



Network dynamics of television use in school classes

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ABSTRACT

Seventy years ago Paul Lazarsfeld and colleagues found empirical evidence for a significant influence of the social context on media effects by interpersonal communication. Subsequently various theories in mass media science incorporated the social context as an independent or dependent variable. However, there is little empirical research that addresses the dynamics of media use within a social context using network analytic methods. This study considers the social context as both an independent and dependent variable in a dynamic network process in order to disentangle social selection and influence processes. Hence, on one hand it tests whether the intensity of TV use and the use of specific TV genres predict the selection of conversation partners in social groups (social selection process). On the other hand it tests if individuals' social context predicts their TV use (social influence process). Here, social context is defined as the conversation structure as well as the media use of all other persons in the social group.

The research design includes a four wave panel survey on interpersonal communication networks and TV use of 707 students (age 13–16) in 29 Swiss school classes. The stochastic actor-based models tested with the program SIENA support the hypothesized selection processes. Conversation partners about TV programs are selected according to the similarity of their TV use. In contrast to this finding, the widely held assumption that individuals are influenced by their social network is not supported. Some inconclusive evidences suggest a possible social influence process on the level of TV intensity but not on the level of specific TV genres. Network-autocorrelation of conversation ties and TV use has therefore primarily be accredited to social selection processes and not social influence. Furthermore, the results show that avid viewers tend to talk more often about TV programs (ego effect), that avid viewers are more likely to be addressed (alter effect), and a general tendency to talk to persons with the same program preference (similarity effect). This challenges the classic idea of a two-step flow of communication in which intensive media users which are well informed would provide information to occasional users which are less conversant with a topic.

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1. Introduction

The use and discussion of mass media are important aspects of social behavior in today's society. People discuss which books might be worth reading, express their music preferences by wearing specific clothes, group together to watch major sport events at home or in public places, and talk about the latest news on politics or celebrities. These examples illustrate how mass media use and effects are embedded in social contexts. But it is not only the mass media that play an important role in social life. The influence is mutual: the social context plays an important role in individuals' media use. Hence, from a dynamic perspective the social context as well as the individual media use can be both an independent and dependent variable. As an example of the first case, a friendship tie may be created, maintained or dissolved because of the similarity

or difference of the media preferences, e.g., taste in music. An example of the second case occurs when a person decides on their media use (e.g., news vs. entertainment, pop vs. classic) on the basis of the preferences of a relevant reference group (e.g., co-workers, or family) or specific individuals (e.g., close friends). It might be possible to integrate oneself into a group by adopting a group's media preferences (e.g., joining a Facebook group) or distinguishing oneself by demonstrating different behavior.

The importance of the social context of mass media use has a long but fragmented research history. The literature review first searches for roots in classic mass communication theories that address the relevance of the social context when analyzing mass media use and media effects. This idea dates back to the 1940s (Lazarsfeld et al., 1968) and is incorporated in some of the most influential approaches in mass communication research. However, a comprehensive theoretical framework combining these various approaches and the different conceptions of the social context is still missing. One reason for this shortcoming is that the social context is seen as either an independent or dependent variable. The

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aim of this contribution is to overcome this limitation both on a theoretical level as well as empirically by including both aspects over time.

For this purpose the plurality of possibly relevant social contexts has to be limited to the most obvious and supposedly most relevant form. Hence, the second part of the literature review focuses on the social context expressed by interpersonal communication about mass media topics. In combination with sociological and psychological approaches, four hypotheses are derived and tested on a dataset of interpersonal communication and TV use of adolescents. More specifically the study tests to what extent individuals' TV use is influenced by topic related conversations within the school class and, on the other hand, to what extent this conversation network is influenced by individuals' TV use. The longitudinal analysis of conversation networks on two important TV genres and TV intensity allow an empirical distinction between social selection and influence processes.

2. The social context of mass media use

The majority of studies on media use, media effects, selection research, media socialization, and appropriation focus on individual audience members. Individual characteristics such as gender, age, education, personality types and changing moods explain differences in use and effects of mass media (Bryant and Zillmann, 2002). Without questioning the relevance of these insights, the present study proposes to also analyze processes of media use in social groups. This approach is not entirely new to the field. Seventy years ago Paul Lazarsfeld and colleagues found empirical evidence that most voters in election campaigns are not influenced by mass media in a direct and causal way. Rather, they proposed a two-step flow of communication – a process in which mass media are (primarily) used by so-called opinion leaders who pass on the information to their social group through interpersonal communication in their social network (Lazarsfeld et al., 1968). This seminal study was an important paradigm shift in mass communication research because it illustrated that the recipients are not isolated individuals. Subsequent to the initial work by Lazarsfeld et al., a number of theoretical and methodological advances emerged ranging from the ego networks (Katz, 1957; Katz and Lazarsfeld, 1964; Merton, 1949) to the analysis of news diffusion and medical practices in complete networks (Coleman et al., 1966).

Beside the hypothesis of a two-step flow of communication, other influential communication theories also take the social context of recipients into account. These include the agenda-setting approach (McCombs and Shaw, 1972), the spiral of silence (Noelle-Neumann, 1973), the knowledge gap hypothesis (Tichenor et al., 1970), and the uses-and-gratifications approach (Herzog, 1971; Katz et al., 1974). While the first two primarily treat interpersonal conversation as a dependent variable which is influenced by mass media, the latter two include the social context as an independent variable to explain media use, and media effects, respectively. Though, only a small proportion of studies on these theories do in fact empirically analyze either individual communication or social networks.

The notion of social context in these and related studies encompass different conceptualizations of “other people” who have an influence on one's behavior or who define the relevant setting for behavior. This includes the relationship to family member and close friends, social groups such as a peer group or co-workers, or a more or less anonymous mass such as the “impersonal influence” of the perception of a somehow abstract public opinion (Mutz, 1998; Rice, 1993). The theories which are discussed in more detail in the subsequent sections (Sections 3–5) are chosen because they elaborate

on different rationales to explain the behavior of individual persons in a social group with respect to mass media use.

3. Interpersonal communication as relevant social network for mass media use

From the myriad of possibly relevant social networks (friendship, sympathy, spending time together, etc.) the interpersonal communication network about mass media topics is the one with the most explicit link between the individual behavior of mass media use and the social context. The operationalization of the social context as a network of interpersonal communication is well grounded in mass communication research. For example, the uses-and-gratifications approach distinguishes different gratifications which people receive by using mass media. One of these gratifications is the use of media topics to participate in everyday conversation, which helps people to become integrated in social groups (Merton, 1949, p. 205). This social function of follow-up conversation was labeled and measured in various ways: “communicatory utility” (Palmgreen and Rayburn II, 1979, pp. 162–163), “interpersonal utility” (Levy and Windhal, 1984, pp. 68–69; Palmgreen et al., 1980, p. 169; Wenner, 1982, p. 545), “personal identity and social contact” (Kippax and Murray, 1980, p. 343), “social resource” (Bantz, 1982, p. 359), and “social interactive function” (Bonfadelli, 1999, pp. 163–164; Bonfadelli and Saxer, 1986, p. 56). A long-term study in Germany found that between 1964 and 1985 the overall gratifications attributed to media use declined, but the social integrative function always remained the most frequent named gratifications by the respondents (Kiefer, 1987, p. 149). Recent findings underline the importance of follow-up conversations as a motive for media use. Empirical evidence includes various media types and topics such as daily talk shows (Paus-Haase, 1999), internet chats about soaps and talk shows (Baym, 2000, p. 119; Krotz, 2001) or major sport events such as the football world championship (Schramm and Klimmt, 2003).

