How Social Software Supports Cooperative Practices in a Globally Distributed Software Project

Rosalba Giuffrida
IT University of Copenhagen
Software and System Section
Copenhagen, Denmark
rogi@itu.dk

Yvonne Dittrich
IT University of Copenhagen
Software and System Section
Copenhagen, Denmark
ydi@itu.dk

ABSTRACT
In Global Software Development (GSD), the lack of face-to-face communication is a major challenge and effective computer-mediated practices are necessary. This paper analyzes cooperative practices supported by Social Software (SoSo) in a GSD student project. The empirical results show that the role of SoSo is to support informal communication, enabling social talks and metawork, both necessary for establishing and for maintaining effective coordination mechanisms, thus successful cooperation.

Categories and Subject Descriptors
D.2.9 [Software Engineering]: Management—Programming teams

General Terms
Human Factors

Keywords
Global Software Development, Communicative Genres, Coordination Mechanisms, Social Software, Socialization, Metawork, Articulation Work

1. INTRODUCTION
Software Engineering (SE) is a cooperative work [8]: software developers must coordinate their individual activities with tasks performed by other team members [20]. Coordination relies on communication — direct communication as well as communication mediated by code, documentation and artifacts. Communication is fundamental to coordinate the cooperative work and to establish and maintain effective collaboration. In Global Software Development (GSD) settings, effective coordination is challenging [12] due to the lack of face-to-face communication [3]. Research in GSD aims to overcome this challenge improving processes and tools for supporting cooperation among remote teams — see e.g. [12].

However, there is often a gap between SE processes and models suggested by literature and everyday practices of software teams. Practices in situated action [23] often differ from plans [19]. Thus, adaptation by teams is necessary: SE methods, tools and processes need to be adopted by the team members and adapted to the team’s necessities in order to establish shared practices. When team members agree on a set of rules, conventions and policies — the so-called social protocols [21] — the cooperative activity works smoothly. While face-to-face communication facilitates the negotiation of social protocols in co-located SE, establishing common practices can be seen as a major issue in GSD, due to temporal, geographical and socio-cultural distances [5]. However, GSD appears a good setting for studying and analyzing whether and how social protocols are negotiated and established: cooperative practices in GSD are mostly computer-mediated, thus traces of communication and coordination are mostly documented or recorded in the logs of the tools used by team members — e.g. issue management system, email, Instant Messaging chats, Wiki. In this setting, an important role is played by Social Software (SoSo) to foster, establish and keep social protocols within a GSD team; thus, studying the use of SoSo appears promising to understand the adaptation of processes and the adoption of tools in a GSD project.

This paper shows how SoSo supports remote cooperation complementing collaborative tools used in the everyday practices of GSD teams. Cooperative practices in a GSD project are analyzed and described through the analytic concepts of coordination mechanisms [21] and communicative genres [24], using a practice-based approach [16], to better understand what is necessary to establish and keep a satisfying cooperation. The paper shows that SoSo is a flexible channel which enables informal communication, supporting a wide range of communicative genres, such as metawork, social talks and work discussions. Socialization among team members through SoSo provides a context for the project, improving subsequent cooperation. Initial metawork through SoSo supports the effective establishment of shared coordination mechanisms and positive reactions to metawork proposals contribute to build good relationships among distributed team members.

2. RELATED WORK
GSD is increasingly becoming a common practice in the software industry [5]. Organizations establish global software projects, which are scattered all round the globe, involving multiple teams located at different sites. There are many
potential benefits that can arise from GSD: it is promoted to
developers [5]. However, GSD is a developing practice, thus there are
challenges to overcome and problems to solve: since GSD is
highly geographically dispersed, teams have to deal with tem-
poral, geographical and socio-cultural distances [4], resulting in
major difficulties in coordination and communication.

