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Promoting Diverse News Consumption Through User Control Mechanisms

Short Paper

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Abstract

News recommender systems (NRSs) are an essential component of online news portals. To avoid the emergence of “filter bubbles” where users display an overly selective perception of the news situation, NRSs must not only display a diverse range of news, but also motivate users to engage with the diversified content. Many existing approaches attempt to achieve this by modifying the recommendation strategy or by applying selection control techniques such as digital nudging. Based on insights from self-determination theory, we present an alternative approach that relies on user control mechanisms to promote self-determined motivation for exploratory use and thus diverse news consumption behavior. We also outline a methodological design to empirically confirm the viability of our approach. As such, we not only contribute to the theoretical understanding of the role of user control in diverse news consumption behavior, but also provide guidance on validating the practical feasibility of our approach.

Keywords: news recommenders, filter bubbles, user control, consumption diversity

Introduction

In the digital age, information consumption frequently takes place on platforms that personalize their content based on user preferences. The demand for personalization arises from the abundance of available information, which has become progressively impossible to filter manually (Raza and Ding 2022). To solve this problem, recommender systems are becoming increasingly integral on many online platforms. In this paper, we focus on information filtering systems for news – commonly referred to as *news recommender systems (NRSs)*. These are used by media companies such as CNN, BBC, and the New York Times to structure their online portals, yet also by news aggregators such as Google and Yahoo (Raza and Ding 2022). NRSs present presumably relevant new content derived from aspects such as the consumption history of the respective user, thereby exercising a strong influence on what users consume (Hosanagar et al. 2014). This approach has proven to be commercially very successful and makes news consumption much more adaptive, expert, and timely. However, concerns have been raised repeatedly that excessive personalization of online news may limit the exposure to diverse and serendipitous types and content of information (Balkin 2018; Raza and Ding 2022), potentially resulting in the development of “filter bubbles” (Pariser 2011).

Personalized news outlets prioritize their content according to the individual user and might expose each of them to (slightly) different content. This could have long lasting effects on the users' willingness to interact with information that is in contradiction with their own beliefs (Helberger 2019). If users find themselves in a "filter bubble," they no longer receive a comprehensive picture of the information and the diversity of opinion available (Pariser 2011). As this happens without the user's awareness, they can be unknowingly manipulated by these systems into a biased worldview (Pariser 2011). This fundamentally undermines the user's autonomy. In addition, tailoring personalized content to the preferences of the user's social environment has been linked to mutually reinforcing group polarization, which can further strengthen a user's initial views and opinions toward an extremist view (Sunstein 2002). Moreover, it is reasonably argued that the algorithmic personalization of news could stand in conflict with the normative desire to inform members of a democratic society on topics in an objective, uncensored, and unbiased way in order to facilitate a healthy political debate (Helberger 2019). News play a decisive role in a democratic society, which is built upon informed citizens, integrating their opinions through assembly, association, and voting (Bernstein et al. 2021; Human Rights Committee 2011). Therefore, the media are a central institution enabling citizens to make meaningful political choices (Balkin 2018). This includes critical and objective reporting as well as presenting the consumers with different opinions and ideas (Balkin 2018). With recent attention to the possible risk of filter bubbles and ongoing policy attention, the call for more diversity and serendipity in NRSs has, thus, repeatedly been put forward (Bernstein et al. 2021; Reviglio 2019).

