Trends, Similarities and Differences in the Usage of Teen and Senior Public Online Newsgroups

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This paper presents an analysis of the human to human interactions in two public online newsgroups, one targeting the young generation and the other the elderly. The main goal of this study was to establish a better understanding of similarities and differences in the ways of interaction among the participants of these two newsgroups. A series of analytical/statistical techniques, like Social Network Analysis (SNA), were used in order to get a better understanding of the on-line communities that have emerged around the participants of these two newsgroups. The SNA analysis showed that the teens newsgroup is more highly connected, has more messages sent and received and has a higher reciprocity. On the other hand, the senior newsgroup has more central dominant people who tend to make the rest of the network dependent on them for communication.

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1. INTRODUCTION

The Internet has facilitated the formation of global online communities. A characteristic example is the UseNet where over 100,000 newsgroups have formed. A study by Madden (2003) reported that 25% of internet users have participated in chat rooms or online discussions and found that chat rooms and online discussions are most popular among young adults. More specifically, it is estimated that 87% of teens are online (Lenhart, Madden & Hitlin, 2005) and 55% of them have visited a chat room. In addition, 47% of 18- to 29 year olds said they communicated via online discussions. On the other hand, only 22% of Americans age 65 or older are reported having access to the internet (Fox, 2004), although an other study showed that wired seniors are often as enthusiastic about the internet as younger users and 11% of them regularly visit a cyber newsgroup (Horrigan, Rainie & Fox, 2005).

Eilers (1989) found that older people who used computers thought they had more social interaction, memory enhancement and mental stimulation. This was re-enforced by Czaja, Nair et al. (1993) who demonstrated that there was a correlation between social interaction and quality of life for seniors. This is also in line with the findings of a Pew survey (Fallows, 2004) that found that 89% of older internet users think the internet is a

good place to go for social interaction or communications (compared to 85% of younger users).

The expansion of the Internet has increased the usefulness and popularity of Computer Mediated Communication (CMC). As Hiltz and Turoff (1978) pointed out, CMC "spans space and time barriers allowing a person to work, learn and communicate from those times that are most convenient for him or her" (p169). In the case of the Internet, people can collaborate through mediums such as email and newsgroups, reducing time and physical location constraints (Olaniran, 1996). These collaborations often achieve to make CMC socially respectable and a good facilitator of interpersonal communication.

Often, virtual/online communities emerge through the use of computers to communicate (Wellman 1997). There have been many definitions and interpretations of online communities. Rheingold (1994) through his WELL (Whole Earth Lectronic Link) project suggested that:

> "Virtual communities are cultural aggregations that emerge when enough people bump into each other often enough in cyberspace. A virtual community is a group of people who may or may not meet one another face-to-face, and who exchange words and ideas through the mediation of computer bulletin boards and networks" (Rheingold 1994).

These online communities form as a result of like-minded people offering information, friendship and support (Wellman 1997) to each other. Often, empathic communities also emerge to offer emotional support to people with special needs (e.g. the elderly) in an environment of trust and equality (Preece 1998; Bakardjieva and Smith 2001). As Taha and Caldwell (1993) correctly indicate, CMC can increase the amount and range of contact between people and reduce the social, physical and temporal distance between them. However, others support that online interactions have a negative effect to social relationships. For example, Parks and Roberts (1998) argue that users of virtual environments such as MUDS (Multi-User Domains) valued their offline friends higher than their online friends. Similarly, Kraut, Patterson et al. (1998) argued that spending large amounts of time online can lead to a decrease in social involvement and a person's psychological well being, and often, other forms of communication such as telephone and face-to-face are seen to be more valuable for sustaining and developing social relationships (Cummings, Butler et al. 2002).

Additionally, the success of CMC engagement is very often highly dependent on the interaction medium used. For example, text based CMC (such as newsgroups and email) does not provide the social and contextual cues that face-to-face communication has.

This can be an advantage when communicating through newsgroups as the absence of information about social status, age and appearance might help to form a more "equal" basis for conversation. On the other hand, others think that text based communication may lead to increased conflict due to people expressing extreme opinions and anger (Sproull and Kiesler 1991).

The emergence of computer-mediated communication and online communities has lead to the formation of complex online social networks. Wellman (2001) suggests that "computer networks are inherently social networks linking people, organizations and knowledge" (p2031). The Internet can be described as one of the largest networks e.g. millions of users participate in UseNet newsgroups and post millions of messages.

A study by Hiltz (1982) investigated the effect of introducing the electronic information exchange system (EIES), a computerised conference system, to five scientific research communities. She concluded that the social ties between the community strengthened as a result of introducing the communication technology. In addition, new ties were established, personal relationships developed and the scientific community became larger and more densely knit. Furthermore, Wellman (1999; 2001; 2002) argues that there has now been a transition from a group to a networked society. These social networks are more sparsely knit than the densely knit bounded groups. The tightly knit groups had the characteristics of a village community where all interaction takes place on a face-to-face basis. Wellman (2002) describes these as "little boxes". On the other hand, social networks are described as groups where boundaries are porous, interaction takes place between different people, communication can switch between networks and the hierarchies are flatter with a more sophisticated structure (Wellman 2002).

This paper presents a study where the online social communities that emerged around two newsgroups (alt.teens and soc.senior.issues) were analysed. The analysis attempts to measure the sociability of each newsgroup and describe the social interactions taking place within them. First the two newsgroups are examined through a series of descriptive data analysis (using qualitative and quantitative) with the goal of identifying and better understanding any similarities and differences in the online behaviour of the participants of these two newsgroups. According to Preece (2001) sociability in an online community can be determined by measures such as number of participants, number of messages, member satisfaction and amount of reciprocity. Then, the Social Network Analysis (SNA) technique was used to answer the following five research questions:

1. What are the properties of the networks and actors within the two newsgroups under investigation?
2. Who is central and powerful within the social structure of these two newsgroups?
3. Have any subgroups (cliques) formed within each of the newsgroups under investigation?
4. What are the network/group positions and social roles within each of the newsgroups?
5. What are the significant patterns, relations and structures within each of the newsgroups under investigation?

Getting a better understanding about how senior citizens interact online through CMC could give the HCI community insights as to how this interaction could best be facilitated. For example, Greene, Gomez et al. (1986) illustrated that by analysing the behaviour of older adults one can design systems to eliminate the difficulties experienced by older adults and also accumulate information on their interface and feature preferences.

2. EVALUATING ONLINE COMMUNITIES

2.1 Online Social Networks

A technique for analysing social networks is Social Network Analysis (SNA).

