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News consumption in the digital society

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Chapter 2

Television news consumption

The interplay between consumer and content features

This chapter is under review as: Vermeer, S.A.M., Trilling, D., Stolwijk, S., Kruikemeier, S., & de Vreese, C.H. (2021). What's on and who's watching? Combining people-meter data and subtitle data to explore television exposure to political news.

Abstract

Understanding television viewing behavior is highly relevant, as it remains an important source of political news for many. Nowadays, television viewers can choose between a growing diversity of formats and genres covering political news, varying from traditional news broadcasts to late-night talk shows and satire. Yet, we have little to no information about the specific political content provided by television programs; and, much less how this can be connected to viewing behavior and audience characteristics (political interest, ideology). Moving forward, using unique Dutch audience-meter data (3,672 viewers from 1,761 different households) from July 2017 to July 2018, we explore *who* is exposed to *which (political) topic* in *what type of television program*. We use automated content analysis to analyze the subtitles of television programs (N = 63,718). Our results indicate that viewers are most often exposed to political topics in news programs irrespective of political interest and political ideology. Politically interested viewers are more likely to watch television programs that primarily provide news programming, and, in turn, are exposed to more political topics. Interestingly, political ideology also has an impact on how viewers allocate their viewing time.

Introduction

An important challenge in communication research is to understand the extent to which people are exposed to various kinds of political news. While there is a substantial growth in the focus on online media (e.g., social media, news websites), relatively less scholarly attention is devoted to television (Robinson, Zeng, & Holbert, 2018). Although a focus on online media is important (Holbert, Garrett, & Gleason, 2010), we cannot shift our attention away from television, as it remains a crucial part of people's media use and an important source of news for many. In Western countries like the United States, United Kingdom, Germany, Spain, and the Netherlands, citizens watch television on average between three and four hours per person per day (Eurodata TV Worldwide, 2019). Television viewing thus remains a high popular activity. The COVID-19 pandemic even generated an atypical increase in the average viewing time (with peaks up to +30 and +40 percent; Eurodata TV Worldwide, 2020; Stichting KijkOnderzoek, 2020). With on-demand, distributed, and

mobile viewing on the rise (Nielsen, 2016), it is increasingly meaningful to understand what kind of political news viewers see, by moving beyond merely exposure to specific programs and investigating the actual content. News exposure research is often enriched with content analyses of *textual* information (e.g., newspapers, governmental publications), yet measuring television exposure to political news on a large-scale continues to be elusive.

Understanding television news consumption is of great importance for a well-functioning democracy (Carpini & Williams, 2001), because the frequency and prominence in which mass media mention and cover certain topics largely affects the perceived importance of these topics among citizens (i.e., agenda-setting theory; McCombs, 2005). To date, we do not fully understand which topics are covered by various formats and genres of television programs; and, more importantly, how this can be connected to important predictors of news use (e.g., political interest, ideology). Previous studies examining exposure to political news on television often make a distinction between exposure to hard news and soft news programs (see e.g., Curran et al., 2009), serious news, serious background, light news, and light background programs (Wonneberger, Schoenbach, & van Meurs, 2013b), or focus on a single topic (e.g., European Parliamentary elections; van Spanje & de Vreese, 2014). As neither television programs nor television genres are purely entertaining or informing, categorizing television programs in mutually exclusive alternatives is ambiguous and insufficient. Viewers can be exposed to *various* political topics in (different parts of) a television program, and the content of a television program differs between broadcasts. For example, viewer A is exposed to the topic of immigration while watching the news and a late-night talk show, viewer B while watching a satirical news program, whereas viewer C is not exposed to the topic of immigration at all. To move forward, we combine television viewing behavior (both linear and time-shifted viewing), content features (i.e., the topics discussed in television programs), and two crucial consumer features (e.g., political interest, ideology), to answer the following research question: “*Who is exposed to which (political) topic in what type of television program?*” In doing so, we are—to the best of our knowledge—the first to link audience-meter data (electronically recorded information of individual viewing behavior) to the *actual* content that these news consumers have watched. This highly unique data set allows us to find a very convincing explanation for the link between political preferences and exposure to political content on television.

We contribute to the literature in various important ways. First, we aim to understand television news consumption in our current digital society. Individual characteristics, such as political interest and ideology, become more important predictors of news media use (Prior, 2007). Building on selective exposure and uses and gratifications theory, we aim to

theoretically and empirically understand and explain how individual characteristics affect television news consumption. Second, studies examining (television) news consumption almost always collect data via surveys or interviews, which, in turn, can be enriched with content analyses of the outlets (for a detailed overview, see Schuck, Vliegthart, & de Vreese, 2014). This type of self-reports of news consumption have often been discussed critically (see e.g., Prior, 2009). Using audience-meter data (3,672 viewers from 1,761 different households), an unobtrusive way of collecting news exposure, can solve some of the issues regarding the reliability and validity of measuring television exposure to political news (Wonneberger, Schoenbach, & van Meurs, 2009). Audience-meter data is unique in offering very precise measures of television exposure. It does not only reflect the channels and programs viewed, but audience-meter data also precisely covers switching behavior. Finally, we contribute to mass communication research by using computational methods to provide a complete picture of television news consumption. Our results are also interesting for television news providers, as they have yet to find their place in this changing media environment (Nielsen, 2016), and seek how to optimally reach and inform their audiences.

Theory

Due to major changes of the viewing environment (e.g., commercialized media organizations, rise of online media), patterns of television news consumption have undergone significant changes during the past decades (Nielsen & Sambrook, 2016). Although linear television viewing has begun to erode, especially among younger cohorts, television content continues to be an important part of people's media use and an important source of news for many (Robinson et al., 2018). For many years, political information was found primarily in newscasts, morning talk shows, and documentaries, but much less in other genres. Politics is now packaged in a variety of formats and genres beyond news and documentary, including late-night talk shows, satire (e.g., *The Daily Show* in the United States, *Zondag met Lubach* in the Netherlands), and other formats of entertainment programs (Jones, 2010; Nielsen, 2016). Television programs that combine political information with entertainment, also known as soft news or infotainment programs, have become increasingly popular (Boukes et al., 2015; Williams & Delli Carpini, 2011).

Soft news programs, such as late-night talk shows, comedy shows and evening shows, primarily cover soft news or non-public policy issues (e.g., human interest, sports news, celebrity news), whereas hard news programs, such as political debates and documentaries,

particularly focus on political and societal issues. The presentation of hard news programs is often guided by ideas of journalistic objectivity and, thus, defined by a balanced and unbiased coverage (Curran et al., 2009). As a result, soft news and entertaining presentations of political and societal issues are often regarded as a threat to citizens' knowledge about politics. Soft news might pull politically uninterested viewers away from traditional formats (Prior, 2005), which could result in higher levels of political cynicism (Boukes & Boomgaarden, 2015).

On the other hand, soft news programs have been perceived as a possibility to reach politically uninterested viewers that would otherwise not be exposed to news about political and societal issues at all (Baum & Jamison, 2006), so-called inadvertent or incidental exposure (Baum & Jamison, 2006; Zaller, 2003). News content becomes more attractive and more accessible for citizens who are less interested in political and societal issues. Although the style of soft news formats is often entertaining or sensational with a more pleasant, empathic, or excited atmosphere (Vettehen et al., 2005), the content of infotainment programming can be equally issue-oriented and informative as news programming. They may cover political issues or invite political guests to discuss political and societal issues. Soft news programs, particularly satire, are watched both to learn and to laugh (Young, Holbert, & Jamieson, 2014). After all, by personalizing political matters or adding humor, soft news and infotainment *can* contribute to the formation of citizens' political attitudes (see e.g., Boukes, 2019; Boukes et al., 2015).

