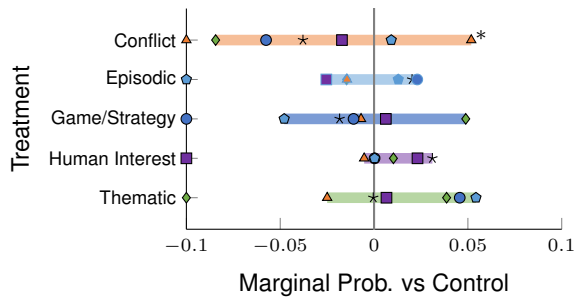


Figure 4: Difference-in-differences estimates showing how much each frame-condition pair deviates from the control group in follow-up query framing. Positive values indicate greater increases in frame usage relative to control. * indicates statistical significance at the 0.05 level.

individual stories, while thematic frames promote broader, systemic interpretations.

For emotional content, we counted the number of emotional terms in each query using the NRC Emotion Lexicon (Mohammad and Turney, 2013), focusing on words associated with anger, fear, or disgust. ANOVA again revealed a significant overall effect of frame condition ($F(5, 2754) = 2.47$, $p = .031$), but no significant pairwise differences emerged in post-hoc tests. Contrary to our initial expectations, participants in the *Conflict* condition did not produce more emotionally charged queries than those in other conditions.

Overall, these findings provide partial support for the hypothesis that framing shapes the linguistic style of follow up queries. Episodic frames increased concreteness, while emotional language was somewhat affected by frame type.

5.2 Do Frames Persist Over Queries?

Framing theory suggests that exposure to a particular narrative structure makes that frame more salient in subsequent interactions (Entman, 1993; De Vreese, 2005). Based on these previous findings we hypothesize that **H2: Exposure to a specific frame in the search results will increase the likelihood that searches from later queries contain that same frame.**

Because user queries are typically short and ambiguous, we do not attempt to classify the frame of each query directly. Instead, we infer query framing indirectly by examining the distribution of frames in the retrieved results from subsequent queries. If exposure to a particular frame influences user behavior, we expect users to submit follow-

up queries that elicit headlines framed in a similar way.

To assess whether observed changes in query behavior are attributable to exposure to framed search results, rather than natural variation or individual intent, we use a *difference-in-differences* (DiD) approach.

In our case, DiD compares the change in frame usage between the initial query (Q1) and the next query (Q2) (*i.e.*, post-treatment) for users exposed to a given frame condition compared to the change observed in a control group. Formally, the DiD estimate for a given frame and condition is defined as:

$$\begin{aligned} \text{DiD} &= (\Delta_{\text{treat}}) - (\Delta_{\text{ctrl}}) \\ &= (Q2_{\text{treat}} - Q1_{\text{treat}}) - (Q2_{\text{ctrl}} - Q1_{\text{ctrl}}) \end{aligned}$$

This expression captures how much more (or less) a given frame increased under treatment relative to its natural trajectory in the absence of framing intervention.

To control for baseline variation in frame preferences, we apply this comparison *within matched frame categories* (*e.g.*, measuring how use of the *Conflict* frame evolves in the conflict condition versus the control condition). The control group provides a reference for expected change due to organic search behavior, while the treatment group reflects potential shifts driven by exposure to framed headlines.

We compute the mean change in frame proportions for each participant and compare the treatment and control groups using two-sample *t*-tests. To adjust for multiple comparisons across frame-condition pairs, we consider Bonferroni-adjusted *p*-values.

Conflict Begets Conflict As shown in Figure 4, the only condition to show a notable increase relative to control is the *conflict* frame in the conflict condition, which yielded a large mean difference (+8.9%) and a nominally significant *p*-value ($p = 0.015$). This finding reinforces the idea that conflict primes further conflict and aligns with prior research suggesting that conflict frames increase perceived stakes, activate adversarial schemas, and persist longer in cognitive processing (Shen, 2004).

Otherwise, we find limited evidence that headline framing systematically alters the use of corresponding frames in follow-up queries. Other frame-condition pairs show smaller or inconsistent changes, suggesting that while framing can

shape short-term attention and interpretation, its influence on query framing is subtle.

