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How does political efficacy condition clicks on politics? Understanding information-selection behavior in algorithmic feeds over time

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Abstract

This study uses political efficacy to explain individual differences in selecting political information on algorithmic feeds. Combining survey data and 186 Dutch individuals' usage histories of Google Discover, a fully algorithmically curated feed, we examined both within-person changes of information-selection behavior over time and between-person differences conditioned by political efficacy in three aspects: the proportion of political information selected by users, exposure diversity as manifested via sources, and proportion of negative political information. While we did not find any longitudinal change conditioned by external efficacy on information-selection patterns, we found that internally efficacious users are more resilient to prevalent concerns about algorithms' negative influence on political information consumption and exposure diversity. We observed their stable proportions of political information consumption and consumption from increasingly diverse sources over time. Alarmingly, there is a growing divide in exposure diversity between less and more efficacious users over time. Altogether, our study not only highlights users' agency in navigating algorithmic environments but also underscores the importance of empowering users with account of different vulnerabilities.

Lay Summary

Many people worry that personalized algorithmic feeds might limit their consumption of political information. This study responds to this concern by looking at people's real usage histories from Google Discover, a feed where content is fully recommended by algorithms. We also checked whether two kinds of politics-related confidence change people's political clicks over time: confidence in getting their voice heard by the government and confidence in their own ability to participate in politics. Using 186 Dutch people's data, we focused on three things: how much of all clicks by them were political, how various the sources of political clicks were, and how much of their political clicks were negative. We found that people with different confidence level in being heard by the government do not differ in their over-time changes of any aspects above. However, people who are more confident in their own ability clicked on political content from a wider range of sources over time, and the gap between them and the less confident grew over time. Our results highlight users' active role in choosing which content to consume, and emphasizes the importance to take users' vulnerabilities into account when trying to empower them.

Given that a well-informed citizenry is crucial for democracy (van der Meer et al., 2020), the quality of citizens' information diets has been central to scholars' attention, especially as algorithms become important curators of information flows (Thorson & Wells, 2016). Recommender systems, which apply algorithms to filter and sort online information, help users find relevant information and thus alleviate information overload (Vrijenhoek et al., 2021). However, concerns have been raised about their potential to limit users to certain information, such as nonpolitical (Huang & Yang, 2024) or less diverse information (Pariser, 2012), as these systems are typically optimized for users' engagement as set by the platform (Vrijenhoek et al., 2021). Yet, some concerns have been challenged for oversimplifying how contemporary algorithms work (Fletcher & Nielsen, 2018) and for downplaying users' active role in selecting and processing information (Möller et al., 2018). This reflects a

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limitation in existing research: While much discussion highlights algorithms' effects on individuals' information diet, less attention has been given to how users navigate algorithmically curated environments and which factors explain differences in this navigation. As a result, the extent to which individuals differ in susceptibility to these risks associated with algorithms remains underexplored.

The curated flows framework (Thorson & Wells, 2016) helps pinpoint where such factors operate. According to the framework, individuals' information experience on digital media is curated by multiple acts of curation, including personal curation, where individuals exercise their agency over an algorithmically curated feed to shape their information environment. To what extent such personal curation is undertaken is conditioned by users' agency, which is a plausible source of the susceptibility differences noted above. In the political domain, a crucial component of citizens' agency is political efficacy (Beaumont, 2011). This established construct captures citizens' beliefs about their competence in the political systems and the political influence they have given systems' responsiveness (Balch, 1974). Prior research has suggested its close link with political information-related behavior in algorithmically curated digital media environments (Boulianne et al., 2023). Through political efficacy, we aim to highlight the importance of users' active role in shaping their own information environments, despite algorithms' power involved in this process (Thorson & Wells, 2016). We argue that individuals with different political efficacy levels differ not only in motives to seek information, as suggested by the framework of motivational forces to selective exposure (Hart et al., 2009) but also in attitudes and habits of using algorithm-driven personalization for such information-seeking. This, in turn, might lead them to distinct information-selection behavior. Limited research has tried to disentangle this possibility. Therefore, this study explicitly centers on individuals and aims to answer: How do individuals with different political efficacy levels select political information in a fully algorithmically curated environment over time?

Information selection in political communication usually centers on whether political information is selected or disregarded, and what specific political information is selected. In this process, individuals make deliberate choices influenced by factors such as political interest but also rely on other easy-to-process cues or other cognitive shortcuts (van der Meer & van der Hameleers, 2022). One such shortcut is information source, that is, the outlet or platform that publishes the information, which individuals use as an easy heuristic to determine whether to read the piece (van der Meer et al., 2020). While source-guided selection helps individuals navigate information overload, habitual reliance on familiar or preferred sources might limit exposure diversity long-term (van der Meer et al., 2020). Another shortcut is negativity bias, the individual's tendency to be drawn to negative content (Knobloch-Westerwick et al., 2020). Even though negativity-guided selection has its value, consuming an overwhelming amount of negative content might produce a distorted worldview (van der Meer & van der Hameleers, 2022). In an algorithmic environment, worries exist about the potential of these two preexisting shortcuts in information selection being amplified.

To examine this possibility, our article combines data donation and survey data from 186 users who donated their Google Discover ("Discover" thereafter) usage histories and completed three surveys in December 2024. Discover is a fully algorithmically curated feed that surfaces interest-based content based on users' prior web and app activity (Strzelecki & Rizun, 2023). The data donation contains what users clicked on from when they started using Discover, which varies by person. We extracted titles from all clicked content cards and identified political content among them, along with their sources and sentiment. In combination with users' political efficacy levels, this dataset enables us to track both within and between-user differences in political information consumption over time in terms of its proportion among all content, exposure diversity reflected in consumed sources, and proportion of negative content.