The interplay between consumer features and program choices

With many formats available, television viewers have to choose between a growing diversity of programs. Whether an increasing variety of formats and genres covering political news results in more citizens avoiding news programs does not only depend on the available programs but also on how citizens make their program choices. For many years, political communication scholars have been studying television news consumption and the ways viewers make their program choices (for a detailed overview, see Wonneberger et al., 2009). Viewers may accidentally encounter news programs or choose programs according to their preferences. Some scholars argue that a noticeable number of viewers encounter news unintentionally or accidentally, rather than based on deliberate program choices that are in line with their viewing interests (van den Bulck, 2006). Other scholars argue that viewers watch news programs because they are motivated to do so. This idea has its origin in the uses and gratifications theory, which posits that viewers act somewhat rationally, based on individual needs and motives, by gratifications sought and obtained, such as (1) escaping

(i.e., “affective needs such as enjoyment and passing time”); (2) surveillance (i.e., “integrative needs such as self-identification and social comparison”); and (3) seeking information (i.e., “the need to be aware of ongoing events and developments”; Comstock & Scharrer, 1999; Wonneberger et al., 2009, pp. 244-245).

The reasons why people begin viewing at all, and which television programs they select, differ individually according to one’s needs. Many viewing patterns depend on individual characteristics. For instance, the frequency and duration of television viewing, the amount of switching between various channels, and the preference for specific programs or program types are related to sociodemographics, such as age, gender, and education (see e.g., Bilandzic & Rössler, 2004; Strömbäck & Shehata, 2019; Trilling & Schoenbach, 2015; Wonneberger et al., 2013b). Wonneberger, Schoenbach, and van Meurs (2012) used audience-meter data to study television news consumption over two decades in the Netherlands (1988–2010). Their results indicate that age, in general, is positively related to the amount of news exposure (Wonneberger et al., 2012), most likely because older people have been found to watch more linear television compared to younger people (Nielsen, 2016). Instead, younger people rely on more on-demand, distributed, and mobile viewing forms (Nielsen, 2016).

The extent to which sociodemographics predict television news consumption is well documented. However, the extent to which political preferences affect television news consumption is less clear. In our high-choice media environment—with more and more television formats and genres available (Aalberg et al., 2013)—citizens have to become more *selective* when deciding what news sources and content to choose (van Aelst et al., 2017). Citizens’ political preferences therefore play an increasingly important role in explaining news use (see e.g. Prior, 2007; Stroud, 2011). In the current study, we focus on two political preferences: *political interest* and *political ideology*, as citizens’ interest in and opinions of politics could strongly influence what kind of television programs they tend to watch.

Political interest

Political interest is one of the most important predictors of news use (Prior, 2007; Strömbäck & Shehata, 2010). Viewers choose specific television programs or genres because they contain content that they find interesting, relevant, or useful (Wonneberger, Schoenbach, & van Meurs, 2011). The increase in the number of available television channels (Aalberg et al., 2013) has enabled politically interested people to access more information and increase their political knowledge, and those who prefer non-political content can easily escape the news, pick up less political information, and opt for more entertaining options (Sunstein, 2007). Since news users are more empowered and have more control over their news use, they can decide not

to consume any news at all (Blekesaune, Elvestad, & Aalberg, 2012). A growing diversity of formats and genres might therefore widen the “knowledge gap” between citizens who prefer news and citizens who prefer entertainment (Prior, 2005).

Political interest is often considered as a predictor of interest in news programming. Wonneberger et al. (2013b) found that political interest is related to a more diverse diet of political information programs. Television viewers who combine news casts (i.e., serious news) with political interviewing programs (i.e., serious background news) have a strong interest in politics. In our current media environment, they find even more programs that match their needs and preferences, and they enjoy watching hard news programs in which politicians and/or experts discuss political topics at length. Studies also found that viewers who are not so much interested in politics primarily watch soft news programs, or even decide to not consume any television news at all (Baum, 2003; Wonneberger et al., 2013b).

Political ideology

Previous research has also indicated that selective exposure varies by political ideology. Theoretically, selective exposure refers to the process by which citizens select information that match their predispositions and political beliefs (Stroud, 2008). At least in the United States, (extremism of) political leaning (in the form of left–right leaning) exerts an influence on the selection of news (Garrett & Stroud, 2014) and interest in news programming (Iyengar & Hahn, 2009). Gil de Zúñiga, Correa, and Valenzuela (2012) examined the interplay between individuals’ ideological predispositions and selective exposure to television news in the context of the United States. The results indicate that Democrats were more likely to watch CNN and less likely to watch FOX News than Republicans who, in turn, were more likely to watch FOX News and were less likely to watch CNN. This relationship eventually affects citizen’s attitudes toward controversial issues (e.g., Mexican immigrants and immigration; Gil de Zúñiga et al., 2012). Iyengar and Hahn (2009) conducted an online experiment in the United States and found that patterns of selective exposure based on political leaning held not only for controversial issues, but also for soft news topics, such as crime, travel, and sports. Earlier work has however mainly focused on two-party systems (e.g., the United States) and partisan news (e.g., FOX News). Dahlgren (2019) therefore focused on the context of Sweden to examine whether political preferences, such as political interest, political leaning and party support, have driven selective exposure to public service news. The results do not indicate any relevant differences in public service news use between Swedish left- and right-leaning citizens. Surprisingly, he found relevant differences between party supporters of parties inside versus outside parliament. In general, citizens who support

parties in parliament tend to use public service news more often, compared with supporters of other parties (Dahlgren, 2019).

Research questions

To date, we do not fully understand which topics are covered by various formats and genres of television programs; and, more importantly, how this can be connected to important predictors of news use, namely *political interest* and *political ideology*. It is highly important to understand the link between political preferences and exposure to political news on television, because the frequency and prominence in which news media mention and cover certain topics largely affects the perceived importance of these topics among audiences (McCombs, 2005).

News exposure research is often enriched with content analyses of *textual* sources of political content (e.g., newspaper articles, government publications). A combination that is often referred to as “linkage analysis” (de Vreese et al., 2017; Schuck et al., 2014; Slater, 2016). Previous studies examining political television exposure often make a distinction between hard news and soft news programs (see e.g., Curran et al., 2009), serious news, serious background, light news, and light background programs (Wonneberger et al., 2013b), or focus on a single topic (e.g., European Parliamentary elections; van Spanje & de Vreese, 2014). However, the distinction between hard and soft news formats can cause difficulties as neither television programs nor television genres are purely hard or soft, and entertaining or informing. The content of soft news programs can be equally issue-oriented and informative as hard news programming. Categorizing formats and genres of television programs in mutually exclusive alternatives is therefore ambiguous and should be replaced by other methods (see Boukes & Boomgaarden, 2015). In order to get a better and deeper understanding of political content on television, we move from political television exposure on a program-level to a content-level. We analyze the actual content of television programs by obtaining the subtitles of a wide variety of television programs. As it is unfeasible to analyze all television content manually (considering time and money), we rely on a knowledge base (Wikipedia, DBpedia, Wikidata) to automatically assign hundreds of thousands of different topics at different levels of abstraction (e.g., *storming of the Capitol Building*, *Donald Trump*, *the Republican Party*, *Politics of the United States*) to television content. By doing so, we are able to identify topics that are theoretically helpful, but perhaps understudied or previously unknown (Grimmer & Stewart, 2013).

Besides, data about (television) news consumption is often collected via surveys or interviews. By doing so, respondents are questioned about their television viewing behavior,

which can, in turn, be connected to content analysis of news coverage (for a detailed overview, see Schuck et al., 2014). This type of self-reports of news consumption has however often been discussed critically (see e.g., Prior, 2009). In general, well known issues of self-reported measures are related to struggles in interpreting the question correctly and of recalling, estimating, and reporting television viewing behavior accurately. For example, recalling whether one has watched news on television yesterday is less complicated than telling whether one has switched to a different channel to avoid a certain news topic. Using audience-meter data instead of self-reports can solve some of the issues regarding the reliability and validity of measuring viewing behavior as well as exposure to political news (Wonneberger et al., 2009).