> "Social Network Analysis (SNA) is the mapping and measuring of relationships and flows between people, groups, organizations, computers or other information/knowledge processing entities. Network analysis is concerned about dyadic attributes between pairs of actors (like kinship, roles, and actions), while social science is concerned with monadic attributes of the actor (like age, sex, and income). The nodes in the network are the people and groups while the links show relationships or flows between the nodes. SNA provides both a visual and a mathematical analysis of human relationships" (Krebs, 2004, pp.1).

Preece (2000) adds that SNA provides a philosophy and a set of techniques for understanding how people and groups relate to each other. SNA has been used extensively by sociologists (Wellman 1997), communication researchers (Rice, 1994; Rice et al., 1990) and others. Analysts use SNA to determine if a network is tightly bounded, diversified or constricted; to find its density and clustering; and to study how the behaviour of network members is affected by their positions and connections (Garton, Haythornhwaite & Wellman, 1997; Wellman, 1997; Scott, 2000; Knoke & Kuklinski, 1982). Table I shows some important units of analysis for SNA (Laghos & Zaphiris, 2003).

Table I. Units of Social Network Analysis

Unit of SNA	Description
Nodes	The actors or subjects of study
Relations	The strands between actors. They are characterised by content, direction and strength
Ties	Connect a pair of actors by one or more relations
Multiplexity	The more relations in a tie, the more multiplex the tie is
Composition	The general characteristics of the population of actors within a given network
Range	The size and heterogeneity of the social networks
Centrality	Measures who is central (powerful) or isolated in networks
Roles	Network roles are suggested by similarities in network members' behaviour
Density	The number of actual ties in a network compare to the total amount of ties that the network can theoretically support
Reachability	In order to be reachable, connections that can be traced from the source to the required actor must exit
Distance	The number of actors that information has to pass through to connect the one actor with another in the network
Cliques	Sub-sets of actors in a network, who are more closely tied to each other than to the other actor who are not part of the subset

SNA can be conducted in one of two ways either as an Ego-centered analysis where the analysis focuses on the individual as opposed to the whole network, and only a random sample of network population is normally involved or as a Whole network analysis where the whole population of the network is surveyed and this facilitates conceptualization of the complete network (Zaphiris, Zacharia, & Rajasekaran, 2003).

In this study, due to the large size of the newsgroup under investigation, it was more practical to follow an ego-centered analysis approach.

3. METHODOLOGY

We observed and studied a large number of newsgroups that target the two generations (teenagers and seniors). Our goal was to focus our study on newsgroups that have enough activity to enable us to carry out detail network analysis on their online communities. Through this approach, two newsgroups were chosen, one popular among the younger generation (alt.teens) and one popular among the older generation (soc.senior.issues). Note that in this paper it is assumed, as the names of the newsgroups suggest, that the big majority of postings in soc.seniors.issues come from seniors and those in alt.teens come from teenagers. This assumption was also cross-verified through content analysis of a large number of postings from these two newsgroups.

Data for three complete calendar years was collected from the Microsoft Netscan research site (http://netscan.research.microsoft.com/default.asp) and statistical analysis on that data was carried out. The Netscan website was developed by Microsoft Research and the main aim of it is to generate social accounting metrics for UseNet newsgroups.

Newsgroup message archives were used to observe a sample of 200 messages to find out general characteristics of each newsgroup and to establish the information flow (i.e. who sends messages to whom and who receives messages from whom) between members of each of the newsgroups.

Initially a descriptive analysis was conducted of the differences in patterns of use among the two newsgroups. This descriptive analysis was then followed by use of social network analysis for a more in-depth study of the nature of the communication.

NetMiner (http://www.netminer.com) was used for the SNA part of the analysis by focusing on the observed message sender and recipient data. The data was entered in the form of a matrix and the various SNA techniques applied to the data. The NetMiner tool generated reports and displayed information visually.

4. RESULTS

In the first part of the results section we present the findings from the descriptive analysis of the postings in the two newsgroups under investigation. Later in this section we present the findings from the social network analysis.

2.1 Descriptive Statistics

The teenager's newsgroup has on average a larger number of visitors (437) than soc.senior.issues (131). The large difference can also be seen in figure 1 and was statistically verified using a t-test (t=11.320, p<0.004).

The average number of messages per person was also higher in the teens newsgroup (10.27) than the senior newsgroup (6.48) (figure 2) (t=3.794, p<0.0003). A trend analysis on this data shows a decreasing trend for both alt.teens (y = -0.347x + 431.38, R2 = 0.4959) and soc.senior.issues (y = -0.1488x + 187.05, R2 = 0.2748). As can be seen both regression equations have a negative slope (-0.347 for alt.teens and -0.1488 for soc.senior.issues) with the negative trend being stronger for alt.teens. A decreasing trend means a reduction in popularity for the two newsgroups. This result is in line with the general popularity of UseNet which seems to be negatively affected by the introduction of alternative means of online communication (e.g. the wide use of instant messengers).
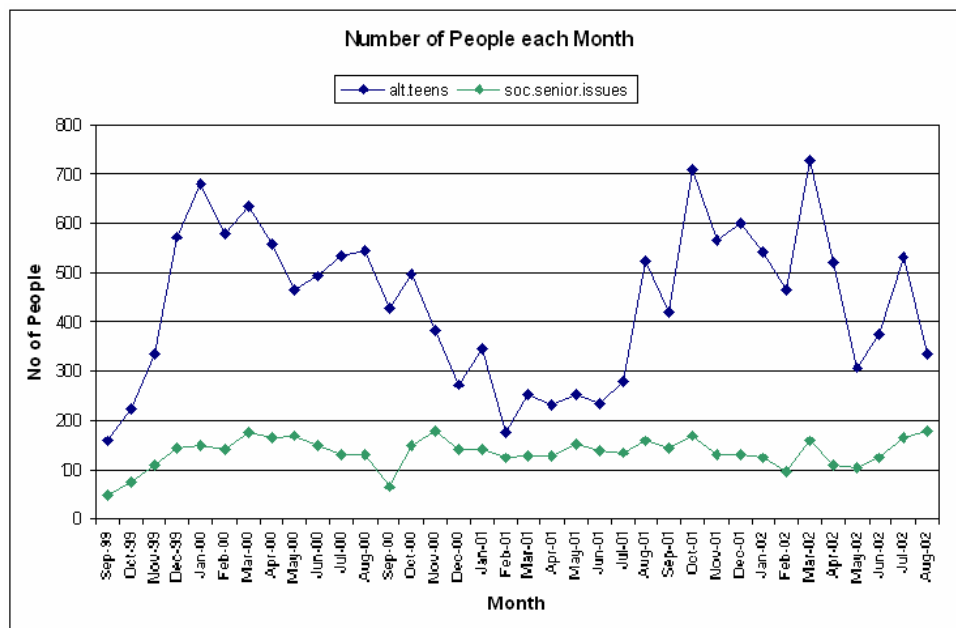

Fig. 1. Number of people each month

The average message length for the teens (39.81 lines) is higher than that of the senior newsgroup (28.94 lines). This is also supported by the results of a t-test (t=5.074, p<3.069E-06). However the standard deviation for the alt.teens newsgroup is higher than that of soc.senior.issues indicating that the message length in alt.teens is not as consistent as that of the senior newsgroup.

