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The Role of Subgroups in the Communication Patterns of Global Virtual Teams

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ABSTRACT

In this paper, we explore the emergence of subgroups in global virtual teams and consider the impact that subgroups have on the communication patterns and interactions of these teams. The study presented here takes the case of eight virtual teams that were formed between two universities in two different countries. Our findings reveal that subgroups exert different degrees of impact on the team as a whole. Where the impact was high, boundaries were created between team members in different subgroups while the development of team cohesiveness was restricted. Nevertheless, all teams were able to produce high quality outcomes suggesting that the emergence of subgroups may not always have a negative influence on team performance. We discuss the implications of these findings for research and practice.

INTRODUCTION

The recent IS literature has paid considerable attention to global virtual teams (GVTs), their effectiveness, dynamics and communication patterns. Maznevski and Chudoba [1] authoritatively define GVTs as "groups that (a) are identified by their organization(s) and members as a team; (b) are responsible for making and/or implementing decisions important to the organization's global strategy; (c) use technology-supported communication

substantially more than face-to-face communication; and (d) work and live in different countries" (cf. also [2, 3]). Studies of GVTs have been conducted in a variety of contexts, such as education [4, 5, 6], software development and inspections [7, 8], project management [9], strategic planning [10] and new product development [11, 12]. It is of paramount importance that GVTs have access to excellent communication technologies, as for much, if not all, of their time, they will not engage in any face-to-face interaction. The technology enables GVTs to maintain a level of functional proximity [13] notwithstanding their physical dispersion. This technology may include one or more of video, audio and text-based communication tools, the precise configuration of which will depend on the nature of the team's tasks. Studies of GVTs have generally assumed that the team is a cohesive unit. However, there is also recognition that clusters of individual team members may form subgroups within the larger confines of the GVT (cf. [14, 15, 16]). The emergence and impact of these subgroups have not been the focus of systematic study until this time. In this article, we examine the impact of subgroups on both the effectiveness and the communication practices of GVTs. In the next section, we explore the conceptual foundations of virtual teams, before considering the nature of subgroups in GVTs in more detail. Using the case of a virtual project undertaken by students from two universities in Europe and Asia, we then demonstrate how we have begun to gain an understanding of the impact that subgroups have on the interactions that take place within these teams.

CONCEPTUAL FOUNDATIONS

Virtual teams consist of geographically dispersed individuals who interact on interdependent tasks guided by a common purpose with links strengthened by webs of communication technologies [17]. In this way, virtual work is carried out across time and space as well as organizational boundaries; moreover, apart from the organization, the team members and the

type and requirements of the project may vary as an individual shifts from one team to another. However, the degree of virtuality also varies among different teams. Consequently, while some teams may experience the luxury of occasional face-to-face meetings, others may have to cope with a communication environment that is relatively impoverished [18]. Furthermore, a virtual team may be permanent or temporary [19]. The notion of a permanent team describes the situation where there is continuity in the membership of the group: a particular group of people is used to address ongoing issues such as strategic planning [20]. On the other hand, a temporary team is characterised by discontinuity: it exists only to accomplish a specific task and then disassembles. Therefore, while permanent teams clearly have more opportunities for the development of interpersonal trust [5], temporary teams seldom have the luxury of time to hold face-to-face meetings which would enable members to get to know each other.

Notwithstanding the fact that GVTs can be described with reference to a large number of characteristics or dimensions, it is noteworthy that three particular dimensions have dominated the literature on virtual teams, viz.: the degree of dispersion, the degree of organizational homogeneity and the level of continuity [5, 17]. Each of these dimensions has a role in defining the situation of a virtual team [19] and an effect on the type of communication media chosen. It would be convenient to label these dimensions in a bi-polar form, e.g. globally dispersed teams vs. nationally dispersed teams. However, in reality a much more subtle degree of dispersion is present. Each of the dimensions can be measured much more precisely on the basis of a continuum from, e.g., high dispersion to low dispersion. Furthermore, this dispersion will not be limited to geographical distance, but may also include cultural, ethnic and linguistic dispersion.

