

# Support While Control: The Curvilinear Influence of Embeddedness on Virtual Community Participation

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## Abstract

For the interesting phenomenon that social embeddedness attracts people to participate while too many relations are barriers for participation in virtual communities, our research tried to explore the relationship between social embeddedness and participation in virtual community. By combining the self-determination theory and social network theory, this paper finds social embeddedness has a curvilinear (i.e. inverted U-shaped) effect on participation via perceived autonomy. Besides, member instability can moderate the relationship between social embeddedness and community participation such that when the virtual community is unstable, both support and control from social network are weaker and thus it reduces the effect of social network on participation. All our hypotheses were supported by the samples of seven virtual communities in China. We then discussed implications and limitations, and suggested directions for future research.

**Keywords:** Virtual Community; Social Network; Self-Determination Theory; Community Participation; Autonomy

## Introduction

An online survey conducted by NetEase Inc (Nasdaq:NTES) investigated why people are no longer willing to participate in virtual communities. It concluded several reasons through interviews and surveys. Two of the top five reasons are associated with deep social network embeddedness, such as interpersonal concerns and acquaintance' constraints. The results suggested that social network embeddedness becomes a barrier for virtual community participation. However, according to previous studies, the number of social ties in a network is positively associated with individuals' knowledge sharing behavior, which is a typical participation behavior in virtual community (Reinholt, Pedersen, & Foss, 2011). Thus, this weird phenomenon contradicting previous studies attracts our attention. Since existing research cannot

explain this paradox phenomenon that participation tends to decrease when users have a great number of social ties (Granovetter, 1985), this study tries to investigate this unanswered question of the relationship between social network embeddedness and virtual community participation.

Previous studies investigate various antecedents of participation, such as satisfaction, perceived autonomy, trust and sense of community (e.g., Langerak, et al., 2003; Ridings & Gefen, 2004; Koh, et al., 2007; Ardichvili, et al., 2003). Among these antecedents we highlight perceived autonomy in terms of the unique characteristic of virtual communities. Different from other organizations, members in virtual community are equal in formal power and stratum. Sustaining anonymity and autonomy is a major characteristic of virtual communities (Hummel & Lechner, 2002), because ensuring the personal privacy of members through anonymity can encourage members' participation (Andrews, 2002). Therefore, autonomy, which is one of basic human needs and determinates of one's behavior (Deci & Ryan, 2002), is an essential and unique feature for virtual community. In light of self-determination theory (SDT), perceived autonomy, which is highly related to autonomous motivation, is an important indicator of behavior. Based on the discussion above, perceived autonomy provide a potential way to investigate the relationship between social network embeddedness and community participation.

Social network embeddedness presents the relative extent to which the individual has connections to all others in the network (Sparrowe, Liden, Wayne and Kraimer, 2001). A growing body of previous research regards social embeddedness as an important antecedence and examines various outcomes, such as organizational assimilation (Sparrowe & Liden, 1997), promotions (Burt, 1992), organizational exit (Krackhardt & Porter, 1986) and social power (Brass, 1984) and so on. Social network theory states that social network embeddedness can influence individual's interpretations of organizational fact (Ibarra and Andrews, 1993: 279; see also Marsden and Friedkin, 1993) and thus has an effect on psychological states and behaviors. On one hand, deeply embedded individuals could get more access to information and social support via broad social ties and relations (Gulati et al., 2002). On the other hand, high level of embeddedness will make people feel more frequently to be influenced by external reasons and more social norms to follow. Besides, people might feel uncontrollable to manage too many social ties (Berkman & Syme, 1979). Thus, when social network embeddedness is low, with limited support and information, people may feel uncontrollable, less autonomy and decrease their autonomous motivation to participate. When social network embeddedness is high, people might feel overwhelmed and experience loss of control because it is hard to manage so many social ties at the same time (Berkman & Syme, 1979), which will decrease community participation. However, at moderate level of embeddedness, people would feel the support from social network and limited stress. People may feel high autonomy and enhance motivation of participation. Therefore, we predict social network embeddedness has a potential curvilinear (i.e., inverted U-shaped) effect on participation in virtual community, mediated by perceived autonomy.

The discussion above is based on the assumption that social networks are stable. However, the assumption of static network is too perfect to be true in real life. Social network is always changing every minute and it is common that new members join and old members quit. Hence, scholars have called long for studies which take dynamic nature of the social network in to

consideration (Sih et al., 2009). Dynamic network, which means members are in a state of high mobility, will weaken the interpersonal interaction and influence. In other words, individuals are less influenced by dynamic social network and member instability is a possible boundary condition of the relationship between social embeddedness and participation. Therefore, this study proposed an integrated perspective that incorporated static network and dynamic network and we explored the moderating effect of member instability.

In the following section, we firstly reviewed the literature on social network theory and self-determination theory. Second, we proposed three hypotheses and built our model. Our model suggests that social network embeddedness has a curvilinear (i.e. inverted U-shaped) effect on participation in virtual communities via perceived autonomy, moderated by member instability. Next, we surveyed a sample of virtual community users in China to test our hypotheses. At last, we summarized contributions and limitations of this study and pointed out potential directions for future research.