This study takes a longitudinal approach to understanding variation in users' selection behavior in an algorithmic environment. The contributions are threefold: First, adopting log data offers granular insights into real-world user behavior and preserves high ecological validity. This adds to the validity of previous findings from studies adopting experiments, simulation, or auditing to research the amplification of information selection bias in algorithmic environments (Huang & Yang, 2024; Knudsen, 2023). Second, users' content selection over time offers a lens to consider algorithms' power on users' information selection behavior, although our study does not directly examine what content is recommended. Third, this study brings together theories of political efficacy and curated flows to explain individual-level variation in algorithmic environments. Our findings contribute to an important yet opaque question: for whom usage of recommender systems may be more or less politically consequential. We emphasize that even within a shared algorithmic system, users interact with content differently, conditioned by characteristics such as political efficacy. Our findings suggest that putting users at the center instead of studying algorithms in isolation is crucial to understanding the influence of algorithms on users and vice versa.

Information selection between personal and algorithmic curation

Users select information online in multiple ways, such as browsing, clicking on URLs, following channels or sources, among other actions. In this study, selection behavior refers specifically to clicking on a URL and landing on a story, as it is a more meaningful way of engaging with content compared to passively browsing (Wojcieszak et al., 2024). When using algorithmically curated feeds, users' information experience is situated at the intersection between personal and algorithmic curation (Thorson & Wells, 2016). Within these algorithmic environments, personal curation refers to curation practice undertaken by individuals' agency, and thus "it is not undertaken to an equal extent by all individuals" (Thorson & Wells, 2016, p. 316). Algorithmic curation does not replace the decisive role of individual selection, but reconfigures the conditions under which users exercise choices by filtering and ordering the content made available at any given moment. Since these recommender systems employ users' prior behavioral data to tailor

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subsequent content recommendations, they create algorithmic feedback loops that influence users' future behavior (Trilling, 2024). This has invited fear that they potentially amplify exposure homogeneity and confirmatory negativity bias (van de Meer & van der Hameleers, 2022).

Prior research reports inconsistent findings regarding political information users select under these feedback loops. Methodologically, existing studies have mainly relied on experiments, simulation, auditing, and sock puppets methods, which risk underestimating the complexity of users or algorithms (Möller et al., 2018). This highlights the need for research that differentiates and captures more nuances of real users' selection behavior in naturally occurring algorithmic environments. Contextually, existing investigation has mainly centered on search engines, where explicit queries and results ranking are decisive for selection (e.g., Slechten et al., 2022), and social media, where algorithms of Facebook (e.g., Thorson et al., 2021) and YouTube's up-next recommendation have gained significant attention (e.g., Huang & Yang, 2024). Researchers have also adopted self-built recommenders to evaluate the influence of algorithms design on users' clicks on political content (e.g., Knudsen, 2023; Mattis et al., 2024).

What remains understudied is users' selection in fully algorithmically curated environments without being anchored to explicit requests or social interactions, unlike search engines or social network sites. Researching such environments, however, is meaningful as it allows observation of how selection patterns stabilize or shift within ongoing algorithmic curation, thus highlighting users' active role in shaping their own information diets: even when all content is algorithmically recommended, what is ultimately consumed depends on users' selection.

Discover stands out in this context. It is fully algorithmically curated, launched by Google in 2018 with 800 million monthly active users as of the same year. Facing its popularity worldwide, the news media industry has noticed its influence on their web traffic and content visibility (Lopezosa et al., 2023). Recent reports have suggested Discover to have replaced search as the main source of traffic click-throughs to content (Sweney, 2025). Despite limited studies, Discover's scale and influence on news distribution suggest its importance to users' political information diets. Taken together, it is well-suited to examine how personal curation varies across users. In the sections below, we evaluate such variation by outlining how internal and external efficacy, respectively, might condition users' political information selection in algorithmically curated flows.

Political efficacy and political information selection

Political efficacy comprises two interrelated but distinct components of individuals' confidence in the political world: internal efficacy, referring to individuals' confidence in comprehending and engaging in politics; and external efficacy, reflecting beliefs in the political system's responsiveness to public demands (Balch, 1974). Accordingly, previous digital media research suggests that while internal efficacy more consistently relates to informational usage of digital media, external efficacy relates more to participatory usage (Boulianne et al., 2023). Therefore, we argue that internal and external political efficacy each have their own unique pathway, if any, to explain political information selection, which we elaborate as follows.

Internal efficacy is positively associated with informational usage of digital media (Boulianne et al., 2023), where algorithmic curation is prevalent. We argue that people with higher internal efficacy are likely to select more politics in the algorithmic feed, given their greater political interest (Kenski & Stroud, 2006) and their major aim of news consumption being gathering information to stay informed (van der Velden & Loecherbach, 2021). Such users are thus more likely to be motivated to consume political information in the feed.

This variance may accumulate over time in algorithmic environments, considering algorithmic feedback loops. Recommender systems on major online platforms, such as Google, are optimized for engagement and rely on users' past activity for further recommendation (Strzelecki & Rizun, 2023). Therefore, internally efficacious users who consistently click more on politics are likely to receive a growing proportion of political recommendations over time, producing a "rich-get-richer" dynamic. In contrast, the proportion of political information selected by users with low internal efficacy may not significantly change over time.