The teens newsgroup on average has 84% of messages as replies per month (SD=11), as compared to the senior newsgroup which has an average of 81% (SD=5). But, a t-test conducted on this data for both newsgroups found no significant difference (t=1.136, p>0.260).
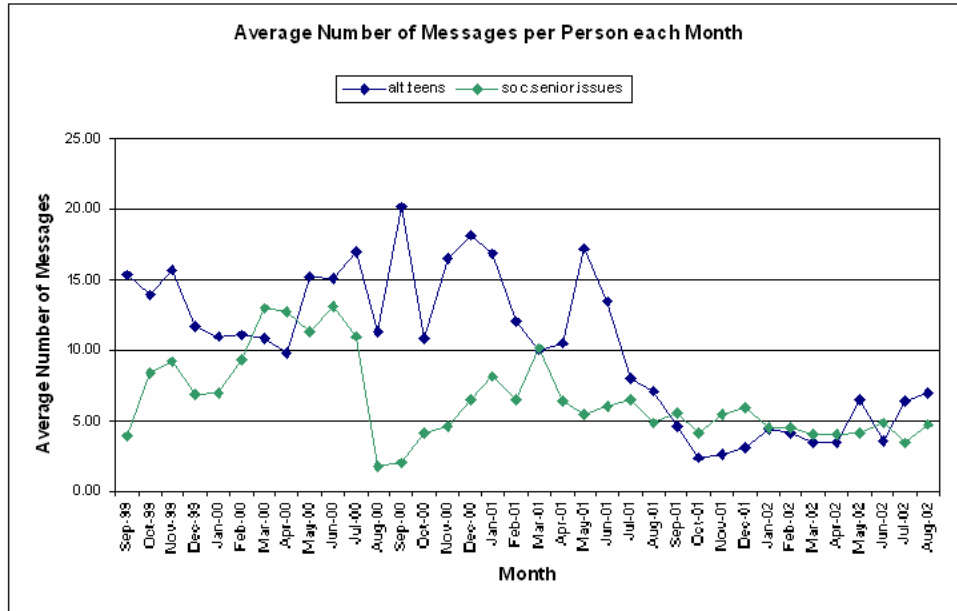
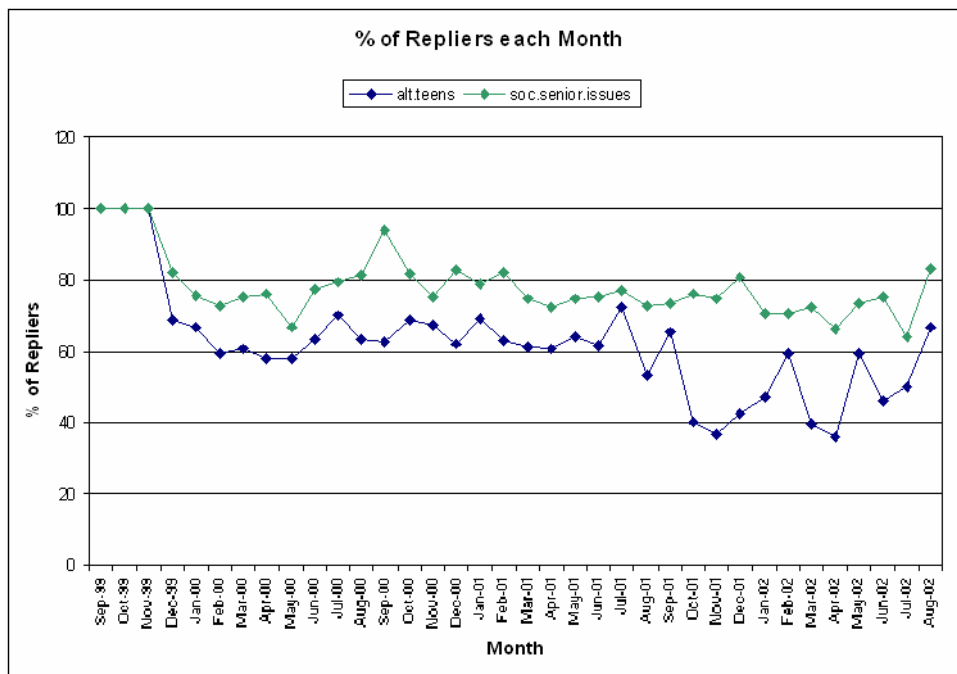Fig. 2. Average number of messages per person each month

Fig. 3. Percentage of repliers each month

On the other hand on average 78% of the senior group members are repliers compared to 62% of the teens newsgroup members (t=-5.565, p<4.497E-07). Again the senior newsgroup shows more consistency (SD= 9 compared to SD=15 for the teens) (figure 3).

The percentage of non-replied messages is lower for soc.senior.issues than alt.teens. This indicates that the senior newsgroup is more active. The percentage of non-replied

messages from the total number of messages posted is on average 10% per month for the teens and 6% for the senior newsgroup (SD=11 for the teens newsgroup, SD=4 for the senior newsgroup). The t-test on this data indicates that there was no significant difference between the non-replied messages for the teens and senior newsgroup (t=1.697, p>0.0944).

The above results show that overall, participants of the senior newsgroup are more responsive than those of the teens group. The results from social network analysis discussed later will shed some more light on this.

