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Moeller, J.; de Vreese, C.

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Judith Moeller¹ and Claes de Vreese¹

Abstract

This study investigates the dynamics of the reciprocal influence of political knowledge and attentive news use. News media are an important source for political information and contribute to political learning. Yet, this process is optimized with increasing levels of pre-existing knowledge about the political world. In extant literature, mutual interdependence is often suggested, but empirical proof is scarce. We propose to conceptualize the relationship of knowledge and news use as an upward spiral. The model is tested on data from a three-wave panel survey among 888 adolescents using growth curve modeling. The results support the model of a spiral of political learning. Interestingly, the influence of political knowledge on news use is estimated to be higher than the other way round.

Keywords

political knowledge, news use, structural equation modeling

Political knowledge is a key factor in becoming an engaged citizen. In order to participate, citizens of democracies must understand the processes and structures of the political system around them (Sotirovic & McLeod, 2004). Electoral decisions can only be meaningful if voters have a basic idea about policies, candidates, and the offices they run for. Moreover, political knowledge is also proven to have a positive impact on attitudes toward politics and participation. In fact, “no other single characteristic of an

¹University of Amsterdam, The Netherlands

Corresponding Author:

Judith Moeller, Amsterdam School of Communication Research (ASCoR), University of Amsterdam, Kloveniersburgwal 48, 1012 CX Amsterdam, The Netherlands.

Email: j.moller@uva.nl

individual affords so reliable a predictor of good citizenship, broadly conceived, as their level of knowledge” (Delli Carpini & Keeter, 1996, p. 6). The more people know about politics, the more they are inclined to take on an active role in a democracy (Verba, Schlozman, & Brady, 1995). An analysis of how young citizens learn about politics from the news media can therefore provide insight in the antecedents of how adolescents become active citizens.

Adolescents learn about politics in a number of different ways. Parents play a key role in fostering the first understanding of politics of their children, although their influence as political educators decreases during the teenage years of their children (Sears & Levy, 2003). In this life phase, conversations about politics with peers and teachers are the prime place in which information is shared and elaborated (Shah, McLeod, & Lee, 2009). Events encountered through news media often spark these conversations. While talking about politics, citizens often exchange information they learned from the news media. Media effects on political socialization have therefore been conceptualized as *mediated* through talking about politics (McLeod, Shah, Hess, & Lee, 2010). But news media also serve as an independent source of information contributing to political learning (Chaffee, Ward, & Tipton, 1970; de Vreese & Boomgaarden, 2006; Delli Carpini & Keeter, 1996).

However, the relationship of news use and political knowledge is reciprocal, as political knowledge is a powerful predictor of news use (Price & Zaller, 1993). In fact, knowing about politics is virtually a precondition to make sense of news stories. Knowledge about political structures, actors, and processes provides the context in which new information is processed. Without basic political knowledge, new information remains largely meaningless. News use and political knowledge are therefore mutually interdependent, or in the words of Norris (2000), “a virtuous circle.” It can be argued that the mutual interdependence is in equilibrium by adulthood as patterns of news use as well as the level of political knowledge have stabilized. Young citizens, however, are still generating political knowledge. They are also still selecting their media diet. Given the developments in this life phase, it is very interesting to investigate whether or not these two processes interact. Do rising levels of knowledge lead to an increase in attentive news use, resulting in even higher levels of political knowledge? In this case, the mutual interdependence would lead to a reinforcing spiral. In this study, we analyze the growth dynamics of learning from news media in detail, using data from a national three-wave panel survey study of 888 adolescents.

Panel survey data are well suited for this purpose and have several advantages over cross-sectional survey data or experimental data. Cross-sectional surveys assess whether and under which circumstances news use and political knowledge are correlated (e.g., Price & Zaller, 1993; Shah, McLeod, & Yoon, 2001), but cannot answer questions of causality or dynamics. In other words, these studies cannot provide a definite answer to the question of whether individuals become more knowledgeable by using news, or, instead, more knowledgeable individuals are more inclined to watch or read the news. Even though some cross-sectional studies, most prominently Norris (2000), speculate that the answer is that both processes are at work simultaneously, they do not support this notion empirically. It is the goal of this study to demonstrate

that the relationship between political knowledge and news use is in fact more than a positive correlation, and rather a mutually reinforcing spiral. This is important for our future theorizing about this dynamic relationship.

While experiments establish stronger causal claims, they often are conducted in a laboratory environment and force news exposure (e.g. Eveland, Seo, & Marton, 2002). This casts doubts on the external validity of those studies. Moreover, they are usually assessed immediately after treatment and we know relatively little about effects knowledge gains over an extended period of time. The foci of this study, however, are stable, long-term developments in political knowledge. Therefore, the analysis is based on data collected over the period of 2 years.

