Eliciting a Sense of Virtual Community among Knowledge Contributors

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Member-initiated virtual communities for product knowledge-sharing and commerce purposes are proliferating as useful alternatives to company information and commerce websites. Although such communities are easy to create with the availability of numerous tools, the challenge lies in keeping the community alive and thriving. Key to sustainability is members' sense of virtual community (SOVC) so that they feel responsible to contribute their knowledge and create value for others. However, it is unclear what leads to the SOVC among knowledge contributors. Building on appraisal theory, we hypothesize that the fulfillment of contributors' informational, instrumental, entertainment, self-discovery, and social enhancement needs will increase their SOVC. To test the hypotheses, we surveyed knowledge contributors in a beauty-product related community to examine the relationship between their needs' fulfillment and SOVC levels. Other than the social enhancement need, all other needs' fulfillment were found to be positively related to SOVC levels. To further understand how the SOVC of knowledge contributors change over time, we conducted a longitudinal analysis of a panel of these members. We discovered that over time, changes in the perceived fulfillment of their instrumental, entertainment, and self-discovery needs determined the change of their SOVC. The results have implications for future research as well as for the sustainability and value generation from such virtual communities.

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General Terms: Human Factors

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1. Introduction

With their ease of creation using freely available templates and interactive building tools, there is a proliferation of virtual communities for a range of purposes. Particularly, there are a growing number of member-initiated virtual communities built to facilitate knowledge sharing among consumers about particular kinds of products, such as cosmetics (e.g., makeupalley.com) and electronics (e.g., forums.MacNN.com). Other than facilitating knowledge sharing, many of these communities also enable their members to buy, sell, or trade products with each other (e.g., forums.MacNN.com). Such member-initiated communities are often considered useful for obtaining authentic customer opinions of products and greater shopping value as compared to company websites.

While it may not require much effort to start knowledge-sharing communities, keeping the community thriving to provide value to members can be challenging [Preece and Shneiderman 2009]. The survivability of these online communities depends on members' contribution of knowledge resources, which is required to attract new members and retain existing members [Ridings and Wasko 2010; Wang and Fesenmaier 2003]. However, a number of studies on online communities found that the majority of members either never post a message or solely post messages to ask questions but never or seldom contribute knowledge to the community [Ma and Agarwal 2007; Zhang and Zhang 2005]. Both researchers and practitioners are thus motivated to attempt to understand what drives virtual community knowledge contribution.

Knowledge contribution is a form of personal investment which is related to members' attachment and their sense of community [Andrews 2002; Wiertz and de Ruyter 2007]. Sense of virtual community (SOVC) is the hierarchy of feelings of belonging of the members towards the online community [Blanchard and Markus 2004]. It has been linked to many positive outcomes [Ren et al. 2007] such as commitment and helping behavior [Gupta and Kim 2004]. If members experience a strong sense of community, they may be committed to keep the community alive by actively contributing knowledge that others value, such as answers to others' questions [Fisher et al. 2006; Rodgers and Chen 2005]. Thus it becomes important to understand how to increase members' SOVC in order to sustain the community. This has, in turn, spawned research on the antecedents of SOVC, with the focus mainly being on technology perceptions, member characteristics, and relationships [Blanchard 2008; Ellonen et al. 2007; Koh and Kim 2004] as antecedent factors. Particularly, it is not clear what are the motivations and needs of members (and specifically contributors) that must be satisfied to enhance their SOVC. Understanding these needs should allow virtual communities to devise ways to satisfy them and thereby obtain the beneficial outcomes resulting from higher levels of SOVC.

With this objective, we attempted to explore members' needs that should be fulfilled to elicit SOVC. How emotions (in our case SOVC) are elicited has been the focus of a distinct line of research, often based on the appraisal theory [Scherer et al. 2001; Smith and Kirby 2000]. According to this theory, emotion is a response to an evaluation or appraisal of one's personal well-being [Smith and Kirby 2000]. Further, based on the uses and gratification paradigm, Dholakia et al. [2004] propose that the personal well-being of a virtual community's member depends on the fulfillment of his/her purposive, entertainment, self-discovery, and social enhancement needs. This

suggests that when knowledge contributors perceive these needs to be fulfilled, they may experience a greater SOVC. However, the above premise has neither been proposed nor tested. Therefore, this study aims to address two important research questions: 1) Fulfillment of what needs drive an individual's SOVC? 2) For which needs does the change in fulfillment determine the change of SOVC over time?

To achieve our research objective, we conducted an online survey in a member-initiated virtual community that deals with cosmetic and skin care products. Based on the members' postings, we first identified the knowledge contributors (members that frequently contribute). This was followed by an examination of their needs fulfillment and SOVC levels. To understand the dynamics of whether the change in particular needs fulfillment affects the change in SOVC levels of the knowledge contributors, we conducted a second survey of a panel of contributors three months after the first survey. This allowed us to gauge those needs whose change in fulfillment determines the change of their SOVC levels over time. The findings have implications for researchers as well as practitioners on how to nurture members' level of SOVC, especially in member-initiated online communities for product knowledge sharing and commerce purposes.

2. Conceptual Background

In this section we describe the concepts and theoretical perspectives employed in our study. First, the uses and gratifications paradigm is reviewed to understand the needs that should be fulfilled for members' well-being in virtual communities. Next, we discuss appraisal theory which can be used to explain how emotions such as SOVC may be generated based on a favorable evaluation of member well-being. Last, the concept of SOVC and its constituent dimensions is elaborated.

