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Unspeaking on Facebook? Testing network effects on self-censorship of political expressions in social network sites

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Abstract The aim of this study is to explore online social network exposure effects on predicting individual's willingness to self-censor political expression (WTSC) and political posting behaviors. The spiral of silence (SOS) theory is applied to the context of online social networks wherein three major network characteristics are highlighted: reduced privacy, integration of multiple social context/relationships, and increase in unanticipated exposure to different opinions. The discussion leads us to propose three possible network effects in terms of WTSC and posting behavior including 'relationship-specific fear of isolation', 'incongruence with dominant political orientation', and 'exposure to diverse opinions'. Results show that the exposure to diverse opinions is positively associated with WTSC, which in turn is associated with political posting behavior online. Interestingly, while fear of isolation from offline contacts increases WTSC, it has a positive association with actual posting behavior. We speculate to what extent the social conformity proposition of the SOS theory should persist online and call for further exploration of informational nfluence as conceptually distinct from normative influence.

Keywords Self-censorship · Spiral of silence theory · Diversity exposure · Political expression · Social network sites · Informational influence

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1 Introduction

Social network sites (SNSs) have become meaningful venues for politically relevant information, activities, and interactions. Statistics reveal that more than half of the adult population in the U. S. is exposed to political content shared by their networked friends via SNSs (Pew Research 2012). As far as political content exposure via SNSs is concerned, it seems that homophily (McPherson et al. 2001) does not always play a meaningful role in user interactions. According to the Pew Research report (2012), a good deal of shared political content on SNSs causes users to be exposed to perspectives dissimilar from their own. The majority of SNS users (73 %) often disagree with their friends' political posts, and furthermore, 38 % of users actually make surprising discoveries about their friends' political perspectives. These results resonate with recent scholarly discussions about the impact that expansive networks and high levels of sociality via social media have on diversifying political discussion networks (Brundidge 2010; Hsu et al. 2013; Kim and Park 2012).

However, an important question remains: To what extent does increased exposure to disagreements and other ideological differences contribute to users' willingness for political opinion expression in social media context? On the one hand, some studies (e.g. Kim 2011; Kim et al. 2013; Wojcieszak and Mutz 2009) suggest that exposure to heterogeneous political discussion networks may buffer online deliberation processes from selective exposure, fragmentation, and polarization effects inherent with online political communication (e.g. Bennett 1998; Hindman 2009; Stroud 2010; Sunstein 2006). Other research is contradictory, suggesting that exposure to disagreements is negatively correlated with the level of political discussion participation (Mutz 2006; Valenzuela et al. 2012). Pew Research (2012) similarly found that the majority of users (68 %) prefer to remain silent when they read disagreeable political material shared by others, and some users (22 %) intentionally decided not to disclose their political opinions due to "fear of offending others" (p. 8).

Ultimately, what social media affords is a *social space* where the visibility of others produces social influence (Kwon et al. 2014; Fadul 2014). Individual behavior may be encouraged or constrained by the presence of others. SNS-based communication reveals a novel level of sociality (Papacharissi and Mendelson 2011) characterized by reduced anonymity and increased peer-to-peer monitoring, extensive networking opportunities with offline social contacts, and greater immediacy. The more sociality SNSs afford, however, the greater interpersonal or group influence is produced. One risk is that the interplay between the medium's instrumental advantages and augmented sociality may contribute to increase social influence on the process of political belief and idea propagation wherein certain perspectives become preferentially diffused far more quickly and broadly while less favorable views might dampen into silence equally as quickly. In other words, there is a possibility that political communication in highly sociable platforms may facilitate the spiral of silence (SOS) process (Noelle-Neumann 1993). The mechanisms underlying how networked exposure to political opinions influence individuals' opinion expressions via social media has not yet been fully explored.

The current study explores how network exposure effects shape online public discussions. More precisely, our focus is on the social network antecedents that predict when users decide *not to engage* in online conversations. To do so, we introduce a non-issue specific model based on Hayes et al. (2005, 2011) measure of self-censoring willingness on SNSs. Note that we use the term *self-censorship* to refer to ordinary online users reluctance to speak out, which is different from conventional use of the term as a coercive force in journalism and free speech rights (Cook and Heilmann 2013). The psychological mechanisms of unspoken opinions have been famously discussed by one of the classic SOS public opinion theory

(Noelle-Neumann 1993). Accordingly, the paper first discusses SOS theory and revisits the social conformity proposition applied in the context of online social networks. The discussion leads us to propose a few ways that social network contingencies—exposure to multiplexed social networks, incongruence exposure, and diversity exposure—influence willingness to self-censor. We test the proposed model by empirically investigating these dynamics on Facebook.

2 Literature

2.1 Spiral of silence theory

In discussing her influential SOS theory, Noelle-Neumann (1993) shares a story about one of her students who had initially pinned a political party badge on her shirt yet soon had to take it off due to the unpopularity of that political party. The student's decision *not* to express her political orientation any longer (by wearing the badge) was drawn not from the actual unpopularity of that party but from the psychological uneasiness induced from her *perception* that her support for that party was contradictory from those around her.

The core of SOS theory emphasizes the human tendency toward social conformity regarding public opinion formation. Stated simply, the theory posits that humans fear isolation, which motivates us to observe our social environment to determine social standards and align our public behavior with observed standards (Hayes et al. 2011). Applying this group psychology mechanism, Noelle-Neumann highlights the normative power of public opinion, which is the collective product of individual opinions selectively expressed as a response to perceived social consensus. The tenet of SOS theory is to conceive public opinion as a social control artifact (Noelle-Neumann and Peterson 2004) in that individuals end up silencing their opinions because they feel that expressing their thoughts may result in social sanctions or disapproval. The perceived deviation of one's opinion from the normative view can induce fear of isolation, which affects individual speech acts (Neuwirth et al. 2007).

