

A Systems Approach to Communication Process: Case Study within an Online Community

Corina Sas, N. Schmidt and A. Patel

Department of Computer Science, University College Dublin
Belfield, Dublin 4, Ireland

ABSTRACT

This study focuses on an on-line community, built on the base of sharing the same scientific interest in a particular field among its members. The unit of analysis is the communication process as it emerges from an electronic mailing list, which represents a forum of discussions and announcements related to the topic of the list. The network analysis and content analysis delineate the methodological space of this research allowing us to capture the main features of the communication process. This level of analysis enabled us to get an insight of the community infrastructure in terms of its members' roles and positions together with their set of interests and values, which motivate participation.

Keywords: virtual community, organizational communication, network analysis, content analysis.

1. INTRODUCTION

Popularity of electronic means of communication, such as e-mail, Internet Relay Chat (IRC), World Wide Web (WWW), coupled with the explosive growth of the Internet, has fostered development of *online communities*—communities of people, most of whom have never seen each other, the Internet being the only means of communication between them. In this paper we study the features and properties of communication process within a particular online community, formed around an electronic mailing list.

2. ON-LINE COMMUNITIES

According to Garton et al., a social network appears “when a computer network connects people or organizations” [5]. A social network involves a set of actors related through a set of relations that hold them together. Through relations they have with each other, the actors share resources such as information, services or social support. As Rheingold defined them, virtual communities¹ are “social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace”[7].

From the perspective of organizational behavior study it is useful to stress the relevant theoretical viewpoints such as Scientific Management, Human Relations and Systems, each of them underlining distinctively the organization functions

together with the role of communication in organizations. For the purpose of our research we will briefly point the latest one, the most eclectic and encompassing approaching, which sees organization as a “nesting of systems, composed of systems within systems” and the communication as its main function, “the cement that holds the units in an organization together” [8].

Grounded on Rogers's theory of organizational communication, we extended the meaning of organization, from “a stable system of individuals who work together to achieve, through a hierarchy of ranks and a division of labor, common goals”, to that of online community. A main distinction should be made here: in the case of the online communities, people attempt some particular goals, which motivate them for sharing resources, but there is no hierarchy of ranks or imposed division of labor. Both joining and leaving the list are unrestricted and open to anybody. Individuals stay subscribed to the list, as long as this provides satisfaction of their own interests, including that one of growing together with the others, as a result of satisfying others' interests too.

DeSanctis and Monge identified six major areas of electronic communication research with greatest impact on virtual organization design: communication volume and efficiency, message understanding, virtual tasks, lateral communication, norms of technology use, and evolutionary effects [4].

3. ORGANIZATIONAL COMMUNICATION

Since communication is a continuous process and the interaction pattern describing social structure can be viewed as a network of relations, the systems approach is an appropriate way for studying communication [14]. As Rogers proved, this perspective will overcome the inherent drawbacks of the linear model of communication. Moreover, he argued that the systems model for approaching human communication allows a “greater degree of equality between participants in the communication process” [8].

Among the representative theories for analyzing organizational communication, we found Weick's Information Systems Approach to be appropriate for our purposes. This approach is also based on General Systems Theory [13]. Weick explains the interrelationships among the individuals in an organization, reflected through the communication process of information enactment, selection, and retention. Communication is seen as a key feature due to its role in the sense-making processes, which attempt to reduce multiple meanings or so-called equivocality.

Enactment represents a first stage when one defines and begins managing information, while selection is the most important one, acting as a filter for the information, which is to be retained

¹ The term ‘virtual community’ is sometimes (inaccurately) used in literature as a synonym for ‘online community.’

or ignored based on the dealing with equivocality. During the third stage, namely retention, one keeps the previously selected information and the associated meanings.

For comprehending the impact of electronic communication on social networks, theories of mediated interaction could be a good starting point. Trying to understand the reason for which organizations process information, Daft and Lengel developed the *media richness theory* [3]. Information richness, seen as an objective characteristic of communication media, defines the “ability of information to change understanding within a time interval” [3]. Its main point stresses that organization success depends on the ability to process information in order to reduce ambiguity. The other well-known theory of mediated communication is *social presence theory* [9]. Short, Williams and Christie defined social presence as the ability of a communication medium to allow the individuals involved in communicative interaction to feel the presence of the communicator [9].