## **Theoretical Background**

### **Social Network Theory**

Social network theory is based on the assumption that the structure of social interactions and the degree of social centrality strengthen or restrict access to valued resources (Brass, 1984; Ibarra, 1993). The number of connections in the social network is defined as social network embeddedness. The more deeply an individual is embedded in the network, the more social ties no matter strong or weak one has among the network. Individuals embedded in social network can acquire information, personal advice (Gulati et al., 2002) and social support through social ties. Therefore, individuals' social network is a resource of information and social support (Meyer, 1994).

Moreover, social relations provide not only benefits like information and social support alone, but also harmfulness including stress, anxiety and feeling of uncontrolled (Fiore et al, 1983). Studies in the clinical field have found it for a long time that interpersonal relationships tend to bring stress and support concurrently and this tricky paradox has been explicitly recognized in recent studies (Barrera, 1981; Eckenrode & Gore, 1981; Gore, 1978). Individuals are overwhelmed when facing and trying to manage so many social relations at the same time and they could feel sick and suffer from over-embeddedness (Berkman & Syme, 1979).

Since the gaining and losing of their social network can influence individual's perception, social network theory argues that social embeddedness has a critical effect on their perceptions of organizations (Marsden and Friedkin, 1993). Besides, individuals invariably tend to behave as others' expectation for the sake of acceptance and appreciation of others. Being embedded in social networks deeply means intensive social relationships with others and thus results in more expectation to be satisfied and more requirements to be reached. Social norms, which come along with social relationships, are potential sources of stress and being controlled. Therefore, people are less likely to feel autonomy with deep embeddedness.

Overall, social network theorists argue that the pattern of social relationships and embeddedness in social ties among individuals in a network provides support and control/constraints concurrently and sharpens their perception (Borgatti et al., 2009). Moreover, a great body of studies have focused on that embeddedness in social network, which is associated with access of information, perceived support and control, is silently related to a variety of critical outcomes, including job creativity (Perry-Smith, 2006), employee retention (Mossholder et al., 2005), job satisfaction (Dean and Brass, 1985), and promotion (Burt, 1992). The contention of this current study is that embeddedness in social network leads to two paradoxical effects – perceived support and control at the same time. Hence, these ambivalent influences are potential antecedent of curvilinear (i.e., inverted U-shaped) relationship between social network embeddedness and psychological states (i.e., perceived autonomy).

### **Self-Determination Theory**

Self-determination theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2002) explains that individual's behavior is influenced by autonomous and controlled motivation. Autonomous motivation involves acting with a sense of volition and having the experience of choice. In contrast, controlled motivation involves acting with a sense of pressure, a sense of having to engage in the actions (Deci & Ryan, 1991). Behaviors that emanate from intrinsic motivations and interest (e.g., children play together) are considered autonomous, while behaviors that are pushed by extrinsic motivations and pressure (e.g., teachers making a student finish homework) are regarded as loss of autonomy and under control. At virtual communities, members are voluntarily aggregated to meet their four basic needs: interest, relationship, fantasy, and transaction (Hagel & Armstrong, 1997). People share an interest in a specific topic and form meaningful personal relationships here (Kozinets 1999). Since virtual community activities are voluntary (Koh, et al, 2007), members are free to behave as their own will without external pressure or control. Therefore, autonomous motivation can better predict members' behaviors in virtual community.

SDT theory proposes that individuals have three basic psychological needs, which include autonomy, competence and relatedness (Deci & Ryan, 1985). Autonomy means perception as one's free will and making a choice without external regulations and pressure. In the vein of philosophy from self-determination theorists like Dworkin (1988), autonomy refers that an individual is free to do absolutely anything they decide to do and it is an important antecedent of autonomous motivation. When an individual makes a decision with perceived autonomy rather than external pressure or stimulations, they choose what they really want and behave wholly voluntarily derived from autonomous motivations. Hence, individuals with more autonomous motivations will act more volitionally and involve the task more actively (e.g., I work because it is fun and I will work harder; Gagné, & Deci, 2005). In summary, in light of SDT, perceived autonomy can bring about autonomous motivation and thus increase individuals' voluntary behaviors (Ryan & Connell 1989).

## Hypotheses

This current study integrates social network theory with self-determination theory via psychological state (e.g. perceived autonomy), because perceived autonomy is both the outcome of social network embeddedness and the antecedent of individuals' behaviors (e.g. community participation). A great number of literatures explore the perception of autonomy as a critical antecedent of individuals' creativity (Sheldon, 1995), individuals' well-being (Sheldon et al., 1996), and learning intention of students (Hardre & Reeve, 2003). Autonomy involves the human need to determine their own behavior as their own will (Deci & Ryan, 2002). Hence, we proposed perceived autonomy indicates the degree to which an individual actively engages in their choice determination process (Jung, 2011). Applying the previous logic to the context of virtual communities, self-determination theorists postulate that when individuals experience autonomous decisions, which rely on their own voluntary choices, they will perceive psychological freedom and be intrinsically motivated (Deci & Ryan, 1985). Therefore, perceived autonomy enhances autonomous motivation and thus results in actively participation intention in virtual communities.