Political Learning From the News

It is evident that news media are an important source of political information and contribute to political learning of adolescents (Chaffee et al., 1970; de Vreese & Boomgaarden, 2006; Delli Carpini & Keeter, 1996). However, as it is common for media effects, this is not a straightforward, stimulus-response process. Political learning from the news media is a complex process, which is conditional upon a multitude of factors: Starting from the information environment on the system level (Elenbaas, de Vreese, Schuck, & Boomgaarden, 2014; Prior, 2007) to features of the media that transmit political information (Chaffee & Kanihan, 1997; Weaver & Drew, 2001). Yet, perhaps the most important determinants of political learning reside on the individual level (Delli Carpini & Keeter, 1996). The reason behind the dominance of individual characteristics is that political learning is in nature a psychological process that consists of a number of steps (Sotirovic & McLeod, 2004)

First, new information needs to be taken in. Mere exposure is not enough to guarantee an effect on political knowledge. Information also needs to be comprehended and retained (Price & Zaller, 1993). The importance of this step cannot be stressed enough. Graber (1997) showed that most TV news users cannot remember most of the items they saw on a recent news broadcast, not to mention any specific details of the stories. In explaining whether a news story is remembered or not, individual motivation also plays a key role (Elenbaas et al., 2014).

Second, mental representations of the information need to be formed, and these representations need to be linked to existing representations and schemata. In this context, pre-existing mental representations of political actors, structures, and processes are of vital importance. The more cognitive networks and schemata already exist, the easier it is to connect and organize new information. Furthermore, individual cognitive abilities determine how much information can be processed (Fiske & Taylor, 1991).

Third, new information needs to be reflected upon (Eveland, 2004). In order to enter the long-term memory, new information needs to be recalled several times. Interpersonal communication about the subject can play an important role in this process, as can repeated exposure (Higgins, 1996).

Knowledge Effects on Media Use

When carefully examining the process of political learning from the news, it becomes apparent that learning is not independent from pre-existing political knowledge (Chaffee & Schleuder, 1986). Since learning requires an ability to link new information into a network of schemata, it is quite clear how essential prior political knowledge in the acquisition of new political knowledge actually is. To take this argument one step further, pre-existing political knowledge is a precondition to make sense of the news at all. Without it, obtained information can remain meaningless, and there is less need to tune in. But pre-existing political knowledge also factors in the motivation to retain information. First of all, individuals who are motivated to follow the news are also likely to be politically interested and knowledgeable in the first place (Elenbaas et al., 2014). Second, knowing about events increases the relevance of further developments connected to the event. (Chang & Krosnick, 2003).

Extant research has shown that efficient information processing is more likely among news users with specific social economic background characteristics. Among these are social economic status (SES; Jerit, 2009), gender (Mondak & Anderson, 2004), formal education (Eveland & Scheufele, 2000), and composition of the social network (Hively & Eveland, 2009). Yet, the very same factors are also predictors of news use and general political knowledge (Delli Carpini & Keeter, 1996). This implies that it is—*ceteris paribus*—the same group of people that (a) watches and reads the news, (b) is able to understand and process information they came across, and (c) has a high level of political knowledge. This leads to a gap in political knowledge that divides citizenry in those who know and understand politics and those who do not, which has serious implications for democratic societies (Tichenor, Donohue, & Olien, 1970).

Civic or Political Knowledge?

Political knowledge is a multidimensional construct (Graber, 2001). In the literature, we often find a difference between *factual* and *structural* political knowledge. The first dimension *factual knowledge* entails (a) knowledge of textbook facts about politics, such as the number of judges in the U.S. Supreme Court and (b) surveillance knowledge such as correctly identifying political key players. Most studies of political learning use measures that focus on the first dimension (de Vreese & Boomgaarden, 2006; Eveland, Hayes, Shah, & Kwak, 2005). The second dimension, *structural knowledge*, is conceptualized as the understanding of political process and structures that form the political system (e.g. the function of a political party, the consequences of certain policy decisions). Eveland, Marton, and Seo (2004) define structural knowledge as the ability to see and understand relations among political actors, organizations, or individuals. *Civic knowledge*, a conceptualization of political knowledge put forward by Delli Carpini and Keeter (1996), falls in between the two ends of the continuum. It encompasses both factual knowledge of key institutions in a political system as well as the ability to relate them to each other.