In distributed teams, informal communication cannot take
place in person as easily as in co-located settings and the
lack of face-to-face communication appears one of the main
obstacles to cooperation [5]. However, research in GSD has
established the importance of informal communication for
collaboration in distributed settings — e.g. [9], [3], [14]. While,
traditionally, main media for informal communication in
distributed teams are email, phone and video conferencing
system, nowadays informal communication take place also in
the so-called Social Software (SoSo). Kaplan and Haenlein
define SoSo as “a group of Internet-based applications,
built on the ideological and technological foundations of Web
2.0, that allow the creation and exchange of user-generated
content”. Essentially, SoSo encompasses a range of new media
systems that allow users to interact and share information,
such as: Instant Messaging (IM), Internet Forums, Blogs,
Microblogs, Wikis, Social Networks, Social Bookmarking. In
a previous literature work [11], we collected research studies
that emphasize the importance of SoSo to build and keep
social relationships between distributed co-workers, to facili-
tate knowledge sharing inside the organization, to support
knowledge management, to push informal communication
between distributed team members. However, very few em-
pirical works focus on the use of SoSo in GSD settings or
analyze in detail how SoSo is used in relation with other
channels adopted in the team [11].

In a previous study [7], we showed the flexible usage of
SoSo, highlighting the central role of SoSo in the ecology of
channels used by an established team. The paper shows that
SoSo serves to support collaboration through other SE tools
and that team members share conventions on how they use
SoSo. This is in line with the fact that proper tool support
is essential to overcome GSD challenges, but it is in itself
not sufficient, as shown also in other research works. Damian
et al. [6], for example, report a case in which differences in
the usage of tools between USA and Canadian sub-teams cause
a lack of awareness of changes to the code base. This
breakdown occurred because the teams did not have a shared
understanding of the usage of the tools; they did not share
common social protocols [21] on how to coordinate about
the changes. Since rules, e.g. in the form of methods and
processes, under define practice, adaptation and appropriation
of the methods are necessary. Another example is the
work by Sigfridsson [22], that highlights the importance of
metawork for the purposeful adaptation of practice. The
analysis of everyday cooperative practices allows to gain
insights on how SoSo is used to foster, establish and keep social
protocols within a globally distributed software team, thus
the role of SoSo appears interesting to understand adaptation
of processes and adoption of tools in GSD.

3. THEORETICAL CONCEPTS

Since in GSD most of the activities are computer-mediated,
the analysis of coordinative and communicative practices can
be performed on the digital artifacts used and produced by
the distributed teams during the remote cooperation. Thus,
artifact-based concepts, such as coordination mechanisms [21]
and communicative genres [17], appear appropriate to analyze
and describe GSD cooperative practices. On the one hand,
a coordination mechanism consists of a coordinative protocol
imprinted upon a distinct artifact which [...] stipulates and
mediates the articulation of cooperative work so as to reduce
the complexity of articulation work [...] [21]. Social protocols
[21] are a set of rules, conventions, policies shared by people
involved in the cooperative activity. Social protocols develop
practices and evolve as the project progresses; changes in
the actual work can cause changes of the social protocols.
On the other hand, a genre of organizational communication is
categorized “by a socially recognized communicative
purpose and a common form” [24]. The form of a genre refers
to the “readily observable features of the communication,
including structural features, communication medium and
language” [17]. Coordination mechanisms and communicative
genres will be used in the following to analyze and describe
how coordinative and communicative practices are negotiated,
established and maintained in a GSD student project and to
understand the role of SoSo in the remote cooperation.

4. CASE DESCRIPTION

The project under study is part of a GSD student cluster
in collaboration between IT University of Copenhagen and
Peking University. The project was carried on by two remote
sub-teams located in Denmark and in China, and took place
from February 2011 to May 2011. An academic supervisor
provided the description of the product to be developed and
he evaluated the work performed by the students based on
the code developed, on a final report produced by each sub-
team and on an oral exam. The goal of the project was to
design and implement an e-collaboration tool. The system
design, the requirement specifications, the development of
the product and the organization of the collaboration were
students’ responsibilities; therefore, the students were “self-
organising” their work, sharing roles, responsibilities and
decision making. The Chinese sub-team was composed by
three Chinese members: Cheng, that acted as a team leader
of the Chinese sub-team, Wang and Wusheng. The Danish
sub-team was composed by five members coming from different
European countries; the Danish team assigned responsibili-
ties to each team member: Arnold acted as a Scrum master,
Jakob was the main developer, Geaorgios was a developer
responsible for the interface, Stella was responsible for the
database. Names are modified for privacy reasons. The team adopted Scrum as a develop-
ment model and used it rather rigorously, e.g. organizing
the project in five Sprints, producing backlogs and weekly
standup meetings, which were locally performed and video
recorded, then shared with remote team members. Each
team started working on different ends of the system: Danish
team was working on the front-end and on the database;
Chinese team on the back-end; the teams then combined
the work in the intermediate layer of the solution, without
encountering major difficulties.