2.1. Review of Virtual Community Needs

To understand people's use of media based on the needs satisfied through using them, communications researchers developed the uses and gratifications paradigm (e.g., [Flanagin and Metzger 2001]). Subsequently, it has been applied in various contexts such as for understanding people's needs met by the usage of MySpace and Facebook [Raacke and Bonds-Raacke 2008]. Relevant to our study, Dholakia et al. [2004] extended this paradigm to explain the types of value perception or needs fulfillment that virtual community members may obtain from their participation in the community (see Table I).

Types of Needs	Definitions
Purposive	Accomplishing predetermined purposes through virtual community participation
Informational	The desire to obtain useful information
Instrumental	Specific task-related needs that are usually defined a priori
Entertainment	Fun and relaxation through visiting the community and interacting with others
Self-Discovery	The understanding and deepening of one's self through social interactions
Social Enhancement	The value that one derives from gaining acceptance and recognition by peers

Table I. Classification of the Needs of Virtual Community Members

The study proposes that individuals often seek a virtual community in a goal-directed fashion to fulfill a core set of needs (classified as self- and group-referent) and obtain the resultant benefits. While self-referent needs primarily involve one's personal self, group-referent needs emphasize social benefits [Dholakia et al. 2004]. Three self-referent needs were identified in the literature, i.e., purposive, entertainment, and self-discovery [Dholakia et al. 2004]. Purposive needs consist of both informational and instrumental needs. *Informational* need refers to the desire to obtain useful information, whereas *instrumental* need represents specific task-related needs that are usually defined prior to participation [Hars and Ou 2002], e.g., purchasing a desired product from another member. While *entertainment* need refers to the desire for fun and relaxation that can be obtained through interacting with other members in the virtual community, the *self-discovery* need represents the desire to understand oneself through interactions with others [McKenna and Bargh 1999]. This could include a better personal understanding of one's own preferences and tastes (e.g., product preferences). Whereas the informational, instrumental, and entertainment needs are related to utilitarian concerns of connecting oneself to external objects or issues, the self-discovery need focuses on intrinsic concerns which are constituted by or embedded within oneself [Dholakia et al. 2004]. Last, *social enhancement* is a group-referent need¹ that refers to people's desire to gain acceptance and recognition from

¹ Dholakia et al [2004] identified another group-referent need i.e., need for maintaining inter-personal interconnectivity, which was not considered relevant for the type of community under study where members mainly seek product related knowledge and conduct transactions.

others [Hars and Ou 2002]. This study aims to find out which of these needs should be fulfilled for a favorable appraisal of personal well-being that elicits knowledge contributors' sense of virtual community (SOVC).

2.2. Appraisal Theory

Reasoning and understanding how emotions (in this case SOVC) are elicited has been the focus of the appraisal perspective [Smith and Kirby 2000]. Appraisal theory proposes that emotions are extracted from our evaluations of situations that cause specific reactions in different people [Scherer et al. 2001]. Thus, rather than being a response to one's objective circumstances, the emotion is a response to an evaluation or appraisal of what those circumstances imply for individual's personal well-being [Roseman and Smith 2001]. Hence, an evaluation of the degree to which one's circumstances are consistent with or conducive to achieving one's goals is important in determining one's positive or negative emotions towards the situation [Smith and Kirby 2000].

Applying the appraisal theory to groups suggests that positive emotions towards the group will depend on the degree that the group or community is evaluated to enhance one's well-being [Garcia-Prieto and Scherer 2006]. Thus, this study is interested in examining whether the perceived degree of fulfillment of knowledge contributors' needs that enhances their well-being is positively related to their SOVC. We now elaborate on the concept of SOVC and its constituent dimensions.

2.3. Sense of Virtual Community

SOVC reflects the *hierarchy of feelings* of belonging of the members towards the community [Blanchard and Markus 2004]. Deriving from McMillan and Chavis' [1986] conceptual model of sense of community, SOVC has been specifically tailored to virtual communities. In our study, we employed a slightly simplified form of the original SOVC that focused on four key dimensions relevant to our study i.e., recognition of other members, identification of themselves and others, relationship with other members, emotional attachment and obligation to the community² (see Fig. 1).



Fig. 1. Hierarchy of Belonging of Virtual Community Members

Recognition is an important first step in experiencing SOVC. At this most basic SOVC level, members recognize other members' names and representations (e.g., avatars) in their postings [Blanchard and Markus 2004]. *Identification* goes a step beyond recognizing the names or representations of other members. Each member of a virtual community creates an identity for themselves through their postings, and in the meantime, starts to develop an understanding of other members' identities which enables them to anticipate others' responses to a particular issue or post [Blanchard and Markus 2004]. While all members may have the ability to 'observe' the relationships between some members of their virtual community, not everyone is able to experience *relationships* with other members. Nevertheless when they do experience relationships with other members, they may gradually feel emotionally attached and obligated to give back to the particular virtual community. *Emotional attachment and obligation* to a virtual community involves a deep connection to the community [Blanchard and Markus 2004]. It goes beyond relationships with individual members and represents the highest level of SOVC in our study.

