



# Nudging towards news diversity: A theoretical framework for facilitating diverse news consumption through recommender design

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[journals.sagepub.com/home/nms](https://journals.sagepub.com/home/nms)**Nicolas Mattis** 

Vrije Universiteit Amsterdam, The Netherlands

**Philipp Masur** 

Vrije Universiteit Amsterdam, The Netherlands

**Judith Möller**

University of Amsterdam, The Netherlands

**Wouter van Atteveldt**

Vrije Universiteit Amsterdam, The Netherlands

## Abstract

Growing concern about the democratic impact of automatically curated news platforms urges us to reconsider how such platforms should be designed. We propose a theoretical framework for personalised diversity nudges that can stimulate diverse news consumption on the individual level. To examine potential benefits and limitations of existing diversity nudges, we conduct an interdisciplinary literature review that synthesises theoretical work on news selection mechanisms with hands-on tools and implementations from the fields of computer science and recommender systems. Based thereupon, we propose five diversity nudges that researchers and practitioners can build on. We provide a theoretical motivation of why, when and for whom such nudges could be effective, critically reflect on their potential backfire effects and the need for algorithmic transparency, and sketch out a research agenda for diversity-aware news recommender design. Thereby, we develop concrete, theoretically grounded avenues towards facilitating diverse news consumption on algorithmically curated platforms.

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## Corresponding author:

Nicolas Mattis, Vrije Universiteit Amsterdam, 1081 HV Amsterdam, The Netherlands.

Email: [n.m.mattis@vu.nl](mailto:n.m.mattis@vu.nl)

## Keywords

Algorithmic news platforms, cross-cutting exposure, news diversity, news selection, nudging, personalisation, recommender systems

## Introduction

News can be regarded as ‘an inherent value for society that extends beyond what can be measured or expressed in market terms’ (Doyle, 2013: 95). News that covers a diverse range of topics and viewpoints has long been considered crucial for well-functioning democracies (Hendrickx et al., 2020; Loecherbach et al., 2020), because it helps citizens learn about and participate in political life (Strömbäck, 2005). Consuming diverse viewpoints has been linked to increased tolerance (Mutz, 2002), more accurate perceptions of public opinion (Dvir-Gvirsman, 2015) and greater political knowledge and interest (Castro et al., 2021; Kim and Pasek, 2020). Scholars argue that reading diverse viewpoints facilitates cohesion, political judgement, understanding (Helberger and Wojcieszak, 2018) and good citizenship (Kim and Kwak, 2017). In this article, we develop a theoretical framework for *personalised* diversity nudges that can contribute to well-functioning democracies by stimulating diverse news consumption on algorithmically curated news platforms.

Thereby, we address concerns about the extent to which citizens still consume diverse and particularly political information sparked by the emergence of today’s high-choice media environment and algorithmic filtering techniques (Van Aelst et al., 2017). Despite lacking empirical evidence (Bruns, 2019; Dahlgren, 2021), concerns over potential filter bubbles (Pariser, 2011) and echo chambers (Sunstein, 2009) dominate this debate. Yet, other reasons for concern also exist, as some individuals appear to be at a greater risk of an impoverished news media diet than others. Related worries include individual-level differences in the interest in and openness to diverse news (Kim and Pasek, 2020) which might cause increasing knowledge gaps (Van Aelst et al., 2017), as well as potential and algorithmic feedback loops that reinforce existing preferences and biases (Lorenz-Spreen et al., 2020).

Because many of these concerns relate specifically to algorithmic filtering tools, our article focuses on news recommender systems (NRSs). NRSs are algorithmic tools that ‘filter incoming streams of information according to the users’ preferences or [. . .] point them to additional items of interest’ (Karimi et al., 2018: 1203). They are popular among both news providers and consumers because they enable users to effectively navigate a plethora of content (Bodó, 2019; Thurman et al., 2019). NRSs constitute the backbone of commercial news aggregators such as Google News, but they are also increasingly implemented on traditional news websites.

NRSs are usually optimised for user engagement, but they could just as well be designed to facilitate more diverse news consumption (Helberger, 2019; Moeller et al., 2018). In fact, some news organisations have already experimented with tools that can help diversify users news diets (e.g. Blue Feed Red Feed,<sup>1</sup> GroundNews<sup>2</sup>), while in direct communication many other organisations have expressed their intention to incorporate diversity considerations in their future products. Although these attempts are still in their infancy, diversity is becoming increasingly prominent in news recommender design

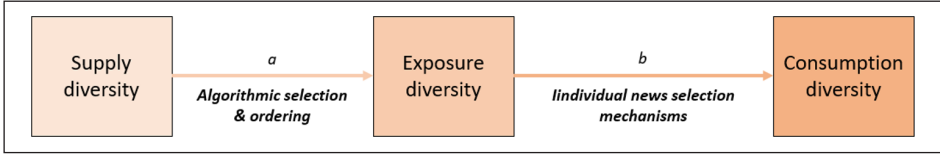
(Bernstein et al., 2021) and recent research indicates that more diverse NRSs do not necessarily impede user utility (Heitz et al., 2022).

Past research has put forward normative ideals and quantifiable metrics that can inform the design of *diversity-aware* news recommenders (Bozdag and van den Hoven, 2015; Helberger, 2019; Vrijenhoek et al., 2021). However, advancing news diversity in the recommendation process is only the first step. In order to benefit democracy, citizens also need to engage with diverse content in ways that translate into pro-social media effects. Therefore, this article explores how, when and for whom diversity-aware NRS design can facilitate diverse news consumption.

Exploring these individual and contextual differences is crucial because more diversity does not always produce the desired outcomes. For example, consuming diverse viewpoints has been linked to decreased political participation (Kim and Kwak, 2017), particularly in cases with low issue relevance (Chen and Lin, 2021). Diverse viewpoints can also cause more critical information processing (Taber and Lodge, 2006) or active counter-arguing, which, in turn, increases political polarisation (Bail et al., 2018). In addition, too much diversity may be overwhelming at times (Baden and Springer, 2017) and can decrease user satisfaction if it is taken to the extreme (Bryanov et al., 2020). Thus, rather than promoting maximal diversity, diversity-aware NRSs need to find the sweet spot in which recommendations are diverse, yet also acceptable and appreciated by the user (see Reuver et al., 2021b).