The accurate measurement of viewing behavior and relevant consumer features in combination with the actual television content allows us to examine whether a growing diversity of formats and genres covering political news encourages certain viewers (based on their political interest and political ideology) to be exposed to various topics in different television programs. We, therefore, pose the following two research questions:

RQ1: *To what extent is exposure to (political) topics in Dutch public service television determined by political interest?*

RQ2: *To what extent is exposure to (political) topics in Dutch public service television determined by political ideology?*

Method

Data

Using electronically recorded audience-meter data (electronically recorded information of individual viewing behavior), we explore television viewing patterns in the Netherlands. According to the viewer audience measurement service in the Netherlands (SKO, *Stichting KijkOnderzoek*), Dutch people spent 188 minutes (3h 8 min) daily watching television in 2018. These numbers account for direct, time shifted (pre-recorded via video, DVD- and HD recorder), as well as on-demand viewing.

We focus on public broadcasting (i.e., NPO, *Nederlandse Publieke Omroep*, the Dutch Foundation for Public Broadcasting), as it has a strong reputation as a reliable source for news, current affairs, and parliamentary reporting in the Netherlands (Nederlandse Publieke Omroep, 2015). Additionally, previous studies have indicated that public service television

news tend to provide more hard news (see e.g., Iyengar et al., 2010; Reinemann, Stanyer, & Scherr, 2016) and more international news (Aalberg et al., 2013) compared to commercial television channels. In 2017, nearly 90 percent of Dutch viewers tuned to public television channels for news and current affairs (compared to 38 percent for commercial television channels)¹. Dutch public service television has scheduled a wide variety of news programs over the last twenty years (Aalberg et al., 2010), ranging from news broadcasts (e.g., *NOS Journaal*), current affairs programs (e.g., *EenVandaag*, *Nieuwsuur*), talk shows (e.g., *Pauw*, *De Wereld Draait Door*) to satirical television programs (e.g., *Zondag met Lubach*).

The data were provided by SKO (*Stichting KijkOnderzoek*; the council for Dutch Television Audience Measurement) for the period from July 3, 2017 to July 1, 2018, and contain the following: (1) viewing behavior (both linear and time-shifted viewing) and (2) consumer features (e.g., sociodemographics, political interest, political affiliation). We used the NPO API (Application Programming Interface) to obtain (3) content features (i.e., the topics discussed in television programs).

Viewing behavior

Based on audience meters, SKO generates audience ratings from a national audience panel. The panel (approximately 1,250 households, 2,750 persons) is representative of all persons in private households in the Netherlands. The panel turnover is about 25 percent per year.

SKO conducts the measurement of viewing behavior by means of audience meters. Audience meters, recording the viewing behavior of all panel members, are attached to every (smart) television set, video recorder, DVD player/recorder, hard disk recorder, set-top box, media center and possibly other devices connected to a television within a household. By relying on audio matching, the audience meter records the station to which the television set is tuned (Stichting KijkOnderzoek, 2018). In order to register *who* is watching, panel members must log when they start and stop watching television themselves using a remote control. Every person in the panel household is assigned a personal character corresponding to one of the buttons on the remote control (Stichting KijkOnderzoek, 2018). The survey company (i.e., meeting certified market, opinion and social research standards) monitors self-assignment discipline and contacts household in case of missing registrations².

¹Previous work by Waterloo, Wennekers, and Wiegman (2018) has indicated that in 2018, Dutch citizens *watched* on average 3 hours and 5 minutes per day (including television, on-demand, distributed, and mobile viewing), *listened* on average 2 hours and 32 minutes (including radio and podcasts), *communicated* on average 1 hour and 4 minutes (including calling, texting, and using social media), and they merely *read* on average 42 minutes (including newspapers, magazines, and books).

²To prevent that the installation of the meter affects viewing behavior, viewing behavior is registered after a concept period of three months.

In short, the data set contains information indicating “*which panel member watched which station when and for how long on which television set*” (Stichting KijkOnderzoek, 2018, p. 55).

Consumer features

Following the installation of the meter, an interview questionnaire is conducted in a new panel household. The questionnaire is repeated annually among all panel members. The questions deal with viewing behavior, as well as individual characteristics regarding gender, age, education, interest in politics, political affiliation, electoral behavior, and media use.

During the period from July 3, 2017 to July 1, 2018, the panel consisted of 3,672 viewers from 1,761 different households (with a panel turnover of about 25 percent), 48.4 percent were male, mean age was 41.60 ($SD = 21.61$; the youngest member is 3 years old, the oldest member is 93 years old). From those that it applies to ($n = 3,215$): secondary school is the highest level of education for 25.6 percent of the panel, a bachelor’s degree for 15.5 percent, and a master’s degree for 13.3 percent. On average, panel members watch 6.07 days of television per week ($SD = 1.78$).

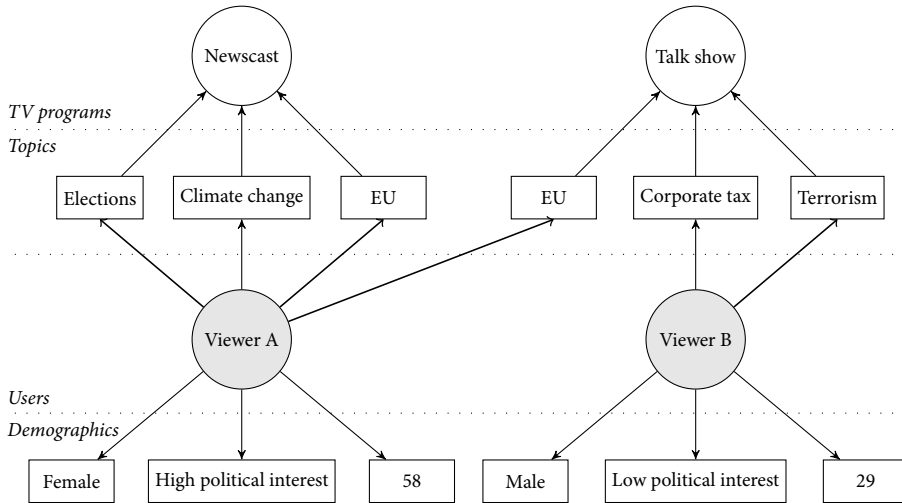
Besides including a set of sociodemographics (e.g., age, education, gender)—that have been shown in previous literature to have an impact on television viewership (see e.g., Wonneberger et al., 2013b)—we used the following set of independent variables:

- Political interest (measured on a 3-point scale, ranging from ‘Not interested’ to ‘Highly interested’): from those that it applies to ($n = 3,137$): 17.0 percent is highly interested in politics, 36.5 percent is somewhat interested in politics, and 46.5 percent is not so much interested in politics.
- Political ideology: from those that it applies to ($n = 3,137$): 40.3 percent votes for a left-wing party (i.e., *D66*, *PVDA*, *GroenLinks*, *SP*, *Partij voor de Dieren*, *Denk*), 36.5 percent votes for a right-wing party (i.e., *50Plus*, *VNL*, *ChristenUnie*, *CDA*, *VVD*, *SGP*, *PVV*), 23.2 percent does not go to vote, votes for a different party, or does not cast a ballot.

Content features

We examine which topics are being discussed in various television programs. Using the NPO API, we were able to obtain the subtitles of public service television programs. In total, the data set includes 45,239 unique programs (i.e., 63,718 programs including reruns) from 3 public broadcasting channels (i.e., *NPO1*, *NPO2*, *NPO3*). We obtained the subtitles from 21,480 television programs.

Figure 3: Exemplary data structure of TV programs, topics, and viewers' demographics



Analytical strategy

Pre-processing

In order to explore exposure measures, we pre-processed the raw data provided by SKO. We developed a Python toolkit to store the raw data in a MySQL database (a relational database system).

The raw data is presented in channel intervals on the household level: the time that a household spent watching that channel. In order to examine the consumer features, the household data were transformed to the individual viewer level. The raw data also included the time shifted viewing of programs broadcasted in the preceding seven days. In total, 3,672 viewers produced 2,420,142 records.

Data analysis

In a next step, these data were merged with the program data. To do so, we allocated the times that viewers spent watching specific channels to programs that were broadcasted on these channels during these times. Hence, the viewing data contained program intervals of individual viewers.