5.3 Do Frames Accumulate?

H3: Queries following exposure to a particular frame will increasingly reflect that frame over time. This hypothesis draws on theories of cognitive carryover and priming: exposure to a specific narrative frame may lead users to unconsciously persist with that framing in subsequent queries. If framing effects accumulate, we would expect users to retrieve increasingly frame-aligned results as their session progresses.

To test this, we calculated the proportion of retrieved headlines that matched each participant’s assigned frame across all six query rounds. As in the prior analysis, we compared these frame match rates against a baseline from the control group. However, instead of a simple before/after comparison, we modeled change over time using a mixed-effects linear regression, with frame condition and query number as predictors. This design allows us to test whether frame alignment increases progressively over the course of a search session, *i.e.*, whether conflict primes more conflict, or episodic frames lead to increasingly concrete queries.

The results (not illustrated) show no evidence of accumulation. Although some frame conditions initially yielded higher match rates than control, there was no significant interaction between condition and query number. In other words, participants did not increasingly align with their assigned frame as the session progressed.

6 Exploratory Analysis

E1: Are Frequent News Seekers More Responsive to Framing? To test whether frequent search users are more sensitive to framing, we included a self-reported news search frequency in our model as a moderator. The interaction between frame condition and search frequency was positive but not uniformly significant across all frames. Participants who reported using search engines more frequently to find news exhibited modestly higher frame match rates following exposure, suggesting a greater susceptibility to framing effects. But the effect did not persist after multiple comparison correction and should be interpreted cautiously.

E2: Does Political Orientation Moderate Framing Effects? To test whether political identity shapes responsiveness to framing, we examined

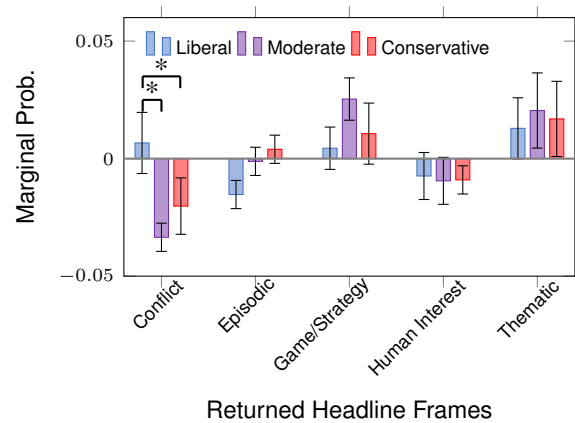


Figure 5: Marginal change in frame usage across political identity groups, relative to the control condition. Liberal participants exposed to conflict-framed headlines exhibit a significantly greater increase in conflict framing than both moderates and conservatives. Error bars represent 95% confidence intervals.

marginal changes in frame use relative to the control group across ideological groups. As shown in Figure 5, the strongest effect emerged for the conflict frame: liberal participants exposed to conflict-framed headlines exhibited significantly greater increases in conflict framing in their follow-up queries compared to moderates and conservatives. This pattern suggests that frame-consistent interpretations may resonate more strongly with participants whose beliefs align with the emotional or ideological tone of the frame, offering support for E2 and broader theories of motivated reasoning.

7 Discussion

This study shows that subtle variations in headline framing significantly influence user behavior in search environments. Even a single exposure can alter how users reformulate queries and what narrative structures persist in follow-up results, revealing a dynamic interplay between algorithmic curation and cognitive bias.

We find strong support for H1: framing shapes immediate search behavior. Conflict and strategy frames reduce semantic alignment with headlines and lead to emotionally or ideologically salient query reformulations. H2 receives partial support: exposure to certain frames increases the likelihood of retrieving similarly framed results in the next turn, but these effects diminish quickly, offering no support for H3. Framing shapes intent, but its influence fades across rounds.

Exploratory findings highlight that individual

traits moderate framing effects. Frequent news searchers (E1) are more responsive to frame cues, and political orientation (E2) amplifies effects of conflict framing—particularly among liberal users—suggesting that ideologically congruent frames may more strongly guide interpretation.

Overall, these findings underscore that search engines do more than reflect user intent; they actively shape it. Even small changes in framing can nudge users along different information paths, influencing not just what they see, but what they search for next.

8 Conclusions

Framing effects in search results are subtle but consequential. This study demonstrates that the narrative structure of headlines can influence the trajectory of user queries, reinforcing certain interpretations and shaping short-term information seeking. While these effects attenuate over time, their immediate impact underscores the importance of framing as a mechanism of cognitive and algorithmic influence. Understanding this dynamic is essential for designing search systems that support informed, reflective engagement with news content.