Finding these sweet spots requires combining media psychological insights and theories on news selection with computational work on news recommendation. While we still lack a nuanced understanding of how various person–situation interactions shape news selection and its effects in NRSs (Bernstein et al., 2021), different disciplines are working on important pieces of the puzzle. This includes social scientific research into news selection mechanisms and the effects of algorithmic news platforms, as well as computational studies on evaluation metrics that go beyond user satisfaction and engagement (Karimi et al., 2018) or work on digital nudges in recommender systems (Jesse and Jannach, 2021).

Presently, much of this literature remains disconnected. Therefore, we conduct an interdisciplinary literature review that synthesises extant research to explore how NRSs can facilitate news diversity in a personalised manner. Drawing on communication science and media psychology, we provide a nuanced account of how the interplay of individual-level and situational factors affects news selection. We then use these insights to propose and critically reflect on five personalised diversity nudges. We also integrate relevant insights from the literature on computer science and recommender systems to explore the potentials and limitations of our proposed diversity nudges. Importantly, our goal is not to provide ready-made solutions to practitioners. Rather, we aim to synthesise interdisciplinary literature that helps us assess the promises and pitfalls of potential diversity nudges on news platforms by identifying potential person-related or situational boundary conditions. This constitutes a crucial first step towards designing targeted interventions that are rooted in empirical research, realistic in scope and cautious of unwanted side effects. Since our literature synthesis brings up a range of open questions, we conclude the article by proposing a research agenda for future work on diversity in NRSs.



**Figure 1.** Three types of news diversity in NRSs.

## Theoretically informing diversity nudges

Users should not only be exposed to diverse information but should also engage with it to ensure the normatively desirable effects of news diversity (Van der Wurff, 2011). To highlight the distinction between mere exposure and more in-depth engagement, we add granularity to the traditional distinction of supply and exposure diversity (Napoli, 1999) (see Figure 1). We distinguish between the diversity of supply, exposure and consumption. We define *supply diversity* as diversity in content, which is theoretically available for recommendation; *exposure diversity* as the share of supply diversity that a user is exposed to; and *consumption diversity* as the overall diversity in content that users actively engage with (see also Loecherbach et al., 2020; Van der Wurff, 2011).

In practice, determining a threshold for meaningful engagement may be difficult, as traditional measures, such as clicks and reading time, are merely proxies (Groot Kormelink and Costera Meijer, 2018). Nonetheless, on a theoretical level, this distinction enables us to differentiate how recommendation logics and user interfaces can influence and potentially facilitate consumption diversity.

As an illustration, imagine the news aggregator Google News. As Google News' recommender engine filters and ranks articles, it influences what users get to see (Figure 1, Arrow a). Depending on the original supply, this ranking can either limit or increase users' exposure diversity, especially if they do not look beyond the first few recommended items. In addition, users themselves make selections among the news that they do get to see (Figure 1, Arrow b). Here, individual preferences and biases can affect the diversity of viewpoints or topics with which users choose to engage. Building on this distinction, we draw on nudging theory to explore when and how the deliberate design of NRSs can facilitate consumption diversity. A *nudge* is 'any aspect of the choice architecture that alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives' (Thaler and Sunstein, 2009: 6). NRSs constitute a form of choice architecture because their user interface provides the context for news selection, and their algorithms inherently prioritise some news articles over others. By altering this choice architecture, diversity nudges can facilitate engagement with diverse news.

To explore not only the visual appearance but also the inner workings of news recommenders, we define *diversity nudges* as the elements of a NRSs choice architecture that facilitate engagement with diverse news while preserving a reasonable variety of choices. By diverse news, we mean *topic diversity* (the scope of topics and issues), *viewpoint diversity* (the range of 'ideas, perspectives, attributions, opinions, or frames'; Voakes et al., 1996: 585) and the *diversity of entities* (the range of people, groups and

organisations; Loecherbach et al., 2020). This somewhat broad definition allows us to integrate the effects of both recommendation algorithms and user interface design into a cohesive theoretical framework.

### *Three types of individual-level news selectivity*

Before we can develop a framework for diversity nudges in NRSs, we first need to present the theoretical mechanisms that can explain why users choose some news over others. News selections are complex processes. They are influenced by stable (e.g. interest) and situational factors (e.g. available cognitive resources or particularly appealing message characteristics). Designing effective diversity nudges thus requires a deep understanding of how these factors interrelate for a given individual in a specific situation. We contribute to this understanding by identifying three types of individual-level news selectivity, namely, interest-based selectivity, attitude-based selectivity and norm-based selectivity, and discussing their most important moderators. Distinguishing different types of individual-level news selectivity contributes to a more nuanced understanding of when and for whom exposure diversity translates into consumption diversity. This helps us better assess the potentials and drawbacks of diversity nudges for different individuals.

*Interest-based selectivity: diverse but still interesting.* Individual interests can affect consumption diversity in two ways. First, they enable NRSs to recommend the supposedly most relevant news (Karimi et al., 2018). However, this form of catering to individual interests may limit the topic diversity of recommendations or create feedback loops that ‘artificially reinforce preference’ (Lorenz-Spreen et al., 2020: 1104). Second, various studies indicate that, especially in high-choice news media environments, interest in entertainment may limit the consumption of political news when more attractive alternatives are available (Dvir-Gvirman et al., 2016; Feldman et al., 2018; Helberger and Wojcieszak, 2018).

Individual interests also affect the subsequent processing of news, as interested individuals are less likely to experience information overload (Schmitt et al., 2018). *Information overload* occurs when the amount of available information exceeds individual information-processing capabilities (Eppler and Mengis, 2004), and can impede information processing (Schmitt et al., 2018). Hence, users with low interest may process and retain less information even when they click on diverse news.

In sum, individual interests constitute a boundary condition for topic diversity in NRSs, as they decrease the likelihood of diverse selections and increase the negative effects of diverse consumption. A core challenge for diversity-aware NRSs, therefore, is to recommend content that is diverse but not boring, irrelevant or difficult to process.

