

Beyond the filter bubble: concepts, myths, evidence and issues for future debates

Dr. Judith Moeller, Prof. Dr. Natali Helberger, University of Amsterdam¹

1. CONTENT

1	Content	1
2	Introduction	1
2.1	Beyond filter bubbles: Concerns related to algorithmic news recommendation	4
a)	Polarization	4
b)	Fragmentation of the public sphere.....	4
c)	New divides: filter bubbles for specific groups.....	5
d)	Algorithmic recommendations can be a means to establish and consolidate economic market power, and create new dependencies	5
3	Empirical research into the effects of algorithmic news recommendation	6
4	Filter bubbles in the Netherlands?.....	19
4.1	Little evidence of polarization.....	20
4.2	Dutch news users still use legacy media	20
4.3	User Attitudes: Trust in media and appreciation of diversity	21
5	Conclusion.....	23
6	Discussion: Filter bubbles and beyond.....	23
7	References	27

2. INTRODUCTION

We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction. (Bill Gates)

In recent years, we have been witnessing a fundamental shift in the form how news and current affairs are disseminated and mediated. Due to the exponential increase in available content online and technological development in the field of recommendation systems, more and more citizens are informing themselves through customized and curated sources, while turning away from mass-mediated information sources like TV news and newspapers. Algorithmic recommendation systems provide news users with tools to navigate the information overload and identify important and relevant information. They do so by performing a task that was once a key part of the journalistic profession: *keeping the gates*. In a way, news recommendation algorithm can create highly individualized gates, through which only information and news fit that serves the user best. In theory, this is a great achievement that can make news exposure more efficient and interesting. In practice, there are many pitfalls when the power to select what we hear from the news shifts

¹ Report drafted for the Dutch Media Regulator (Commissariaat voor de Media)

from professional editorial boards that select the news according to professional standards to opaque algorithms who are reigned by their own logic, the logic of advertisers or consumes personal preferences.

Recommendation logics depend on the underlying business model and economic incentives

What exactly the logic is that a news recommender follows, depends, among other things, on the reason for which the system is being implemented as well as the underlying business model. In the discourse around filter bubbles, the underlying assumption is that the news recommender prioritizes like-minded content and content that conforms to already existing preferences. It is important to realize that this recommendation logic may be true for many, but certainly not all of the currently operating news recommenders. It may be true where the business model of the entity that deploys the recommender is primarily focused on generating advertising revenues, such as in the case of certain social networks or aggregation sites. In this case, there is a strong economic incentive to maximize user engagement, as user engagement and attention directly translates into advertising revenue. A news recommender may be then optimized to show users a mix of contents that the user is most likely to click on, like or feel satisfied with. These recommendation algorithms aim to recommend items that engage users, measured in clicks. The probability to click is estimated through combining information from a number of different sources. The most important source is data collected from other users (collaborative filtering). That means that a user is recommended those items that other users with a similar profile have clicked on before. The second source of information is the content of news items a user has clicked on in the past. Using text-mining techniques other items with similar content can be identified and recommended. Finally, news recommender can recommend sponsored items, thus third parties provide content and pay for placement in recommendations.

A threat to diversity and democracy? The filter bubble argument

The logic of the algorithms to prioritize content liked by similar users or content that resembles content specific users like can have consequences for the diversity of the overall set of news that is presented to users, that is the extent to which users receive contents from different perspectives, sources, and categories. **In the US** this has led to concerns that diversity could be reduced to a degree in which challenging content would virtually disappear from citizens news menus. As a result news recommendation algorithms allegedly construct bubbles of like-minded content around news users, prominently dubbed *filter bubbles*. The term was coined by Eli Pariser, an internet activist who defines filter bubbles as “this unique, personal universe of information created just for you by this array of personalizing filters. It’s invisible and it’s becoming more and more difficult to escape.” But also **in Europe**, the potential negative effect of news recommenders on diversity and the public sphere has been voiced prominently. As the European High-Level Expert Group on Media diversity warned: “[I]ncreasing filtering mechanisms make it more likely for people to only get news on subjects they are interested in, and with the perspective, they identify with. ... It will also tend to create more insulated communities as isolated subsets within the overall public sphere. ... Such developments undoubtedly have a potentially negative impact on democracy.” And the UK regulator OFCOM has suggested that “[t]here is a risk that recommendations are used in a manner that narrows citizens exposure to different points of view, by reinforcing their past habits or those of their friends.” (Ofcom, 2012, p. 25).

Recommendation algorithms and their potential impact on diversity

Following this line of reasoning, the seclusion of users in an information environment that primarily features like-minded content has often been attributed to popular and policy discussion to the news recommendation algorithms. It is important to note, however, that the tendency to prefer consonant content, information that feels like an intellectual home, has been known in communication science and psychology for decades. The resulting news menu that avoids counter-attitudinal information is conceptualized as an *echo-chamber* (Sunstein), in which all new information echoes what we already think. In fact, during the period of *verzuiling* the walls of these echo-chambers were much thicker than they are today in the Netherlands and a similar argument could be made for most European countries. Hence, it is at least questionable that algorithmic recommendation systems cause or create users preference for like-minded content. This highlights the importance of understanding the influence of pre-existing preferences and behavior for the actual recommendation. In a situation that the algorithm picks up clear signals that a user does not click on challenging or divergent information, it may cease to offer it, thereby reinforcing the attitudes of these users and limit their choice set. Research has shown that over time these attitudes can become more extreme (Stroud, 2008). Yet, if a user does have a preference for diverse content, an algorithmic recommendation set can also pick up this signal and provide balanced and diverse content (Messing & Westwood, 2014). In other words, it is not a given that algorithmic recommendations present user with 'more of the same', they can also do the opposite and present users with more diverse or different news, depending on the input (signals from users), the design of the algorithm itself and, ultimately, the objectives of the entity employing the algorithm. Much will depend on the importance of 'diversity' as a design principle for the recommender.

This is well demonstrated by the recent controversy around Facebook's Trending Topics algorithm, and claims of bias. A closer look into the editorial guidelines and instructions for the human editors of Trending Topics revealed that considerations of media diversity were more or less absent in trending topics (meanwhile Facebook has again changed its algorithm and probably also the editorial guidelines in response to the Trending Topics criticism). Trending Topics editors were, for example, asked to get a good overview of what is trending, the Facebook Trending algorithm that notes whether topics are disproportionately often mentioned, engagement (likes, comments, and shares) and what the headlines from top news sites suggest that is trending, namely a selection of news websites that is strongly US/UK centred. Arguably, the Trending Topics algorithm thereby completely failed to reflect the diversity of the media scene in Europe, local content, etc. More generally, many recommender systems display a certain bias towards popular recommendations or recommendations that reflect individual interests and personal relevance (DeVito, 2017). To the contrary, as our interviews with newsrooms in (quality) newsmedia and public service broadcasters showed, there is a lot of experimentation currently under way to design news recommenders in a way to present users with more diverse, more in-depth content, unlock the long tail and inform better. Designing the algorithm to also display diverse information is often a central consideration in that context, particularly for public service broadcasters who have a clear legal mandate to promote diversity (Helberger, 2015).