Degree of Dispersion

There is general agreement in the literature that if a team or group is described as being virtual, then it should also be geographically dispersed. However, the degree of dispersion may vary enormously. Some virtual teams may be dispersed locally, others nationally or internationally – and of course some nations are much larger than others. For example, a four-person team with two members in Seattle, USA and two in Vancouver, Canada (geographical dispersion, approx 140 miles) is very different from another four-person team with one member in each of a) Sao Paulo, Brazil b) Waikato, New Zealand, c) Sai Wan Ho, Hong Kong, and d) Nicosia, Cyprus, where the geographical extent of dispersion is much stronger. Globally dispersed teams are likely to experience considerable diversity, in not only physical but also organizational and cultural terms. From the example above, it is likely that the cultural differences between US and Canadian team members will be less pronounced than between Brazilians, New Zealanders, Hong Kong Chinese and Cypriots. However, relying on such stereotypical conceptions of culture as espoused, for instance, by Hofstede [21] may be unwise: in these times of increasing migration, the cultural homogeneity of any one nation state is very much in a state of flux [22]. Furthermore, cultural and geographical dispersion will in addition exert an impact on the way team members communicate with one another. Depending on the degree of dispersion, the occasional use of face-to-face communication may be possible. Face-to-face communication in this case may even take on a social focus, rather than being restricted to task-orientation alone, in order to encourage rapport and familiarity with other team members and thus improve the development of trust. However, face-to-face communication may not be possible with teams that are dispersed globally or across significant geographical distances within one country [23], thus restricting the extent to which team members can develop familiarity with one another.

Degree of Organizational Homogeneity

The more homogeneous a team is in terms of features such as shared backgrounds, interests, attitudes and values, the easier it is to promote cohesiveness [24]. This suggests that there is a need to understand the type of relationship that participants have with each other. Many examples of virtual teams in the literature refer to an intra-organizational arrangement, where it can be expected that there is considerable common ground shared by all team members, i.e. with the norms and values of the organization for which the task is to be completed. For example, Davenport and Pearlson [25] report the case of a large consumer product firm which adopted a policy whereby new sales force employees were discouraged from working virtually for the first year of their employment. In this way, employees were encouraged to familiarise themselves with both the organizational culture and other employees. Even though, in this kind of virtual team environment, traditional social mechanisms that facilitate interactions and interpersonal relations are lost and members must learn new methods of electronic communication, their common history and future as members of the same organization should be an effective bond which can facilitate electronic work interactions and improve or sustain their sense of presence. However, there are other types of teams whose members have diverse organizational backgrounds, often as a result of an inter-organizational arrangement such as a joint-venture or a strategic alliance agreement. Such organizational diversity implies that members may possess very different knowledge about the task context.

Level of Continuity

The literature is dominated by an interest in teams that are formed on a temporary basis, though the duration of temporariness may vary from days (even hours) to months [26, 27]. Temporary teams are formed on an as-needed basis to provide knowledge and skills for a relatively short period of time, usually the duration of a project life-cycle, before disassembling. By way of contrast with temporary teams, a permanent team would relate to a

situation where there is continuity in the membership of the group, for example, where a particular group of people is used to address ongoing issues over a long period of time. Thus, the notion of continuity is defined here in terms of the duration of the team's life. When a team experiences some level of continuity, the opportunities to develop familiarity and trust among participants increase whilst there is also a higher degree of comprehension of the virtual team situation [17, 19].

SUBGROUPS IN GLOBAL VIRTUAL TEAMS

Even though the intra- and inter-organizational dimensions of virtual teams have been recognised [28], the two have tended to be explored in separate studies. In this paper we bring the two dimensions together. We do this by exploring the emergence of subgroups in global virtual inter-organizational teams. Subgroups reveal a certain level of heterogeneity in team composition [29] as some team members will share characteristics that will unify them whilst at the same time differentiating them from other members with different characteristics [30, 31]. Similar characteristics might include a common language, a common preference for a particular genre of music or hair style, as well as age, gender occupation, location, ethnicity and the like. As a result, subgroups may produce reference points and a tendency to view one subgroup as distinct from others [32].

Gibson and Vermeulen [29, p.202] developed the construct of 'subgroup strength', defined as "the degree of overlap across multiple demographic characteristics among a subset of team members". A strong subgroup is thus one where there is considerable overlap in the demographic characteristics of the team members. They present this construct as a team-level attribute that can influence the functioning of the team as a whole. In relation to this, there is also evidence to indicate that subgroups whose members have exhibited consistency in proposing a position and who have achieved mutual agreement are more likely to exert an

influence on final group outcomes than those subgroups whose members were inconsistent in their positions [33]. This is consistent with the literature on minority influence [34, 35], which suggests that the effectiveness of influence is at least in part dependent on consistency. In this respect, each subgroup can be considered as a minority in the larger group.