Numerous public opinion studies have applied SOS theory to empirical examinations. The mixed results are mainly due to different methodological approaches (Glynn et al. 1997; Scheufele et al. 2001; Yun and Park 2011). The opinion (in)congruency with the present or future opinion climate is often measured differently as well, including either dummy/trichotomous coding (e.g. Neuwirth 2000; Scheufele et al. 2001; Matthes et al. 2010) or the interval treatment of variables (e.g. Kim 2012; Ho and McLeod 2008; Petric and Pinter 2002). Likewise, as Neuwirth et al. (2007) point out, measuring fear of isolation (FI) as a variable has been inconsistent and often replaced with other similar variables such as communication apprehension. Moreover, the effect of opinion incongruence on invoking fear or isolation and reducing opinion expressions has been found contradictory depending on whether other related individual factors were addressed including opinion strength, issue interest, and attitude certainty (e.g., Matthes et al. 2010). And most importantly, the results of empirical testing are heavily dependent on issue choice, which hinders generalized assessments of theory validity across context and cultures (Matthes et al. 2012).

Regardless, the virtue of this theory lays in its attempt to link group psychology mechanisms to the societal process of public opinion formation (Price and Allen 1990). Among various psychological phenomena, SOS highlights the issue of social conformity and treats FI as a trigger of this mechanism. Some studies challenge the effect of FI, suggesting that this variable is not the only psychological hindrance of opinion expression. For example, Salmon and Neuwirth (1990) argue that different variables such as 'fear of appearing igno-

rant' account for more variance in opinion expression willingness than FI. Some criticisms, however, appear to be drawn from a somewhat narrow and literal understanding of the concept. As Noelle-Neumann and Peterson (2004) elucidate, FI is another name for generic concerns about social sanctions that would trigger social conformity intention (or, *normative influence*; Price and Allen 1990). The foundational motives beneath social conformity intention resonate with what Reiss (2004) categorizes as intrinsic motivations including the "desire for peer companionship" and "desire for approval." As far as socially conforming behaviors are produced as an outcome, fear of isolation, fear of appearing ignorant, or other similar alternative variables can be understood as being rooted in the same fundamental human motives.

2.2 Rethinking SOS effects online

Critical assessment of the theory should start with the question of whether a particular social surrounding actually invokes the fear of disapproval and whether the invoked intrinsic motivation is indeed correlated with normative pressures. These questions are especially worth re-speculation in the context of SNSs given three characteristics of the hyper-networked online: the "publicly-private" nature of SNSs as opposed to traditional discussion forums online (Papacharissi 2009), the coexistence of various types of social relations with different tie strengths (Marwick and Boyd 2010), and the greater chance to be exposed to heterogeneous opinions (Eveland and Hively 2009).

2.2.1 Reduced privacy

First of all, the blurred boundary between public- and private-ness of communication via SNSs might affect the extent to which users feel pressure to conform their online disclosures to the perceived majority. Inasmuch as *public exposure* is a key component for the fear of isolation to be triggered (Noelle-Neumann 1993), perceived communication privacy may also be an important determinant for social conformity intention. For example, Ho and McLeod (2008) compare subjects' willingness of opinion expression in face-to-face and computer-mediated settings and find that anonymity online increases the sense of privacy, which functions to "abate some of dysfunctional social-psychological influence" and "create an environment conducive for public deliberation" (p. 201). Kim (2012) also studies SOS processes and finds that conformity effects were strongest in the most public conditions. Kim (2012) additionally shows that anonymous online discussions result in the highest level of expression willingness. This suggests that although participation in forums might be regarded as 'public' activity, users construct conventional online discussion forums as "privately-public" spaces in which limited self-identity is accentuated more so than the act of publicizing opinions (Lange 2007; Papacharissi 2009).[1]

In other words, SOS effects online are contingent upon user perceptions regarding the level of private-ness (or inversely, public-ness) the technology offers. In this sense, SNS is distinctively characterized from traditional online discussion communities as "publicly-private" realms (Papacharissi 2009) where personal and private activities are *"nonymously"*

[1] The connotation of "anonymity" in this paper needs to be subtly differentiated from what Noelle-Neumann (1993) intends to mean when she used the terminology in her SOS theory. While we suggest that anonymity increases a sense of privacy by less exposing the individual's identity to the public, Noelle-Neumann (1993) discusses that anonymity in public arena encourages to participants to overlook their individuality and is more likely to result in greater conformity with crowds. Her discussion seems to be in line with many early computer-mediated communication scholars' discussion on online disinhibition effects, which takes a different view from more recent discussions on anonymity as a protector of privacy rights.

publicized, as opposed to "privately-public." For example, Facebook requires users to provide their real names when creating personal profiles (https://www.facebook.com/help/292517374180078). It is obvious then that the perceived private-ness of SNS is expected to be much lower than traditional online discussion settings. Accordingly, SOS effects are likely to be more salient on SNSs than an anonymous discussion condition.