4. METHODOLOGY

The main goal of the online community studied in this paper consists in enabling individuals who are interested in a particular topic to exchange ideas, to inform and to be informed, to raise and to answer to questions regarding it. Communication within the group is carried over an electronic mailing list, which provides a forum of discussion and announcements related to the list topic. The subscribers joined freely the list because of the commonly shared scientific interest in the list topic. Being one-to-many and asynchronous way of communication, the mailing list allowed us to capture particularly the information flow, as well as to delineate the features of communication process.

Therefore, the primary data for our research consist of all messages sent and received during one year. They were processed by content analysis, which allowed us to depict, according to Berelson [1], the community goals, interests and communication trends.

The *study hypothesis* is whether the mailing list allows a complex approach to the infrastructure of communication process within an online community.

The *study objectives*, allowed us to:

- Analyze the communication process;
- Identify communication roles associated with subscribers;
- Emphasize the interests, the common goals and the values of a social network.

The communication process was described in terms regarding “netiquette” [6], as a set of rules applicable to people communicating via the Internet. Since networks can also be described mathematically, based on interaction frequency analysis and Wasserman’s mathematical theory [11], we performed mathematical analysis for our online community.

Content analysis was used to determine the interests, goals and values of the online community. We implemented computerized content analysis, carried out for the particular purpose of this research, which enabled us to obtain accurate word counts. Key Word In Context search was used for a better grasp of the

meaning applied in a particular context [10]. Categorizing and coding the data preceded this approach, where a category is “a group of words with similar meaning or connotations” [12].

5. RESULTS AND DISCUSSIONS

5.1. Overall Communication

The mailing list had 145 subscribers at the time when the case study was carried out, facilitating a multi-group communication process. The analysis was performed on 259 messages sent during one year. Almost a quarter (24.3 %) of the messages posted to the list are *long messages*, having more than 100 lines [6]. Analyzing the content of the messages, we identified 8 major topics. *Table 1* presents them together with their frequencies of appearance.

Table 1: The subjects of messages and their frequencies

No	Subject	Frequency
1	Definition and explication	36 %
2	News	24 %
3	Related concepts	18 %
4	Examples	8 %
5	Conference announcements and call for papers	5 %
6	Measurement	5 %
7	Academic positions announcements	2 %
8	List administration announcements	2 %

More than 40% of the messages posted on the list are focused on the theoretical and methodological issues relevant to the main topic list e.g. definition, explication and measurement. Other 50% of them present concepts, examples or news related to the same main topic. Information regarding conferences and available academic positions in the filed constitutes 7% of the messages.

Encompassing the lower levels of communication as *intra-personal*, e.g. interpreting and developing messages for the others, *interpersonal*, e.g. communicating within a dyad, and *small group*, e.g. communicating among three or more people, the communication is still significantly limited. Only 25% of subscribers sent messages to the mailing list, while 75% never took part in a dialogue. Moreover, among these 37 subscribers, just 43% could be considered active participants on the basis of their engagement in the dialog, e.g. message followed by other message, vs. posted announcements. The messages sent by this group cover 82% of the total messages considered for the analysis (*Table 2*).

Table 2: List of active subscribers and their posting frequencies

Actor	Frequency	Actor	Frequency
1	36 %	9	2 %
2	9 %	10	2 %
3	7 %	11	1 %
4	7 %	12	1 %
5	6 %	13	0.5 %
6	4 %	14	0.5 %
7	3 %	15	0.5 %
8	2 %	16	0.5 %

The network analysis has been performed on this group only. Based on analysis of the messages posted by the members of this group, we could identify subscriber's opinions about the relevant issues regarding the list topic, and the way in which these opinions are similar or adverse. Table 3 presents the socio-matrix of this group, where replies which sustain the opinions from the messages they reply to are marked "1+", and those devaluating them are marked "1-".

Table 3: Socio-matrix

Subscriber	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	-						1-	1-	1+							
2		-		1+	1+											1-
3			-													
4	1-			- 1-	2+							1-				
5		1+	1-	-												
6						-		2+								
7	1-	1+		1+	-	2+			1-	1-						
8		1-					1+	-		1-			2-			
9						1+		-								
10	1+	1-								-						
11											-					
12				2-		2-				1+	-	1+				
13													-			
14							1-							-		
15			1+	1+											-	
16							1+									-

Figure 1 presents the sociogram of this clique, term which means a subsystem whose members communicate with each other more than with other members of the organization. The lines indicate the communication contact, which can be either one-way (just one arrow) or two-way (two-way arrows). Based on the number of agreements and disagreements targeting one's particular opinion, we identified groups within the clique.