A hierarchical relationship is suggested among the SOVC dimensions [Blanchard and Markus 2004], which implies that each successive level of SOVC contains all the other levels below it. For example, knowledge contributors who are emotionally attached and feel obligated to a virtual community are able to recognize other

² Specifically, we omit the Support dimension from Blanchard and Markus [2004] i.e., informational support in the context of study, which is already captured in the contribution behavior of our subjects.

members' names and avatars in their postings (recognition), understand other members' identities which enables them to anticipate others' responses to a particular issue or post (identification), and build relationships with other members (relationship). Thus SOVC is an aggregate construct [Law et al 1998], combining the different dimensions, that we are interested to study as a whole. As per the previous discussions, the needs fulfillment of knowledge contributors in the community should lead to higher SOVC.

3. Research Hypotheses

Based on appraisal theory and the uses and gratifications paradigm, we expect the degree of perceived fulfillment of knowledge contributors' needs to be related to their SOVC. Specifically, the fulfillment of informational, instrumental, entertainment, self-discovery, and social enhancement needs are hypothesized as determinants of their SOVC. The model hypotheses are summarized in Fig. 2.



Fig. 2. Proposed Research Model for SOVC

Members including contributors may browse the topics of discussion in the virtual community with no specific question in mind. When these topics are congruent with their interests, they may correspondingly find the information valuable. Alternatively, contributors could be seeking information about products that they know less about. One way they could obtain information is by going through the postings in the community to see whether the information they need is available. If they lack the will or time to search or do not find relevant information, they could alternatively make an enquiry. Through this process, they may be able to identify members who are acknowledged as experts in their area of interest [Nonnecke and Preece 2001]. When looking for information, they will begin to recognize other members' user names or representations, as well as form impressions of these members [Donath 1999]. Gradually, they may even be able to identify with and build relationships with these members, and ultimately lead to attachment and obligation to the community. These processes would increase their SOVC level. Thus, we hypothesize:

H1: The fulfillment of informational need is positively related to the SOVC of knowledge contributors

A salient objective in the communities of interest is the purchase of desired products. Therefore contributors would be interested to fulfill their instrumental needs through accomplishing purchase objectives. For instance, a contributor in a product-related community could seek offers of a product with purchase intention in mind. In response, other members may inform him/her about the product quality, where to buy the product, or even offer to sell it at a reduced price. The process of fulfilling the instrumental need necessitates some form of exchange or interaction with other members in the community. Before deciding on the product purchase, the member may want to recognize and identify the provider and ensure that he/she is trustworthy [Abdul-Rahman and Hailes 2000]. This may involve such actions as checking the other member's profile, searching the community to obtain a list of postings he/she has made, and reading them to better understand the other members may even build relationships with the other members and develop attachment and obligation, which corresponds to higher SOVC levels. Accordingly, we hypothesize:

H2: The fulfillment of instrumental need is positively related to the SOVC of knowledge contributors

Another reason likely to enhance knowledge contributors' SOVC is the ability of the community to fulfill their entertainment need. The use of the Internet has been viewed as a new form of recreation similar to watching television [Jackson 1999]. The entertainment value also applies to virtual communities e.g., when members visit a virtual community as a way to pass time [Nonnecke and Preece 2001]. While obtaining pleasure by browsing through the postings, knowledge contributors may be able to recognize and identify other members in the virtual community. They begin to recognize the avatars and user names of the most active members and are able to anticipate these members' responses to a particular issue or post. This will help them to build relationships with others and potentially develop attachment and obligation, thus increasing their SOVC levels. Hence, we hypothesize:

H3: The fulfillment of entertainment need is positively related to the SOVC of knowledge contributors

For knowledge contributors, interaction with others through contributing answers can allow access to social resources in the community [McKenna and Bargh 1999]. These interactions may help one to form, clearly define, and understand one's own preferences and values [Dholakia et al. 2004], such as product preferences. Satisfaction of their self-discovery need may thus be linked to recognition and identification of other members through the interactions. Subsequently knowledge contributors may develop relationships with those who have similar preferences and tastes and this may eventually translate into feelings of attachment and obligation to the community [Rotman et al. 2009]. Thus the increased satisfaction of knowledge contributors' self-discovery need may lead to higher levels of SOVC. Therefore, we hypothesize:

H4: The fulfillment of self-discovery need is positively related to the SOVC of knowledge contributors

Members may contribute knowledge in a virtual community in order to gain recognition by others as experts [Wasko and Faraj 2000]. The desire for recognition derives from the need for fame and esteem [Maslow 1987]. At the most basic level, this may occur for knowledge contributors when other members start to recognize their names in their postings. Other members may then begin to acknowledge the contributor's personal views and regard him or her as a reliable source of information [Donath 1999]. Simultaneously, this can allow the contributors to recognize and develop relationships with other members who seek their advice. Subsequently, these contributors may exhibit a high sense of belonging and attachment towards the virtual community that recognizes their contributions, as this reaffirms their self-worth. The satisfaction of these social enhancement needs can thereby lead to higher SOVC levels of the knowledge contributors. Thus, we hypothesize:

H5: The fulfillment of social enhancement need is positively related to the SOVC of knowledge contributors

