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Collaboration in Translation: The Impact of Increased Reach on Cross-organisational Work

Abstract Coping with the increased levels of geographic and temporal distribution of work and the near ubiquitous accessibility of information fostered by today's networking technologies has been recognised as one of the greatest challenges facing CSCW research. This trend is reflected in the development of workflow-based tools which cross organisational boundaries, putting pressure on established coordination mechanisms aimed at articulating the work of teams that include co-located and remote members. In this paper we explore these issues by analysing a localisation activity carried out across organisational boundaries where the pressures for increased distribution and accessibility of information manifest themselves quite clearly both in the way work is specified and locally articulated. We look at how the work is realised in practice, and present an analysis based on the coordination mechanisms, awareness mechanisms and communication flows which occur both inside and outside of the formal workflow-support tools. The analysis reveals a wide variety of informal communication, ad-hoc coordination mechanisms and bricolage activities that are used for local articulation and metawork. As well as providing a concrete illustration of the issues caused by increased distribution, beyond those inherent in the complexity of the work, the analysis reveals a number of opportunities for better supporting the work and for the successful integration of new technologies.

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1 Introduction

Commercial and technological trends in recent years have led to a situation where work is increasingly done across organisational boundaries. The use of electronic mail and other technologies supporting electronic document exchange has had an enormous impact on the way work is carried out and distributed between individuals. This trend towards increased distribution of tasks *"across organisational, spatial and temporal boundaries"* is referred to by Gerson (2008, p. 194) as increased *reach*. A concrete example is found in the software localisation industry, which translates software products, manuals and support documentation into a range of different languages (Esselink 2003). Increased technological support has resulted in greater distribution with activities segregated and standardised across organisations and sites. More recent trends such as crowd-sourcing (Lewis et al. 2009) push this distribution to an extreme with commoditisation applying at the level of individual segments of text to be translated.

This trend towards increased reach raises a number of profound challenges for CSCW. Within a work system, members need to coordinate their activities with others, communicate, and generally maintain awareness of the work system and the performance of activities within it. While information technology has enabled greater distribution, it has also created a situation where the mechanisms employed for communication, coordination and awareness differ from those employed in a face-to-face setting, and may suffer from problems not present in their face-to-face counterparts.

The work system may be designed to explicitly support these activities (for example computer systems which are intended to support the handover of work from one team to another), but such support is often based on partial formalisations of the work. Collaborative and co-located workers explore particular aspects of the activities performed in order to create a well adapted system (locally, at least), and, in doing so, often conflict with the strategy for segregation and standardization used to facilitate distribution. While partial formalisations are useful and translate conveniently into technological support (for example, those based on models of business process or workflow), the limits to formalised and rationalised coordination in the performance of work have been previously identified within the CSCW community. Gerson (2008) argues that such limits manifest themselves in the mechanisms employed to reconcile differences in work settings. Such mechanisms cannot be entirely formalised because they involve agreeing (designing, enforcing etc) those very mechanisms of reconciliation. A similar comment on the recursive character of local articulation and cooperative work is made by Schmidt and Simone (1996, p. 159).

It has been suggested that *cross-cutting ties*, that is, overlaps in *"relations among friends, neighbours and coworkers"* (Gerson 2008, p.208), often help soften the disputes arising in articulation work. Most co-located local articulation work is handled seamlessly, invisibly, through cross-cutting ties, shared past, and richness of modalities available through face-to-face interaction, as documented by the works of Harper et al. (1991) and Heath and Luff (1992) on air traffic control, for instance. Cross-organisational boundaries act

as barriers to such forms of articulation. Other trends such as outsourcing to multiple providers and the use of freelance workers can also frustrate efforts to build and maintain the ties, shared context, and communication channels on which these articulation strategies depend.

Hence, the situation is one in which increased reach is made possible through new technologies, allowing work to be distributed across time, place and organisations. As we will see in the case study, this increased reach disrupts the articulation of work, and demand a variety of additional mechanisms for the articulation and re-articulation of work. However, the formalisations on which support is most conveniently based can only ever account for a subset of the mechanisms in play. In this paper, we will examine how these mechanisms operate in the localisation of software — an activity where the impact of increased reach is clearly observable.

1.1 A typical localisation narrative

To contextualise the discussion, we give here a brief and simplified example of a localisation process. This illustration is meant to provide a sample of the general coordination and communication mechanisms we discuss in greater depth in the following sections.