Content features

We use automated content analysis to process the subtitles and extract meaningful features. To do so, we split the subtitle files (.srt) in chunks of 40 seconds (based on work by; Raimond, Smethurst, McParland, & Lowis, 2013)—resulting in 629,072 chunks.

We use TextRazor to extract the topics that are discussed in the respective programs. TextRazor is a commercial service that provides natural language processing tools, including a tool for automatic multilingual topic detection. We rely on the Topic Tagging module that leverages an ensemble of automated techniques to assign topics to the chunks. The models are trained based on Wikipedia, DBpedia, and Wikidata. Based on a score ranging from 0 to 1, TextRazor determines the relevance of this topic to the processed text. We merely focus on topics with a score higher than or equal to .60³.

Next, we use a network approach to obtain a better understanding in topics discussed in public service television (see Trilling, 2019). We use topics as nodes, whilst edges were created for topics that co-occurred in the same chunk. First, a Python script was developed to iterate through each of the chunks and create edges between topics within the same chunk (e.g., *Politics of the United States - Donald Trump*). The edges between topics have been saved and imported in R. We used the package *igraph* to conduct network analyses, as it is capable of handling large graphs efficiently (Csardi & Nepusz, 2006).

The ties within these networks formed an undirected graph, as edges in the graph do not have an associated direction. We employ weighted edges to indicate the strength of a relationship between two topics. We created different topic-networks for different types of television programs.

Results

In the current study, we aim to explore *who* is exposed *what (political) topic* in Dutch public service television. The NPO distinguishes 31 genres of television programs, including news ($n = 17,611$; i.e., a wide variety of news programs, such as news broadcasts), current affairs ($n = 4,661$; i.e., a wide variety of programs that pay particular attention to Dutch and

³To examine whether this tool is optimal for our data set, and to prevent wrong or biased results, we validated the output. Since the topics of interest are not defined a priori, it is not possible to use a so-called gold standard (Maier et al., 2018). Instead, two coders coded the returned topics for 120 chunks—the number of correct identified topics set against the number of total identified topics for each chunk—resulting in an average score of .84, indicating conceptually valid and useful output.

European politics as well as other international events), opinion ($n = 3,570$; i.e., a wide variety of programs that aim to discuss current affairs as well as sports and culture, such as talk shows), satire ($n = 377$), as well as education ($n = 3,915$), human interest ($n = 2,220$), religion ($n = 1,402$), and sports ($n = 620$). We focus on four genres, namely news, current affairs, opinion, and satire.

In the next paragraphs, we discuss the role of political interest and political ideology. First, regression analyses are used to predict exposure to news programming (i.e., news, current affairs, opinion, and satire programs). Next, we build on previous work, by focusing on exposure to specific political topics. This offers a more nuanced understanding of the role of political interest and political ideology in television news consumption.

Political interest

First, we examined whether political interest is associated with exposure to news, current affairs, opinion, and satire programs. We utilized a series of regression models. We included several sociodemographic variables such as age, gender, and education, as well as exposure to public service television (in hours). As our data is highly skewed, we used a log transformation, $\log(y + 1)$, to transform exposure to television programs and exposure to public service television (both in hours) to conform to normality. Due to the nested structure of our data, with viewers nested within households, our model includes cluster-robust standard errors⁴. The results are shown as estimated marginal means (predictive margins) in Figure 4. The bars represent marginal means, after controlling for age, gender, education, and the logarithmic transformation of exposure to public service television (in hours). In this way, the mean response has been adjusted for any other variables in our model.

Table 1 shows the regression models predicting exposure to various television programs. Political interest significantly increases exposure to all four genres, namely news ($b = .06$, $p < .01$), current affairs ($b = .21$, $p < .001$), opinion ($b = .19$, $p < .001$), and satire ($b = .05$, $p < .05$). This indicates that politically interested viewers are more likely to watch genres that primarily provide news programming. Considering the beta coefficients, it can be argued that viewers who are more interested in politics are particularly more likely to watch programs within the second and third genre, namely current affairs and opinion.

⁴To examine the robustness of our findings, we also conducted multilevel regression analyses predicting exposure to television programs. This yielded identical findings. Yet, on average, a household consists of 1.8 viewers. This indicates that group sizes are rather small.

Figure 4: Exposure to television programs (log): Political interest (*predictive margins and SEs*)

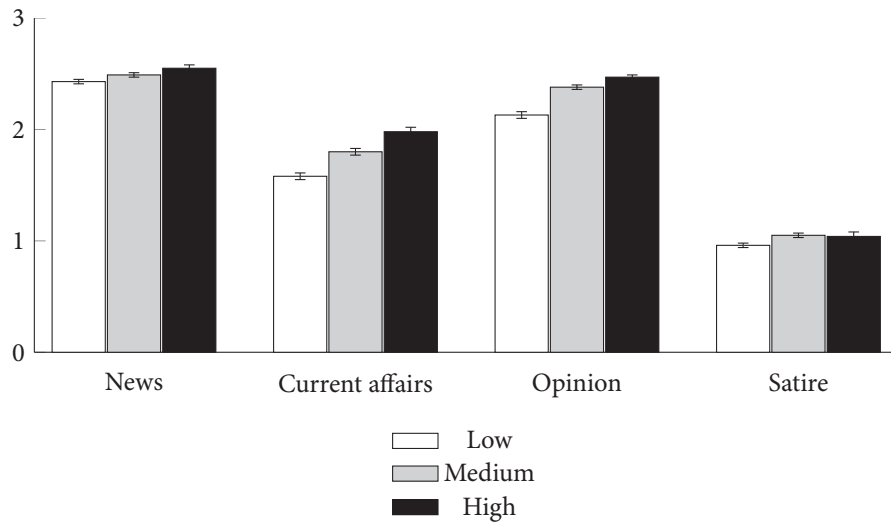


Table 1: Predicting exposure to television programs (log): Political interest

	News <i>b</i> (SE)	Current affairs <i>b</i> (SE)	Opinion <i>b</i> (SE)	Satire <i>b</i> (SE)
Political interest	.06 (.02)**	.21 (.02)***	.19 (.02)***	.05 (.02)*
Public service TV	.75 (.01)***	.61 (.01)***	.80 (.01)***	.43 (.01)***
Age	.01 (.00)***	.01 (.00)***	.01 (.00)***	-.01 (.00)***
Gender (female = 1)	.01 (.02)	-.03 (.02)	.04 (.02)	-.05 (.02)**
Education	-.01 (.01)***	-.02 (.00)	.03 (.01)***	.02 (.01)**
<i>N</i> _{viewers}	3,122	3,122	3,122	3,122
<i>N</i> _{households}	1,713	1,713	1,713	1,713
R ²	.83	.83	.76	.67

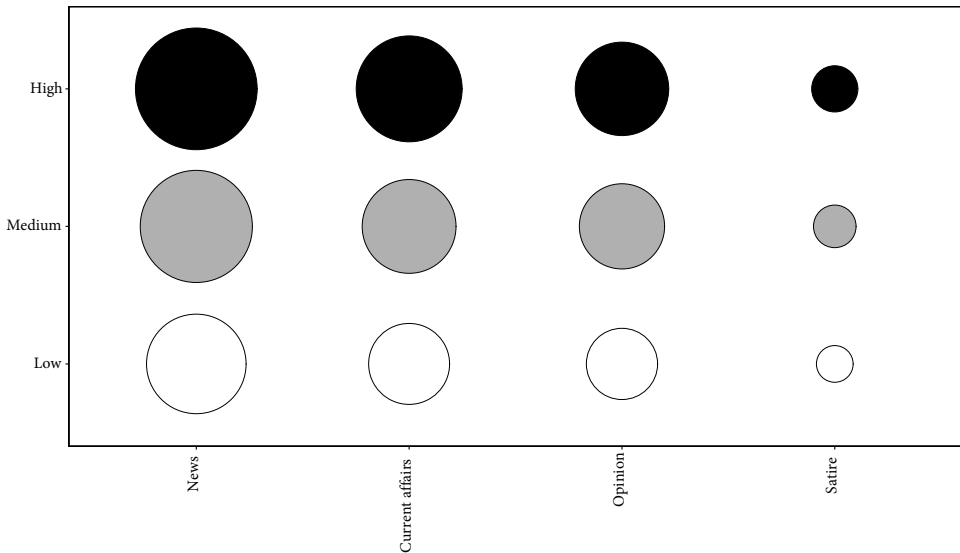
Note. * $p < .05$. ** $p < .01$. *** $p < .001$. OLS regressions. Entries are standardized beta coefficients and SE. Men as the reference category for gender. Public service TV = Total number of hours of exposure to public service television.