Our analysis also gives strong evidence that the teens newsgroup shares more messages with other newsgroups than the senior newsgroup. This is clearly visible in figure 4. On average 35% of its messages per month compared to 5.15% for the senior newsgroup are shared (t=7.031, p<1.095E-09).
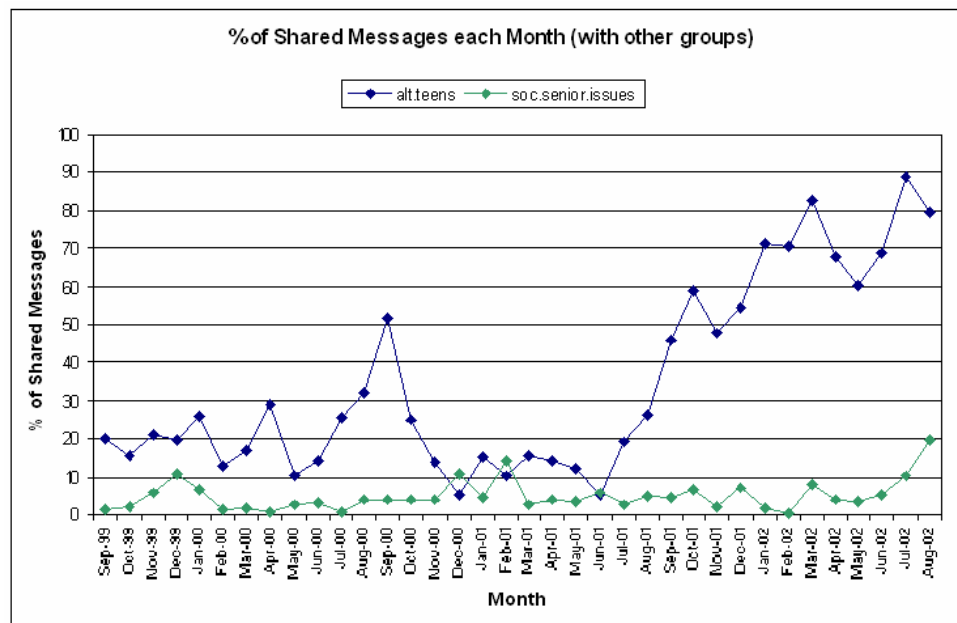

Fig. 4. Percentage of shared messages each month

Similarly, the alt.teens newsgroup has more neighbouring newsgroups than soc.senior.issues (t=13.886, p<8.568E-22).

Also the number of messages shared by other groups with alt.teens is much higher than the senior newsgroup. Abortion newsgroups such as alt.abortion and religious newsgroups e.g. alt.bible are the most popular amongst alt.teens. Other topics of popular discussion include politics, parents, drugs and music. The soc.senior.issues newsgroup had as its popular topics retirement, politics, military, culture, engineering housing, and

health. It is clear that the two newsgroups have very different interests (except for discussions on politics).

Our analysis found that the teens newsgroup members use more abbreviations than the senior newsgroup members (t=2.868, p<0.004). Although, it was also observed that the members of the teens newsgroup use more emoticons but that difference was not statistically significant (t=1.380, p>0.168).

2.2 Social Network Analysis (SNA)

Two hundred messages were observed from each newsgroup and the message sender and receiver(s) recorded. The teens newsgroup had 70 unique authors and the seniors newsgroup 90. From this data, a 70*70 adjacency matrix was produced for the alt.teens newsgroup data set. The sociogram from this data is displayed in figure 5. Actors are identified as y1, y2 (young person 1, young person 2 etc.). Similarly, a 90*90 adjacency matrix was produced for the soc.seniors.issues data set. The sociogram for this data is displayed in figure 6. Actors are identified as s1, s2 (senior 1, senior 2 etc,).
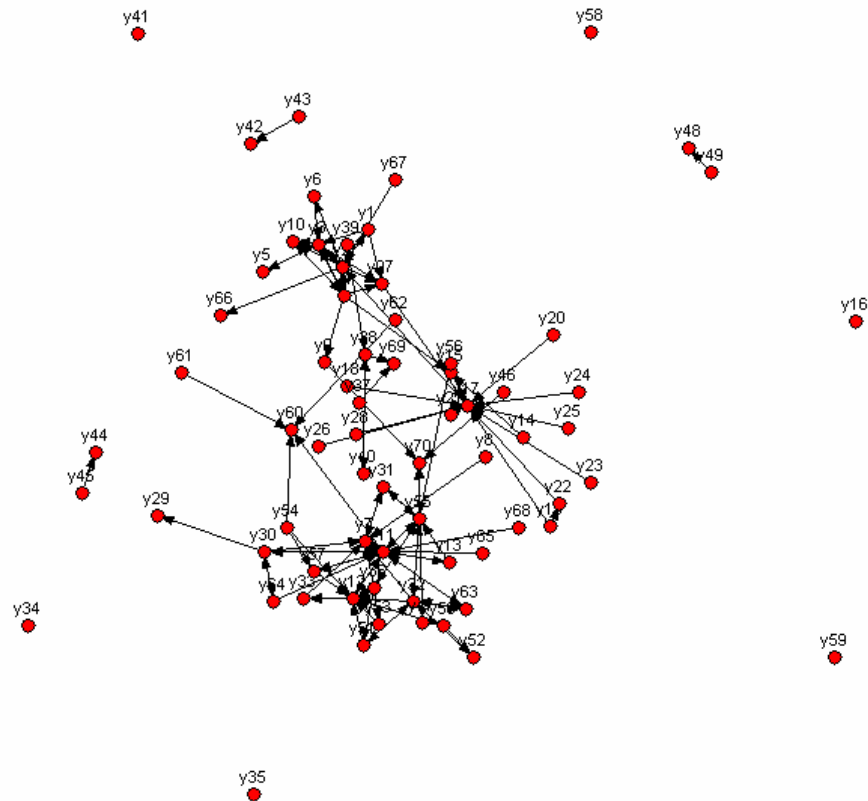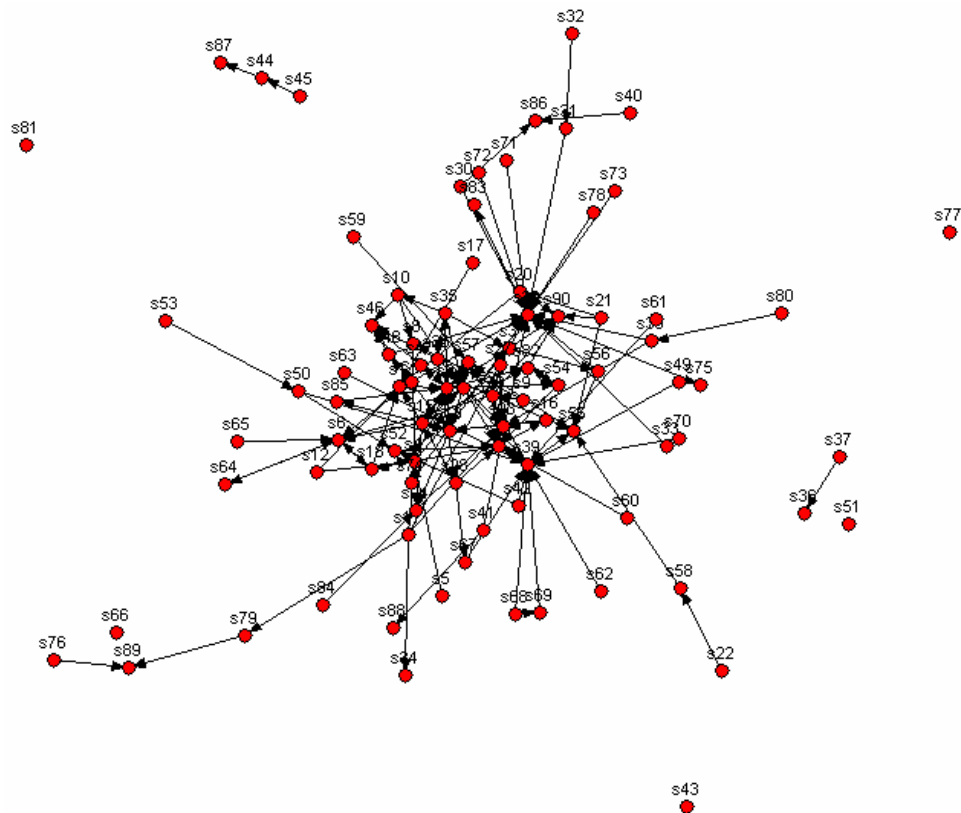