*Attitude-based selectivity: diverse but not confrontational.* Another potential threat to consumption diversity is *selective exposure*, which refers to ‘the motivated selection of messages matching one’s beliefs’ (Stroud, 2017: 1) or attitudes. The main mechanism behind selective exposure stems from Festinger’s (1957) theory of cognitive dissonance. It posits that individuals select attitude-congruent information to prevent or reduce situations

in which conflicting cognitions cause an unpleasant mental state (Stroud, 2017). Alternative explanations argue that processing attitude-congruent information is either less cognitively effortful and, therefore, more appealing (Ziemke, 1980) or is perceived to be of higher quality (Stroud, 2017). Selective exposure might manifest in different ways depending on the context (see Stroud, 2017), but it is most often referred to as confirmation bias.

Confirmation bias influences news consumption in NRSs in two interrelated ways: biased selection and algorithmic feedback loops. Much research shows that individuals tend to select pro-attitudinal over counter-attitudinal news (e.g. Dvir-Gvirsman et al., 2016; Knobloch-Westerwick et al., 2020). This effect also applies to NRSs (e.g. Beam, 2014). Given that many NRSs learn from past user behaviour (Karimi et al., 2018), such biases can manifest further in future recommendations through algorithmic feedback loops (Ohme, 2021; Pariser, 2011).

However, the extent of confirmation bias also depends on various moderators. Confirmation bias is generally more pronounced when individuals hold strong attitudes (Stroud, 2017; Taber and Lodge, 2016) that they are certain of (Knobloch-Westerwick and Meng, 2009) or when they are close-minded (Hart et al., 2009). By contrast, individuals with a high need for cognition, meaning that they generally enjoy engaging in effortful thinking, are less susceptible to selective exposure (Tsfti and Cappella, 2005) and consume more diverse viewpoints in the media (Dvir-Gvirsman, 2015). Personal relevance has also been shown to limit selective exposure (Mummolo, 2016). This introduces situation-dependent worries about potential backfire effects. In some cases, diverse viewpoints may be interesting to a given user but recommending them could also decrease user satisfaction (Bryanov et al., 2020) or elicit negative affect (Taber and Lodge, 2016).

Taken together, attitude-based selectivity therefore highlights the challenge of accounting for individual-level differences to recommend viewpoints that not only diversify users' news diets but also translate into pro-social outcomes instead of unwanted backfire effects.

*Norm-based selectivity: diverse but not for everyone.* Norm-based selectivity describes the observation that readers vary in the extent to which they value and seek out diversity in news (Munson and Resnick, 2010). This notion is best captured by Kim and Pasek (2020), who differentiate between *diversity values*, the overarching goal or motivation to seek out diversity, and *diversity traits*, the tendency to act on these values over time. Their work shows that not all readers strive towards consumption diversity and that even those who do might still not live up to their diversity values.

Diversity values can be understood as social norms that constitute important influences on human behaviour (Cialdini et al., 1990). Generally, social norms can be distinguished into two major types (for a detailed review, see Chung and Rimal, 2016): *descriptive norms*, which refer to the perceived prevalence of a certain behaviour, and *injunctive norms*, which capture what individuals perceive as normatively desired behaviour (Cialdini et al., 1990). As their underlying mechanisms differ, the effects of injunctive and descriptive norms can vary across individuals. Thus, combining them in behavioural interventions can be beneficial (Van der Meer and Hameleers, 2020).



The effects of social norms depend on two important moderators. First, an individual's relationship to the norm-referent group can affect how norms are interpreted (Wojcieszak et al., 2020). Second, as highlighted by the focus theory of normative conduct (Cialdini et al., 1990), norms only affect behaviour if they are made salient (Chung and Rimal, 2016). Thus, diversity-aware NRSs that rely on social norm interventions need to communicate diversity values to the right users at the right time.

### *Moderating roles of situational factors*

Accounting for individual-level selectivity constitutes a valuable starting point for diversity-aware NRS design, as it contributes to our understanding of when and for whom different diversity nudges are effective. However, the influence of individual-level selectivity on news selection is also contingent on a broad range of situational factors (Constantinides and Dowell, 2018; Raza and Ding, 2019). While our goal is not to develop an exhaustive account of all relevant situational moderators, we want to highlight the ways in which our current understanding of different *routes of information processing*, *individual reading goals* and *presentational factors* can inform personalised diversity nudges.

*(Un)conscious information processing.* Understanding the impact of situational moderators requires distinguishing between two routes of information processing: rational elaboration (System 2) and peripheral processing (System 1) (Chaiken, 1980; Kahneman, 2011; Petty and Cacioppo, 1981). *System 1 thinking* captures subconscious, heuristic decision-making, whereas *System 2 thinking* refers to more effortful, conscious deliberation (Kahneman, 2011). The two systems can shape news selection either separately or in conjunction. For example, local news about the impact of COVID-19 might be unconsciously more attractive because it is negative and, therefore, more attention grabbing (Soroka and McAdams, 2015). But it might also be selected for conscious considerations such as higher personal relevance. Of course, both factors could just as well work together. Thus, any individual news selection may be predominantly driven by either System 1 or System 2 thinking, which has important implications for the diversity nudges that we propose.

*Reading goals.* A core driver of news selection is situational reading goals, which can take various forms. Qualitative research indicates that individuals seek out news for various reasons, such as gaining new perspectives, catching up with recent events or acquiring fodder for conversation (Costera Meijer and Groot Kormelink, 2020). Although many reading goals relate to individual needs and gratification-seeking motives (Katz et al., 1973), we argue that their influence on news selection needs to be understood on a more situational basis (see also Hasebrink and Popp, 2006). Directional goals that inform selective exposure theories also play an important role.