While exploring the antecedents of SOVC, we want to understand how the change of knowledge contributors' SOVC levels could take place in the community. Specifically, for which needs does the change in fulfillment determine the change of SOVC over time? We propose that the change in satisfaction of informational (seeking) needs over time may not determine the change in SOVC levels of knowledge contributors. This is because knowledge contributors are less likely to be motivated by information seeking needs when they have already been in the community for a while and become experts. For contributors in the communities of interest, the change in fulfillment of instrumental (purchase), entertainment, self-discovery and social enhancement needs is still expected to be important to the change of their levels of SOVC. This could be because over time, the increment or decrement in their instrumental need, such as buying a product, may increase or decrease their tendency to be actively involved in instrument need over time may influence their active involvement in the entertainment activities of the virtual community which in turn affect their familiarization with the virtual community over time and alter their SOVC levels. Further, knowledge contributors would still want to discover their preferences and improve their social status as their SOVC increases. Thus, we would like to verify whether change in needs fulfillment other than the informational need may alter the SOVC levels of the knowledge contributors over time.

4. Research Methodology

Survey methodology is appropriate for this study because needs fulfillment and SOVC are both self-reported beliefs and our aim was to achieve greater generalizability of results [Neuman 2003]. As discussed earlier, the survey was administered in a member-initiated virtual community that focuses on product discussions and commerce. The virtual community chosen for this study is one of the largest repositories of user comments and discussions relating to skincare, beauty, and fashion information. It has sub-forums dedicated to the discussion of different types of products (e.g., Skincare Talk, Cosmetic Talk, and Eyes Talk). The technology base of the community is an asynchronous discussion board. While the majority of the communication takes place through public postings, there is also a chat room for real-time communication, and a messaging feature for private communication. The virtual community under study has over 6,000 members. While some members post more than 100 messages within a single day, many members do not post anything. The community is non-commercial and is entirely run by volunteers, where members may expect to get less-biased opinions of products than company-run forums.

Items	Item Wording	Source		
This virtua	l community enables me to:			
Informatio	onal Need			
INFO1	Get information on a particular topic	Ridings et al. [2002]		
INFO2	Learn about the information of a particular subject			
INFO3	Get advice from other members			
Instrumen	tal Need			
INST1	Purchase products sold by other members in the community	Dholakia et al. [2004]		
INST2	Make a bulk purchase with other members in the community	Self-developed		
INST3	Find a seller for the product I wish to buy			
Entertainr	nent Need			
ENTR1	Be entertained	Dholakia et al. [2004]		
ENTR2	Pass the time away when bored			
ENTR3	Relax			
Self-Disco	very Need			
SELF1	Discover my product preferences	Dholakia et al. [2004]		
SELF2	Discover my product tastes			
SELF3	Discover which brands I like of a particular product			
Social Enh	ancement Need			
SENH1	Impress others	Dholakia et al. [2004]		
SENH2	Feel important			
SENH3	Attain a higher membership level [e.g., become a moderator]	Self-developed		
SOVC				
Recognitio	n			
RECG1	I can recognize other members by their usernames	Blanchard [2007]		
RECG2	I can recognize other members by their avatars	Self-developed		
Identificat	ion			
IDEN1	I know which members are friends	Blanchard [2007]		
IDEN2	I can identify the cliques [groupings of people] in this community	Blanchard and Markus [2004]		
IDEN3	I know which members do not like each other			
Relationsh	ір			
RELN1	I have developed online relationships with several members	Blanchard [2007]		
RELN2	I have developed online bonds with several members	Self-developed		
RELN3	I frequently contact some members via online private messaging			
Emotional	Attachment and Obligation			
ATCH1	I feel a great deal of loyalty to the community	Wasko and Faraj [2005]		
ATCH2	I care about the community	Gupta and Kim [2004]		
ATCH3	I feel obligated to contribute to the community	Blanchard [2007]		

4.1. Instrument Development

A two-stage process of item creation and sorting was carried out to develop the survey instrument. First, we created the survey items by adapting them from existing validated measures³, deriving them from qualitative findings of

³ We borrowed some items but did not make use of the entire measure of SOVC from Blanchard [2007] since it is a composite scale whereas our measure assessed the sub-dimensions of SOVC separately.

previous studies, or self-developing them based on the definitions of the constructs. Second, we carried out item sorting with four judges to ensure content validity of the survey items. The results of the sorting exercise were satisfactory. The survey items are shown in Table II. All items were measured using Likert scales from 1-5 (i.e., from strongly disagree to strongly agree). Of these, SOVC is considered as an aggregate construct, which is formed as an algebraic composite of its dimensions (Law et al. 1998). This is because, SOVC reflects the hierarchy of feelings of belonging of the members towards the community (Blanchard and Markus 2004) where each successive dimension of SOVC contains all the other dimensions below it. Accordingly, each successive dimension of SOVC (after averaging the items under the dimension) was weighted more heavily (recognition = 1, identification = 2, relationship = 3, emotional attachment and obligation = 4) when combining them into the single measure for SOVC. This is similar in spirit to previous constructs in management research such as the technological interdependence aggregate hierarchical construct where weightage of pooled = 1, sequential = 2, reciprocal = 3, and team interdependence = 4 is employed to combine the dimensions (Doty et al. 1993).