In this study, we chose to study *civic knowledge* related to the structures of a democratic system for two reasons. First, this type of knowledge is a precondition to participate in a democracy in a meaningful way. As Buckingham (1997) put it, "Being an 'informed citizen' must surely be seen as rather more than just a matter of being able to regurgitate facts on demand" (p. 351). It is arguably less important to know the symbol of political party than its function in a democracy in order to vote for the party or join it. Second, civic knowledge develops quickly in young adulthood (Inglehart, 1990). All in all, civic political knowledge seems to be an appropriate and valid dimension of political knowledge to be tested in this context, which is why we focus on this aspect of political knowledge in this study.

Toward a Dynamic Model of Learning From the News

As we have established in the previous section, political knowledge and attentive news use are mutually interdependent. Higher levels of political knowledge make news more accessible and relevant and provide a framework to make sense of the obtained information. Using the news, on the other hand, is an important source for political learning, at least if new information in the news is retained and processed.

When taking on a longitudinal perspective, it can be argued that what is conceptualized as mutual interdependence at a specific point in time is actually an equilibrium that can transform into a spiral if either of the two variables is changing. When adolescents are exposed to an interesting news story, their knowledge about current events increases. As a result, they become more attracted to news and are more likely to use it attentively in the future. Yet, following the news attentively leads to rising levels of political knowledge over time. In its structure, this spiral resembles the spiral dynamics of selective exposure proposed by Slater (2007). If this theory holds, then the difference in political knowledge between those in the upward spiral and those who are not should become larger over time. Three hypotheses can be deduced from this notion.

Hypothesis 1: Political knowledge at one point in time has a positive effect on attentive news use at a later time point.

Hypothesis 2: Attentive news use at one point in time has a positive effect on political knowledge at a later time point.

Hypothesis 3: The process of growth in news use and growth in political knowledge are mutually interrelated.

Studies of knowledge gains have found evidence on specific aspects of this model. For example, Tichenor et al. (1970) demonstrated that coverage of an issue widens the gap in knowledge about this issue, in one of the earliest studies on media-related knowledge gaps. Those who knew about an issue beforehand learned more from coverage than those who did not. Norris (2000) demonstrated that political knowledge and news use are positively correlated based on multiple data sets reaching from European Election data to the U.S. National Election Survey, but causality or dynamics are not

tested. Eveland et al. (2005) did test the causal relationship between political knowledge and news use in a two-wave panel study and concluded that a model of unidirectional influence of news use best describes the phenomenon. However, their study differs from this study in a number of aspects. Most importantly, their study was specific to an American presidential campaign. Political knowledge was defined as factual knowledge about issue placements of the two candidates and media use as exposure to campaign-related information. Second, the model used in their study is not a model that explains growth in either political knowledge or news use, but the level of knowledge at the second measurement. In this study, however, we analyze the phenomenon as a general causal mechanism that is not specific to a certain political event. We aim to explain growth during a 2-year time span and not the absolute level of knowledge. To do so, we assess whether causal relationships in growth in political knowledge and news are still significant when the other growth process is controlled. In other words, a comprehensive model of a reinforcing spiral of political knowledge is being tested.

Political Learning During Adolescence

Adolescence is a key phase for political learning, as it marks the period in which the brain is sufficiently developed for abstract and complex thinking. During childhood, political knowledge is restricted to the knowledge of symbols and a general idea of power, whereas young adults are able to grasp the complex processes and institutions of modern democracy (Chaffee et al., 1970). Moreover, late adolescence is also a period in which many young citizens face their first electoral decisions. This gives political information and political knowledge a new relevance in their lives and a reason to seek out information about politics on news media (Sears & Valentino, 1997). Therefore, adolescence is a life phase in which not only political knowledge develops but also political knowledge is likely to be influenced by news media (Jennings, 1996). The same applies to political learning (Sears & Levy, 2003; Sigel & Hoskin, 1981).

Method

In order to investigate the reciprocal influence of news use and political knowledge, we rely on a three-wave panel survey conducted in the Netherlands between 2010 and 2012 among a sample of adolescents aged 15 to 18 years at the beginning of the survey. The data were collected through computer-assisted web interviewing (CAWI). This study was supported by the National Center of Competence in Research on “Challenges to Democracy in the 21st Century” (NCCR Democracy), funded by the Swiss National Science Foundation.

