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3   Effects of Cultural Tightness-Looseness and Social Network Density on Expression of

4   Positive and Negative Emotions:

5   A Large-Scale Study of Impression Management by Facebook Users

6   Pan Liu and David Chan

7   Singapore Management University

8   Lin Qiu

9   Nanyang Technological University

10   William Tov

11   Singapore Management University

12   Victor Joo Chuan Tong

13   Agency for Science, Technology and Research

21   Corresponding Author: Pan Liu, Behavioural Sciences Institute, Singapore Management
22   University, 81 Victoria Street, Level 9, Singapore 188065, Singapore. Email:
23   pliu@smu.edu.sg.
24
25
26

1   Abstract

2   Using data from 13,789 Facebook users across U.S. states, this study examined the effect of

3   societal-level cultural tightness-looseness and its interaction with individuals' social network

4   density on impression management (IM) in terms of online emotional expression. Results

5   showed that individuals from culturally tight (vs. loose) states were more likely to express

6   positive emotions and less likely to express negative emotions. Meanwhile, for positive

7   emotional expression, there was a tightness-looseness by social network density interaction

8   effect. In culturally tight states individuals with dense (vs. sparse) networks were more likely

9   to express positive emotions, while in culturally loose states this pattern was reversed. For

10   negative emotional expression, however, no such interaction was observed. Our findings

11   highlight the influence of cultural norms and social network structure on emotional

12   expressions as IM strategies.

13   *Keywords*: impression management, emotional expression, cultural tightness-looseness,

14   social network density

1 **Effects of Cultural Tightness-Looseness and Social Network Density on Expression of**

2 **Positive and Negative Emotions:**

3 **A Large-Scale Study of Impression Management by Facebook Users**

4 Research has shown that how people interact socially with others and maintain good

5 relationships with others is important to their social well-being (Bloomberg, Meyers, &

6 Braverman, 1994). During social interaction, individuals often adopt impression management

7 (IM) strategies to establish and uphold a desired personal image based on their social roles, in

8 accordance with social norms (Leary & Kowalski, 1990). In recent decades, as online

9 interactions have become an important part of daily life, IM behaviors previously observed in

10 face-to-face interaction have also manifested in computer-mediated communication (Walther,

11 Van Der Heide, Kim, Westerman, & Tong, 2008).

12 The extant studies on IM are focused on how the deployment of IM strategies varies

13 across persons (e.g., personality; Rosenberg & Egbert, 2011) or institutions (e.g.,

14 organizational culture; Bolino, Long, & Turnley, 2016), and relatively few studies have

15 explored how IM behaviors may vary across societal cultures such as across nations or

16 provinces within a nation (Bolino et al., 2016).

17 The prevalence of IM is likely to depend on social norms, which vary across societies.

18 An important research question that has not received sufficient attention is how IM strategies

19 are adopted and used in different societal contexts with regard to cultural norms. Thus, he

20 current research investigates how IM behaviors are influenced by cultural norms at the

21 societal level. Specifically, we examined IM behaviors in the expression of emotion by

22 Facebook users across states in the U.S. and how such expressions may be moderated by the

23 level of cultural tightness-looseness in each state. Findings from this research may advance

24 our knowledge of impression management in social media and extend to a better cross-

25 cultural understanding of individuals' daily communication in general.

1 **Impression Management and Online Emotional Expression**

2   Impression management (IM) is a self-regulatory process in which a person adjusts

3 his or her behavior or appearance to influence the perceptions of other people about him or

4 her (Leary & Kowalski, 1990). Individuals use IM strategies to present themselves to others

5 in a way that satisfies their needs and goals, which is usually based on their social roles, in

6 accordance with social norms and what they perceive as others' preferences and values.

7   Past research has found that IM strategies may be acquisitive or protective (Arkin,

8 1981). Acquisitive IM aims to seek approval and promote a desirable image by presenting

9 positive aspects of oneself, whereas protective IM aims to avoid disapproval and rejection

10 from the audience by concealing negative aspects. IM behaviors are pervasive in everyday

11 interactions and important in developing social relationships and gaining social support.

12 Understanding how individuals adopt and apply IM strategies plays an important role in

13 advancing our knowledge of the interpersonal processes (Leary & Kowalski, 1990).

14   With the rise of social media, online interactions have become an important part of

15 daily life, and IM behaviors are pervasive in computer-mediated communication (CMC).

16 According to the hyperpersonal interaction model (Walther, 1996), CMC lacks non-verbal

17 cues such as facial expressions and gestures available in face-to-face communication, and

18 therefore it allows individuals to easily manipulate their self-presentation to create a desirable

19 self-image. Users of social networking sites (SNSs), such as Facebook, have been found to

20 selectively choose physically more attractive photos as their profile pictures (Walther, Van

21 Der Heide, Kim, Westerman, & Tong, 2008) and use photos with others to create an active

22 social image (Zhao, Grasmuck, & Martin, 2008).

23   Moreover, studies show that social media users selectively disclose their emotional

24 experiences and that IM is a source of motivation for selective disclosure. In particular, users

25 prefer to display significantly more positive relative to negative emotions on Facebook than

1 in real life (Bazarova, Taft, Choi, & Cosley, 2013; Lin, Tov, & Qiu, 2014). This is consistent

2 with findings that positive emotional expressions often yield a good impression of one's

3 emotional well-being (Ekman & Friesen, 1975), while negative emotional expressions can

4 lead to an impression of low self-control and weak emotion regulation capability (Gross,

5 Richards, & John, 2006). The frequency of positive emotion words was about twice as much

6 as that for negative emotion words (Liu, Tov, Kosinski, Stillwell, & Qiu, 2015). Importantly,

7 it is found that positive emotional expression was related to users' IM concerns (Bazarova,

8 2012; Lin et al., 2014) rather than their actual well-being (Liu et al., 2015).

9   The research reviewed above suggests that Facebook users apply both acquisitive

10 (i.e., expressing more positive emotions) and protective (i.e., expressing fewer negative

11 emotions) IM strategies to enhance and optimize their self-representation. Therefore, in the

12 current research, we examined individuals' online impression management in terms of the

13 frequency of positive and negative emotional expression in Facebook status updates.

14 **Culture, Tightness-Looseness, and Emotional Expression**

15   Culture is one of the most important but complex concepts in the social sciences.

16 Decades of culture studies have given hundreds of definitions to this concept. Hofstede and

17 colleagues (2010, p. 6) defined culture as "the collective programming of the mind that

18 distinguishes the members of one group or category of people from others". Triandis (1994)

19 defined culture as a system of shared practices, beliefs, norms, and values that are socially

20 transmitted. Scholars have proposed various cultural dimensions that differentiate human

21 societies, such as individualism-collectivism in Hofstede's six-dimension model of national

22 culture (Hofstede et al., 2010).

23   The complexity of the culture concept stems from the fact that culture itself has many

24 layers. For example, Hofstede and colleagues contend that there are six layers of culture,

25 including nation/country, regional/ethnic/religious/linguistic affiliation, gender, generation,

1   social class, and organization/corporation (Hofstede et al., 2010). Among them, the national,

2   or more aptly, the societal level of culture refers to the set of knowledge, beliefs, customs,

3   and norms shared among a population of a sovereign nation or a district within a nation, e.g.,

4   provinces in China (Talhelm et al., 2014) or states in the U.S. (Harrington & Gelfand, 2014;

5   Vandello & Cohen, 1999). For example, individualism-collectivism varies across countries

6   (Hofstede et al., 2010), with China being recognized as a typical collectivistic culture and the

7   U.S. a typical individualistic culture. However, there are often important cultural differences

8   within nations. Talhelm et al. (2014) found that southern China is more collectivistic and

9   northern China is more individualistic. Vandello and Cohen (1999) also reported prominent

10   differences in individualism-collectivism across U.S. states. Societal culture is probably the

11   most prevalent level in popular lay perceptions and empirical academic studies of cultural

12   differences. Note that the current research also focuses on societal culture as we attempt to

13   examine the role of cultural variation across U.S. states in impression management.