As shown in Figure 1, there are five subgroups: A, B, C, D and E, formed on the basis of sharing the same opinions regarding the list topic, but different than the others'.

Analyzing the sociogram from a double perspective: the nature of component subgroups and the nature of relations established between them, we conclude that the clique is characterized by a high level of granularity. Firstly the only identifiable subgroups within the clique structure are dyads and triads, without any hint for a possible greater subgroup.

Then, the number of relations based on disagreement exceeds the number of those built on agreement. The subscribers' opponent opinions are strongly attacked and the consensus wanted though, seems difficult to reach. This underlined background makes the clique less cohesive. The dynamism residing in adverse points of view is constructive at this stage, where the relevant ideas just arise and the conceptualization requires cumbersome labor for achieving the commonly accepted meaning and shape. A consensus too much postponed could impede the group productivity as long as collaboration is still a required dimension.

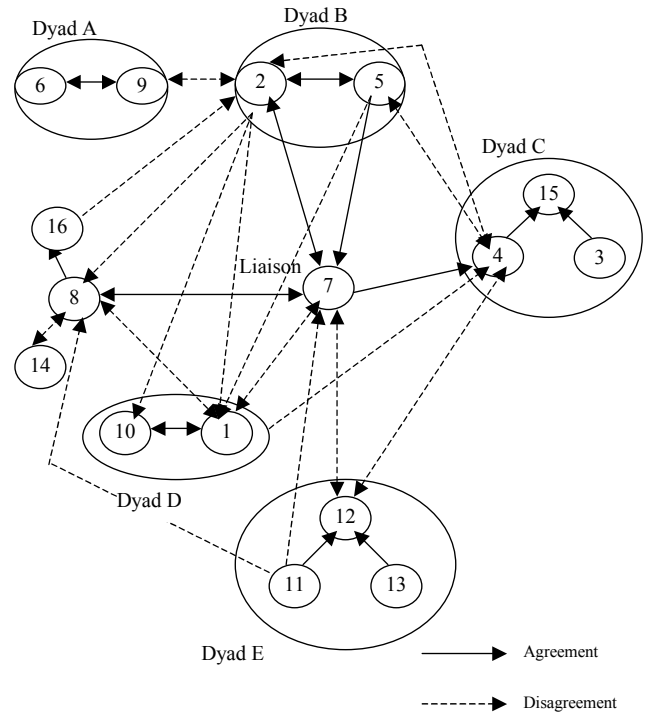


Figure 1: Sociogram

Studying an online community, whose subscribers joined freely to participate, we did not expect to find any hierarchy of authority. This explains the absence of any opinion leader, able to influence others' attitudes. Thus, communicational flow will be analyzed only horizontally. Theoretically the communicational flow is not blocked, people being able to post messages to the list whenever they want. Practically, the clique previously identified is an elitist one. From those who intended to take part to discussions by posting a question or an observation to the list, 44% received an answer, while 56% did not receive any answer. None of these subscribers have later tried again to participate in conversation.

5.2. Network Analysis

Furthermore we focus on measuring actors' positions within the social network, computing centrality, prestige and closeness indices (Table 4). They quantify the "prominence of an individual actor embedded in a network" [11]. Across the whole clique, the 16 subscribers (240 possible subscriber-subscriber pairs) maintained an average of 4.43 (median 3) relations across the studied year.

According to Wasserman and Faust, centrality as a feature that defines a participant in communicational process resides in the number of ties or non-directional relations he/she is involved with [11]. Non-directional relations are those where no distinction between receiving and sending is made. The most central subscribers are individual 7 (centrality = 11) followed by individual 1 (centrality = 9), 8 (centrality = 8), 2 and 4 (centrality = 7). When the relations are analyzed on the basis of distinction between ties sent and ties received, Wasserman and Faust defined prestige, as a dimension focusing on an individual as a recipient of messages.

Table 4: Measures of actors' positions in social network

Actor	Relation to others	Relation to him	Centrality	Closeness
1	5	4	9	0.11
2	4	3	7	0.17
3	2	1	3	0.33
4	3	4	7	0.17
5	3	2	5	0.2
6	1	2	3	0.33
7	5	6	11	0.09
8	3	5	8	0.125
9	1	1	2	0.5
10	0	1	1	1
11	2	0	2	0.5
12	2	4	6	0.16
13	1	0	1	1
14	1	1	2	0.5
15	0	2	2	0.5
16	1	1	2	0.5

There is no distinction if the initiated relation to a certain individual whose prestige is assessed, if it has a positive e.g. agreement or negative e.g. disagreement aspect. The individual 7 (*prestige* = 6) is again that one with the highest score, followed by individual 8 (*prestige* = 5), and 1, 4, 12 (*prestige* = 4).