Although Figure 4 and Table 1 help us in understanding exposure to certain genres of television programs, we do not know *who* is exposed to *which* (political) topic in *what type of television program*. Viewers can be exposed to various political topics in (different parts of) a television program. In order to get a better and deeper understanding of exposure to

different (political) topics in Dutch public service television, we used a network approach. We created different topic-networks for all four types of television programs. By relying on the Louvain community detection algorithm in *igraph* (Blondel, Guillaume, Lambiotte, & Lefebvre, 2008), we detected subgroups of topics. A detailed description of this method can be found in the appendix.

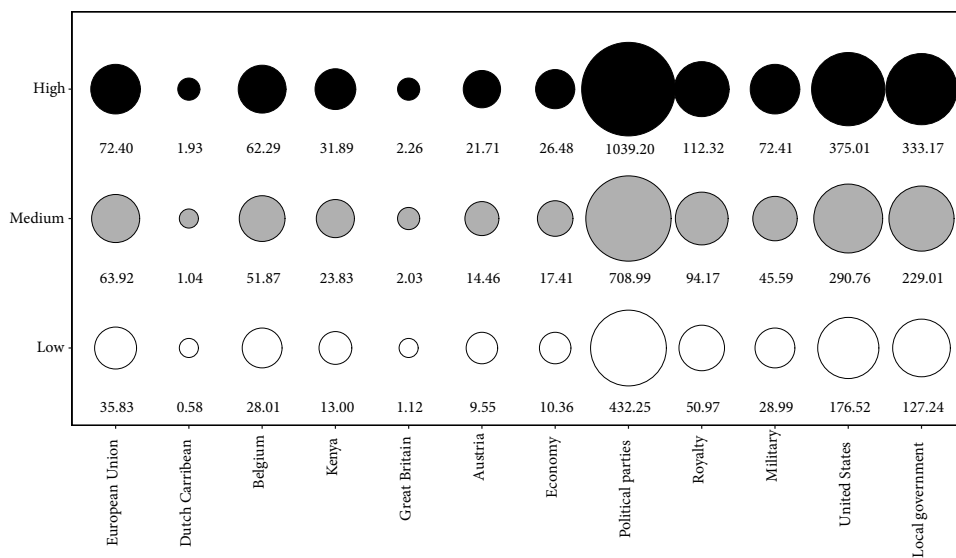
We distinguished 6,453 different political topics in public service television, varying from *Mark Rutte* to *Fake news*, *European Parliament*, *Politics of the United States*, and *Immigration*. We visualized exposure to political topics in a contingency table (see Figure 5). The bubble sizes represent the average number of political topics that viewers have been exposed to. The colors represent different levels of political interest. Two patterns are particularly clear in Figure 5. Viewers are particularly exposed to political topics in the news programs, followed by current affairs, opinion, and satire, irrespective of political interest. Yet, politically interested viewers are more often exposed to political topics compared to viewers who are less interested in politics.

Figure 5: Visualization of exposure to political topics: Political interest



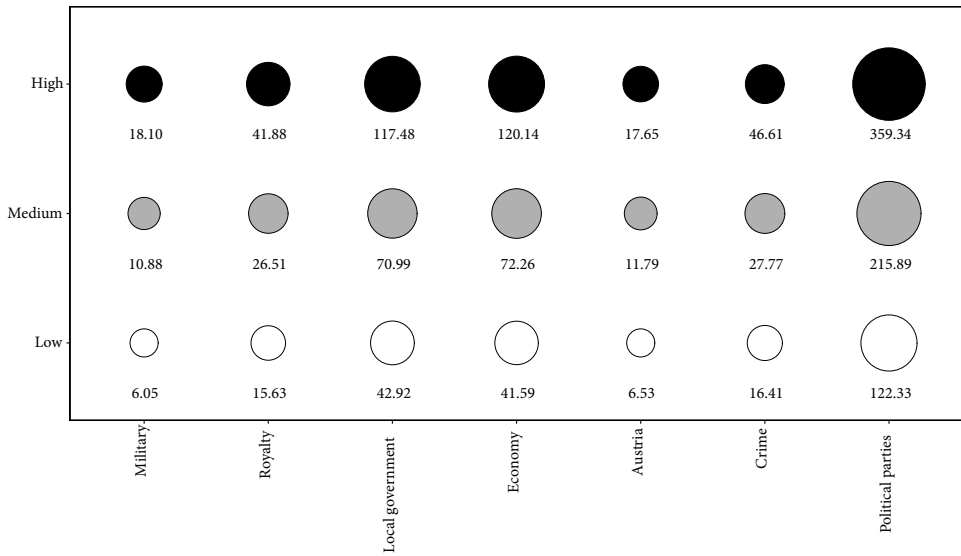
We aim to understand which political topics are covered by various television genres, and, more importantly, how this can be connected to political interest. We re-run the Louvain community detection algorithm again to detect smaller subgroups of political topics. In Figures 6a, 6b, 6c, and 6d, we visualized exposure to subgroups of political topics. The largest subgroups of political topics cover news about Dutch political parties (e.g., *The Hague*, *Mark Rutte*, *GroenLinks*) as well as politics in different Dutch regions and cities (e.g., *Ahmed Aboutaleb*, *Local politicians*, *Municipal council*). Another large subgroup covers political news from foreign countries, including the United States (e.g., *Barack Obama*, *Bill Clinton*, *the Republican Party*) and the European Union (e.g., *European Parliament*, *Brexit*, *Frans Timmermans*). A detailed description of the subgroups of (political) topics can be found in the appendix. As visualized in Figure 6a, we found twelve subgroups of political topics in news programs. On average, politically interested viewers are exposed to approximately 1,000 topics related to political parties. Viewers who are less interested in politics are exposed to approximately 400 topics related to political parties. Overall, politically interested viewers are more often exposed to political topics compared to viewers who are less interested in politics. Yet, the differences in satire programs appear to be smaller.

Figure 6: Visualization of exposure to political topics in four genres: Political interest