Even though there seems to be wide support for the general idea that mass media are used for social purposes, the specific structural dynamics of these processes have not yet been analyzed. Furthermore, the validity of these findings can be questioned because they are all based on questionnaires using rating scale items to measure the importance of different gratifications. This is problematic because recipients might not be fully aware of their motives and gratifications of media use (Scherer and Schlütz, 2002). Facing the difficulties in collecting information on motives of individual behavior to understand the dynamics in social groups, the study reported here uses an alternative approach. Individuals are not asked to verbalize their *motives* why they watch TV and why they talk to others about it. Rather, they are asked to report their *behavior* of TV use and interpersonal communication. This information is then used to reconstruct individual decisions rules (which can be assumed to be rooted in motives). Dynamic social network analysis is proposed both as a theoretical and methodological approach to address the long lasting question of whether and how social networks are influenced by mass media use, as well as the effect of mass media use on the formation of social networks.

Conversations about TV programs can be regarded as one of the most explicit manifestations of social interaction related to TV use. This is in contrast to music preferences which can also be communicated by non-verbal signals such as specific fashion or hairstyles. This project therefore focuses on the dynamics of TV use and TV-related conversations within the social context of interpersonal networks. Based on the idea of a two-step flow of communication and the social function of conversations about mass media topics (uses-and-gratifications) it can be hypothesized that TV use and conversations about TV use are positively correlated.

H1. The intensity of TV use is positively associated with conversation ties about TV programs.

Beside this basic hypothesis of interdependence on a quantitative level, no further assumptions can be drawn from the cited theories. To develop more precise hypotheses on possible network dynamics and behavior change, psychological and sociological theories need to be included.

4. Dynamics of social structure and behavior

Cultural tastes such as media preferences can be seen as part of the individual *habitus* (Bourdieu, 1979) which is both socially determined and socially operant. Historically, this idea of a relation between culture and social structure can be traced back to classic statements by Marx/Engels and Durkheim (Lizardo, 2006, p. 778). Hence, one's cultural tastes are not primarily shaped by individual traits but rather by social networks (DiMaggio, 1987). However, the reverse influence of media preferences on network structures is rarely analyzed (Lizardo, 2006). Lizardo found some evidence that highbrow taste is associated with a denser network of strong ties, while popular culture is more likely to be associated with more weak ties. The study reported here was not designed to analyze the dynamics of different status groups and the potential use of mass media for signaling this stratification. Therefore no hypotheses are drawn based on this line of research.

Psychologists developed theoretical concepts that are more focused on the micro level of individuals and their effects on the meso level of small social groups. Social psychologists Berger and Calabrese proposed an *uncertainty reduction theory* (Berger and Calabrese, 1975) which builds on balance theory (Heider, 1946; Newcomb, 1959), psychology of interpersonal relation (Heider, 1958), and social comparison theory (Festinger, 1954). The uncertainty reduction theory is of special relevance for this study because it addresses the interpersonal communication during initial interaction and in the further development of social relationships. The basic assumption of this theory is that interaction is used to reduce uncertainty in social relations. The more we know about other persons the more predictable their behavior becomes. At the same time it is assumed that the likelihood of interaction is increasing as uncertainty is decreasing. The more similar two persons are the more likely they will interact. This leads to a self-reinforcing process: low uncertainty due to similarity → increasing interaction → decreasing uncertainty due to increased similarity → increasing interaction →, etc. It is assumed that this is true for verbal communication (axiom 1) as well as nonverbal expressions of affiliation (axiom 2). Further axioms postulate that low uncertainty leads to reciprocity in relationships (axiom 5) and that similarity decreases uncertainty (axiom 6).

There are no empirical tests of the uncertainty reduction theory so far with respect to mass media use. However, there are some relevant results from the theory of social identity (Tajfel and Turner, 1986), self-categorizing theory (Turner et al., 1987), as well as the tendency to homophilic selection (McPherson et al., 2001). The *theory of self-categorization* is a more general formulation of the social identity theory which posits that people define their identity to a certain extent by the social group they are affiliated with. This self-stereotyping leads to the emergence of norms in social groups. With respect to mass media there are interesting findings for music taste which support social identity theory. Bakagiannis and Tarrant (2006) as well as Tarrant et al. (2001) found in an experiment that students (mean age of 15) evaluate other people more positively when they believe that the others are listening to the same music style compared to a situation in which they have no information on the music preferences of the out-group. It has to be acknowledged that uncertainty reduction theory as well as social identity theory

posit that people have multiple identities, deriving from membership to different social groups. Hence, TV program preferences or any other cultural values can only be regarded as one aspect among many which could have social implications.

5. Functions of conversation about mass media content

The theories and empirical findings introduced in this study all address different aspects of the same phenomena – the interdependence of social interaction and individual attributes. Friemel (2008) proposed a theoretical framework for an integrative analysis of these processes with respect to conversations and mass media use. In line with the uses-and-gratifications approach, this framework proposes to take an actor-oriented view and distinguishes *five functions of conversations about mass media content*. These include cognitive elaboration, affect regulation, social positioning, media selection, and information. The *function of information* is based upon the classic idea of a two-step flow of communication cited above and suggests a correlation between quantitative mass media use and conversation frequency (see H1). The notion of “function” refers to the non-media user who receives information mediated by a media user via the channel of interpersonal communication. Hence, hypothesis H1 has to be specified for “sender” and “receiver” in conversation dyads. The two-step-flow hypothesis suggests that the sender uses mass media more intensely than the receiver, which enables the sender to provide information to the receiver. Hence, a positive ego effect can be assumed for the sender which would indicate that *the creation of conversation ties is more likely if ego has a higher mass media use (H1a)*. At the same time a negative alter effect can be assumed (H1b), which would indicate that *the likelihood to create a conversation tie increases with decreasing mass media use of the addressed alter*.

In contrast to the hypothesized tendency to asymmetric media use concerning the information function, the other four functions suggest a co-orientation on the level of overall intensity as well as specific program preferences. The *function of cognitive elaboration* means that people use conversation to make sense of media content. This function has been empirically demonstrated for political information (Eveland, 2004) as well as entertainment (Katz and Liebes, 1985). For example after watching a “strange” cinema movie, people can elaborate on it by discussing it with other persons who have seen it. It can be assumed that this gratification increases the likelihood that people adjust their media use to each other to increase the set of common knowledge, which is a prerequisite for cognitive elaboration.

The *function of affect regulation* can be important during and after media use. During media use the presence of other persons and verbal as well as non-verbal interaction with them help to increase enjoyment as well as to obtain relief from negative emotions such as tensions and fear. Similar gratifications are assumed for conversations after media use (Davies, 2007; Raney, 2006). Similar to the function of cognitive elaboration, this function suggests a co-orientation of media use within social groups because this maximizes the individual benefit.

The *function of social positioning* comprises two very distinct processes. As outlined in the social psychological approaches cited above, mass media can be used to integrate oneself in a social group through expressing shared norms and values. This idea of value homophily was introduced by Lazarsfeld and Merton (1954) and is empirically documented for delinquency or political orientation (McPherson et al., 2001). On the contrary, some sociologists (Bourdieu, 1979) and social-psychologists (Snyder and Fromkin, 1980) emphasize the tendency of distinction and uniqueness, respectively. Hence, people would tend to use different mass media to distinguish themselves from others. It has to be noted that

these very different ideas of social positioning are not contradictory. Integration in one group normally implies the distinction from another group. Hence, within a social group defined by conversation ties we would rather assume co-orientation, while distinction is more likely to occur between groups (which communicate less frequently – see also social identity mentioned above).