2.2.2 Coexistence of different tie strengths

SNSs merge multiple social contexts into a single network. As Donath (2007) characterizes, SNSs are "social supernets" where users encounter and interact with social contacts in a much larger scale than offline. The supernet comprises various tie strengths that range from strangers to very intimate bonds (e.g., spouse), and various social clusters from extremely casual relationships (e.g., clubbing friends) to formal groups (e.g. a supervisor at work). Here users must negotiate between to what extent personal content should be disclosed or self-censored. According to Brandtzaeg et al. (2010), content sharing activities are disrupted due to unwanted surveillance and control from oversized networks: When a user has too large a social network, these online networks often turn into a form of "big brother," restricting sharing (p. 1022). Similarly, Das and Kramer (2013) show that Facebook users intentionally delete their own postings more frequently when their online network size is larger and comprised of many distinct groups. Brandtzaeg et al. (2010) and Das and Kramer's (2013) findings on the positive association between network size and self-censoring behaviors are contradictory to the conventional understanding (offline basis) that a smaller social network is usually more cohesive thus produces stronger normative social influence than a larger network (Coleman 1988). Accordingly, our first set of questions address the effect of network size, positing the competing hypotheses.

H1 Because a smaller social network produces greater normative social influence, online social network size has (a) a negative relationship with willingness to self-censor and (b) a positive relationship with political posting behaviors.

H2 Because a larger social network produces greater level of social surveillance, online social network size has (a) a positive relationship with willingness to self-censor and (b) a negative relationship with political posting behaviors.

Insofar as self-disclosure is selective based on audience scope (Marwick and Boyd 2010), SOS mechanisms on SNS fall into a network dilemma. For example, whereas college students may feel comfortable expressing prochoice attitudes to their college friends, fear of isolation may restrict this behavior if prochoice attitudes are disclosed to a pastor or priest. The fact that political expressions are visible to not only college friends but also church members may likely restrict his or her disclosive behavior. In other words, online social networks are characterized as composed of multiple social relational contexts with varied tie strengths that may produce different levels of fear of isolation and subsequently normative influence. Accordingly, users in online social networks need to be aware of information propagating across different social spheres and consciously make decisions about what to share. We explore whether different social relationships maintained in SNS convey different level of fear of isolation, and how the fear of isolation generated by different relationships influences users willingness to self-censor and political posting behaviors:

R1: Do different social relationships maintained in SNS invoke different level of fear of isolation?

R2: How does fear of isolation from different social relationships ("relationship-specific FI") affect (a) willingness to self-censor and (b) political posting behaviors in SNS?

2.2.3 Exposure to heterogeneous opinions: incongruence versus diversity

The unintended exposure situation described above offers a third rationale to rethink SOS effects on SNSs, along with two additional conceptualizations of 'exposure to different opinions' as either exposure to 'incongruence' or to 'diversity' (Eveland and Hively 2009). On the one hand, the enhanced visibility of one's own opinions beyond intended audiences creates opportunities for unintended exposure to others with discrepant views and opinions (Kim 2011). Indeed, Pew Research (2012) reports that more than one third of SNS users who posted political content have ever perceived the existence of incongruent political views in SNS. Noelle-Neumann (1993) highlights that such *incongruent* opinion climate can result in reluctance to share political thoughts. Individuals who perceive a high level of incongruence from the majority in SNS social network should be reluctant to share political comments due to possible negative consequences:

H3 Perceived incongruence with others' political view has (a) a positive relationship with willingness to self-censor and (b) a negative relationship with political posting behaviors in SNS.

On the other hand, exposure to different opinions can alternatively result in users perceiving opinion *diversity*: The hyper-networked environment may increase the chance of encountering heterogeneous views, which may make users' attempt for selective attentions less effective (Garrett 2009). As a result, a user can sample various opinions and may appreciate these diverse beliefs. This diversity claim resonates with the "inadvertency thesis" evidenced by Brundidge (2010) and Kim et al. (2013, p. 500), which suggests that social media use is positively associated with discussion network heterogeneity. These studies, however, do not explain whether network heterogeneity reduces fear of isolation or increases willingness to express opinions.[2]

Some scholars have even argued that diverse opinion climate actually decreases the participation in political discussions (Mutz 2006; Eveland and Hively 2009; Valenzuela et al. 2012). The negative association between diversity exposure and political discussion participation can be explained as *informational* influence effects: Individuals become less determined about their political beliefs when faced with divergent opinions, and more cautious in publicly asserting their positions due to the increased uncertainty. Price and Allen (1990) suggest that this type of influence is neglected in SOS research and call for distinguishing informational influence from normative or conformity effect on public opinion formation. Given the possible informational influence and subsequent hesitancy of opinion assertion, we hypothesize that diversity exposure should negatively influence political expressions.

H4 Perceived opinion diversity has (a) a positive relationship with willingness to self-censor and (b) a negative relationship with political posting behaviors in SNS.

In sum, the relationship between social influence and the willingness to express opinions (or censorship) proposed in SOS theory is worth revisiting today. The three major characteristics of SNS platforms—reduced privacy, the concurrence among multiple social contexts,

[2] While the zero-inflated poission (ZIP) model is one way to take account for overdispersion, Allen (2012) points out that the negative binomial model not only usually fits better than a ZIP model but also takes a much simpler approach to estimate and interpret. For more details, see Allen (2012). Logistic Regression Using SAS: Theory and Application (2nd Ed.).

and unanticipated exposure to heterogeneous opinions—can affect the extent to which users are motivated for social conformity and the need to self-censor. As hypothesized above, different outcomes are conceivable, either to increase or to reduce the conformity effect on political opinion censoring willingness. Moreover, the increased willingness to self-censor might affect actual political expression behavior. Thus,

H5 Willingness to self-censor has a negative relationship with political posting behavior.

3 Methods

3.1 Data

We chose Facebook as an exemplary SNS community for exploration. A convenience sample of college students ($N = 403$) in Communication at a large public university in the eastern United States was recruited to participate. Participants were offered research credit for their voluntary participation. An announcement was made in class to approximately 475 students by one of the researchers. Those who do not use Facebook were not considered. These students were offered alternative venues for research credit. Online survey was administered and survey items were presented in randomized order to prevent any ordering effect. The full questionnaire is available in Appendix.