Research has been inconclusive on the impact of subgroups on teams. On the one hand, some studies have shown that subgroups exert a positive impact as they can function as supportive cohorts within a team [36, 37]. On the other hand, it has been argued that the presence of subgroups impedes interaction and leads to increased conflict and deterioration in performance [38]. Subgroups may also attempt to diffuse responsibility for any negative team performance to other subgroups which in turn will weaken team cohesion [39]. DeSanctis and Jiang [16] have found that high subgroup strength in distributed multinational teams has hindered team performance. In this study, we are interested in understanding whether and how geographically-proximate subgroups affect the interactions that take place in GVTs.

Arguably, such subgroups will have more opportunities for face-to-face communication, described as the richest communication medium [40]. Face-to-face communication provides opportunities for the spontaneous, simultaneous and continuous exchange of messages whilst also enabling messages to be mutually constructed and coordinated. Researchers have found that when a task requires significant interaction among team members, such as brainstorming and decision making, team members tend to prefer face-to-face communication [41, 42]. Furthermore, according to Handy [43], for trust to develop in virtual environments there is a need for constant face-to-face communication. As he puts it: “paradoxically, the more virtual an organization becomes, the more its people need to meet in person” [43, p.46]. This view has also been reinforced by Lipnack and Stamps [17, p.226]: “if you can drop by someone’s office, see first-hand examples of prior work, and talk with other colleagues, you can more easily evaluate their proficiency”. Researchers have

already argued that the lack of proximity depersonalises trust [44] while the virtual context of a geographically dispersed workforce may constrain or impede rich information exchange [40] since communication becomes highly computer-mediated [25]. Consequently, we suggest that the emergence of geographically-proximate subgroups will reduce the GVT's reliance on computer-mediated communication, as most of the information flows will take place between subgroup members, not between the subgroups themselves.

THE CONTEXT OF THE GLOBAL VIRTUAL TEAM PROJECT

The project presented here was a collaboration between the University of Bath, UK (UBath) and the City University of Hong Kong, China (CityU). In March-April 2003, students from both universities were asked to work on a group project as part of their assessment. In total there were 47 students involved, 23 at UBath and 24 at CityU. All students at CityU were postgraduates while at UBath there was a mix of both postgraduate and final year undergraduate students. There were eight teams and most consisted of six students, 3 from CityU and 3 from UBath (2 undergraduates and 1 postgraduate). Team 7 consisted of 5 members due to the withdrawal of a UK student from the course. The teams had no prior working experience together and were not expected to work together again in the future. All the teams were given the same task to complete which involved a case study analysis on the use of a knowledge based system within a global consultancy firm. The task mandated a cooperative effort on the part of all team members who were assessed as a group. Random grouping was adopted in the formation of these GVTs as our intention was to expose students to the challenges of working in diverse teams where there was limited familiarity with other co-participants. Thus, students could not choose their own team members.

All HK students were part-time postgraduate students attending evening courses; they had full time jobs mainly in the financial sector. Their average age was 30. In the UK,

participants consisted of both undergraduate and postgraduate students, all of whom were studying on a full time basis; the dominant ethnicity was British, but each group also included at least one student from a different national group: Greek, Norwegian, Russian, French, Singaporean, Malaysian and Venezuelan. The average age was 24. While there are notable demographic differences between the HK and UK sub-populations, all the members of each sub-population share a similar set of demographic characteristics such as age, mode of study, type of employment, ethnicity. Thus, notwithstanding the differences between individual team members, all eight teams were composed of two geographically-distinct sets of members of roughly similar strength. No instructions were given to the students on whether or not they should form subgroups – this was entirely a matter of their own choosing. Indeed, the concept of subgroups was never raised in any of their classes either.

Participants in the project were given access to Blackboard, a web-based conferencing system. Blackboard is defined as a tool for "teaching and learning and provides the functionality required to successfully manage distance, web-enhanced or hybrid education programmes" (http://www.blackboard.com/products/index.htm). The Blackboard site was hosted at CityU and all students were given specific instructions on how to access the site. Each team had its own private web space (accessible only by team members and instructors), which enabled such communication activities as email, file sharing, synchronous and asynchronous discussions. The asynchronous discussion forum provides a threading option so that team members can organise messages in a structure of their choice. All contributions made through Blackboard were automatically identified with the real name of the contributor.