The fifth function of conversation about mass media, the *function of media selection*, has its roots in research about diffusion of innovation (Rogers, 1995). In contrast to the two-step flow of communication it is not the media content itself which diffuses through social networks, but the information about the existence of media content and optionally an evaluative component about it. Hence, people receive information from their social network which helps them to select media content which might be of interest for them. Again, this diffusion process possibly leads to a co-orientation of mass media use.

The outlined taxonomy of the five functions of conversation about mass media is of special relevance for this study because one function (information) suggests an asymmetric distribution of media use (similar to the two-step flow of communication which is captured in H1) while the other four functions theoretically support the assumption of auto-correlative tendencies as a result of influence and selection processes. Hence, it is assumed that people are likely to adapt their program preferences to their personal network and vice versa because this enables them to elaborate the content cognitively, regulate emotions, integrate socially, and because they receive hints to media content which are of interest for them. It has to be acknowledged that these functions are not limited to the use of the very same media content (e.g., a specific soap opera, news content, or music group) but can also occur on a broader level of media content (e.g., TV genres, political information, or music styles). However, it is assumed that especially the gratification of the cognitive elaboration function and affective regulation function can be maximized by aligning media use of oneself with the conversation network as specifically as possible.

Over time the homophilic selection as well as influence processes lead to a homogenization of behavior in social groups. Rogers and Kincaid (1981) describe this idea in their convergence model of communication, and McLeod and Chaffee (1973) refer to it as a co-orientation process. Despite this theoretical groundwork, only a few empirical studies have worked on the topic of the social context of mass media use (Mark, 1998; Mulder et al., 2007; Renfrow, 2003; ter Bogt et al., 2003; Vogelgesang, 1996; Weiss, 1996). Even though none of the cited studies applies social network analysis, they clearly support the assumption of homophilic media use. It should be noted that so far most of the research has focused on music taste. However, it is plausible to assume that similar effects can be found for other mass media too (Tarrant, 2007, p. 648).

Within the past years a number of empirical studies on dynamics of social structure and behavior among adolescents have emerged. Most of these have focused on dynamics of delinquency, substance abuse and school performance (Burk et al., 2007; Gerich and Lehner, 2005; Knecht, 2008; Mercken et al., 2010; Pearson et al., 2006; Steglich et al., 2010, 2006) and tried to analyze how the emergence of behavior homogeneity in social networks can be explained. So far there is only one analysis on behavioral dynamics of mass media use. Steglich et al. (2006) analyzed the co-evolution of adolescents' friendship networks, tastes in music styles and alcohol consumption. However, their study focused on the explanation of the analytical method and not on substantive research questions. Nonetheless, the study reported selection effects for classical music and influence effects for rock and techno music. Furthermore, findings confirmed typical characteristics of network dynamics such as reciprocity.

Based on the theories and research findings cited above, two additional hypotheses can be made which contrast H1 to a certain

extent. Based on the two-step flow hypothesis and the information function H1a and H1b assume a distinct media use of conversation partners. The persons who talk about media content to others are supposed to be avid media users (positive ego effect) while the addressed ones are assumed to be casual users (negative alter effect). As opposed to this H2 and H3 are both derived from the assumption of a tendency towards co-orientation which is theoretically grounded in four of the five functions of interpersonal communication about mass media content (cognitive elaboration, affect regulation, social integration and media selection).

H1a. The creation of conversation ties is more likely if ego has a higher mass media use (Ego effect).

H1b. The likelihood to create a conversation tie increases with decreasing mass media use of the addressed alter (Alter effect).

H2. Conversation partners about TV programs are selected according to similarity of TV use (Similarity effect).

H3. Pupils who talk about TV programs will adjust their TV use to each other (Influence effect).

6. Method

6.1. Topic of communication

According to Bourdieu (1979), cultural preferences can be used to demonstrate various lifestyles. This is most obvious for adolescents and their music preferences, which are not only expressed verbally in conversations but also in the way they dress and behave. However, the tendency to express music preferences non-verbally escalates the difficulty of studying this topic by a questionnaire. How should a visual influence be operationalized? The time people spend together would only be a rough proxy. It would be necessary to measure how often people look at each other which is at least partially unconscious and less salient. Furthermore it is possible, that these kinds of networks have different structures – e.g., less reciprocal and more hierarchical. Hence, one reason why TV programs were chosen as the subject of analysis is, that the interpersonal communication about TV programs is primarily verbal and therefore better identifiable. A second argument for analyzing TV use is the almost equal access to this medium across all socio economic strata. 93% of the Swiss households have a TV at home, with a slightly negative correlation between TV access and income (IP Multimedia, 2007). Hence, having no access to television is rather a free choice and not a consequence of low income. A third reason was the high relevance of TV as conversation topic and the high duration of average use per day which was found in a preceding study in the same sample. In this study TV ranked second with 56 min/day compared to 80 min/day for music.

6.2. Site and sample

It can be assumed that selection effects are most important at the beginning of a group formation process. Therefore only newly formed school classes were included in the study. In Switzerland, students normally enter secondary school when they are 13 years old and enter grammar school at the age of 15. Moreover, this age group is of special interest because the in-class peers are of higher relevance for them compared to other age groups. Younger children are more sibling- and family-oriented, while for older adolescents the peer outside of the school class becomes more important (Friemel and Knecht, 2009).

Data were collected in 5 Swiss schools which were chosen to represent both rural and urban areas of the German-speaking part of Switzerland. In four of the five schools all newly formed school classes were included. In one school a random sample of 8 classes

was drawn. In total 895 Students in 35 classes were interviewed four times within one school year, or once every quarter (September 2006–June 2007). The data reported here include 7 classes from secondary level (184 students with a mean age of 13.0; SD = 0.50) and 28 classes with 711 students from grammar school (mean age of 15.6; SD = 0.79). Class sizes ranged from 16 to 29 with a mean of 24.8 (SD = 0.81). There were slightly more females in the sample than male (56%). Most classes were mixed with respect to gender. Three classes were gender homogeneous with two girls-only classes and one boys-only class.

The overall response rate within each of the four waves ranged from 93% to 98%. Among the missing values no systematic bias with respect to media use or network position was found. The motivation of the students to participate was rather high because they perceived the topic of mass media use as an interesting and important part of their life. The open-ended feedback possibility at the end of each questionnaire was frequently used to express positive comments and interest in the topic.

6.3. Procedures

In wave 1 and 4 the researcher went to the different school classes, introduced himself and the project and assisted the students when problems occurred. A whole school lesson (40–50 min) was reserved to fill in the questionnaire. The wave 2 and 3 questionnaires were distributed by the teachers. The students were asked to fill them in during their spare time and send them back to the researcher. In wave 1 and 4 an electronic questionnaire was used. In wave 2 and 3 the students were free to choose between a printed and an online questionnaire. 69% of the students made use of the online questionnaire in wave 2, and 77% in wave 3, respectively. Stamped address envelopes were provided with the questionnaire as well as with the reminder which was directly sent to the students' home address. Wave 1 was conducted in weeks 4–6 of the new school year. Because the dynamics in social structure were expected to slow down over time the intervals between the waves were progressively increased (8, 12, and 16 weeks).