However, research also suggests that using such algorithmic features is mostly habitual (van der Velden & Loecherbach, 2021). Another possibility thus emerges: Individuals, regardless of internal efficacy levels, may use algorithmic feeds without strong aims in mind. Discover, for instance, affords this type of usage through its constant availability on users' smartphones and its placement directly beneath the search bar on the main Google Search homepage (Google, 2025). In such environments, the aim of staying informed may be secondary to more immediate usage driven by convenience, curiosity, or routine (Lopezosa et al., 2023). Moreover, users with high internal efficacy may not rely on Discover to stay informed, given that content from "a variety of sources can appear on the feed" (Google, 2025). Instead, they probably directly access trusted news websites. Thus, even for highly internally efficacious users, they may not select a larger proportion of political information in the algorithmic feed. Following this reasoning, the proportion of political information selected may not significantly differ among users over time.

In comparison, external efficacy is less stably linked with consuming political information on digital media while more reliably associated with participatory usage of digital media, such as being vocal on political issues online (Ruess et al., 2023). However, Discover is not designed as an interactive political space (Google, 2025). Pure presentation of content cards on Discover does not afford direct participatory opportunities and thus may not particularly appeal to individuals with higher external efficacy (Kenski & Stroud, 2006). Accordingly, external efficacy may not be linked to any differences in the proportion of political information users select or disregard over time.

However, information utility research indicates another possibility. Perceiving online news as of high-utility value relates to higher external efficacy (Ognyanova & Ball-Rokeach, 2015). The goal of political information consumption online goes beyond staying informed, because information selected can serve a range of social functions such as provoking conversations and information sharing (Ognyanova & Ball-Rokeach, 2015), which is

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positively related to external efficacy (Boulianne et al., 2023). Therefore, it is likely that individuals who have higher external efficacy are more likely to evaluate political information as important resources for participatory usage and thus worth attending to, whereas those who believe political systems as unresponsive may see less value in choosing such information regardless.

Given these mixed, but not directly competing, expectations of internal efficacy and external efficacy, we keep the question open:

RQ1: How do individuals with different levels of (a) internal and (b) external political efficacy differ in the proportion of political information among all content selected on Discover over time?

Political efficacy and exposure diversity

Exposure diversity in this study refers to the diversity of political information sources that users actually select, that is, the outlet or platform which publishes the content. As a dual-concept, it captures both the number of sources and how evenly the attention is distributed across them (Mcdonald & Dimmick, 2003). This notion of exposure diversity is both practically grounded and theoretically informed. Practically, algorithmic recommenders often rely on observable signals such as topics and sources users choose for further recommendations because they struggle to capture deeper content dimensions like viewpoints (Trielli & Diakopoulos, 2019). Theoretically, consuming information from diverse sources aligns with the deliberative model of democracy, which emphasizes the audience's engagement with different and challenging viewpoints, and correspondingly calls for a diverse media offering (Helberger, 2019). For recommenders, while we cannot retrospectively argue that diverse sources chosen by individuals are equal to diverse sources offered to them, it is safe to state that without diverse offering, diverse selection within such a pool is simply impossible. For citizens, while a greater number of sources does not guarantee consumption of different viewpoints, it is a buffer against concentrated opinion power and increases opportunities for competing ideas (Jürgens & Stark, 2022).

Individuals with different levels of internal efficacy differ in their political information diets. Regarding exposure diversity, two competing possibilities are plausible based on existing research. On the one hand, internally efficacious individuals have a stronger desire to understand and be involved in politics, making them more likely to actively seek information from diverse sources. This is supported by a media-repertoire study that has found news repertoires of Norwegian citizens with the highest political efficacy are composed of the most diverse news providers (Moe et al., 2021). When using algorithmic feeds, these efficacious individuals may likewise be more inclined to seek out and evaluate diverse sources, especially if they perceive such engagement as part of responsible civic involvement. Supporting this view, research shows that people with higher political efficacy value news personalization less, suggesting greater preferences for agency and autonomy in news selection (Bodó, 2019).

On the other hand, internally efficacious users may approach information selection with stronger source preferences. Prior research on television audiences shows that higher internal efficacy is associated with a preference for public broadcasting channels compared to commercial channels (Norris, 2001). Sources in this regard function as brands of the information product, which internally efficacious individuals have a better chance of having knowledge of, given their higher political interest and knowledge (Kenski & Stroud, 2006). As a result, internally efficacious users' exposure diversity may be limited, because their exposure is concentrated on a narrower set of sources they prefer or reckon as high-quality.

Compared to internal efficacy, external efficacy's relationship with exposure diversity is less established because previous studies have barely examined the direct relationship between external efficacy and information source selection. Several studies based on social cognitive theory suggest a positive association between external efficacy and purposeful information seeking as such behavior generates a sense of control and responsiveness (Zhou & Pinkleton, 2012), but its implication for exposure diversity is mixed. We argue that purposeful information seeking can either be reflected in targeted information consumption, and thus low exposure diversity, or broad consumption across all kinds of sources, and thus high exposure diversity. This relationship becomes even more uncertain in algorithmically curated environments, where political information consumption can be more habitual than purposeful (van der Velden & Loecherbach, 2021).

Taken together, the complexity and inconsistency of existing findings make it hard to predict whether and how users with varying levels of internal and external efficacy differ in the changes of their exposure diversity over time. Therefore, we propose the second research question:

RQ2: How do individuals with different levels of (a) internal and (b) external political efficacy differ in their exposure diversity of political information selected on Discover over time?

Political efficacy and negativity bias

Besides sources, another well-established shortcut in information selection is negativity bias, that is, preferences for negative over positive content. In this study, negativity specifically refers to a negative tone (Esser et al., 2016). Compared to positive news, negative news garners more attention (Knobloch-Westerwick et al., 2020), as demonstrated by experiments showing that negative and emotional words in news titles significantly increase click-through rates (Robertson et al., 2023). This tendency also holds for political information due to its features such as unexpectedness, sensationalism, etc. (Lengauer et al., 2012). Psychology researchers connect preferences for negative stimuli to human beings' built-in mechanism for scanning threats in the environment (Esser et al., 2016).