As a result of these considerations, numerous studies have investigated how diversity and related metrics such as novelty or serendipity can be enhanced by technical adjustments to the algorithm (Harper et al. 2015; Loecherbach et al. 2021; Mattis et al. 2021). Such adjustments include selection control techniques like digital nudging as well as system behavior modifications such as displaying content in a different form, stating additional opinions, and ranking recommendations in a different way (Harper et al. 2015; Loecherbach et al. 2021; Mattis et al. 2021). However, as these adjustments are typically nontransparent to the users, some authors propose a second approach referred to as *user control*, where the enhancement of the recommendations is induced by user inputs (Ekstrand et al. 2015; He et al. 2016; Jannach et al. 2017). These authors argue that letting the user determine the system's behavior endorses their perceived autonomy by increasing their level of understanding and control over the system (Harambam et al. 2018; Laitinen and Sahlgren 2021). In particular, a study by Harambam et al. (2019) shows that increasing user control can make NRSs more transparent and explainable and increase the responsiveness of recommendations to the interest of users. This observation is in line with *self-determination theory (SDT)*, a psychological framework that describes the relationship between different types of motivation and the resulting behavioral intention (Ryan and Deci 2000). According to SDT, an individual's willingness to engage in a certain behavior is largely determined by the extent to which the corresponding motivation is self-determined rather than externally regulated (Ryan and Deci 2000). In contrast to nontransparent algorithmic adjustments, user control mechanisms (UCMs) add to the user's perceived autonomy and provide an affordance to try out system features in an exploratory way (Harambam et al. 2019; Saeed and Abdinnour-Helm 2013). This seems particularly relevant for optimizing diversity in news consumption as the sole exposure to more diverse news items is insufficient to overcome antagonism to ideologically discordant information sources if taking place contrary to the user's preferences (Kitchens et al. 2020).

With their qualitative research, Harambam et al. (2019) have displayed first promising results on impact of UCMs on users' intention to engage in diverse news consumption. As part of our work, we aim to measure whether the application of diversity-fostering UCMs to NRSs actually brings about a self-determined exploratory usage behavior that ultimately leads to more diverse consumption of news. Therefore, we propose the following research question:

RQ: *How do user control mechanisms in news recommender systems influence the level of self-determination and, thus, the amount of diversity in online news consumption?*

As part of this short paper, we conceptualize a novel theoretical approach to answering this question based on SDT and already by doing so we extend current research. Moreover, we also propose a methodological design to empirically confirm the practical viability of our approach. Our design set-up draws from media, psychological, and information system research in order to tackle the complex societal issue of filter bubbles.

The remainder of this paper is structured as follows: In the section *Theoretical Background*, we introduce the theoretical concepts underlying our research design, including user control mechanisms and diverse news consumption. In the subsequent section on *Hypothesis Development*, we outline our research model and derive its hypotheses. Before concluding our paper, we present in the section *Outlook and Discussion* our suggested methodological approach as well as the expected contributions, implications, and limitations.

Theoretical Background

Diversity in news consumption

Diversity of news is strongly rooted in the concepts of participatory democratic societies and human rights (Bernstein et al. 2021; Human Rights Committee 2011). The consumption of diverse perspectives has been linked to raise tolerance (Mutz 2002), to assist in deriving more accurate perceptions of public opinion (Dvir-Gvirzman 2015), as well as to create greater political interest and knowledge (Castro et al. 2021; Kim and Kwak 2017; Kim and Pasek 2020). Thus, from a normative perspective, it is often argued that NRSs should expose users to content beyond their previous news consumption or current beliefs. To measure diversity in news consumption, Kitchens et al. (2020) proposed a set of metrics referring to *information source diversity*. As we are interested in consumption diversity of individual news items, we slightly adjust the metrics as listed in Table 1. Based on our adjusted metrics, we postulate news consumption diversity as the *aggregated difference in quantity, dispersion, parity, and variety* of consumed news items. Consequently, a high diversity in news consumption is given if the respective user shows an extensive individual consumption behavior with a balance in political slant and time spent per news item.