9 Limitations

Although our findings provide evidence that headline framing influences search behavior, several limitations remain.

First, the study was conducted in a controlled experimental setting. Although this design allows us to isolate the effects of framing, it may not fully capture the complexity of real-world search behavior, where goals are more varied, distractions are greater, and attention is more fragmented.

Second, although we model user interaction across multiple query rounds, the total session length is only six queries—a few minutes in duration. It is possible that framing effects, especially those related to accumulation (H3), may require longer exposure periods or more organic engagement to manifest more strongly.

Third, our operationalization of framing relies on a discrete set of frame categories drawn from political communication literature. While these are well-established and cover common types such as conflict, thematic, and human interest, they may not capture all the nuanced or hybrid frames that

users interpret in context. Additionally, frame classification may carry some subjectivity.

Fourth, it is important to note that some language patterns could independently impact participant behavior. An example being low-entropy headlines, whose vocabulary is subsequently repeated in user searches. Due to the significance of the findings, we can determine that framing does impact user behavior, but it is possible that another influence could be strengthening the change in behavior.

Fifth, our sample is drawn from an online participant pool and may not be representative of the broader population. In particular, exploratory findings related to political identity (E2) should be interpreted cautiously given potential imbalances in ideological self-identification and the correlational nature of these subgroup comparisons.

Finally, while we observed statistically significant effects, many were small in magnitude. This highlights both the subtlety of framing influence and the need for large samples or complementary measures (*e.g.* response time, gaze tracking, or qualitative follow-ups) to fully understand the mechanisms at work.

Future work should explore how these framing effects unfold in more naturalistic settings, over longer sessions, or across different types of platforms. Additional attention should also be paid to how repeated exposure, emotional tone, and algorithmic feedback loops interact with individual predispositions. By treating search behavior as both a cognitive and sociotechnical process, we can better understand the forces that govern attention, interpretation, and ultimately, belief.

10 Acknowledgement

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References

- Florian Arendt. 2021. The opioid-overdose crisis and fentanyl: the role of online information seeking via internet search engines. *Health Communication*, 36(10):1148–1154.
- Christian Baden. 2019. Framing the news. *The handbook of journalism studies*, pages 229–245.
- John A Bargh, Mark Chen, and Lara Burrows. 1996. Automaticity of social behavior: Direct effects of trait construct and stereotype activation on action. *Journal of personality and social psychology*, 71(2):230.