SuperSoftware will soon release NewProduct2.0. Bob, a technical writer based in the company's headquarters in Country A, updates the electronic documentation (manuals, help files, text displayed on the user interface and pop-up dialogs) for the new release by editing the English documentation for the previous version, NewProduct1.0.

The documentation for NewProduct2.0 has to be translated from English into several languages prior to release. To prepare the project for translation, Stephen, a localisation engineer who works for SuperSoftware's localisation division in Country B, uses a custom tool to divide the English documentation for NewProduct2.0 into segments (mostly sentences).

NewProduct1.0 was translated a few years ago into the same languages. The segments of NewProduct1.0 and their translations for each language are stored in a Translation Memory (TM). Because a lot of the documentation has not been changed, many of the segments of NewProduct2.0 match segments in the TM. Each segment of NewProduct2.0 is paired with similar segments from the TM in order to "recycle" previous translations.

Jane, a terminology manager who works for SuperSoftware's localisation division, tries to ensure that the terms and expressions used within the documentation of NewProduct2.0 are as standard and consistent as possible. For example, Jane identifies the menu option "Quick Print" as a term and ensures that "Quick Print" is used every time this menu option is mentioned in the documentation. The terms identified ("harvested") by Jane are translated by SuperSofware's linguists. Each linguist is responsible for each language that the documentation will be translated to. A project glossary (usually a spreadsheet or an electronic document) is created which includes the terms and their translations for each language.

The translation will be carried out by GlobalVoice, a Language Service Provider (LSP) based in Country C. Kate, a project manager from Glob-

alVoice, communicates with SuperSoftware's localisation division to determine the budget and set a deadline for the completion of the project. Once GlobalVoice has accepted the project, Stephen prepares a "Translation Kit" and sends it to Kate using a commercial workflow tool. The Kit consists of the segmented documentation for NewProduct2.0 as well as the TM, and a glossary for each language that the project will be translated to. It also includes other reference material (additional manuals, styleguides, etc) that translators may find helpful.

The translators at GlobalVoice are divided into language departments according to the languages that they specialise in. Each department consists of a number of translators. The most senior translator in each department has the role of the team leader (or Language Manager). Kate contacts each team leader about the new project.

Carmen, the team leader of the Spanish department, allocates work to herself and the other translators in her team. Smaller projects are usually given to one person. However, large projects such as NewProduct2.0 need to be split between several translators to meet the deadline. There are no available translators in the French department, and instead the project is passed on to freelancers. Unlike the translators in GlobalVoice, freelancers are not co-located and are paid "by the word". A project may also be given to freelancers if this costs less than doing the translation internally.

Each translator translates their allocated files using commercial software. For each segment, the software presents the best match from the TM and its translation, which can be selected and revised by the translator. Each translated segment is added to the TM. Kate keeps track of how much each language department is producing while each team leader keeps track of the individual translator's progress. Kate also collates queries from translators and sends them on to SuperSoftware.

When the project is close to completion, translations begin to be reviewed, usually by the team leader or another experienced translator. Once the entire project has been translated, Kate returns it to SuperSoftware, along with the updated TM incorporating the new translations, using the workflow tool.

2 Analytic Frame

It can be seen from the brief description above that, ideally, the localisation process consists of clusters of standardised activities. Translation, in particular, is conceived as temporally contingent upon certain preparation activities (such as creating a glossary or providing the translator with a TM) but is otherwise conceived as self-contained and as temporally, spatially and organisationally segregated from these activities. On the other hand, the various actors involved must coordinate their work, and perhaps communicate with each other, in some cases across organisational boundaries. The translation task is particularly interesting since it is not usually thought of as an inherently collaborative activity. Work that could be carried out by a single individual is split among various translators, who may or may not be co-located, to satisfy practical constraints (i.e. to meet a deadline or to reduce cost). Given the direct dependencies between the work of each translator and

the other actors involved, it is informative to look at how members monitor and respond to emerging issues, given the potential knock-on effects of any problems, and the need to manage change within any complex setting.

A distinctive aspect of this case study is the fact that the work is distributed not just across time and space, and intra-organisational boundaries, but between distinct organisations. The client[1] is not the only client of the LSP, and the LSP is not the only provider for the client. The fiscal aspect of the relationship can also be seen to contribute towards the "necessary fiction" of distinct responsibilities and strict segregation of activities. While the individual cognitive task facing a translator doing translation is important, the way in which the work is articulated *in the presence of* the organisational boundary (and not just across it) is of interest from a CSCW perspective. The type of distribution evident in the case study is a relatively recent development but is becoming increasingly common.