Students and their parents were informed about the design and purpose of the study by a letter from the researcher several weeks before the beginning of the new school year. This letter was sent to the students and their parents by the head of the school which recommended participating in the survey. Parents of the younger age group received an additional letter which informed them about the legal situation and included an opt-out form for their children. 7 out of 184 students (4%) of the younger age group made use of the opt-out possibility.

6.4. Measures: TV use

To test the hypotheses it is important to measure habitual media use in as detailed a form as possible. Beside the questions about frequency and duration of general media use (TV, radio, newspapers, magazines, books, computer games, and internet) more specific data was collected on the most important TV programs for this age group. The 46 programs included in the first wave were selected on the basis of open ended-questions in a pre-survey conducted in the same school classes (response rate of 80% of all students). The list of TV programs was updated for every wave by including new programs and deleting programs which were not screened any more. A total of 41 TV programs were identified as being available on television across all four periods. The students were asked to indicate whether they knew the respective program and how frequently they watched it (never, sometimes, frequent, always).

Due to the fact that the SIENA model (Snijders et al., 2007) used for this analysis was limited to a small number of behavioral variables, a dimension reduction had to be undertaken. Therefore a

principal component analysis of all the individual programs was carried out, by which 8 factors were identified. The factors were clearly interpretable as genres as similar programs loaded on the same factor. For all genres the rate of change between the subsequent networks was analyzed. Since dynamic processes can only be studied if changes occur the rate of change was used to select a subsample of two TV genres to test the hypothesized dynamics of social structure and behavior. Genres such as news programs and traditional crime series, which are often viewed together with parents, were excluded from this analysis for substantial reasons since the conversation networks did not cover this social context. The genre CSI refers to four C.S.I. and C.I.S. series which are a kind of criminal series (crime scene investigation). The genre MTV includes five programs. Three of these programs are screened on the television station with the same name (MTV). There are also other youth oriented TV stations with a clear focus on music. Therefore, the genre includes also video clips and music charts broadcast by other TV stations. Appendix A lists the programs of the two genres, the alpha reliability scores for the aggregated programs for each genre, and statistics of usage frequency and conversations per program. The variable TV intensity was calculated as a product of duration (minutes per day) and frequency (days per week). The variables for the two genres are summative indices of the frequency of use of the programs assigned to a genre. Both genre variables were rescaled to a range from 1 to 5.

6.5. Measures: conversation networks

The network data were collected with a roster design. All names of the pupils in each class were displayed in a list (including the students who did not participate in the survey). Students were asked about their conversation partners on the topic of TV (without specifying specific genres or programs): "How often do you talk with the various persons in your school class about TV programs?" Answer options included "never", "sometimes", and "often". Data were collected on this three point scale to enlarge possibilities for future data analysis. However, the SIENA version used for this analysis allows binary data only. Both possible thresholds for dichotomization (i.e., never/sometimes vs. often, and never vs. sometimes/often) were tested. Because the higher threshold leads to a rather small and sparse network with little network dynamic, the lower (second) threshold was used. The data reported here therefore represent occasional and regular conversations about TV programs within school classes.

6.6. Analytical approach: stochastic actor-based model

Stochastic actor-based models build on the assumption that individual actors are able to change their behavior (e.g., TV use) as well as their outgoing ties (e.g., conversation) (Snijders et al., 2010). Furthermore, it is assumed that these changes are not completely random. The actor-based model of SIENA assumes these changes can partially be explained by the attribute of the actor itself (e.g., TV use might lead to an increasing TV use), the pattern of outgoing or incoming ties (e.g., if other actors talk a lot about TV programs this might increase the use of TV), as well as the attributes of the connected actors (e.g., if the connected others are heavy TV users this might lead to an increased TV use of the actor). We speak of a *selection process* if the tendency to establish a conversation tie is influenced by the attribute similarity of the actor and the respective others. If an actor changes his or her attributes based on the attributes of connected others it is called an *influence process*.

The following analysis uses a stochastic actor-based model as implemented in the SIENA program (Ripley and Snijders, 2011; Snijders et al., 2007) to analyze the joint dynamic of multiple actors with several behavioral rules. Given a dataset of observations of

subsequent time points the software enables estimating the parameters in such a way that the behavior rules governed by these parameters lead to similar outcomes for fundamental statistics of the simulated networks as were empirically observed. Furthermore, these parameters indicate how important the included behavior rules are. High parameter estimates, indicating high importance of a behavior rule, are normally found for the tendency to reciprocate ties. That is, given a tie from actor i to j in the observed time one ($x_{ij} = 1$) it is calculated how likely it is to find a reciprocal tie from j to i ($x_{ji} = 1$) in time two.

As in a multiple regression analysis all included parameters control for each other. This enables one to distinguish selection from influence processes as well as network changes based on exogenous effects. Analyzing auto-correlative processes like the one given in this study is an important advantage compared to other statistical techniques. More detailed non-technical introductions to stochastic actor-based models and SIENA are provided by Steglich et al. (2010), Snijders et al. (2010), and the SIENA manual (Ripley and Snijders, 2011; Snijders et al., 2007).

To combine the results of the 35 school classes a two stage procedure was applied. In a first step, the model parameters were estimated for each school class separately. For this stage an unconditional Method of Moments estimation in SIENA version 3.18 was used. At the beginning of the model development only gender was included as a control variable. At this stage three school classes with convergence problems (due to too many missing network data) were excluded from further analysis. The variables on TV use and the respective model parameters were subsequently included in the model in a forward selection process. Additional three classes were excluded in this stage (due to too many missing values on the behavioral data) resulting in a sample of 29 classes for which the final model was calculated. The separately estimated parameters for each class are then aggregated according to the meta-analytical method proposed by Snijders and Baerveldt (2003) using the RSIENA software (Ripley and Snijders, 2011). The idea of this meta-analysis is to estimate and test the mean and variance of the true parameter values across the school classes. Hereby, the results for the separate networks are regarded as a random sample from a population. A further assumption of this method is that the true deviation and random error of the parameters are uncorrelated (Ripley and Snijders, 2011). Both assumptions can be challenged in the present study. Alternatively Fisher's combination of one-sided tests can be applied which does not make these assumptions (Mercken et al., 2010). Fisher's combination procedure should especially be considered when large estimated parameters go along with large standard errors (Snijders, 2008).

7. Results

The results are reported in the following order: descriptive statistics and missing values, general network dynamics, general dynamics of TV use, control variables (gender), selection effects, influence effects, and other effects. Before testing the hypotheses it has to be validated whether TV is as important for everyday conversations in school classes as it is assumed. The responses show that a main topic of conversation among the pupils is about school and TV. 83% of the respondents said that they have school-related conversations daily or several times a week. The second most important subjects are TV related (72%) which makes TV even more frequently discussed than music (66%) and personal issues (56%). It has to be noted that the question regarding the importance of different conversation topics uses answer categories that are not exclusively related to specific media. For instance music can be listened on a radio or from CD's, or downloaded from the internet, and the various music channels on TV have a high reach among adolescents. At

Table 1
Percent missing values across the sampled classrooms.