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Negativity biases are universal, although individuals with different political efficacy exhibit negativity bias probably for different reasons. The framework of motivational forces in information selection (Hart et al., 2009) introduces two motives in information selection: accuracy and defense. Accuracy motivation is an individual's desire to accurately appraise and represent reality, and defense motivation is an individual's desire to defend their existing attitudes, beliefs, and behavior (Hart et al., 2009). For less efficacious individuals, we argue that their negativity bias may stem from their higher defense motives, because negative political information can justify their lack of perceived capacity, reflected in lower internal efficacy, and lack of perceived influence on political outcomes, reflected in lower external efficacy. Such higher defense motives can help maintain their emotional and cognitive harmony. In contrast, we argue that more efficacious individuals exhibit stronger accuracy motives in information selection. With more confidence in their political competence, that is, internal efficacy, and existing political systems, that is, external efficacy, they are less likely to feel threatened by negative political information. Instead, they may interpret it as necessary for understanding the sophisticated political world and gaining more competence.

While these motivational differences help explain why negativity bias occurs for people with different political efficacy levels, existing research offers little insights into how individuals may vary in their degree of negativity bias, as reflected via the proportion of negative political content selected, or how this bias evolves in algorithmic feedback loops. It is plausible, though, that recommendation systems optimized for user engagement may feed this bias by offering a more skewed selection of negative stories based on users' previous selection of comparable items (van der Meer & van der Hameleers, 2022). Given the limited empirical evidence, especially in algorithmically curated environments, we approach this question exploratorily:

RQ3: How do individuals with different levels of (a) internal and (b) external political efficacy differ in the proportion of negative information selected on Discover over time?

Methodology

Design and sample

To answer the research questions, we combined survey and data donation methods. Survey data came from the LISS panel, a panel representative of the Dutch population, where participants could also consent to data donation, allowing us to collect their digital traces on Discover. In Discover, each piece of information is presented as a content card with only the source and title. This means that users' selection is more likely guided by these cues, aligning with our interest in content categories (political vs. nonpolitical) and sources. Since all content is recommended without explicit user-initiated search queries or subscriptions (Google, 2025), each click represents users' active choice to engage with certain content. Data collection was fielded in December 2024 after ethical approval from the University of Amsterdam (Survey: FMG-7010; Data donation: FMG-10177). The methods were pre-registered on Open Science Framework (https://doi.org/10.17605/OSF.IO/EDJX9).

Participants were guided to upload their Discover data donation packages (DDPs) via a secure interface, PORT (Boeschoten et al., 2023). Before uploading, participants could inspect all the data and delete traces they did not want to share. Altogether, 255 unique users of Discover uploaded their DDPs, which were processed sorely and securely on the server. We excluded 53 DDPs containing only links redirecting to users' Google account center and Google Maps instead of content, and 16 that cannot be linked to survey data. After data-cleaning, 186 unique DDPs remained for further analysis.

Among the 186 users, Discover usage ranged from one to 2,544 days, with a median of 398 and an average of 509 days. The average age was 48.90 years old ($SD = 16.79$), 42.5% were female ($N = 79$), and 57.5% had completed higher-level education (WO or HBO-level).[1] Our sample included fewer females and was relatively older and more highly educated compared to the Dutch population (CBS, 2024, 2025, 2026). These three demographics were controlled in the analyses.

Survey measures

Internal efficacy

The scale is composed of three items adapted from Halpern et al. (2017). Each item was measured on a seven-point scale (1 = *strongly disagree*, 7 = *strongly agree*). Three items (e.g., I consider myself to be well-qualified to participate in politics) present good reliability (Cronbach α = .82). Their average score is internal efficacy ($M = 4.03$, $SD = 1.50$).

External efficacy

It was measured by three items (e.g., People like me don't have any say about what happens in politics.) adapted from Craig et al. (1990) on a seven-point scale (1 = *strongly disagree*, 7 = *strongly agree*). Items were recoded so the higher score represents higher external efficacy ($M = 3.95$, $SD = 1.48$). The scale exhibited high reliability (Cronbach α = .91).

Control variables

We controlled for three socio-demographics: age, biological sex, and education level, in all analyses for their potential association with political information consumption (Wojcieszak et al., 2024). Additionally, we controlled for political interest across all analyses because it strongly correlates with internal efficacy (Kenski & Stroud, 2006) and shows no collinearity issue in our study. It was assessed with a seven-point scale (1 = *completely disagree*, 7 = *completely agree*) asking participants' agreement with the statement "I find politics interesting" ($M = 4.25$, $SD = 1.87$). In the analysis of exposure diversity, political identity is also controlled, as previous studies have shown that people with different ideologies gather information from different sources (Kim & Schwarze, 2021). It was measured by asking participants to place themselves on an eleven-point scale where zero means left and 10 means right ($M = 4.47$, $SD = 2.27$).

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Digital trace data

Discover DDPs contain URLs of content that users clicked into, but not recommended content without clicks. Altogether, we collected 70,821 URLs from 186 DDPs, with each URL representing a user click on a content card in Discover. We scraped titles for all URLs using Selenium in Python 3.11.11. Titles relevant to issues of public concern are considered political, including not only those directly covering political figures and events but also broader sociopolitical issues. To identify political titles, we combined automatic methods and manual screening (see Supplemental Material A).

First, we applied a developed political information classifier (Wojcieszak et al., 2024) to the whole dataset and filtered out 58,649 nonpolitical titles. The classifier's performance was validated on a random subset of 2,000 titles manually annotated by the first author. The overall F1 score is satisfactory (precision: 0.62, recall: 0.99, F1 score: 0.76). However, extremely high recall score and relatively lower precision score suggest that the classifier successfully identifies almost all political information at the cost of overflagging some nonpolitical titles.