What exactly is the impact on diversity, and is it negative?

A major shortcoming of the current debate is the lack of a clear conceptualization of diversity in the context of recommenders and the definition of clear benchmarks that can be used to assess whether or not there is a risk to (exposure) diversity and a healthy public sphere. Even if users do consume more and more personalized news, and even if that news is adjusted to their personal preferences, does this already constitute a problem for diversity, or as the High-Level Expert

Group would put it ‘an undoubtedly negative impact on democracy’? Under which conditions would we need to worry about such a negative impact?

1.1 Beyond filter bubbles: Concerns related to algorithmic news recommendation

While it is important to understand the potential impact of news recommenders on diversity and the role of diversity as a value in recommender design, it is also important to be aware that the potential effects of recommenders on diversity are only a first step in understanding the broader implications of the shift from mass-to personalized communication. For a meaningful policy debate, however, it is critical to untangle these different implications. The filter bubble rhetoric is a powerful one, and one easy to convey, not at least because of the compelling imaginary that it uses. It should not, however, divert the attention of regulators and policymakers from more structural challenges that may require their attention. Although it would go far beyond of the scope of this report to list and explain those potential challenges exhaustively, we would like to point in passing at least to four of what we think may be equally or even more pressing issues behind algorithmic news recommendations:

- a) algorithmic news recommendation can lead to increased polarization of the society,
- b) algorithmic news recommendation can lead to a fragmentation of the public sphere,
- c) algorithmic news filtering leads to new divides in the society;
- d) algorithmic recommendations can be a means to establish and consolidate economic market power, and create new dependencies.

a) Polarization

Polarization was one of the first concerns put forward in relation to algorithmic news recommendation, at least in the academic debate. In a nutshell, polarization means that when more and more people become reinforced in their beliefs by the (algorithmically selected) news media they use, they become more extreme in their beliefs over time (Stroud, 2008). If this happens on a large scale a society will become increasingly divided as all individuals are moving towards opposing ideological poles. In the US context, this has become a serious problem. 50 years few people expressed any anger when asked how they would feel if their child married someone from the other party. Today, one-third of Democrats and nearly half of Republicans would be deeply upset (McConnel et al. 2017). It should be noted that polarization is a larger societal trend, that is reinforced and catalyzed, but not caused by media use.

b) Fragmentation of the public sphere

The second concern is connected to the affordance of recommendation systems to individualize news menus by prioritizing topics and issues relevant to specific users. While this has many positive effects like higher engagement with news and ability to learn from the news, it threatens the notion of a collective public sphere that serves as the stage all citizens of society share to find out what is important to society as a whole. This stage is not only the place we find out what the most pressing issues are, it also gives us the opportunity to engage with each other in a conversation with each other. Algorithmic news personalization could lead to a situation in which the shared public sphere becomes increasingly disintegrated and breaks up into smaller issue publics. Citizens in those smaller issue public become less aware of other issues. This leads to a situation in which the experience and perception of the public become individualized. We might think that everyone agrees that our most pressing issue, because our news environment seems to prioritize it, unaware that for most of the population the same issue is only of small relevance. To

sum it up, algorithmic news recommendation might affect our ability to get a sense of what the majority of the population is thinking about. First research in the field indicates that selective exposure can be connected to misperceptions of facts about current events (Kull et al. 2004).

c) New divides: filter bubbles for specific groups

Finally, there is a concern connected to the fact that algorithmic news recommendation is not adopted at the same rate in the same way. We see, for example, that the users of news on social media are significantly younger. We also see that those with lower political sophistication and media literacy skills make use of news of news recommended through social media, without the ability or motivation to reflect on the quality of the sources or potential biases that could arise from the algorithmic selection. The same group has also been shown to find ways to tune out of complex political discussions entirely (Mindich, 2005) and can make use of the tools of algorithmic news personalization to realize avoiding political news quite efficiently. This can lead to a widening knowledge gap, on the one side are people who are part of the political debate and whose news recommenders select news items that help them to stay up to date and learn even more, on the other side are those whose recommenders rarely ever present them with political news at all.

Connected to this argument is the fear that algorithmic recommendation systems can be used by counter-publics or societal groups that situate themselves outside of the “mainstream” public discourse to create a bubble in which alternative news and information can be easily exchanged and disseminated while excluding mainstream media sources. For example, closed groups on social media that share a certain conspiracy theory or have strong opinions about immigration.

d) Algorithmic recommendations can be a means to establish and consolidate economic market power, and create new dependencies

Personalization, search and recommendation play a rather pivotal role in exposure to information, and diverse exposure, but also: to gain a competitive edge in the digital attention economy. Good personalization requires sufficient amount of both contents as well as input data, as well as sophisticated recommender technologies. It remains to be seen to what extent the traditional media will be able to compete with the new information intermediaries for the attention of users, also seeing the amount of data that some of the latter hold and the size of sophisticated R&D departments to analyze and use that data in the competition for eyeballs. Dommering warns that the traditional media are at risk of losing more and more of their identity in their attempt to assimilate and create a functional symbiosis between themselves and the traditional media (Dommering 2016). And Van Dijk & Poell point to the risk of new dependencies as the result of a shift in the news process from “an editorial logic to an algorithmic logic”, a shift whose main driver are platforms (Van Dijk, Poell et al. 2016).

3. EMPIRICAL RESEARCH INTO THE EFFECTS OF ALGORITHMIC NEWS RECOMMENDATION

Research into the effects of algorithmic recommendation on society is still in a very early stage (Kitchin, 2017). It is notoriously difficult to study this particular phenomenon due to the complexity of algorithms, but also due to the complexity of the issue and the need to disentangle the different effects (see above). To our knowledge, there are no studies of the actual algorithms used to select news, as they are trade secrets. But even if the algorithms themselves could be studied, it would be impossible to investigate their impact on diversity without also knowing the input data and how the algorithms are embedded in the larger system. Therefore the current body of work focuses on either analyzing the diversity of the recommendation output (for example search results, a social media feed) or users attitudes and behavior by measuring, for example, the attitude extremity before and after being exposed to personalized, biased news. The majority of this research stems from the US, although in the past year there have been a couple of studies that investigated filter bubbles in the European context. Some of the research is so recent that it has not been published in academic journals yet, but is according to our assessment of high quality, which is the reason why we did include it in our overview.

In the following, we present an overview of the academic body of work on the effects of algorithmic news recommendation systems or filter bubbles. We selected studies that have been published in renowned academic journals in policies science or communication since 2015 we could identify, as well as a couple of older key studies that have been central to the academic discussion so far. In this overview we provide information about every study on a number of categories: the research question, the definition of diversity employed, which explanation or cause of potential filter bubbles are used and which effects are specified, in which country the study was carried out as well as key information about the method, the results and whether or not the study includes policy advice.