We consider below some of the different aspects of the work and the mechanisms which allow such highly distributed activity to be carried out. This was developed out of the observed account, making reference to the literature. We present it here as it provides us with a useful vocabulary as well as an analytic frame for discussing the case study.

2.1 Local Articulation, Metawork and Workflow

Strauss (1988) introduces a useful distinction between two kinds of *articulation work*: *"the work of specifying the work to be done"* on a high level, which Gerson (2008) calls *metawork*, and the work of connecting together local tasks and acting in order to ensure that the resources necessary for the performance of these tasks in specific circumstances are in place, generally referred to as *local articulation* or simply *articulation* (Strauss 1988; Schmidt and Simone 1996; Gerson 2008). Although there is necessarily a lot of overlap between the different types of articulation work, we found the distinction helpful in the analysis of the distributed work arrangements (and the different mechanisms that support them) investigated in this paper.

Formalised workflow systems, for instance, provide crude descriptions of metawork, while the analysis of the case study in this paper will provide an account of local articulation, building a more complete picture of metawork from the bottom up, from the accountable descriptions of the activities of individuals, obtained during fieldwork.

Workflow can be conceived of as a theoretical concept which describes the act of arranging tasks into sequences, hierarchies etc "in the service of work flow" (Strauss 1988, p. 160). Many business processes can be conceptualised this way, since they consist of a number of distinct activities between which work "flows" in a process typically mediated by documents. Workflow can also be used as a tool - an organisational formalisation, a freezing of a particular understanding as a description in the form of a diagram for example.

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[1] We use the word "client" as a collective noun to refer to an organisation or (more often) to a group of people within that organisation. This is the case even in cases where usage might suggest a singular, as in "the client's awareness of certain translation activities".

This formalisation may be used in the design of the business process itself, but is often also embedded in software and other artifacts used to support the work (Bowers. et al. 1995).

As generalisations of the work, there will always be aspects which are not accommodated in the formal workflow and associated tools. Indeed in some cases, underspecification may be the most effective solution where flexibility may be needed to deal with local contingencies (Suchman 1987). With respect to those aspects which are formalised, Schmidt and Simone (1996), citing Bittner (1966), observe a certain naivety in the way the status of such protocols is dealt with in the literature, and note how "formal" protocols for coordination are appropriated and modified based on need, but *"actors deviate from the stipulations of the protocol if and when they have compelling reasons to do so, and only then"*. They also point out that the role of a protocol may vary with the situation, from providing weak guidance to strong constraints.

The pertinent issue for us is the way in which increased reach places pressure on the mechanisms for articulation work which have emerged to support the achievement of the goals of those working in the setting.

2.2 Articulation of distributed collaborative work

The topic of distributed collaboration and the work of distributed teams has been studied from a variety of perspectives. Orlikowski (2002) studied collaboration in distributed software teams involved in global product development, taking *organisational knowing* as the analytic lens. The distributed teams in that case represent a range of expertise, with some close to the customer and others more engineering focused, for example. The study looks at how the organisation deals with the knowledge of how to do distributed product development. While there are significant differences to the setting we study, there are a number of common themes. Knowledge of how to do *coordination* across boundaries of time and space is a major focus of the analysis. Given the varied and changing structure of software projects, a degree of flexibility in the organisation of work is needed, but a common project management model, planning tool and software development methodology help with maintaining a consistent approach to the articulation of work. The significance of face-to-face contact between people in distributed teams in the study goes beyond establishing trust, and sharing information, negotiation and building social relationships were all found to be important. This relates to our own consideration of trust and cross-cutting ties, which were found to be significant in the case study.

Malone and Crowston (1994) review a number of approaches to the study of coordination grouped under the general banner of "coordination theory". Their systematisation draws on several disciplines and defines coordination in terms of managing dependencies between activities. Different types of coordination processes are identified, including management of shared resources, managing produce-consumer relationships, managing simultaneity constraints, managing the task-subtask relationship, group decision-making

and communication. While these patterns may be helpful in identifying opportunities for cross-pollination between disciplines at a conceptual level (and subsequent expression of these concepts within tools), the framework described is far from constituting a cohesive theory, as Malone and Crowston acknowledge. This, in our view, makes it inadequate as a starting point for the analysis of coordination in a specific instance. It can be used to augment a given domain-specific view on coordination but does not in itself provide one.