4.2. Survey Administration

Following the instrument development, two surveys (three months apart) were conducted to empirically examine the hypotheses. The time interval is similar to previous longitudinal studies of virtual communities (e.g., [Chen 2007]) since it allows sufficient time for changes in member perceptions and yet there were no changes to the virtual community context (e.g., new features, incentives) that may affect our results. The first survey sampled knowledge contributors from the whole community while the second survey resampled the knowledge contributors from the first survey for within-subjects analysis of the hypotheses over time.

The surveys were conducted after gaining permission from the owner of the community. For the first survey, the respondents were recruited through an announcement on the community site within which a link to our web survey was placed. The announcement highlighted the importance of the survey to understand the sustainability of such virtual communities. Members were asked to respond only if they had contributed knowledge to the community. Participation in the survey was entirely voluntary without any incentive being offered. Three months later, we invited the validated knowledge contributors from the first survey for a second survey. This time, we offered a token incentive in the form of a \$10 voucher. The first and second surveys were kept running for one week each to minimize any potential differences in response between early and late respondents.

Demographics	Category	First Survey $(N = 226)$		Second Surve	ey (N = 75)		
		Frequency	Percentage	Frequency	Percentage		
Gender	Male	11	4.9%	3	4.0%		
	Female	215	95.1%	72	96.0%		
Age	15 years and below	3	1.3%	1	1.3%		
	16 – 20 years	69	30.5%	27	36.0%		
	21 – 25 years	128	56.6%	40	53.3%		
	26 – 30 years	21	9.3%	5	6.7%		
	31 – 35 years	5	2.2%	2	2.7%		
	36 years and above	0	0%	0	0%		
Membership	<= 3 months	28	12.4%	10	13.3%		
Duration	4-6 months	50	22.1%	20	26.7%		
	7-9 months	37	16.4%	8	10.7%		
	10 months – 1 year	34	15.0%	10	13.3%		
	13 months -2 years	43	19.0%	14	18.7%		
	25 months – 3 years	22	9.7%	8	10.7%		
	> 3 years	12	5.3%	5	6.7%		
Frequency of	At least once a day	182	80.5%	63	84.0%		
visiting the virtual	At least once a week	44	19.5%	12	16%		
community	At least once a month	0	0%	0	0%		
	Less than once a month	0	0%	0	0%		

Table III. Demographics of the Respondents in the First and Second Surveys

4.3. Sample Characteristics

We initially collected 300 responses for the first survey. We then validated contributors as those who had made at least 12 posts in the 12-week duration prior to the survey i.e., average of 1 post or more per week. This was to ensure that we did not mistakenly include those who rarely posted messages as contributors. As an additional check we also coded the messages posted by the respondents in the 12 weeks. The message type was coded as (1) Announcement (personal update or pointer to information source), (2) Response to Query, (3) Query to Person or Group, are per the coding schema from Burnett and Buerkle [2004]. We verified that the contributors had a significantly higher percentage of posts of types Announcement and Response to Query than the rest of the respondents. Based on the above criteria, there were 226 contributors among the first survey respondents. Characteristics of the respondents are shown in Table III.

These 226 knowledge contributors were then invited for the second survey three months later. In the second survey, we obtained 75 valid respondents with an attrition rate which is not unusual in panel data studies [Fitzgerald et al. 1998, Sawyer et al. 2010]. Characteristics of the respondents of the second survey are also shown in Table III. There was no significant difference in the demographic characteristics compositions of the first sample and second sub-sample (sig. > 0.05). Also, the second sample was large enough [Hair et al. 2009] that we could perform a within-subjects longitudinal analysis as desired.

5. Data Analysis and Results

Hypotheses 1 through 5 were tested through multiple regression analysis to examine the relationships between the perceived fulfillment of the contributors' needs and their SOVC levels. Prior to running the regression, its assumptions were tested and found to be satisfied [Hair et al. 2009]. The within-subject longitudinal analysis was conducted via latent growth modeling (LGM) to examine the relationships between the changes in the perceived fulfillment of the knowledge contributors' needs and the changes in their SOVC levels.

LGM is a statistical technique to estimate growth trajectory. It is a longitudinal analysis tool that provides a means of modeling individual differences in growth curves. It is widely used in the field of behavioral science, education, and social science [Willett and Bub 2004]. The strength of the LGM approach includes an ability to test the adequacy of the hypothesized growth form [Duncan and Duncan 2004]. Since LGM is carried out within structural equation modeling (SEM) framework, it shares the same assumptions such as validity, reliability, and sample size. Recent Monte Carlo simulations have demonstrated that basic LGMs hold up well with relatively small sample size of even around 40 [Muthen and Muthen 2002].

Prior to testing the hypotheses, the measurement items of the reflective constructs (5 needs) as well as the 4 reflective dimensions of SOVC were assessed to establish their convergent and discriminant validity. Separate factor analysis was conducted for the SOVC dimensions since they were combined (weighted sum) into a single item prior to hypothesis testing. Appendix A shows the factor analysis and Cronbach Alpha results for the independent variables from both surveys; whereas Appendix B shows the factor analysis, Cronbach Alpha, correlations, and sqrt Average Variance Extracted (AVE) results for the SOVC dimensions from both surveys⁴. All items were found to load on their intended constructs and the Cronbach Alpha as well as the AVE values were acceptable i.e., above or equal to 0.7 [Hair et al. 2009; Nunnally 1992], providing evidence of the convergent validity of the instrument. The descriptives, sqrt AVE, and correlation values for the independent variables are shown in Table IV and for the SOVC dimensions in Appendix B. This table and the results in Appendices A and B indicate adequate discriminant validity of the instrument.