Selective exposure is moderated by two opposing reading goals: accuracy motivations and defence motivations (see Druckman, 2012). *Accuracy motivations* capture individuals' desire to come to a 'correct or otherwise best conclusion' (Taber and Lodge, 2006: 756), whereas *defence motivations* aim at 'defending prior beliefs or

behaviors' (Druckman, 2012: 200). Defence motivations are core drivers of selective exposure and biased information processing (e.g. see Winter et al., 2016). Accuracy motivations appear to have less, but nonetheless significant, influence on selective exposure (Hart et al., 2009). Accuracy motivations can mitigate partisan selective exposure (Bolsen et al., 2014; Liao and Fu, 2014) and lead individuals to evaluate information more carefully and with less bias (Druckman, 2012; Kunda, 1990). Accounting for or affecting individual motivations in NRSs thus constitutes a promising nudging strategy.

*Presentational factors.* News selections in NRSs depend not only on when and why readers seek out news but also on how they are presented. For example, Loecherbach et al. (2021) showed that positioning can increase selection likelihood by up to 23%. This aligns with a larger body of research into recommender systems, which points to order effects that influence the perception and selection of choices (see Jesse and Jannach, 2021). Theoretical explanations for order effects range from habitual behaviours (Loecherbach et al., 2021) or primacy effects (Tintarev, 2017) to the perceived importance of prominently positioned items (Groot Kormelink and Costera Meijer, 2020).

Another core aspect of articles' presentation refers to heuristic cues that accompany them. For instance, visuals serve as triggers for more in-depth engagement with the news (Vergara et al., 2020) and can drive clicks even if readers are not interested in a topic (Groot Kormelink and Costera Meijer, 2018). Headlines, teasers and source cues help users evaluate whether an article is interesting and relevant (Groot Kormelink and Costera Meijer, 2020), but they can also drive selective exposure by communicating the stance and topic of a given article (Garrett and Stroud, 2014). Thus, the content, inclusion and presentation of headlines, teasers, source cues and visuals can affect news selections.

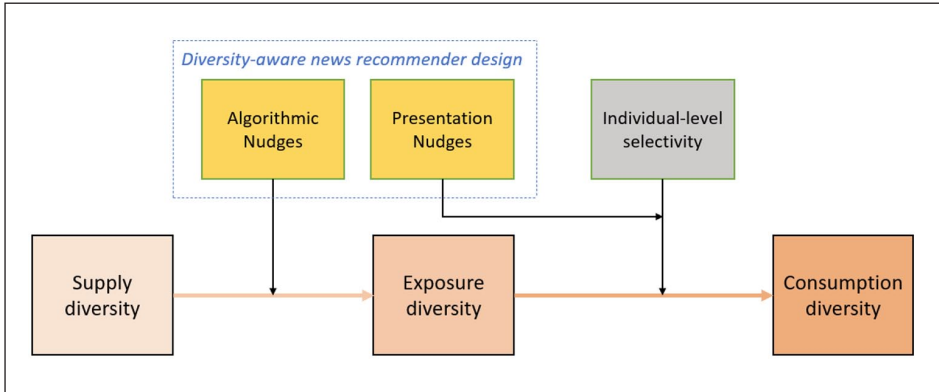
This argument extends to the notion of *clickworthiness*, which refers to linguistic headline elements that drive news selection. This includes the *negativity bias* (Soroka and McAdams, 2015), which suggests that negative news attracts more attention and/or elicits stronger reactions, as well as other elements (e.g. language intensity, forward referencing) that appear to affect click-through rates (Lagerwerf and Govaert, 2021). Clickworthiness should not be confused with clickbait. Clickbait constitutes a specific form of journalism that lures readers by overpromising or misrepresenting the actual content (Chakraborty et al., 2016). By contrast, clickworthiness describes well-crafted headlines that accurately summarise an article's content in a way that makes it engaging to readers (Lagerwerf and Govaert, 2021).

Taken together, the presentation of news clearly matters for how users engage with them. In the remainder of this article, we further pursue this notion and explore the potential of different diversity nudges to facilitate the selection of more diverse news.

## Motivating diversity nudges

The core argument of our article is that personalised diversity nudges can facilitate consumption diversity by determining what users see and how it is presented to them (see also Helberger et al., 2018; Rieger et al., 2020; Tintarev, 2017). In the following, we





**Figure 2.** Nudges towards consumption diversity in NRSs.

build on previous insights into individual-level news selection mechanisms to theoretically motivate five diversity nudges.<sup>3</sup>

We broadly distinguish two types of diversity nudges<sup>4</sup> (see Figure 2). Whereas *algorithmic nudges* shape consumption diversity indirectly by affecting exposure diversity, *presentation nudges* alter the user interface in ways that affect moderators of individual-level selectivity or alleviate information processing, in general. Although we discuss each nudge individually, we want to stress that because they come with different mechanisms and trade-offs, combinations may often be particularly fruitful. Therefore, we not only explain why and how the nudges work, but we also discuss when and for whom they are most effective, as well as what potential backfire effects they might have. We summarise our core insights in Table 1.

### Algorithmic nudges

Algorithmic nudges are re-ranking approaches that increase exposure diversity. Loecherbach et al. (2021) showed that ‘even non-preferred articles will be more likely selected if they are only high enough on the page’ (288). By accounting for this position bias when recommending diverse news articles, algorithmic nudges might considerably increase consumption diversity, especially when readers experience information overload or when their decisions are guided by System 1.

Algorithmic nudges could help users who seek but do not find diverse news items by making these more available, or provide serendipitous recommendations that prevent unwanted algorithmic feedback loops. In fact, the notion of serendipity is crucial for recommender systems in various contexts (for a recent review see Ziarani and Ravanmehr, 2021) as it enables users to develop new interests and recommendation algorithms to evolve (Karimi et al., 2018). As such, serendipitous recommendations might contribute to greater user satisfaction. As users’ interests develop over time (Li et al., 2014), recommendations that initially seem uninteresting or outrageous might also become more acceptable over time. Interestingly, field experiments suggest that users often do not