14   Culture has a powerful influence on behavioral patterns and thinking styles. One

15   important influence of culture on daily life is on the display rules that guide emotional

16   expressions. For example, Japanese smiled more than Americans did in front of

17   experimenters after viewing stressful films even though they expressed similar negative

18   emotions when they were alone (Friesen, 1972). Olympic athletes from Eastern cultures

19   expressed their emotions less than those from Western cultures after their matches

20   (Matsumoto, Willingham, & Olide, 2009). These display rules are part of social norms that

21   help people manage their self-expression in specific situational contexts and in accordance

22   with their social roles (Hwang & Matsumoto, 2012).

23   Tightness-looseness is a cultural dimension that measures the strength of social norms

24   in a society and the degree to which deviations from these norms are tolerated. Pelto (1968)

25   introduced cultural tightness as an emphasis on the adherence to social norms among

1   traditional societies. According to Pelto (1968), tight societies like the Pueblo Indians and

2   Japanese have clearly articulated norms and impose severe sanctions on deviants, whereas

3   loose societies such as the Thais lack formality and order in general and have high tolerance

4   of deviant behaviors. Triandis (1989, 1994) proposed three conditions critical for the

5   development of cultural tightness: geographic isolation, dense population, and cultural

6   homogeneity. In particular, first, geographic isolation decreases people's exposure to other

7   cultures and thus helps to reinforce the existing norms within their own culture, leading to

8   enhanced cultural tightness. Second, when a given residential area is more crowded, the need

9   for behavioral regulation increases in order to reduce friction and avoid conflict. Therefore,

10 dense population is likely to be associated with high cultural tightness. Third, in a society

11 where people are more similar in ethnicity, language, and religion, it is easier to reach

12 agreement on social norms. On the contrary, societies that are more diverse and

13 heterogeneous tend to tolerate deviations and dissimilarities.

14   In 2006, Gelfand and colleagues advanced the theory of tightness-looseness and

15 argued for the utility of the construct for explaining societal variation at multiple levels.

16 According to Gelfand et al. (2006), cultural tightness-looseness consists of two key

17 components: the strength of social norms (number and clarity) and the degree of sanctioning

18 (intolerance for deviance from norms). This cultural dimension emphasizes how the external

19 influence of norms and constraints accounts for cross-cultural differences in behaviors,

20 making it theoretically distinct from the more common cultural dimensions (e.g.,

21 individualism-collectivism) that focuses mainly on variation in personal characteristics and

22 internal values[1].

23   During the past decade, Gelfand and colleagues have conducted a series of empirical

24 studies using multiple approaches to show that tightness-looseness is a critical cultural

25 dimension that may account for differences across societies in various fields (Gelfand et al.,

2006; Gelfand et al., 2011; Harrington & Gelfand, 2014; Li, Gordon, & Gelfand, 2017). For example, societies that are vulnerable to ecological and man-made threats, such as natural disasters, diseases, and territorial conflicts, tend to have tight cultures with strong norms to coordinate social actions for survival (Gelfand et al., 2011). Cultural tightness-looseness is also reflected in prevailing institutional practices, everyday situational constraints, and individual psychological processes. Tight cultures tend to have more media restrictions, fewer civil and political rights, and more severe punishment in the justice system compared to loose cultures (Harrington & Gelfand, 2014). In everyday social situations (e.g., job interview, movies, workplace), tight (vs. loose) cultures have clearer rules and a narrower range of behaviors (e.g., eat, laugh, argue) that are considered appropriate. Individuals in tight cultures have higher self-regulatory strength including cautiousness, impulse control, and self-monitoring compared to those in loose cultures (Gelfand et al., 2011).

Given that tight cultures tend to punish deviations from social norms, we predicted that individuals from tight cultures tend to exhibit a higher degree of IM during social interactions compared with those from loose cultures. Based on this prediction and previous research findings that expressing more positive emotions and fewer negative emotions are common IM strategies on Facebook (Bazarova et al., 2013), we hypothesized that:

Hypothesis 1. Individuals in tight cultures will be more likely than those in loose cultures to express positive emotions.

Hypothesis 2. Individuals in tight cultures will be less likely than those in loose cultures to express negative emotions.

1   **Tightness-Looseness, Social Network Density, and Emotional Expression**

2   Existing IM research has shown that individuals' use of IM strategies depends on the

3   partners with whom they interact. In particular, individuals exhibit more IM when their

4   interaction partners are more valuable to them. For example, people are highly motivated to

5   manage their self-image when interacting with someone who is powerful or of high status

6   (Swencionis & Fiske, 2016), and they may also tend to ingratiate themselves with their

7   bosses and teachers rather than with their friends (Kowalski & Leary, 1990). In social

8   networking sites like Facebook, users' interaction partners consist of many types, such as

9   family, friends, and acquaintances. Users often do not direct their messages to a particular

10   group of individuals, making their postings available to their whole social network. The

11   publicness, non-directness, and mixture of social circles involved in the communication

12   process make Facebook a complex environment for social interaction (Bazarova et al., 2013).

13   An important characteristic of social networks, including those on Facebook, is social

14   network density. It represents how closely members in a social network are connected to each

15   other (Burt, 2000) and indicates the quality of interpersonal relations in the network (Hogan,

16   2009). In a dense social network, members tend to have close relationships and be highly

17   familiar with each other (Burt, 2000; Hogan, 2009); they are also more likely to receive

18   social support (Skowronski, Gibbons, Vogl, & Walker, 2004) and long-term assistance from

19   each other (Walker, Wasserman, & Wellman, 1993). In contrast, members in a sparse social

20   network tend to be mere acquaintances from diverse social circles, often embodying distinct

21   social roles (Burt, 2000).

22   Previous studies have suggested that people from different cultures value network

23   density to varying degrees. For example, individuals who have a large and sparse social

24   network are considered "foolish" or "naïve" in Ghana (Adams & Plaut, 2003). One

25   explanation is that, in a crisis-prone society like Ghana, a small but dense social network with

1 close friends is more useful than a large sparse network with mere acquaintances given that

2 close friends are more reliable than mere acquaintances in fighting threats for survival (Oishi

3 & Kesebir, 2012).

4   As societies with high probability of threats tend to have tight cultures to coordinate

5 social actions for survival (Gelfand et al., 2011), it is likely that individuals in tight cultures

6 value dense social networks more than sparse ones. In contrast, individuals in loose cultures

7 may value sparse networks (with mere acquaintances) more than dense networks (with close

8 friends) because of the "strength of weak ties" (Granovetter, 1973, 1974). For example,

9 Granovetter (1974) found that most individuals obtained a job through someone who they

10 had known for less than one year, and those who got their job through weak ties were paid

11 more and more satisfied with their job than those who got a job through close friends. This

12 suggests that weak ties can be more valuable than close friends when facing less threatening

13 problems because the information and support they provide have a broader range. Since

14 individuals in loose cultures have a low probability of fighting threats and crisis (Gelfand et

15 al., 2011), they are likely to favor sparse social networks to provide them with diverse

16 information and resources that may be helpful in highly specific, non-threatening situations.

17 Therefore, we expected that individuals from loose (tight) cultures would tend to value their

18 sparse (dense) social networks more.

19   Given that individuals exhibit a higher degree of IM when facing more valuable

20 interaction partners (Kowalski & Leary, 1990), Facebook users from tight (vs. loose) cultures

21 should exhibit a higher degree of IM (i.e., expressing more positive and fewer negative

22 emotions) in dense (vs. sparse) social networks. Therefore, we predicted that for positive as

23 well as negative emotions, the direction of the relationship between social network density

24 and frequency of emotional expression is dependent on cultural tightness-looseness according

25 to the following nature of interaction.

1   **Hypothesis 3.** There will be a cultural tightness-looseness by social network density

2   interaction effect on positive emotional expression such that:

3   **Hypothesis 3a.** In tight cultures, individuals with *dense* social networks will be more likely

4   than those with sparse social networks to express positive emotions; whereas

5   **Hypothesis 3b.** In loose cultures, individuals with *sparse* social networks will be more likely

6   than those with dense social networks to express positive emotions.

7

8   **Hypothesis 4.** There will be a cultural tightness-looseness by social network density

9   interaction effect on negative emotional expression such that:

10 **Hypothesis 4a.** In tight cultures, individuals with *dense* social networks will be less likely

11 than those with sparse social networks to express negative emotions; whereas

12 **Hypothesis 4b.** In loose cultures, individuals with *sparse* social networks will be less likely

13 than those with dense social networks to express negative emotions.

