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Sustained Participation in Virtual Communities from a Self-Determination Perspective

Zhe Zhang

School of Management, Fudan University, Shanghai 200433, China; zhezhang@fudan.edu.cn;
Tel.: +86-21-250-111-89

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Abstract: Customers' participation and contribution are vital to the sustainability of virtual communities (VCs) platform while people have many options to freely surf on the Internet. Sustained participation, instead of initial participation, is more meaningful to virtual communities' sustained development. From the perspective of self-determination theory, this paper explores the effect of community artifacts on sustained participations through users' satisfaction of psychological need and virtual community identification. With empirical studies in two types of virtual community platforms (interest-based and relational-based), our results reveal several important findings. Firstly, this study finds that virtual co-presence and deep profiling can increase users' satisfaction of inner psychological needs. But the use of persistent labeling does not affect the user's satisfaction of psychological needs. In addition, self-presentation is positively related to relational-based community, and rather has no impact on interest-based community. Secondly, this study finds that there exists a positive relationship between users' satisfied psychological needs and virtual community identification. Finally, virtual community identification significantly impacts sustained participation. This paper offers a new perspective on the psychological mechanism of sustained participation and yields important implications for the managerial practice.

Keywords: sustained participation; sustainability; self-determination theory; virtual community identification; basic psychological needs; community artifacts

1. Introduction

The issue of user participation in virtual community platforms is receiving increasing attention from business practitioners and academics [1–7]. The majority of virtual community contents including knowledge, social support, friendship, and entertainment are dependent on voluntary contributions by community members. Therefore, active participation of virtual community members is considered to be the core of sustainability of the community and has been identified as an important measure for online community performance [8]. From the perspective of organizers, the participation rate directly determines business value and potential profitability. A key to successfully carry out online customer community in today's era is in motivating and maintaining virtual community members to continuously become actively involved in the long-term [9–11].

Some of the management scholars have researched VC participation behavior through a motivation or identification theory perspective [9,12–14]. However, these studies do not distinguish the pattern of participation in virtual communities. The sustained participation behavior from the perspective of the psychological mechanism has even more theoretical and practical value for researchers and practitioners [10,15].

This study argues that the self-determination theory (SDT) provides a theoretical framework to comprehend the psychological mechanisms related to the sustained participation behaviors of virtual community members. SDT reveals the process of how an external environment promotes

internalization mechanisms of intrinsic and extrinsic motivation [16]. Because in the virtual community context, satisfying users' intrinsic and extrinsic motivation is a key mechanism for motivating users toward sustained participation [17,18].

The sustained participation of online communities is a form of source usage [19]. This study adopts source usage from [17] about virtual community artifacts including virtual copresence, persistent labeling, self-presentation, and deep profiling. This study explores the psychological mechanisms of virtual community members and their sustained participation behaviors behind the users' perceived effectiveness of community artifacts in virtual communities from the perspective of the self-determination theory. Beyond identification with virtual communities, this study aims to put forward the antecedents driving virtual community identification through fulfillment of basic psychological needs. These issues contribute to contemporary organizational sustainability research for information technologies [19–21].

In the next section, based on theoretical background, this study proposes a theoretical framework and research hypotheses. This framework in two virtual communities was tested because I expected differences between an interest-based and a relational-based service community. Finally, a general discussion of our findings is concluded and managerial implications and future research directions are derived.

2. Theoretical Background

2.1. Sustained Participation

Participation behavior in community behavior is essentially described in terms of the common following factors: members' voluntary involvement, the requirements of members' creative efforts, and the critical role of participation in the sustained development of the community [8,22].

Furthermore, the classification of virtual community participation lays more emphasis on a static base instead of a dynamic one considering the members' psychological changes from the initial participation to sustained participation [19,23,24]. This establishes the distinction between initial participation and sustained participation. Some scholars have noted that there are different motivating factors for sustained participation and initial participation [25,26]. As Shah [26] finds, drivers for short-term and long-term participants in a software community are not the same. The former mainly seeks to meet the needs of searching software, while the latter is driven by hobby for programming and the like, and for interacting with other members of the community. In the research about Public Document Repositories, Peddibhotla and Subramani [25] view members' contribution to Public Document Repositories as one type of participation behavior. They also point out that this kind of behavior is determined by two aspects: contribution quantity and quality, which are also different in terms of their inner motivations.