### **Social Network Embeddedness and Community Participation**

Participation in a virtual community can be defined as a form of information sharing and knowledge exchange (Ridings, Gefen and Arinze, 2002), which is a critical factor that determines whether a virtual community can succeed or not. The degree of participation could be an evidence of success in a virtual community, which can be comprehended as the number of active participants and the number of messages exchanged in the community (Preece, 2001). Although all of the previous models clarified the linear effects of various factors on community participation, social network theory and self-determination theory that we used suggest the potential curvilinear (i.e. inverted U-shaped) effect of social network embeddedness on participation in virtual communities.

Social network theory underlines that the connections in networks have a critical effect on individuals' behaviors (Borgatti & Foster, 2003; Brass et al., 2004). This argument postulates that individuals depend on each other in network and interpersonal interactions from social relations supply support and control on individuals' behaviors (Borgatti & Foster, 2003; Brass et al., 2004; Granovetter, 1985). This frame has also emphasized that social embeddedness acts as a source of information and interpersonal support (Brass, 1984; Coleman, 1988; Ibarra, 1992; Podolmy & Bron, 1997, Wellman 1992). If an individual stands in a peripheral position, they have fewer relationships with others in network. Fewer relationships supply individuals a narrow chance to approach others who are ready and capable to provide help and support as well as fewer chances to give a hand to others when others are in trouble. Therefore, it is less probable that peripheral individuals perceive social ties with others and relations to the community (Morrison, 2002; Wellman, 1992). In contrary, if an individual own a growing body of relations with others in network, this brings the individual more chances to those who are ready to exchange information and social support. In consequence, the individual will experience a feeling of embeddedness, being supported and belonging to the community (Morrison, 2002; Wellman, 1992) which

influence their affective commitment positively (Lee, & Kim, 2010) and thus lead to more community participation. Hence, when moving from low to moderate social network embeddedness, we predict an enhancement effect on community participation.

Conversely, some researchers (Brass et al., 2004; Burt, 1992; Labianca & Brass, 2004; Ray, 1991; Riley & Eckenrode, 1986; Stokes, 1983) find that deep social embeddedness and immense networks do not necessarily generate positive consequences due to social support benefits decrease as the number of relations rises. Managing huge networks and exchanging information with massive other individuals among network consumes one's time and energy (Burt, 1992), which limits individual's potential to receive (or supply) high-level social support. In addition, massive networks bring about relations with annoying guy, contradictory expectations, stress (Labianca & Brass, 2004; Podolny & Baron, 1997) and absence of superior social support. Individuals who are embedded deeply in social networks involve a great number of relations and are likely to depend heavily on others via information exchange and social support, and less tend to intrinsically commit in the community (Ray, 1991). Consequently, this decreases the intention of participation in virtual community. In sum, when moving from moderate to high level of social network embeddedness, we predict a negative relationship with community participation.

A moderate degree of embeddedness which means a middle level of social ties in network may supply individuals more chances to avoid social desolation coming from peripheral positions where they encounter the shortage of chance to interact with other individuals. Furthermore, it is less likely to confront with annoying individuals, stress, and contradictory expectations brought by deep social network embeddedness. In addition, it increases the possibility that more benefits of information exchange and social support. Furthermore, moderate level of embeddedness generates highest intention of community participation. Therefore, this study proposes the following hypothesis related to a network centrality and affective organizational commitment:

*Hypothesis 1. Social Network Embeddedness has a curvilinear (i.e., inverted U-shaped) relationship with community participation.*

### **The Mediation Role of Perceived Autonomy**

SDT distinguishes autonomous motivation from controlled motivation (Vazou-Ekkekakis, & Ekkekakis, 2009) and postulates that individuals have three basic psychological needs including autonomy (the others being competence and relatedness), the satisfaction of which is critical for the welfare of all humanity. Autonomy is defined as the degree to which an individual experiences a sense of high flexibility to make their own decision (Deci & Ryan, 1987, 2000). Individuals with high perception of autonomy are intrinsically motivated due to self-determination is boosted. Therefore, autonomy is composed of three dimensions including perceived locus of causality, volition, and perceived choice (Deci & Ryan, 1987; Reeve, Nix, & Hamm, 2003). The dimension of "perceived locus of causality" can be understood as the degree of which individual's behaviors are derived from internal or external focus. The dimension of "volition" mirrors the feelings of whether individuals are voluntary or unwilling while taking an action. The third dimension called "perceived choice" means that individuals have perceived discretion in the choice process (Deci & Ryan, 1987; Reeve et al., 2003). Furthermore, social network theorists point out that

embeddedness is a probable origin of support and stress coherently (Fiore et al, 1983) and thus social ties is likely to have an curvilinear (i.e., inverted U-shaped) effect on perceived autonomy which influences community participation intention.

Peripheral individuals who lose information exchange and social support via personal interactions tend to perceive less autonomy. They are socially dependent due to constrained access to exchange social support especially when they are in need (Wellman, 1992). In a word, social relations are the access to information and social support. When social network embeddedness is low, with limited support and information, people may feel uncontrollable, less autonomy and decrease their autonomous motivation to participate.