14

15 **The Current Research**

16   To summarize, this study investigates the direct effect of societal-level cultural

17 tightness-looseness as well as its interaction with individuals' social network density on

18 impression management (as reflected in their emotional expression on Facebook).

19   First, our hypotheses regarding the direct effect of cultural tightness-looseness on

20 impression management are based on two lines of research in literature. On the one hand,

21 past research has indicated that expressing positive emotions more frequently and negative

22 emotions less frequently are found to be common IM strategies on Facebook and the

23 adoption and application of IM strategies conform to social norms in social media (Bazarova,

24 2012; Bazarova et al., 2013); on the other hand, according to the theory of cultural tightness-

25 looseness, tight (vs. loose) cultures encompass stronger social norms and greater intolerance

1   of deviance from these norms (Gelfand et al., 2006). Therefore, we expected that compared

2   to those from loose cultures, individuals from tight cultures would adopt and apply more IM

3   strategies on Facebook, i.e., to express positive emotions more frequently (**Hypothesis 1**) and

4   negative emotions less frequently (**Hypothesis 2**).

5   Second, our hypotheses regarding the interaction effect between cultural tightness-

6   looseness and social network density on impression management are also based on previous

7   IM research findings and the theory of cultural tightness-looseness. On the one hand, it has

8   been shown that IM strategies tend to be used in social interaction with partners that are

9   considered more valuable (Kowalski & Leary, 1990). On the other hand, how valuable a

10   certain type of interaction partners is (e.g., strong ties vs. weak ties) may vary across cultures.

11   Specifically, a dense social network that consists of strong ties (e.g., family and close friends)

12   is more likely to provide mutual social support (Skowronski et al., 2004) and long-term

13   assistance (Walker et al., 1993), which is particularly important in tight cultures that value

14   homogeneity in a society and cooperation to fight threats and crisis (Gelfand et al., 2011); in

15   contrast, weak ties in a sparse social network that consists of mere acquaintances or even

16   strangers tend to provide more information and more diverse resources (Granovetter, 1973),

17   which may be critical to those in loose cultures who value heterogeneity and tolerate deviant

18   ideas and behaviors (Gelfand et al., 2011). Therefore, we expected that in tight cultures,

19   individuals with dense social networks would employ more IM strategies on Facebook than

20   those with sparse social networks. Specifically, those in tight cultures would express positive

21   emotions more frequently (**Hypothesis 3a**) and negative emotions less frequently

22   (**Hypothesis 4a**). In contrast, in loose cultures, individuals with sparse social networks would

23   be more likely to employ IM strategies on Facebook than those with dense social networks.

24   Again, the greater deployment of IM would manifest in more frequent expressions of positive

1 emotions (**Hypothesis 3b**) and less frequent expressions of negative emotions (**Hypothesis**

2 **4b**)—primarily among those with sparse (rather than dense) networks.

3 We tested our hypotheses in a large-scale study with 13,789 Facebook users from

4 different U.S. states. Through such a large sample, we were able to offer strong tests of the

5 role of cultural tightness-looseness in online impression management. Emotional expressions

6 and social network density were measured with Facebook status updates and users' existing

7 friend list, thereby serving as natural records of individuals' daily expressions and social

8 media profile. State-level cultural tightness-looseness scores were obtained from Harrington

9 and Gelfand (2014, p. 2), which has been proven a valid and reliable index to account for the

10 wide variation across U.S. states in many fields such as ecological and historical conditions,

11 substance abuse, discrimination rates, resistance towards immigration, etc. We highlight that

12 compared to traditional research methods using survey or experimental approaches, the

13 current measurements eliminate demand characteristics and similar forms of invalidity in data

14 collection.

15 In our analyses below, we controlled for the potential confounding factors that are

16 conceptually distinct from cultural tightness-looseness but may be empirically related to IM

17 and emotional expression. First, we controlled for social network size, which is distinct from

18 social network density (Borgatti, Jones, & Everett, 1998) and is closely related to emotional

19 sharing on social media (Lin et al., 2014).

20 Cultural tightness-looseness is just one aspect of complex social systems, which

21 encompass a variety of characteristics at the societal level. Therefore, we also controlled for a

22 set of state-level socio-demographic variables, including racial minority percentage,

23 educational attainment, personal income level, and homicide rate per state. In addition, state-

24 level residential mobility, i.e., the extent to which individuals change their residence (Oishi,

1 2010), was also tested as a control variable given its close relationship with social networking

2 strategies (Oishi & Kesebir, 2012).

3   Political conservatism (vs. liberalism)—a political philosophy that emphasizes

4 traditional institutions and maintenance of the existing order in a society—is closely related

5 to the enforcement of social norms and thus the deployment of IM strategies in social

6 interactions (Heywood, 2017). Similarly, collectivism (vs. individualism)—the extent to

7 which individuals in a society define themselves as interdependent with each other (de-

8 emphasizing the independence of the self)—is related to emotional expressivity (Matsumoto,

9 Yoo, & Fontaine, 2008). Therefore, we also controlled for state-level political conservatism

10 and collectivism in the current study. It is noteworthy that although cultural tightness-

11 looseness is conceptually distinct from political conservatism (Harrington & Gelfand, 2014)

12 and collectivism (Gelfand et al., 2011), the former construct is empirically correlated with the

13 latter two such that many tight cultures tend to be more politically conservative and/or

14 collectivistic (e.g., Mississippi), while many loose cultures tend to be less conservative and/or

15 more individualistic (e.g., Oregon) (Harrington & Gelfand, 2014; Vandello & Cohen, 1999).

16

17   **Method**

18 **Participants**

19   Data were obtained from the myPersonality project (http://mypersonality.org) where

20 over seven million Facebook users took various psychometric tests via the myPersonality

21 application from 2007 to 2012 (Kosinski, Matz, Gosling, Popov, & Stillwell, 2015). Users

22 gave consent before they took the tests and had the option to grant researchers permission to

23 download their Facebook data for research purposes. The original data in the myPersonality

24 dataset were collected with an explicit opt-in consent for reuse for research purposes beyond

25 the original project, and the data used in the current study were anonymized and secondary.

1   This study was submitted to the Institutional Review Board at the Singapore Management

2   University and was exempted from further review (also see Youyou, Kosinski, & Stillwell,

3   2015, p. 1).

4   In this study, we first selected participants who had granted access to their status

5   updates and social network information (i.e., the friend list and connections between friends)

6   and also provided U.S. location information in their profile. Next, we selected U.S. states

7   with at least 100 participants each to ensure the representativeness of the sample for each

8   state[2]. This resulted in a total of 13,789 Facebook users (5,394 male, 8,334 female, and 61

9   with no gender indicated) from 37 states in the final analysis. A total of 13,511 users

10   indicated their age ($M = 26.7$, $SD = 10.0$).

11   **Focal Study Variables**

12   **Emotional Expression**. Emotional expression was quantified by the frequency of

13   positive/negative emotional words in Facebook users' status updates using the Linguistic

14   Inquiry and Word Count (LIWC) software (Pennebaker, Booth, & Francis, 2007). LIWC

15   counts the frequency of words in predefined categories that have been validated by

16   independent judges (Pennebaker, Chung, Ireland, Gonzales, & Booth, 2007) and has been

17   proven a well-validated text analysis tool to assess psychological attributes, behavioral

18   activities, and emotional experiences (Tov, Ng, Lin, & Qiu, 2013). For a sample of text such

19   as "I am happy today", LIWC will output a positive emotion score of 25% (1 of 4 words

20   expressed positive emotion) and a negative emotion score of 0%. In the current sample of

21   status updates, the average frequencies of positive and negative emotion words were 4.1%

22   ($SD = 1.4\%$) and 1.9% ($SD = 0.9\%$), respectively. These frequencies were in the same range

23   as those reported in previous studies (Liu et al., 2015).

24   **Social Network Density**. Social network density was calculated by dividing the total

25   number of existing connections between friends in one's friend list over the maximum

1 number of all possible connections between these friends (Borgatti et al., 1998). The value of

2 network density approaches "0" in extremely sparse networks where no members are

3 connected and "1" in extremely dense networks where everyone is connected to one another.

4 In this study, social network density per user ranged from .001 to .907 (M = .064, SD = .121).

5   **Cultural Tightness-Looseness**. We obtained tightness-looseness scores for U.S.