- Rithesh Bhat and Bhanu Jain. 2024. Stock price trend prediction using emotion analysis of financial headlines with distilled llm model. In *Proceedings of the 17th International Conference on PErvasive Technologies Related to Assistive Environments*, pages 67–73.
- Paolo Boldi, Francesco Bonchi, Carlos Castillo, and Sebastiano Vigna. 2011. Query reformulation mining: models, patterns, and applications. *Information retrieval*, 14:257–289.
- Ted Brader. 2005. Striking a responsive chord: How political ads motivate and persuade voters by appealing to emotions. *American journal of political science*, 49(2):388–405.
- Kees Brants and Peter Neijens. 1998. The infotainment of politics. *Political Communication*, 15(2):149–164.
- Marc Brysbaert, Amy Beth Warriner, and Victor Kuperman. 2014. Concreteness ratings for 40 thousand generally known english word lemmas. *Behavior research methods*, 46:904–911.
- Pew Research Center. 2021. [More than eight-in-ten americans get news from digital devices](#). Accessed: 2025-04-02.
- Mei Chen and Michel Décary. 2018. A cognitive-based semantic approach to deep content analysis in search engines. In *2018 IEEE 12th International Conference on Semantic Computing (ICSC)*, pages 131–139. IEEE.
- Alice Holmes Cooper. 2002. Media framing and social movement mobilization: German peace protest against inf missiles, the gulf war, and nato peace enforcement in bosnia. *European Journal of Political Research*, 41(1):37–80.
- Claes H De Vreese. 2005. News framing: Theory and typology. *Information design journal+ document design*, 13(1):51–62.
- Nicholas Diakopoulos. 2015. Algorithmic accountability: Journalistic investigation of computational power structures. *Digital journalism*, 3(3):398–415.
- Teun A van Dijk. 1988. *News as discourse*. University of Groningen.
- Bosheng Ding, Chengwei Qin, Linlin Liu, Yew Ken Chia, Boyang Li, Shafiq Joty, and Lidong Bing. 2023. [Is GPT-3 a good data annotator?](#) In *Proceedings of the 61st Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)*, pages 11173–11195, Toronto, Canada. Association for Computational Linguistics.
- Earl English. 1944. A study of the readability of four newspaper headline types. *Journalism Quarterly*, 21(3):217–229.
- Robert M Entman. 1993. Framing: Toward clarification of a fractured paradigm. *Journal of communication*, 43(4):51–58.
- Robert Epstein and Ronald E Robertson. 2015. The search engine manipulation effect (seme) and its possible impact on the outcomes of elections. *Proceedings of the National Academy of Sciences*, 112(33):E4512–E4521.
- Herbert J Gans. 1979. Deciding what’s news: Story suitability. *Society*, 16(3):65–77.
- Erving Goffman. 1974. Frame analysis: An essay on the organization of experience. *Northeastern UP*.
- Eric Goldman. 2005. Search engine bias and the demise of search engine utopianism. *Yale JL & Tech.*, 8:188.
- Kimberly Gross and Lisa D’ambrosio. 2004. Framing emotional response. *Political psychology*, 25(1):1–29.
- Lei Guo, Chris Chao Su, and Hsuan-Ting Chen. 2025. Do news frames really have some influence in the real world? a computational analysis of cumulative framing effects on emotions and opinions about immigration. *The International Journal of Press/Politics*, 30(1):211–231.
- Xingwei He, Zhenghao Lin, Yeyun Gong, Alex Jin, Hang Zhang, Chen Lin, Jian Jiao, Siu Ming Yiu, Nan Duan, Weizhu Chen, et al. 2023. Annollm: Making large language models to be better crowdsourced annotators. *arXiv preprint arXiv:2303.16854*.
- Lucas D Introna and Helen Nissenbaum. 2000. Shaping the web: Why the politics of search engines matters. *The information society*, 16(3):169–185.
- Bernard J Jansen, Danielle L Booth, and Amanda Spink. 2009. Patterns of query reformulation during web searching. *Journal of the american society for information science and technology*, 60(7):1358–1371.
- Daniel Kahneman. 2011. *Thinking, fast and slow*. macmillan.
- C Peng Kee, Faridah Ibrahim, and Normah Mustaffa. 2010. Framing a pandemic: analysis of malaysian mainstream newspapers in the h1n1 coverage. *Journal of media and information warfare*, 3:105–122.
- Maria Konnikova. 2014. How headlines change the way we think. *The New Yorker*, 17.
- George Lakoff. 2014. *The all new don’t think of an elephant!/: Know your values and frame the debate*. Chelsea Green Publishing.
- Regina G Lawrence. 2000. Game-framing the issues: Tracking the strategy frame in public policy news. *Political Communication*, 17(2):93–114.
- David MJ Lazer, Matthew A Baum, Yochai Benkler, Adam J Berinsky, Kelly M Greenhill, Filippo Menczer, Miriam J Metzger, Brendan Nyhan, Gordon Pennycook, David Rothschild, et al. 2018. The science of fake news. *Science*, 359(6380):1094–1096.