However, although individuals deeply embedded in a network own more access to approach others, result in less dependent on others and higher level of autonomy (Ibarra & Andrews, 1993), massive networks can bring interaction with annoying individuals, contradictory expectations, stress (Labianca & Brass, 2004; Podolny & Baron, 1997), and lack of quality support. Deep embeddedness means too many relations and make central individuals tend to depend on others heavily, which decreases the possibility of independent commitment to communities (Ray, 1991). The increasing social autonomy allows them to improve self-control and to handle healthier social ties with others, which have an effect on their affective commitment positively (Lee, & Kim, 2010). In sum, a high level of embeddedness will make people feel more frequently to be influenced by external reasons. And there will be more social norms to follow due to other individuals have various social expectations. Besides, people might feel overwhelmed and experience loss of control because it is hard to manage so many social ties at the same time (Berkman & Syme, 1979). Thus, people may feel low autonomy and decrease intrinsic motivation for participation.

In contrast, at moderate level of embeddedness, people would feel the support from social networks and limited stress. People may feel high autonomy and enhance motivation of participation.

In short, combined social network theory and self-determination theory, we propose that social network embeddedness have a curvilinear (i.e., inverted U-shaped) effect on perceived autonomy and thus influences community participation intention. Therefore, this study proposes the following hypothesis:

*Hypothesis 2. Perceived autonomy mediates the curvilinear (i.e., inverted U-shaped) relationship between Social Network Embeddedness and community participation.*

### **The Moderating Role of member instability**

In real life context, social network is almost changing all the time because it is common that new members join and old members quit. Researchers have also called for the applications of dynamic social network perspective rather than taking the static framework for granted (Sih, 2009). Hence, this current study takes networks dynamic nature into account. Perceived autonomy refers to that individuals believe they can make a decision initially, control and regulate their own actions. Based on social network theory, social network environment can boost or hinder perceived autonomy (Guay, et al., 2006). Besides, member instability is a critical factor of social

network environment and thus it could have an effect on perceived autonomy and further influences participation intention.

According to dynamic perspective of social network, members are free to join or withdraw and thus network is changing all the time. Therefore, as social ties and interpersonal relations are easy to change and unstable, the low quality of social relations are not so harmful. In that situation, individuals can get in touch with new members, while the high quality of social relations are not so beneficial because individual may lose touch with old individuals once they quit. When instability is high, the constraints of social networks are also decreased. The social norms or controls are hard to exist due to the uncertain social network. And people with high embeddedness would feel less interference from others, the relationship between embeddedness and participation would could possible be insignificant or very weak. In contrary, when instability is low, the support and control of social network would be increased for higher and more stable relationship quality. In sum, member instability may weaken the function of social network including both supporting and controlling for losing social ties. Therefore, we propose the following hypothesis related to moderator:

*Hypothesis 3. Perceived member instability moderates the curvilinear (i.e., inverted U-shaped) relationship between Social Network Embeddedness and community participation such that: at relatively low levels of member instability, the curvilinear relationship is stronger.*

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Insert Figure 1 about here  
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## **Methods**

### **Sample and Procedure**

We conducted the analysis in the setting of Chinese VCs (virtual communities). The samples included seven VCs from Baidu Tieba, which is the largest Chinese online communication platform. Each of them is based on a specific topic, such as an online computer game, fans club of a young male movie star. All these VCs have the characteristics of "Online Community" which means the members of these VCs stay in the community voluntary, meet each other online in the first place (Online) and they have a lot of interactions (Community). Our interviews with their members confirmed that whether can be themselves or have enough autonomy was critical for their participation in communities.

We used a web-based survey because the target subjects were individual members within the communities. With the assistance of core members in each community, we distributed the online survey web link through the posts in their communities. We contacted their core members

to explain the purpose of the survey and ensure them of the voluntary nature of participation and data confidentiality.

Both the independent and dependent variables were operationalized through self-reports. Although such measures have well-known weaknesses, they are particularly useful in studies of human behavior (Howard, 1994). Thus, most studies of intraorganizational knowledge processes make use of self-reported measures (Brock, Zmud, Kim, & Lee, 2005; Cabrera, Collins, & Salgado, 2006).

Common method bias is an obvious limitation of such measures. To decrease the influence caused by common method bias, we make the questionnaire consist of different scales, some of which were reversed, which diminishes the risk of biases (Rust & Coil, 1994). More importantly, we collected data with 2 times. And the time leg between Time 1 and Time 2 is more than 2 weeks. Except the dependent variable community participation and perceived instability are collected in Time 2, the independent variable network embeddedness, perceived autonomy and all controlled variables are collected in Time 1.

The final sample we get included 96 individuals in these seven communities (community size ranging from 10 to 21). For the social network approach we used, we sampled all active members in these seven virtual communities similar to the traditional whole-network approach. The designed questionnaire asked each individual identify his or her community which we were investigating so that we could identify which VC he/she is in. The mean team size was 13.86 (SD = 4.22).