Author (year)	RQ	Definition of diversity	Causes of filter bubble, concerns	Country, Method	Results	Policy suggestions
Studies into diversity of content						
Bakshy et al. (2015)	How do online (social) networks influence exposure to perspectives that cut across ideological lines?	Ideologically cross-cutting content	the function of curating content has shifted from newsroom editorial boards to individuals, their social networks, and manual or algorithmic information sorting. This can lead to a lack of counter-attitudinal information which can lead to more extreme opinions or a misperception of facts.	USA, Cooperation with facebook, Using deidentified data, they examined how 10.1 million U.S. Facebook users interact with socially shared news. Ideological leaning was determined by machine learning based on the content selected by users who ideologically identify as either liberal or conservative	How much cross-cutting content individuals encounter depends on who their friends are and what information those friends share. The chance to see cross-cutting content relative to ideologically consistent content is 5% for conservatives and 8% for liberals. The chance click on a cross-cutting content relative to consistent content is 17% for conservatives and 6% for liberals. Exposure to cross-cutting content happens through traditional media shared in social	The cause for selective exposure resides primarily on the individual level, although algorithms also influence exposure to attitude-challenging content in the context of Facebook. No policy implications or normative stance

					media	
Moeller, Trilling, Helberger, & van Es (2016)	What are the effects of different algorithmic recommendation settings on diversity	Diversity is conceptualized as a function of the media system and operationalized as diversity in topics, diversity in tone, and share of content about politics	Algorithmic news selection based on user data can lead to a situation in which counter-attitudinal and different content is no longer displayed and therefore accessible to the users. However, in the American context diversity in content is reduced to political ideology in a binary system (republican – democracy). Considering the public value of news media other forms of diversity should be considered as well, for example, whether users are sufficiently informed about a variety of topics, in different journalistic formats etc.	Netherlands, data-scientific experiment (N= 1000 articles, 500 users). Recommendation outputs of different recommendation logics (3 articles recommended after reading one of the 1000 articles) are compared with regard to multiple dimensions of diversity with each other and with the pick of human news editors.	All algorithmic settings were on par with the diversity that human journalists produced. The inclusion of personal data in the personalization process even increased diversity on topic diversity, implying that standard algorithms can, in fact, increase diversity, depending on the input data.	Stimulate alternative KPIs (Key performance indicators) in recommendation systems to include measures of diversity.
Flaxman et.al, 2016;	Does algorithmic curation lead to more or less exposure to diverse perspectives?	Exposure to news stories from the opposing side of the political	Cause of potential filter bubbles: combination of tendency to self-select conform content catalyzed by algorithmic	The USA, Analysis of web browsing histories for 50,000 US-located users who regularly read	Usage of social networks and search engines are associated with an increase in the	None

		spectrum	selection	online news.	mean ideological distance between individuals. However, somewhat counterintuitively, these same channels also are associated with an increase in an individual's exposure to material from his or her less preferred side of the political spectrum. Finally, the vast majority of online news consumption is accounted for by individuals simply visiting the home pages of their favorite, typically mainstream, news outlets, tempering the consequences—both positive and negative—of recent technological changes.	
Adomavicius, Kwon, 2012	How can algorithms include diverse recommendation	Exposure to unpopular items (in the long-tail	Filter bubble is not mentioned, diversity is seen as an added benefit	USA, analysis movie rating data sets, including	It is at least technically possible to program	None

	without losing accuracy?	of the catalog)	to the user	MovieLens (data file available at grouplens.org), Netflix (data file available at netflixprize.com), and Yahoo! Movies (individual ratings collected from movie pages at movies.yahoo.com).	recommendation algorithms in a way to promote more diverse exposure to content. In general, all proposed ranking approaches were able to provide significant diversity gains, and the best performing ranking approach may be different depending on the chosen data set and rating prediction technique	
Zweig, 2017	To what extent is the output of search engines personalized in the context of elections	Overlap in search engine results	Algorithmic personalization could lead to a different portrayal of candidates for individual users who want to inform themselves about the candidate using search engines	Germany, data collected through users volunteering access to their browser to perform automatic searches (N= 5.991.500 searches of 4379 participants)	80% overlap in search results between users in candidate searches, slightly less overlap when parties are considered.	NA
Puschmann, 2017	To what extent is the output of search engines personalized in the context of elections	Overlap in search engine results	Algorithmic personalization might affect certain users to a much larger extent compared to others	Germany, data collected through users volunteering access to their browser to perform automatic searches (N= 5.991.500	While the majority of users shares most of the search engine results, there are small clusters of users who receive entirely different	NA

				searches of 4379 participants)	sets of search results and hence have a different perception of the candidates and parties	
Humprecht & Esser (2017)	Evaluation of the diversity of political news produced by online media and whether differences in diversity can be attributed to the organizational and national environments in which these media are produced.	Four dimensions of diversity: actors (diversity of speakers), geographical regions, viewpoints	Market structure leads to a weaker financial bases for online news services, which can have an impact on the diversity in online news	6 countries (F, Ger, It, CH, UK, USA), content analysis of 48 online news outlets, (N=1660 stories) in a constructed week in June and July 2012	Findings show that online news attains the highest levels of diversity (measured with three different indices) in national environments with strong public service media, and that even in the internet age, public broadcasters add considerably to the diversity of political news. The much discussed category of made-for-Web outlets (including the Huffington Post and Rue89) revealed considerable variety in ownership and escape simple explanations with regard to diversity.	Both online and offline outlets offer approximately the same ranges of diversity in their news coverage

Studies into effects on users attitudes and behavior						
Beam 2014	Effects of news personalization on exposure to counter-attitudinal sources	Exposure to counter-attitudinal sources	The diffusion of news through algorithmically curated sources might lead to a situation in which users are not exposed to information necessary to make informed civic decisions. The ability to selectively filter information based on user preferences allows newsreaders to more easily ignore stories that they deem irrelevant or counter-attitudinal, thereby eroding editorial control of news information by traditional gatekeepers in the news industry.	US, experiment (N=490), convenience sample. Stimulus: Manipulated homepage with 6 news stories	The study finds evidence of selective exposure as a result of algorithmic recommendations but interestingly the same study also found that explicit user-driven customization can result in higher exposure to counter-attitudinal views	Further research is needed to inform recommendation designers about choices that mitigate potential negative effects
Beam et al. 2017	Does diversity in social network increase news reading and sharing?	“Context collapse”(how different the social network online is perceived from one’s own views)	News exposure on algorithmically curated social networks might lead to more or less diverse news view depending on the network ties	US, survey (N=771) (Questions include the perception of the network, willingness to read and share news, privacy management).	If the social network is perceived to be more diverse people are more inclined to share news and participate in an active debate.	Contrary to the theory-based democratic argument states that when users are placed in an information environment populated by people in their personal social networks and

						personalized algorithms, they are less likely to be exposed to diverse perspectives this study indicates that when people connect with more diverse others, they are increasingly engaging in news exposure and sharing.
2017 Reuters News Report	Exposure to diverse content, effects of content curation on brand recognition	Sources users would not normally see (self-report)	NA	UK, method mix: tracking plus survey (N=3000) p	Users of, inter alia, social media were significantly more likely to see sources they would not normally use, likely including those that offer dissimilar viewpoints Echo chambers and filter bubbles are undoubtedly real for some, but the study also finds that – on average – users of social media, aggregators, and search engines experience <i>more</i>	NA