Bayerl and Lauche (2010) present a study of distributed team coordination, drawing on grounded theory. The teams they investigate are distributed between offshore oil platforms and onshore workers. Their account is mostly activity based. From the account presented, activity does not seem to be based on a strong workflow model. *Coordination* is broken down into nine primary activities, including monitoring and coordination across team boundaries. *Awareness* is a central issue within their study, both in terms of problems with existing practice, and specifically problems surrounding shift change and decision making, and also the changes observed with the introduction of continuous real-time videoconference links between onshore and offshore teams. The *communication* which occurs is also examined in detail, both in terms of media use, and uses such as troubleshooting and reporting. While dealing with the same organisation, there is a clear separation of responsibilities and division of labour (planning vs. execution), but with tight integration of the work of the two teams, made even tighter with the introduction of videoconferencing. While much of the change brought about by introduction of real-time data and continuous communication was positive (including increased social connection), of relevance to our case study is the identified danger of pulling planners into short term activities when awareness is increased.

Within work on distributed open-source software development, *awareness* has also been the focus of analysis (Gutwin et al. 2004). While very different in terms of lacking a formal workflow or allocated responsibilities, this activity has a number of interesting parallels in terms of the distribution between people who may have little or no face-to-face contact with each other, and may provide insight into the operation of different forms of awareness support and the activities and strategies used to exploit them. Of particular interest is the problem of allowing new members of a team to build up an overview of the history of the work. Also in the area of distributed software development, (Ågerfalk et al. 2005) present a framework based on *communication, coordination* and *control*, and the orthogonal dimensions of temporal distance, geographical distance and socio-cultural distance. Again, given the relatively stable workflow model employed in the localisation setting we investigated, the issue of control was not found to be central to the case study presented here. Likewise, socio-cultural issues, while certainly relevant to the translation work itself, were less evident in differences between the client and LSP, given the close relationship and often common background of workers in the different organisations (several staff had previously worked on the other side of the organisational divide, albeit with different organisations). Further in relation to this point, it is certainly true that artefacts such as

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the TM can be regarded as *boundary objects* (Star and Griesemer 1989), in that they are seen differently from the perspectives of the client and the LSP and yet provide support for communication. However, as we will see, the barriers between these groups are not so much due to differing viewpoints of linguists and translators (linguists are very likely to have trained and worked as translators), but related to the segregation and distribution of work.

Schmidt and Wagner (2004), in their detailed account of architectural design and planning, explore the nature of coordinative practices, and introduce the notion of ordering systems, inter-related coordinative practices, operating over a network of coordinative artefacts. Our own study demonstrates clearly that an array of coordinative artefacts and practices contribute towards goals such as producing consistent translations. Schmidt and Wagner (2004) also present an interesting critique of the array of frameworks in CSCW which have been applied to coordinative practices. They posit that since these different frameworks are overlapping but incomplete, they do not provide an appropriate conceptual foundation for CSCW. This question of coherency of analytic frame is a fundamental one for CSCW research, hence we consider here the appropriate elements of an analytic frame for our cross-organisational study, and their relationship to one another (we comment on the development of this framing in the methodology section). When producing an account of a setting such as the one we study, we will encounter activities which relate to individual work, and also coordination work. Coordination work can be seen as involving both local articulation and metawork, as well as the broader work concerned with the social order, including building and maintaining trust, and cross-cutting ties. A given activity might contribute simultaneously to these different aspects of coordination work.

Within our own study, it became clear that many of the more challenging aspects of the work concerned the articulation of work at several levels. We look at three different aspects of articulation work which contribute at these levels. Communication is vital in achieving articulation, but also in maintaining awareness, and establishing and maintaining cross-cutting ties. Awareness is important not just for local articulation, but also for metawork - workers need to realise that change is necessary and formulate an opinion on what needs to be changed, before re-articulation. Thus, they must maintain an awareness of both the abstract configuration of the work system (who is doing what and how), and moment-by-moment awareness of the state of the system, in order to identify emergent problems (disarticulation), and come up with a strategy for their resolution. Coordination mechanisms can be seen as primarily concerned with local articulation, in that there is enough stability for an artefact and set of practices around it to be implemented. However, creation and adaptation of these mechanisms to changing circumstances is part of the metawork. Within this context, we can see awareness as something which is achieved mainly through communication and the operation of coordination mechanisms, even though it can be engendered in other ways (co-location and overhearing for example). Thus, while the *property* of awareness is conceptually distinct, it is brought about through accountable acts of communication and the operation of some types of coordination mechanism.

2.3 Coordination

The articulation work needed to support the performance of cooperative work is achieved through a range of coordination mechanisms. We use the definition from Schmidt and Simone (1996, p. 180):

> A *coordination mechanism* is a specific organizational construct, consisting of a *coordinative protocol* imprinted upon a *distinct artifact*, which, in the context of a certain cooperative work arrangement, *stipulates* and *mediates* the articulation of cooperative work so as to *reduce the complexity of articulation work* of that arrangement.