Second, to mitigate this issue, we manually screened the remaining 12,172 titles and removed 6,024 false positives. Before manual screening, the first author and a native Dutch speaker jointly assessed a random subset ($n = 300$) of classifier-identified "political" titles and achieved satisfying intercoder reliability after two rounds of training (Cohen's κ = 0.79, Krippendorff's α = 0.79). Then the first author finished the whole manual inspection.

After these two steps, we identified 8.7% ($N = 6{,}148$) of all digital traces as political information, covering 304 unique published websites. These political titles comprise 5,874 in Dutch, 149 in German, and 125 in English. In the following, we outline the core variables computed based on users' digital traces (see Table 1 for an overview).

Proportion of political information

The proportion of political clicks among all clicks ($M = 0.06$, $SD = 0.08$) was low. Among all 186 users, 66 had never clicked on any political information on Discover. For the remaining 120 with a proportion above zero, the distribution of their number of political clicks ($M = 51.23$, $SD = 112.90$, Mdn = 14.5 (IQR 10.2–20.5)) was heavily right-skewed (skewness = 4.81), indicating that while most users clicked relatively few political links, a small number of users clicked substantially more political links. For those 120 users, we also calculated their weekly political information proportion, yielding 1,683 observations.

Exposure diversity

Exposure diversity is measured with Shannon's entropy H (Shannon, 1948). This measure accounts for both the number of sources users accessed and the distribution of click frequency across them, which best captures the conceptualization of "dual-concept diversity" discussed above (Mcdonald & Dimmick, 2003). It is calculated as the negative sum of the proportions of clicks on a certain domain relative to all domains times the log of the proportion (see below). Higher Shannon's H means more diverse sources. We computed Shannon's H for 120 individuals with political information diets over their entire period of using Discover ($M = 1.64$, $SD = 1.14$) and for their weekly diets.

$$H = -\sum p_i \ln p_i$$

Proportion of negative political titles

Before computing the proportion of negative political titles, we first identified negative titles using a fine-tuned Large Language Model (LLM). Titles are categorized as "negative" if they convey political failure, crisis, frustration, or disappointment, whereas "positive" if they reflect political success, achievement, improvement, hope, or gain (Esser et al., 2016). Each title's sentiment level was rated on a five-point scale (−2 = *Predominantly negative*, −1 = *Slightly negative*, 0 = *Balanced or neutral*, 1 = *Slightly positive*, 2 = *Predominantly positive*), with levels below zero considered negative.

We followed the protocol of using fine-tuned LLM for text annotation (Alizadeh et al., 2024). The base LLM is GPT-4.1, which performed well in supervised fine-tuning on classification tasks (OpenAI, 2025). First, a subset of 1,000 Dutch titles was manually coded by two native Dutch coders after two rounds of coder training (complete codebook in Supplemental Material B), reaching a satisfying inter-coder reliability (Krippendorff's α = 0.73). Second, we split these manually annotated 1,000 titles into a training set of 500 titles and an evaluation set of 500. The training set was used to fine-tune GPT-4.1 in both zero-shot and few-shot settings. Third, we ran the fine-tuned models (zero-shot vs. few-shot) on titles in the validation set twice. Model performance was evaluated with two metrics: average accuracy, which is the percentage of correct predictions among all predictions using the evaluation set as the gold standard; and inter-

Table 1 Overview of the core variables computed based on digital traces.

RQ	Time frame	Variable	*N* (observations)	*N* (participants)
RQ1	Cross-sectional (overall)	Overall proportion of political information	186	186
	Longitudinal (weekly)	Weekly proportion of political information	1,683	120
RQ2	Cross-sectional (overall)	Overall exposure diversity of political information consumption	120	120
	Longitudinal (weekly)	Weekly exposure diversity of political information consumption	1,683	120
RQ3	Cross-sectional (overall)	Overall proportion of negative political information	120	120
	Longitudinal (weekly)	Weekly proportion of negative political information	1,683	120

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coder reliability measured with Krippendorff's α, treating each trial of the same model as an independent coding practice. Since fine-tuned zero-shot GPT-4.1 (average accuracy: 70.9%, Krippendorff's α = 0.97) slightly outperformed few-shot (average accuracy: 70.0%, Krippendorff's α = 0.95) on both metrics, we selected zero-shot fine-tuned model for sentiment categorization. Fine-tuning prompt and other details are in Supplemental Material C.

Using zero-shot GPT-4.1, we labeled the sentiment of all 6,148 political titles. We computed the overall proportion of negative titles relative to all titles for 120 users who had consumed political information (M = 0.59, SD = 0.27) and their weekly proportion of negative titles.

Results

Proportion of political content

We first checked differences in the proportion of political content among individuals with different levels of political efficacy cross-sectionally. The proportion of political clicks is highly right-skewed and contains many meaningful zeros, that is, no consumption of political content. Therefore, we adopted a two-part modeling approach (Boulton & Williford, 2018). The first part was a logistic regression on all individuals' click-level data over the whole usage period. It examines the likelihood of clicking political (coded as 1) versus nonpolitical content (coded as 0). Results suggested that those individuals with higher internal efficacy (b = 0.11, β = 0.17, $p < .001$) were significantly more likely to click on political content, while those with higher external efficacy (b = 0.05, β = 0.08, $p < .001$) were significantly less likely to do so. The second part was a beta regression focusing solely on 120 individuals who had clicked at least once on political content. No significant differences were found in the proportion of political content by internal efficacy (b = 0.10, β = 0.15, p = .159) and external efficacy (b = 0.05, β = 0.07, p = .304). In sum, while individuals with higher internal and higher external efficacy were more likely to click on politics, their variation in the proportion of political content was not conditioned by political efficacy.