**Table 1.** Typology of diversity nudges: how, why, when and for whom are they likely to (not) work.

Nudge	What does it do?	Addressed challenges	Effective for readers who . . .	Mechanism	Facilitating/ constraining factors	Potential backfire effects
Gatekeeper's nudge	Re-ranks articles to prioritise diversity	Limited exposure diversity	. . . exhibit a strong position bias . . . hold diversity values but fail to live up to them (e.g. due to limited exposure diversity)	- Position bias	- Information overload - Individual-level selectivity - Reading goals	- Decreased user satisfaction - Decreased recommendation accuracy
Click-worthiness nudge	Re-ranks articles to prioritise diversity and clickworthiness	Lack of interest/more appealing alternatives and limited exposure diversity	. . . rely on heuristic cues . . . are not guided by pronounced reading goals . . . exhibit a strong position bias	- Position bias - Clickworthiness	- Information overload - Cognitive resources	- Decreased user satisfaction - Decreased recommendation accuracy - Cynicism, distrust, decreased political engagement
Model citizen nudge	Makes diversity values or accuracy motivations salient	Lack of motivation to seek out diverse content	. . . hold non-salient diversity values . . . might develop diversity values . . . can identify diverse news	- Diversity values - Norm salience	- Attitudes/ideology - Defence motivations - Norm-referent group - Efficacy	- Decreased user satisfaction - Self-confirmation bias - Exacerbated information overload - Widening knowledge gaps
Self-actualisation nudge	Provides additional information or possibilities for exploration	Inability/difficulties to identify and explore diverse content	. . . want consumption diversity . . . are interested in feedback . . . need help identifying/finding diverse news	- (Self-)awareness - Perceived item diversity - Norm salience - Trust - Highlighting effects	- Defence motivations - Diversity values - Accuracy motivations - Cognitive resources - Self-actualisation goals	- Amplified selective avoidance - Widening knowledge gaps
Popularity Nudge	Indicates article popularity/ establishes diversity norms and makes them salient	All forms of individual-level selectivity (in case of heuristically driven news selection)	. . . rely on heuristic cues . . . consume news to participate in every day conversations . . . are high in need for cognition . . . are impression motivated	- Descriptive norms - Norm salience	- Impression motivations - Defence motivations - Information overload - Need for cognition - Self-monitoring - Norm referent group	- Sacrificing the long tail of diversity - Decreased user satisfaction - Decreased recommendation accuracy

perceive increased exposure diversity (Heitz et al., 2022; Loecherbach et al., 2021) which might leave platforms some leeway for prioritising diversity without sacrificing user utility.

**Gatekeeper's nudge.** The gatekeeper's nudge implements a normative version of algorithmic gatekeeping (Bozdag, 2013) by prioritising content that is deemed important and newsworthy for the audience. This mirrors traditional notions of gatekeeping (Gans, 1979), albeit on a more personalised level. Using a meaningful diversity metric, NRSs could calculate the distance between any given news article and users' past consumption and recommend more or less diverse articles (see Lu et al., 2020; Mulder et al., 2021).

The challenge in implementing such a nudge is balancing the trade-off between recommendations that are diverse and recommendations that are relevant and appreciated (Karimi et al., 2018). Reuver et al. (2021b) therefore proposed the concept of individual users' *latitudes of diversity*. Acknowledging that users' acceptance of diverse recommendations is limited, the latitude of diversity describes the range of articles with diverse viewpoints with which users are still open to engage in a given situation. However, as the authors acknowledge, implementing this notion remains challenging since openness to diversity varies between individuals and across situations.

**Clickworthiness nudge.** The clickworthiness nudge provides another potential solution to the trade-off between diversity and relevance. Building on insights into the linguistic elements that make news more clickworthy, we consider this nudge as an umbrella category for recommendation logics that find a balance between diversity and article appeal in ways that prioritise news that is not only diverse but also attractive to a given user. Therefore, it takes advantage of not just the position bias but also other heuristic selection biases that relate to the content and presentation of news articles. If faced with a choice, users may often select the more appealing or attention-grabbing article. A clickworthiness nudge ensures that these articles are also diverse.

As it exploits a range of heuristic biases, the clickworthiness nudge is likely to be effective across the board, especially if information overload or limited cognitive capacities facilitate heuristic decision-making. Personalising this nudge also seems fruitful because individual-level differences matter for how pronounced heuristic biases, such as the negativity bias (Bachleda et al., 2020), are for a given user.<sup>5</sup> However, depending on how it is operationalised, prioritising clickworthiness might have downsides in the long term. For example, in the short term, negative content is likely to increase click-through rates, but over time, it could cause cynicism, distrust or decreased political engagement (Lengauer et al., 2012). Therefore, a key consideration for an effective clickworthiness nudge is finding the balance between article appeal, diversity and quality (e.g. highlighting news that is clickworthy but not clickbaity).

### **Presentation nudges**

Whereas algorithmic nudges change the recommendation logic, presentation nudges change how recommendations are displayed. These nudges influence individual news selection mechanisms through deliberate changes to an NRS' user interface in ways that

facilitate consumption diversity. Building on the previously discussed moderators of individual-level selectivity, we propose three such nudges. We particularly highlight their inherent risks and trade-offs, as all nudges work better for some users than for others (see Table 1).

*Model citizen nudge.* The model citizen nudge aims to make diversity norms salient, as social norms only affect behaviour when they are on people's minds (Cialdini et al., 1990). Norm salience is a core aspect of various recent news media literacy interventions that successfully highlighted injunctive norms of open-mindedness or broadly informed citizens to facilitate cross-cutting exposure, increase exposure to balanced information and reduce polarisation in online settings (Van der Meer and Hameleers, 2020; Vraga and Tully, 2019; Wojcieszak et al., 2020). In NRSs, such interventions could take various forms of texts that highlight the importance of diverse news diets as a crucial part of good citizenship (e.g. pop-ups, messages next to the newsfeed or more subtle labels and ribbons attached to particular articles).

Ideally, they should also be personalised, as normative interventions do not work for all individuals. Factors such as an individual's ideology (Vraga and Tully, 2019), prior attitudes and the relationship to the norm-referent group (Wojcieszak et al., 2020) constitute important moderators.

A potential problem is that this nudge might leave behind those who do not hold diversity values, thereby contributing to existing knowledge gaps. Moreover, even if the model citizen nudge succeeds in making diversity values salient, there remains a danger of self-confirmation bias. For example, Winter et al. (2016) showed that higher accuracy motivations can exacerbate confirmation bias, as users genuinely believe in engaging in balanced information searches but nonetheless fall prey to selective exposure. The success of this nudge depends also on readers' tools and capabilities to identify and process diverse and normatively desired news articles (Lu and Luqiu, 2020). Furthermore, while the model citizen nudge could encourage conscious reflection, it is unlikely to cancel out heuristic decision-making completely and might even exacerbate perceived information overload. Finally, to avoid annoying users, real-world implementations of this nudge will need to find ways of communicating normative messages without coming across as overly paternalistic.