The artefact (for example, a form) may reflect the protocol itself, provide a means for communication, support awareness (discussed further below), and mediate changes to the protocol.

Coordination may be directly supported by software - the workflow-based systems mentioned above, common in many organisations, would be one example. Computational coordination mechanisms such as these differ in the sense that both the artefact and aspects of the protocol are integrated into the software (Schmidt and Simone 1996). However, computational coordination mechanisms also support temporal and physical distribution of the coordination activities, increasing reach. This in turn places greater demands on the articulation mechanisms they support which may have evolved to cope with the demands of less distributed cooperative work.

2.4 Awareness

Awareness within CSCW systems is defined by Dourish and Bellotti (1992) as *"an understanding of the activities of others, which provides a context for your own activity"*. Schmidt presents a compelling critique of the use of the term within CSCW to represent a range of different things, as well as on the notion of "passive" awareness (Schmidt 2002). For our own purposes, the interpretation of awareness as denoting "practices through which actors tacitly and seamlessly align and integrate their distributed and yet interdependent activities", is most relevant. Supporting such awareness is an important factor in maintaining the ability of any complex organisation to effectively detect and respond to unforeseen and exceptional situations, and to manage the evolution of the system itself in response to changes in the operating environment.

Awareness is related to coordination mechanisms in the sense that specific parts of the protocol may be present in order to maintain awareness, and conversely awareness is important for supporting modifications to the coordination protocol (higher level articulation work or metawork).

Increased reach can make it difficult for workers to maintain awareness, given the physical distribution of workers and aggregation within and across organisations. The introduction of automation can exacerbate this situation, as workers also need to maintain awareness of the automation, and the evolution and operation of the automation (which may be opaque), as well as that of the work system itself.

2.5 Communication

Communication patterns associated with the performance of work are observable and informative. Communication may form part of the normal performance of work (perhaps outside of the formalised part), the operation of the coordination mechanisms, or dealing with contingencies which require modification of these mechanisms.

The distribution of work across organisational boundaries can result in bottlenecks where communication is constrained to occur through particular channels and people. This distribution may also impact on the effectiveness of the communications themselves as there is less shared context between those communicating. Furthermore, computer mediated communication does not have the same properties as face-to-face communication (Galegher and Kraut 1994). Increased reach can also have indirect effects through issues such as trust (a worker may trust a remote collaborator less than a co-located co-worker), which will in turn impact on the nature and need for communication.

2.6 Outline

In this paper, we examine the communication, coordination and awareness mechanisms observed in cross-organisational localisation activities. Despite the highly structured, indeed standardised, view of the work within the industry, in which formal workflow-based tools are used, and the view of translation as an individual activity, the analysis reveals a wide variety of informal communication, ad-hoc coordination mechanisms and *bricolage* activities (Büscher et al. 2001) that are used for local articulation and metawork.

Furthermore, technologies introduced to facilitate the work of individuals have an impact on these mechanisms, since, as we will demonstrate, the individual tools are woven into the local articulation and metawork vital to the effective performance of the system. By providing this account, and an analysis of the issues arising in practice, we provide a concrete illustration of the issues raised by Gerson (2008) and a basis for discussing how the impact of increased reach might be addressed within the investigated setting to meet previously unidentified needs.

3 Methodology

This study was conducted as part of a research project investigating existing and potential uses of technology within the localisation industry. Preparatory work included offline study of the available tools as well as review of the research literature and other background materials pertaining to localisation. This was followed by site visits and engagement with various stakeholders including employees in the localisation division of a large software company and in two LSPs. Overall, we carried out over 55 hours of fieldwork in three sites in three countries.

The first LSP employs over 150 in-house staff and acts as a multi-language provider localising products in several languages. The software company is

one of its significant clients. Initially, we visited the localisation division of the software company and the LSP. We carried out 14 semi-structured interviews at these sites, typically lasting between 45 minutes to an hour each. Interviews were carried out with linguists, a terminology manager, project managers in the client and LSP organisations, and translators at all levels of seniority. This set includes the main actors on both sides of the organisational boundary who deal with individual localisation jobs.

At this stage, handwritten interview and observational notes were taken, which were then transcribed and grouped iteratively. This provided us with an understanding of the main activities within and across sites and of the official roles of people involved in these activities, as described in section 1.1, and consolidated the main categories and concepts employed for analysis which are outlined in section 2. This analytic frame was applied and refined through group interpretation sessions, drawing on the CSCW literature with regard to the use and definition of concepts such as co-ordination mechanisms.