Sample

The sample was drawn from a population representative database administered by a Dutch opinion poll institute, GfK, using a quota sample. The quotas used were age

(15-18 years), gender, and education. A total of 1,653 respondents participated in the first wave (16 June through 10 July 2011). Of those respondents, 1,186 also participated in the second wave (16 June through 10 July 2011). The attrition rate was 28%. The third wave took place from 14 June to 3 July 2012. In all, 888 respondents participated in the third wave, implying that the attrition rate was 25% from the second to the third wave. As we are interested in the process of obtaining knowledge relevant to active citizenship, we investigated a sample of adolescents in the last 2 years prior to their first general election, which took place on 12 September 2012. Those respondents who did not participate in all three waves did not differ significantly from the panel in terms of gender, age, and educational level.

Measures

News use. News exposure was measured using a combined measure of news exposure and attention to news.¹ News exposure is measured as a cumulative scale of exposure to 22 Dutch news sources (TV, newspaper, and online news sources). For each outlet, the typical exposure per outlet interval is assessed and added up ($M = 3.14$; $SD = 2.58$).² Attention to news was measured using a single item indicator on a 7-point scale ($M = 4.34$; $SD = 3.77$). The question was asked for news consumption in general, not separately for each news outlet.³ Attention to news and exposure were multiplied to create a combined indicator ($M = 12.28$, $SD = 10.63$).

Political knowledge. Political knowledge was measured using a summative scale of answers to four different questions testing for general knowledge about democratic society. These questions cover knowledge about important aspects of Western democracies like the function of political parties and international politics. The purpose of using rather general questions instead of more common knowledge checks (e.g. by recognition of politicians) was to tap long-term knowledge gains that are important for the development of democratic citizens. The questions were adapted from International Association for the Evaluation of Educational Achievement (IEA) Civic education studies. Each question was recoded into 1 = *correct answer* and 0 = *wrong answer or don't know*.⁴ The recoded items were used to construct a scale (Kuder-Richardson 20 = .70; $M = .27$; $SD = .02$).

The same questions were used in all three waves to ensure that the questions had the exact same level of difficulty. Given the long time span between measurements, it could be expected that respondents are likely to have forgotten the questions. To test panel sensitization, a separate, representative sample of 200 respondents in the same age group was asked the same questions during the fieldwork period in 2011. There was no significant difference in their responses compared to panel members.

Covariates. Four covariates were used in the analysis: formal education, age, gender, and SES. Data on age, gender, and formal education was provided by the research institute that carried out the fieldwork. Formal education was assessed on a 3-point scale (low, middle, and high education in secondary schools in the Netherlands). As

we are dealing with an adolescent sample, education did not have to be completed at the time of the interview. SES was assessed using a single item indicator in which respondents self-reported their social class on a 5-point scale ($M = 3.53$; $SD = .01$).

Data Analysis

In order to analyze the reciprocal influence of news use and political knowledge as a reinforcing spiral, two interrelated growth processes need to be modeled simultaneously. We rely on Structural Equation Modeling for this purpose. The model used is an adaptation of the model used by Schemer (2012) to model a spiral of negative issue affects and campaign attention. In this model, two parallel growth curves are estimated (Bollen & Curran, 2006). In a growth curve model, multiple measurements of the same indicator over time are used to model a latent intercept and a latent slope. The initial level of the manifest variables, political knowledge and news use, was modeled as a latent intercept. Intra-individual variance in the political knowledge and attentive news use across waves was modeled as a latent slope (see Figure 1). To model the latent intercept, the mean of the intercept of the individual indicators was constrained to zero and the regression weight of each of the paths between the indicators and their respective intercepts was set to 1. To model intra-individual linear growth, the paths between the indicators and their respective slope were restricted to 0, 1, and 2. To account for autocorrelation, the growth factors (latent slopes and latent intercept) were allowed to co-vary. The covariation between error terms of the manifest variables was restricted to 0.

Results

Measures of model fit indicate that the model fits the data well (chi-square = 13.71; $df = 7$; $p = .55$; comparative fit index (CFI) = .996; root mean square error of approximation (RMSEA) = .033). This means that it is appropriate to analyze the relationship of political knowledge and news use as an interrelated growth process. Before discussing the reciprocal measures, let us first describe the two growth processes of political knowledge and news use separately.

The mean of the slope of political knowledge was estimated to be .19 (standard error (SE) = .03; $p < .001$). This implies that political knowledge has grown significantly over the 2-year time span. The variance of the slope was estimated to be .049 ($SE = .02$; $p = .02$). The mean intercept of political knowledge was estimated to be 2.48 ($SE = .04$; $p < .001$). Keeping in mind that political knowledge was measured on a 4-point scale, we can conclude that the initial level of political knowledge is rather high. The variance of the intercept was estimated to be 1.062 ($SE = .078$; $p < .001$). Intercept and slope of the political knowledge growth curve were significantly correlated ($COV = -.10$; $SE = .49$; $p = .02$). The direction of the correlation was negative. This means that individuals with a high level of political knowledge in wave 1 have obtained significantly less political knowledge than those with a low initial level of political knowledge. Given the high mean intercept of political knowledge, this is most likely a ceiling effect.