Metric	Description
Quantity	Number of distinct consumed news items
Dispersion	Time-weighted standard deviation of political slant of consumed news items
Parity	Relative share of time spent on each consumed news item
Variety	Time-weighted mean variety of consumed news items based on the frequency of overlapping consumers

Table 1. News consumption diversity metrics (adjusted from Kitchens et al. (2020))

Self-determination theory (SDT) and exploratory usage

SDT is a psychological framework that describes the relationship between different types of motivation and the resulting behavioral intention. According to SDT, an individual's willingness to engage in a certain behavior is largely determined by the extent to which the corresponding motivation is self-determined rather than externally regulated (Ryan and Deci 2000). The degree of self-determination is influenced by the fulfillment of three basic psychological needs: *autonomy*, *competence*, and *relatedness* (Deci and Ryan 1985). In this context, autonomy refers to the perception of exercising control over one's choices and actions (Deci and Ryan 1988). Competence is defined as a general ability to control the outcome of one's actions (Harter 1978). Lastly, relatedness describes the desire for interaction and connectedness with others (Baumeister and Leary 1995). Due to the subjective perception of these three aspects, we will refer to them in the following as *perceived autonomy*, *perceived competence*, and *perceived relatedness*.

Applying SDT in the context of diversity-aware NRS allows for theorizing the effect of UCMs on a user's willingness to try out new features, thereby engaging in exploratory usage behavior (Hsu and Chiu 2004; Ke and Wei 2015). Therefore, SDT is appropriate for examining the effect of control mechanisms on consumption behavior with a NRS that allows control the diversity among its recommended items. In IS literature, SDT has been repeatedly applied to examine IS adoption and use from multiple perspectives (Chung et al. 2014; Gerow et al. 2013; James et al. 2019; Venkatesh 1999). Hence, the application of SDT can be considered a promising approach to investigate the adoption of diversity-aware NRS and the resulting level of exploratory usage, resulting in more diversity in news consumption.

User control mechanisms (UCMs)

To enable active participation in democratic societies in an informed way, it is important that the news consumed by individuals has a certain degree of diversity (Helberger 2019). At the same time, research has shown that solely increasing exposure diversity by algorithmic means is insufficient from a normative perspective as awareness of opposing viewpoints can sustain or even increase polarization if it hardens existing ideological positions (Shore et al. 2018). Therefore, a diversity-aware NRS should be designed in a way that its users feel they can control and consume the displayed content in a self-determined way, rather than having a particular ideology or viewpoint imposed on them (Helberger et al. 2018). By putting them in control over how the recommendation engine behaves, user control mechanisms (UCMs) represent a promising approach to provide users of NRSs with a transparent way to diversify their consumption patterns. Based on previous work by He et al. (2016) and Jannach et al. (2017), Harambam et al. (2019) name three stages of the recommendation process where the users can exercise control over the system:

- (i) *Input control*. A user shall be able to provide the NRS with information about their consumption preferences prior to using the system. For instance, the user shall be able to (un)follow different news categories. This way, the system can to some extent avoid the cold start problem (i.e., not knowing what to recommend to a new user) and the user can choose the level of control they want to retain themselves or hand over to the system.
- (ii) *Process control*. A user shall be able to choose the type of algorithm used by the recommendation engine of the NRS. For example, the system could offer different recommendation strategies to choose from, such as “most popular”, “similar to your favorites”, or “surprise me!”. Moreover, the user could be enabled to adjust the weights of the metrics corresponding to each strategy.
- (iii) *Output control*. When provided with concrete recommendation results, the user shall be able to adjust their presentation by modifying the ranking, applying filters, or visualizing which recommendations were omitted due to the applied recommendation strategy.

For the scope of our paper, we will focus on the first two of these options – *input control* and *process control*. Besides having been identified as the most popular options in the study by Harambam et al. (2019), these two mechanisms allow the user to influence the entire recommendation process rather than only adjusting individual results. In the following section, we will therefore derive a theoretical model that, based on the considerations of SDT, shows how the use of input and process control mechanisms in NRSs can lead to self-determined exploratory usage behavior and thus to effective diverse news consumption.

Hypothesis Development

Motivated by the relevance of diverse news consumption for participation in a democratic society (Bernstein et al. 2021), we propose our research model depicted in Figure 1. It shows how the application of UCMs in NRSs could, through the mechanisms described by SDT, help to increase the user’s perceived self-determined motivation to use NRSs in an exploratory manner, thus increasing news consumption diversity. In the following, we discuss each part of our model in more detail and derive the corresponding hypotheses.