Tools used by the team are: Skype [http://www.skype.com/] for video conference
and IM chats, a traditional phone, emails and Assembla\textsuperscript{2} an issue sharing, Wiki, Forum and an integration to Subversion (SVN)\textsuperscript{1}, the version control system used. Assembla was used for keeping track of the status of the project, for managing issues, for defining deadlines and as a shared repository for file exchange. Most of the communication took place in Assembla, IM chats and during the weekly meeting. Email were rarely used, the forum of Assembla substituted the email for communication: it worked as a common repository of the messages exchanged by team members; moreover, it was possible to enable the notification via mail functionality that updated team members about the new events of Assembla. Despite time differences, IM chats were used by some team members, thanks to their flexible working hours and to the semi-synchronous communication offered by the tool. A Skype group chat with all team members was carried on during the whole project; it was mainly used in the initial phase of the project, though. Being a student project, team members were not working on a daily basis on the product and no fixed working hours were imposed. However, the team defined two fixed days a week for working on the project; due to the time difference of seven hours, there were no official overlapping working hours between team members, the only exception for both teams was the one hour weekly meeting in which synchronous communication was possible: every Friday at 1 p.m Danish time, i.e. 8 p.m. Chinese time. Skype resulted in very bad quality for video conference, thus the meetings were carried on through a normal phone for the audio; however, a visual channel was kept through Skype with mute audio. Despite distance, team members managed to have a smooth collaboration, without major frustrations; the team succeeded in having a working prototype; in the final report and in the interviews team members reported positive impressions towards the collaboration; finally the researcher noted during on-site observations and in the analysis of the field material a positive evolution of the project and the establishment of a good working environment.

5. METHOD

This research is carried out through an ethnographically-inspired approach: the first author attended most of the meetings from the Danish site and visited the Chinese team for a week, collected pictures, took notes during observations and interviewed participants. The team provided the researchers with free access to the whole Assembla repository, including Forum discussions, documentation, Wiki, files exchanged and source code. Moreover, the researchers had access to the Skype logs, to some emails and to the final report produced by the Danish team. The analysis is mainly performed on the Assembla Forum, on the Wiki, on the group chat and on two one-to-one IM chats; nevertheless, data from mail, the final report, and other Assembla sources are used as well to support evidences provided by the main analysis and to triangulate the findings. The first author coded all conversations carried on in the Forum and in the Wiki pages of Assembla, identifying communicative genres. She incrementally developed the coding schema while coding the messages; the coding schema was then discussed with the second author. Moreover, in order to limit research biases, a colleague not involved in the project was asked to check the coding schema and to independently code a sample of the messages; divergences in the coding were discussed and resolved. Finally, the same coding schema has been used to analyze IM chats — both group chat and one-to-one chats. The coordination mechanisms have been identified by the researchers going through artifacts and documentation available in the Assembla repository. Findings were triangulated with first author’s observations and with semi-structured interviews with team members, both in the Danish and in the Chinese site.

6. ANALYSIS

This section describes which coordination mechanisms the teams established to accomplish their work and it shows the evolution of the communication over time, as it happens in the main communication channels used. The analysis illustrates how cooperative practices evolved during the project and it is performed on a weekly base: being a student project, the work is concentrated in few days a week, thus a weekly perspective provides sufficient information about the cooperation.

6.1 Coordination Mechanisms

Six main coordination mechanisms (CM) have been identified and are described in the following.