Therefore, one characteristic of sustained participation is continuous voluntary contribution [27]. Why do members choose to participate in such a way? Ma and Agarwal [17] study the influence of contextual characteristics on participant's knowledge sharing from the perspective of identity verification. Furthermore, Toubia and Stephen [14] use Twitter as an example to study why people are willing to contribute content and knowledge through social media based on intrinsic utility and image-related utility. Similarly, social constructionists view that people acquire information and knowledge through an interactive process with other people, resulting in the formation of a community membership [28,29]. Such a highly contextualized learning process and identity can directly affect the user community's participation behavior [8,9]. Further, Porter et al. [30] suggest that managers can adopt a three-stage process to successfully nurture and maintain consumers' sustained participation in virtual communities, which is first to understand consumer needs and motivations, second to promote participation, and third to encourage cooperation. In addition, Lin and Lu [15] propose a rational model that integrates motivation theory with network externalities to interpret users' continuously join

in social network sites. Fang and Zhang [10] analyze different users' continued participation behavior in social Q&A communities from a motivation perspective.

2.2. Self-Determination Theory

We adopt self-determination theory (SDT) as the theoretical perspective. In recent years, the self-determination theory has especially received widespread attention (e.g., [12,19,31]). Deci and Ryan [32,33] develop the self-determination theory to understand what sustains individual behavior. The self-determination theory reveals the impact of external influences on individual motivation from an organic and dialectical perspective and describes the process of how an external environment promotes internalization mechanisms of intrinsic and extrinsic motivation [16].

The basic psychological needs theory branches from the self-determination theory [34]. Researchers identify three basic psychological needs: the need for autonomy, the need for competence, and the need for relatedness. The self-determination theory identifies human motivation by two categories—*intrinsic* and *extrinsic*—which are not antagonistic, but exist in a continuum. *Intrinsic* motivation does not weaken with the presence of *extrinsic* motivation [13]. *Intrinsic* motivation refers to doing an act in order to gain pleasure and satisfaction authentically; *extrinsic* motivation refers to the performance of an activity to attain some separable outcome. According to the self-determination theory, *intrinsic* motivation and *extrinsic* motivation internalization is a natural process. Whether or not this process can be successfully completed depends on whether or not the three basic psychological needs in this process can be met.

2.3. Virtual Community Identification

Virtual community identification is a specific type of organizational identification. The process of organizational identification occurs as individuals' self-concept come to share attributes in common with their organization [34,35]. Such identification and self-categorization processes also exist within the virtual context [36]. Virtual community identification refers to the users' identifying themselves with the virtual community [8]. Individual social identity construction comes from his/her cognitive recognition of membership in one group, as well as his/her affective connection and personal evaluation [37].

Ellemers et al. [38] proposed three components of social identification: cognitive, affective and evaluative. Cognitive component refers to one's cognition of a group's membership after self-categorization process. Cognitive component of social identification demonstrates a process to identify and strengthen their similarities to other members of the organization, as well as differences from non-members of the group [39]. The affective component is a personal emotional connection to the belonged group. Even such a group is virtual [8]. The affective component determines whether the members love such groups. The evaluative component is a personal positive or negative evaluation towards his/her membership of one group they belong to, which actually yields the formation of self-esteem at organizational level [38].

3. Theoretical Framework and Hypotheses

Building on the self-determination theory and virtual community identification, our theoretical framework is shown in Figure 1. According to [17], there are four technical features of virtual communities including virtual copresence, persistent labeling, self-presentation, and deep profiling. To sustain the behavior of using an online community and share knowledge, the behavior has to be self-determined [6,12,19,40]. The community artifacts amplify the satisfaction of basic psychological needs, which strengthens virtual community identification, which, in turn, relates to sustained participation. Our theoretical framework figures out the underlying mechanism of the virtual community identification process through the perspective of members' basic psychological needs fulfillment.

Figure 1. Theoretical framework.

3.1. Community Artifacts and Satisfied Psychological Needs

Virtual copresence refers to individuals subjectively feeling being together with the others in a virtual environment. Many factors affect this subjective feeling such as interactivity (using instant messaging tools such as chat rooms or instant messaging), media vividness (such as how many users are available online, what they are doing). When the users are able to feel this virtual copresence, knowing each other also with a virtual community, their communication with each other can get immediate feedback, and they feel care and attention by the other party. Then, the users' psychological needs will be satisfied. Therefore, based on the discussion summarized above, the study proposes the following hypothesis:

Hypothesis 1a (H1a). *Community artifact supporting virtual copresence is positively related to satisfaction of psychological needs.*