*Self-actualisation nudge.* The self-actualisation nudge combines various strategies that help users reflect on their past news consumption and actualise diversity values because rather than 'just present users with the best possible items, [personalised recommenders should] support users in developing, exploring, and understanding their own unique tastes and preferences' (Knijnenburg et al., 2016: 11). To this end, we distinguish four subtypes of self-actualisation nudges: feedback on one's media diet, feedback on news items, explanations and exploration features.

Ways of providing readers with feedback on their past media diet have already been explored by several studies and browser plug-ins (e.g. Blue Feed Red Feed;<sup>6</sup> Munson et al., 2013; Nagulendra and Vassileva, 2014). Research from other domains, such as movie recommendations, can also serve as an inspiration here (e.g. Tintarev et al., 2018b). Generally, these tools provide a comprehensive overview of users' overall media

diets compared with those of other users (e.g. Nagulendra and Vassileva, 2014) or with an ideal standard, such as ideological balance (e.g. Munson et al., 2013). They usually achieve this by aggregating past reading behaviours in comprehensive visualisations. For example, Munson et al. (2013) depicted users balancing on a tightrope, with non-diverse readers looking like they are about to fall. Theoretically, such tools could help readers become aware of their own biases and address them (Knijnenburg et al., 2016). Visualising blind spots has indeed been shown to facilitate the exploration of music recommendations (Kumar and Tintarev, 2018), but whether these findings extend to the NRS domain remains to be seen.

A related nudge is exploration tools (e.g. Park et al., 2009; Newsmap<sup>7</sup>). Knijnenburg et al. (2016) argued that exploration should constitute a core component of recommender systems and ideally go beyond the top N recommended items. Among other ideas, the authors even suggested a *things you might hate* recommendation list, which shows users items they would usually not see. While this approach might appear comparably drastic, there are also more subtle ideas. For example, visual exploration tools have been proposed to explore dissonant viewpoints (Graells-Garrido et al., 2016), new topics (Sullivan et al., 2019) or content beyond one's own filter bubble (Nagulendra and Vassileva, 2014). Relatedly, Bountouridis et al. (2018) developed a tool that lets readers explore content that particular articles omitted. Another idea comes from Harambam et al. (2018), who propose algorithmic recommender personae as a means for users to 'express voice or influence the algorithmically curated information they get to see'.<sup>7</sup> However, while NRS users generally say they welcome features allowing them to explore content in new ways, many also admit that they would only use them sporadically (Harambam et al., 2019).

Indicators (henceforth labels) for which content is useful for a user's self-actualisation goals can add to such exploration tools. For example, feedback on individual news items can make explicit whether certain content counts as diverse to a given user or signals its quality. Liao and Fu (2014a) tested how labels for the ideological position and valence of news affect selection. Their labels helped individuals with strong accuracy motives select more balanced information, but also made it easier for defence-motivated individuals to avoid challenging news items. Other research suggests that credibility labels might positively affect consumption diversity (Gao et al., 2018) and common ground seeking (Liao and Fu, 2014b), and article perceptions (Duncan, 2020). Research in other areas of information search indicates that additional information can help mitigate selection biases (e.g. Liao et al., 2015). However, labels are also often ignored (Peacock et al., 2020), and their effectiveness varies considerably between individuals.

NRSs are often criticised for their black-box nature, as users do not know how their recommendations are produced (e.g. Harambam et al., 2019). This can create distrust (Kunkel et al., 2020). It also makes it difficult for users to understand the trade-offs involved in any form of recommender system. To alleviate such issues, a vast literature on explainable artificial intelligence (AI) and its challenges has emerged (for recent interdisciplinary reviews see Hermann, 2021; Mohseni et al., 2021). One suggestion is 'textual explanations for surprising items' (Tintarev, 2017: 3). Following this notion, explaining particularly diverse news recommendations

might be worth considering to prevent users from being irritated with unexpected content. This might even create a highlighting effect that generates additional attention and makes diversity norms more salient. Alternatively, NRSs could feature explanations for single items. Ter Hoeve et al. (2017) tried this on Blendle by testing textual and visual explanations for why a given article was recommended. Their respondents reported liking such explanations, but did not change their reading behaviour, presumably because of limited attention.

As many of the aforementioned studies have shown, self-actualisation nudges only diversify the news consumption of those who wish to do so, whereas they might even backfire for alternatively motivated readers (see Liao and Fu, 2014). Thus, the lack of attention, cognitive resources or diversity values is a general challenge to the success of these nudges. As a result, self-actualisation nudges might widen rather than close the gap between diversity seekers and challenge avoiders, but they could work well in combination with the model citizen nudge.

**Popularity nudge.** The previous nudges largely rely on users' intrinsic goals and motivations. But what about users who find reading diverse news neither interesting nor valuable? One potential nudge for such users may be (personalised) popularity indicators. Popularity indicators constitute a range of social cues that reflect other users' behaviours and evaluations of particular news articles (Dvir and Gvirsman, 2019). Indicators, such as likes, shares, ratings or *most-read* labels, can serve as powerful social norms that increase article selection (Van der Meer et al., 2020). They can also be personalised, for example, by highlighting what similar users read and shared in the past (Agapie and Munson, 2015).

Popularity nudges can serve as powerful heuristic cues that make articles appear more interesting, relevant or important (Knobloch-Westerwick et al., 2005). This matters especially in information-rich media environments, where individuals need to cope with constant information overload (Metzger et al., 2010). Yang (2016) showed that incorporating a *most viewed* recommendation feature on a news website speeds up the selection process, thereby increasing the available reading time (see also Knobloch-Westerwick et al., 2005). Moreover, popularity indicators add an additional dimension to normatively based news media literacy interventions. As they affect heuristic decision-making, they can help facilitate consumption diversity even among users who do not hold strong diversity values, especially when they are impacted by others' behaviour. For example, popularity indicators have been shown to reduce partisan selective exposure among individuals who exhibit impression motivations (Messing and Westwood, 2014; Winter et al., 2016). Impression motivations capture 'the goal of appearing likeable and developing a positive relationship with others (whose opinions are not fully known)' (Winter et al., 2016: 687).