3.2 Measures

3.2.1 Independent variables

(1) Network size: Respondents were asked to indicate how many friends they have in their Facebook network. The distribution of responses was skewed, and the variable was log-transformed.
(2) Relationship-specific FI: We modified Neuwirth et al.'s (2007) FI question wording and applied it to nine relationship categories suggested by Johnson et al. (2012) which include 'immediate family', 'extended family', 'coworker', 'high school/college friends', 'best friend' 'a friend of a friend', 'someone never met offline', 'someone a user socializes with offline', and 'a stranger who is not in your Facebook friend network.' Two questions were asked with 6-point scales regarding how uncomfortable or concerned they would be if their Facebook friends in each relational category disagreed with them in a comment.
(3) (In)congruence with others' political view in Facebook: We modified Ho and McLeod's (2008) procedure to evaluate the level of exposure to congruent opinions. First, we asked respondents about their political predispositions with a 6-point scale (1 = very strong democrat/liberal perspectives, 6 = very strong republican/conservative perspectives). Second, respondents were asked about their perceptions about the political orientation of the majority of their Facebook contacts based on a 6-point scale. These scales were dichotomized such that values ranging between one and three were assigned '−1,' and values between four and six were assigned '1.' As suggested by Ho and McLeod (2008), we then multiplied a respondent's own orientation with the dichotomized score of the current Facebook opinion climate. As a result, positive scores reflect congruence exposure, and negative scores towards incongruence exposure, with the absolute value representing the intensity of either congruence or incongruence exposure.

(4) Perceived opinion diversity in Facebook: Eveland and Hively (2009) elucidate the conceptual difference between "dangerous discussions"—discussions with incongruent viewpoint holders, and "diverse discussions"—having various viewpoints in an individual' discussion network. While we adapt Eveland and Hively's (2009) diversity measure, note that we measure the level of reported *exposure* to political posts that others share rather than actual engagement in discussions with them. Stated in detail, we first asked respondents (on a 7-point scale) to what extent political contents shared by their Facebook friends represent either democrat or republican positions where 1 = democrat only, 4 = balanced, 7 = republican only). Then, we rescaled this measure to reflect the proportion of perspectives. For example, each end point means that users are exposed to only one perspective, resulting in 1:0 or 0:1. The mid-point (=4), on the other hand, indicates that users are exposed to equal portions of each perspective, or the greatest level of diversity, resulting in 0.5:0.5. After rescaling, we computed Simpson's D score, as proposed by Eveland and Hively (2009, p. 208), by using the proportions. Simpson's D is measured as

$$D = 1 - \sum p_i^2$$

where p_i is the proportion of democrat and republican positions. This computation results in a diversity index ranging from zero to 0.5 where zero indicates a complete lack of diversity and 0.5 indicates the most balanced exposure to both democrat and republican positions.

3.2.2 Dependent variables

(1) Willingness to self-censor (WTSC): Hayes et al. (2005) measure of WTSC was adapted to fit Facebook. Each statement was presented with the guideline for participants to record their agreement based on their first impressions without spending too much time on each statement ($\alpha = .84$). Eight items were used employing a 7-point Likert scale with higher scores indicating greater willingness to self-censor.
(2) Political posting behaviors: An open-ended question was asked about participants' political expression behaviors. Respondents were asked to count the number of politics-related posts (e.g. news articles, opinions, photos, videos) they had made on Facebook during the past month.

3.2.3 Control variables

One of the important variables known to affect WTSC is individual's personality toward feeling FI (Hayes et al. 2011; Neuwirth et al. 2007). Therefore, we controlled the 'FI personality trait' by adapting Hayes et al. (2011). Their measurement includes five items ($\alpha = .90$). We modified the wording to fit Facebook and asked respondents about their agreement on seven-point scale items. Exemplary questions are: "It is scary to think about not being invited to social gatherings by people in my Facebook network," "One of the worst things that could happen to me is to be excluded by people in my Facebook network". In addition, 'opinion climate observation' was controlled considering that SOS literature has suggested positive associations between the opinion climate observations and opinion expressions (Hayes et al. 2011). Opinion climate observation within Facebook network was measured by asking respondents their agreement with four items on a 7-point scale pertaining to how much they pay attention to political information, news, and opinions shared by others ($\alpha = .93$). Lastly, demographic variables including gender, age and Facebook use were included.

4 Results

4.1 Descriptive analyses

After data cleaning, we retained 328 responses for the analyses: Users with no awareness of their own political orientation should not be included in the analyses because some variables would be valid only when respondents were mindful of their political stance. Therefore, we included the 'don't know' option as a possible response to the question about the respondent's political orientation, and excluded the cases. Outliers and missing values were also removed. As a result, 75 cases were excluded from further analyses. Demographic distributions are as follows: Age with $M_{age} = 20.00 (SD_{age} = 2.83)$; 45.7 % male; Facebook visit frequency with $Median_{visit} = 6$ (more than once a day); Facebook update frequency with $Median_{update} = 3$ (*a few times a month or less*). The mean score of FI personality trait was $M_{fi} = 2.88$ out of seven points ($SD_{fi} = 1.46$). This score reflects that FI personality trait may be shown weaker in Facebook context than offline, when compared to the mean score of FI measured by a previous offline study with undergraduate sample from a large university in the U.S. (Hayes et al. 2011), which was 2.96, measured on a five point scale.