%	CSI	MTV	TVInt	Sex	NW1	NW2	NW3	NW4
Min	1.9	1.9	1.9	0.0	0.0	0.0	0.0	0.0
Max	29.8	27.9	31.5	1.0	11.1	38.9	39.1	12.9
Mean	14.7	13.6	13.9	0.0	1.5	7.3	6.2	2.5

the same time TV-related topics like casting shows and TV movies are discussed in newspapers, magazines and on the internet. Hence, the numbers above can only be used as a rough estimate which media are of importance for conversations. However, the findings provide sufficient support for the assumption that TV content provides important resources for conversations in school classes.

7.1. Descriptive statistics and missing values

The mean degree in the networks ranged from 4.1 in wave one ($SD_1 = 1.5$) to 6.6 in wave two ($SD_2 = 1.9$). The scores for wave three and four are slightly lower than the maximum value reached in wave two ($M_3 = 6.3$; $SD_3 = 2.0$; $M_4 = 6.3$; $SD_4 = 2.1$). This means that on average an actor has between four and six outgoing conversation ties in the observed networks. Table 1 reports the proportion of missing of network and behavioral variables. The average share of missing values is around 14% for the behavioral variable and between 1.5% and 7.3% for the network data. The constant covariate sex was missing only for one person.

SIENA sets missing data on network relations to zero indicating that there is no tie in the initial observation of a period. Missing data of the behavioral variable (frequency of TV) are imputed by the last observation carried forward (if available) or the modal value at the observation wave. In the simulation process these imputed start values are free to evolve. However, to ensure a minimal effect on the parameter estimations the calculation of the statistics is restricted to non-missing data (Snijders et al., 2007, p. 16).

The network dynamics is governed by the rate parameters as well as structural parameters. It was assumed that the network dynamic slows down during the process of group formation. The results regarding the rate function show that the dynamics in the later period decreased even though the intervals between the surveys were increasing in length ($R_1 = 11.12$; $SE_1 = 0.78$; $R_2 = 8.50$; $SE_2 = 0.58$; $R_3 = 7.15$; $SE_3 = 0.37$). In other words, the average number of tie and behavior change per actor decreased from about 11 in the first interval (between wave one and two) to about 7 in the last interval (between wave three and four). Hence, the observed network became increasingly stable over time.

Table 2 includes for each structural model parameter a prediction of the effect direction which is derived from the hypotheses (pred.), the estimated mean parameter based on the independently calculated models for each school class (est. mean) as well as their standard error (s.e.) and the significance level of the mean parameter. The result of the Snijders–Baerveldt method is reported in the between-classroom standard deviation column (BCSD) followed by the p -values of Fisher's combination procedure of one-sided tests (left and right). The numbers for the estimated mean parameter are unstandardized coefficients of the statistics for which the mathematical formulae are given in the SIENA manual (Ripley and Snijders, 2011). According to Snijders et al. (2010) these parameters can be interpreted in two ways, of which one is to interpret it like log odds in logistic regression and loglinear models.

7.2. General network dynamics

The parameters reported first control for dynamics in the network structure which are only dependent on the existing network (the network attributes are hereby not considered). All parameters

Table 2
Model for the dynamic of TV use in school classes.

Parameter	Pred.	Est. mean	s.e.	BCSD	Fishers left (<i>p</i>)	Fishers right (<i>p</i>)
General dynamic of conversation network						
Outdegree (density)	neg.	−1.531*	0.055	0.213*	0.000	1.000
Reciprocity	pos.	0.962 [†]	0.042	0.056	1.000	0.000
Transitive Triplets	pos.	0.245*	0.011	0.048*	1.000	0.000
3-Cycles	neg.	−0.248*	0.013	0.040	0.000	1.000
General dynamic of TV use (basic shape effects of attribute dynamics)						
CSI linear	–	0.419 [†]	0.095	0.000	1.000	0.000
CSI quadratic	–	−0.295 [†]	0.052	0.000	0.000	1.000
Music TV linear	–	0.443 [†]	0.110	0.000	1.000	0.001
Music TV quadratic	–	−0.424 [†]	0.067	0.000	0.000	1.000
TV intensity linear	–	−0.161 [†]	0.042	0.000	0.000	1.000
TV intensity quadratic	–	0.116 [†]	0.018	0.022	1.000	0.000
Effect of gender on conversation network (selection effects)						
Gender ego	–	−0.114 [†]	0.044	0.119	0.000	0.923
Gender alter	–	−0.024	0.031	0.000	0.117	0.681
Gender similarity	pos.	0.801 [†]	0.052	0.191*	1.000	0.000
Effect of television use on the conversation network (selection effects)						
<i>Ego</i>						
CSI	pos.	0.030	0.029	0.098*	0.394	0.023
Music TV	pos.	0.080 [†]	0.026	0.060	0.991	0.000
TV intensity	pos.	0.042 [†]	0.020	0.072*	0.761	0.000
<i>Alter</i>						
CSI	neg.	0.023	0.022	0.047	0.345	0.132
Music TV	neg.	0.106 [†]	0.028	0.083	0.998	0.000
TV intensity	neg.	−0.004	0.015	0.040	0.214	0.320
<i>Similarity</i>						
CSI	pos.	−0.070	0.112	0.326	0.032	0.398
Music TV	pos.	0.342 [†]	0.104	0.290	0.970	0.000
TV intensity	pos.	0.132	0.086	0.257	0.868	0.008
Effect of the conversation network on television use (influence effects)						
<i>Average similarity</i>						
CSI	pos.	–	Score test	–	0.947	0.413
Music TV	pos.	–	Score test	–	0.963	0.213
TV intensity	pos.	–	Score test	–	0.986	0.049
<i>Total similarity</i>						
CSI	pos.	–	Score test	–	0.508	0.396
Music TV	pos.	–	Score test	–	0.924	0.219
TV intensity	pos.	–	Score test	–	0.982	0.107
<i>Average alter</i>						
CSI	pos.	–	Score test	–	0.473	0.432
Music TV	pos.	–	Score test	–	0.972	0.026
TV intensity	pos.	–	Score test	–	0.995	0.062

BCSD = Between-classroom standard deviation.

* Significance: $p < 0.05$.

of general network dynamics of conversation networks are significant and are pointing in the direction which was expected based on the hypotheses and other network studies (Table 2). The outdegree effect models the overall tendency to form a tie. It controls for the density of the network and its negative value (−1.53) indicates that tie creation is a rather selective process. Thus, ties are not created in a random and unlimited manner since the creation and maintenance of a conversational relationship seem to be entailed with ‘costs’. A basic structural phenomenon in social networks of friendship is the tendency to reciprocate incoming ties (Wasserman and Faust, 1994, pp. 505–555). The positive parameter for reciprocity (0.96) indicates that pupils are likely to choose classmates as conversation partners which also have chosen them. This means that on the level of dyads interpersonal communication about TV programs is not an asymmetric process but rather a mutual exchange.

The picture is getting a bit more complicated if a third person is included. The model parameters which describe triadic structures reveal a tendency to transitive triplets (0.24) and a low probability to form ties which lead to 3-cycles (−0.25). The positive parameter for transitive triplets means that conversation ties are likely to be created to persons to whom one is already indirectly connected via a third actor. Given an indirect connection of i via h to j ($x_{ih} = x_{hj} = 1$) a direct tie from i to j ($x_{ij} = 1$) leads to a transitive closure of the triad. It has to be noted that the direction of the ties is of relevance here. Given the same situation ($x_{ih} = x_{hj} = 1$) a reverse

tie from j to i ($x_{ji} = 1$) would lead to a cyclical structure between the three actors (3-cycle). The positive parameter estimate for transitive triplets together with the negative parameter estimate for 3-cycles indicate a tendency towards local hierarchy (Ripley and Snijders, 2011). Hence, the communication networks among pupils seem to have a tendency towards distinct communication roles on a local level (e.g., leader, intermediaries, and follower). It has to be noted that this finding does not yet include any information about the mass media use of the distinct communication roles. This will be addressed in Section 7.5.