For these 120 individuals with political information consumption, we further examined over-time changes in their weekly proportion of political content to address RQ1 (see Table 2). A beta mixed-effects model with both random intercepts and slopes of change over time suggested that the proportion of political information significantly decreased over time, which was measured as relative weeks of usage (β = −0.18, p = .011). However, neither internal efficacy (β = −0.01, p = .907) nor external efficacy (β = 0.11, p = .086) was significantly associated with the weekly proportion of political content. Their interactions with time were non-significant either (internal efficacy * time: β = 0.10, p = .214; external efficacy * time: β = −0.07, p = .339). Together, these results suggest that although the proportion of political clicks slightly decreased over time, this change was not conditioned by political efficacy.

To further understand whether this over-time decrease in proportion corresponds to fewer political clicks, we conducted the following complementary analyses. We checked the differences in the absolute number of political clicks both cross-sectionally and longitudinally among 120 individuals with political consumption. An Ordinary Least Squares (OLS) regression showed that the total number of clicks on political content significantly differs among people with different internal efficacy (b = 21.70, β = 32.32, p = .049) but not external efficacy (b = −0.60, β = −0.84, p = .937). Additionally, a linear mixed effects model allowing for random intercepts and slopes observed no significant decrease

Table 2 Results of two longitudinal mixed-effects models with proportion of political clicks and the number of political clicks as the dependent variable respectively.

	DV = proportion of political clicks				DV = the number of political clicks			
Predictors	***b***	β	***SE***	***p***	***b***	β	***SE***	***p***
Intercept	−3.016	−2.592	0.281	<.001	4.282	4.151	2.954	.160
Internal efficacy	−0.007	−0.011	0.092	.907	0.871	1.445	0.638	.023
External efficacy	0.074	0.109	0.063	.086	0.279	0.227	0.499	.648
Time (relative week)	−0.002	−0.176	0.069	.011	−0.005	−0.420	0.918	.648
Interaction terms								
Internal efficacy × Time	0.001	0.095	0.076	.214	−0.002	−0.126	0.967	.897
External efficacy × Time	−0.001	−0.070	0.073	.339	0.008	0.700	1.029	.496
Controls								
Political interest	0.026	0.048	0.087	.584	−0.209	−0.237	0.328	.470
Biological sex	0.044	0.044	0.115	.702	−0.87	−0.777	0.860	.367
Age	0.006	0.090	0.051	.078	−0.002	−0.002	0.028	.944
Education	0.074	0.074	0.045	.103	0.213	0.240	0.304	.431
Model performance								
Marginal R^2	0.092				0.027			
Conditional R^2	0.658				0.752			

Note. Unstandardized coefficients (b) are based on a model with mean-centered interaction terms. The other estimates, including standardized coefficients (β), are based on a model with standardized predictors and an unstandardized dependent variable. Marginal R^2 is the variance explained by fixed factors. Conditional R^2 is the variance explained by both fixed and random factors.

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in the absolute number of weekly political clicks over time (β = −0.42, p = .648) (see Table 2), meaning that the decrease in proportion is not due to the decrease in the absolute amount of political information selected over time.

Exposure diversity of political information

Regarding RQ2 about exposure diversity, we first used an OLS regression model ($F(7, 108) = 2.26$, p = .035, R^2 = .13) to explore how people with different political efficacy levels differ in their overall exposure diversity, controlling for three sociodemographics and two political characteristics, political interest and political identity. The model shows that people with higher internal efficacy (b = 0.22, β = 0.33, p = .047) and people who were more right-leaning (b = 0.10, β = 0.24, p = .031) had higher exposure diversity. No other factors, including external efficacy (b = −0.02, β = −0.03, p = .81), were significant.

For longitudinal change, we ran a linear mixed-effects model over weekly exposure diversity scores, allowing intercept and slopes of change over time to vary by individual (see Table 3). The model shows that on average, individuals with higher internal efficacy had higher exposure diversity (β = 0.17, p = .035). And these more internally efficacious users experienced more increases in their exposure diversity over time as well, as suggested by the positive and significant interaction between time and internal efficacy (β = 0.17, p = .023). No other fixed effects are significant, including interaction between time and external efficacy (β = −0.04, p = .536) and time (β = 0.01, p = .848).

Table 3 Results of the linear mixed-effects model with exposure diversity as the dependent variable.

	DV = exposure diversity (Shannon's H)			
Predictors	***b***	***β***	***SE***	***p***
Intercept	0.048	0.303	0.262	.247
Internal efficacy	0.113	0.167	0.079	.035
External efficacy	−0.000	−0.001	0.056	.991
Time (relative week)	0.000	0.013	0.068	.848
Interaction terms				
Internal efficacy × Time	0.001	0.167	0.073	.023
External efficacy × Time	−0.000	−0.043	0.070	.536
Controls				
Political ideology	0.009	0.022	0.052	.680
Political interest	−0.004	−0.008	0.076	.914
Biological sex	−0.121	−0.121	0.105	.249
Age	0.005	0.069	0.047	.141
Education	0.070	0.070	0.041	.092
Model performance				
Marginal R^2	0.119			
Conditional R^2	0.587			

Note. Unstandardized coefficients (b) are based on a model with mean-centered interaction terms. The other estimates, including standardized coefficients (β), are based on a model with standardized predictors and an unstandardized dependent variable. Marginal R^2 is the variance explained by fixed factors. Conditional R^2 is the variance explained by both fixed and random factors.