## **Measurement**

All our measures have been previously validated in virtual communities. Following the procedure suggested by Brislin (1986), we used translation and back translation to minimize translation errors for all scales into Chinese version. We used a seven-point Likert-type response format ranging from 1 = “strongly disagree” to 7 = “strongly agree” for measures from community members.

***Community Participation.*** We used the six-item scale (Koh, kim, 2007) to capture community participation from the viewpoint of community members. Sample items included: “I take an active part in our virtual community”, “I do my best to stimulate our virtual community”, “I often provide useful information for our virtual community members”, “I eagerly reply to postings by the help-seeker of our virtual community”, “ I take care about our virtual community members” and “I often help our virtual community members who seek support from other members.” The Cronbach alpha for this scale was 0.87.

***Perceived Autonomy.*** Perceived autonomy was measured by three items adapted from Yoon and Rolland (2012). Examples included "I am free to express my idea and opinions in this virtual community" and “ I feel like I can pretty much be myself in this virtual community.” Responses were also made on a 7-point scale ranging from "strongly disagree" to "strongly agree." The Cronbach alpha for this scale was 0.71.

***Member Instability/Fluctuation.*** Perceived membership fluctuation was measured similar to Matzat (2010). We used single-item asking the respondents to identify on a 7-point

scale of the statement "There are fluctuations in the number of members in the community (new members and member exit)".

**Embeddedness.** We used degree centrality, which is the number of direct contacts an employee is connected to (Freeman, 1979), to capture community members' network embeddedness. According to the previous research, degree centrality is a good indicator of the network embeddedness conferred by large, open egocentric networks, such as those virtual communities we are interested. We followed the measurement adapted from Reinholt and Pedersen (2011), which is a self-reported measure of how many contacts a community member had in his or her social network in community. We asked each respondent to answer: "How many persons within the virtual community do you contact with on a regular basis?" (responses could range from "0" to "21 or above"). Since the studied virtual communities varied in size and therefore also in the availability of persons with whom to build network ties, we normalized the number of people in a social network by the size of the sampled respondents in each virtual community. The final proxy variable of embeddedness is a single-item measure (the number of contacts in the network divided by the size of the sampled core members in each virtual community).

**Control Variables.** Control variables included the community members' demographic information such as age, education background. Also using time (length of membership) was measured. Since previous research has proved that the intrinsic motivation of members affect their participation largely, we also included a control of intrinsic motivation that is perceived playfulness. Perceived playfulness was measured using Moon and Kim (2001)'s nine-item scale. Examples of the items were "When interacting with community, I do not realize the time elapsed." and "Using community gives enjoyment to me." Respondents were asked to rate in a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The Cronbach alpha was 0.87.

## Results

### Descriptive Statistics and Correlations

The descriptive statistics and correlations among dependent variables, independent variables and controls are displayed in Table 1. From the descriptive statistics, we can see, among the respondents, 70% were male, most of them have bachelor's degree (82.5%), they had a mean time of being a community member for 29.39 months (SD= 39.11). Besides, the correlation suggests that embeddedness is not significantly related to community participation. However, perceived autonomy is significantly positively related to community participation, which is consistent with our prediction.

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## Hypothesis Testing

We used regression models to examine the relationship of embeddedness, perceived autonomy and community participation. We investigated the interaction term and the interaction effect was also investigated using the simple slope analysis (Aiken & West, 1991). Table 2 summarizes results of regression analyses for testing Hypotheses 1–3. We included control variables including gender, education, using time and perceived playfulness in all analyses.

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Insert Table 2 about here  
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## Embeddedness and Community Participation

To test Hypothesis 1, and as shown in Model 5, entering embeddedness and its quadratic term into the model resulted in a significant amount of incremental explained variance in community participation ( $\Delta R^2 = .074, p < .05$ ); the coefficient of the quadratic term was significant and negative ( $-4.10, p < .05$ ), indicating an inverted U-shaped relationship between community participation and network embeddedness. We followed Aiken and West's (1991) guidelines to graph the results. As shown in Figure 1, and supporting Hypothesis 1, community participation increased as network embeddedness increased, and once embeddedness reached a certain level, community participation peaked and then declined as network embeddedness increased further.

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To test Hypothesis 2 that is perceived autonomy as a mediator, we examined whether embeddedness has a curvilinear relationship with perceived autonomy (Model 2) and whether perceived autonomy is positively related to community participation (Model 6). As shown in Model 2, entering network embeddedness and its quadratic term into the model resulted in a significant amount of incremental explained variance in perceived autonomy ( $\Delta R^2 = .068, p < .05$ ); the coefficient of the quadratic term was significant and negative ( $-5.03, p < .01$ ), consistent with the anticipated inverted U-shaped relationship. As shown in Figure 2, perceived autonomy increased as network embeddedness increased, and once network embeddedness reached a certain level, perceived autonomy peaked and then declined as embeddedness increased further. Model 6 shows that the addition of perceived autonomy into the model resulted in a significant amount of incremental explained variance in community participation ( $\Delta R^2 = .21, p < .01$ ) and the coefficient of perceived autonomy was significant ( $.53, p < .01$ ). These results show that there is an inverted U-shaped relationship between network embeddedness and perceived autonomy, and perceived autonomy is linearly, positively related to community participation.