Construct	Mean	Std. Dev.	SOVC	INFO	INST	ENTR	SELF	SENH
SOVC	7.67 (7.13)	1.48 (1.43)	$1.00(1.00)^5$					
INFO	3.79 (3.25)	0.56 (0.72)	0.37 (0.36)	0.92 (0.89)				
INST	2.98 (2.70)	0.88 (0.92)	0.23 (0.59)	0.16 (0.48)	0.94 (0.95)			
ENTR	3.90 (3.46)	0.69 (0.86)	0.21 (0.30)	0.08 (0.49)	-0.03 (0.40)	0.91 (0.92)		
SELF	3.25 (3.04)	0.96 (0.93)	0.34 (0.25)	0.09 (0.54)	0.32 (0.50)	0.24 (0.39)	0.94 (0.94)	
SENH	2.08 (1.99)	0.76 (0.79)	0.22 (0.47)	0.10 (0.27)	0.26 (0.49)	0.18 (0.22)	0.29 (0.40)	0.93 (0.93)

Table IV. Descriptives, AVE, and Correlation Matrix for Survey 1 (Survey 2)

⁴ Sqrt AVE values of the independent variables are shown in the diagonal of Table IV, except for SOVC.

⁵ The values shown here are the correlations i.e., 1. Sqrt AVE values of the SOVC dimensions are shown in Appendix B, Table B2 diagonal.

After confirming the validity of the measurement items, we examined the relationships between the fulfillment of contributors' needs and their SOVC levels. Table V summarizes the hypotheses testing results for the SOVC model. It can be seen that four (H1-H4) out of five hypotheses are supported⁶. This implies that while the perceived fulfillment of all four self-referent needs (i.e., informational, instrumental, entertainment, and self-discovery) influenced knowledge contributors' SOVC, this was not the case for the group-referent need (i.e., social enhancement). Discussion of these findings will be presented in the next section.

Dependent Variable	Independent Variable	В	Std. Error	t	Sig.	Hypotheses
SOVC of Knowledge	INFO	0.827	0.157	5.259	0.000	H1 (Supported)
Contributors	INST	0.211	0.106	1.987	0.048	H2 (Supported)
$(R^2 = 0.279)$	ENTR	0.263	0.128	2.062	0.040	H3 (Supported)
	SELF	0.363	0.098	3.688	0.000	H4 (Supported)
	SENH	0.159	0.121	1.314	0.190	H5 (Not Supported)

Table V. Results of Hypotheses Testing

Our final data analysis made use of LGM with Mplus software to examine the relationships between the changes in the needs fulfillment of the respondents and the changes in their SOVC levels. The results of the data analysis are shown in Table VI. This indicates that the changes in fulfillment of instrumental, entertainment, and self-discovery needs over time affect the change in SOVC level.

Parameters	Estimates	Std. Error	Т	Sig.
Δ INFO $\rightarrow \Delta$ SOVC	4.078	5.284	0.772	n.s.
Δ INST $\rightarrow \Delta$ SOVC	1.051	0.245	4.285	Sig. at $\rho < 0.00$ level
$\Delta \text{ ENTR} \rightarrow \Delta \text{ SOVC}$	1.739	0.836	1.960	Sig. at $\rho < 0.05$ level
Δ SELF $\rightarrow \Delta$ SOVC	0.892	0.434	2.058	Sig. at $\rho < 0.05$ level
Δ SENH $\rightarrow \Delta$ SOVC	0.605	0.330	1.836	n.s.

Table VI. Results of Within-Subjects Analysis (Longitudinal Data)

Due to the single source of response in our study, we tested for common method bias in two ways. First, we checked if a single factor could account for a majority of the covariance (i.e., more than 50% variance) [Podsakoff et al. 2003]. Our factor analysis (see Appendices A and B) showed that none of the factors contributes more than 24.25% of the total variance. Second, we created a dummy variable that consists of the items of all the independent variables and included this into our hypotheses testing [Podsakoff et al. 2003]. We found that adding this dummy variable does not increase the R-square. This suggests that common method variance is not likely to be an issue here.

6. Discussion and Implications

Our study findings provide evidence for the different kinds of needs fulfillment that lead to greater SOVC of knowledge contributors in the communities of interest. Of the five hypotheses regarding antecedents of SOVC, four were supported. While the perceived fulfillment of self-referent needs (i.e., informational, instrumental, entertainment, and self-discovery) were all found to influence knowledge contributors' SOVC, this was not the case for the group-referent need (i.e., social enhancement). This could be because group-referent needs are likely to have greater importance for the personal well being of members of a small-group-based community [Dholakia et al. 2004] as compared to members in a large network-based community (e.g., an online bulletin board) as in this case. This is because members in a network-based community are less noticeable than members in a small-group-based community. Hence, the SOVC of knowledge contributors in a large network-based community such as the virtual community in our study is more likely to be associated with their utilitarian and intrinsic self-referent needs instead of with their group-referent needs.

⁶ None of the control variables (gender, age, duration, and frequency) were found significant towards SOVC.