Proportion of negative political information

We first examined the proportion of negative political information in individuals' overall political diets. With three sociodemographics and political interest controlled, an OLS regression shows no significant difference in negative political information proportion among people with different internal efficacy (b = 0.00, β = 0.00, p = .965) or external efficacy (b = −0.02, β = −0.03, p = .242).

We then turn to the longitudinal perspective (see Table 4). With the same controls, we fit a linear mixed-effects model with weekly proportion of negative political information as the dependent variable, interaction terms between time and two political efficacy variables as predictors, allowing intercept and slopes to vary by individual. The model found no significant differences in over-time changes that people with different internal (β = 0.01, p = .650) and external efficacy (β = −0.01, p = .469) experienced. Exploratory analysis on political information sentiment found no significant differences either (see Supplemental Material D).

Discussion

This study is amongst the first to take a longitudinal approach in examining information-selection behavior in a fully

Table 4 Results of mixed-effects model with the proportion of negative political information as the dependent variable.

	DV = proportion of negative content			
Predictors	***b***	***β***	***SE***	***p***
Intercept	0.508	0.561	0.065	<.001
Internal efficacy	0.009	0.013	0.019	.497
External efficacy	−0.013	−0.019	0.015	.191
Time (relative week)	0.000	0.007	0.013	.579
Interaction terms				
Internal efficacy × Time	0.000	0.006	0.013	.650
External efficacy × Time	−0.000	−0.010	0.013	.469
Controls				
Political interest	−0.002	−0.003	0.019	.864
Biological sex	0.014	0.014	0.028	.621
Age	0.001	0.018	0.013	.174
Education	0.001	0.001	0.011	.916
Model performance				
Marginal R^2	0.005			
Conditional R^2	0.027			

Note. Unstandardized coefficients (b) are based on a model with mean-centered interaction terms. The other estimates, including standardized coefficients (β), are all based on a model with standardized predictors and an unstandardized dependent variable. Marginal R^2 is the variance explained by fixed factors. Conditional R^2 is the variance explained by both fixed and random factors.

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algorithmically curated environment. Our findings are informed by users' digital traces on Discover, covering each participant's entire usage period from several days to over 7 years. Relying on this unique and robust dataset, we analyzed how users with different political efficacy select political information over time in personalized algorithmic feeds. Specifically, we disentangle three key aspects of information-selection behavior: how much political information users selected (RQ1), the diversity of sources (RQ2), and negativity bias (RQ3).

For the first aspect, we found that the likelihood of clicking on political content is higher for more internally efficacious users, but among those who had already clicked on politics, they neither significantly differ in the proportion of political content within their overall clicks, nor how the proportion changes over time. Besides, political interest, a well-established driver for political diets as shown in earlier research (e.g., Kenski & Stroud, 2006), showed no significant relationship with proportion of political information among people who at least clicked on politics once. These findings together suggest that internal efficacy matters for crossing the "threshold" of choosing politics or not at all, but once this threshold is crossed, it is not decisive for the political information proportion and its change in people's information diets through algorithmic feeds. One possible explanation is that since political information only constitutes a small share of people's information diets (Wojcieszak et al., 2024), there is simply not enough variation to be detected. Alternatively, another possible explanation is that users who have already crossed the threshold, regardless of their political interest and internal efficacy, do not actively seek political information in their further selection on algorithmic feeds. This aligns with research suggesting that using algorithmic features is mostly immediate usage driven by convenience, curiosity, or routine (Lopezosa et al., 2023). This possibility, however, is beyond the scope of our current study. Future research, especially qualitative work, can investigate users' experience in navigating algorithmic environments.

Interestingly, we observed a small but significant decrease in the proportion of political information for an average user who consumed political information, even though this change is not conditioned by political efficacy. Since the absolute number of political clicks does not significantly decrease over time, this decrease in proportion should be attributed to the increased consumption of other nonpolitical content in the algorithmic feed. Our study thus did not find sufficient support for the concern regarding recommender systems deterring users away from political information (Huang & Yang, 2024). In other words, users' decision on how much politics to consume seems to be relatively stable over time and not that easy to drift. This "saturation" point is reasonable given users' limited cognitive capacity and cognitively demanding nature of sheer amount of news (Wojcieszak et al., 2024). Future research could examine other algorithmic environments that are comparable in accessibility but use distinct recommenders, such as TikTok, to see whether similar patterns of stable political consumption emerge over time. Meanwhile, generally low proportion of political information consumption can also make temporal fluctuations hard to detect. Therefore, for scholars interested in temporal dynamics of political information consumption on algorithmic feeds, we suggest a longer data observation window, if feasible, to obtain more data points. Additionally, they may also consider other measures to complement measure of proportion of political information, such as attention, follow-up searching behaviors, to better capture users' engagement with political content on algorithmic feeds.

Zooming in on exposure diversity, we found that more internally efficacious users consumed political content from more diverse sources, putting them at an advantageous position in algorithmic feeds, while the gap between them and less efficacious users widened over time. This finding extends prior media repertoire research which finds that, cross-sectionally, internally efficacious users consume more diverse sources (Moe et al., 2021), by providing evidence indicative of an enlargement of this division over time. One possible mechanism is that recommenders pick up on users' selections of (less) diverse sources as input to inform further recommendations in the feed, creating a rich-get-richer dynamic via algorithmic feedback loops (Trilling, 2024). This speculation aligns with how current recommenders work, as they typically draw on sources to recommend content (Trielli & Diakopoulos, 2019). However, since media offering was not captured by DDPs in this study, this mechanism requires future work to unpack. Scholars may consider designs that can capture both users' choices and available options, such as combining data donation and screen recording.