The mean of WTSC in Facebook was $M_{wtsc} = 3.97 (SD_{wtsc} = 1.12)$ out of a seven point scale. The mean score of incongruence exposure was $M_{current} = .15 (SD_{congr} = .62)$, which suggests that our respondents perceive slightly more congruence than incongruence in the opinion climate on Facebook. The average diversity exposure rate was $M_{div} = .37 (SD_{div} = .17)$. On average, users had 775.61 friends with log-transformed $M_{size} = 6.31$ (and $SD_{size} = .91$), and posted politics-related content 2.14 times ($SD_{post} = 9.99$, maximum count = 100). Summary, descriptive statistics, and zero-order correlations are presented in Table 1.

4.2 Relationship-specific FI

To explore the research questions (RQ1 and RQ2), we conducted principal components factor analysis with Varimax rotation solution to identify the underlying structure of the 18 items addressing relationship-specific FI. The analysis yielded two factors with an eigenvalue greater than 1.0, explaining 66.77 % of the variance. Table 1 presents the factor loading of the items. The first factor pertains to the relationships that are maintained from offline social contexts, while the second factor includes tenuous ties that users either have no preexisting interactions or knows only indirectly through their friends. The items in each factor revealed high reliability score, $\alpha = .93$ for Factor 1 and $\alpha = .89$ for Factor 2, and were combined into "*fear of isolation from offline contacts (FIOC)"* and *"fear of isolation from tenuous ties (FITT)*" variables. The mean score of FIOC ($M_{fioc} = 3.27$, $SD_{fioc} = 1.40$) was higher than FITT ($M_{fitt} = 2.90$, $SD_{congr} = 1.58$), indicating that users tend to be more concerned about the perceptions of social contacts within their personal networks than out of network contacts (Table 2).

4.3 OLS regression modeling

To explore network exposure effects on WTSC, a series of ordinary least square (OLS) regression models were run. The final model explained 25.7 % of the total variance, $F(12, 315) = 9.09$, $p < .001$, with an additional 7.3 % variance explained by adding network exposure variables, $F(4, 190) = 2.834$, $p < .05$ (Table 3).

Among the control variables, Facebook visit and update frequency were significant, $\beta = .13$, $t = 2.49$, $p < .05$, and for update, $\beta = -.12$, $t = -2.21$, $p < .05$, respectively. FI

Table 1 Means, standard deviations, and zero-order correlations ($N = 328$)

	Sex	Age	FRQV	FRQU	OCO	FI	NS	FIOC	FITT	CONCO	DE	WTSC	PB
Sex	–												
Age	−.13*	–											
FRQV	.12*	.02	–										
FRQU	.05	.10	.30	–									
OCO	.06	.12*	.26**	.33**	–								
FI	−.03	−.01	.17**	.16**	.10	–							
NS	.08	−.23**	.09	−.07	−.02	−.10	–						
FIOC	.05	−.01	.11	.06	.11*	.41**	−.12*	–					
FITT	.01	−.04	.08	.06	.02	.31**	−.08	.28**	–				
CONPV	.01	−.05	.05	.04	−.02	.04	−.01	.01	.06	–			
DE	.02	−.07	−.02	−.03	−.20**	.09	.01	.08	.08	−.07	–		
WTSC	.07	.01	.19**	.01	.07	.39**	−.08	.32**	.31**	.09	.13*	–	
PB	.01	.01	.12	.23**	.17**	−.03	.02	.05	.05	.08	−.08	−.06	–
M	1.54	20.00	5.66	3.25	3.62	2.88	6.31	3.27	2.90	0.15	0.37	3.97	2.14
SD	0.50	2.83	1.53	1.11	1.62	1.46	0.91	1.40	1.58	0.62	0.17	1.11	9.99

FEQV Facebook use frequency, *FRQU* Facebook update frequency, *OCO* opinion climate observation in Facebook, *FI* fear of isolation in Facebook, *NS* network size, *FIOC* fear of isolation from offline contacts, *FITT* fear of isolation from tenuous ties, *CONPV* congruence with others' political view in Facebook, *DE* diversity exposure, *WTSC* willingness to self-censor, *PB* posting behavior

Means and standard deviations reported in this section are based on data after the transformation.

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

Table 2 Factor analysis of fear of isolation from multiplexed network environment ($N = 328$)

Rotated component matrix			
	M (SD)	1 FIOC	2 FITT
Best friend 1	3.45 (2.09)	**0.835**	−0.124
Immediate family 1	3.56 (2.01)	**0.833**	−0.141
Best friend 2	3.46 (2.16)	**0.828**	−0.19
Immediate family 2	3.57 (2.05)	**0.799**	−0.198
School friends 2	3.08 (1.72)	**0.786**	0.176
School friends 1	3.10 (1.72)	**0.782**	0.239
Extended family 1	3.32 (1/75)	**0.782**	0.173
Extended family 2	3.22 (1.80)	**0.758**	0.091
Someone socializing offline 2	3.12(1.65)	**0.664**	0.331
Coworker 2	3.21 (1.65)	**0.658**	0.357
Coworker 1	3.17 (1.70)	**0.616**	0.51
Someone socializing offline 1	3.03 (1.73)	**0.605**	0.452
Someone never met offline 1	2.77 (1.99)	0.008	**0.866**
Someone never met offline 2	2.89 (2.09)	−0.025	**0.846**
A stranger (public) not in my FB network 1	2.81 (2.10)	−0.039	**0.846**
A stranger (public) not in my FB network 2	2.89 (2.16)	−0.099	**0.845**
A friend of friend 1	3.00 (1.74)	0.492	**0.65**
A friend of friend 2	3.02 (1.73)	0.453	**0.613**

Bold values signify the items loaded under the same factor
Extraction method: principal component analysis, rotation; varimax with Kaiser normalization; question wording 1 = "how concerned", 2 = "how comfortable"
FIOC fear of isolation from offline contacts, *FITT* fear of isolation from tenuous ties

personality trait was also associated with WTSC, $\beta = .26, t = 4.63, p < .001$, indicating that users who were more concerned about social isolation tended to be more willing to self-censor their political opinions.