The results for the between-classroom standard deviation are significant for the outdegree and the transitive triplets. This means that the parameters for some classes differ significantly from the estimated mean. However, the comparably low magnitude of the standard deviation as well as the Fisher's combination of one-sided tests show that for a given model parameter all estimates for the different school classes point in the same direction (positive vs. negative effects).

7.3. General dynamics of TV use

The linear tendency parameter controls for an overall level, as well as increase or decrease of TV use in the school classes. A positive parameter indicates a high level and an overall increase during the observation period while a negative parameter stands for a

low level and decrease of TV use. Since this general behavioral dynamic is not necessarily linear but rather curvilinear a quadratic effect is included which controls for the effects of TV use on itself. The quadratic effect considers only the attribute and does not take the network characteristic into account. A positive quadratic shape effect (or effect on itself) indicates a U-shaped bimodal distribution of behavior in which people tend either to have very low or high behavior characteristics. People with lower values tend to further decrease their value while people with higher values tend to increase their values. For example people with below-average TV use further decrease their use over time while the avid viewers tend to watch more often. This self-reinforcing process is typical for addictive behavior. A negative parameter would lead to a unimodal distribution of the behavior meaning that people tend to change their behavior in the direction of a mean value (Snijders et al., 2010). This phenomenon is also called regression to the mean and describes the tendency that deviations from the mean become less pronounced over time (e.g., in the end people watch with about the same intensity). The results reported in the second part of Table 2 reveal both patterns. For CSI and Music TV a positive overall tendency can be observed (0.42 and 0.44, respectively) which is combined with a negative quadratic effect (−0.30 and −0.42, respectively). This indicates that in the observed time period both genres became more popular in general (positive tendency effect) but more so for the casual viewers which increased their intensity while the avid viewers decreased their intensity (negative quadratic effect). For the overall TV intensity the opposite is found. While the linear shape effect is negative (−0.16), a positive quadratic effect (0.12) indicates a self-reinforcing process which leads to a decreasing or enduring low TV intensity for casual viewers and an increasing or enduring high TV intensity for avid viewers. For all parameters no significant difference was found between the classrooms.

7.4. Control variables (gender)

Research on dynamics of adolescents social networks show that gender is an important determinant of friendship selection, especially for children and adolescents in school classes (Burk et al., 2007; Knecht, 2008; Steglich et al., 2006). Even though this project focuses on conversation about TV programs and not on friendship ties it is assumed that the tendency to gender homophily is important as well. Furthermore, the model controls also for alter effect and ego effect of gender. The non-significant alter-parameter (0.02) indicates that there is no evidence for differences between boys and girls in the extent to which they are addressed by others. In contrast, the significant ego effect (−0.11) shows a slight tendency for boys to create more conversation ties than girls. Furthermore, a clear tendency to talk to persons with the same gender (0.80) is found. Hence, for the control variable of gender a homophilic selection of conversation partners about TV programs is found.

7.5. Selection effects

The last section of Table 2 includes all parameters which predict the maintenance of an existing tie or the creation of a new tie dependent on TV use of the involved persons. A positive ego effect indicates that a person is more likely to talk about television programs (e.g., create a new tie) if TV in general, or a specific TV genre, is used more often. A positive alter effect models the tendency to talk to persons who are more avid TV viewers. In this instance, network ties would preferably be created to persons with high values on the attribute variables of TV use. While these two parameters take only the attribute of ego or alter into account (irrespective of the other) the similarity effect considers the equality of the two behavior attributes. A positive similarity parameter indicates that

pupils are more likely to talk to class mates with similar TV use patterns than to dissimilar others.

It was hypothesized (H1a) that the ego effects are positive because one needs to be informed (by TV use) to be able to talk about it (TV content). Indeed, the estimated mean parameters for Music TV and TV intensity are positive and significant. Furthermore, the results for Fisher's right one sided test support the hypothesis (the effects are positive). However, the comparably large between-classroom standard deviations (in relation to the small means) indicate considerable variations between the classes. Taken this limitation into account *only the positive ego effect for Music TV can be regarded as a stable support for the hypothesis H1a that the creation of conversation ties is more likely if ego has a higher mass media use (ego effect)*.

Based on the idea of a two-step flow of communication, hypothesis H1b assumes that pupils preferably talk about TV programs to those classmates which are less avid viewers. The result for Fisher's left-sided test does not support this hypothesis since the *p* values are well above the suggested significance level of 0.025. In fact, the exact opposite seems to be the case for Music TV. The estimated mean parameter is positive and significant (0.11). Hence, *in contrast to the hypothesis H1b the likelihood to create a conversation tie increases with an increasing mass media use of the respective alter (positive alter effect)*.

Positive similarity effects indicate that the likelihood of conversations about TV programs is positively associated with the similarity of TV use of the two pupils. The similarity parameters were assumed to be positive (H2). *No significant effect was found for CSI and TV intensity but the similarity of pupils' Music TV use has a significant influence on the network pattern of their TV related conversations*.

As already mentioned the between-classroom standard deviations indicate that some effects differ significantly between the different school classes. Based on these findings it was tested whether significant differences exist between the two included age groups or different school types. However, no evidence was found to support these assumptions.

7.6. Influence effects

Of special interest are the findings for the influence effects which test whether the behavior of individual actors is influenced by the behavior of their acquaintances (H3). In an actor-based model influence means that ego would adjust a behavior to the behavior of the connected alters. Three different parameters were tested to account for these processes: *average similarity*, *total similarity*, and *average alter* (please refer to the SIENA manual for the mathematical definition of the effects: Ripley and Snijders, 2011). The *average similarity* effect is defined as the average of centered similarity scores between ego and the connected alters. The similarity score takes the range of possible values into account and the subsequent centering accounts for the overall similarity in the network. Hence, the similarity score is a scale-invariant indicator of how close two actors are on the variable in question. By taking the average of the similarity scores this effect is not sensitive to the number of connected alters. The *total similarity* effect uses the same similarity scores (centered) as the *average similarity* but calculates their sum and therefore takes the number of connected alters into account (the influence is proportional to the number of alters). The *average alter* effect is defined as the product of ego's behavior and the average behavior of the connected alters which captures changes in ego's behavior that are proportional to the average of their connected alters' behavior. Hence, the *average alter* effect takes only the scores of the related alters into account and not those of the whole network (as the *average similarity* does by its centering).

Table 3
Additional testing of influence effects.

Parameter	n	Est. mean	s.e.	BCSD	Fishers left (p)	Fishers right (p)
TV intensity average similarity	24	1.848*	0.730	0.000	1.000	0.092
TV intensity average alter	29	0.210*	0.104	0.000	0.998	0.277
Music TV average alter	14	0.672	0.369	0.000	0.998	0.203

* Significance: $p < 0.05$.