Persistent labeling refers to an individual consistently using the same user name (ID) or label (label) for a long time in a virtual environment. The lack of information about self and others will inhibit the interaction between anonymous members in a virtual environment. When a user uses a continuous label, he can be more easily identified by others. Information exchange is much simpler and easier to establish a stable relationship with others. When the user is always constantly changing labels, as it is more difficult to be identified, others may also be mistaken for a different user. Therefore it becomes more difficult to establish relationships with others, albeit the exchange of information. Therefore, this study proposes:

Hypothesis 1b (H1b). *Community artifact supporting persistent labeling is positively related to satisfaction of psychological needs.*

Self-presentation is represented using a variety of ways such as a personal home page, personalized signature, screen name, avatar to represent themselves, which will make others understand themselves better. On the one hand, when the user can choose how to show their own, such as the ability to modify their own signature, the ability to choose their screen name and image, the ability to choose how to decorate their own personal home page, the user can experience the feeling of autonomy. To take control of their own image and behavior in a virtual environment means that they are their own masters. Such artifacts can promote intrinsic motivation or extrinsic motivation internalization for community members. What is more, virtual environments can support more users in the freedom to express their

views, thereby strengthening their inner sense of autonomy. On the other hand, self-presentation can also provide others better understanding of their own way. Then, the users can more easily express their views and the characteristics of their hobbies, and it is easier to build a relationship with others who meet their social relatedness requirements. Therefore, the study proposes:

Hypothesis 1c (H1c). *Community artifact supporting self-presentation is positively related to satisfaction of psychological needs.*

Deep profiling refers to the virtual community providing more information about a user, such as ranking data (based on professional competence, credibility, contribution, or other criteria), interaction (with most members of the interaction, etc.), the user prior information, and effective search tools. These functions are able to allow users to be more convenient and more accurate in understanding others as well as themselves, which are more conducive to the establishment of mutual relations between the members. Therefore, the study proposes:

Hypothesis 1d (H1d). *Community artifact supporting deep profiling is positively related to satisfaction of psychological needs.*

3.2. Satisfied Psychological Needs and Virtual Community Identification

Humans spend a great deal of time, energy, and money in virtual contexts (such as video-gaming, blogging, chatting etc.). Recent empirical research indicates that virtual environments may be motivating to the degree that they allow individuals to experience ideal aspects of themselves [41,42]. On the other side, SDT suggests that three basic psychological needs are the essential constituents for identity development and well-being [32]. Therefore, we can speculate that social identities in VC are adopted in the service of these basic psychological needs [43].

In Marcia's paradigm [44], identity formation is operationally defined according to two dimensions, exploration, and commitment. Exploration refers to the degree to which individuals actively examine values, beliefs, and goals, and experiment with different social roles, plans, and ideologies. Commitment refers to the determined adherence to a set of convictions, goals and values. Luyckx et al. [45] find that the autonomous orientation was positively related to making commitments and feeling certain about commitment. Meanwhile, identity integration, a key element in identity exploration and development [46], was positively related to self-esteem and positive effects, which are the bases of affective and evaluative social identity in a virtual community [3]. Gagne and Deci [34] summarize that autonomous motivation is related to organizational commitment as indexed by identification and integration in a work context. Satisfaction of psychological needs will bring work engagement emotionally and increase general collective self-esteem [3,38]. Accordingly, VC participants will enhance their affective and evaluative social identity after satisfaction of intrinsic needs.

Competence need refers to an individual's faith to achieve a certain outcome after own behavior and to believe himself/herself capacity to take control of certain activities and the environment. In the virtual community, users' ability to act with a certain degree of confidence and control will help them to engage in the community deeper and longer which, in turn, will enhance their identification with the virtual group. Particularly, the competence of learning in the community is helpful to an individual's development of a social identity [9,47].

Social identification with the virtual community originates from the individual member's innate need for belonging [9]. The sense of belonging yields understanding and meeting others' expectations within a group. At the same time, while the individual feels his relatedness, he will form a positive evaluation towards being in this community considering others' caring, understanding, and appreciation [48]. Identification reflects a conscious valuing of a behavioral goal or regulation, such that the action is accepted or owned as personally important. Therefore, satisfaction of psychological needs will integrate extrinsic motivation into an intrinsic one with an autonomous or self-determined

form, resulting in the formation of social identity in a virtual community. This is summarized in the following hypothesis:

Hypothesis 2 (H2). *Users' satisfied psychological needs are positively related to their virtual community identification.*

3.3. Virtual Community Identification and Sustained Participation

Ellemers et al. [38] propose a form of social identity of three components: cognitive identity, affective identity and evaluative identity. Bergami and Bagozzi [49] using field observations find that three dimensions of social identity can contribute to employees' organizational citizenship behavior within the organizational context. Previous scholars also show that such an identity and self-categorization process also exists in a network environment [36].