6 states from Harrington and Gelfand (2014, p. 2), where the scores were calculated from a

7 composite index consisting of nine items of state statistics such as "the legality of corporal

8 punishment in schools" and "the severity of punishment for violating laws" (Cronbach's α =

9 .84). For the 37 states in this study, tightness-looseness scores ranged from 27.37 to 78.86 (M

10 = 52.21, SD = 13.53).

11 **Control Variables**

12   **Social Network Size**. Social network size was defined as the number of members in

13 an egocentric network, i.e., the number of Facebook "friends" that each user has plus the user

14 himself or herself. In this study, social network size per user ranged from 22 to 1,988 (M =

15 316.7, SD = 286.0).

16   **Racial Minority Percentage**. State-level racial minority percentage was indexed by

17 the percentage of non-"White Alone" residents per state. The data were obtained from the

18 American Community Survey 1-Year Estimates datasets (U.S. Census Bureau, 2007-2012)

19 and were averaged across years from 2007 to 2012[3]. In this study, racial minority percentage

20 per state ranged from 8.0% to 40.5% (M = 22.8%, SD = 9.4%).

21   **Educational Attainment**. State-level educational attainment was indexed by the

22 percentage of high school graduates or higher degree holders among residents aged 25 years

23 or over per state. The data were also obtained from the American Community Survey 1-Year

24 Estimates datasets (U.S. Census Bureau, 2007-2012) and were averaged across years from

1   2007 to 2012. In this study, educational attainment per state ranged from 80.3% to 91.7% (*M*

2   = 86.4%, *SD* = 3.3%).

3   **Personal Income**. State-level real personal income (i.e., personal income after taking

4   into account the effects of inflation on purchasing power) was obtained from Bureau of

5   Economic Analysis, U.S. Department of Commerce (averaged data across years from 2008 to

6   2012). In this study, personal income per state ranged from 33,539.60 USD to 55,787.20

7   USD (*M* = 40,671.43, *SD* = 4,308.67).

8   **Homicide Rate**. State-level homicide rate (i.e., number of murder and nonnegligent

9   manslaughter crimes per 100,000 total population) was obtained from FBI Uniform Crime

10   Reporting (averaged data across years from 2007 to 2012). In this study, homicide rate

11   ranged from 1.5 to 11.9 (*M* = 4.9, *SD* = 2.1).

12   **Residential Mobility**. State-level residential mobility was indexed by the percentage

13   of residents aged 1 year or over who changed residence in the previous year per state. The

14   data were obtained from the American Community Survey 1-Year Estimates datasets (U.S.

15   Census Bureau, 2007-2012) and were averaged across years from 2007 to 2012. In this study,

16   residential mobility per state ranged from 10.2% to 22.0% (*M* = 15.8%, *SD* = 2.4%).

17   **Political Conservatism**. State-level political conservatism was calculated by

18   subtracting the percentage of self-identified liberals from the percentage of self-identified

19   conservatives in a state (Harrington & Gelfand, 2014). The data were obtained from the

20   Gallup U.S. Daily survey results (www.gallup.com) and were averaged across years from

21   2009 to 2012. For the 37 states in this study, political conservatism ranged from -0.1% to

22   36.6% (*M* = 19.8%, *SD* = 9.1%).

23   **Collectivism**. State-level collectivism scores were obtained from Vandello and Cohen

24   (1999), where collectivism was measured with eight indicators such as "Ratio of people

25   carpooling to work to driving alone" and "Percentage of households with grandchildren in

1 them" (Cronbach's α = .71). For the 37 states in this study, collectivism ranged from 31 to 72

2 (M = 50.9, SD = 10.2).

3

4 **Results**

5 Table 1 below summarizes the state-level data on the variables in our study.

6

7 [Table 1 insert about here]

8

9 We first examined the zero-order correlations among all variables in this study (Table

10 2). Results showed that cultural tightness-looseness was significantly and positively

11 correlated with positive emotional expression at the state level, $r(37)$ = .496, p = .002. There

12 was also a significant negative correlation between tightness-looseness and negative

13 emotional expression at the state level, $r(37)$ = -.498, p = .002. This showed the direct

14 association between cultural tightness-looseness and individuals' emotional expression.

15

16 [Table 2 insert about here]

17

18 To further examine the direct effect of cultural tightness-looseness and its interaction

19 effect with social network density on emotional expression, we tested two multilevel models

20 for positive and negative emotions, respectively. In each model, the two focal study

21 predictors (i.e., social network density at the individual level and cultural tightness-looseness

22 at the state level) and the cross-level interaction term between the two predictors were

23 entered.

24 Multilevel analysis requires a sample of at least 20 groups with at least 30 individuals

25 each to achieve an acceptable level of power (Heck & Thomas, 2000). In this study, there

1   were 13,789 individuals nested in 37 groups with 101 to 1,610 individuals per group thereby

2   providing sufficient statistical power for the analysis. Following previous research (Hox,

3   2010), the individual-level predictor (i.e., social network density) was group-mean centered,

4   while the state-level predictor (i.e., cultural tightness-looseness) was grand-mean centered.

5   In the following analysis, multilevel models were tested using the Linear Mixed

6   Models function in SPSS (IBM Corporation, New York). Note that the covariance structure

7   was specified as "Unstructured" for maximal estimation of the random effects, and maximum

8   step-halvings was set as 100 to ensure model convergence (more details of model

9   specifications can be found in the Table S1 in Supplemental Material). The intraclass

10   correlation coefficients (ICC) for positive and negative emotional expression were .021 and

11   .005, respectively.

12   Gamma (γ) was used as the regression coefficient symbol to represent the

13   standardized effect size in multilevel modeling tests, which was calculated using Hox

14   (2010)'s method (p. 22). Meanwhile, we also calculated and reported the percentage of

15   variance accounted for by the multilevel regression models, as compared with "null" models

16   (i.e., intercept-only models), according to Snijders and Bosker's (1999) method using pooled

17   variances (also see Hox, 2010, pp. 75-76).

18   For the analysis of positive emotional expression, the model explained 0.8% of the

19   total variance at the individual level and 22.8% of the total variance at the state level.

20   Cultural tightness-looseness significantly and positively predicted positive emotional

21   expression ($\gamma = .079$, 95% confidence interval (CI) = [.032, .126], $p = .002$), indicating that

22   individuals from culturally tight states were more likely to express positive emotions online

23   than those from culturally loose states (see Table 3 below). Therefore, Hypothesis 1 was

24   supported.

25

1   [Table 3 insert about here]

2

3   For the analysis of negative emotional expression, the model explained 0.3% of the

4   total variance at the individual level and 20.6% of the total variance at the state level.

5   Cultural tightness-looseness significantly and negatively predicted negative emotional

6   expression (γ = -.045, 95% CI = [-.072, -.017], p = .003), indicating that individuals were less

7   likely to express negative emotions online in culturally tight than loose states (see Table 3).

8   Therefore, Hypothesis 2 was also supported.

9   Table 3 also showed that social network density was not significantly associated with

10   positive emotional expression (γ = .005, 95% CI = [-.017, .028], p > .50). However, the effect

11   of social network density was moderated by cultural tightness-looseness (γ = .036, 95% CI =

12   [.013, .059], p = .004)[4]. The interaction effect was plotted to understand the nature of the

13   interaction. As shown in Figure 1a, an ordinal interaction effect was observed.

14

15   [Figure 1 insert about here]

16

17   Specifically, for culturally tight states, social network density was positively

18   correlated with positive emotional expression. Simple slopes analysis showed that the

19   standardized slope for culturally tight states (1 SD above the mean of the tightness-looseness

20   scores among the 37 states) was .044 (95% CI = [.011, .076], p = .008). This suggested that

21   in culturally tight states, individuals with dense social networks were more likely than those

22   with sparse social networks to express positive emotions. Thus, Hypothesis 3a was supported.

23   In contrast, for culturally loose states, social network density was negatively

24   correlated with positive emotional expression. Simple slopes analysis showed that the

25   standardized slope for culturally loose states (1 SD below the mean) was -.033 (95% CI =

1 [-.063, -.002], p = .035). This indicated that in culturally loose states, individuals with sparse

2 social networks were more likely than those with dense social networks to express positive

3 emotions. Thus, Hypothesis 3b was also supported.