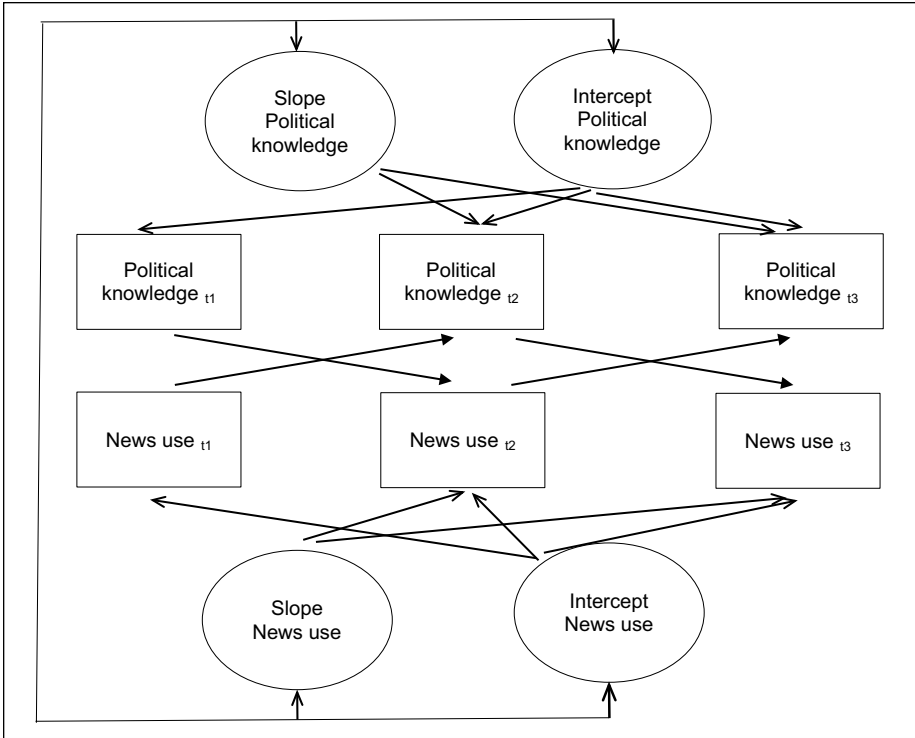


Figure 1. Analytical model of the reinforcing spiral of political knowledge and news use. Note. The figure shows only the structural relationships between political knowledge and news use. The effects of covariates are considered but not depicted in the model. Residuals and correlations between residuals are also considered, but not shown.

When inspecting the estimations for the growth curve of news use, the picture is different. The mean slope was positive, but not significant ($M = .51$; $SE = .49$; $p = .43$). This means that there has not been an increase in attentive news use, besides what can be explained by the increase of political knowledge. The variance of the slope was estimated to be 6.32 ($SE = 1.48$). Again, we find a negative, significant correlation between intercept and slope of news use ($COV = 16.85$; $SE = 3.43$; $p < .01$). That means that respondents who used a variety of news media regularly in the first wave are less inclined to expand their news menu. The variance of the intercept was estimated to be 78.99 ($SE = 5.42$; $p < .001$), and the mean of the intercept was estimated to be 9.78 ($SE = .36$; $p < .001$).

The latent slopes of political knowledge and news use were not significantly correlated ($COV = -.06$; $SE = .09$; $p = .51$), but the latent intercepts were ($COV = 2.12$; $SE = .81$; $p < .01$). The correlation of the initial levels of news use and political knowledge means that the two variables are already dependent upon each other before the first measurement. Turning to the cross causal paths and hypothesis testing, we find confirmation for most of the hypotheses (see Table 1).

Table 1. Reciprocal Influences of Political Knowledge and News Use.

Parameters	Estimates (SE)	Parameters	Estimates (SE)
Political knowledge _{t1} → news use _{t2}	.407* (.182)	News use _{t1} → political knowledge _{t2}	.004 (.003)
Political knowledge _{t2} → news use _{t3}	.856** (.331)	News use _{t2} → political knowledge _{t3}	.010* (.005)

Note. Unstandardized parameters. SE = standard error.

*p < .05. **p < .01.

Hypothesis 1 posits a significant positive impact of political knowledge on news use at the next point in time. The findings support this hypothesis as knowledge at time point t increases news use at a subsequent time point. It is worth noting that the estimated influence seems to have doubled during 1 year.