Fang and Neufeld [50] propose that legitimate peripheral participation theory is composed of situated learning, identity construction, and sustained participation. Situated learning and identity construction interact with each other, which attribute to sustained participation [51]. Through situated learning, a member's ability is gradually recognized by both the community (through adjustment of status) and other community members (through identity activities). Furthermore enhanced identity promotes the members to join situated learning (meanwhile contributing to other's situated learning). The participants ultimately engage the sustained participation behavior through this process. Therefore, this process also explains that the identity construction can enhance sustained participation behavior. Tsai and Pai [52] testify that members' identification with the virtual community influences members' proactive participation behavior. Based on the above analysis, the study proposes Hypothesis 3:

Hypothesis 3 (H3). *Virtual community identification is positively related to sustained participation behavior for users.*

4. Methodology

4.1. Research Setting

To test the proposed hypotheses, this study conducted a study in cooperation with two virtual community platforms in China. One of the research site, Douban (<http://www.douban.com/>), is a Chinese website allowing registered users to record information and create content related to films, books, music, and recent events and activities in Chinese cities. It was launched in 2005. Douban also owns an internet radio station. Douban has about 160 million registered users. Another research site, Sina Weibo (<http://weibo.com>), is a Chinese microblogging website. It is one of the most popular sites in China, in use by well over 30% of Chinese Internet users, with a market penetration similar to what Twitter has established in the USA. It was launched by SINA Corporation in 2009, and has 503 million registered users. About 100 million messages are posted each day on Sina Weibo. The two research sites chosen represent two types of virtual communities categorized by [53]: interest-based community (Douban) and relational-based community (Sina Weibo). Through the inclusion of two communities, the study sought to extend the generalizability of the findings by exploring the differentiation of self-determination theory and virtual community identification across different settings.

4.2. Measurement

This study used the existing scales whenever possible and adapted them to the virtual community context (see scale resources in Table 1). The multidimensional constructs used 7-point Likert-type scales. Based on literature research, an initial set of items was generated.

Table 1. Construct measures and sources.

Constructs	Scale Sources	7-Points Likert-Type Scale
Environmental characteristics of virtual communities	Biocca et al. (2003) [54] Schroeder et al. (2001) [55]	1-strongly disagree or never like that 7-strongly agree or always like that
Satisfied psychological needs	Deci et al. (2001) [56] Ilardi et al. (1993) [57] Kasser et al. (1992) [58]	1-not accurate 7-very accurate
Virtual community identification	Brown et al. (1986) [47] Crocke & Luhtanen (1990) [59] Ellemers et al. (1999) [38] Rosenberg (1965) [60]	1-not accurate 7-very accurate
Sustained participation	Wasko & Faraj (2005) [40] Koh et al. (2007) [4]	1-strongly disagree 7-strongly agree

Next, to enhance the constructs' face validity, this study worked with Douban and Sina Weibo marketing managers to evaluate each item with respect to wording, fit with construct, completeness, and uniqueness. The study rephrased improperly worded items and deleted those that did not fit the construct definition. In the final step, the study invited 60 Douban and Sina Weibo users to participate in a pretest, obtaining 52 fully completed responses. These respondents provided open-ended feedback on the questionnaire. This study used this information to make several minor changes to wording and finalized the items used for the main study. English translations of the study measures are provided in the Appendix A.

4.3. Data Collection

In total, 585 complete responses from Douban were received. There were 506 valid responses, yielding a valid response rate of 86.5%. Meanwhile a total of 237 complete responses from the Sina Weibo were received. There were 210 valid responses, yielding a valid response rate of 88.6%. As this study is to investigate the respondents' sustained participation, the study screened out users who have been participating for more than one year in the community (considered as sustained participants) to conduct the following data analysis. After screening, Douban has 432 sustained participants, and Sina Weibo has 191 sustained participants. Table 2 presents an overview of the sample characteristics.

Table 2 shows that among the respondents from both Douban and Sina Weibo, the proportion of female users is relatively higher, and the majority is in the age group of 21–30 years. Furthermore, most of the members have a bachelor's degree or higher (80% in Douban and 94% in Sina Weibo). In terms of the length of involvement in the community, among the respondents from Douban, 38% have been involved for 1–2 years, 24% for 2–3 years, and 38% for more than 3 years. Comparatively, among the respondents from Sina Weibo, 41% have been involved for 1–2 years, 23% for 2–3 years, and 36% for more than 3 years. It shows that there is no significant difference in the demographic profile of both communities' respondents.