4   Social network density was not significantly associated with negative emotional

5 expression (γ = .006, 95% CI = [-.018, .029], p > .50). Furthermore, the interaction between

6 cultural tightness-looseness and social network density was not significant (γ = -.006, 95% CI

7 = [-.030, .017], p > .50). Therefore, Hypothesis 4 was not supported.

8   To rule out the potential influence of confounding factors (individual-level social

9 network size and state-level racial minority, educational attainment, personal income,

10 homicide rate, residential mobility, political conservatism, and collectivism), we also tested

11 16 pairs of extended multilevel models, with each pair respectively predicting positive and

12 negative emotional expression after controlling for one of the eight confounding variables.

13   Results showed that after controlling for social network size, racial minority,

14 educational attainment, personal income, homicide rate, residential mobility, or collectivism,

15 cultural tightness-looseness was still associated with higher levels of positive emotional

16 expression (all ps < .015) and lower levels of negative emotional expression (all ps < .022),

17 again supporting Hypotheses 1 and 2. However, after controlling for political conservatism,

18 cultural tightness-looseness was not significantly associated with either positive emotional

19 expression (p = .086) or negative emotional expression (p > .50). In contrast, political

20 conservatism was positively associated with positive emotional expression (γ = .155, p <

21 .001) but was unrelated to negative emotional expression (p = .170). We discussed this result

22 in detail in the Discussion (also see Table S8 in the Supplementary Materials).

23   The interaction effect between cultural tightness-looseness and social network density

24 on positive emotional expression remained significant (all ps < .023) after controlling for the

25 eight confounding variables, respectively. In particular, for culturally tight states (1 SD above

1   the mean), social network density was positively correlated with positive emotional

2   expression (all ps < .036 after controlling for social network size, racial minority percentage,

3   homicide rate, residential mobility, collectivism, and political conservatism, respectively; ps

4   = .073 and .056 after controlling for educational attainment and personal income,

5   respectively). Thus, Hypothesis 3a was still supported generally. In contrast, for culturally

6   loose states (1 SD below the mean), the association between social network density and

7   positive emotional expression was negative (all ps < .045). Thus, Hypothesis 3b was also

8   supported. Finally, the interaction effect of cultural tightness-looseness by social network

9   density on negative emotional expression was not significant. Therefore, Hypothesis 4 was

10   not supported as previously.

11   To further verify the robustness of our findings, we conducted a supplementary

12   analysis using OLS (ordinary least squares) regression models in SPSS with the PROCESS

13   macro, which is a well-established and widely used method to test moderator effects (Hayes,

14   2013). The 50 U.S. states measured in Harrington and Gelfand (2014, p. 2) had a median

15   tightness score of 49.15, ranging from 27.37 (California) to 78.86 (Mississippi). Therefore,

16   we defined tight states as those with a tightness score in the top 50% (above 49.15) and loose

17   states in the bottom 50% (below 49.15). For the 37 states in our study, this resulted 7,014

18   users from 17 loose states (Arizona, California, Colorado, Connecticut, Illinois, Iowa,

19   Maryland, Massachusetts, Michigan, Minnesota, Montana, Nevada, New Jersey, New York,

20   Oregon, Washington, and Wisconsin) and 6,775 users from 20 tight states (Alabama,

21   Arkansas, Florida, Georgia, Indiana, Kansas, Kentucky, Louisiana, Mississippi, Missouri,

22   Nebraska, North Carolina, Ohio, Oklahoma, Pennsylvania, South Carolina, Tennessee,

23   Texas, Utah, and Virginia). Accordingly, cultural tightness-looseness was converted into a

24   dichotomized variable (loose culture vs. tight culture). We then conducted separate OLS

25   hierarchical multiple regression analyses to test the moderator hypotheses for predicting

1   positive and negative emotional expressions, respectively. All variables were standardized

2   before entering the regression models.

3   Results showed that cultural tightness-looseness level significantly and positively

4   predicted positive emotional expression (β = .057, 95% CI = [.040, .074], p < .001) and also

5   provided negative prediction for negative emotional expression (β = -.034, 95% CI =

6   [-.050, -.017], p < .001), indicating that compared to those in culturally loose states,

7   individuals in culturally tight states were more likely to express positive emotions and less

8   likely to express negative emotions. Thus, these results from the OLS regression analysis

9   replicated the support for Hypotheses 1 and 2 in the previous multilevel model analysis.

10   Meanwhile, a significant interaction effect of cultural tightness-looseness level by

11   social network density was found on positive emotional expression (β = .027, 95% CI =

12   [.010, .043], p = .002). Simple slopes analysis showed that social network density was

13   positively correlated with positive emotional expression for culturally tight states (simple

14   slope β = .028, 95% CI = [.003, .053], p = .026), but it was negatively correlated with

15   positive emotional expression for culturally loose states (simple slope β = -.025, 95% CI =

16   [-.048, -.003], p = .030). This result replicated the findings from the previous multilevel

17   model analysis, which again supported Hypothesis 3. In contrast, the interaction effect of

18   cultural tightness-looseness level by social network density on negative emotional expression

19   was not significant (β = .005, p > .50). Thus, Hypothesis 4 was not supported as previously.

20   To sum up, results from the OLS regression analysis where cultural tightness-

21   looseness was treated as a dichotomous variable at the individual level replicated the findings

22   from the previous multilevel model analysis in which cultural tightness-looseness was

23   operationalized as a continuous variable at the state level.

24

1 **Discussion**

2   In this study, we examined the effects of state-level cultural tightness-looseness and

3 individual-level social network density on individuals' impression management using large-

4 scale data on emotional expressions on Facebook. As predicted in Hypotheses 1 and 2, our

5 results showed that individuals from culturally tight (vs. loose) states in the U.S. were more

6 likely to express positive emotions and less likely to express negative emotions. Our

7 prediction of a cultural tightness-looseness by social network density interaction effect on

8 positive emotional expression (as specified in Hypothesis 3) was also supported. In

9 particular, individuals from culturally tight states were more likely to express positive

10 emotions in dense social networks (supporting Hypothesis 3a), whereas individuals from

11 culturally loose states were more likely to express positive emotions in sparse social networks

12 (supporting Hypothesis 3b). However, contrary to our prediction in Hypothesis 4, we did not

13 find a cultural tightness-looseness by social network density interaction effect on negative

14 emotional expression. Specifically, social network density was not significantly related to

15 negative emotional expression in either tight or loose states.

16   The present findings provide several theoretical contributions and practical

17 implications for cross-cultural studies on emotional expression and impression management

18 in social media.

19 **Cultural Influence of Tightness-Looseness on Emotional Expressions**

20   First, the current research provides fairly robust evidence that cultural tightness-

21 looseness may influence how individuals express emotions in their online communications in

22 social media. While individuals may manage impressions by expressing positive emotions

23 rather than negative emotions on Facebook, those from tight (vs. loose) states in the U.S.

24 were more likely to express positive emotions and less likely to express negative emotions in

1   social media. This suggests that individuals from tight (vs. loose) cultures may use more IM

2   strategies to project and maintain a positive image in their online social communities.

3   Previous research has suggested that social media users tend to adopt IM strategies to

4   establish and uphold a positive self-image online (e.g., Cunningham, 2013). This includes the

5   usage of acquisitive and protective IM strategies (Arkin, 1981; Leary & Kowalski, 1990), by

6   overexpressing positive emotions and refraining from disclosing negative emotions,

7   respectively (Bazarova et al., 2013). Facebook, unlike many traditional online discussion

8   boards, is a semi-public communication platform where users often use their authentic

9   identity and their connections on Facebook may include family, friends, colleagues, and other

10   individuals in their social network. Therefore, the posting of status updates is to be viewed by

11   the users' contacts in real life, which may further motivate users to maintain a positive self-

12   image on Facebook. Past studies have shown that Facebook users tend to selectively disclose

13   more positive than negative emotions (Bazarova et al., 2013; Lin et al., 2014). In an auxiliary

14   analysis, the present study found that the usage frequency of positive emotional words (4.1%)

15   was about twice as that of negative emotional words (1.9%).