Among the utilitarian needs (i.e., informational, instrumental, and entertainment), it is important to note that informational need fulfillment had the strongest positive relationship with knowledge contributors' SOVC. Besides contributing knowledge, knowledge contributors are initially seeking for new knowledge or information from the virtual community. The ability of the virtual community to fulfill their need for information appears to strongly affect their SOVC level. However, as expected, we did not find a significant relationship between the change in their perceived fulfillment of informational need and the change of their SOVC over time. This is because knowledge contributors are less likely to be motivated by information seeking needs when they have already been in the community for a while and become experts.

The second most important need fulfillment which had the next strongest positive relationship with knowledge contributors' SOVC is the self-discovery need, followed by the entertainment and instrumental needs fulfillment. This could be because the better personal understanding of one's own product preferences could lead to a greater sense of belonging as compared to entertainment and instrumental needs satisfaction for which respondents may not see such an impact immediately but more over time. The change in the ability of the virtual community to facilitate interactions that help personal discovery of the knowledge contributors' product tastes also affected the change of their SOVC over time.

As expected, for knowledge contributors in the communities of interest, the change in fulfillment of instrumental (purchase) and entertainment needs were found to be important for the change in their SOVC levels over time. The degree of change in their instrumental need, such as buying a product, could change their tendency to be involved in instrumental activities, which in turn would affect their SOVC change. Similarly, the change in their entertainment need over time could alter their involvement in entertainment activities, which would impact their SOVC change. However, since knowledge contributors in a network-based community (as in this case) may be less noticeable than those in a small-group-based community [Dholakia et al. 2004], their change in perceived fulfillment of their group-referent need (social enhancement) over time was unrelated to the change in their SOVC.

6.1. Limitations and Future Work

The above findings should be viewed in the light of the limitations of this study. First, the findings of the study might be affected by the characteristics of the virtual community under study, i.e., a member-initiated virtual community for product knowledge sharing and commercial purposes. Other virtual communities may have different social or informational environments that influence members' needs fulfillment and SOVC. For example, interpersonal connectivity need could be salient in social network communities and the support dimension of SOVC could be important for healthcare support communities. Thus, future research could extend this model to other virtual communities to test the external validity of the findings. Second, a large proportion of the survey respondents in this study were females owing to the nature of the virtual community. While the findings of the study indicate that gender did not affect the results, future work could replicate the study in virtual communities which have a more balanced gender ratio to assess the generalizability of the model. Third, the sampled knowledge contributors may not be fully representative of the overall knowledge contributors in the virtual community, which we did not have a record of. While the gender, age, and tenure characteristics of our sample appeared to be typical of the population, future work can attempt to ensure representativeness of the sample. Fourth, the dimensions of SOVC could be investigated separately to assess how individual dimensions can be enhanced. This could be a fruitful area to be explored by future research. In spite of the limitations, the findings of this study provide several theoretical and practical insights.

6.2. Theoretical Contributions

For researchers, this study contributes to the explanation of whether the fulfillment of various needs of knowledge contributors are associated with their SOVC levels. Other than the group-referent need of social enhancement, all other needs fulfillment were related to knowledge contributors' SOVC. Though this finding could be explained by the individualistic nature of human beings, it could also be a result of the type of virtual community under study. With over 6,000 members, it may be difficult for members to impress others through their knowledge contributions in the community. The fulfillment of a group-referent need such as status enhancement could be less important for members in a large network-based community as compared to members in a small-group-based community.

Our study also results in a clearer understanding of needs fulfillment as a means of enhancing the sense of belonging towards a virtual community for knowledge contributors. While several previous studies have explored the determinants of SOVC, the antecedents examined included technology perceptions, member characteristics, and relationships [Blanchard 2008; Ellonen et al. 2007; Koh and Kim 2004]. This study adds to the extant literature by

providing an understanding of the needs that must be satisfied to enhance members (particularly contributors) SOVC.

Our longitudinal analysis revealed that the change in perceived fulfillment of two utilitarian self-referent needs (i.e., instrumental and entertainment needs) and an intrinsic self-referent need (i.e., self-discovery need) were associated with the change in knowledge contributors' SOVC over time. It appears that besides the interactions to understand one's product preferences, the interactions for product buying/selling or entertainment purposes could also determine the change of knowledge contributors' SOVC levels over time.

In terms of extending existing theories, this study builds on appraisal theory to examine how the development of SOVC takes place in a virtual community. It also applies and extends the uses and gratifications perspective to understand how fulfillment of various needs of knowledge contributors leads to greater SOVC. Hence this study differs from previous studies in virtual communities that focus mainly on the utilitarian motivations of participation (e.g., informational and instrumental needs). Here we go beyond the utilitarian aspect to also include the emotional response of contributors by investigating their overall well-being and sense of community. Further, this study is novel in making use of the latent growth modeling technique (a relatively underutilized technique in IS research) to investigate the antecedents of change of SOVC levels. It also develops instruments to measure the needs fulfillment and SOVC dimensions for the communities of interest. Thus it adds to our knowledge about a key but understudied outcome in virtual communities, i.e., sense of virtual community.

6.3. Practical Implications

The fulfillment of informational and instrumental needs was found to be important for knowledge contributors' SOVC. Moreover, the change in knowledge contributors' perceived fulfillment of instrumental need is related to the change in their SOVC levels over time. This suggests that to increase the SOVC of knowledge contributors, the organizers of virtual communities for product knowledge-sharing and commerce purposes should provide the necessary facilities to support the fulfillment of these needs. For example, a reputation system and private messaging feature [Jin et al. 2010] can facilitate member organized collective purchase of products to enjoy more discounts. By making the virtual community a place for knowledge contributors to pursue their instrumental needs in addition to their basic informational needs, the organizers of these communities may be able to increase members' SOVC levels.