Figure 5: alt.teens Sociogram

Figure 6: soc.senior.issues Sociogram

2.2.1 Adjacency

The adjacency connection reports show that the network density for the teens network is higher (0.034) than the senior newsgroup (0.020) network. A strongly connected network has a high density, showing that the younger newsgroup is more highly connected compared to the senior newsgroup.

The reports also indicate that the teens network has more messages being sent and received with a mean of 2.343 per person compared to 1.756 for the senior network. The number of isolated actors (those that have a degree of '0') and the number of pendant actors (those that have a degree of "1") is higher for the senior network. This shows that the teens network has more actors receiving and sending more than one message to each other, therefore a higher level of reciprocity.

2.2.2 Path

In order to show how individuals are embedded in a network the distance from one actor to another is measured. The path reports show the distance between actors (nodes) and their reachability.

The geodesic distance measures the shortest possible path from one actor to another. From the path reports the mean geodesic distance for the teens network is smaller, because the network is dense, indicating that the information can travel quickly within the network. The standard deviation is also smaller than that of the senior newsgroup network. Both networks are highly connected with only one node that is not reachable from the maximum possible reachable nodes. This indicates that the networks are highly integrated with a minimum number of sub-groups.

2.2.3 Degree

This measure analyses the centrality of the network structure by the degree or connections of the actors. It measures which actors are more central to the network structure based on the number of messages they receive and send.

Looking at the centrality concentric maps (figures 7-10) the senior newsgroup has more people towards the central circles for the in degree analysis than the teens newsgroup. This indicates that the senior newsgroup has more central people who tend to be dominant making the rest of the network dependant on them for communication.
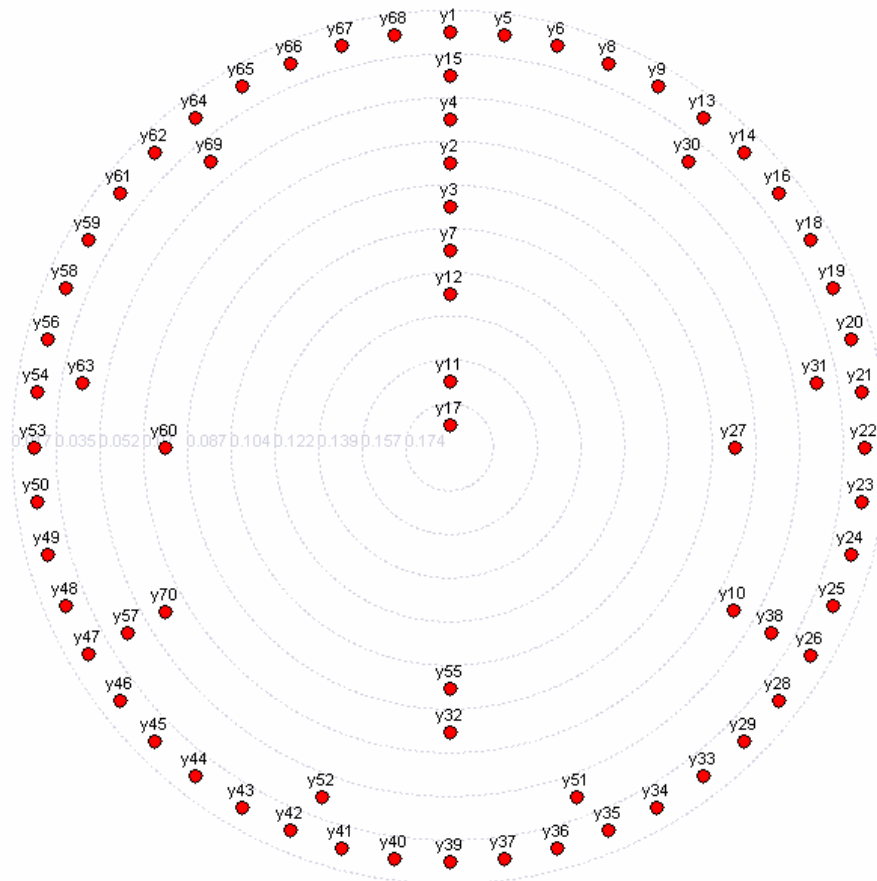
Figure 7: alt.teens Message Senders/Receivers In-degree Centrality (scale: 10)