The results also show that both FIOC ($\beta = .14, t = 2.56, p < .05$) and FITT ($\beta = .17, t = 3.29, p < .01$) were positively associated with WTSC even after controlling for the effects of FI. Among other variables including network size, incongruence, and diversity exposures, only diversity exposure was positively associated with WTSC, $\beta = .10, t = 1.992, p < .05$. Therefore, only the hypothesis H4a was supported in terms of WTSC as a dependent variable.

4.4 Negative binomial regression modeling

In addition to WTSC, we examined network effects on political posting behavior. Political posting behavior was measured as a count variable (number of political posts). The data included a large portion of participants with zero posting frequency, which subsequently demonstrated over-dispersion (VMR > 1)[2] in the data. Therefore, a negative binomial regression model with robust estimate was performed instead of poisson regression.

An omnibus test indicated that the overall model showed a significant improvement over a null model, with a likelihood ratio $\chi^2(12) = 233.83, p < .001$. Interestingly, the results suggest that a few variables that were significantly associated with WTSC did not show significant effects on actual posting behaviors. In particular, among control variables, the

Table 3 OLS regression results predicting WTSC on Facebook ($N = 328$)

Model	Coefficients			t
	B	SE	Beta	
1				
(Constant)***	2.376	0.504		4.717
SEX	0.169	0.115	0.076	1.473
AGE	0.011	0.020	0.027	0.534
FRQV*	0.101	0.040	0.139	2.561
FRQU*	−0.114	0.055	−0.114	−2.054
OCO	0.019	0.037	0.028	0.520
FI***	0.294	0.039	0.385	7.471
$R^2_{Adj} = .169$, $F(6, 321) = 12.05$, $p < .001$.				
2				
(Constant)**	1.940	0.709		2.735
SEX	0.147	0.111	0.066	1.321
AGE	0.013	0.020	0.034	0.665
FRQV*	0.096	0.039	0.132	2.487
FRQU*	−0.119	0.054	−0.118	−2.213
OCO	0.031	0.037	0.045	0.836
FI***	0.198	0.043	0.259	4.632
NS	−0.044	0.063	−0.704	0.482
FIOC*	0.112	0.044	0.140	2.550
FITT**	0.121	0.037	0.172	3.291
CONPV	0.133	0.088	0.074	1.514
DE*	0.673	0.338	0.100	1.992
$R^2_{Adj} = .229$, $F(11, 316) = 9.82$, $p < .001[R^2_{chg} = .071$, $F_{chg}(5) = 6.01$, $p < .001]$				

All measures consider Facebook context; dependent variable = the willingness to self-censor
FEQV Facebook use frequency, *FRQU* Facebook update frequency, *OCO* opinion climate observation in Facebook, *FI* trait-like fear of isolation in Facebook, *NS* network size, *FIOC* fear of isolation from offline contacts, *FITT* fear of isolation from tenuous ties, *CONPV* congruence with others' political view in Facebook, *DE* diversity exposure
$^*p < .05$; $^{**}p < .01$; $^{***}p < .001$

effects of FI (as a trait) and Facebook visit frequency were *ns*. Instead, opinion climate observation showed a positive association with posting behavior, $b = .369$, Wald $\chi^2(1) = 12.88$, $E(b) = 1.47$, $p < .001$. The percent change in the incident rate of posting behaviors was 47 % for every unit increase in opinion climate observation.

Among the hypothesized predictors, network size, congruence exposure, and diversity exposure all demonstrated no relationship with posting behavior. Instead, WTSC significantly predicted posting behavior, $b = -.52$, Wald $\chi^2(1) = 5.34$, $E(b) = .60$, $p < .01$. Therefore, only H5 was supported. For every unit increase in WTSC, the percent change in the incidence rate of posting behavior decreased by 67 %. There was also a significant effect of FIOC on posting behavior, but not for FITT. As opposed to our expectation, however, FIOC effectively increased the likelihood of posting behavior: for every unit increase in FIOC, the percent change in the incidence rate of posting behavior increased 31 %, $b = .27$, Wald $\chi^2(1) = 6.41$, $E(b) = 1.31$, $p < .01$ (Table 4).

5 Conclusion and discussion

SNSs have become mainstream channels for the propagation of political information and opinion (Barnett 2011; Park 2014; Otterbacher et al. 2013). This study attempted to under-

Table 4 Negative binomial regression model to predict posting behaviors on Facebook ($N = 328$)

Parameter estimates									
Parameter	B	SE	95 % Wald CI		Hypothesis test		Exp(B)	95 % Wald CI for Exp(B)	
			Lower	Upper	Wald χ^2	df		Lower	Upper
(Intercept)	−2.58	2.53	−7.55	2.38	1.04	1.00	0.08	0.00	10.83
Sex	−0.22	0.32	−0.84	0.40	0.48	1.00	0.80	0.43	1.49
Age	−0.05	0.04	−0.13	0.04	1.23	1.00	0.95	0.88	1.04
FRQV	0.16	0.10	−0.05	0.36	2.21	1.00	1.17	0.95	1.44
FRQU*	0.38	0.15	0.08	0.68	6.37	1.00	1.46	1.09	1.96
OCO***	0.39	0.11	0.17	0.60	12.19	1.00	1.47	1.18	1.83
FI	0.02	0.12	−0.22	0.26	0.02	1.00	1.02	0.80	1.30
NS	0.15	0.19	−0.23	0.53	0.61	1.00	1.16	0.79	1.71
FIOC*	0.27	0.11	0.06	0.48	6.40	1.00	1.31	1.06	1.62
FITT	0.19	0.10	0.00	0.38	3.85	1.00	1.21	1.00	1.46
CONPV	0.37	0.26	−0.14	0.89	2.00	1.00	1.45	0.87	2.44
DE	−0.88	0.91	−2.67	0.91	0.92	1.00	0.42	0.07	2.49
WTSC*	−0.52	0.22	−0.95	−0.09	5.54	1.00	0.60	0.39	0.92