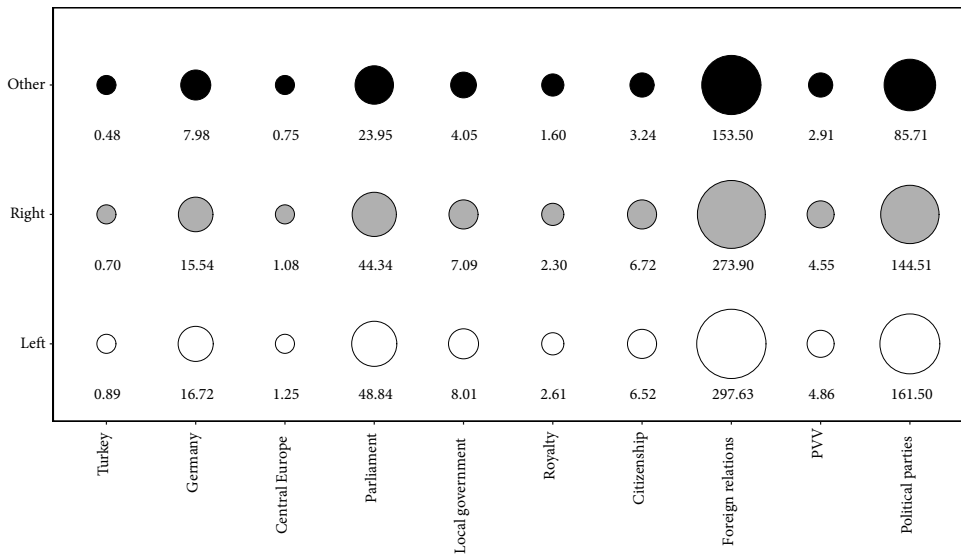


(a) News programs

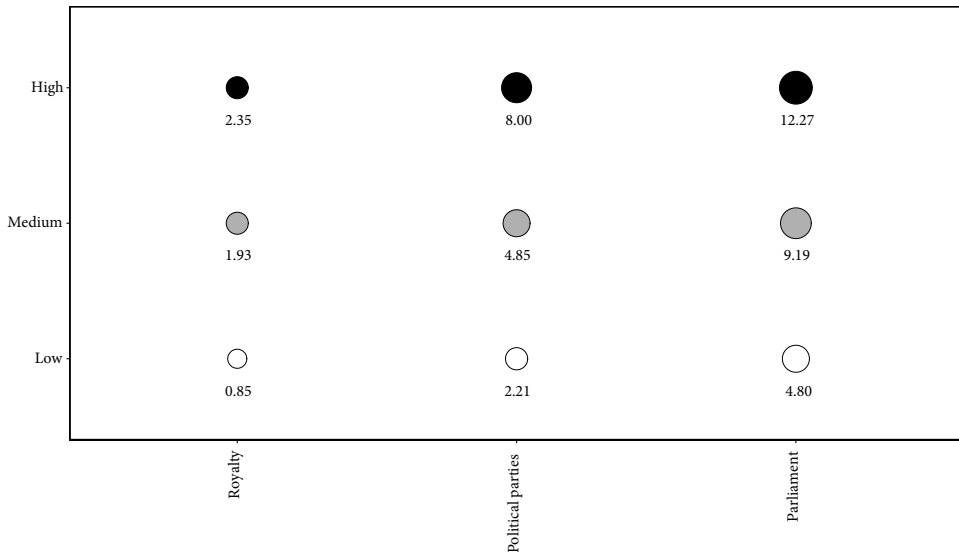
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(b) Current affairs programs



(c) Opinion programs



(d) Satire programs

Political ideology

Second, we examined whether political ideology is associated with exposure to news, current affairs, opinion, and satire programs. Again, we utilized a series of regression models⁵. We included several sociodemographic variables such as age, gender, and education, as well as the logarithmic transformation of exposure to public service television (in hours). The results are shown as estimated marginal means (predictive margins) in Figure 7⁶.

⁵To examine the robustness of our findings, we also conducted multilevel regression analyses predicting exposure to television programs. This yielded identical findings.

⁶To examine the robustness of our findings, we also conducted our analysis with D66 as a right-wing party. This yielded somewhat different findings. This indicates that viewers voting for a right-wing party are somewhat less likely to watch programs within merely one genre, namely opinion ($b = -.08, p < .05$). The results do not indicate any significant findings for news ($b = -.01, p = .69$), current affairs ($b = -.06, p = .13$), and satire ($b = -.04, p = .18$). Besides, we conducted our analyses using the Chapel Hill 2019 Expert Survey (Bakker et al., 2020). By doing so, political ideology is operationalized as the position of the party in terms of its overall ideological stance (ranging from 0 'Extreme left' to 10 'Extreme right'). Hence, we could only include *CDA*, *PvdA*, *VVD*, *D66*, *GroenLinks*, *SGP*, *SP*, *ChristenUnie*, *PVV*, *Partij voor de Dieren*, and *50Plus*. This analysis also revealed that viewers voting for a right-wing party are somewhat less likely to watch programs within merely one genre, namely opinion ($b = -.02, p < .05$). The results do not indicate any significant findings for news ($b = -.003, p = .55$), current affairs ($b = -.01, p = .21$), and satire ($b = -.004, p = .52$).

Figure 7: Exposure to television programs (log): Political ideology (*predictive margins and SEs*)

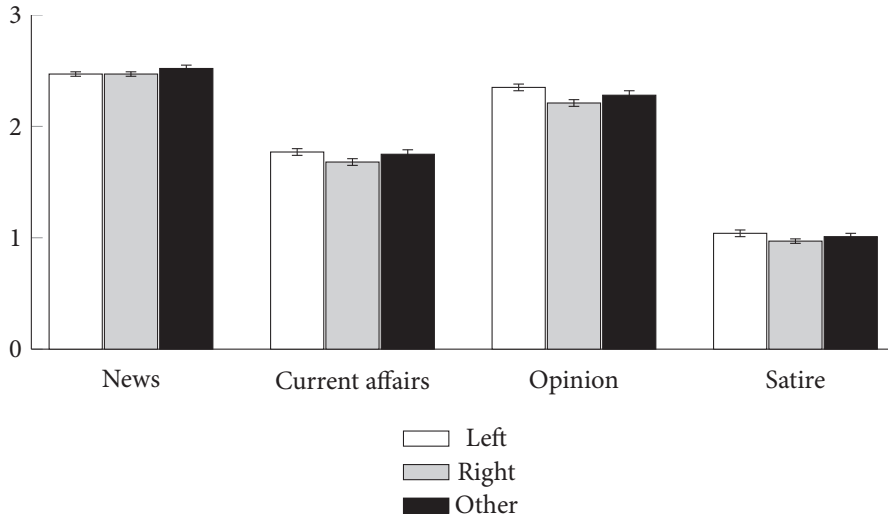


Table 2: Predicting exposure to television programs (log): Political ideology

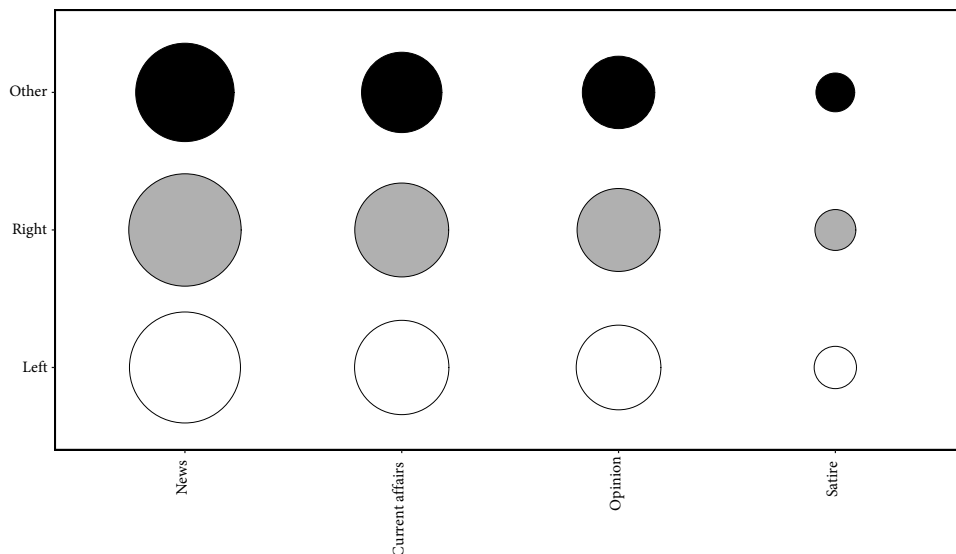
	News <i>b (SE)</i>	Current affairs <i>b (SE)</i>	Opinion <i>b (SE)</i>	Satire <i>b (SE)</i>
Political ideology				
<i>Right</i>	-.002 (.03)	-.09 (.04)*	-.15 (.04)***	-.07 (.03)*
<i>Other</i>	.06 (.03)	-.02 (.04)	-.07 (.04)	-.03 (.04)
Public service TV	.76 (.01)***	.63 (.01)***	.81 (.01)***	.43 (.01)***
Age	.01 (.00)***	.02 (.00)***	.01 (.00)***	-.01 (.00)***
Gender (female = 1)	-.01 (.02)	-.09 (.02)***	-.02 (.02)	-.07 (.02)***
Education	.0003 (.01)	.01 (.01)	.05 (.00)***	.02 (.01)**
<i>N</i> _{viewers}	3,122	3,122	3,122	3,122
<i>N</i> _{households}	1,713	1,713	1,713	1,713
R ²	.63	.84	.78	.50

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. OLS regressions. Entries are standardized beta coefficients and SE. Left-wing as the reference category for political ideology. Men as the reference category for gender. Public service TV = Total number of hours of exposure to public service television.