Figure 8: alt.teens Message Senders/Receivers Out-degree Centrality (scale: 10)
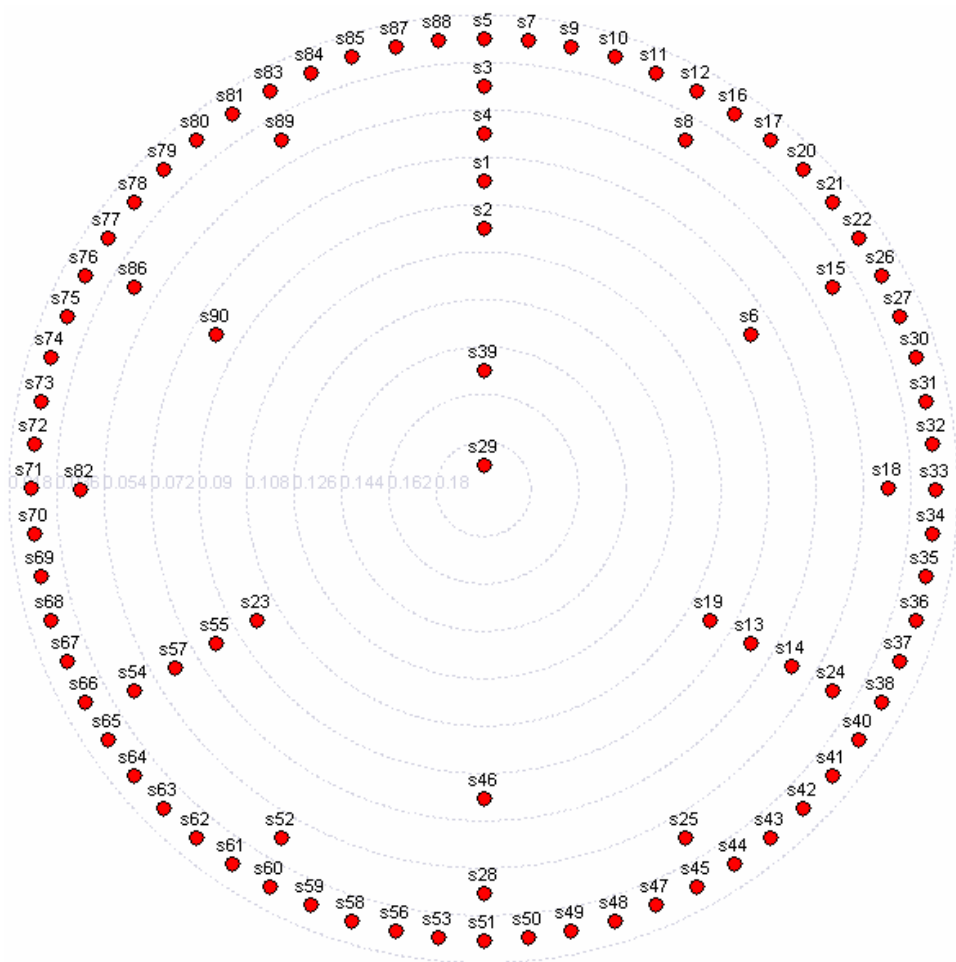
Figure 9: soc.senior.issues Message Senders/Receivers In-degree Centrality (scale: 10)
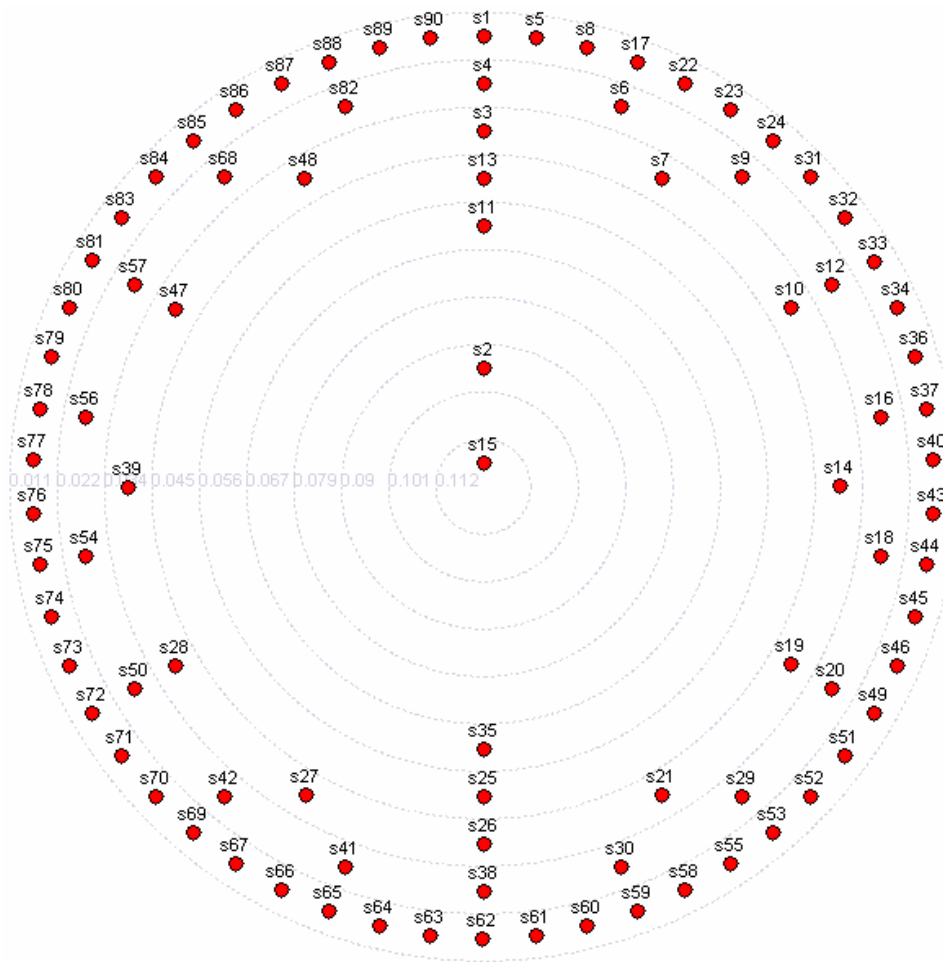
Figure 10: soc.senior.issues Message Senders/Receivers Out-degree Centrality (scale: 10)

In terms of receiving messages y17 (in degree of 0.174) and s29 (in degree of 0.180) are the most central actors. This indicates that these two actors are important in the network, as many other actors tend to send messages to them. Now, considering the out-degree of both networks it can be seen that y11 (out-degree of 0.116) and s15 (out-degree of 0.112) are the most central actors. This shows that these actors can exchange messages with many other network members, and are seen to be influential and others are made aware of their views (Hanneman 2005).

The in and out-degree centralisation indexes for both of the networks are very similar with small differences i.e. the senior network has a slightly higher percentage. The degree centralisation index measures the variability of individual centrality scores. Both networks have higher unequal positional advantages in terms of receiving (in-degree) and sending (out-degree) messages, with some senior network members having slightly higher advantages.