					<p>diversity than non-users.'</p> <p>Overall, the authors found that roughly two-thirds remembered the path through which they found the news story (Facebook, Google, etc.), but less than half could recall the name of the news brand itself when coming from search (37%) and social (47%). Respondents were more likely to remember the brand if they had a previous connection with it or used it as the main source.</p>	
<p>Quattrociocchi; Scala and Sunstein, 2016</p>	<p>Do echo chambers actually exist on social media?</p>	<p>Exposure to and engagement with counter-attitudinal information (attitude defined as believing in either science or</p>	<p>Algorithmic filtering in combination with confirmation bias affects decisions about whether to spread content, potentially creating informational cascades within identifiable</p>	<p>Italy/US, Analysis of membership and user engagement of polarized facebook groups (N-1105 pages)</p>	<p>Social network users create like-minded echo chambers around certain issues that limit exposure to attitude-challenging views</p>	<p>None</p>

		conspiracy)	communities. In these circumstances, online behavior can promote group polarization			
Haim, M., Graefe, A., & Brosius, H. B. (2017)	Effects of algorithmic filtering on diversity on search engines	Source diversity (pluralism of quoted actors' affiliations or status positions & diversity in news outlets)	Definition filter bubble: algorithms filter out information that is assumed to be of little interest to individual users while presenting more content that users are more likely to consume. For example, users who have a history of consuming a lot of sports news will receive even more sports news, presumably at the cost of other topics (e.g., political news)	Germany, content analysis of output of different google news account, with different settings (N=972 retrieved news articles)	The study found only minor effects of personalization on content diversity. While explicit personalization slightly affected content diversity in that users saw more articles for their preferred topics, implicit personalization based on manipulations of user behavior did not affect content diversity. Furthermore, neither type of personalization had any effect on source diversity.	None
Moeller, Trilling, Helberger, Irion, de Vreese (2016)	Does news personalization affect the shared issue agenda?	Number of issues on the public agenda	The paper addresses the question whether algorithmic filtering might lead to a fragmentation of the	Netherlands, cross-sectional representative survey (N= 1,556), DV: Position of the	Offline media use, in particular, TV, increases the chance of naming issues at the top of the news	Existing diversity safeguards need to be re-evaluated in the light of the opportunities from

			public sphere. The paper investigates the preference for specific over issues at the top of the general news agenda as a result of algorithmic filtering. This is caused by a more active role of the user in the gatekeeping process that is reinforced by algorithmic selection.	news issue that is perceived the most pressing of a respondent on the general list. IV: Use of personalized news (in particular on facebook)	agenda, use of personalized news use does not. This can be explained by different user groups. Personalized news media are mainly used by younger, more educated users.	personalized media for the user as self-organizing agenda setter. Further research is needed into exposure diversity.
Thurman, Moeller, Trilling, & Helberger, 2017	What audiences think about news selection mechanisms (algorithmic, peer-based, or editorial) and why?	Exposure to challenging viewpoints	Gatekeepers play an important role in opinion formation. Lack of quality and diversity and presented to citizens have had consequences on political systems and trust in media as an institution.	26 countries survey (N=53,314), representative population sample. DV: Appreciation of selection by a) algorithms b) editors c) peers. IV: Trust in media and independence from influence, concerns about algorithmic curation, background variables	The results show that, collectively, audiences believe algorithms guided by a user's past consumption behavior can outperform editors. There are, however, significant variations in these beliefs at the individual level. People's trust in the news media, concerns about privacy and information diversity, and news consumption behaviors all affect	The study suggests that it is important that recommendation algorithms are designed in a way that means users do not miss out on important information and continue to receive challenging viewpoints. Users care about diversity.

					their opinions about the utility of algorithmic and editorial news selection.	
Anspach, 2017	Has the introduction of social media into the information landscape changed the heuristics individuals use when selecting news?	Content in favor or against six different issues (e.g. health care, cabinet)	The tendency to seek sources of information that align with their preexisting attitudes and interests. The article highlights that social media provide the opportunity for incidental exposure to political news to entertainment seekers	USA, Survey experiment (N=105) in which subjects, in a series of exercises, select articles from mock Facebook News Feeds	Endorsement of peers and family increase the chance for selection, regardless whether or not the content is counter-attitudinal. Social media is found to be the medium that provides most counter-attitudinal information	None
Dylko, 2017	Is there a causal relationship between the presence of customizability technology (i.e., a technology that allows individuals/websites to tailor the information environment according to user's preferences) and political selective	Exposure to articles about issues with a clear ideological stance (liberal or conservative)	News personalization can potentially undermine the deliberative democratic processes by reducing exposure to political opinions different from one's own Selective exposure (preference for consonant news) is facilitated by personalization technology	USA, survey experiment. (N=93, university students) IV: Users were presented with personalization technology they had control over or no control over. DV: increased clicks on and time spent reading pro-attitudinal and contra-attitudinal political articles.	The study finds that exposure to system-driven recommendation technology can result in political selective exposure, especially when combined with ideology-based customizability	The findings suggest that one important element of today's Internet customizability technology has a strong potential to undermine this important aspect of deliberative democracy theory. The authors believe that due to its automatic and unobtrusive

	exposure.					operation, customizability technology might be particularly effective at reducing cognitive dissonance associated with the avoidance of challenging information
--	-----------	--	--	--	--	---

1.2 Summary: Diversity in diversity research

Looking at the body of academic work investigating algorithmic news recommendation we can observe large differences. These differences are evident on multiple layers: a) the research design (digital trace data or tracking, large scale surveys or experiments), b) the sample size of the sample and how representative it is of the population (e.g., Digital news survey uses a large representative sample, whereas the experiments (e.g., Dylko et al) are carried out with university students, c) the conceptualization and operationalization of diversity (viewpoint diversity, topic diversity, or network diversity) and, most importantly, whether or not they find evidence for detrimental effects of algorithmic news recommendation. On a general level, we can conclude that while the larger scale studies provide little evidence of negative effects of algorithms on the diversity of the content (e.g. Bashky et al 2015.) or users attitudes and behavior (e.g. Reuters Digital news study), smaller more experimental studies do find significant effects. In other words, if the study aims to measure *in vivo* effects of algorithmic filtering on society at large, there is little evidence of filter bubbles. On the contrary, several studies demonstrated that algorithmic news recommendation can (e.g. Moeller et al., 2016), for example, increase source diversity, or cause incidental exposure to news among users who otherwise avoid certain political information (Reuters, 2017). Studies that do find evidence of filter bubbles either studied very specific groups like conspiracy theorists (Quattrociocchi; Scala and Sunstein, 2016) or in an experimental, *in vitro* setting (e.g. Dylko et al. 2017). It should be noted that there are vast differences in the methodological quality of these studies. On the one side of the spectrum is the study by Bashky et al, using original user data of a large sample of Facebook users, however, the academic independence from Facebook can be questioned. On the other side is the study by Dylko et al. (2017) or Anspach (2017) who support their claims using data collected from about 100 university students, which casts serious doubts on the generalizability of the results.