Table 2. Sample characteristics.

Overall Characteristics	Douban (N = 432)	Sina Weibo (N = 191)
Gender		
male	160 (37%)	78 (41%)
female	272 (63%)	113 (59%)

Table 2. Cont.

Overall Characteristics	Douban (N = 432)	Sina Weibo (N = 191)
Age		
20 years and younger	74 (17%)	28 (15%)
21–30 years	331 (76%)	124 (65%)
31–40 years	24 (6%)	38 (20%)
41–50 years	3 (1%)	1 (1%)
Over 50 years	0 (0%)	0 (0%)
Education		
High school and lower	29 (7%)	4 (2%)
College	56 (13%)	7 (4%)
Undergraduate	273 (63%)	92 (48%)
Master and above	74 (17%)	88 (46%)
Annual Income (in thousand)		
Less than 10	199 (46%)	72 (38%)
10–50	129 (30%)	46 (24%)
50–300	101 (23%)	52 (27%)
Over 300	3 (1%)	21 (11%)
Length of the Participation in the Community		
1–2 years	166 (38%)	79 (41%)
2–3 years	102 (24%)	44 (23%)
Over 3 years	164 (38%)	68 (36%)

5. Results and Analyses

The theoretical model is multistage, suggesting the need for a structural equation modeling technique that simultaneously tests multiple relationships. This study uses SPSS and AMOS as the main statistical technique.

5.1. Reliability and Validity

The structural validity mainly is assessed by using the Kaiser-Meyer-Olkin (KMO) measure of the sampling adequacy test and Bartlett's test of sphericity. Before analyzing the validity, we must first carry out KMO and Bartlett's test of sphericity to confirm whether the data are suitable for factor analysis. The results of the tests show that all variables of the KMO scale are greater than 0.7, the χ^2 value of Bartlett's test of sphericity was significant, meaning that the common factors exist between the scale items and therefore they are suitable for carrying out a factor analysis. The results of the validity analysis of Douban and Sina Weibo are shown in Table 3. The loading coefficients of the factors are an important indicator for inspecting the validity of scales, as shown in Table 3, the loading coefficients are greater than 0.5 [61]; therefore, we consider the design of the scale to be effective.

Based on the survey data from the 432 responses of the Douban and the 191 responses of Sina Weibo, we use SPSS for analyzing the measurement reliability. As shown in Table 4, each Cronbach's α is greater than 0.7, we believe that these measurements have a relatively high internal reliability.

Table 3. Factor loading and accumulated variance.

Constructs	Items	Douban (the Interest-Based Community)		Sina Weibo (the Relational-Based Community)	
		Factor Loading	Accumulated Variance	Factor Loading	Accumulated Variance
Sustained participation	Q7_1	0.747	71.164%	0.721	69.193%
	Q7_2	0.873		0.798	
	Q7_3	0.884		0.918	
	Q7_4	0.864		0.877	
Virtual community identification (Cognitive)	Q6_1	0.718	72.350%	0.705	70.247%
	Q6_2	0.794		0.724	
	Q6_3	0.807		0.737	
	Q6_4	0.784		0.623	
Virtual community identification (Affective)	Q6_5_0	0.871		0.660	
	Q6_6_0	0.830		0.603	
Virtual community identification (Evaluative)	Q6_7	0.902		0.735	
Satisfied psychological needs (Relatedness)	Q5_5	0.863	75.592%	0.828	74.974%
	Q5_7	0.754		0.633	
	Q5_2	0.663		0.802	
Satisfied psychological needs (Competence)	Q5_4	0.698		0.824	
	Q5_3	0.910		0.866	
Satisfied psychological needs (Autonomy)	Q5_1	0.851		0.868	
	Q5_6	0.811		0.877	
Virtual copresence	Q1_1	0.650		0.699	
	Q1_2	0.872		0.874	
	Q1_3	0.856		0.873	
Persistent labeling	Q2_1	0.723		0.927	
	Q2_2_0	0.788		0.899	
Self-presentation	Q3_1	0.550	66.090%	0.611	69.745%
	Q3_2	0.523		0.597	
	Q3_3	0.847		0.805	
	Q3_4	0.829		0.808	
Deep profiling	Q4_1	0.814		0.831	
	Q4_2	0.864		0.822	
	Q4_3	0.857		0.834	

Table 4. Cronbach's Alpha.