However, the effect of popularity indicators still depends on individual-level moderators. In addition to impression motivations, this includes an individual's need for cognition and self-monitoring (Dvir-Gvirsman, 2019). Therefore, popularity nudges are most effective when they are personalised (e.g. through tailored norm-referent groups) and when readers rely on heuristic information processing. Popularity nudges also come with potential downsides. They might hurt the long tail of diversity by narrowing the overall



range of topics or sources to which news audiences pay attention, and they could backfire if they draw on the wrong norm-referent group.

## Implementing diversity nudges

Our framework suggests that all diversity nudges come with trade-offs, as they work better for some users than for others. Personalising diversity nudges thus seems fruitful. However, implementing personalised diversity nudges in a real-world NRS remains challenging and haphazard implementations might do more harm than good if they end up repelling users. Therefore, this section highlights several key considerations for future implementations. We deliberately omit a precise operationalisation of diversity because this can be highly context dependent. Moreover, extant research has already reflected on and developed various metrics and potential measurement approaches in greater detail than we could (e.g. Draws et al., 2022; Loecherbach et al., 2020; Lunardi et al., 2020; Reuver et al., 2021a; Tintarev et al., 2018a; Vrijenhoek et al., 2021) with some of them relating to broader discussions of fairness in artificial intelligence and machine learning (e.g. Gharahighchi et al., 2021).

Assuming the existence of a meaningful metric for diversification, a core objective for personalised diversity nudges is capturing individual-level differences that may facilitate or constrain the effectiveness of a nudge (see Table 1). This can be done with a combination of explicit and implicit feedback (Bobadilla et al., 2013; Karimi et al., 2018), in which individual attitudes, interests and preferences are either deduced from past consumption (e.g. Loecherbach et al., 2021) and user ratings (e.g. Heitz et al., 2022), or customised by the users themselves (e.g. Beam, 2014).

However, situational differences complicate the matter. Recent efforts to better account for situational factors include algorithmic personae to express situational reading motivations (Harambam et al., 2018), as well as so-called context-aware recommenders (for an overview, see Raza and Ding, 2021). For now, context-aware recommenders largely remain limited to location, time of day or device used (e.g. De Pessemier et al., 2016; Lommatzsch et al., 2017), but there have also been attempts to account for different emotional states (Mizgajski and Morzy, 2019). Further advancing context-aware recommendations might be a major step towards more effective personalised diversity nudges.

Another challenge is the lack of meaningful user data, as many readers consume news anonymously (Raza and Ding, 2021). However, session-based recommendations can serve as remedies in anonymous browsing environments. For example, Gharahighchi and Vens (2021) showed that various session-based recommendation approaches could help increase topic diversity. That said, we believe it is important to remember that news consumption can take various forms and that measures, such as clicks, are at best crude proxies for meaningful engagement (Groot Kormelink and Costera Meijer, 2018).

There are also normative questions of why and how diversity should be facilitated in NRSs (Bozdog and van den Hoven, 2015) that will always be up for debate. For example, a critical recommender should prioritise marginalised voices and introduce a certain extent of conflict, whereas a deliberative recommender should optimise content that fosters tolerance and open-mindedness (Helberger, 2019).

Finally, diversity nudges may potentially ‘violate, undermine or decrease people’s (personal) autonomy’ (Engelen and Nys, 2020: 137). This illustrates an important tension between systematic personalised nudges and concerns over limited user agency and NRS’ black-box nature. In this context, we believe it is helpful to think of autonomy ‘as the ability to set your own ends’ (Engelen and Nys, 2020: 137). As we frequently fail to meet those ends for various reasons, nudges can be thought of as useful aids that do not necessarily undermine autonomy (Engelen and Nys, 2020). Nonetheless, if nudges are to be ethical and trustworthy, their underlying logic and motivations should be made transparent to users (Diakopoulos and Koliska, 2017).

## Discussion

Diversity-aware NRSs can potentially benefit democracies by facilitating pro-social outcomes, such as increased political knowledge, participation or tolerance (Helberger, 2019). However, recommending diverse news alone is inadequate to produce such effects. Readers also need to actively engage with the news (Van der Wurff, 2011). In this article, we develop a theoretical framework that helps us understand under which conditions this may or may not happen, as well as how different diversity nudges can facilitate the active consumption of more diverse news without causing unwanted side effects such as decreased user satisfaction and engagement, selective avoidance or self-confirmation biases. Based on a synthesis of interdisciplinary literature, we develop concrete, theoretically grounded avenues for facilitating diverse news consumption on algorithmically curated platforms that future research can further test and develop.

Our study contributes to the existing literature in several ways. First, as Loecherbach et al. (2020) suggested, we provide a clear differentiation between exposure and consumption diversity in NRSs. Second, we discuss how individual-level news selectivity based on interests, attitudes and norms varies between individuals and across situations. Thereby, we arrive at a nuanced account of when, why and for whom exposure diversity in NRSs translates into consumption diversity. Third, drawing on nudging literature and a broad range of interdisciplinary recommender systems literature, we build on these insights to theoretically motivate five diversity nudges that address individual-level news selectivity and facilitate consumption diversity in NRSs. These nudges affect either what users see or how it is presented to them. While all nudges come with important trade-offs, our work suggests that, especially when they are personalised, they can contribute to a stepwise increase in the diversity of users’ news diets, which may help users develop new reading habits and explore novel interests.

Two nudges implement algorithmic re-ranking. The *gatekeeper’s nudge* prioritises news diversity and thus makes diverse articles more prominent. However, it might miss the individual-level sweet spot where news is sufficiently diverse but still interesting and acceptable. The *clickworthiness nudge* alleviates this issue by highlighting news that is not merely diverse but also appealing. As such, it exploits heuristic decision-making and may potentially facilitate the discovery of new interests. However, implementing this nudge requires careful considerations to what extent article appeal should trump journalistic quality.