In both networks influential actors are more equally distributed than the prominent actors. Posts seem to be specifically addressed to certain members of the group. This gives them a stronger 'social' status than other network members despite the fact that everyone has an equal chance of broadcasting their view to all other actors and be influential.

2.2.4 Closeness

This is a measure of centrality in terms of how close an actor is to other actors. The higher the closeness of an actor to a higher number of other actors the more powerful and central the actor's position within the network structure is. The geodesic distances between actors are taken into account for the analysis.

In terms of receiving messages the most central actors in the network are y11 (in-closeness of 0.194) and s19 (in-closeness of 0.207). The centralisation index for the in-closeness of the senior network (29.852%) is higher than that of the teens network (27.697%).

Looking into the out-closeness, again y11 (out-closeness of 0.151) and s15 (out-closeness of 0.172) are the most central actors in the network. There is an indication from the closeness results that y11 is at an optimum position in the teens network in the context of closeness to other actors when receiving and sending messages, y11 is also one of the most consistently present authors in the newsgroup, therefore views of y11 are heard by a larger number of other members. S19 in the senior network moves away from the central layers for out-closeness.

The centralisation index for out-closeness indicates that there is more inequality of closeness in the senior network than the teens. Overall in both networks in-closeness (receiving messages) is more unequal than out-closeness (sending messages). This is due to the nature of newsgroups as once a message is posted it is available to all the actors. Therefore everyone has an equal chance of posting messages that can be seen by others.

2.2.5 Betweeness

This is a measure of dependency between actors. Some actors' positions in the network structure may be at a more advantageous place than others.

In terms of 'betweeness' actors y17 (betweeness of 0.089) and s29 (betweeness of 0.302) are the most powerful. This is because they are less dependent in the network as they lie between many other actors so are in a favourable position and play an intermediating role.

The centralisation is again higher for the senior network (28.156%) than the teens network (8.348%). This indicates that there is a concentration of power in the senior network. The low concentration of power in the teens network shows that it has less structural constraints (Hanneman 2005). Even though actor's y17, y11 and y2 are seen to be more powerful than other network members, in the senior network many actors depend on s29, s39 and s11 to make connections with other actors.

2.2.6 Bi-component

A bi-component is a subgraph with more than one path between its actors. The results from the bi-component analysis show that the teens network has three bi-components and the senior network has two (figures 11 and 12). This indicates that the senior network is better connected with alternative paths.

The teens network has three bi-components however amongst these components there are less cutpoints than the senior network. This reinforces the point that what keeps the senior network together is a few critical actors.

2.2.7 Cliques

The clique measure is used to analyse the subgroups in the network. A clique is a subset of actors who are closely tied to each other (Hanneman 2005). In a clique all points are adjacent to each other so it is maximal and complete (Scott 2000).

The clique analysis shows 14 cliques for the teens network and 18 for the senior network. For both networks the clique cohesion index is greater than 1. There is a lot of overlapping in the clique membership, for example, y11, S2 and S15 appear in many cliques. It should be noted that these have been the central actors throughout the analysis of the two newsgroups.
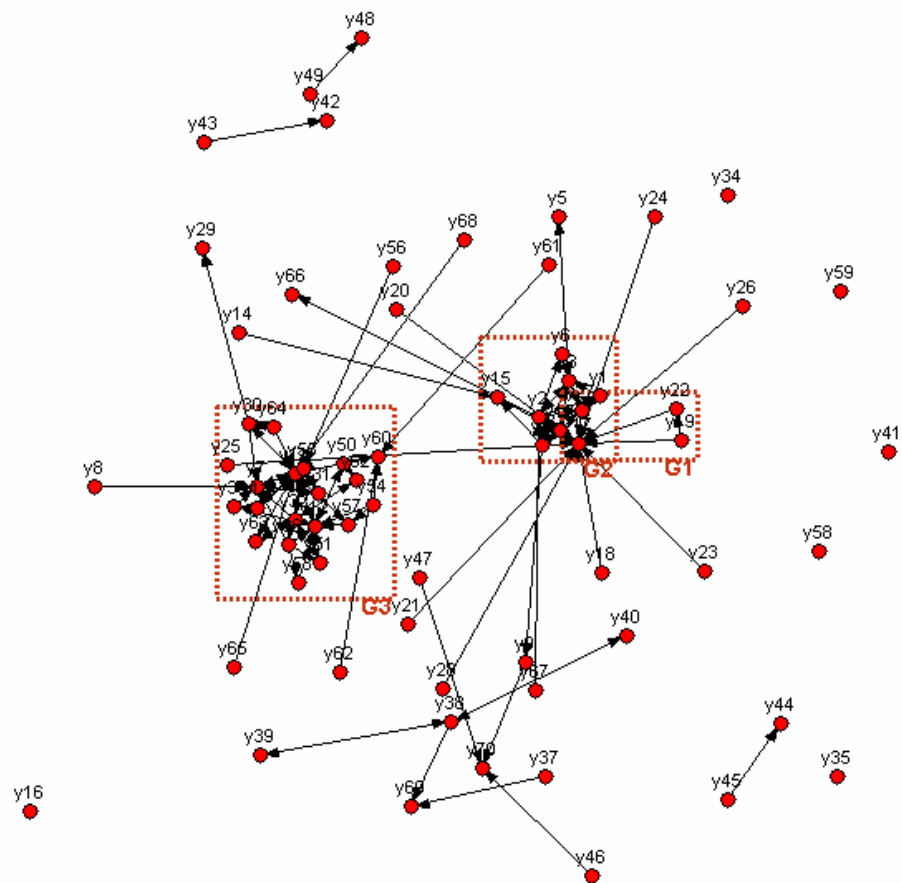
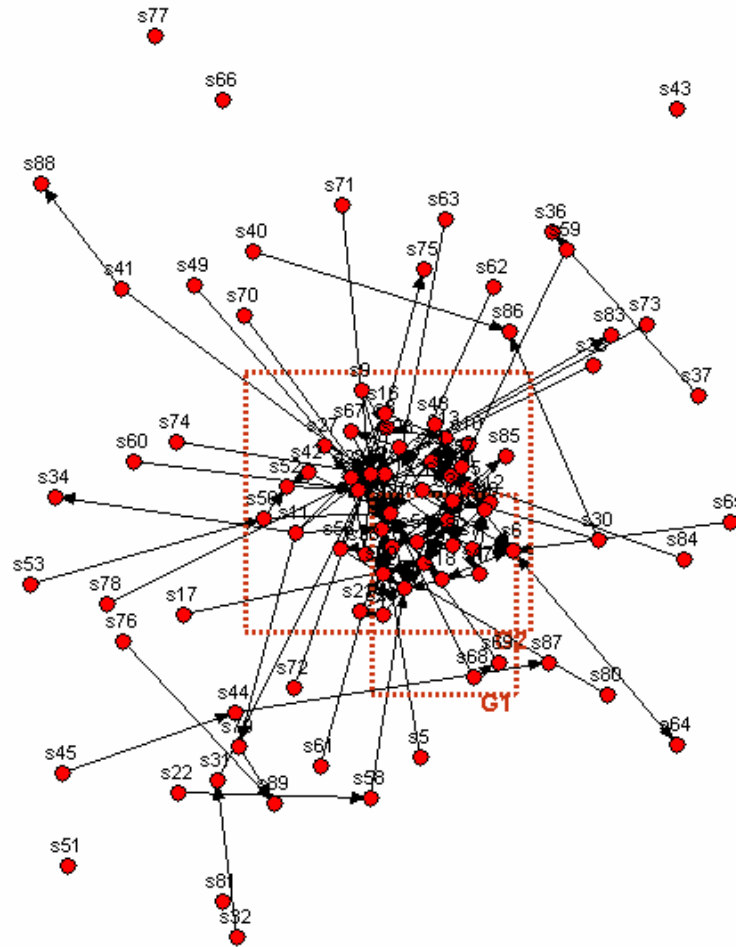Figure 11: alt.teens Bi-Component sociogram showing cutpoints