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Insert Figure 3 about here  
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We next followed Hayes and Preacher's (2010) method and used the macro they provided to test the mediating role of perceived autonomy on the curvilinear relationship between network embeddedness and community participation. We ran the macro with 5,000 bootstrap samples using task interdependence, LMX median, team size, team power distance orientation, relationship conflict, and team potency as covariates; network embeddedness and its quadratic term as predictors; perceived autonomy as a mediator; and community participation as the dependent variable. For the model using perceived autonomy as the dependent variable ( $R^2 = .17, p < .05$ ), the coefficient of network embeddedness squared was significant and negative ( $-5.02, SE = 1.89, p < .01$ ), and the coefficient of relationship conflict was significant ( $-.18, SE = .08, p < .05$ ). For the model using community participation as the dependent variable ( $R^2 = .38, p < .01$ ), the coefficient of perceived autonomy was significant ( $.53, SE = .094, p < .01$ ). We further computed the instantaneous indirect effect of network embeddedness on community participation through perceived autonomy at different values of network embeddedness (i.e.,  $-1 SD, +1 SD$ ). The instantaneous indirect effect was significant at both lower ( $1.7157, bias corrected bootstrap CI = 95\% [.085, 4.32]$ ) and middle levels of LMX differentiation ( $0.84, bias corrected bootstrap CI = 95\% [0.06, 1.90]$ ), suggesting that an increase in network embeddedness for individuals low in embeddedness is associated with an increase in community participation via its relationship with perceived autonomy; in contrast, an increase in network embeddedness for individuals high in network embeddedness is associated with a decrease in community participation via its relationship with perceived autonomy, supporting Hypothesis 2.

We hypothesized that the inverted U-shaped relationship between network embeddedness and community participation is moderated by both perceived member instability (Hypothesis 3). As shown in Table 2 (Models 7), and consistent with prior examinations of moderating effects of curvilinear relationships (Tangirala & Ramanujam, 2008; Van der Vegt & Bunderson, 2005), the linear interaction between network embeddedness and perceived member instability was significant in the presence of the network embeddedness squared term ( $-3.31; \Delta R^2 = .07, p < .05$ ). The significance of these interactions indicates that the slope of the relationship between network embeddedness and community participation, at any particular level of LMX differentiation, was a function of perceived member instability. As expected, the interactions between the moderators and the quadratic term of the predictor were not significant, indicating that the shape of the inverted U was constant at different levels of the moderators. To further probe these results, we estimated the curves between network embeddedness and community participation for perceived low member instability ( $-1 SD$ ) and perceived high member instability ( $+1 SD$ ) teams and plotted the relationship in Figure 3. As shown in Figure 3, at relatively low levels of member instability, there is positive relationship between embeddedness and participation and is stronger for low embeddedness individuals, rather than high embeddedness

individuals; at relatively high levels of perceived members instability, the relationship between network embeddedness and community participation is not significant. Following Bunderson and Sutcliffe (2003), we computed the maximum points for each curve showing the exact point at which increases in network embeddedness begin to compromise community participation, which shifts to the right as perceived member instability increases. Thus, Hypothesis 3 is supported.

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## Discussion

Departing from previous virtual community studies that examine antecedences of participation in linear logic, we combine social network theory and self-determination theory as the theoretical framework, and create a complex, curvilinear, moderated mediation model. Overall, we posit that perceived autonomy mediates the curvilinear (i.e., reversed U-shaped) relationship between social network embeddedness and community participation. Furthermore, member instability moderates the curvilinear (i.e., inverted U-shaped) effect, such that the curvilinear relationship is weakened when member instability is high. Our complex moderated mediation model demonstrates that the antecedents of community participation is much more complicated than previous research has suggested.

### Theoretical Implications

This study has several implications for the way scholars think about the relationship between social network embeddedness and community participation. Even though prior theoretical perspectives assumes linear relationships, we refine this conventional wisdom by theorizing and finding that social network embeddedness is curvilinear (i.e., reversed U-shaped) related to community participation. Based on social network theory and self-determination theory, we extend social network research by theoretically explaining why a moderate level of embeddedness leads to the highest amount of perceived autonomy and thereby most participation. Social network theory provides a new theoretical perspective to examine the influence of embeddedness.

Secondly, the findings of this study make a significant contribution to the literature on social network. Previous studies mainly highlight the benefits from social network such as social support and information exchange. Only a few theoretically propose that social network could be a source of stress and support concurrently (Barrera, 1981; Eckenrode & Gore, 1981; Gore, 1978). In this study, we took an initial step to empirically test the two sides of social network. We provide evidences of the mixed effects of social networks in organizations, which reminds people not to neglect the downside.

Finally, scholars have called long for studies which take dynamic nature of social network in to consideration because static network is too perfect to be true in real life (Sih et al., 2009). Our

finding about the moderating role of member instability enriches existing literatures by expanding the perspective from static to dynamic. This study also suggests that a high level of member instability could increase the amount of perceived autonomy and thereby overcome the downside of social network embeddedness, which better understands the complex relationship between social network embeddedness and community participation.