CM1: File Sharing. In the file sharing system, important files (artifacts) were regularly exchanged and, when the file was considered of particular relevance, a message was posted in the Forum to notify to other team members that the file was available in the system (social protocol). The first files were exchanged in Week 1, both by Danish and by Chinese sub-teams. The file sharing system was used throughout the whole project by both sub-teams until the last week of the collaboration. Several kinds of files were exchanged, such as: diagrams, images for the product interface, zipped files with source code, documentation, minutes of the meetings. The latter deserves a categorization on its own.

CM2: Minutes Sharing. Producing and sharing the minutes of the meeting was an initiative of the Danish sub-team and it was not a practice commonly defined or requested; however, it became an established practice in Week 4. The minutes were produced by the Danish sub-team starting from the first week of the cooperation: however, in Week 4, the Danish sub-team started to share the minutes, including the ones previously produced, and the minutes sharing coordination mechanism got established. Chinese members considered it very important to overcome the language and the technological barriers: the minutes helped them to go through the discussions occurred in the meeting and check whether their understanding was correct or not.

CM3: Issue Managing System. Initial issues were created in Week 3 and the issues managing system was used and updated during the whole project, until Week 12. 110 issues have been created and used for coordinating the software development activities. Issues (artifacts) were created by all team members in the Danish sub-team and only by the team leader of the Chinese sub-team, Cheng. Issues were assigned to all team members, that completed the issues or re-assigned them to other team members (social protocol).

\textsuperscript{1}\url{http://www.assembla.com/}
\textsuperscript{2}\url{http://subversion.apache.org/}
CM4: Subversion (SVN) Repository. In Week 3, the team started to use SVN, the version control system for sharing the source code (artifact). Commits in SVN were regularly supported by comments about changes implemented (social protocol); SVN was used until the end of the project.

CM5: Standup Meeting. In Week 4, the first standup meeting was video recorded (artifact) by the Danish sub-team. Chinese team started to record and share standup meetings in Week 5. Video were uploaded in a private web server and the associated link was shared through a Forum message in Assembla. The video recorded standup meeting consists in about 5 minutes video in which each team member provides a status update to other team members. One standup meeting was independently recorded and shared by both sub-teams every week (social protocol). Both sub-teams reported that this practice goes beyond pure coordination: the advantage is that team members can clearly see each others, getting familiar with the environment where the remote team works, getting used to the accents of different participants, thanks to the possibility to watch the video several time, if necessary.

CM6: Agenda. The Danish sub-team started to share an agenda for the meetings in Week 1; the agenda was shared during the meeting through the Group Chat. In Week 4 a problem was reported in a Forum message by the Chinese sub-team in reaction to a not successful meeting: the Chinese sub-team explicitly requested to share the agenda prior to a meeting:

We, PKU, advise that you, ITU, tell us agenda in advance. In that case, we, PKU, have time to prepare for it. And our meeting will be better.

In the same week, the Danish sub-team produced a document about the collaboration, in which rules for the sharing of the agenda were proposed:

A written meeting agenda should be uploaded at Wednesdays in order to accomplish effective virtual meetings. The author of these should be shifting between China and Denmark. So e.g. 1: one team post a agenda proposal on Wednesday 2: the other team confirm, write a respond to it or add things to the agenda latest 2 hours before the meeting on friday. 3: the team who originally created the draft will add a final agenda latest 1 hour before the meeting starts.

The suggested rules were discussed in a Forum thread in Week 5 and the coordination mechanism got adopted and established in the same week: in Week 5 the agenda (artifact) was shared by the Chinese sub-team through a Forum message, it was integrated by the Danish sub-team and finally modified by the Chinese sub-team (social protocol). This practice was carried on alternatively by the two sub-teams similarly during all the remaining weeks.

6.2 Communicative Genres

Communication among team members occurred mainly through SoSo and during the weekly meetings. Communicative genre analysis has been performed in all logs of the Group Chat, Wiki, Forum and in two one-to-one IM chats occurred between the Chinese team leader, Cheng, and two members of the Danish team, Stella and Jakob. Other one-to-one chats were not provided to the researchers, thus, it was not possible to include them in the analysis. Table 1 shows the amount of instances of communicative genres coded in relation with the different kinds of SoSo (form) and the various purposes identified.