Hypothesis 2 states a significant effect of growth in attentive news use on political knowledge. Here, the results are mixed. Whereas we do not find a significant impact of news use at t1 on political knowledge at t2, this path was estimated to be significant between news use at t2 and political knowledge at t3. Like in the case of the influence of political knowledge, the size of the effect had doubled in the second wave.

With regard to the third hypothesis, it can be concluded that the level of political knowledge and the level of attentive news use are interrelated and influence each other over time. Yet, the influence of political knowledge on news use was stronger than the other way round. First, political knowledge was consistently estimated to influence attentive news use in both time periods. Second, the level of significance was much stronger for these paths.

Four control variables were included in the analysis. Adding the control variables to the model did not change the results significantly (see Table 2). When looking at the effect of the control variables on the growth factors, a few interesting observations can be made. The initial level of political knowledge is influenced by all four control variables. Older, male, highly educated respondents with a higher SES are predicted to have a higher level of political knowledge at the start of the first wave. Yet, younger respondents are likely to learn more about politics during the 2-year time span. With regard to news use, the picture is slightly different. Older, female, higher educated respondents were estimated to have higher initial levels of news use. Those with a higher education were less likely to increase their use of news over time.

Robustness Checks

News exposure and attention to news. As we are using a combined measure of news use and attention to news, we tested whether the results hold up when both factors are tested independently. The results are mixed. We do find comparable results for models based on attention to news (CFI = .97; RMSEA = .02). All relevant estimates that were significant in the combined model are also significant in a model based on attention to

Table 2. Effects of Control Variables on the Growth Factors.

	Intercept political knowledge	Slope political knowledge	Intercept news use	Slope news use
Sex	-.18**	.10	.10**	-.09
Age	.21**	-.23**	.12**	-.09
SES	.12**	.08	.16	.09
Education	.29**	-.12	.27**	-.25**

Note. Standardized parameters. SES = social economic status.

* $p < .05$. ** $p < .01$.

news only (w1 news→w2 political knowledge: $\beta = .03^*$, $SE = .01$; w2 news→w3 political knowledge: $\beta = .07$, $SE = .03$; w1 political knowledge → w2 news: $\beta = .75^*$, $SE = .34$; w2 political knowledge → w3 news: $\beta = .15^{**}$, $SE = .06$). In the model relying on exposure to news only ($CFI = .98$; $RMSEA = .06$), this is not the case. Here, we do find a significant impact of political knowledge on exposure to news, but exposure to news had no significant effect on political knowledge (w1 news→w2 political knowledge: $\beta = .03$, $SE = .06$; w2 news→w3 political knowledge: $\beta = .07$, $SE = .11$; w1 political knowledge → w2 news: $\beta = .23^{**}$, $SE = .009$; w2 political knowledge → w3 news: $\beta = .46^{**}$, $SE = .005$). It should be noted that in this model, the correlation between the two slopes becomes significant, implying that the relationship between growth in exposure to news and growth in political knowledge is better described as a parallel process.

Lagged variable model. Additionally, cross-lagged models were estimated in which the influence of the prior time point on the subsequent measure is controlled. Using a lagged model rather than explicitly measuring change in the random effects regression allows for maintaining the simultaneous paths between variables rather than forcing an independent variable/dependent variable (IV/DV) relationship. After controlling for the influence of measurements of prior time point, the key finding of a simultaneous relationship of political knowledge and attentive news use remains significant. However, we did not find any additional cross-lagged effects, with the exception of w1 political knowledge on w2 attentive news use.

Discussion

In this study, we set out to test the idea of a spiral of political learning. Extant studies on the relationship between news use and political knowledge have often concluded that growth in political knowledge and increase in attentive news use must be interrelated (Norris, 2000; Price & Zaller, 1993), but empirical proof has been scarce until now. This study looks at the mutual interdependence from a longitudinal perspective. If the effects of political knowledge and news use are disentangled over time, they take the shape of an upward spiral. The results support the conceptualization of a spiral of

political learning. To be precise, we find time-specific reciprocity between news exposure and knowledge that is increasing over time and asymmetric. Political knowledge is a much better predictor of future attentive news use than the other way round. Two conclusions can be drawn from this finding. First, the upward spiral of political learning can be entered at both ends. In order to stimulate political learning, it is effective to encourage young citizens to pay more attention when reading or watching the news. Yet, it is probably even more efficient to spark the upward spiral at the end of political knowledge. The results imply that adolescents first need to have a general understanding of democratic institutions and democratic processes before they are willing to follow the news attentively.