Constructs	N of Items	Douban	Sina Weibo
		Cronbach's α	Cronbach's α
Sustained participation	4	0.861	0.849
Virtual community identification	7	0.745	0.706
Satisfied psychological needs	7	0.826	0.717
Environmental characteristics	12	0.799	0.753
Virtual copresence	3	0.759	0.782
Persistent labeling	2	0.738	0.805
Self-presentation	4	0.721	0.715
Deep profiling	3	0.854	0.838

5.2. Common Method Variance

Because our constructs are measured in a survey-based study, common method bias arises possibly [62,63]. To address the possibility, this study followed Podsakoff's et al. [63,64] method to include a common method factor in a structural equation model. The study used AMOS6.0 to test the effects of interest either with or without including a common method factor. The coefficients of independent variables did not change substantially.

5.3. Hypothesis Tests—Douban (Interest-Based Community)

To test the research hypotheses, this study used AMOS6.0 to evaluate the structural equation model.

In Table 5, the fit statistics for the full model are as follows: $\chi^2(374) = 728.324$, $p \approx 0.00$, $\chi^2/df < 2$, RMSEA < 0.08 , GFI and AGFI ≈ 0.9 , NFI ≈ 0.9 , and TLI and CFI > 0.9 . The χ^2 is significant ($p < 0.05$); however, this is usually the case for large sample sizes like the one we have. All the other statistics are relatively good. Results indicate a good model fit.

Table 5. Fit statistics for the full model (the interest-based community—Douban).

Absolute Fit Index				Relative Fit Index				
χ^2	df	χ^2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
728.324	374	1.947	0.047	0.896	0.871	0.876	0.924	0.935

Table 6 shows the internal consistency statistics for construct measures. As Table 6 shows, the reliability of the combination of all constructs is greater than 0.6, and the average variance extracted is greater than 0.5 [65]. Therefore, good internal consistency is indicated.

Table 6. Internal consistency statistics (the interest-based community—Douban).

Constructs	Construct Reliability (CR)	Average Variance Extracted(AVE)
Virtual copresence	0.7881	0.5669
Persistent labeling	0.6297	0.5213
Self-presentation	0.7458	0.5010
Deep profiling	0.8555	0.6647
Satisfied psychological needs	0.8371	0.6342
Virtual community identification	0.6198	0.5031
Sustained participation	0.8323	0.5556

The results of path analysis are shown in Figure 2.

Figure 2. The path coefficients (the interest-based community—Douban); Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

5.4. Hypothesis Tests—Sina Weibo(Relational-Based Community)

In Table 7, the fit statistics for full model in Sina Weibo are as follows: $\chi^2(377) = 699.405$, $p \approx 0.00$, $\chi^2/df < 2$, RMSEA < 0.08 , GFI and AGFI ≈ 0.9 , and NFI, TLI, and CFI ≈ 0.9 . The χ^2 is significant ($p <$

0.05); however, all the other statistics are relatively good, which means that the overall fit of the model is acceptable.

Table 7. Fit statistics for the full model (the relational-based community—Sina Weibo).

Absolute Fit Index					Relative Fit Index			
χ^2	df	χ^2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
699.405	377	1.855	0.067	0.887	0.862	0.858	0.879	0.899

Table 8 shows the internal consistency statistics for construct measures in Sina Weibo. As Table 8 shows, the reliability of the combination of all constructs is greater than 0.6, and the average variance extracted is greater than 0.5. Therefore, good internal consistency is also indicated.

Table 8. Internal consistency statistics (the relational-based community—Sina Weibo).

Constructs	Construct Reliability (CR)	Average Variance Extracted (AVE)
Virtual copresence	0.8051	0.5900
Persistent labeling	0.7887	0.6174
Self-presentation	0.7927	0.5051
Deep profiling	0.8494	0.6579
Satisfied psychological needs	0.7519	0.5038
Virtual community identification	0.6198	0.5031
Sustained participation	0.8895	0.6728

The path coefficients in the structural model are shown in Figure 3.

Figure 3. The path coefficients (the relational-based community—Sina Weibo). Note: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

The results of hypothesis tests in Douban and Sina Weibo are summarized in Table 9. Data from Douban support Hypotheses 1a, 1d, 2, and 3. Data from Sina Weibo support Hypotheses 1a, 1c, 1d, 2, and 3. Both communities support the posited links between virtual copresence (H1a) and deep profiling (H1d) and satisfied psychology needs. However, the relationship between persistent labeling and satisfied psychology needs (H1b) is not supported in either community. Moreover, the relationship between self-presentation and satisfied psychology needs (H1c) is significant for Douban but not for Sina Weibo. In both communities, satisfied psychology needs significantly and positively relate to virtual community identification (H2), which, in turn, relates to sustained participation (H3).