- Sophie Lecheler and Claes H De Vreese. 2011. Getting real: The duration of framing effects. *Journal of communication*, 61(5):959–983.
- Sophie Lecheler and Claes H De Vreese. 2012. News framing and public opinion: A mediation analysis of framing effects on political attitudes. *Journalism & mass communication quarterly*, 89(2):185–204.
- Siyi Liu, Lei Guo, Kate Mays, Margrit Betke, and Derry Tanti Wijaya. 2019. Detecting frames in news headlines and its application to analyzing news framing trends surrounding us gun violence. In *Proceedings of the 23rd conference on computational natural language learning (CoNLL)*, pages 504–514.
- Saif M Mohammad and Peter D Turney. 2013. Nrc emotion lexicon. *National Research Council, Canada*, 2:234.
- Abbe Mowshowitz and Akira Kawaguchi. 2002. Assessing bias in search engines. *Information Processing & Management*, 38(1):141–156.
- W Russell Neuman, Marion R Just, and Ann N Crigler. 1992. *Common knowledge: News and the construction of political meaning*. University of Chicago Press.
- Safiya Umoja Noble. 2018. Algorithms of oppression: How search engines reinforce racism. In *Algorithms of oppression*. New York university press.
- Zizi Papacharissi. 2018. The importance of being a headline. *Trump and the Media*, pages 71–78.
- Maja Pavlovic and Massimo Poesio. 2024. The effectiveness of llms as annotators: A comparative overview and empirical analysis of direct representation. *arXiv preprint arXiv:2405.01299*.
- Amrit Poudel, Yifan Ding, Jurgen Pfeffer, and Tim Weninger. 2025. Digital gatekeepers: Google’s role in curating hashtags and subreddits. *arXiv preprint arXiv:2506.14370*.
- Amrit Poudel and Tim Weninger. 2024. Navigating the post-api dilemma. In *Proceedings of the ACM Web Conference 2024*, pages 2476–2484.
- Amrit Poudel and Tim Weninger. 2025. Social and political framing in search engine results. *arXiv preprint arXiv:2507.13325*.
- Steve Rathje. 2017. The power of framing: It’s not what you say, it’s how you say it. *The Guardian*, 20.
- Nils Reimers and Iryna Gurevych. 2019. [Sentence-bert: Sentence embeddings using siamese bert-networks](#). In *Proceedings of the 2019 Conference on Empirical Methods in Natural Language Processing*. Association for Computational Linguistics.
- Ronald E Robertson, Shan Jiang, Kenneth Joseph, Lisa Friedland, David Lazer, and Christo Wilson. 2018. Auditing partisan audience bias within google search. *Proceedings of the ACM on human-computer interaction*, 2(CSCW):1–22.
- Kris Ruijgrok. 2017. From the web to the streets: internet and protests under authoritarian regimes. *Democratization*, 24(3):498–520.
- Holli A Semetko and Patti M Valkenburg. 2000. Framing european politics: A content analysis of press and television news. *Journal of communication*, 50(2):93–109.
- Fuyuan Shen. 2004. Effects of news frames and schemas on individuals’ issue interpretations and attitudes. *Journalism & Mass Communication Quarterly*, 81(2):400–416.
- Karen Sullivan. 2023. Three levels of framing. *Wiley Interdisciplinary Reviews: Cognitive Science*, 14(5):e1651.
- Gaye Tuchman. 1978. Making news: A study in the construction of reality. *Free Pres.*
- Amos Tversky and Daniel Kahneman. 1974. Judgment under uncertainty: Heuristics and biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *science*, 185(4157):1124–1131.
- Amos Tversky and Daniel Kahneman. 1981. The framing of decisions and the psychology of choice. *science*, 211(4481):453–458.
- Xuanhui Wang and ChengXiang Zhai. 2008. Mining term association patterns from search logs for effective query reformulation. In *Proceedings of the 17th ACM conference on Information and knowledge management*, pages 479–488.

APPENDIX

A Framing Classification Prompt

Box 1: Framing Classification Prompt

You are an assistant trained to classify news headlines into one of the following generic frames based on their dominant focus. Below are the definitions of each frame:

1. conflict

- Description: Presents events as a conflict between competing actors, issues, or interpretations.

2. game_strategy

- Description: Focuses on the efforts of actors to gain support, influence, or achieve specific goals.

3. thematic

- Description: Centers on the substantive content of public concerns and issues.

4. human_interest

- Description: Narrates events from the perspective of individuals affected by the issues or events.

5. episodic

- Description: Presents specific events or episodes without extensive context or connection to broader themes.

6. other

- Description: if the news does not fit into any of the above frames

Task:

Given a news headline, classify it into one of the above frames by selecting the most appropriate single frame that best represents the headline's primary focus. Respond only with the name of the frame (e.g., "conflict").

Additional Notes:

- Select Only One Frame: Assign only the dominant frame that best fits the headline, even if multiple frames seem relevant.

- Consistency: Use the exact frame names provided in the definitions for clarity and consistency.

- Clarity: Ensure that the classification is based solely on the headline's content without requiring external context.

Example:

- Headline: "Local Hero Rescues Family from Burning Building"

- Frame: Human Interest Frame

Now, classify the following headline:

Headline: *title*