To investigate work practices in more depth we carried out additional visits to the first LSP and to a smaller LSP which acts as a single-language provider and employs only four in-house staff. These visits included naturalistic observation and a set of interviews focused on translators (including team leaders) and the project manager. Permission to make audio recordings was obtained during these visits in addition to taking handwritten notes. 11 interviews were carried out at this stage which lasted between 1.5-2.5 hours. The interviews were accompanied with observations of employees performing their normal duties in order to understand and document, among others, the social and organisational structure (employees' roles and interactions), the use of software tools and other artefacts, any obstacles and deviations from official processes as well as concerns expressed about perceived problems. Our method was informed by the ethnomethodological approach in that we aimed to provide an analysis of how the people studied "accountably reproduce" their work "in and through ordinary activities" (Suchman et al. 2002). In doing so we contrast our analysis to "disembodied idealisations of workflow" (Randall et al. 2007) often used to describe or formalise the localisation activity.

Notes and audio transcripts were initially coded to an open scheme with ELAN to avoid overlooking important aspects of the work, and then subsequently annotated using the concepts presented in section 2, which provided a general framework for analysis of the observed phenomena. Additional themes were identified iteratively and used to consolidate the analysed data into a coherent account which presents recurring patterns of work in detail. This account focuses on work which spans across the larger LSP and its clients, supplemented with data collected in the other sites. These themes are stated and discussed in the various subsections of section 4 through reference to documented observations, and exemplify how the particular work practices observed relate to the concepts of section 2. The account produced was validated with stakeholders on both sides of the organisational divide.

4 Localisation work in practice

We structure the presentation of the study around the activities and mechanisms observed within the LSP. These mechanisms may simultaneously play a role in coordination, awareness and communication between workers. To a large extent, these mechanisms are brought into play when translation is not straightforward. While an artefact analysis would be of interest, our concern with these mechanisms, whether embodied in an artefact or not, is better explored in this more activity based format.

4.1 Coordinating job allocation with the Task Sheet

An in-house job tracking system is used to monitor progress in the large LSP. The system provides an estimate of how busy each translator is. Projects are often divided into smaller jobs and the system shows which job the translator is currently working on. Information about the job (including available resources, deadline and expected daily productivity) is also contained in a spreadsheet which is called "the task sheet".

When a new job comes in (crossing the organisational boundary), the project manager contacts the various team leaders (section 1.1). The project manager comes to each team leader's desk, hands her over a printout of the task sheet and discusses the job briefly with her.[2] The team leader looks for an appropriate and available translator (sometimes by checking the job tracking system) and confirms her availability with a quick verbal interaction. The team leader then passes on the job to the translator by handing over the task sheet to her.

When the translator is done with the job, she emails the project manager and her team leader. The translator then writes on the task sheet and hands it back to the team leader. Her comments might indicate the next step e.g. "to be reviewed" or raise awareness about emerging issues (e.g. a pending query, see section 4.6).

Updates on the job tracking system may occur in parallel to these actions, although on a few occasions translators finished the job first and then they allocated it to themselves on the system and ticked it off. When they were demonstrating the system, they sometimes identified information related to job allocation as inaccurate or not up to date. Job allocation is a bricolage activity which relies on informal communication and the use of the task sheet as an ad-hoc coordination mechanism in addition to the job tracking system.

4.2 The TM tells me how we dealt with a term as a team

4.2.1 I want to know what my team agrees with

One of the main tools used by the translators in both LSPs is the software which displays matches from the TM and their translations. The software

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[2] We use "she" and "her" to refer both to men and women.

has a concordance function which can be used to search the TM for text entered by the translator. Translators were observed searching the concordance frequently, mostly for subparts of the segment they were working on such as a single word or a short phrase (i.e. a term).

In the following incident, the translator was working in a large project which was split between her, another translator in the LSP and freelancers in order to be completed on time. A third translator from the LSP acted as the reviewer. The participant searched the concordance for a term and explained the motivation behind this action:

> it's not very easy because "stacking" is the way images go one on top of the other, you can say that in several ways [...] in most cases the translator is not really stuck as in they don't have a clue about what a term means, I can easily find what "stacking" means e.g. with a dictionary or online, so it would be more helpful for me to know what he [Team Leader] thinks or what my team agrees with

Searching the concordance returns a list of segments from the TM which contain the searched term and their translations. The concordance interface shows who translated each entry and when the translation was done. The same properties are displayed when the translation of a matching segment is retrieved from the TM. These properties make the translator aware of what his team agrees with:

> it's very important to look at properties [...] to see the name of one of my team-mates it means that they have the same references as I have on the server, they went to the briefing with me so I trust them more

Contributions by the team leader are of particular value because she "has the last word and the responsibility if the client complains". In addition to enabling the translator recycle translations, the TM "tells me how we dealt with a term as a team", thus serving as a coordination mechanism of the co-located team.