Although internally efficacious users consume political information from more diverse sources in Discover, we cannot draw conclusions about their (absence of) preferences for specific sources, such as high-quality ones. Instead, echoing our speculation above for internal efficacy not explaining variation in the proportion of political consumption, it likely reflects people's exploratory state when using algorithmic feeds. Instead of actively curating their political information diet in certain ways, they probably use these feeds in a more casual way (van der Velden & Loecherbach, 2021) and thus more guided by their curiosity and open mindset. This explanation is supported by the accessibility of Discover and its interface for low-effort scrolling. Moreover, if this exploratory state reflects users' general usage pattern of Discover, comparable gaps in exposure diversity might emerge for other nonpolitical information as well, a possibility that requires future comparative research to empirically unpack.

The last aspect of information-selection behavior we probed is users' negativity bias, as reflected via the higher share of negative political content compared to neutral and positive sentiment. Despite prevalent concern about the amplification of negativity bias over time in algorithmic environments, we found no significant changes in people's negativity bias over time, and no differences among people with different internal or external efficacy levels either, even though they selected predominantly negative content. This confirms our assumption that despite possible variation in motivations for selecting negative political information (Hart et al., 2009), users are attuned to negativity regardless of political efficacy. One plausible reason is that political content is predominantly negative because negativity is of inherent news value, and democracy relies on publicizing deviance, criticism, and competing ideas (Lengauer et al., 2012). Therefore, users' consumption of political information is unavoidably negative since the very beginning, leaving little room for change in negativity proportion over time. We encourage

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replication studies in other algorithmic feeds to check whether such stability in negative political information consumption holds across different algorithms. Future research can also examine nonpolitical information to evaluate if such stability is unique to political information only or can be generalized to other domains.

While internal efficacy explained increasing divergence in political information consumption among individuals over time, external efficacy did not account for longitudinal changes in any aspects above. This null finding echoes previous digital media research suggesting that external efficacy is linked with participatory usage of digital media such as online interactions with officials and online political discussion (Boulianne et al., 2023; Kenski & Stroud, 2006), whereas the algorithmic environment in our case does not afford such type of usage. Although one can argue that political information users get on Discover potentially still facilitate potential interactions elsewhere or at a later stage, this speculation might be too remote or contingent on follow-up behavior to produce any observable associations on Discover at the current stage. By contrast, as algorithms on Discover support informational usage mainly, internal efficacy remains relevant for longitudinal changes on exposure diversity on the feed. For future research on algorithms and political efficacy, more attention can be put on algorithmically curated environments that afford both informational and participatory opportunities for users.

Three limitations should be noted. First, following privacy and ethics guidelines, participants in our study were allowed to delete digital traces they did not want to share, which may influence the results. Previous research suggests that only a minority of donors would delete traces in DDPs, and what they tend to delete is interpretable metadata perceived as sensitive (Wedel & Ohme, 2026). Consistent with this pattern, only 8.06% of our sample (15 out of 186 participants) did so. As this was part of a larger data collection (with other Google activity data, including YouTube Watch Histories and Google Search), we are unable to identify how many of these deletions are part of Discover, yet. For future studies using data donation methods, we encourage researchers to record the number of user-omitted data points by categories and, when necessary, reasons for deletion. Second, since DDPs do not contain content recommended by algorithms but not clicked by users, this study cannot explicitly compare users' agency relative to algorithms' influence. Ideally, access to media offering would have allowed clearer differentiation between conditions when users' preferences override algorithmic suggestions and when algorithmic curation constrains users' choices. Third, we operationalized diversity as a single dimension manifested through sources given current recommenders' struggle to detect deeper content dimensions. However, as recommenders develop, they potentially detect dimensions beyond sources, such as frames and viewpoints, adding complexity to research about information-selection behavior in algorithmic environments.

Despite these limitations, our study advances understanding of users' agency in the algorithmic age. Overall, the variation and stability observed in information-selection patterns over time imply that more internally efficacious users are more resilient to concerns of algorithmic feeds limiting users to nonpolitical or less diverse content: They maintained a stable amount of political information consumption, and gained it from more diverse sources over time. In contrast, a growing digital divide emerges between more and less internally efficacious users, given the cumulative advantage of efficacious users. Less efficacious users were less likely to click on politics initially, and even if they did, they experienced slower growth in exposure diversity than efficacious users. Responding to broader discussion on "how to avoid being left out in the algorithmic age," our findings imply that while using algorithms seems inevitable and habitual, how to use them is a choice dependent on, among others, users' efficacy.

Our findings are also relevant to inform policy making and future platform regulation. There is a potential systemic risk for democracy and civic discourse because of growing digital divides between more and less politically efficacious people. This points to the difficulty of one-size-fits-all policy measures aimed at strengthening users' agency in algorithmic environments, and indicates a need to differentiate more between users' categories when developing policy measures. Our study calls for particular attention to less politically efficacious users who are more vulnerable to negative effects of algorithmic curation.

Supplementary material

Supplementary material is available at *Journal of Computer-Mediated Communication* online.

Data availability

This study is pre-registered on OSF, accessible via link: https://doi.org/10.17605/OSF.IO/EDJX9. Details of political information classification, manual coding of political titles' sentiment level, fine-tuning process of LLM, and exploratory analysis are available in the Supplementary Material: https://osf.io/hy6pu/overview. The raw dataset, i.e., users' digital traces on Discover, is not available since it cannot be anonymized or pseudonymized given its nature, but the aggregated-level datasets for analysis are available on the same OSF repository.

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Conflicts of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Note

1. Higher education in the Netherlands is made up of HBO (hoger beroepsonderwijs in Dutch) and WO (wetenschappelijk onderwijs in Dutch). Both provide bachelor's degrees, with HBO representing higher vocational education and WO representing scientific or academic education. These two forms of education are provided by hogescholen (polytechnics/universities of applied science) and universities, respectively.

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