Figure 12: soc.senior.issues Bi-Component sociogram showing cutpoints

2.2.8 Structural

This is an analysis of the structural equivalence of actors. Two actors are structurally equivalent if they have the same relationship to other actors in the network i.e. the same patterns of relation.

The maximum structurally equivalent pairs for the teens network are y11 and y27 with a value of 12.689 and s2 and s29 for the senior network with a value of 6.928. The mean measure for structural equivalence is higher for the teens network (3.540) than the senior network (2.556). However the teens newsgroup has an unevenly distributed structural role equivalence (SD=2.451).

2.2.7 Summary of SNA results

The above SNA analysis showed that the teens newsgroup is more highly connected, has more messages sent and received and has a higher reciprocity. On the other hand, the senior newsgroup has more central dominant people who tend to make the rest of the network dependent on them for communication.

Both networks are highly integrated

4. DISCUSSION-CONCLUSIONS

This project explored the use of social network analysis to investigate trends, similarities and differences in the usage of teen and senior public online newsgroups.

The results suggest that the senior newsgroup was more interactive than alt.teens and offered a stable and consistent environment with a high level of activity. Both newsgroups had different interests except for 'politics' and also had differences in the use of language and ways to express themselves in an absent of social cues CMC environment. The teens newsgroup however was part of a larger network with more neighbours than the senior newsgroup.

The SNA carried out provided a deeper analysis of the newsgroups' properties; structure and member positions; social roles and relations. The SNA showed that the teens newsgroup was more densely knit making members more connected and reachable. Both networks had an unequal distribution of power with the senior network showing more inequality. The larger number of clique formations for the senior network was due to a large number of network members who formed separate subgroups. Interaction styles of the seniors were more consistent than those of the teens. This was also evident in the statistical analysis where the senior newsgroup offered a more stable and consistent environment with a high level of activity from members.

Overall the SNA has conveyed that the teens newsgroup is more densely connected with an unequal distribution of power. On the other hand the senior newsgroup was less dense but also with an unequal distribution of power and a high dependency on critical members of the group. In both networks the most powerful and central members were also the ones that were most consistently present in the newsgroups.

This study has given new insights into how people from the younger and older generation may interact through CMC and also the group dynamics of online social networks. The study by Garton, Haythornthwaite et al. (1997) analysed the effects of media use in a bounded organization, however this study makes a contribution by

studying two global networks which have no boundaries and individuals are tied up into the larger network of social connections through CMC.

This study showed that online communities can provide support to its members (irrespective of age) on a plethora of topics. This is evident through the type and number of neighbours the members of the communities we studied interact with. This shows that CMC can reduce social isolation in the online community. The older people were also more interactive as there was greater reciprocity through more repliers, returnees and less unreplied messages than the teens newsgroup. This shows higher commitment as members were present for longer and formed long term relationships. SNA on network roles also indicated a more consistent behaviour amongst members of the senior network providing stability. Our analysis shows that older people can be as active as younger users of CMC and can form more stable and interactive groups with emerging natural leaders and influencers through CMC.

This study analysed the behaviour and interaction patterns of people in a networked group communicating through the use of CMC, thus combines computer science and social science, which can lead to developing better CMC interfaces where members have an increased awareness of other participants and reintroducing some of the missing social cues by taking into consideration the use of language e.g. abbreviation and emoticons. The social network approach taken in this study has been successful at eliciting the complex internal structures of newsgroup communication and how these function as part of a larger global network where boundaries are non-existent and large amounts of information can be exchanged. The difference between older and younger networks was established through network characteristics, centrality and power, subgroups and clique formations and roles of individuals in the networks.

5.1 Suggestions to Researchers

The project has a number of limitations. First the study is concentrating on only two newsgroups and not the whole UseNet. We are currently exploring ways to expand our analysis to additional newsgroups with the goal of investigating whether our findings can be generalized.

Further work can also be carried out in the domain of content analysis through a deeper study of the themes and content of exchanged messages.

Finally, the reported study can become a first step in a longitudinal study of the issues reported. It will be interesting to observe how the different metrics reported in this paper change through time.

5.2 Suggestions to Practitioners

Some initial suggestions about the design of CMC interfaces could be deducted from our results. For example, for seniors it will be interesting to design CMC interfaces that encourage less central actors to contribute more actively to the discussions. These suggestions though, need to be taken forward by designing and formally evaluating the effectiveness of different alternative designs. Through the use of the SNA methodology proposed in this paper the neighboring newsgroups of a newsgroup can be identified. This information could then be included on the CMC interface making it possible for the participant to explore other groups that discuss topics of similar interests. Finally, the provision of a visual presentation of the structure of the social networks (e.g. figures 7 – 10), through the interface of CMC tools, might encourage users to participate more actively in the discussions or/and might give them the opportunity to explore relationships with people of a specific status or role.

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