Most of the communication happened in the Forum and in the Group Chat; Wiki pages were rarely used; Cheng did not have many conversations with Stella, while a relevant amount of discussions were carried on in the one-to-one IM chat with Jakob. This section provides an analysis of the evolution of the communication over time, relating it with the coordination mechanisms established in the team. Figure I synthesizes the analysis.

Work. Work discussions can be related to different topics such as decision making, requirement specification, technical issues, etc. This genre usually starts with a question, followed by one or more answers, that sometimes lead to a broader discussion. The Work genre is identified in all kinds of SoSo, but Wiki. In particular, work discussions occurred mainly in the initial phase of the project until the coordination mechanism of the standup meeting (CM5) was established in Week 5. Nevertheless, work discussions start again at the end of the project when teams needed to integrate the different pieces of code. In this phase, few instances of Work genre appear in the Forum and in the Group Chat, however, an important role is played by semi-synchronous communication through one-to-one IM chat between the Chinese team leader, Cheng, and the main Danish developer, Jakob.

Knowledge Sharing. Genres identified with the purpose of knowledge sharing can be tutorials, how-to, solutions to potential problems. It is usually a message written by one team member to share his knowledge with other members. It includes a technical description of a problem and a suggestion on how to solve it. Often it provides links to other tutorials available online or to other sources, such as a tool webpage or documentation about API. Most of the Knowledge Sharing chats appear in the initial phase of the project in the Group Chat and during the project in some of the one-to-one IM chats. However, the Wiki and the Forum function as a permanent support for reporting some of the knowledge in a more structured and persistent way.

Metawork. Metawork communication consists in metacomment about how to structure the work within the team. It can be proposals, questions, answers or discussions about how to carry on the work. Most of the metawork occurred in the initial phase of the project, especially through the Group Chat. However, also in the Forum, metawork discussions occurred in order to suggest how to establish coordination mechanisms. An example of metawork Forum message is reported below:

Hello, everyone of ITU, I made a table by Word.

In order to find the best time for our meeting,

\footnote{Instances are considered as Wiki pages, Forum messages and chunks of IM chats. The same instance can have more than one code. In chats, an instance is the minimum meaningful chunk of information exchanged, e.g. when one person writes one sentence in several lines of chat, the whole sentence constitutes the chunk of information.}
Table 1: Number of instances of communicative genres identified

<table>
<thead>
<tr>
<th>Form</th>
<th>Purpose</th>
<th>Metawork</th>
<th>Situated Articulation</th>
<th>Encouraging Chats</th>
<th>Socialization</th>
<th>Knowledge Sharing</th>
<th>Work</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Chat</td>
<td></td>
<td>95</td>
<td>77</td>
<td>57</td>
<td>120</td>
<td>30</td>
<td>89</td>
<td>468</td>
</tr>
<tr>
<td>IM Cheng-Jakob</td>
<td></td>
<td>11</td>
<td>26</td>
<td>6</td>
<td>8</td>
<td>19</td>
<td>28</td>
<td>98</td>
</tr>
<tr>
<td>IM Cheng-Stella</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>21</td>
<td>1</td>
<td></td>
<td>22</td>
</tr>
<tr>
<td>Forum</td>
<td></td>
<td>21</td>
<td>51</td>
<td>29</td>
<td>1</td>
<td>3</td>
<td>17</td>
<td>122</td>
</tr>
<tr>
<td>Wiki</td>
<td></td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>

Figure 1: Temporal overview. The amount of instances of communicative genres identified in the SoSo communication among team members. Vertical lines show when the six coordination mechanisms are established. Week 9 is not reported in the Figures because it was an holiday week, thus no communication happened among team members during that week.

Situated Articulation. Situated Articulation communication are question, answers or informative messages about the work that has been done so far, in order to provide awareness to all team members about the status of the project. The Situated Articulation genre is present in all kinds of SoSo, but Wiki. In the one-to-one IM chats, the Situated Articulation is mainly related to awareness, in which team members ask for updates or provide information about the status of the project; in the Forum, the Situated Articulation genre is particularly interesting because it is used for supporting established coordination mechanisms. In particular, a large amount of "File Notification messages" is reported: these messages consist in notifications about the sharing of files, of minutes, of the agenda and of the standup meeting that supported the associated coordination mechanisms. It is interesting to note that, once coordination mechanisms got established from Week 5, patterns of collaboration are clearly visible in the Forum, e.g. as sequences of messages: standup, agenda, minutes.