Besides the above needs, knowledge contributors' SOVC is also related to the perceived fulfillment of their entertainment need. The implication of this finding is that organizers of virtual communities for product knowledge-sharing and commerce purposes could arrange online gaming activities, such as online puzzles and card games, to promote enjoyable interactions among members. These entertainment activities may bring members closer together, thus enhancing their sense of belonging to the community.

Finally, the fulfillment of their self-discovery need was also found to be significant towards knowledge contributors' SOVC levels over time. Self-discovery includes the understanding of one's product preferences and tastes [Dholakia et al. 2004]. An organizer of a virtual community for product knowledge-sharing and commerce purposes may make use of this finding for two-fold benefits. By implementing features such as a product recommendation system or a product comparison system, the organizer may cultivate knowledge contributors' sense of belonging to the community as well as generate revenues to pay for the virtual community's infrastructure, such as the servers and database.

7. Conclusion

Building on appraisal theory, the study applies and extends the uses and gratifications perspective to understand a key outcome variable in virtual communities, which is the sense of belonging towards the virtual community (SOVC). Our study argued and validated that fulfillment of knowledge contributors' needs can provide a way to elicit their SOVC. Specifically satisfaction of informational, instrumental, entertainment, and self-discovery needs enhanced the SOVC of knowledge contributors. A longitudinal analysis of a panel of knowledge contributors also showed that the changes in perceived instrumental, entertainment, and self-discovery needs fulfillment were associated with the change in their SOVC levels. These findings can assist virtual community organizers in designing appropriate strategies to nurture knowledge contributors' SOVC and maintain their feeling of belonging for the sustainability of the virtual community.

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Appendix A: Table A1	Factor Analysis and	Cronbach Alpha for IVs in	n Survey 1 (Survey 2)
	. I dotor i marysis and	Cronouch ruphu for 1 v 5 h	$1 \operatorname{Survey} 1 (\operatorname{Survey} 2)$

Components	1	2	3	4	5
INFO1					0.843 (0.798)
INFO2					0.827 (0.864)
INFO3					0.690 (0.692)
INST1		0.944 (0.832)			
INST2		0.937 (0.842)			
INST3		0.915 (0.809)			
SELF1	0.927 (0.914)				
SELF2	0.952 (0.941)				
SELF3	0.938 (0.929)				
SENH1			0.913 (0.918)		
SENH2			0.913 (0.890)		
SENH3			0.833 (0.767)		
ENTR1				0.771 (0.765)	
ENTR2				0.868 (0.786)	
ENTR3				0.841 (0.872)	
Eigenvalues	2.611 (2.825)	2.262 (2.409)	2.205 (2.283)	1.587 (2.159)	1.499 (1.986)
Variance Explained	20.084 (18.831)	17.399 (16.058)	16.960 (15.222)	12.204 (14.396)	11.532 (13.240)
Cumulative Variance	20.084 (18.831)	37.483 (34.890)	54.443 (50.111)	66.647 (64.507)	78.179 (77.747)
Cronbach Alpha	0.963 (0.969)	0.942 (0.809)	0.893 (0.863)	0.765 (0.782)	0.701 (0.705)

Appendix B: Table B1. Factor Analysis and Cronbach Alpha for SOVC in Survey 1 (Survey 2)

Components	1	2	3	4
RECG1				0.750 (0.806)
RECG2				0.869 (0.886)
IDEN1			0.694 (0.757)	
IDEN2			0.837 (0.881)	
IDEN3			0.794 (0.689)	
RELN1	0.864 (0.882)			
RELN2	0.874 (0.888)			
RELN3	0.801 (0.837)			
ATCH1		0.829 (0.810)		
ATCH2		0.881 (0.889)		
АТСН3		0.722 (0.752)		
Eigenvalues	2.459 (2.668)	2.227 (2.174)	2.017 (1.963)	1.587 (1.636)
Variance Explained	22.351 (24.251)	20.246 (19.760)	18.332 (17.842)	14.423 (14.876)
Cumulative Variance	22.351 (24.251)	42.597 (44.011)	60.929 (61.853)	75.352 (76.729)
Cronbach Alpha	0.896 (0.892)	0.806 (0.790)	0.751 (0.739)	0.704 (0.709)

Note: factor loadings below 0.3 have been suppressed in both tables for easier readability.

Dimension	Mean	Std. Dev.	RECG	IDEN	RELN	ATCH
RECG	3.59 (3.50)	0.75 (0.76)	0.84 (0.84)			
IDEN	3.06 (3.30)	0.74 (0.80)	0.43 (0.47)	0.89 (0.92)		
RELN	2.95 (2.97)	0.80 (0.77)	0.37 (0.02)	0.51 (0.36)	0.93 (0.93)	
АТСН	2.89 (2.85)	0.70 (0.67)	0.38 (0.23)	0.30 (0.32)	0.47 (0.41)	0.91 (0.92)

Table B2. Descriptives, AVE, and Correlation Matrix of SOVC Dimensions for Survey 1 (Survey 2)