4.2.2 I want to be consistent

The interfaces to the TM also display whether a translation has been revised:

> I did this segment on [date] at 5pm, it was reviewed by her and she changed something, I have to keep this, I want to be consistent, to have the same translations, I know that this is correct so I accept this

In this example, the translator willingly accepts the change done by the reviewer (one of her team members). The use of the TM as a coordination mechanism within the team is summarised in the following quote:

> in most cases if there is a difficult term someone researches it and it goes to the TM, after the review it stays in the TM and this is the final decision about it, if I am a new translator and I come across this term I trust the TM

The examples above highlight the use of the TM to ensure *consistency*. Although translation is usually seen as an individual activity, producing consistent translations and maintaining the appropriate quality level turns out to be a collaborative task involving several team members.

4.2.3 I trust freelancers less

While work is shared between team members in the LSP relatively seamlessly, freelancers are trusted less. These comments were made during another concordance search:

> I would trust this user more because the other one is a freelancer and I know that freelancers do not have all the materials that we have and did not have the briefing

Again, the interfaces to the TM support awareness by identifying the origin of the retrieved translations.

Mistrust towards freelancers has implications for several stages of the process. The first project for a new client is always done internally. There is a preference for not splitting projects between team members and freelancers although for large projects this cannot always be avoided. One translator said that when large projects are split between her and freelancers, the project manager tries to give easier parts to the freelancers. Giving freelancers harder parts has caused problems in the past. Another translator was observed reviewing a job done by a freelancer who was used by the LSP for the first time. She mentioned that she did a "more thorough" review than usually. After she completed the review, the project manager emailed her about the quality of the translation and whether they should give work to this freelancer again.

Translators trust freelancers less because "they are not working with us on a day to day basis" although they accept that "the cheapest options are sometimes the fastest." The managerial view was similar: "Freelancers are paid by the word and want to finish the job as soon as possible. They don't spend time looking up references". Freelancers were also seen as hard to get in touch with when a problem comes up (also see section 4.5).

Ideally, a project would be split to satisfy time and cost constraints without much consideration of whether the work would be carried out by in-house translators or freelancers (section 1.1). In practice, the trend towards increased reach causes tensions between translators and freelancers. The process is adjusted in various ways in response to these tensions.

4.2.4 I look at the TM first

We exemplified how the TM is used by translators to coordinate decisions about terminology. In the "stacking" example above (section 4.2.1), several other resources were provided to the translator who said that "they gave me all I need". The TM was the first resource that she consulted. Other translators were observed following the same strategy:

> whenever we get a project we look in the reference folder for anything that could help us, there is a glossary there and [a file called] previous UI terms, so I can look in there for terminology and in the TM also, whenever I don't find something in TM I look at the other two

"I look at the TM first, the TM is the main reference", as another translator said. While workflow systems make various resources available across organisational boundaries (also see section 4.3.1), the TM often takes precedence over those.

Decisions about terminology are typically seen as being made at the client's side and handed over to the LSP (section 1.1). Ideally, the translator would resolve terminological issues simply by looking up the glossary. In practice, mutual trust built on shared context and coordination also plays a role on how translators deal with these issues. We will provide additional examples of the collaborative effort expanded on "difficult terms". Making decisions about terminology and translating seem to be more closely related than the typical handover process suggests. However, the presence of the organisational boundary introduces not just an obstacle to communication regarding any breakdown, but to re-articulation, or metawork of development of a new coordination mechanism which could serve as the basis for coordination between the terminology management activity and dealing with difficult terms during translation.

4.3 Coordinating and Collaborating with References

Although the TM was often the first resource that the translators consulted to resolve an issue (section 4.2.4), it did not always give the answer. The translators would also check the glossary, which sometimes illuminated the issue. Although rationalisation and segregation support the translator up to a degree, there were also cases in which the glossary was less helpful. In this section, we discuss the coordinating and collaborating practices that were observed in those less-than-ideal situations.