16   Taken together, overexpressing positive emotions but concealing negative emotions is

17   a prevalent IM strategy for presenting and maintaining a positive self-image among Facebook

18   users. Such prevalence has become a social norm on online communication platforms

19   (Bazarova et al., 2013; Lin et al., 2014). According to the theory of cultural tightness-

20   looseness (Gelfand et al., 2006), tight (vs. loose) cultures emphasize explicit and stringently

21   enforced social norms and have less tolerance for deviant behaviors. Consequently,

22   individuals from tight cultures are more likely to regulate their behaviors in compliance with

23   social norms and, in the case of emotional expressions on social media, more heavily adopt

24   IM strategies such as disclosing more positive emotions and fewer negative emotions than

1 individuals from loose cultures. Therefore, the current findings provide empirical evidence

2 for the effects of cultural tightness-looseness on IM.

3 **Moderator Effects of Tightness-Looseness on Emotional Expressions**

4 The current research reveals the pattern of IM in social media in terms of online

5 emotional expression as a function of both cultural tightness-looseness and social network

6 density. The precise nature of the effect of social network density on emotional expression is

7 dependent on cultural tightness-looseness and the valence of the emotion.

8 Specifically, in culturally tight states, individuals with dense social networks tended

9 to express positive emotions more frequently than those with sparse social networks (solid

10 line in Figure 1a); in culturally loose states, this pattern was reversed such that individuals

11 with dense social networks tended to express positive emotions less frequently than those

12 with sparse social networks (dashed line in Figure 1a). In contrast, the expression of negative

13 emotion did not covary with network density in either tight or loose states.

14 Previous research has shown that emotional displays depend on both cultural

15 environment (e.g., individualism-collectivism) and social context (e.g., interpersonal

16 relationship). For example, members of collectivistic cultures tend to express more positive

17 emotions and fewer negative emotions to in-group (versus out-group) members. In contrast,

18 members of individualistic cultures tend to express more negative emotions and fewer

19 positive emotions to in-group members than out-group members or strangers (Matsumoto,

20 1990). Researchers have argued that in-group and out-group social networks may have

21 different meanings to individuals from individualistic versus collectivistic cultures.

22 Similarly, in the current study, individuals from tight versus loose cultures may adopt

23 different IM strategies to maintain their self-image online because they have different

24 concerns when expressing emotions in different social networks. On the one hand, tight

25 cultures highly value the compliance of social norms and have low tolerance of deviant

1   behaviors (Gelfand et al., 2006; Pelto, 1968). In addition, violation of social norms may bring

2   more severe consequences in a dense than sparse social network, given that close contacts in

3   dense social networks are likely to be viewed as more valuable than acquaintances in tight

4   cultures. Therefore, for individuals from tight cultures, maintaining a positive image within a

5   dense social network is a key concern.

6   On the other hand, loose cultures define wider latitude for proper behavior and are

7   more permissive of deviations from social norms (Gelfand et al., 2006; Pelto, 1968).

8   Therefore, unlike those from tight cultures, individuals from loose cultures may not only

9   focus on whether their behaviors are violating the social norm such as maintaining a positive

10 self-image online. Instead, they may also value what they can get from disclosing emotions to

11 an audience. According to previous findings on the strength of weak ties (Granovetter, 1973,

12 1974), contacts in a sparse social network tend to be acquaintances with diverse social roles

13 and resources and may be more likely to provide social support that one needs to solve minor

14 problems.

15   Negative emotional expression was not related to social network density in either

16 tight or loose cultures. This may be related to the nature of the two types of emotions.

17 Disclosing positive emotions generally helps to establish a good impression. In contrast,

18 disclosing negative emotion can be damaging to one's self-image in some instances (Gross et

19 al., 2006); but may also help one attract attention and receive social support (Skowronski et

20 al., 2004). Perhaps the social consequences of negative emotional expression differ in tight

21 versus loose cultures. Although tight cultures tend to *punish* deviations from social norms,

22 they do not necessarily *reward* compliance. Thus, in such a cultural context, protective IM

23 strategies (e.g., avoiding disapproval) may be deployed more uniformly across social

24 contexts. As a result, whether social networks are dense or sparse, negative emotional

25 expression is less frequent compared with loose cultures. In contrast, the consequences of

1   negative emotional expression may be more varied in loose cultures. People may be harmed

2   or helped when they expressed negative emotion regardless of social network density.

3   **Implications for Making Better Use of Social Media in Psychological Studies**

4   The present findings on emotional expressions have high ecological validity. Using

5   social media data, the current study involves a large-scale dataset where emotional

6   expressions through actual daily communications were retrieved from a sample of over

7   thirteen thousand participants in a natural setting (i.e., coded from everyday status updates on

8   Facebook). Hence, this study may offer greater generalizability than studies of emotional

9   expression in laboratory experiments or survey questionnaires.

10   Over the past decade, social media have not only become an important part in daily

11   life but also a powerful research tool for the social sciences (Kosinski et al., 2015). Previous

12   research has shown that activities in social media serve as effective markers of individuals'

13   personality traits, psychological states, and behaviors in real life. For example, Facebook

14   likes predicted a variety of users' private attributes such as gender, race, religion, and

15   personality (Kosinski, Stillwell, & Graepel, 2013), and the prediction of personality was even

16   more accurate than human judgments (Youyou et al., 2015). Here, we presented an initial

17   attempt to study IM through online emotional expressions and the findings argued for the

18   importance of jointly considering both culture (i.e., cultural tightness) and social network

19   structure (i.e., network density).

20   The present study sheds some light on the characteristics of computer-mediated

21   communication and provides practical implications on how user-generated content on social

22   media can be utilized for studying individuals' behavioral patterns. Given the increasing

23   importance of social media in people's daily life, it is hoped that, beyond the specific findings

24   on IM and emotions, the research methods used in this study and the findings obtained will

1 help open up new and fruitful avenues of research on individual and cultural variables that

2 may influence other attitudes and behaviors expressed in social media communications.

3 **Robustness of the Current Findings**

4 We highlight that the present findings were replicated after controlling for the

5 potential confounding effects of individual's social network size and various state-level

6 factors including racial minority percentage, educational attainment, personal income,

7 homicide rate, residential mobility, and collectivism. Although the main effects of cultural

8 tightness disappeared after controlling for political conservatism, the cultural tightness-

9 looseness by social network density interaction effect on positive emotional expression still

10 held. Meanwhile, the findings were replicated in OLS regression models where cultural

11 tightness-looseness was dichotomized and treated as an individual-level characteristic instead

12 of being operationalized as a state-level context variable in the multilevel models. Taken

13 together, these replicated results demonstrated the robustness of our findings regarding the

14 direct effects of cultural tightness-looseness on both positive and negative emotional

15 expression as well as its interaction effect with social network density on positive emotional

16 expression.

17 **Limitations and Future Directions**

18 The main effects of cultural tightness-looseness on emotional expression were no

19 longer significant after controlling for political conservatism. In addition, cultural tightness-

20 looseness was highly correlated with political conservatism among the 37 U.S. states in our

21 study ($r(37) = .862$, $p < .001$), which is consistent with Harrington and Gelfand (2014, p. 3)'s

22 study ($r(50) = .720$, $p < .001$). From the perspective of statistical analysis, a high correlation

23 between two explanatory variables in regression analysis runs the risk of the multicollinearity

24 and undermining the statistical significance of an explanatory variable (Allen, 1997). This

1   seems to apply to negative emotional expression as neither political conservatism nor

2   tightness-looseness was predictive when both were entered into the model (see Table S8).

3   Despite the high correlation between tightness-looseness and conservatism and the

4   fact that the two are likely to be mutually reinforcing (Harrington & Gelfand, 2014), the two

5   constructs differ in important ways. Tightness-looseness refers to an external social reality

6   and is independent of any single individual. It reflects the relative strength of social norms

7   and degree of behavioral constraint versus latitude in a social system as a whole (Gelfand et

8   al., 2006). In contrast, conservatism is an individual-level set of beliefs consisting of personal

9   attitudes and values such as preserving social institutions, and emphasizing stability and

10   continuity (Heywood, 2017). Moreover, tightness-looseness and conservatism correlate

11   differently with other constructs. For example, as shown in Table 2, tightness-looseness was

12   significantly and positively correlated with collectivism ($r(37) = .361$, $p = .028$) whereas

13   conservatism was less strongly correlated ($r(37) = .289$, $p = .083$). In contrast, there was a

14   significant positive correlation between conservatism and residential mobility ($r(37) = .344$, p

15    $= .037$) whereas no such correlation was observed between tightness-looseness and

16   residential mobility ($r(37) = .085$, $p > .50$). These results provided discriminant validity

17   evidence that the two constructs are distinct although correlated.