At the end of the project, all team members were required to submit individual reflections on the project, documenting their personal reactions to the way the project was arranged, the behaviour of the other team members and how the project could be improved in the future.

FINDINGS

For all eight teams, we extracted all communication exchanges, including discussion forums, file exchanges and online chats from Blackboard. In this way, we were able to read about and follow team interactions and work processes as they occurred throughout the course of the project. There were two discussion forums (viz. 'introductions' and 'case study forum') for each team which were created by the project coordinator in Hong Kong. In all the teams, there was at least some evidence of subgroup-oriented communication, but this varied among the teams: some teams exhibited stronger evidence than others.

Table 1 presents an array of measures associated with each team, including the number of exchanges in the discussion forums and virtual chats, the grades awarded at the end of the project, and the impact of the subgroups within the teams. The grades are used in the paper to indicate the effectiveness of the teams in terms of meeting the project's requirements. The grades themselves were not inflated or scaled in any way.

Analysis of the teams' interactions in both the discussion forums and the virtual chats indicates evidence of the formation of geographically-proximate subgroups. It could be argued that geographically-proximate subgroups are to a large extent formed by default: the team members are already in a face-to-face working situation and they are relatively familiar with one another. This reasoning is supported by the transcripts of team member interactions: team members refer to team members working with one another at the start of the project before attempting to contact their remote counterparts. Nevertheless, we clarified the existence of geographically-proximate subgroups through an analysis of a) the language used by team members when they discussed their physically collocated (or remote) team members and b) the extent to which tasks were allocated on the basis of team members' locations. No other subgroups could be identified, either from the discussions on Blackboard or from any

other facet of the team members' behaviour. The extent to which these subgroup dimensions were evident was used as the basis for our definition of the degree of subgroup impact. Our analysis has revealed that there were different degrees of subgroup impact among the eight GVTs. We label these low, moderate and high impact. Factors which contribute to subgroup impact labelling include: the timing of subgroup emergence (early or late); the effect on task allocation and the effect on communication. The latter included the type of media chosen (i.e. synchronous or asynchronous and face to face communication) and the type of information exchanged (i.e. task-orientated, social-orientated).

Thus team 2, which is defined as having high impact subgroups, was characterised by: the collocated team members describing themselves as 'we' and their remote team members as 'you'; the work being subdivided into the two subgroups; and the absence of synchronous social communication between all team members. By way of contrast, in team 1 (low impact subgroups) the whole team engaged in synchronous social communication on several occasions, and individual team members contributed to the online discussions directly, i.e. without going through a subgroup process of local consensus development beforehand. In the following sections, the characteristics of subgroups are presented according to their relative impact on the eight teams.

Table 1: Characteristics of the Eight Teams

Teams	Discussion Forum – Introductions	Discussion Forum – Case Study	Virtual Chats	Subgroup Impact	Grade Awarded
Team 1	10	16	3	Low	B
Team 2	12	12	3	High	A-
Team 3	7	61	3	High	B+

Team 4	10	35	2	Medium	B
Team 5	38	53	1	High	A-
Team 6	31	60	0	Low	B+
Team 7	5	83	0	Medium	B
Team 8	27	76	1	Medium	A-

Teams with High Impact Subgroups

In teams 2, 3, and 5, subgroup-oriented communication emerged very early in the project. In these teams, subgroups were essentially self-imposed without any prior negotiation. For example, in team 3, evidence of a high impact UK subgroup emerges when two of the UK members jointly sign communications in Blackboard, e.g.

> *David and I have had a look at the summary of points on challenges that Daniel [from Hong Kong] posted on March 9th. We feel that we may have all interpreted the question differently. ... We would be happy to get together in the virtual classroom to discuss this further if you would like.*

All three teams made use of both synchronous and asynchronous communication. Their communication however was primarily task-oriented, whilst face to face meetings were organised to coordinate work in the different locations. This is exemplified in the statement below extracted from a virtual classroom archive:

> *I think that the two separate teams should get together and brainstorm. And we should keep checking the discussion board throughout the week for any questions or suggestions*.

These teams generally paid little attention to personal introductions and social issues (the exception was team 5, where coincidentally all 6 team members shared a passion for football), preferring to move straight into the task related discussions.