Social Talks. Socialization chats consist in messages with the main purpose of socializing with remote team members, talking, for example, about each others’ country; an example of IM one-to-one chat is reported below:

Cheng: Denmark is a beautiful country. I will go to Denmark to have a tour if there any chance, To got to know this country
Stella: well please come... It is beautiful!! I have several chinese colleagues and friends at work (sushi restaurant)

It is interesting to note that most of the one-to-one chats occurring between Cheng and Stella have a socialization purpose. Socialization chats appear only in the Instant Messaging, both in the one-to-one chats and in the Group Chat. In particular, they happen mostly at the beginning of the collaboration. Some socialization chats are intended for gaining contextual information about the project, as in the following example:

Please download the .doc file and fill the table, and then upload it in a reply message. By it, we can have a clearly view which is the proper time. Thanks! [Cheng, China]
Cheng: how busy are you with courses? Do you have time to work on the project?

Once the standup meeting got established as a coordination mechanism (CM5), socialization chats dropped, as social chats were happening through the standup meetings themselves and during the weekly meetings. The socialization chats appear again in the Group Chat in the final phase and they are jokes and funny chats that show the good relationship that has been established among team members; while discussing work-related topics, students have fun about each others’ culture and habits, e.g. exchange of messages in Chinese and lots of smiles. Social chats were mainly pushed by Cheng, Stella and Jakob, that can be considered the members that mostly tried to create a bridge among the two sub-teams, acting as cultural liaisons [3] for the team.

Encouraging Chats. Encouraging messages are positive feedback to a message posted by another team member, that can belong to any of the previous genres. An example is provided below:

You did a great job! 佩服你们。And we will finish our part of self-introduction soon.
[Cheng, China]

Encouraging Chats are present during the whole collaboration, mainly in the Forum and in the Group Chat. Positive feedback on the work of the remote colleagues and appreciation on their work or metawork proposals are frequent in both sub-teams and seem related with encouraging good collaboration, providing a positive attitude among team members. They are rarely present in the one-to-one IM chats, except than in the final phase, when closer cooperation occurred in this medium between Cheng and Jakob. Encouraging chats appear in Week 7, 8 and 9 in the Forum, as a positive response to the funny standup meetings shared.

7. DISCUSSION

The previous Section illustrates communicative and coordination practices of a successful GSD student team. This Section investigates the possible reasons for the success of the cooperation and discusses the findings of this paper.

7.1 Challenges Encountered

The main challenges the team encountered during the collaboration were: (a) language barriers: no one was native English speaker, Chinese were less self-confident with English than Danish team members; (b) technological barriers due to low bandwidth connection that causes troubles in the weekly video conference meetings; (c) different professional background: Chinese sub-team did not have knowledge or experience with Scrum methodologies.

The main challenge the team experienced was the language issue during weekly meetings due to strong accent on both sides; moreover, the low bandwidth connection with China aggravated the language difficulties and misunderstandings, causing breakdowns and frustrations among team members, especially in the initial phase of the project. However, team members tried to find a workaround for barriers in the cooperation. As an example, the video recorded standup meetings helped to overcome low bandwidth connection and language barriers, enabling an easy way to asynchronously exchange information with remote team and providing occasions for informal jokes and fun. Also the combined use of Skype for video and of the phone for the audio helped the team to carry on the weekly meetings avoiding frustrations caused by technological barriers. Professional inexperience of the Chinese team with Scrum methodologies was compensated through the usage of SoSo for knowledge sharing: in the group chat and in Wiki, tutorials and documentations were provided to share the knowledge about e.g. the methodology used. Good relationships among team members, established through social chats, enabled them to find a workaround for barriers in the cooperation; moreover, the high level of metawork in the initial phase of the project allowed to establish effective coordination mechanisms; finally, SoSo turned to be a flexible channel that allowed to overcome the lack of face-to-face communication and to complement collaborative SE tools, supporting the establishment and maintaining of coordination mechanisms. These aspects will be detailed in the following paragraphs.