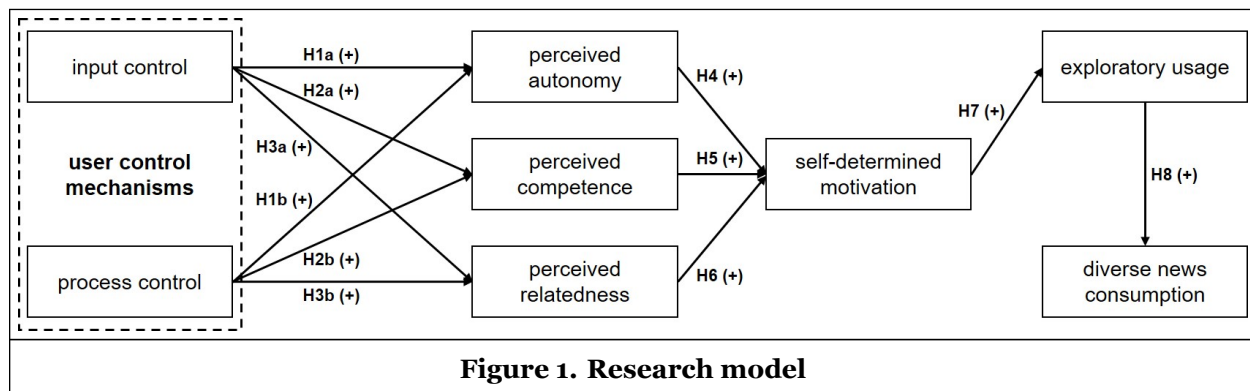


Figure 1. Research model

Input and process control

Recommender systems without UCMs typically base their recommendation strategy on implicitly collected data about users and their preferences (Ekstrand et al. 2015). In their study, Harambam et al. (2019) have shown that showing such implicitly collected data to users raises concerns about their level of autonomy and control over the system, as they could neither influence nor fully comprehend where the data comes from and how it is collected. In contrast, when providing input control mechanisms, users can autonomously decide which data they would like the system to take into account when generating recommendations (Harper et al. 2015). In addition, they also gain an understanding about which information is used for selecting the recommended items (Knijnenburg et al. 2012). Moreover, when providing users with different personae to pick a profile from, participants in a study by Harambam et al. (2018) have shown to increase relatedness with different personalities varying in their news consumption preferences. We therefore hypothesize:

H1a: *Applying input control to NRSs has a positive effect on a user's perceived autonomy.*

H2a: *Applying input control to NRSs has a positive effect on a user's perceived competence.*

H3a: *Applying input control to NRSs has a positive effect on a user's perceived relatedness.*

Besides controlling the input of a NRS, letting the user select the recommendation algorithm is a popular way of enabling user control (Jannach et al. 2017). There is widespread evidence that allowing users to control the recommendation strategy in an interactive manner is very likely to increase their level of perceived autonomy, as they are able to adjust the system behavior and immediately observe the effects of their adjustments (Ahuja and Thatcher 2005; Harambam et al. 2019). Furthermore, by immediately observing the consequences of their adjustments to the system's behavior, users can empirically develop competence concerning the functionality of the recommendation algorithm (He et al. 2016). Finally, the ability to modify the suggested content of a NRS leads users to discover news content that would not have been displayed to them otherwise. This way, users are encouraged to "think outside the box" and learn about different perspectives and viewpoints on controversial topics (Helberger et al. 2018). Since the respective change in content display was triggered voluntarily by the users rather than forced by the system, we argue that, rather than unreflectedly judging it as manipulative, users are likely to develop a certain relatedness with different viewpoints and the people who represent them (Van Alstyne and Brynjolfsson 2005). Thus, we hypothesize:

H1b: *Applying process control to NRSs has a positive effect on a user's perceived autonomy.*

H2b: *Applying process control to NRSs has a positive effect on a user's perceived competence.*

H3b: *Applying process control to NRSs has a positive effect on a user's perceived relatedness.*

Self-determined motivation

Noticeably, confronting users with a selection of diverse news items does not necessarily foster the adoption of different viewpoints or opinions. Instead, it might even reinforce their existing opinion due to a phenomenon known as *affective polarization* (Iyengar et al. 2019). According to SDT, a person's intention to show a certain behavior – like engaging in diverse news consumption – largely depends on the extent to which the person's motivation to engage in such behavior is self-determined (Ryan and Deci 2000). In particular, studies have shown that a broadened diversity in online content consumption can be achieved by establishing relatedness between people with opposing ideological views (Goel et al. 2010) or by empowering users to autonomously provide information concerning their consumption preferences to the system (Jannach et al. 2017). In addition, psychological insights from cognitive evaluation theory (CET) indicate that variability in self-determined motivation to engage in a certain behavior, such as exploratory usage of a diversity-aware NRS, can be explained by social and environmental factors that contribute to the fulfillment of individuals' needs for autonomy and competence (Deci and Ryan 1985). We thus hypothesize:

H4: *A higher level of a user's perceived autonomy positively influences their self-determined motivation to explore the features of a diversity-aware NRS featuring UCMs.*

H5: *A higher level of a user's perceived competence positively influences their self-determined motivation to explore the features of a diversity-aware NRS featuring UCMs.*

H6: *A higher level of a user's perceived relatedness positively influences their self-determined motivation to explore the features of a diversity-aware NRS featuring UCMs.*

Exploratory usage and diverse news consumption

By incorporating UCMs into an NRS, its users gain the opportunity to diversify their news consumption through exploratory usage behavior (Harambam et al. 2019). However, since the users of the NRS are by no means forced to use the control mechanisms in a way that favors exploratory usage, they first need to develop an intention to voluntarily do so UCMs (Nambisan et al. 1999). Concerning the case of UCMs in NRSs, we assume that the development of such an intention is facilitated by the self-determined motivation stemming from a high degree of perceived autonomy and control when interacting with the system (Ahuja and Thatcher 2005). Yet, sustained change towards a more diverse consumption behavior also requires a high level of user satisfaction from engaging with the diverse news items. Otherwise, albeit seeing diverse content, users might classify it as irrelevant or unsatisfying, thus ignoring it in their pursuit of information (Kitchens et al. 2020). To this end, we argue that exploratory usage also has a significant positive effect on user satisfaction given the presence of self-determined motivation for exploration (Ke et al. 2012). Consequently, we propose that a self-determined motivation towards exploratory usage will have a sustained positive effect on the observed consumption diversity, and thus hypothesize:

H7: *A higher self-determined motivation to explore its features positively influences the degree of exploratory usage within a diversity-aware NRS featuring UCMs.*

H8: *A higher degree of exploratory usage within a diversity-aware NRS featuring UCMs positively influences the amount of diversity in news consumption.*

Outlook and Discussion

With our work, we have developed a model that, based on insights from SDT, explains how the application of UCMs in NRSs can promote diverse news consumption. By presenting this model, we suggest a novel and promising alternative to prior work that focuses on technical approaches such as modified algorithms, digital nudging, or explainable system design (Mattis et al. 2021; Raza and Ding 2022; Tsai and Brusilovsky 2021). Drawing on insights from psychological research to theoretically deduce how augmented perceived autonomy, control, and relatedness triggered by UCMs can increase diversity in online news consumption. Therefore, we already provide a theoretical contribution to IS research. Moreover, our approach shows high practical relevance, as it describes a concrete, practically implementable intervention to new or existing NRSs that can help avoiding the negative consequences of excessive personalization in news consumption, such as the emergence of filter bubbles or group polarization (Pariser 2011; Sunstein 2002).