The subgroups exerted a high impact on the interactions of the team as a whole. The language used is noteworthy for the proliferation of 'we's and 'you's, e.g. "we will post the file today", "how do you guys communicate at your end?" and "do you meet every time?". Further evidence of the subgroup structure comes from the suggestion made by a UK member of Team 3:

> *Perhaps we should have two leaders, one in each country? That might make it easier to coordinate?*

This team organised an online meeting with all participants where they decided on the two leaders and set up deadlines for the agreed tasks. Conflicts and misunderstandings have occurred during the project as exemplified by the quotation below:

> *Throughout the two weeks, I felt resentment towards the HK team members – they didn't put as much effort into the project as me, and they seemed to be unable to understand the question. However, in hindsight, I would say that we did not communicate as much as we should have done. We did not develop personal relationships, so there was little trust between us.*

Teams 2 and 5 never appointed an official team leader: rather, each subgroup organised itself and asked for feedback from the other subgroup. One member of team 2, in

the individual reflection report, recognised the isolation and ineffectiveness associated with subgrouping, suggesting that many deadline related disagreements could have been resolved less painfully if both subgroups had been more open-minded and willing to communicate openly and synchronously with each other.

Teams with Moderate Impact Subgroups

In teams 4, 7 and 8, subgroups exerted a moderate impact on team interactions. In these teams there is progressive evidence of an evolving level of subgroup impact on the interactions between members. Team members made an effort in the initial project phases to establish mutual understanding before realising the importance of face-to-face communication with at least some of the physically collocated team members:

> *The challenge of working as a team especially divided in two locations was to build a sense of team. ... Virtuality [made it] extremely difficult to create synergy between all the team members. Indeed, progressively we faced the issue of having two groups within the team: "UK team" and "HK team" as we called them*.

In team 4, the suggestion was made early on in the team's discussions that the tasks be divided between HK and UK members – i.e. in subgroups. This suggestion was rejected by the other team members, yet with time this arrangement prevailed.

Synchronous communication between all team 4 members was maintained throughout the project, though usually for issues associated with project output structure and style. In team 7, much of the work was undertaken asynchronously by individuals (i.e. not in a subgroup structure). Draft components of the project output were posted to Blackboard on a

regular basis. These were then revised by individual members of physically collocated team members – a form of subgroup arrangement. One team member suggested that the revision and discussion process be opened up to the whole team, but this was rejected by other team members on the grounds of ineffectiveness. In teams 7 and 8, occasional face-to-face meetings between the physically collocated subgroup members did occur. The main benefit of subgroups was identified as the face-to-face communication with at least some team members. This is clearly exemplified in the message below which was posted on the discussion forum:

> *Today I met up with Maria for the first time, and it was nice to be able to meet at least one of my group members face-to-face :-) We talked about how to set up the report and made a suggested structure together. It would be great if you guys could take a look at it and let us know what you think.*

The issues discussed in these face-to-face meetings were reported back to the whole team via Blackboard, diminishing the exclusiveness of any subgroup arrangement.

Teams with Low Impact Subgroups

Teams 1 and 6 can be characterised by a clear propensity for members to attempt to build intra-team coherence and familiarity regardless of team member location. Team members introduced themselves in detail, uploaded photos to their team workspaces in Blackboard, and engaged in discussions about issues not specifically related to the task (e.g. world politics). In these low impact subgroup teams, specific work tasks were allocated by mutual consent and on an individual basis, not a subgroup basis.

The teams relied extensively on Blackboard to mediate their communications, even though only Team 1 organised synchronous online meetings. A member of team 1 in her reflection report identified several benefits of accessing the virtual classroom facility on a regular basis:

> *The obvious benefit was that early ideas and brainstorming sessions could take place to allow people to find their roles within the group and for the project itself to take shape. It quickly allowed people to find out if they viewed the project from the same angle as other members of the team. It was also advantageous when approaching the deadline for the same reasons; it allowed quick conformation that everyone was happy with the project and allowed speedy allocation of any of the routines tasks that remained to complete the report. On a different level the virtual classroom allowed an interaction between the group to take place before any issues were discussed. People would chat and talk about current events, home life and their families. This was important as it meant that a certain amount of trust was built up between members of the group*.