The inclusion of the three influence effects in the model was guided by score tests. In the last section of Table 2 (effect of the conversation network on television use) the score tests of the three effects are reported in the column of Fishers left/right one-sided tests for the two genres and TV intensity. For three effects the score-test suggested an inclusion in the model due to low p values (Music TV average alter $p = 0.026$; TV intensity average similarity 0.049; TV intensity average alter 0.062). Based on this finding additional models were tested including each effect separately. The parameters of the model reported in Table 2 did not change significantly when additional influence effects were included and therefore only the influence parameters of the additional models are reported in Table 3 (i.e., TV intensity average similarity, Music TV average alter, TV intensity average alter).

Table 3 includes the same statistics like Table 2. Additionally the number of school classes for which the respective effect converged is reported in the column "n". In contrast to the findings of the main model reported in Table 2 the results of the two significance test of the meta-analysis (see Section 6.6) lead to divergent results. The Snijders–Baerveldt method reports positive and significant selection effects for TV intensity average similarity and TV intensity average alter. However, according to Fisher's combination of one-sided tests the right sided p values are well above 0.025 and hence not significant. No significance at all was found for the third tested effect which modeled influence effects regarding the genre of Music TV (Music TV average alter).

Hypothesis H3 states that pupils who talk about TV programs will adjust their TV use to each other (influence effect). Due to the divergent results of the two significance tests no clear support for this kind of influence effect was found. However, if there are any social influence effects they seem to be limited to TV intensity. No empirical support was found for a selection processes on the level of genres (i.e., the use of CSI series and Music TV).

7.7. Other effects

Further parameters which were tested by score-tests or included temporarily during the model development are the interaction effect of behavior and similarity, effects of gender on the behavior variables, effect of one behavior (genres and TV intensity) on the others and indegree popularity (sqrt). All these parameters were not considered in the final model due to non-significant results and non-substantial influence on the other parameters. Their inclusion would have led to an over-specification of the model in relation to the restricted class room sizes (mean = 24.4 pupils, min = 16, max = 29).

8. Discussion

The analysis of conversation networks and TV use of 707 students in the social context of 29 Swiss school classes with a stochastic actor-based model for network dynamics provides unique insight into selection and influence processes. The theory based hypotheses on the relation between intensity of TV use and conversation frequency were only partially supported and differences between the two genres and the overall TV intensity became apparent.

8.1. Is there a two-step flow of communication? (H1a & H1b)

The positive ego effects for Music TV and TV intensity support the hypothesis H1a that TV content provides the sender in a dyadic conversation with resources (information to talk about). This finding is in line with a long tradition of research in mass communication science on the two-step flow of communication (Katz, 1957; Weimann, 1994). Based on this idea the hypothesis H1b suggests negative alter effects which would indicate that conversation ties are most likely directed to persons who use TV less intensively. However, this hypothesis is not supported by the results: neither for the two genres nor the overall TV intensity. In fact, the parameter for Music TV points in the exact opposite direction. Pupils tend to talk preferably to frequent viewers of this genre. The differences between the two genres might be determined by their viewing and conversation frequency in the observed groups. Table 4 (Appendix A) shows that the programs included in the Music TV genre are viewed and discussed about twice as frequently as the CSI series. Hence, the observed tendencies might only occur if certain intensity is given.

When comparing these results with the existing research on the two-step flow of communication it has to be noted that the latter was proposed and mostly analyzed for information such as political content. However, based on the theoretical argumentation of the five functions of conversation about mass media no fundamental difference was expected for entertaining content in contrast to news. Hence, it is assumed that the divergent results should primarily be accounted to the research method and not the topic. The method applied in this project can be regarded as more sophisticated than previous analysis because the actor-based model permits to account for selection and influence processes simultaneously. This is a major methodological improvement since the influence effect would be overestimated if selection processes are not controlled for. Regarding the relation between TV use and conversation patterns about TV (H1a and H1b) it can be concluded that pupils are more likely to talk to others about TV programs if they use it more intensely and preferably address those pupils who are more avid viewers themselves.

8.2. Are conversation partners selected according to their similarity of TV use? (H2)

The second hypothesis (H2) predicts a network auto-correlation of TV use and TV related conversation due to the process of homophilic selection. It is hypothesized that the likelihood that pupils who use similar TV programs will select each other to talk about TV programs is higher than the likelihood that pupils select pupils who use dissimilar TV programs (i.e., conversation partners about TV programs are selected according to similarity of TV use). The final model indicates that this effect is empirically found for Music TV. However, no similarity effect was found for CSI series and TV intensity.

The divergent results for the two genres can again be explained by the more intensive use of the genre of Music TV compared to CSI series. Another possible explanation for the difference between the genres and the TV intensity in this study as well as differences compared to other studies (e.g., Steglich et al., 2006) is that the

selection effect depends on the possibility to observe the behavioral attribute of the other actors before deciding on the creation of a new tie (De Klepper et al., 2010). This might be more likely to be the case for the topic of music and friendship networks than for TV use and conversations. Music preferences can (at least partially) be observed (heard) before becoming friends. In contrast to this, people need to talk about their TV use to gain information about the TV preferences of the other person. Hence, it is more difficult to make a homophilic choice (for a somewhat similar argument relating to adolescent peer network effects on different kinds of drug use, see Rice et al., 2003). For future research it would therefore be interesting to compare different kind of mass media types and content to try to control for their “observability” (an important aspect for the diffusion of innovation in general – Rogers, 1995). It has to be noted that the genre of Music TV primarily refers to a certain type of adolescent-specific formats (see Table 4) and not only to music video clips. Therefore, it can be assumed that the observed effect is not only an artifact of similar music preferences.

8.3. Is pupils' TV use influenced by their classmates? (H3)

The third hypothesis (H3) assumes influence processes within the school classes as a reason for network auto-correlation on TV use. The results regarding this hypothesis are inconclusive in consequence of the divergent results for the two significance tests. However, it seems that influence effects could possibly exist on the level of TV intensity while they seem to be unlikely on the level of specific genres. This contrasts with the general (sometimes implicit) assumption that interpersonal influence processes are the main driver for network-autocorrelation by the means of a diffusion process. The relevance of this finding is augmented when taken together with the observed selection process which will be discussed in Section 8.5.

8.4. General structural dynamics in conversation networks

Based on the general findings in the social network literature that in various kinds of networks ties tend to be reciprocated (Wasserman and Faust, 1994, pp. 505–555) it was assumed to find positive parameter for reciprocity. This assumption is clearly supported. With respect to the findings from other school related analyses (e.g., Knecht, 2008) this is not surprising. Furthermore, it can be argued that interpersonal communication is by definition a reciprocal process (Merten, 1977). However, in addition to this tendency to reciprocal ties there is also evidence for a hierarchical structure. The combination of a positive result for transitive triplets and the negative 3-cycle effect indicate a tendency towards local hierarchy. A transitive triplet is given if a person A has outgoing ties to person B and C while B has an outgoing tie to C. If ties represent information flow then person C would be informed directly from A as well as indirectly via B. Thus, A could be called an (opinion) leader, B a middleman or intermediary, and C a follower. The positive parameter for the transitive triplets indicate that this structure is more likely than a triad in which A chooses B, B chooses C and C chooses A (i.e., 3-cycle for which negative parameter resulted). This seems to be plausible if the ties are interpreted as a flow of information. In this instance it would not make much sense to have cyclical structure since A would be informed by C which is indirectly informed by A (via B). Taken by itself this finding would support the assumption of distinctive structural positions in a network of interpersonal communication as suggested by the two-step flow hypothesis (separating leader from follower). However, as discussed above, the avid TV viewers, who are more likely to talk about TV content

(positive ego effect), do not primarily address non viewers but other avid viewers (positive alter and similarity effect). Hence, while the network structure supports the classic two-step flow hypothesis on a local level the behavior of the pupils (TV use) within this network structure does not.