7.2 Social Talks Enable Good Cooperation

Social talks largely appear in the initial communication through IM, both in the one-to-one and the in the Group Chat. This channel allows team members to get to know each other and to establish informal relationships, which allowed a positive attitude for further negotiations, resolution of conflicts and establishment of effective cooperative practices. Moreover, the social chats helped in providing a context for the cooperation, offering background information on the project and on the team members. Socialization appear fundamental to enable good work, in line with previous research — e.g. [18]. Through the analysis based on communicative genres and coordination mechanisms, it is possible to show how and why good practices come about. Moreover, in GSD research, it is often suggested to physically visit the remote site or to foster team building through ad hoc activities in order to reach informal relationship among distributed team members [3]. The team studied in this work overcomes challenges such as the lack of face-to-face communication or the low bandwidth connection mainly through the establishment of effective practices supported by SoSo. Nevertheless, an important role in helping the two sub-teams to overcome distance and to foster a sense of cohesion seems to be played by some team members, in literature often referred as cultural liaisons [3]: social chats are indeed pushed mainly by Cheng, Stella and Jakob. Especially thanks to these members, the team managed to develop a negotiated project culture [2] that permitted team members to effectively work together, despite being distributed and belonging to different cultures. Social talks supported by SoSo and pushed by the three team members enabled good collaboration and helped to find a workaround for the barriers in the cooperation. The personal attitude of these team members in fostering social talks appears influential as it lowered the potential socio-cultural distance among teams.

7.3 Metawork for Establishing Effective Coordination Mechanisms

In the initial phase of the project, thanks to the social talks, the two remote sub-teams established an effective informal channel, where metawork discussions could take place. The importance of metawork has been highlighted in previous research [22]; however, this study shows how metawork takes place and how it evolves, especially for establishing effective
coordination mechanisms. The high level of metawork in the initial phase of the project, both in the Group Chat and in the Forum, shows an effort by the two sub-teams to discuss how the collaboration should be carried out; the metawork chats go along with encouraging chats and smileys, indicating acceptance of the proposals put forward by the remote team members. Metawork disappears in Week 5 when all the coordination mechanisms got established and team members start to work effectively thanks to commonly adopted coordination mechanisms. The team succeeded in establishing effective coordination mechanisms and social protocols thanks to the initial metawork and the associated encouraging and social chats, supported by SoSo.

7.4 The Role of Social Software

The analysis performed in this paper highlights the central role of SoSo as an informal and flexible channel that supports different kinds of communicative genres, such as work discussions, metawork, situated articulation and social chats. This is in line with previous research that highlights the possible usages of SoSo though the six communicative genres identified in this paper have not been previously explored. SoSo has been researched and it is widely used in OSS, however the analysis presented in this paper helps to show the complementing role of SoSo in respect with other collaborative SE tools that provide templates for coordination mechanisms. In particular, it is interesting to note the support of SoSo as an informal channel in the initial phase of the project, when decisions need to be taken, social relationships need to be established and social protocols need to be negotiated. After the initial phase, Forum and Wiki serve as a persistent repository for the knowledge shared, while communication through Forum and IM allows situated articulation, decision making and collaboration record.

A special role is played by IM chats and it deserves further discussions. At the beginning of the cooperation, team members need to define and establish common social protocols and IM is fundamental in this phase, being used for socialization and metawork. Figure 1a and 1b show that in Week 5, 6, 7, and 8 there is not much communication in the chats, because coordination mechanisms are established and are supported by situated articulation through Forum Messages (Figure 1c). The collaboration through IM chats does not exist when team members have another working channel and effective coordination mechanisms are in place. At the end of the project, when more synchronous collaboration is needed in order to merge the two pieces of code developed, communication through chat appear again. This can be explained with the glue concept we introduced for IM in a previous work when the team is established, as in a chat is a glue between other channels and works as a situated dispatcher: through chat team members coordinate meetings, propose to move to other channels, e.g. mail, calls. When closer collaboration is required, as in some examples reported in and in the initial and in the final phase of this project, IM works as a realtime communication channel among team members. Finally, socialization happens mostly in the IM chats as a subtext or as a genre on its own, as in the case illustrated in this paper.