18   The analysis of positive emotional expression provides additional discriminant

19   validity evidence for conservatism and tightness-looseness. Conservatism, but not tightness,

20   was associated with higher levels of positive emotional expression. In contrast, tightness, but

21   not conservatism, moderated the effects of network density on positive emotional expression

22   (see Table S8). Past research suggests that political conservatism (at the individual level) is

23   associated with traits indicative of politeness (Hirsh, DeYoung, Xu, & Peterson, 2010). Such

24   traits include pleasantness and nurturance—which are concerned with respecting and

25   pleasing others. Such traits may be more directly related to positive emotional expression

1 than tightness—which refers more to a cultural system in which norms are strongly enforced.

2 However, nothing in the concept of politeness implies *to whom* one should be polite—which

3 may explain why tightness and not conservatism moderates the relation between social

4 network density and positive emotional expression. The distinction between conservatism

5 and tightness deserves more attention—preferably in a wider sample of societies outside of

6 the U.S.

7   Another limitation of this study is its correlational design precluded a rigorous test of

8 possible causal mechanisms that may underlie the effects of cultural tightness-looseness and

9 social network density. Future research including experimental design studies could test these

10 potential causal mechanisms.

11   Finally, in our study, LIWC coding of emotional expressions from Facebook status

12 updates is unable to distinguish between emotional expressions in the private sphere (e.g.,

13 "I'm lonely and bored") and those about subjects in the public sphere (e.g., "I hate the

14 President of my university, cause he is an embezzler")[5]. The two types of emotional

15 expressions may reflect different psychological meanings (e.g., reflecting individual

16 differences in personality) and indicate different behavioral outputs (e.g., drinking problems

17 vs. street protests), which could be distinctively influenced by cultural tightness-looseness.

18 With more advanced text analysis tool or method that can differentiate between emotional

19 expressions in the private sphere and those in the public sphere, future studies could examine

20 the boundary conditions or moderators for the effects of cultural tightness-looseness on

21 people's emotional expression and impression management.

Footnotes

[1] We note that tightness-looseness is a distinct construct from authoritarianism. According to Adorno et al. (1950), authoritarianism (or called the authoritarian personality) is considered a complex culmination of several attitudes, consisting of nine traits such as conventionalism and authoritarian submission. Feldman and Stenner (1997) developed a four-item scale of the authoritarianism emphasizing values such as respect for elders, obedience, good manners, and being well-behaved. From the definition and measurement of authoritarianism, it can be seen that authoritarianism tends to focus on individual-level values and thus is theoretically distinct from tightness-looseness, which "describes an external social reality that exists independent of any one individual and reflects the relative strength of norms and degree of behavioral constraint versus latitude in a social system as a whole" (Harrington & Gelfand, 2014, p. 3). We thank the anonymous reviewer for raising this important issue.

[2] We first identified 14,702 U.S. Facebook users who indicated their hometown country as the U.S. or, if hometown country was not provided, indicated their current country as the U.S. Among these U.S. users, we used their hometown state as the cultural background or their current state if hometown state was not available. After excluding the states that have fewer than 100 users each, a final sample of 13,789 users from 37 U.S. states was included in the current study.

[3] Since the Facebook data from the myPersonality database were collected from 2007 to 2012 (http://mypersonality.org), we made efforts to locate all data collected in that period and used average data across years between 2007 and 2012 whenever available.

[4] Following the equation in Hox (2010, p. 22), the standardized regression coefficient of the cross-level interaction term was calculated by multiplying the unstandardized regression coefficient with the standard deviation (SD) of the interaction term divided by the

1   SD of the outcome variable (i.e., positive emotional expression). This standardized regression

2   coefficient ($\gamma = .036$) points to the change of positive emotional expression per SD change in

3   the interaction term. We also tested the interaction effect by first standardizing the predictors

4   (i.e., group-mean centered social network density and grand-mean centered cultural tightness)

5   before they were entered into the multilevel models and obtained the standardized regression

6   coefficient for the cross-level interaction term, $\gamma = .052$, 95% CI = [.019, .086], $p = .004$. This

7   points to how much the effect of social network density on positive emotional expression

8   changes per SD change in cultural tightness-looseness.

9   [5] We thank the anonymous reviewer for raising this important point.

10

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14

1   Table 1

2   *Characteristics of the 37 U.S. states in the study*

State	*N*	Age	Female %	NS[a]	ND[a]	PE[a]	NE[a]	MP[b]	EA[b]	PI[b]	HR[b]	RM[b]	PC[b]	CO[b]	TL[b]
Alabama	193	27.8	62.3	397.1	.057	4.5	1.8	30.3	82.2	37,925.0	7.1	15.6	34.7	57.0	75.5
Arizona	256	25.2	62.0	259.7	.053	4.2	2.0	21.0	84.8	34,464.2	6.2	19.9	20.0	49.0	47.6
Arkansas	171	25.7	64.1	368.6	.065	4.3	1.8	21.6	82.8	37,023.2	5.8	17.4	29.3	54.0	75.0
California	1,610	25.9	61.1	285.5	.059	4.1	1.9	37.9	80.7	38,725.2	5.3	15.9	8.3	60.0	27.4
Colorado	257	25.7	59.1	249.4	.064	4.4	2.0	15.8	89.6	40,790.2	3.0	19.4	15.0	36.0	42.9
Connecticut	146	26.5	52.8	351.2	.046	3.8	1.9	21.2	88.8	55,787.2	3.5	12.2	5.8	50.0	36.4
Florida	613	26.6	61.6	293.4	.049	4.2	1.9	23.4	85.6	38,671.4	5.7	16.5	19.3	54.0	49.3
Georgia	394	26.6	61.5	382.2	.061	4.3	1.8	38.7	84.1	37,598.8	6.2	17.0	25.8	60.0	60.3
Illinois	675	27.4	59.3	330.0	.061	4.0	1.9	27.8	86.6	41,859.4	5.8	13.4	13.0	52.0	46.0
Indiana	409	25.6	63.5	342.5	.058	4.3	1.9	14.8	86.8	38,612.8	4.9	15.6	24.0	57.0	54.6
Iowa	233	27.7	59.2	317.4	.072	4.0	2.0	8.0	90.5	43,226.6	1.5	15.6	21.7	39.0	49.0
Kansas	241	26.6	61.1	331.0	.079	4.3	2.0	14.3	89.6	44,974.2	3.7	17.5	24.4	38.0	60.4
Kentucky	214	26.6	61.0	321.2	.081	4.2	1.9	11.5	82.0	37,144.4	4.3	15.4	23.0	53.0	63.9
Louisiana	217	28.6	64.4	374.1	.048	4.5	1.7	36.6	81.8	40,702.8	11.9	14.8	32.4	72.0	65.9
Maryland	252	26.1	57.4	360.5	.062	3.9	1.9	40.4	88.3	44,823.8	7.8	13.6	8.6	63.0	45.5
Massachusetts	251	26.6	54.8	373.3	.055	3.6	2.1	18.4	89.0	48,914.0	2.6	13.4	-0.1	46.0	35.1
Michigan	648	27.1	59.2	308.0	.063	4.1	1.8	20.5	88.4	37,322.0	6.2	14.8	16.1	46.0	48.9
Minnesota	440	26.3	58.3	286.7	.130	3.9	1.8	13.2	91.7	43,728.6	1.8	14.4	14.7	41.0	47.8
Mississippi	141	27.5	58.3	480.2	.068	4.4	1.9	40.5	80.5	35,233.4	7.3	14.8	36.6	64.0	78.9
Missouri	329	26.3	64.6	291.3	.058	4.2	2.0	16.5	86.9	41,686.8	6.7	16.5	23.0	46.0	59.6