### **Practical Implications**

Keeping virtual community members' high participation is extremely important and also a challenge for community managers. Our research has the following implications of management practice for community managers. First, learning more knowledge of the basic behaviors patterns of members is necessary for the management of community. Our research provides more knowledge and reminds community managers of noticing the influence of social embeddedness on members' community participation. It is helpful for community managers to realize the ignored dark side of social embeddedness. When they make decisions related to promoting members overwhelmed into the social network, they should notice and try to avoid the problem of decreasing perceived autonomy and intrinsic motivation. Secondly, for community managers, low participation of high embeddedness members should be noticed. To solve this problem, community managers should try to foster a safer climate, keep the confidence of community members and encourage of bravely to protect members' perceived autonomy. Thirdly, community managers should also pay attention to the members with low level of embeddedness. To foster their community participation, community managers can give more supports for them, encourage members caring about each other, construct the community with low power distance, low centralization to make them perceived more support, autonomy and participate more. Last, since when member instability is high, the stress caused by social embeddedness may decrease. Community managers should know that keeping proper degree of instability can be seen good for enhancing community participation and thereby benefits communities.

### **Limitations and Future Research**

Despite our contributions, the study has several limitations than can open avenues for future studies. First, our sample is limited and only composed of 97 individuals in seven communities. Bigger sample size can increase our confidence of existing findings. Besides, we collected degree centrality as the measurement of social network embeddedness and more dimensions of measurements can increase the validity, such as betweenness centrality and closeness centrality. In addition, we selected the sample from the virtual community which is different from real working context, so it is a possible concern of generalization of other settings. Future research can extend our findings in organization settings to generalize our theoretical findings. Finally, even though we found that perceived autonomy mediated the curvilinear relationship between social network embeddedness and community participation. We cannot exclude the potential exists for other critical mediations, such as trust, organization commitment and sense of community. Future studies can provide a more diverse and comprehensive

understanding of social network embeddedness – community participation relationships by considering more mediating processes.

### Conclusion

Based on social network theory and self-determination theory, we find a curvilinear (i.e., reversed U-shaped) relationship between social network embeddedness and community participation, a mediating role for perceived autonomy, and a moderating role of member instability. We investigate the underlying psychological mechanisms that influence community participation in the context of social network embeddedness. In addition, this research supplies empirical evidence of the two-side of social embeddedness, which means that the social network is a source of not only support but also stress. Finally, it calls for the scholars' attention to develop more powerful theories of community participation as well as alert practitioners to the dynamic nature of social network.

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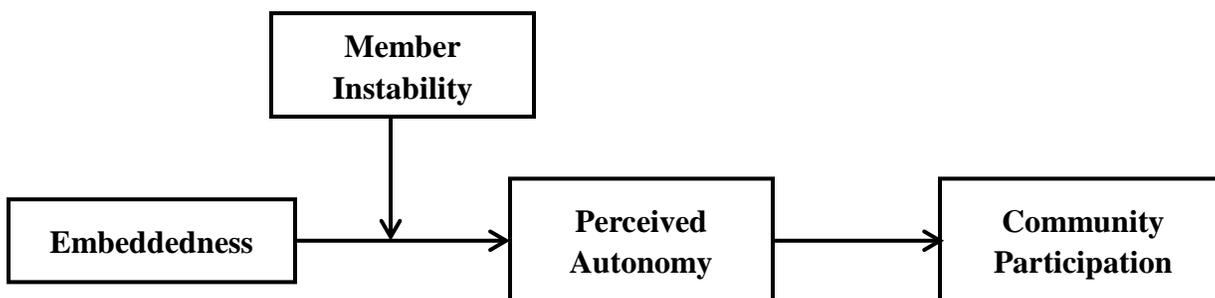
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**Figure 1\***  
**Research Framework**



**Table 1\***  
**Means, Standard Deviations, and Intercorrelations of Variables in the Study**

Variable	Mean	SD	1	2	3	4	5	6	7	8
1.gender	0.71	0.46								
2.education	3.03	0.56	0.02							
3.using time	29.19	33.45	0.04	0.20						
4.perceivedplayfulness	5.21	1.08	-0.06	-0.17	-0.05					
5.embeddedness	0.23	0.17	0.08	0.06	0.09	.21*				
6.perceived autonomy	5.3	1	-0.18	-0.07	0.00	.26**	0.09			
7.community participant	5	1.23	0.07	-0.02	0.18	.23*	.25*	.53**		
8.instability	4.41	1.59	1.59	0.14	0.14	0.09	.25*	0.14	.26*	

Note. N = 96. \*p < .05, \*\*p < .01, + < .10.