All measures consider Facebook context; dependent variable = political posting frequency
FEQV Facebook use frequency, *FRQU* Facebook update frequency, *OCO* opinion climate observation in Facebook, *FI* trait-like fear of isolation in Facebook, *NS* network size, *FIOC* fear of isolation from offline contacts, *FITT* fear of isolation from tenuous ties, *CONPV* congruence with others' political view in Facebook; DE = diversity exposure, *WTSC* willingness to self-censor
* $p < .05$; *** $p < .001$

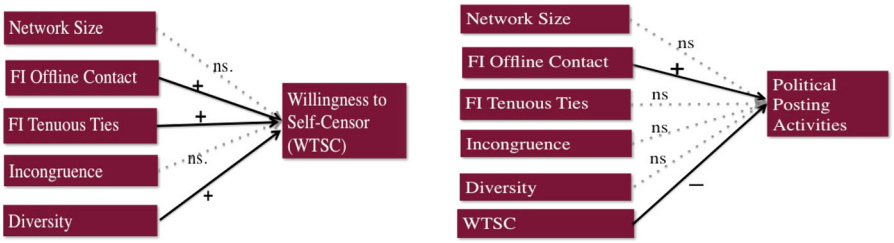

Fig. 1 The summary of results: **a** shows the result from OLS modeling with WTSC as a dependent variable and **b** shows the result form negative binomial regression modeling with posting behaviors as a dependent variable

stand to what extent social influence is shaping the public opinion landscape in social media by revisiting SOS theory. We suggest that SOS propositions are worth revisiting in recent online networks given socio-technological characteristics of SNS such as publicly privateness (Papacharissi 2009), convergence of multifarious social contexts and relational qualities (Rainie and Wellman 2012), and greater opportunity for inadvertent exposure to divergent political views (Brundidge 2010; Kim et al. 2013). Drawing upon the literature reviewed above, we explored the effects of 'network size', 'relationship-specific FI', 'incongruence with others' political views' and the 'perceived opinion diversity' on Facebook users' WTSC and subsequent posting behaviors. Figure 1 summarizes the results of the study.

The most notable finding is that relationship-specific FI, which was further defined into FIOC and FITT, and diversity exposure contributed to increased WTSC, while other network variables did not. In particular, the incongruence exposure, which has been importantly highlighted by original SOS theory as a cause for social conformity, was found to exhibit no significant relationship with WTSC. Instead, the significant diversity effect is in line with existing arguments that exposure to diverse political views within political discussion networks does *not* necessarily enhance political communication activities (Eveland and Hively 2009; Knoke 1990; Mutz 2002).

On the one hand, the significant diversity exposure effect may reflect the possibility of informational influence within SNSs, as opposed to normative pressures: Perceived variability in perspectives and opinions may induce informational ambiguities and uncertainties about current political affairs, leading users to hesitate publicly claiming specific political positions as their own when they encounter disagreements or conflicting information online. In this sense, WTSC can be interpreted as a product of informational inconclusiveness rather than as a product of social pressure toward conformity. This conclusion resonates with Price and Allen's (1990) recommendation to differentiate the psychological mechanism for informational influence from normative influence on public opinion formation.

On the other hand, however, it is also possible that borrowing a preexisting measure of incongruence might not be an appropriate approach to examine generalizable patterns of self-censorship. If the measurement that this study borrowed from extant SOS studies is only applicable to topic-specific cases and not to a general pattern model, new measurements need to be developed for macroscopic research and to better operationalize perceived deviance from majority viewpoints. It is also conceivable that other unexamined yet important factors such as political interest and political knowledge could have a confounding effect in predicting WTSC. For example, one of the control variables, 'opinion climate observation,' was significantly associated with political posting behaviors. Although we interpret that this variable may be closely related with the users' political interest or knowledge, it is at best a proxy variable. In other words, the incongruence measurement is worth revisiting in relation with other possible interrelated variables.

While network size was not significantly associated with the outcome variable, relationship-specific FIs influenced the level of WTSC even after controlling the variable FI as a personality trait. In particular, FITT effect was larger ($\beta = .17$) than FIOC ($\beta = .14$) when it comes to WTSC as a dependent variable. However, FITT turned out non-significant regarding the behavioral dependent variable. Moreover, further investigation indicates that our results are counter-intuitive when it comes to posting behavior. The results indicate that FIOC *increased* political posting behaviors. The results seem contradictory from the tenets of original SOS theory that outline the role of FI in dampening opinion expressions. While our results are in contrary to this point, one possible interpretation is such that political posting activities should be regarded as part of everyday online social networking practice through which users signal their presence towards their personal networks in order to be continuously connected with them. Then, it is possible to interpret that FIOC is linked to the fear of "missing out" (FOMO; Rainie and Wellman 2012). That is, the volume of political postings may be due to the function of this more abstract form of social fear. Such interpretation is reasonable when our results are understood in conjunction with the effects of Facebook update frequency, which was also positively related to political expression behaviors.