Montana	108	26.9	62.0	271.9	.091	4.3	1.9	10.5	91.4	37,975.4	2.5	16.7	24.8	31.0	46.1
Nebraska	178	27.0	64.0	333.4	.075	3.8	1.9	11.4	90.2	45,791.6	3.2	17.0	24.9	35.0	49.7
Nevada	101	24.9	65.4	262.0	.047	4.2	2.0	26.4	84.1	37,043.0	5.9	22.0	16.4	52.0	33.6
New Jersey	333	27.1	54.4	343.8	.061	3.9	2.0	30.3	87.7	45,241.6	4.2	10.2	7.8	59.0	39.5
New York	764	27.3	57.7	341.2	.064	4.1	1.9	33.8	84.7	42,092.2	4.1	11.4	4.9	53.0	39.4
North Carolina	302	26.7	57.5	327.8	.072	4.3	1.8	29.9	84.3	39,297.2	5.6	16.1	23.1	56.0	60.7
Ohio	648	26.6	63.7	315.9	.061	4.1	1.9	16.6	87.9	40,995.2	4.4	14.8	20.5	45.0	52.3
Oklahoma	215	28.8	62.2	300.0	.070	4.5	1.8	25.5	85.9	41,359.4	5.8	18.4	30.6	42.0	75.0
Oregon	193	27.5	68.2	231.1	.058	4.4	1.9	14.5	89.0	36,690.4	2.2	18.2	7.3	33.0	30.1
Pennsylvania	549	28.2	59.9	328.6	.048	3.9	1.9	17.0	88.0	42,686.4	5.4	12.3	17.8	52.0	52.8
South Carolina	222	27.1	64.7	394.1	.080	4.5	1.7	32.7	83.7	35,677.8	6.8	15.5	28.2	70.0	61.4
Tennessee	289	28.6	59.0	318.8	.061	4.3	1.8	21.3	83.4	39,347.4	6.3	15.9	27.4	56.0	68.8
Texas	931	27.3	60.0	306.6	.059	4.1	1.9	26.4	80.3	40,250.6	5.1	17.9	26.1	58.0	67.5
Utah	187	25.0	65.2	285.4	.053	4.6	1.8	10.7	90.5	33,539.6	1.8	17.8	31.9	61.0	49.7
Virginia	332	26.6	61.8	344.9	.059	4.0	1.8	30.1	86.8	44,078.4	4.4	15.7	19.9	60.0	57.4
Washington	383	26.0	63.5	249.9	.072	4.2	1.8	20.6	89.8	41,775.4	2.7	17.7	7.1	37.0	31.1
Wisconsin	364	25.9	62.1	283.7	.076	4.1	1.9	12.5	89.9	41,787.4	2.8	14.5	18.9	46.0	46.9

1   *Note*: NS = Social Network Size; ND = Social Network Density; PE = Positive Emotional Expression (%); NE = Negative Emotional Expression

2   (%); MP = Racial Minority Percentage (%); EA = Educational Attainment (%); PI = Personal Income (in dollars); HR = Homicide Rate (per

3   100,000); RM = Residential Mobility (%); PC = Political Conservatism (%); CO = Collectivism; TL = Cultural Tightness-Looseness; [a]

4   individual-level variables (values presented are the mean score of individuals in the corresponding state); [b] state-level variables (values presented

5   are state statistics obtained from U.S. government websites or published academic articles).

1

2 Table 2

3 *Zero-order correlation between key variables in the study*

	PE[a]	NE[a]	NS[a]	ND[a]	MP[b]	EA[b]	PI[b]	HR[b]	RM[b]	PC[b]	CO[b]	TL[b]
PE	—											
NE	$-.218^{***}$	—										
NS	.003	$-.072^{***}$	—									
ND	-.002	.001	$-.365^{***}$	—								
MP	.084	$-.335^{*}$	$.544^{***}$	-.290	—							
EA	$-.346^{*}$	.288	$-.431^{**}$	.324	$-.657^{***}$	—						
PI	$-.730^{***}$	$.345^{*}$	.100	.006	-.095	$.422^{***}$	—					
HR	.299	$-.422^{**}$	$.479^{**}$	$-.384^{*}$	$.695^{***}$	$-.695^{***}$	-.252	—				
RM	$.516^{***}$	-.010	$-.478^{**}$	-.043	-.205	-.093	$-.507^{**}$	-.037	—			
PC	$.694^{***}$	$-.531^{***}$	$.350^{*}$	.076	.023	$-.381^{*}$	$-.527^{***}$	$.395^{*}$	$.344^{*}$	—		
CO	.198	$-.437^{**}$	$.608^{***}$	$-.358^{*}$	$.721^{***}$	$-.684^{***}$	-.232	$.682^{***}$	-.274	.289	—	
TL	$.496^{**}$	$-.498^{**}$	$.554^{***}$	.091	.177	$-.498^{**}$	-.307	$.499^{**}$	.085	$.862^{***}$	$.361^{*}$	—
Mean	4.1	1.9	316.7	.064	22.8	86.4	40671.4	4.9	15.8	19.8	50.9	52.2
SD	1.4	0.9	286.0	.121	9.4	3.3	4308.7	2.1	2.4	9.1	10.2	13.5
N	13,789	13,789	13,789	13,789	37	37	37	37	37	37	37	37

1   *Note*: [a] individual-level variables; [b] state-level variables; Correlation between individual-level variables was performed at the individual level (N

2   = 13,789); Correlation between state-level variables or between an individual-level variable and a state-level variable was performed at the state-

3   level ($N = 37$); [*] $p < .05$; [**] $p < .01$; [***] $p < .001$.

1   Table 3

2   *Summary of multilevel model analyses of cultural tightness-looseness and social network*

3   *density effects on positive and negative emotional expressions*

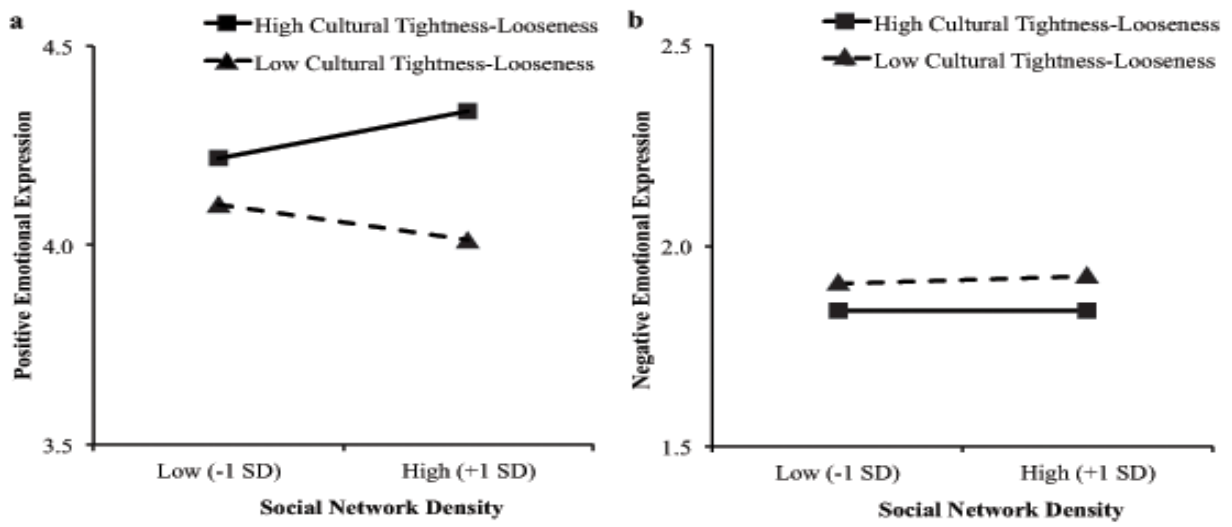|	Positive Emotional Expression		Negative Emotional Expression	
Fixed Part	γ	p	γ	p
ND	.005	.624	.006	.608
TL	.079	.002	-.045	.003
ND×TL	.036	.004	-.006	.573
Random Part	Estimate	p	Estimate	p
δ_e^2	1.850	.000	0.730	.000
$\delta_{\mu 0}^2$	0.029	.001	0.002	.068
$\delta_{\mu 1}^2$	0.174	.251	0.070	.302

4

5   *Note*: ND = Social Network Density (individual-level); TL = Cultural Tightness-Looseness

6   (state-level); δ_e^2 = Residual at the individual level; $\delta_{\mu 0}^2$ = Random intercept variance; $\delta_{\mu 1}^2$ =

7   Random slope variance of social network density; Gamma (γ) coefficients represent

8   standardized multilevel regression coefficients.

9

10

1

2
3   *Figure 1*. Positive and negative emotional expression as a function of cultural tightness and
4   social network density.