It should also be noted that those studies indicating the algorithmic filtering produces filter bubbles are almost exclusively carried out in the US context, whereas studies by European researchers often conclude that in the European context the ideological segregation in a politically left and politically right bubble, is not evident on a large scale. However, there is evidence that algorithmic filtering contributes to a fundamental transformation of news audiences. We see that filtering technology is not adopted by all users at the same rate in the same way. Less politically sophisticated users use news filtering technologies with much less concern that it might influence the diversity of their news menu. Additionally, there are first indications that smaller groups, often skeptical of mainstream media, make avid use of algorithmically filtered social media to construct alternative news realities and create echo chambers clear of challenging viewpoints. Finally, we see that algorithmic news filtering is related to shift in the shared issue agenda. We see that topics at the margins gain more traction and attention if algorithmic filtering is used, for better or worse.

4. FILTER BUBBLES IN THE NETHERLANDS?

So far there are only a few studies that have investigated the influence of algorithmic filter systems on diversity and plurality in news in the Netherlands (e.g. Moeller et al., 2015). It should be noted, however, that there is sufficient empirical evidence that algorithmically filtered, biased news make up only a minor share of Dutch news users at present (see also Zuiderveen Borgesius et al., 2016). If we take the current situation of the Dutch media system and users attitudes and

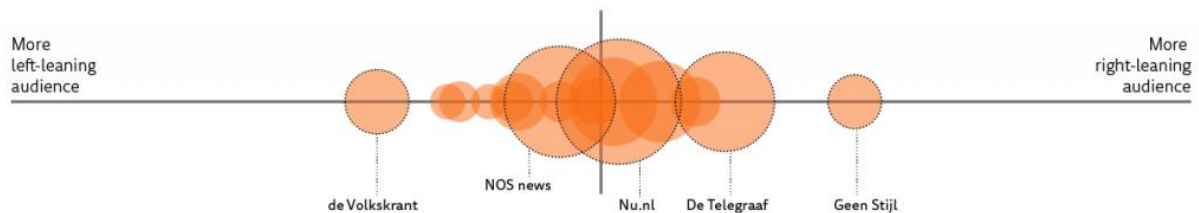
behavior into account, we can conclude that filter bubbles do not affect the majority of the population to a large extent. In the following we will support this claim using data from the Reuters Digital News survey and our own research, to demonstrate that the conditions of filter bubbles (polarized news media, users receive news primarily through algorithmically filtered news sources, and news users prefer like-minded content) cannot be empirically substantiated in the Netherlands.

This is a first tentative analysis of the current situation in the Netherlands. We can extend this analysis based on our 4 wave panel survey by for example analyzing trends over time using our panel data collected over two years or detailing differential effects on specific groups in the population.

1.3 Little evidence of polarization

Filter bubbles are mostly conceptualized as an algorithmic reduction on ideological diversity in a binary system of politically left and politically right in the US American context (see the literature review above). In the Dutch context, however, there are few sources that can be considered to be polarized and therefore used by algorithmic systems to inform in a biased, or polarized way. The figure below presents data from the Reuters Digital News report 2017. It displays the ideological leaning of the audience of the largest Dutch news brands. The figure clearly shows that most participants of the study place themselves in the center of the political spectrum and the ideological leaning of most source audiences overlap, with the notable exception of the Volkskrant and Geenstijl. It can be concluded that at present the overwhelming majority of the Dutch news audience is not divided along the ideological line of left and right.

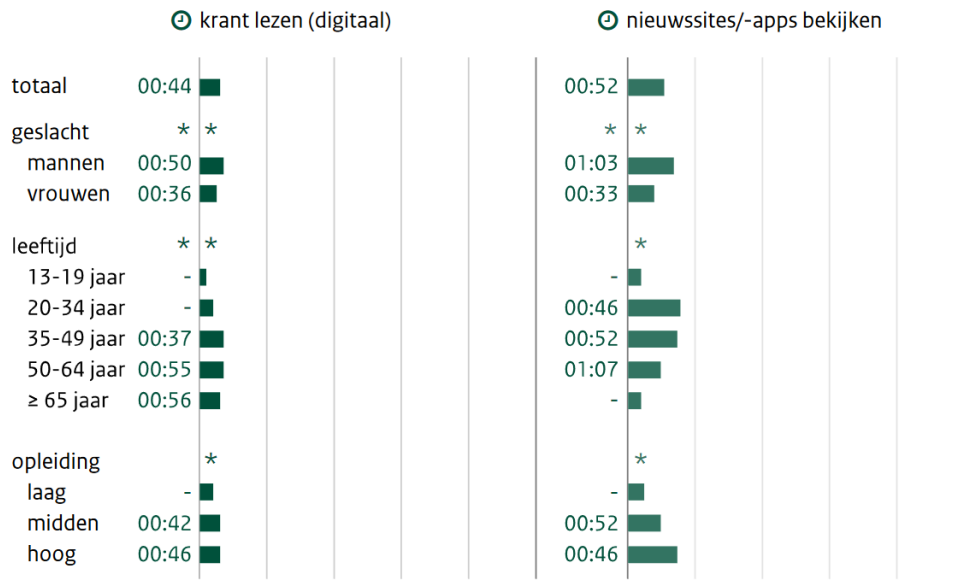
Figure 1: Audience map for top online brands in the Netherlands



Source: Reuters Digital news report

1.4 Dutch news users still use legacy media

Filter bubbles are also not problematic yet because most Dutch media users prefer legacy or traditional media to get their news. According to the mediation analysis (Wennekers & de Haan 2017), 53% of the Dutch media users access news through classic channels and only 17% using online sources to get the news. More than half of these users also use offline news sources. Moreover, not all of the news Dutch citizens get online is filtered. Many news sites use no recommendation services at all or only to a limited degree (though this is likely to change in the near future, as our interviews with most of the major news publishers in the Netherlands showed). If we look at the users of news apps and news sites specifically we find that these services are most popular among young adults with a higher education level (see figure 2)