Another member of team 1 noted that "*once we had got used to 'talking' to each other, the topics of conversation moved on to the case study…".* Face-to-face interactions between the physically collocated team members did occur towards the end of the project, but there is no evidence to suggest that these teams depended on the subgroups to make progress in addressing their tasks. In these teams, asynchronous communication was viewed to be beneficial and was linked to the time difference between the two countries:

Using the discussion board and the data exchange feature on blackboard it was possible for work to be done on several sections of the document in HK during their daytime (the night and early hours of UK time) and then the document sections could be finished and consolidated as soon as the UK members of the team woke up. Because of the time difference there was no need to wait for a day for the production of a section of the report.

One weakness associated with the unstructured nature of a free-for-all approach to asynchronous discussion was identified by a member of team 6, who indicated that sometimes it was unclear who was responsible for a piece of work and what exactly was required from each member. This then led to duplication of efforts and disagreements about the amount of work undertaken by individual members. It was recognised among members of this team that such misunderstandings could have been minimised or avoided with the use of synchronous communication.

DISCUSSION

At the beginning of this paper, we noted that three dimensions in particular have been used to categorise different types of virtual teams, i.e. the degree of dispersion, the degree of organizational homogeneity and the level of team continuity. In this study, we examined the case of global virtual teams characterised by a high level of geographical and cultural dispersion contributing to time and language differences, inter-organizational and intra-organizational homogeneity among team members, and temporality. Two linked factors were found to have enabled the formation of subgroups which contributed to similar subgroup strength across all eight teams: the geographical proximity of team members and the organizational homogeneity of subgroup members in the two locations. For example, the UK-

based participants were full time students whilst the HK participants were part-time, evening students with work and often family commitments. As one HK member commented:

> *The expectations of contribution are different between the two subgroups. UK's may expect everyone to read more and input more within a short period of time while those in the HK may find it difficult to devote too much effort since we have daytime job and evening classes to deal with*.

Eight global virtual teams were formed by the organizers of this project at the two universities involved and each team was made up of two equally strong subgroups. Despite this similarity in the degree of subgroup strength, and in contrast to earlier findings [46], different degrees of subgroup impact were identified. With the exceptions of teams 1 and 6, where there was limited evidence of subgroup impact, in all the other teams there were clear indications that the subgroups were exerting an impact on the team as a whole in both the way tasks were allocated and the language used by team members. In some teams (notably 4, 7 and 8), the subgroup impact evolved gradually, primarily as a result of the need to reduce isolation and enjoy face-to-face communication; thus, these teams were characterised as having a medium level of subgroup impact.

Participants in the project were asked to use a specific web-based communication tool for their interactions with both synchronous and asynchronous features. We found in our study that the emergence of subgroups has not affected or been affected by the choice of these communication features. For example, both teams 1 and 2 used the same number of online meetings and exchanged a similar number of messages in the asynchronous discussion forums. Nevertheless, in team 1, the subgroup arrangement had less of an impact on the

team's communication processes, whereas in team 2, the subgroup arrangement had a stronger impact.

Where subgroup impact was high (i.e. teams 2, 3 and 5), communication at the team level was hindered, boundaries were created and social interactions were limited. Accordingly, it became more difficult to build cohesiveness and team identity, although some cooperation was evident in the final stage of the project when collating material for the final joint report. In these teams, the emergence of subgroups contributed to limited opportunities for social interactions among members from the different universities. There was clear evidence of a 'them and us' attitude and a greater awareness of cultural differences that led to conflicts and miscommunications. A paradox therefore emerges from the findings of our study: the presence of subgroups enables team members to overcome their sense of isolation at the local level, with increased opportunities for face-to-face meetings, but it contributes to the isolation of team members at the global level, especially when the impact of these subgroups is high.

Teams 2, 3 and 5, which demonstrated strong evidence of subgroup development at an early stage, shared a task oriented communication style. In contrast, teams with weak evidence of subgroups were found to be more relaxed and were more oriented towards a positive whole team spirit. Even though these teams mainly communicated electronically, they shared opinions and views on issues other than the task (e.g. world politics). Teams with low impact subgroups first achieved a sufficient understanding of the case study by discussing several relevant aspects of the case in the asynchronous forum and then arranged to meet in the virtual classroom. They also developed good social interactions between members. In these teams, the emergence of subgroups contributed to reducing isolation at the local level but nevertheless did not hinder the development of team cohesiveness and identity.