However, another possible explanation may be attributed to the limited operationalization of posting behaviors. First, we did not distinguish explicit opinion expressions from rather neutral political posting such as simply sharing news articles or clicking "like" button. Also, we did not tap into selective posting—that keeps posts visible only to particular

audiences. In order to examine more accurately whether relationship-specific FI induces normative influence on political posting behaviors, much more work needs to be done for clearer conceptualization and operationalization of various modalities of political posting behaviors.

Some of the results cast a question about the linkage between perceptional variable and behavioral outcome. Specifically, diversity exposure was significantly associated with WTSC but not with political posting behavior. Similarly, one of the important control variables suggested by spiral of silence theory, FI as a personality trait, was associated only with WTSC but not with actual posting behaviors. While there is no direct effect of these perception-based variables on behavioral outcomes, the result of WTSC being strongly associated with the posting activities suggests the possibility of an indirect pathway from user perceptions (the diversity exposure as well as FI as a personality trait) to psychological effect (WTSC) then to behavioral consequences (posting activities). In other words, it is conceivable that WTSC plays a mediating role for some network exposure effects in explaining political content sharing online. Future research is recommended to design a path model to verify these direct and indirect relationships.

To conclude, the results of this study generally suggest that social relational environment in SNS produces not just normative pressures that resemble offline conversational settings but also informational influences on political opinion expressions. Fundamental human desires for social approval (Reiss 2004) manifest themselves via online social networks, which may influence the way we manage self-presentation and the extent to which we exchange our opinions, thoughts, and feelings. Simultaneously, the exposure to diverse perspectives visible in the expansive online social networks may help users to self-reflect their own viewpoints and ultimately nurture deliberative online discussion culture in the long run. The findings of the current study may not be generalizable to the entire population of SNSs users due to the use of an undergraduate sample and a particular social network site, Facebook. That is, the findings should not be taken wholesale and applied to a dissimilar online environment. Further study should seek to replicate and extend the current study with other Internet-based SNSs and with more diverse samples.

Acknowledgments We are thankful to reviewers and the editor for constructive comments.

Appendix: Survey questionnaires

1. How frequently do you visit Facebook?

   (1) Never used Facebook
   (2) Once or twice a year
   (3) A few times a month or less
   (4) Weekly
   (5) Daily
   (6) More than once a day (but less than 5)
   (7) Five to 10 times a day
   (8) Too many times to count

2. How frequently do you update your status (or profile) on Facebook?

   (1) Never updated my status or profile
   (2) Once or twice a year.
   (3) A few times a month or less

(4) Weekly
(5) Daily
(6) More than once a day
(7) More than five times a day
(8) Too many times to count

3. About how many friends do you have on Facebook ? (Open-ended)
4. FI as a personality trait (7-point scale)

(1) It is scary to think about not being invited to social gatherings by people in my Facebook network
(2) One of the worst things that could happen to me is to be excluded by people in my Facebook network
(3) It would bother me if no one in my Facebook network wanted to be around me
(4) I dislike feeling left out in Facebook
(5) It is important to me to fit into the Facebook group I am with

5. Observation of Opinion Climate in Facebook (7-point scale)

(1) I check out political news or video if they are updated from my Facebook newsfeed
(2) I pay attention to political opinions/thoughts posted by others in my Facebook network
(3) I pay attention to political activities that my Facebook friends posts
(4) I read political discussion posts on Facebook if they are updated

6. FI from Multiplexed Social Networks: Imagine that you are interested in a recent controversial social issue (for examples, gun control, government surveillance, gay marriage, marijuana legalization, debt ceiling debate, universal health care, foreign policy over Syria, etc.). You shared your opinion about the issue on your Facebook wall. Suppose that you discover that many of Facebook friends have an opposite standpoint to yours, including your family members, close friends, and even strangers. We want to know how you would feel if each of these kinds of Facebook friends, listed below ("a member of your immediate family", "a member of your extended family", "a coworker", "your high school/college friends", "your best friend", "a friend of a friend", "someone you've never met offline", "someone you socialize offline", "a stranger who is not in your Facebook friend network"), read your post about that controversial social issue and disagreed with you in a comment of their own.

(1) For each kind of Facebook friend listed below, please indicate how comfortable you would be if they disagreed with you in a comment of their own (a 7 point scale)
(2) For each kind of Facebook friend listed below, please indicate how concerned you would be about receiving disagreement comments (7-point scale)

7. WTSC: For each statement, please indicate your agreement based on 1–7 point scale. Don't spend too much time on any one question. Simply record your first impression.

(1) On Facebook, it is difficult for me to express my opinion if I think others won't agree with what I post.
(2) On Facebook, there have been many times when I have thought others in my social networks were wrong but I didn't let them know.
(3) On Facebook, when I disagree with others' opinions, I'd rather go along with them than argue about it.

(4) On Facebok, it is easy for me to express my opinion around others who I think will disagree with me (R)
(5) On Facebook, I'd feel uncomfortable if someone asked my opinion and I knew that he or she wouldn't agree with me.
(6) On Facebook, I tend speak my opinion only around friends or other people I trust.
(7) On Facebook, it is safer to keep quiet than publicly speak an opinion that you know most others don't share.
(8) On Facebook, if I disagree with others, I have no problem letting them know (R).

8. Political Expression Behaviors: During the past month, approximately how many politicrelated posts do you think you posted on Facebook? (e.g. news article, opinions, photos, videos, etc) (Open-ended)
9. Exposure Measures

(1) What is your political orientation? (6-point scale)
(2) Apart from your current political orientation, which political party do you believe the majority of your FB friends are leaning toward? (6-point scale)
(3) Among these political posts on Facebook, which political party perspective was more strongly represented? (7point scale)

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