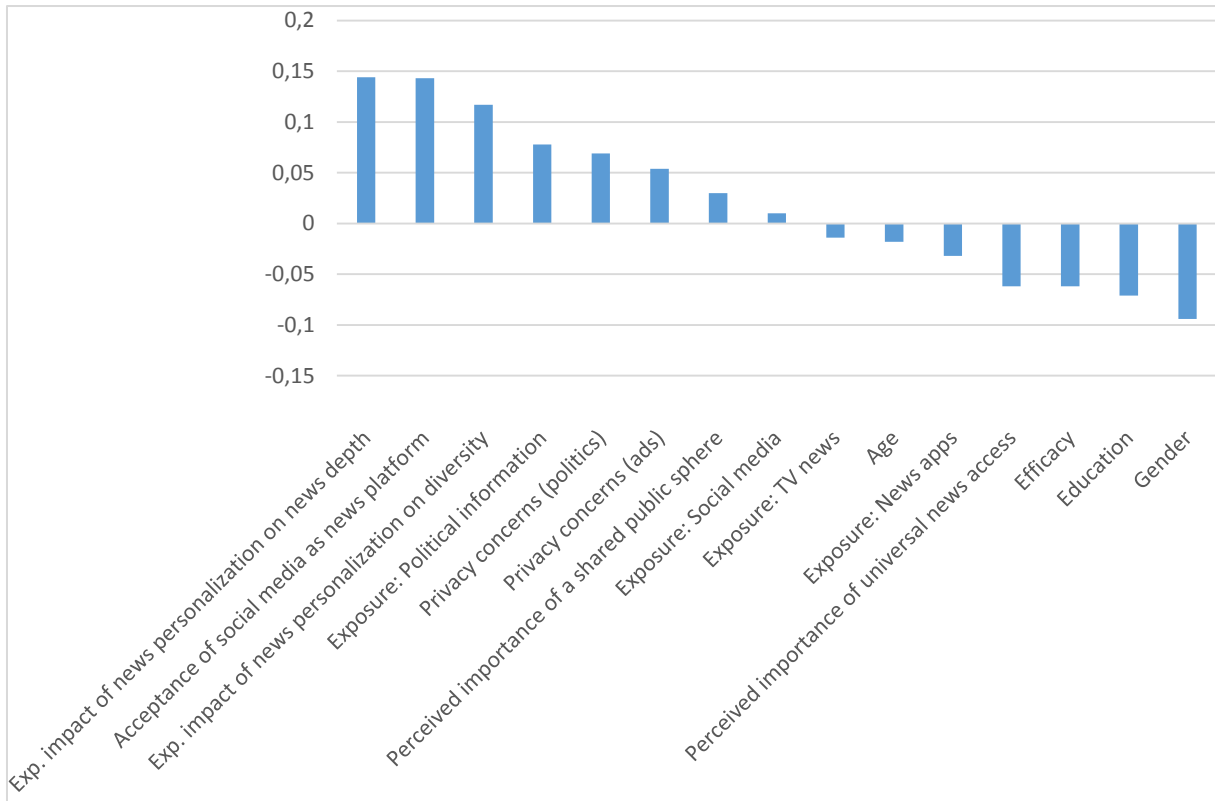


Source: Media:Tijd in kaart.

1.5 User Attitudes: Trust in media and appreciation of diversity

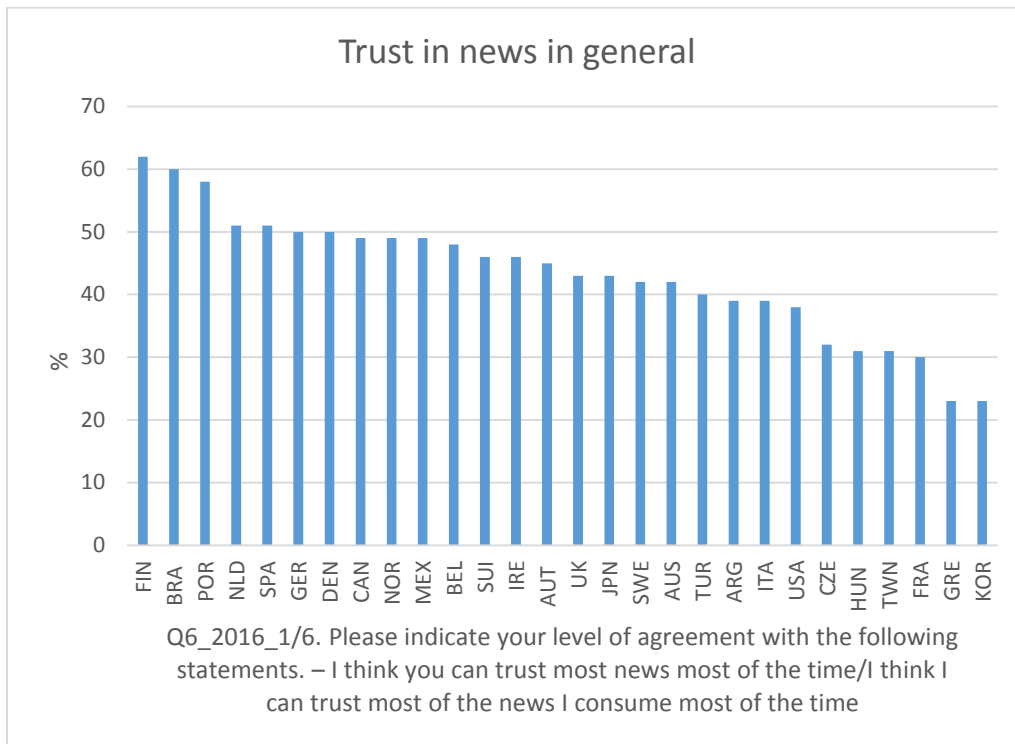
Finally, Dutch news users report themselves that they actually prefer diverse news over biased information (Bodo et al. 2017). It is important to note that there is a difference between what users report themselves, and what they actually do, but it is quite clear that users are at least motivated to expose themselves to diverse news. In fact, our research indicates that whether or not they will receive diverse information is one of the most important factors of users in the acceptance of news recommendation technology (see figure 3)

Figure 3: Effect strength (regression coefficients) of factors explaining the acceptance of news personalization based on a representative sample of the Dutch population (N= 1556).



Source: Bodo et al., 2017

According to data from the Reuters digital news report, 2017 Dutch news users are also among those who trust their news sources the most (see figure 4). This indicates that at present Dutch news users are quite satisfied with their news environment and therefore less likely to seek out alternative news sources through social media.



Source Reuters Digital News Report 2017

5. CONCLUSION

All in all, we can conclude that there is yet no consolidation in the academic debate with regard to what diversity in recommendations actually entails, or how exposure diversity should be conceptualized and measured in the context of recommendations. In the US context, it is often conceptualized as exposure to counter-attitudinal information or operationalized in source diversity (republican vs. democratic sources), while in the European context other aspects of diversity, for example, diversity in topics have been investigated. That means, that studies conducted in the US situation hardly transferable to the situation in Europe. In the Netherlands specifically, sources cannot easily be attributed to liberal or conservative and strong public service broadcasters still have a dominant impact on the information landscape.