The remaining three nudges describe strategic changes to NRS' user interfaces. The *model citizen nudge* uses insights from social norm theory and facilitates diverse news selections by making diversity norms salient. If readers consider diverse news consumption important, this nudge might facilitate cross-cutting exposure (Van der Meer and Hameleers, 2020). Taking a slightly different route, the *popularity nudge* highlights the behaviour of others through popularity indicators. This nudge is likely to be effective for a variety of readers and might thus contribute to narrowing knowledge gaps. However, by facilitating popular content, it sacrifices the long tail of diversity. Finally, the self-actualisation nudge provides readers with opportunities to develop and actualise their own reading goals. This nudge is strongly tied to notions of autonomy and transparency, but its effects on consumption diversity are entirely up to the goals and motivations of individual readers who need to make active use of these tools.

Our review highlights not only the potentials but also the challenges of implementing diversity nudges. First, although differences in diversity do not necessarily impede user utility or affect perceived diversity (see Heitz et al., 2022), there is a limit to how much diversity a given user will appreciate and engage with. Practitioners therefore need to think of diversity as an optimisation constraint that has to be balanced with other important evaluation metrics. Our work also highlights that no diversity nudge works for everyone. In fact, some might even backfire or actively contribute to widening knowledge gaps between more and less politically interested individuals. Therefore, diversity-aware NRSs should tailor diversity nudges to individual-level differences and combine them where possible to avoid potential backfire effects. However, this introduces both technical and normative challenges.

On a technical level, our literature review highlights the difficulties of accurately capturing relevant individual-level and situational differences and of meaningfully measuring diversity and user engagement. From a normative perspective, any form of deliberate change to an NRS' choice architecture must account for some ethical challenges and consider its users' AI literacy (see Hermann, 2021). Addressing these challenges requires a concrete set of goals and concrete evaluation metrics by which the success of a diversity-aware NRS can be judged.

Moreover, the normative arguments underlying diversity-aware news recommenders need to be supported by empirical evidence. Currently, most theoretical insights that inform our nudges are rooted in empirical studies with forced-choice settings and carefully created stimuli materials that may be quite different from people's everyday news consumption. Thus, we need more nuanced research into the exact implementation of diversity nudges and their effects on different groups of users. To this end, we develop an initial research agenda.

### *Avenues for future research*

First, empirically validating the proposed diversity nudges in the specific context of algorithmically curated NRSs is important. Future studies should test whether labels, popularity indicators and social norm interventions can indeed increase consumption diversity on a personalised level. This also includes creating more realistic experimental conditions that mirror complex high-choice media environments (see Powell et al.,

2020). Here, eye tracking could help understand the extent to which diversity nudges can attract attention in crowded user interfaces.

To test the pro-social effects of diversity-aware news recommenders, we also need more ecologically valid field experiments that examine selective exposure and consumption diversity in realistic contexts. While controlled experiments are valuable for causal tests, only realistic field studies can help us better understand whether diversity nudges facilitate pro-social outcomes, such as tolerance, social cohesion and political learning in the long term. Indeed, results from Juergens and Stark (2022) indicate that short- and long-term effects of using algorithmically curated news platforms can differ considerably.

Developing convincing evaluation metrics against which the success of particular design choices can be judged is also crucial. As a next step, future studies could compare the nature of content that more technical diversity measures, such as distance (Gharahighehi and Vens, 2021), and more normatively informed measures, such as alternative voices (Vrijenhoek et al., 2021), prioritise.

Once we can gauge which metrics facilitate the desired diversity dimensions, they can be fed into an experimental news recommender (e.g. Loecherbach and Trilling, 2020) that taps into potential media effects, such as political learning, tolerance or attitude change. Importantly, this should go hand in hand with more qualitative research into what constitutes meaningful engagement with news in the first place.

Finally, future work must address the tensions between implementing subtle nudges and respecting users' autonomy (see also Hermann, 2021). User autonomy and transparency are key considerations for ethical news recommender design that can increase users' trust and satisfaction (see Kunkel et al., 2020, Monzer et al., 2020). Under the right conditions, autonomy can also facilitate consumption diversity (Beam, 2014). Future work should therefore critically reflect on when and how much nudging is justifiable. While any NRS constitutes a choice architecture that nudges users towards some content to at least some extent, diversity-aware news recommender design should go hand in hand with means to increase transparency and empower users.

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## ORCID iDs

Nicolas Mattis  <https://orcid.org/0000-0001-5110-6612>

Philipp Masur  <https://orcid.org/0000-0003-3065-7305>

## Notes

1. <https://graphics.wsj.com/blue-feed-red-feed/>
2. <https://ground.news/>
3. While we try to cover a broad range of different approaches, we do not claim to present an exhaustive list. For a more complete overview of digital nudges that have been tested or proposed, see Jesse and Jannach (2021).

4. It could be argued that there is a third type – altering content – but we choose to omit this both for practical and ethical considerations.
5. Apart from the negativity bias, there are also various other ways in which this nudge could incorporate past news selections to better account for individual preferences of style and headline elements. In fact, doing so might be more promising than broad generalisations as past research has found the effects of headline elements on news selection to be rather limited on aggregate (e.g. Hagar et al., 2021).
6. <http://graphics.wsj.com/blue-feed-red-feed/>
7. <https://newsmap-js.herokuapp.com/>

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### Author biographies

**Nicolas Mattis** is a PhD candidate at the department of Communication Science at the Vrije Universiteit Amsterdam.

**Philipp K. Masur** is an Assistant Professor of Persuasive Communication at the Vrije Universiteit Amsterdam. His research focuses on different aspects of digital communication including social influence and persuasion processes on social media, privacy and self-disclosure in networked publics, and media literacy.

**Judith Moeller** is an Associate Professor of Political Communication at the University of Amsterdam and an Adjunct Associate Professor at the Department of Sociology and Political Science at the University of Trondheim.

**Wouter van Atteveldt** is a Professor of Computational Communication Science and Political Communication at the Vrije Universiteit Amsterdam.