Table 9. Results of the hypotheses testing.

Research Hypotheses	Path Description	Results
H1a. Community artifacts supporting for virtual copresence is positively related to satisfaction of psychological needs.	Virtual copresence → Satisfied psychological needs	Supported
H1b. Community artifacts supporting for persistent labeling is positively related to satisfaction of psychological needs.	Persistent labeling → Satisfied psychological needs	Not Supported
H1c. Community artifacts supporting for self-presentation is positively related to satisfaction of psychological needs.	Self-presentation → Satisfied psychological needs	Supported (relational-based community) Not supported (interest-based community)
H1d. Community artifacts supporting for deep profiling is positively related to satisfaction of psychological needs.	Deep profiling → Satisfied psychological needs	Supported
H2. Users' satisfied psychological needs are positively related to their virtual community identification.	Satisfied psychological needs → Virtual community identification	Supported
H3. Virtual community identification is positively related to sustained participation behavior for users.	Virtual community identification → Sustained participation	Supported

6. Discussion

From the perspective of the self-determination theory, this study explored the psychological mechanism of how satisfied psychological needs influenced the users' sustained participation through the process of identification in the virtual community environment. This study focused on two types of communities, an interest-based community (Douban) and a relational-based community (Sina Weibo), and carried out verification for the proposed hypothesis.

Regarding the relationship between community artifacts and the satisfied psychological needs, this study discovered that the community artifacts, which supported virtual copresence and deep profiling, could enhance the satisfaction of the users' psychological needs, which was verified in both the interest-based community (Douban) and the relational-based community (Sina Weibo). Through use of virtual copresence, the users can feel other users' presence in the same community, weakening the Internet's barrier of not seeing each other, creating an environment in which people can face each other as in reality and strengthening the users' trust in other users and the community. Through use of deep profiling, the users can autonomously access others' exposed information and their performance in the community, so that they can deepen their understanding of the others, which makes it easier to build relationships with other people. In this process, the users in virtual community gradually remove their precautions and start to participate in the community actively. Through taking part in the community's activities they can demonstrate their competence and obtain the satisfaction of their inner psychological needs. This shows that in the virtual environment, the community artifacts supporting virtual copresence and deep profiling can enhance the satisfaction of users' inner psychological needs.

The relationship between persistent labeling and satisfied psychological needs was not supported in both the interest-based community (Douban) and the relational-based community (Sina Weibo). This study posits that in Douban, the main reason for users to build relationships is due to the users' common interests, while the true identity of the other person is not found out; at the same time, the user name also only serves the purpose of identification in the beginning. Once the relationship is established between the users, they interact more frequently and become more familiar with each other; hence, the role of the username for identification was not salient anymore. Therefore, it is understandable that the effect of persistent labeling on the satisfaction of the sustained participants' psychological needs was not significant. With regard to the relational-based community (Sina Weibo), most of the users have "offline" contact as well, and are familiar with the other person's identity;

at the same time, the username's role of identification is somewhat weakened, and thus, it is also understandable that the effect of persistent labeling on the satisfaction of users' psychological needs in the relational-based community is nonsignificant.

This study finds a remarkable difference in the path from self-presentation to satisfied psychological needs, which is not significant in the interest-based community (Douban) and significant in the relational-based community (Sina Weibo). Thus this effect is relevant to the type of the virtual community. Douban belongs to the common interest communities, the approval of the interests and information determines the extent of the satisfaction of the users' psychological needs, while the effect of the personal information shown is rather small. On the other hand, Sina Weibo belongs to the relational-support communities, the establishment of relationships requires the presentation of personal information, which also enhances the identifiability and quality of the relationship; therefore, self-presentation has a significant effect on satisfied psychological needs.

The relationship between satisfied psychological needs and virtual community identification received empirical support in both communities. Regarding the three types of psychological needs of the self-determination theory, previous researchers found out that through satisfying an individual's autonomous, relational and competence psychological needs, the virtual environment factors and the individuals' interaction enhances intrinsic motivation and internalization of extrinsic motivation, eventually motivating the working behavior of the individual and enhancing the mental health of the individual.

Within the virtual environment, the relationship between virtual community identification and sustained participation is supported by both the interest-based community (Douban) and the relational-based community (Sina Weibo), which means that the users' virtual community identification can contribute to their sustained participation in the virtual community.