All teams, irrespective of their level of subgroup impact, can be described as cooperative. This was due to the nature of the virtual team project which required a joint deliverable by all team members regardless of their location. We found, however, that the degree of subgroup impact had an effect on the type of cooperation experienced in the GVTs: teams with low impact subgroups were able to work in a more collaborative fashion than teams with high impact subgroups.

Collaboration is a process of shared creation: two or more partners with complementary skills interacting to create a shared understanding [45]. In some teams, a co-decision approach was used where all members had the opportunity to participate in the decision making process. This co-decision approach was employed in teams with low-impact subgroups that actively practiced a collaborative communication style. In contrast, following De Michelis [46, p.315], coordination, the second type of collaboration, occurs when two or more subgroups work to achieve different sub-tasks that are part of the same general task. In other words, each subgroup has its own task, but "all tasks are mutually related". Even though the virtual team project was well-defined, with specific guidelines, each team could decide on its own how best to pursue the project. High impact subgroup teams allocated tasks based on the subgroup location. In this case, each subgroup could work independently from the other, yet cooperation was required in the last stage of the project to collate material into the final joint report.

CONCLUSION, LIMITATIONS AND IMPLICATIONS FOR FURTHER RESEARCH

The main objective of this study was to enhance our understanding of the role of subgroups in virtual teams. Using the case of a virtual, collaborative student project, we found that the emergence of geographically-proximate subgroups has an effect on team cohesiveness; accordingly, members may define their membership to the team more narrowly by excluding

members of subgroup(s) to which they do not belong. This was found to raise awareness of the salience of boundaries between the different subgroups which in some cases resulted in conflicts and misunderstandings within teams as they contributed to a 'them and us' attitude, and hindered the development of team cohesiveness.

There are several limitations that need to be mentioned before discussing the implications of the study. The chosen teams were student teams [cf. 47] and even though these are "naturally occurring teams", risks and rewards were grade based [5]. Such teams formed within the university environment have also been criticised as having pre-specified goals and lacking power differentials which are prevalent in the business organizational environment [8]. Moreover, the composition of the teams was not homogeneous: each team had a mix of undergraduate and postgraduate students, the former studying full time, the latter working full time and studying part time. Despite these limitations, student based teams are suitable exemplars of teams formed on the spot with limited experience of mediated technology. For all team members, this was the first time that they had worked on a virtual collaborative project. In their individual reports, where they were asked to reflect on this team experience, they all acknowledged that despite the problems and difficulties experienced, they had gained a better understanding of the issues associated with virtual team success.

Despite its limitations, this is the only study thus far that has explored the emergence of subgroups within global virtual team environments and examined the role of subgroups in the communication patterns of team members. In the case of this study, all subgroups were geographically-proximate. However, other subgroup arrangements are possible, e.g. those based on commonalities of gender, race, ethnicity, language, etc., but we did not observe any of these in this study. Consequently, more studies that analyse the emergence and work of subgroups within a virtual team context are needed, as these may reveal intriguing implications for in-group boundaries and identities as well as team performance. For

example, in the current study, teams with high subgroup impact were found in both partner-universities, even though in some situations these were clearly imposed by one subgroup on the other (e.g. in team 3). Some intra-team conflicts were identified, but these did not seriously affect team effectiveness. Interactions, however, may be more complex where a team consists of a high impact subgroup in one country and one or more low impact subgroups in other countries. It remains unclear whether other subgroup types, e.g. those based on commonalities of gender, race, language, etc., would also produce outcomes of comparable quality. Further research will contribute to an enriched understanding of the dynamics of virtual teams and enable generalisability.

Where practical implications are concerned, there are a number of important considerations. For the task type that we studied (a cooperative one involving brainstorming and group authoring), all teams (irrespective of subgroup-impact) performed more or less equally well. Future research needs to consider additional task types (cf. McGrath's [48] task circumplex). Even though all the subgroups were of approximately equal strength, different levels of subgroup impact were manifested. Our findings suggest that team leaders should monitor subgroup development carefully in order to ensure that a sense of team identity and coherence is maintained and so prevent a 'them and us' attitude from getting out of hand. In this way, the beneficial effects of geographically-proximate subgroups, including mitigating the isolating effects associated with distributed teamwork, can be realised without destroying the fabric of the team as a whole. If a task requires a high level of coordination among all team members, then subgroup-based working arrangements may well hinder team effectiveness. In such cases, organisations may need to take active measures to prevent the emergence of high impact subgroups.

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