Future work and expected contribution

Despite the contribution achieved so far, we consider our project as work in progress and therefore aim to empirically validate our conceptual model by the ICIS 2022 conference. To do so, we first plan to implement a prototype for a simple NRS providing UCMs in the form of input and process control. For *input control*, users shall be able to select their news consumption preferences in terms of news categories and political slant. For *process control*, users shall be able to select the variance in serendipity in terms of news categories and political slant applied during the interaction with the system. Applying full variance would basically result in no personalization, whereas no variance would result in minimal diversity.

By populating this prototype system with a static message dataset for NRSs such as the MIND dataset (Wu et al. 2020), we subsequently intend to conduct an experimental study. To this end, we plan to randomly divide the participating subjects into two groups. While both groups will be asked to interact with the system, only one of the groups will be given access to the UCMs described above, whereas the control group will face a recommendation algorithm that will adjust its behavior based on their implicit inputs (the more diverse they consume at the beginning, the more diverse recommendations they will obtain, and vice versa). While conducting this study, we aim to capture for each group the values of perceived autonomy, competence, and relatedness as well as the amount of self-determined motivation for diverse news consumption by presenting a questionnaire after the interaction with the system, with items adapted from those used in past studies of SDT related to IT system use (Carter et al. 2020; Ke and Wei 2015; Rezvani et al. 2017). Moreover, by tracking the usage behavior of the NRSs, we aim to determine whether the experimental group that has

UCMs available exhibits more exploratory usage behavior and thus more diverse news consumption than the control group. In particular, we plan to measure exploratory usage by the amount of time spent interacting with the system, and consumption diversity by calculating an aggregate value for the metrics provided in 1. This approach does not only allow us to validate (or reject) our hypotheses, but in particular ensures that any direct effect of using UCMs on news consumption diversity could be revealed.

Limitations and future research opportunities

Through the empirical validation of our model with an experimental setting, we extend our present contribution by testing the theoretical arguments for practical validity. By doing so, we show to what extent UCMs can lead to an increase in self-determined motivation and to more diverse news consumption. Nevertheless, our model and proposed methodological approach have some limitations, which we briefly discuss subsequently. First, (personalized) user interaction with NRSs usually takes place over a long period of time. This allows the system to capture users' consumption preferences over a lengthy time span and continuously improve the personalized recommendations, which cannot be accounted for in our experiment. Therefore, we suggest that future research should also address the longitudinal effects of using UCMs in NRSs to investigate whether changes in diversity of news consumption that can be observed in the short term are maintained in the long run. Second, our research design currently does not allow for isolating effects specific to a particular type of UCM or moderation effects stemming from individual user characteristics such as demographics, digital media literacy level, or political partisanship, leaving respective analyses open to future research. Third, within the scope of our study, we cannot implement a comprehensive definition of diversity in news that can account for all aspects of diversity of information, opinions, and viewpoints known from literature (Vrijenhoek et al. 2021). Instead, we have to restrict ourselves to rather simple diversity metrics related to differences in the metadata of news items and variations in usage behavior between users. Future research could therefore seek to further differentiate our operationalization of news diversity by developing algorithmic techniques to consider other aspects of diversity. Finally, our NRSs operates on a static news dataset, such that effects due to novelty and immediate relevance of headlines cannot be taken into consideration. Therefore, another possible avenue for future research is to dynamically compose the dataset from data provided by news aggregators in order to account for this effect.

Conclusion

Due to their particular importance for information retrieval and opinion formation in democratic societies, news diversity is an important design principle of NRSs. Based on the findings of SDT, we therefore propose an approach that, by applying UCMs to NRSs, aims at contributing to users' self-determined motivation to exploratory NRS usage, resulting in higher news consumption diversity. To complete our present work, we plan to empirically validate our model and its hypotheses. In doing so, we hope to establish a viable approach for user-centered design of NRSs that, if implemented practically, generates positive social impact.

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