7. Conclusions

Our research results show that the community artifacts supporting the use of virtual copresence, self-presentation, and deep profiling can enhance the satisfaction of its users' inner psychological needs. For this reason, creating a convenient environment for users' sustained participation is of crucial significance for the virtual community's sustained development. From a business perspective, the manager should take advantage of all community artifacts to create a convenient and trusted environment for the virtual community users, encouraging the virtual community users to actively participate in the community activities.

Our study found out that the satisfied psychological needs (autonomy, competence, relatedness) can contribute to the virtual community identification. The importance of the satisfaction of the users' inner psychological needs for the virtual community is confirmed. Therefore with regard to the manager, knowing the users' different requirements and motivations is very important. At the same time, while supporting and launching activities in the virtual community, the community users' inner psychological requirements should be fully taken into account.

Furthermore, our study confirmed that in the virtual environment, the users' identification can contribute to sustained participation. Therefore, for users who have formed identification with the virtual community, the virtual community manager can strengthen their sense of belonging and superiority by intensifying the difference between the members inside and outside the community; thus, further increasing their sense of belonging towards the community, and promoting their sustained participation; for users who have not yet established identification with the virtual community, the virtual community manager can form the virtual community's specialty and superiority by emphasizing the difference to other communities, also attracting their attention by creating or strengthening the common ground of the community and the users, strengthening the cognitive resonance, and then impelling them to form identification with the community, further enhancing sustained participation, thus contributing to the virtual community's sustainability.

8. Limitations and Directions Further Research

This study found out the sustained participation of virtual community members using the self-report method scale measurement. If the users' actual behavior data could be obtained further, the research results could be further validated and enriched.

With the rapid development of information technology, the elements of the virtual environment are becoming increasingly more diverse, not just being limited to chatting, inbound mails, username, labeling, avatar, and self-presentation elements. Now, it has already extended to offline activities, same city activities, small-group activities, etc. Porter, Donthu, Macelroy, and Wydra [30] also show that intensifying the interconnection between the community members promotes the community members' sustained participation, encouraging the members to form small groups based on the location, common interests, or other characteristics, and also encouraging the users to meet face to face, increasing the opportunities of offline contact, increasing the relationships and emotional ties between the community members, and thus promoting the community members' active sustained participation. Therefore, future studies can consider digging further into virtual community elements exploring how the users' active sustained participation can be promoted more effectively in the virtual community.

In addition, our research findings are limited to just only our dataset in China. Therefore, testing based on a different dataset in different countries will be encouraged.

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Appendix A Summary of Constructs and Their Measures

Virtual copresence

Q1_1 I find that people respond to my posts or private messages quickly.

Q1_2 To what extent, if at all, did you ever have a sense of “being there with other people” in this community?

Q1_3 To what extent, if at all, did you have a sense that you were together with other members in the virtual environment of this community?

Persistent labeling

Q2_1 I consistently use a single ID to communicate with other members in this community.

Q2_2 I use more than one ID in this community (reversed). (Q2_2_0 = 8- Q2_2)

Self-presentation

Q3_1 I share my photos or other personal information with people from this community.

Q3_2 I present information about myself in my profile.

Q3_3 I use a special (or meaningful) signature in this community that differentiates me from others.

Q3_4 I use a special (meaningful) name or nickname in this community that differentiates me from others.

Deep profiling

Q4_1 I think that other people search the archive to find out more about me.

Q4_2 I think that other people have read my previous posts.

Q4_3 I think that other people look at my profile to find out more about me.

Satisfied psychological needs

Q5_1 I am free to express my ideas and opinions in this community.

Q5_2 I consider the people I am with in this community to be my friends.

Q5_3 I have been able to learn interesting new skills in this community.

Q5_4 Most days, I feel a sense of accomplishment from being in this community.

Q5_5 People in this community care about me.

Q5_6 I feel like I can pretty much be myself in this community.

Q5_7 People in this community are pretty friendly towards me.

Virtual community identification

Q6_1 I identify with other members of the community.

Q6_2 I am like other members of the community.

Q6_3 I can reflect very well who I am.

Q6_4 When I talk about this community I often want to say “We” instead of “They”.

Q6_5 I dislike being a member of the community (reversed). ($Q6_5_0 = 8 - Q6_5$)

Q6_6 I would rather belong to the other communities (reversed). ($Q6_6_0 = 8 - Q6_6$)

Q6_7 I feel good about this community.

Sustained participation

Q9_1 I often help other people in this community who need help/information from other members.

Q9_2 I take an active part in this community.

Q9_3 I have contributed knowledge to this community.

Q9_4 I have contributed by imparting knowledge to other members that resulted in the development of new insights for them.

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