The regression coefficients are presented in Table 2. We found three significant effects. Viewers voting for a right-wing party are somewhat less likely to watch programs within three genres, namely current affairs ($b = -.09, p < .05$), opinion ($b = -.15, p < .001$), and satire ($b = -.07, p < .05$). This indicates that political ideology has an effect on exposure to television programs. Considering the beta coefficients, it can be argued that viewers voting for a left-wing party are particularly more likely to watch opinion programs.

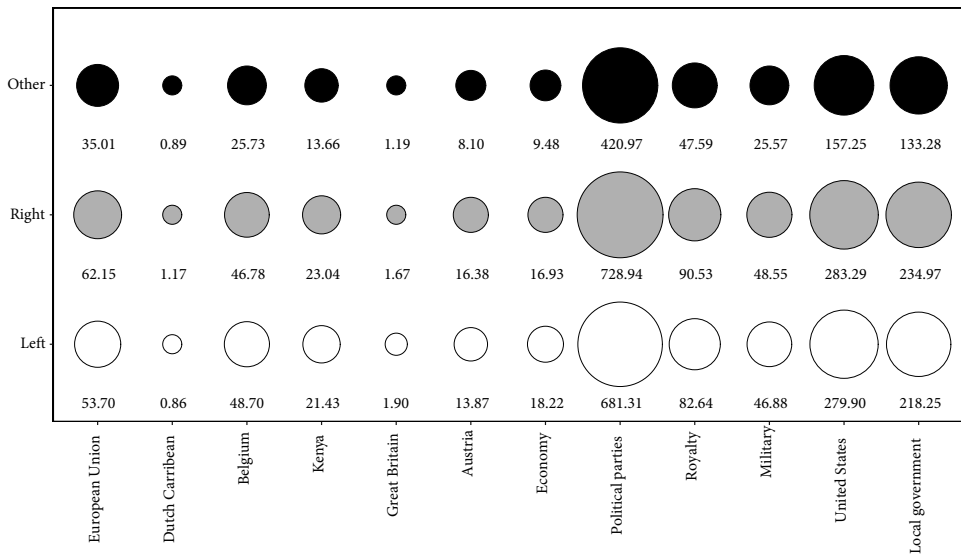
Figure 7 and Table 2 help us in understanding exposure to certain genres of television programs. Next, we aim to obtain a better understanding in exposure to specific political topics. We visualized exposure to political topics in a contingency table (see Figure 8). The bubble sizes represent the average number of political topics that viewers have been exposed to and the colors represent political ideology (in the form of left–right leaning). As shown in Figure 8, there is evidence that viewers are most often exposed to political topics in news programs irrespective of political ideology. Overall, viewers who do not go to vote, vote for a different party, or do not cast a ballot, are less often exposed to political topics compared to viewers who vote for a left-wing or right-wing party.

Figure 8: Visualization of exposure to political topics: Political ideology

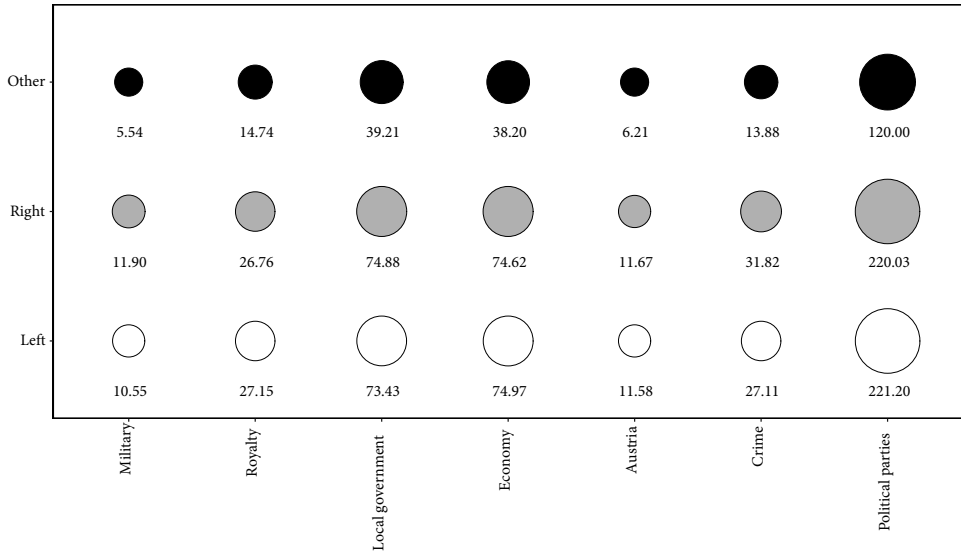


Finally, we examine whether exposure to political topics varies across television genres. In Figures 9a, 9b, 9c, and 9d, we visualized exposure to subgroups of political topics. Two patterns are particularly clear. Although viewers who vote for a right-wing party are less likely to watch opinion programs (as shown in Table 2), they are just as likely as left-wing viewers to get exposed to political topics in such programs. This could indicate that viewers who vote for a right-wing party are not interested in other topics that are discussed in opinion programs, such as *Entertainment*, *Human interest*, and *Culture* (see appendix: Table 12). Contrarily, although viewers who do not go to vote, vote for a different party, or do not cast a ballot (as shown in Table 2), are just as likely as left-wing viewers to watch, for example, current affairs and opinion programs, they are less often exposed to political topics in such programs. This could indicate that such viewers are indeed interested in other topics that are discussed in current affairs and opinion programs, such as *Health*, *Law*, *Entertainment*, *Sports*, and *Culture* (see appendix: Table 11 and Table 12).

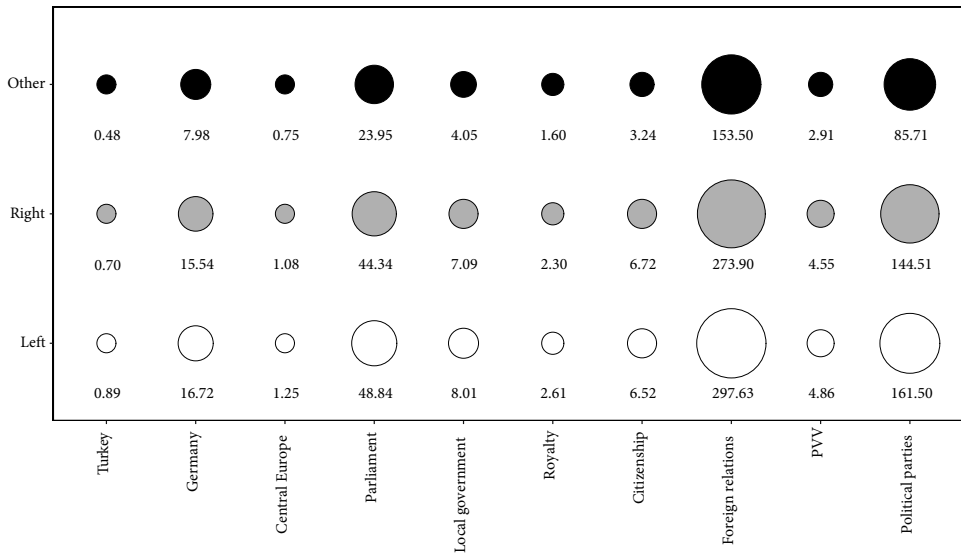
Figure 9: Visualization of exposure to political topics in four genres: Political ideology