Many empirical questions are still unanswered. For example, there are very few studies looking into the effects of search engines on personalization, and to our knowledge none that focuses on exposure diversity of the end user. We also need to learn more about how *personalized news use* complements news use from other, not personalized media sources. Based on survey data collected as part of the Reuters digital news study, we know that many users experience the news they encounter through social media as news they would not have seen otherwise, but this needs to be assessed more systematically on the content level to find out exactly how important algorithmic news recommendation has become to individual news menus, and whether or not it leads to changes in the kind of information users receive. Also, studying exposure on the level of one particular outlet or platform is only useful to a limited degree to assess the overall diversity consumed across the different news outlets. Arguably, for the question of whether or not personalized news recommenders pose a risk for diversity or the public sphere, it is important to understand the overall diversity of consumption. What is even more important, these studies have not looked into actual recommendation logics, goals and business models. In order to assess the potential of news recommenders to change plurality and diversity of news in the future, we need to assess differences in recommendation systems, for example, whether the purpose is to recommend personal relevant news or news items that generate the most income for the offering service.

In 2017 many studies on the effects of algorithmic news filtering have been published, and it is to be expected that there will be even more in 2018. Due to the large societal relevance of these processes, the topic has been discovered by several other disciplines, in particular, computer science, information science, political science, and economy. In the Netherlands, in particular, more studies on the topic are likely, considering multiple NWO and SIDN financed projects are about to start in 2018, and the personalized communication project is completing the data collection of tracking data of over 500 Dutch internet users.

Whether or not these studies will come to the same conclusions depends mostly on how algorithmic news filtering will be applied moving forward. In the short term, it can be expected that the filtering technology will become better, and therefore less obstructive and creepy. At present, many users become aware of algorithmic filtering, if it performs suboptimally. Especially when it comes to personalized advertising, many people find it creepy and useless to be followed by ads for items they have just bought, but a similar argument can be made for news. This experience of what are in essence bad recommendations is an important source of literacy and awareness. However, as the selection becomes more refined, we become less aware that news stories we encounter are selected especially for us, which could affect our need to seek out other news. Additionally, it will be important if and how mainstream news media will adopt news

personalization on their own websites and apps. Currently, most large Dutch news websites are mostly identical for all users with the exception of smaller recommendation boxes or specific “your news” pages, but many are experimenting with personalization as part of their service on a larger scale..

In many ways, researching the effects of algorithmic filtering is like shooting on a moving target. What we know now, is based on empirical evidence collected in the current context, as the context changes, so will the findings. This is even more prevalent in the long term. News use is guided by user norms, for example about how news should look like, what constitutes a healthy news diet, and how and when news should be used. The news use of pre-millennial generations is guided by norms obtained in a time when daily newspapers were far more common in households and the overwhelming majority would watch linear TV broadcasts several times a week. This has an impact on how we think news should look like and how diverse it should be. However, as younger generations grow up without these experiences it is unknown whether they will have the same norms in relation to news use. That means if we, for example, now find that most users would not forego general news items and only use news on social media as an addition, the next generation might be less inclined to participate in a shared public sphere.

6. DISCUSSION: FILTER BUBBLES AND BEYOND

Scientific evidence for the existence of filter bubbles is scant and riddled with methodological challenges. This is particularly true for Europe, as so far, most existing studies have concentrated on the US. Does that mean that in Europe, and in the Netherlands, there is no reason to be concerned? Are “filter bubbles” not much more than a catchy phrase for a captive audience? This would be too fast a conclusion. In Europe, the media have but started to experiment with recommendation technologies and offering new, data-driven forms of media content. It is therefore critical to keep monitoring the evolution of digital news markets, and the way users are exposed to diverse news. Here lies clearly an important task for regulators, even if doing so may require new means and methods of conceptualizing and measuring (exposure) diversity and impact for the overall vitality of media markets.

Behind the filter bubble discourse hide more fundamental concerns about the (lasting) structural impact of algorithms and new, data-driven forms of communication for the vitality and diversity of the media landscape. It cannot be denied that as a result of the proliferation of the profiling and targeting practices, the way news is distributed as well as consumed change, and profoundly so. A growing number of users (also) consume news content via large, highly personalized information intermediaries or platforms – platforms that do not share the editorial ethos and commitment to diversity that traditional, quality news outlets adhere to. Particularly those parts of the population for whom these platforms are the main gateways to information do risk, if not ending up in filter bubbles, then at least having only limited access and to a strongly filtered, and potentially biased towards popular (mainly US and UK based) information sources. In addition, the multiplication of informational content and sources online do create the need for new ways of curating and filtering news content.

Insofar, a real risk of the reigning filter bubble rhetoric is the development of ill-conceived prejudices against digital technologies that help to sort and order online information. In the worst case, concerns about filter bubbles will discourage media companies in Europe from exploring new ways of distributing content and using algorithms and personalized recommendations as a way to better inform users, to offer better (and monetizable) services, and to compete with highly

personalized non-news platforms for the attention of consumers. The challenge is deploying algorithmic filtering of information in a way that promotes diversity instead of reducing it, better informs citizens instead of simply selling more advertising, and ultimately re-establishing trust in the media as trusted recommenders of what is worth knowing. More sophisticated recommendation algorithms that also take into account medium-term objectives such as diversity, or at least giving users a choice between different recommendation logic may have a positive effect on the diversity of content users are exposed to. Again, facilitating and stimulating these developments could be a task for law and policymakers.

Ultimately, at least in Europe, the real concern about filter bubbles is a concern about the vitality of the European media landscape, also and in particular in the light of the increasing influence of globally operating information intermediaries. After all, the reason why users in Europe are less likely than their counterparts in the US to end up in filter bubbles is the fact that the European and Dutch media landscape are far more diverse, with the presence of a strong, though aging public broadcasting. Also, users in the Netherlands seem to value diversity, and generally access news versus multiple sources. But the public service media is aging, and the survival of many (advertisement-financed) quality media is at risk.

In other words, whereas in the US, the ultimate concern is one about polarization and the lack of internal diversity, in Europe it is probably even more so external diversity to be concerned about, and here in particular whether or not traditional media survive the transition to the digital society and global information markets where users attention is scarce, and the media compete with large, data-driven co-operations that seem far more effective in arresting the attention of users. A real concern, therefore, is the issue of market and opinion power. To what extent will the new information intermediaries, such as search engines, social media but also virtual assistants and successful news apps use their wealth of data and control over cutting-edge technology to monopolize eyeballs? When do data and control over proprietary algorithms turn into market power, and what are the effects for both, the competition of ideas, and of companies operating in the digital market? At which point do these information intermediaries stop being hosts of user-created content, and turn into media companies themselves? And at which point is it no longer justified to maintain the differences in (self)regulation between the traditional media and platforms, in terms of advertising regulation, taxation, program standards, diversity and editorial independence? These are important questions for regulators. These are also questions that to address them satisfactorily will most likely require a cooperation between the different regulators for the media, competition and data protection.