**Table 2\***  
**Results of Hierarchical Regression Analysis**

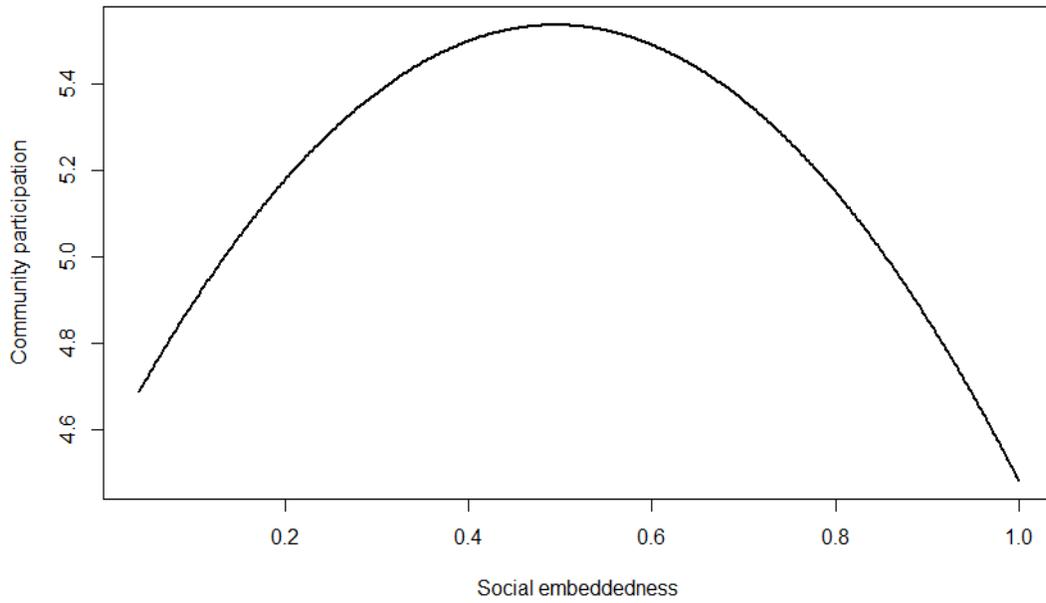
Independent variables	Percieved Autonomy			Community Participation			
	Model1	Model2	Model3	Model 4	Model 5	Model 6	Model 7
Main effects							
Gender	-0.33	-0.26	-0.19	0.16	0.19	0.33	0.39*
Education	-0.04	-0.49	0.02	-0.03	-0.06	-0.03	0.03
Time	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Perceived Playfulness	0.29*	0.25*	0.25*	0.29**	0.21	0.08	0.11
Embeddedness		3.94**	17.39*		4.07**	2.00	16.71*
Embeddedness squared		-5.02**	-22.74		-4.11*	-1.48	-22.65
Perceived Autonomy						0.53**	0.44**
Instability			0.41*				0.47**
Embeddedness * Instability			-3.09*				-3.31*
Embeddedness squared * Instability			3.91				4.55

R	0.10	0.17	0.24	0.10	0.17	0.38	0.46
$\Delta R^2$	0.10	0.07*	0.73*	0.10	0.07*	0.21**	0.07*

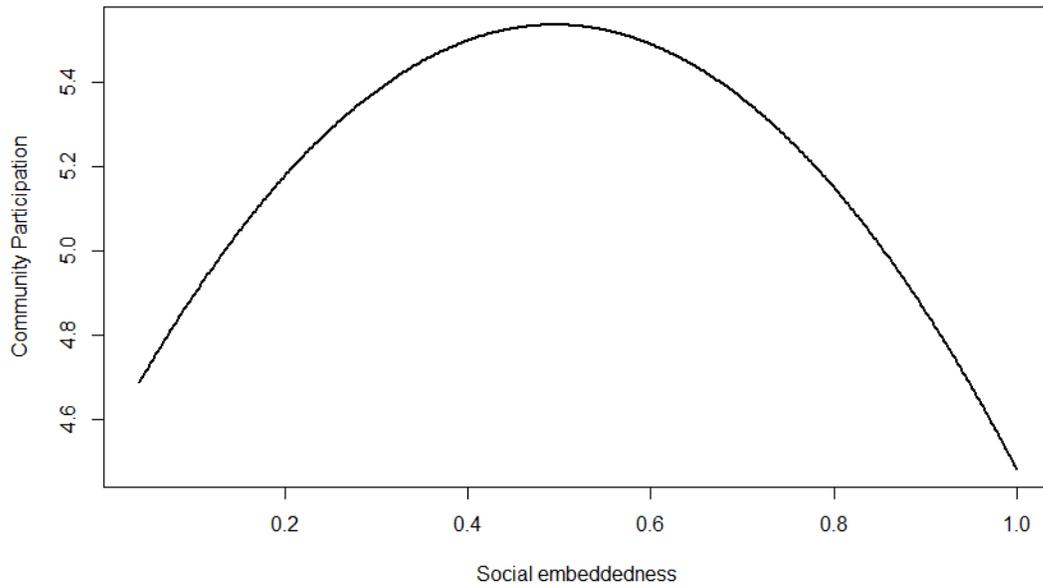
Note.  $n = 96$ . Unstandardized regression coefficients and unadjusted values are reported.

\* $p < .05$ , \*\* $p < .01$ , +  $< .10$ .

**Figure 2\***  
**The Relationship Between Embeddedness and Community Participation**



**Figure 3\***  
**The Relationship between Embeddedness and Perceived Autonomy**



**FIGURE 4\***  
**The Moderating Effect of Perceived Member Instability on the Network Embeddedness-Community Participation Relationship.**