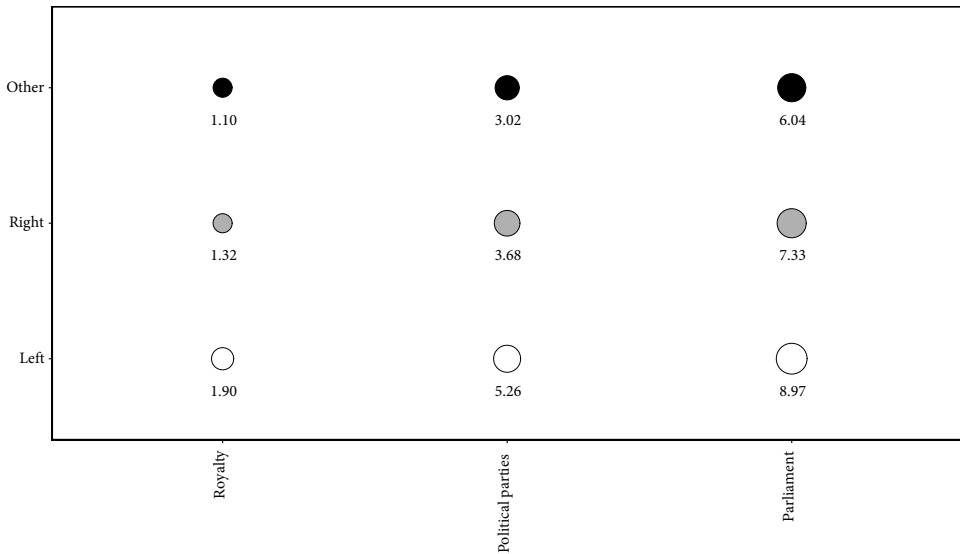
(a) News programs



(b) Current affairs programs



(c) Opinion programs



(d) Satire programs

Discussion

Despite the ubiquitous use of online media, television viewing remains a crucial part of citizens’ media use and an important source of political news for many (Robinson et al., 2018). To understand which political topics are covered by various formats and genres of television programs; and, how this can be connected to viewing behavior and audience characteristics, we combined television viewing behavior (both linear and time-shifted viewing), content features (i.e., the topics discussed in television programs), and consumer features (i.e., political interest, political ideology). Our unique electronically recorded audience-meter data provides rich information about individual television viewing behavior and excludes recall as a possible cause of measurement error. By investigating the actual content, we were able to examine *who* is exposed to *which (political) topic* in *what type of television program*. This study adds to existing literature by empirically exploring the democratic implications of television news consumption.

First, news programs clearly are the most important program to get exposed to political news for the majority of viewers and their relevance has not necessarily been replaced by other formats, such as talk shows and satire programs. Soft news and entertaining

presentations of political news are often considered as a threat to citizens' knowledge about politics (Prior, 2005). In line with previous work by Wonneberger et al. (2013b), our results do not indicate that more entertaining formats, such as talk shows and satire programs, pull politically uninterested viewers away from traditional news programs.

Political interest is nevertheless an important predictor of news use (Strömbäck & Shehata, 2010). According to the uses and gratifications theory, viewers consciously select programs based on their needs, interests and preferences (Comstock & Scharrer, 1999; van den Bulck, 2006). With more formats and genres available, politically interested viewers are able to watch more programs covering political news. Our results indicate that politically interested viewers are indeed more likely to watch formats and genres of television programs that primarily cover news. Viewers who are not so much interested in politics, in contrast, were, on average, less likely to watch such programs. The analysis of the subtitles also reveals that politically interested viewers are more often exposed to political topics compared to viewers who are less interested in politics. Future work should examine whether a growing diversity of formats and genres might widen the "knowledge gap" between viewers who prefer news programs and viewers who prefer entertainment programs.

Plausibly, political ideology also has an impact on how viewers allocate their viewing time. In contrast to Dahlgren (2019), we found that viewers voting for left-wing parties are more likely to watch current affairs, opinion, and satire programs of public service television in comparison to viewers voting for right-wing parties. Our results also indicate that, although viewers voting for right-wing parties do not necessarily watch opinion programs, they are just as likely as left-wing viewers to get exposed to political topics in such programs. This could indicate that public service television is an important source for news, current affairs, and parliamentary reporting in the Netherlands, yet viewers voting for right-wing parties are not interested in entertainment news provided by such channels. Bos et al. (2016) already indicated that Dutch news consumers with different political party preferences do have somewhat different media diets. They found that many left-wing voters prefer public news and current affairs programs, while right-wing populist voters favored the popular news broadcast and satire shows. A possible explanation may be the operationalization of political ideology. In the current study, political parties are classified as left-wing and right-wing parties. Yet, political parties in the Netherlands are not necessarily (extreme) left and right on the political spectrum (which is certainly more present in the United States). Future work should focus on other ways to examine the role of political ideology. For instance, Bos et al. (2016) relied on dichotomous variables for party preferences. This could offer a more nuanced understanding of the role of political ideology in television news consumption.

Contrarily, although viewers who do not go to vote, vote for a different party, or do not cast a ballot, are just as likely as left-wing viewers to watch, for example, current affairs and opinion programs, they are less often exposed to political topics in such programs. This indicates that there seems to be an association between television news consumption and participation (Ksiazek, Malthouse, & Webster, 2010). Previous work has already indicated that news consumption and participation demonstrate a reciprocal relationship in which the news media “serve to further activate activism” (Norris, 2000, p. 7). In the current study, we did not focus on determining causation. It requires further investigation to understand whether exposure to political news, or specific political topics, can activate the inactive or indecisive.

Methodologically, by applying a computational approach we demonstrated how to combine television viewing behavior (both linear and time-shifted viewing), content features (i.e., the topics discussed in television programs), and consumer features (i.e., political interest, political ideology). By doing so, we were able to tackle the complexity of studying exposure to political news today. We move beyond categorizing television programs in mutually exclusive alternatives. Instead, we examine an endless number of political topics in a wide variety of television programs. Our results indeed confirm that viewers are exposed to *various* political topics in (different parts of) a television program.

Although this study has provided a set of findings to understand television news consumption in the Netherlands, a few shortcomings should be noted. First, we used a commercial off-the-shelf natural language processing tool (i.e., TextRazor; www.textrazor.com). This tool involves a proprietary algorithm to conduct topic modeling on a large data set. However, the source code is not publicly available for scrutiny. In such instance, the software is essentially a black box: it is difficult to understand its internal workings (Boumans & Trilling, 2016). We have to acknowledge the potential challenges that this commercial tool introduces with respect to providing full transparency of the current findings (Broussard, 2016).

Second, many audience-meter data sets do not yield perfect measures but have their own issues of validity (Napoli, 2003; Wonneberger et al., 2013a). Our data does not include any significant shortcomings in the sample selection procedures, in the gathering and processing of the data or in quality control. This allows for a greatly stable way of data collection with consistent and comparable measures over time (for a detailed overview see Stichting KijkOnderzoek, 2018). However, as this is a secondary analysis, we had to rely on the availability of certain variables (e.g., the operationalization of political interest).

A final general note concerns the characteristics of the Dutch context. There are substantial differences between media systems that are more heavily regulated by the state and with stronger public-service aspects, found in the majority of European countries, such as the ones of the Netherlands, Belgium, the United Kingdom, and Norway, and media systems that are more market-oriented such as in the United States (Aalberg, van Aelst, & Curran, 2010). Particularly, public service broadcasting systems provide a greater availability of news and current affairs programming at several slots during primetime. As a consequence, citizens in media systems that are more heavily regulated by the state and with stronger public-service aspects are more likely to be exposed to political news as a by-product of watching television. By regularly tuning in to public service channels, television viewers have more opportunities to get exposed to political news—irrespective of their motivation levels—than typical viewers of commercial television channels that primarily offer more entertaining options during primetime. It can therefore be argued that public service television offers a political information environment that encourages inadvertent news exposure. Research indeed suggests that citizens of countries with strong public service television are better informed about hard news (Aalberg et al., 2013; Fraile & Iyengar, 2014; Soroka et al., 2013) compared to market-oriented media systems. Strömbäck and Shehata (2019) found reciprocal effects between political interest and public service television news exposure, but not when it comes to commercial television news. Future work therefore needs to use new approaches to compare public service television news and commercial television news.

Notwithstanding, this study has provided a strong set of findings, relevant to television news consumption. By using a computational approach, these findings not only update and advance earlier research about television news use, but also provide a further understanding of the role of political preferences in news consumption patterns.

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