Second, we should be careful to over-interpret media effects on political knowledge in cross-sectional studies. Our findings suggest that causality in the relationship of political knowledge and news use goes in fact both ways, and more importantly, the reverse path is probably stronger. In other words, the commonly found correlation of political knowledge and news use (e.g. Chaffee et al., 1970; Norris, 2000) is rather a result of an increased interest in news of individuals with a high level of political knowledge, than a result of political learning through news media. It is important to note that this also holds when covariates are included in the model.

It should be noted that this spiral is not necessarily a *reinforcing* spiral. In our model, the two latent slopes were not correlated. This means that the reciprocal relationship of news use and political knowledge is specific to the 2 years we measured. During this period, the size of the effects increased, yet we did not find evidence of a continuous underlying parallel growth process. Further studies covering a longer period in time are needed to assess whether or not the same relationship can be found for citizens younger than 15 and older than 18.

By using an adolescent panel, we intended to measure the antecedents of the upward spiral. At this age, neurological development is advanced enough to enable grasping abstract information (Chaffee et al., 1970), and individuals are slowly growing in their role as active participants in democracy (Sears & Levy, 2003), which makes political information relevant for the first time. However, the results suggest that political knowledge and news use are already correlated at the age of 15. That means that the analysis does not cover the *antecedents* of the spiral. Accordingly, children younger than 15 must already be able to make enough sense of news to learn from it about political structures. The observed high initial level of political knowledge supports this conclusion. That means that the foundation of the spiral of political knowledge is probably laid much earlier. This finding is in line with a study of Prior's (2010) study on the development of political interest over the life course. He found that political interest is already fully developed at the age of 16 and changes little over the life course. To fully uncover the beginning of the spiral, it is necessary to start observing the process at a young age in future research. Yet, even though the very beginning of the spiral was measured, it was still investigated at an early stage.

A similar conclusion can be drawn with regard to the effect of covariates in the analysis. According to the data, male, highly educated respondents, with higher SES have higher initial levels of political knowledge and news use (with the exception of

the higher initial level of news use among women). This finding is in line with extant literature on the knowledge gap (Eveland & Scheufele, 2000; Jerit, 2009; Mondak & Anderson, 2004). Yet, these factors had little impact on the growth in political knowledge and news use. However, the analytical model was designed to validly measure news effects and not necessarily to assess the influence of education or gender. As background variables were used as covariates only, we should not interpret too much into the lack of effects of background factors on growth in knowledge.

Another interesting finding of this study worth noting is that the upward spiral of political learning is not found when news use is defined as mere exposure to news. In fact, we find that the media use diet does not change very much in the period of investigation at all. Only once exposure is weighted by the amount of attention news users are paying to the news, the spiral occurs. This finding reiterates the results of other studies on knowledge effects of news (Chaffee & Schleuder, 1986), and is linked to the argument that political learning is a psychological process that is dependent upon motivation and ability of the recipients of political information to retain and process new information (Price & Zaller, 1993). By weighting exposure with attention to news measures, the notion of motivated news use was included in the model, as it allows to distinguish between those who are not interested in processing information and those who actively seek out the news. Future research would be well advised to factor in the *contents* of political information (e.g. de Vreese & Boomgaarden, 2006) so as to further assess the impact of news exposure on learning.

In this study, a complex structural model based on three waves of panel data is presented. Although the data fit the theoretical model well, a number of limitations of this study should be taken into account when interpreting the results: First, the interval of 1 year in between the measurements, which could be either too long or too short, depending on the point of view. Political learning is a life-long process (Sears & Levy, 2003), and a time span of 2 years is therefore relatively short. An interval of 1 year in between the measurements, on the other hand, can be considered to be rather long. It might very well be that political knowledge and news use develop in a much faster pace. For example, de Vreese and Boomgaarden (2006) demonstrate knowledge gains during a very short time period, so do many studies of knowledge gains during electoral campaigns (Eveland et al., 2005). That means that we are neither able to present a complete model of the dynamics of political learning nor a very granular model. Rather we provide a comprehensive model of the spiral.

Second, as an adolescent sample forms the basis of this analysis, caution is warranted with regards to the generalizability of the results. In order to be confident that our results hold for the general population, the analysis would have to be repeated with older and younger respondents. Third, in this study only three waves of data were available to model longitudinal developments. This is the minimal amount of measurements to construct such a model. Additional measurements would increase the robustness of the model as such. Fourth, we are using a quite elaborate measure of attentive media use in this study that incorporates both exposure to various news outlets as well as the attention paid to news, yet we cannot link that exposure to specific content. This means our measure of information flow is limited. Future studies should strive to combine measures of media use with measures of actual media content.