At the same time, it is impossible to ignore the growing importance of social media platforms for the way users encounter and engage information (Reuters, 2017), and the impact that at least the larger platforms exercise on the overall structure of news markets and information flows (Moore, 2016; Kleis Nielsen & Ganter, 2017). These are strong reasons to argue that diversity should matter, in one way or other, also in the context of social media platforms. And one of the challenges for regulators is to define how, what does diversity on platforms means, and how to include platforms in their overall measurement of diversity.

Finally, upon a closer look, ‘filter bubbles’ are as much about the effects of inclusion (how diverse is the media offer of those within the filter bubble) as about the effects of exclusion (how about those that do not receive certain messages, because of their profile, because the algorithm has not deemed them suitable recipients of particular messages. Will the algorithmization and the strategic use of personalized communications ultimately result in a situation in which the smarter,

more media literate and politically engaged users become smarter, and the disengaged and disinterested more disengaged? Will digital skills, but also concerns about privacy and diversity stand in the way of technology benefiting users and helping them to get better informed? Next to concerns about the quality of the overall information offer & consumption, maybe a far more pressing concern than filter bubbles is the creation of new digital inequalities as a result of the different ways in which users use, and are used by the internet.

7. REFERENCES

- Adomavicius, G., & Kwon, Y. (2012). Improving aggregate recommendation diversity using ranking-based techniques. *IEEE Transactions on Knowledge and Data Engineering*, 24(5), 896-911.
- Anspach, Nicolas M. 2017. The new personal influence: How our Facebook friends influence the news we read. *Political Communication*. 1-17. 10.1080/10584609.2017.1316329.
- Bakshy, Eytan, Solomon Messing & Lada A. Adamic. 2015. Exposure to ideologically diverse news and opinion on Facebook. *Science* 348 (6239). 1130-1132.10.1126/science.aaa1160
- Beam, Michael. A. (2013). Automating the news: How personalized news recommender system design choices impact news reception. *Communication Research*, 14. 1019-1041
- Beam, M. A., Child, J. T., Hutchens, M. J., & Hmielowski, J. D. (2017). Context collapse and privacy management: Diversity in Facebook friends increases online news reading and sharing. *new media & society*, 1461444817714790
- Bodó, B., N. Helberger, K. Irion, F. Zuiderveen Borgesius, J. Möller, B. van de Velde, N. Bol, B. van Es & C. De Vreese. (2017). Tackling the algorithmic control crisis - the technical, legal, and ethical challenges of research into algorithmic agents.” *Yale Journal of Law & Technology* 19. 133-180.
- Bodo, B., Moeller, J., Eskens, S. & Helberger, N. Piercing the filterbubble - bubble – Algorithmic feedback loops and endangered user groups in the era of personalized news (2017): the paper uses cross-sectional survey data to understand what news readers expect from algorithmic news personalization. Paper presented at the TILTING2017: TILTING PERSPECTIVES conference 2017, 27-29 May 2017, Tilburg
- Dommering, E. J. (2016). Het Verschil van Mening, Geschiedenis van een verkeerd begrepen idee. Uitgeverij Bert Bakker.
- Dylko, I., Dolgov, I., Hoffman, W., Eckhart, N., Molina, M., & Aaziz, O. (2017). The dark side of technology: An experimental investigation of the influence of customizability technology on online political selective exposure. *Computers in Human Behavior*, 73, 181-190.
- Flaxman, Seth, Sharad Goel & Justin M. Rao. 2016. Filter bubbles, echo chambers, and online news consumption. *Public Opinion Quarterly* 80 (Special Issue). 298-320.
- Haim, M., Graefe, A., & Brosius, H. B. (2017). Burst of the Filter Bubble? Effects of personalization on the diversity of Google News. *Digital Journalism*, 1-14.
- Helberger, N. (2015). Public Service Media | Merely Facilitating or Actively Stimulating Diverse Media Choices? Public Service Media at the Crossroad. *International Journal of Communication*, 9, 17.
- Helberger, Natali, Kari Karppinen & Lucia D’Acunto. 2016. Exposure diversity as a design principle for recommender systems. *Information, Communication & Society*. 1-17.
- Kitchin, R. (2017). Thinking critically about and researching algorithms. *Information, Communication & Society*, 20(1), 14-29.

Kull, S., Ramsay, C., & Lewis, E. (2003). Misperceptions, the media, and the Iraq war. *Political Science Quarterly*, 118(4), 569-598.

Lee, Jae Kook, Jihyang Choi, Cheonsoo Kim and Yonghwan Kim. 2014. Social media, network heterogeneity, and opinion polarization." *Journal of Communication* 64(4). 702-722.

Lee, Jae Kook & Eunyi Kim. 2017. Incidental exposure to news: Predictors in the social media setting and effects on information gain online. *Computers in Human Behavior* 75. 1008-1015.
<http://dx.doi.org/10.1016/j.chb.2017.02.018>

McConnell, C., Margalit, Y., Malhotra, N., Levendusky, M. (2017). Research: Political Polarization Is Changing How Americans Work and Shop. *Harvard Business Review*:
<https://hbr.org/2017/05/research-political-polarization-is-changing-how-americans-work-and-shop>

Messing, Solomon & Sean J. Westwood. 2014. Selective exposure in the age of social media: Endorsements Trump partisan source affiliation when selecting news online. *Communication Research* 41(8). 1042-1063.

Mindich, D. T. (2005). *Tuned out: Why Americans under 40 don't follow the news*. Oxford University Press.

Pariser, E. (2011). *The Filter Bubble: What the Internet Is Hiding from You* (Penguin Press, London, 2011).

Sunstein, C.(2007). *Republic.com 2.0* (Princeton Univ. Press, Princeton, NJ).

Stroud, N. J. (2008). Media use and political predispositions: Revisiting the concept of selective exposure. *Political Behavior*, 30(3), 341-366.

Tufekci, Z. (2015). Algorithmic harms beyond Facebook and Google: Emergent challenges of computational agency. *J. on Telecomm. & High Tech. L.*, 13, 203.

Quattrociocchi, W., Scala, A., & Sunstein, C. R. (2016). Echo chambers on facebook.

van Dijck, J., & Poell, T. (2015). Social media and the transformation of public space. *Social Media+ Society*, 1(2), 205630511562248

Wennekers, A.M. en J. de Haan (2017). Gebruik van nieuwsmedia. In: Media:Tijd in kaart. Geraadpleegd op 06.12.2017 via https://digitaal.scp.nl/mediatijd/gebruik_van_nieuwsmedia

Zuiderveen Borgesius, Frederik, Damian Trilling, Judith Möller, Balázs Bodó, Claes H. de Vreese & Natali Helberger. 2016. Should we worry about filter bubbles? *Internet Policy Review* 5(1). 1-16.