8.5. Summary

Taken together the results not only challenge the idea that homophilic patterns of TV use are the results of influence process but also offer an alternative explanation. In instances where pupils have the freedom to decide on their network ties (e.g., conversations) they are most likely to follow a homophilic selection (e.g., use of similar TV programs). Since selection and influence processes lead to the same result (network-autocorrelation) it is vital to test both effects simultaneously in any analysis to come to valid conclusions about dynamic network processes. Otherwise one might make fundamental mistakes in interpreting network-autocorrelation. Hence, any empirical evidence for influence processes which are solely based on cross sectional data have to be questioned if network ties can be formed dependent on the attributes. Only in an exogenously defined and fixed network structure selection effects can be excluded as an alternative explanation for the emergence of network-autocorrelation.

Furthermore, it seems to be necessary to differentiate various levels of possible selection and influence processes. The results regarding the influence effects suggest that influence is more likely to happen on the quantitative level of TV intensity and not on the qualitative level of specific TV genres.

9. Limitations

A point of criticism might be that the selection effects could be determined by unobserved actor attributes like personality traits and not the observed TV use. In fact, there are evidences that for example the big five personality traits are related with selection effects among late adolescents (Selfhout et al., 2010). Furthermore, personality traits are related to mass media use as well as interpersonal communication (Finn, 1997; Greetham et al., 2011). Depending on the substantial research question one might try to disentangle the relation between mass media use and personality traits in future research.

Social networks normally consist of a multiplexity of different relationships. As part of this study, data on different relations were collected, such as spending time together, conversations about other mass media such as music and cinema movies, sympathy, as well as perceived similarity of music tastes and TV preferences. These data would allow addressing a myriad of other research questions. For example it can be argued that the lack of similar TV use not only leads to a dissolving of conversation ties about TV but might simultaneously increase the likelihood of creating a new conversation tie about another topic. However, the discussion of these multiplex dynamics lies beyond the scope of this paper because of three reasons. First, because of restricted questionnaire length not all relations were included in all four panel waves. Also, the different intervals between subsequent measures complicate an integrated analysis of the different network relations. Second, the joint analysis of multiplex networks would require a different theoretical basis such as exchange theory (Blau, 2008). Third, the computational models to analyze dynamics in multiplex social networks are still in an early stage of development with some first presentations at network conferences (e.g., Snijders, 2009).

Since this study covers “only” one year it cannot be analyzed how the observed network dynamics change in the long run. It

might be possible that after an initial phase of social selection the influence processes become of increasing importance.

10. Conclusions

The theoretical reasoning about the relevance of the social network in relation to mass media use and media effects dates back several decades. However, Reardon and Rogers (1988) detect a deep divide between research of interpersonal and mass communication which is rooted in historical convenience and university politics. Therefore, in the field of mass communication research the social context of mass media use is theoretically as well as empirically often treated as a black box. Furthermore, the empirical testing of network dynamics was limited due to the lack of appropriate statistical tools. This study tries to bring some light into this black box and demonstrates how such processes can be analyzed.

The research setting in school classes proved to be fruitful for this kind of analysis and the stochastic actor-based models for network dynamics seem to be adequate. More specifically, the aim of this study was to test whether and how TV use is influenced by the social context and vice versa. The longitudinal analysis of conversation networks and TV use allowed an empirical distinction between selection and influence processes. It was found that network-autocorrelation of conversation ties and TV use is more likely to be the result of selection processes and not influence as would be assumed from classic diffusion theory. This underscores the importance not to consider the conversation network as a static “infrastructure” through which opinion leaders spread ideas and norms which in turn they have learned from mass media. Instead, if people are free to define their network, they tend to select conversation partners with similar TV use. Hence, the main network dynamic of television use in school classes is a selection process.

Regarding the hypothesized influence processes only inconclusive results were found. Since the two significance tests lead to divergent results there is no clear support for social influence processes regarding TV use nor does it seem to be completely implausible. Some support was found for influence processes on the level of TV intensity while on the level of TV genres these can most likely be excluded.

The idea of a two-step flow of communication from avid viewers of a TV program to occasional viewers is tested with several model parameters. On the one hand this classic idea is supported by the finding that more frequent TV use is associated with more conversation ties, and that there is a tendency towards local hierarchy. On the other hand these ties are not directed at occasional viewers. In fact, avid viewers are more likely to be chosen as conversation partners. Put in other words, the results show that TV is used as information source for interpersonal communication in everyday life (positive ego effect). However, the thereby gained information is not primarily addressed to persons who use TV less intensely. If anything, avid viewers are more likely to be addressed (positive alter and similarity effect). Hence, TV provides something to talk about with others (conversational resource) as well as a basis to be addressed by others.

On the theoretical side this study did not aim to test or extend all cited theories. However, the findings support the assumption of an interdependence of individual TV use and the social context operationalized as frequency of conversation with specific others. Therefore, it is proposed to apply the research design used in this project to analyze the relevance of the social context and its specific dynamic in different social settings, mass media types, and media contents.

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Appendix A.

Table 4.

Table 4
Variables of TV use and conversation.

	TV use					Conversations	
	W1	W2	W3	W4	Wilcoxon	W1	W4
Music TV							
Cronbach's alpha	0.90	0.89	0.89	0.89			
Mean	2.54	2.50	2.54	2.52			
Standard deviation	1.00	0.94	0.96	0.89			
% of frequent user							
Video clips	37%	29%	28%	32%	−0/+3	44%	54%
Music charts	26%	21%	20%	21%	−3/+2	35%	40%
MTV date my mom	18%	13%	12%	9%	−0/+3	14%	17%
MTV pimp my ride	18%	12%	10%	9%	−0/+6	19%	19%
MTV dismissed	15%	10%	8%	6%	−1/+2	11%	14%
Sum of Wilcoxon					−4/+16		
CSI							
Cronbach's alpha	0.91	0.93	0.93	0.92			
Mean	2.63	2.55	2.49	2.48			
Standard deviation	0.96	0.88	0.84	0.80			
% of frequent user							
CSI NY	14%	14%	14%	12%	−1/+3	22%	20%
CSI (Las Vegas)	15%	15%	16%	14%	−5/+0	22%	21%
CSI Miami	25%	21%	20%	18%	−0/+4	27%	26%
Navy CIS	10%	10%	11%	11%	−1/+0	18%	14%
Sum of Wilcoxon					−7/+7		
TV intensity							
Mean	2.98	3.01	2.91	2.86			
Standard deviation	1.35	1.43	1.43	1.49			

Note: Values in the “use” column report for each survey wave Cronbach's alpha of the two genres (Music TV and CSI) which include the programs listed. The mean and standard deviation refer to the rescaled summative index of the viewing frequency (scale from 1 to 5). For each program the percentage of students watching the respective program “frequently” or “always” is listed (% of frequent user). The “Wilcoxon” column indicates for how many classes significant down or upward changes in the frequency of using a specific program can be observed between wave one and four. This was tested by the Wilcoxon signed rank test. The “conversation” rows report the share of students which talk “sometimes” or “frequently” about the respective program in wave one and four.

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