Table 5: The clique matrix of shortest path and closeness score

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Closeness
1	0	1	3	1	1	3	1	1	2	1	2	2	3	2	2	2	0.5556
2	1	0	3	1	1	2	1	1	1	1	2	2	3	2	2	1	0.625
3	3	3	0	2	3	5	3	4	4	4	4	3	4	5	1	5	0.283
4	1	1	2	0	1	4	1	2	2	2	2	1	2	3	1	3	0.5357
5	1	1	3	1	0	3	1	2	2	2	2	2	2	3	2	2	0.5172
6	3	2	5	4	3	0	3	3	1	3	4	4	5	4	4	3	0.2941
7	1	1	3	1	1	3	0	1	2	2	1	1	2	2	2	2	0.6
8	1	1	4	2	2	3	1	0	2	2	1	2	3	1	3	1	0.5172
9	2	1	4	2	2	1	2	2	0	2	3	3	4	3	3	2	0.4167
10	1	1	4	2	2	3	2	2	2	0	3	3	4	3	3	3	0.3947
11	2	2	4	2	2	4	1	1	3	3	0	1	2	2	3	2	0.4412
12	2	2	3	1	2	4	1	2	3	3	1	0	1	3	2	3	0.4545
13	3	3	4	2	2	5	2	3	4	4	2	1	0	4	3	4	0.3261
14	2	2	5	3	3	4	2	1	3	3	2	3	4	0	4	2	0.3488
15	2	2	1	1	2	4	2	3	3	3	3	2	3	4	0	3	0.3947
16	2	1	5	3	2	3	2	1	2	3	2	3	4	2	3	0	0.3947

Another measurement, namely *closeness* identifies how close an individual is to the others [11]. For a particular actor this value is based on the sum of the shortest path between his/her node and all others' nodes. The result is divided by $g-1$, where g is the group size (Table 5).

The individuals with the highest score of closeness are 2 (*closeness* = 0.625), 7 (*closeness* = 0.6) followed by 1

(*closeness* = 0.555), 4 (*closeness* = 0.535), 5 (*closeness* = 0.517).

Not being a leader, individual 7 is the most remarkable personage with the highest scores for both centrality and prestige. He plays a real role of linking subgroups and gathering approval. Individual 1, practically the list initiator, plays the most active communicational role since more than one third of the messages posted to the list are sent by him/her. An interesting position belongs to individual 8 who critically interrogated list goal, triggering a long string of debates regarding the relevant list issues.

5.3. Communication Roles

According to the function served in the communication process, there is a set of roles, which can be assigned to individuals in organization as parts in the informational flow. More than 75% of subscribers are *isolated*, since they are simply passive participants in the network. Individual 7 is a *liaison*, connecting links between subgroups in organization. Individuals 2, 4, 9, 12 are *bridges*, communicating mostly within a specific subgroup, but having links to other groups. Individual 1 plays a role of *gatekeeper*, who passes information to others, since he/she sent about 36% of all the messages. Since more than 80% off the messages regarding news or examples related to the list topic, were posted by individual 1, he/she plays also the role of *cosmopolite*, whose main features consist in entering new ideas in the system and relating the system to its environment. There is no *leader of opinion*, able to influence others' attitudes, since no hierarchy of authority has been previously established.

Another perspective upon our community brings Burnett's typology of information exchange behavior [2] (Table 6). The author defines *lurking* as one's limited participation within online communication process, to the passive role of reader only. It seems to be the basic non-interactive behavior in virtual communities and the greatest type of information exchange behavior. Even *largely invisible*, this *silent majority* (89% in our case) should be considered as a consumer of information, since its primary gathering information activity is significant for community.

Flaming and trolling are the hostile interactive behaviors identified within the studied community. As Burnett noticed, "all virtual communities at some time or another – can appear to be structured around a sort of verbal violence" [2]. An explanation was offered by the lack of "social presence" [9], which may emphasize the anonymity and exhibition of antisocial behavior. Flaming was defined as "simply ad-hominem argumentation, aiming neither for logic nor for persuasion, but purely and bluntly as insult" [2]. Individual 5 exhibited flaming behavior towards individual 4, in a personal e-mail addressed to individual 2, but posted incorrectly to the list. It was followed by apologies.