These shortcomings notwithstanding, this study contributes to the extant body of literature on news effects on political knowledge by proposing and testing a theoretical model of the dynamics of political learning from the news. It advances our knowledge on the topic in several ways: (a) By using a measure of news use that combines exposure on all major sources of news in one country (see also Dilliplane, Goldman, & Mutz, 2013), including specific Internet news sources, and attention to news; (b) by taking on a longitudinal perspective which allows to test the mutual causal influence of news use and political knowledge simultaneously; and (c) by adding the dimension of time to the notion of mutual interdependence of the two factors, which leads to the conceptualization of a reinforcing spiral of political knowledge.

One question remains open. What happens to those who play no part in the upward spiral? Those who do not build enough knowledge to get interested and understand the news? If only those who already know fairly much about politics can learn from the news, how can adolescents with low political knowledge become informed and engaged citizens? It is clear that media can only provide a very small part to the solution for this problem and the importance of political education in school cannot be emphasized enough. But once the foundation is laid, news media are a prime place to enrich and reinforce political knowledge.

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Notes

1. News exposure is combined with a measure of attention, because both of these factors of news use are essential to guarantee news processing (Chaffee & Schleuder, 1986). In fact, attention to news measures has been proven to explain gains in political knowledge better than exposure as information that is not received attentively fades away quickly (Eveland, Seo, & Marton 2002). Chang and Krosnick (2003) tested a combined measure of exposure and attention as a moderator for various media effects. The moderator, the combined measure, was found to be significant in all cases, whereas the main effects of attention and exposure became insignificant, implying that a combined measure is able to explain most of the variance that would be explained by the individual factors otherwise. For sake of parsimony, we rely on a combined measure in the models. To guarantee robustness, we conducted additional test using the individual measures.
2. It is important to note that this is a cumulative scale not a factor. Some of the TV shows are being broadcasted at the same time, so it is virtually impossible to be exposed to both. A similar argument can be made for newspapers. Most respondents only buy one newspaper.
3. We chose a general measure for news attention based on the research of Chaffee and Schleuder (1986) who have tested a number of detailed attentions to news measures, but

could not find significant differences compared with a general attention measure. The question wording was as follows: When you use one of the news sources described above, are you doing this . . . with no attention at all, with a lot of attention. The item was measured on a 7-point scale.

4. The four questions were as follows: (1) In democratic countries what is the function of having more than one political party? (a) To represent different opinions interests in the Parliament, (b) To limit political corruption, (c) To prevent political demonstrations, (d) To encourage economic competition, (e) Don't know (Recoded $M = .68$; $SD = .007$); (2) What is the major purpose of the United Nations? (a) Safeguarding trade between countries, (b) Maintaining peace and security among countries, (c) Deciding where countries' boundaries should be, (d) Keeping criminals from escaping to other countries, (e) Don't know (Recoded $M = .77$; $SD = .006$); (3) The government has lowered tax rates on income from interest and investment (finance income) and raised tax rates on salaries. A large group carried signs in protest in front of the government's buildings. The protesters are most likely to be . . . (a) people who have large savings accounts, (b) people who own shares in companies, (c) unemployed, (d) people who receive government benefits, (e) . . . people who are employed in factories, (f) Don't know (Recoded $M = .50$; $SD = .007$); (4) A country has a declining birth-rate and an increasing life span. Which of the following problems will have to be solved as a result? (a) Schools need to be built, (b) Pensions for the elderly have to be financed, (c) Low income housings have to be built, (d) Crime and violence have to be fought, (e) Don't know (Recoded $M = .77$; $SD = .006$).
5. Political knowledge and attentive news use are modeled as manifest variables because they were measured and treated as cumulative scales rather than factors. In the case of news use, we chose to apply this method because a factor analysis would lead to different results. Some of the news shows are broadcasted at the exact same time, so no respondent could have seen both. Still we argue that exposure to either one of them is equally effective. In case of the knowledge variable, we chose this approach because the question measuring political knowledge covered different dimensions and level of knowledge.

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Author Biographies

Judith Moeller is a postdoctoral researcher at The Amsterdam School of Communication Research ASCoR, University of Amsterdam. Her research focuses on media effects, media influence on political socialization, and news dissemination through online news media.

Claes de Vreese is professor and chair of political communication and scientific director of The Amsterdam School of Communication Research ASCoR, University of Amsterdam. He has published extensively on media effects, elections and campaigns, political journalism, and media coverage of European affairs. For more information, see www.claesdevreese.com