8. LIMITATIONS AND FUTURE WORK

The main limitation of the present study is that it is based on a single student project. Being a qualitative study, generalization can be done by triangulating the findings with other studies. For example, results of this paper are in line with the work of Sigfridsson that highlights the importance of metawork. In addition, the present article shows how metawork is supported by SoSo and how it is developed in the team, thanks to the communicative genre analysis. Though our case is a student project, Sigfridsson work suggests that similar processes take place also in professional contexts. Moreover, in this work, the project setup is not artificially imposed by any experiment-like constraint and it shows how a software product is developed, from the design phase until the delivery phase, in a distributed team, dealing with geographical, temporal and socio-cultural barriers that characterize real-world GSD projects. Though the product developed is relatively small — it required only three months part time development — students were asked to act as professionals, dealing with GSD challenges on their own. Practices observed in this student project provide insights about how novices seek channels to communicate in software development. The commitment and the responsibility of the students to accomplish their tasks were not dissimilar to professional developers. Some of the students were part-time software developers in industrial settings. Undoubtedly, additional cooperative practices can be found in other cases: supplementary coordination mechanisms and communicative genres can be identified, other kinds of SoSo could be adopted by team members, other techniques can be used to overcome the lack of face-to-face communication. However, the focus of the research presented here is not on the quality of the code produced nor on the evaluation of specific methods and tools, but on how the team establishes the cooperation across distance, allowing to study how practices are negotiated, established and maintained in a GSD project.

Three lines of future research arise from this work. Firstly, the concept of culture has been briefly touched in the discussions of this paper, as it did not appear fundamentally affecting the cooperation. However, to reliably affirm that, comparisons with other teams with similar background should be performed. Moreover, culture should be analyzed with appropriate analytic concepts in order to establish whether and how the cultural liaison role of some team members affected the cooperation.

Secondly, we can certainly affirm that social chats appear fundamental to support trusting relationships, thus enabling good work, in line with previous research — e.g. However, in this article, the role of trust has not been explicitly explored as it poses a different perspective to the analysis — psychological rather than sociological. From our work, that takes a practice-based approach, it is visible that socialization helps to create trusting relationships among team members, in turn facilitating the negotiation and establishment of common practices. However, we have not proven the relationship, as we have not performed any psychological testing or controlled-experiment. We exclusively show that there is a relationship between socialization and metawork and the establishment of effective coordination practices, both facilitated and supported by the usage of SoSo: a deeper analysis could be performed in future research relating the roles of social talks, metawork and trust.

Finally, the relationship between coordination mechanisms and communicative genres deserves further investigation, resulting in a theoretical framework for analysing and describing cooperative practices in GSD and deepen our un-
derstanding of the role of social protocols. In a previous work [4], we described the role of SoSo in the ecology of channels of an established team; in this work we have shown how the ecology of channels is established in a new team. Further develop the ecology of channels concept in a more comprehensive theoretical framework could provide theoretical underpinnings for future research that aims to analyse and describe not only the role of SoSo but how cooperative practices and are established in GSD teams.

9. CONCLUSIONS

In GSD, the lack of face-to-face communication poses challenges to the cooperation among remote teams: establishing and maintaining common practices appears to be a major issue. This paper shows that SoSo is a flexible channel that can enact different kinds of communicative genres and that supports coordination mechanisms, helping GSD team members to deal with the lack of face-to face communication. The development of effective coordination mechanisms depends on the successful initial metawork, which is related with the social cohesion of the team, through encouraging chats and social talks. Moreover, thanks to SoSo, it is possible to negotiate and establish common social protocols, thus to reach shared practices despite distance. Various kinds of SoSo have different roles in the diverse phases of the project: Wiki and Forum are a persistent repository for the knowledge shared; IM is a glue between other channels and is the media where things happen if they can not take place somewhere else, acting as a dispatcher for other channels and as the main channel for social talk; Forum and IM serve as channels for situated articulation, that support established coordination mechanisms.

10. REFERENCES