Trolling consists in "posting a message for the purpose of eliciting an intemperate response" [2]. Such kind of behavior could be identified with regard to individual 8, which actually triggered the longest debate of the list. Almost 14% of the list messages were focused on it. Eventually it seemed to be useful, because such primary questions come to clarify issues previously accepted only the base of commonsense. We did not notice any kind of spamming defined as "the online equivalent of unsolicited junk mail" [2].

Table 6: Burnett's typology of information exchange behavior

Non-interactive behavior	Lurking		
Interactive behavior	Hostile	Flaming	
		Trolling	
		Spamming	
		Cyber-rape	
	Collaborative or positive	Behaviors not specifically oriented toward information	Neutral behaviors: pleasantries and gossip
			Humorous behaviors: language games and other types of play
			Empathic behaviors: emotional support
		Behaviors directly related to either inf. seeking or providing inf. to other community members	Announcements
			Queries or specific requests for information
			Directed group projects

The identified collaborative behaviors are focused especially towards information, rather than providing any social support. Among those not specifically related to information, there are just two e-mails representing Christmas and New Year greetings and 7 e-mails containing emoticons. The emotional support is completely absent, due to the fact that the list scientific interest points to research activity only. The information-oriented behavior is prevalent through all its three specific types: announcements, specific requests for information and group project.

Announcements as the fundamental information sharing activity covered more than 40% of the posted messages. As Burnett pointed it, a spirit of a "gift economy" governs virtual communities, since "information is given freely and is accepted freely" [2].

Queries made by other community participants, together with those taken out of the community, represent about 3% of the e-mails posted on the list. The most significant number of queries, 47%, reflects those presented to the community by its own members in the shape of explicit articulated questions triggered by specific information needs.

Directed group projects are designed "to support the interests and information needs of the community" [2]. According to this desiderate, information resources made to meet the community interests and information needs were developed. The most relevant ideas such as explication, measurement, examples, bibliography, conferences and links related to main topic list,

are posted for the benefit of every ones: members or non-members. Another example of community-based development of information resources stressed by Burnett is the summary of responses carried out by a single community member. Individual 1 plays a particular role in this management of information. As list initiator he is the mostly involved member of the community in compiling and up-dating list resources. He/she also carried out all the *synthesis*, about 15% of the posted messages, regarding list debates together with delineated conclusions.

The analysis carried out in terms of Burnett's typology of information behavior, emphasized once again that the studied community purses its goals regarding conceptualization and measurement of the main concept list. The collaborative behavior oriented towards seeking and providing information is mostly carried out in terms of announcements and specific requests. The ties, which keep people together, are grounded on the scientific information exchange and very less on emotional support provided among the subscribers.

5.4. Netiquette

As Rogers argued, "the organizational structure limits and guides communication flows" [8]. Joining, leaving or posting messages to a list are restricted by a set of rules applicable to every electronic communication. There is also an underling set of rules, restricting any on-line behavior, namely the *netiquette* [6]. The messages analysis with respect to the netiquette, led to the following results: 8 messages (3%) contain apologies for cross-postings, while 3 e-mails represents apologies for sending personal messages to the list. The emotional icons are sparingly used: just 7 e-mails contain " :-) " symbolizing smile. The upper cases for emphasizing the importance of the conveyed ideas are widely used, especially for the relevant subjects to the list topic, six subjects being stressed with upper cases (20% of the posted e-mails).

5.5. Social Network Interests and Values

In order to carry out the content analysis, we performed a first analysis of coding the data into categories, where a category is "a group of words with similar meaning or connotations" [12]. Table 7 presents the categories and the associated frequencies for each of them. In order to compute these frequencies we performed a computerized content analysis, where for a better grasp of the meaning applied in the given context, the basic search was Key Word In Context. This technique searches for "all instances of a word, but also pull up the sentence in which that word was used" [10].

Table 7: The content analysis categories and their frequencies

	Category	Frequency
Main Topic 60.3%	Main Concept	21.80%
	Sensation, Perception	13%
	Subjective experience	11.80%
	Media, Mediation	9%
	Conceptualization	3.60%
	Consciousness	2.10%
	Measurement	2.70%
	Related concept	36%

The content analysis allowed us to do a more refined investigation of communication process. Comparing with the *Table 1* which refers to the subjects of messages, there are some significant differences. Firstly the weight of the main topic is greater than the subjects of messages reflect it. Actually, only the main concept of the list has a frequency of appearance greater than 20%. The main topic as a whole covers more than 55% among the identified categories. Thus, the community assesses the importance of the main topic. The focus on measurement is less than it was suggested by the subject's list, while the related concepts covered more than one third of the analyzed categories.

6. CONCLUSIONS

The study carried out allowed us to attain the proposed objectives and to validate our hypothesis, highlighted that communication process is not only one of the dimensions of organizations. It proved again that when analyzed methodically, communication opens a door for a better understanding of community as a whole.

The content of the messages reflects the declarative goal of the list, as being primarily focused on theoretical and methodological issues, together with concepts, examples or news related to the topic list.

The majority of subscribers (75%) are completely passive and isolated. Several studies proved that the great number of lurkers is a common feature of the online community [2]. The role of flaming and trolling behavior in discussions dynamism should not be overridden though.

This issue significantly limits communication. The identified clique, which groups 11% of the subscribers, represents the unit of analysis, since it covers 82% of the communicational process. The fact, which keeps people together within this clique, is disagreement with others' opinions. Though constructive, the dynamism provided by continuous arguments (and contra-arguments) makes the clique less cohesive.

This identified clique is also an elitist one, since its members are prominent names in the field and 56% of subscribers, who tried to participate in dialogue, were completely ignored. Of course the eventuality that these subscribers received answers to their question or feedback for their ideas, in private responses, cannot be ignored. Still, there is no obvious reason for this, since their observations related to list topic could be of interest for all the others.

Individual 7, the most remarkable subscriber with the highest scores for both centrality and prestige, is the group liaison. Individual 1, the list initiator, is both a gatekeeper and a cosmopolite. An interesting position belongs to individual 8 who critically interrogated list goal, triggering a long string of debates regarding the relevant list issues, while individuals 2, 4, 9 are bridges for their subgroup.

The content analysis led to idea that the list's declarative goal—to be a forum of discussion and announcements regarding a main concept—is highly pursued. Even if nothing can be new at the beginning of the Third Millennium, the advanced technologies allow and push to carry out interdisciplinary reanalysis of the old concepts. This pioneering work of re-conceptualizing ideas within new frames emerged from the list messages. People here simply try to achieve a consensus, which appears to be a difficult task, due to the different subscribers' backgrounds. From this battle of strongly attacked and defended opinions, a conceptualization accepted among both scientific community and large public is the main goal.

7. REFERENCES

- [1] B. Berelson, *Content Analysis in Communication Research*, New York: Free Press, 1952.
- [2] G. Burnett. Information exchange in virtual communities: a typology. *Information Research an international electronic journal*, Vol. 5, No. 4. 2000.
- [3] R.L. Daft and R.H. Lengel. "Organizational Information Requirements, Media Richness and Structural Design". *Management Science*, Vol. 32, No. 5, 1986.
- [4] G. DeSanctis and P. Monge, "Communication Process for Virtual Organizations", *Journal of Computer Mediated Communication*, Vol. 3, No. 4, 1998.
- [5] L. Garton, C. Haythornthwaite and B. Wellman, "Studying Online Social Networks", *Journal of Computer- Mediated Communication*, Vol. 3, No. 1, 1997
- [6] Netiquette Guidelines. <http://sunsite.cnlab-switch.ch/ftp/doc/standard/rfc/18xx/1855>
- [7] H. Rheingold, *The Virtual Community: Homesteading on the Electronic Frontier*, Reading, MA: Addison-Wesley, 1993.
- [8] E. Rogers and R.A. Rogers, *Communication in organizations*, London: The Free Press, 1976.
- [9] J. Short, E. Williams and B. Christie, *The social psychology of telecommunications*, London: John Wiley, 1976.
- [10] S. Stemler, *Investigating the Practical Applications of Content Analysis*. Available on-line: <http://www2.bc.edu/~stemler/contentanalysis.html>
- [11] S. Wasserman, S. and K. Faust, *Social network analysis: Methods and applications*, Cambridge: Cambridge University Press, 1994.
- [12] R.P. Weber, *Basic content analysis*, Beverly Hills, London: Sage, 1985.
- [13] K.E. Weick, *The social psychology of organizing*, Reading, MA: Addison-Wesley, 1969.
- [14] M.H. Zack, "Researching Organizational Systems using Social Network Analysis", *Proceedings of the 33rd Hawaii International Conference on System Sciences*, Maui, Hawaii, 2000.