4.3.1 Use with care

Ideally, the terminology manager and the linguist would anticipate every terminological issue that the translator may face and include all potentially problematic terms in the glossary. In practice, this was rarely the case. The translator is given various additional resources: "The project manager tries to provide us with as many references as possible". "The reference folder has everything we need or that the client and the project manager think we need", as another translator said.

Increased reach enables other actors to provide the translator with "as many references as possible" (and thus potentially overcome possible shortcomings of the glossary). Ad-hoc mechanisms are then employed in response to the emerging coordination needs. The references are usually listed on the task sheet (section 4.1) under a field called "special instructions". The phrase "use with care" was written on the task sheet next to one of the many references to be used for a project. A "reference priority" document was included in the reference folder on another occasion to make a translator aware of the order in which the various references should be used.

Although these forms of (segregating) rationalisation are relatively effective, the strain on these processes is still observable. One Translator commented: "They gave me too many files that I have to open and look for information." Some references were not considered very relevant: "This styleguide is not really used because it is for software manuals and this is a multimedia

presentation". Giving feedback on the available resources is not considered part of the translator's normal performance of work (also see section 4.6.1). As a result, the degree to which such resources are exploited is quite opaque to those providing them. Again, the distribution of teams and presence of the organisational boundary acts to discourage communication between the translator and reference provider; we can also see view the issue in terms of a lack of awareness of the use or non-use of references within translation.

4.3.2 We did this ourselves

Another large project was split between several translators. They noticed that the TM was "inconsistent", containing terms that can be translated in "a few ways". The team collected these terms, resolved them collaboratively and recorded their decisions in a spreadsheet called "terminology issues":

> you see this, we did it ourselves, maybe the TM is inconsistent sometimes so in the case of "device" there are a few ways to translate it, we decided to go for this among ourselves

The spreadsheet serves as an additional communication medium which facilitates local articulation by enabling the translator to "see what [her] colleagues decided":

> if tomorrow an update of this project comes and I start and I have never worked on it before I can see what my colleagues decided and I can see how they translated these things

Shared context plays a role here as well. The translator feels that she can trust this "team tool" without the need to question the team members about their decisions:

> because this is a team tool I am not really interested in why exactly they found this and they decided that, I start after they have already worked on it for a while so I trust them

The spreadsheet is updated as the work progresses and a need to communicate changes emerges. In another example of bricolage, an email is sent to make team members aware of such developments:

> [Translator reads email] "For "quiet mode" we are going to use this, I added it to the list", she [Team Member] is warning me and her [Team Member] that she decided, probably together with him [Team Leader] and her [Team Member], that this is the decision for this mode, so guys let's make it consistent

Producing consistent translations again turns out to be a collaborative task involving several team members, similarly to the use of the TM (section 4.2.2). There is enough shared context that there is no need to mention too much information when emailing:

> you see there is no project number or link, she [Team Member] and I are now working on this project and we know we'll be working on that today and tomorrow, if I send her an email she knows what I am talking about

This further illustrates that making decisions about terminology and translating are more closely related than suggested by the typical process. Translators do not simply receive resources, they also *create* resources. This activity is not represented in the typical process and is not visible to the client since these resources are not shared with them: "The client is interested in the finished product, this [the spreadsheet] is an internal tool for translators", as one translator said. The form of articulation illustrated in this section involves communication practices embodied in tools and expressed through events which do not cross the organisational barrier. As a consequence, the client's awareness of translation activities and issues (even those aspects of it which are specified in the formal workflow as being of direct concern to the client, such as terminology preparation) are rather limited. This restricts the organisation's ability to improve the process by, say, effecting changes to higher level articulation practices.

4.4 The internet is a dangerous place

Sometimes the translator is not given "everything she needs": "If the references do not have the answer, I'll search online". A translator was observed searching an online dictionary which included "forum discussions" for a term. After looking at the meanings of the dictionary entries, she checked the links in the forum. This was followed by a web search "to check if it means what I assume that it means".

"Sometimes there is no glossary or other reference, for new clients we might even not have a TM". Another translator was observed working on a job in which references were not available. Whenever she was unclear about a particular term she would search the concordance. Each unsuccessful concordance search was followed by web searches. For each search, she commented on the reliability of the websites that the search engine was directing her to. Websites that were deemed reliable were explored further, the non-reliable ones were ignored. Similarly to the creation of a "team tool" (4.3.2), searching online is not formalised in the typical process and takes place to address limitations caused by segregation.

Increased reach has clear implications in terms of trust, as we will discuss below.

4.4.1 I want to know why they chose this term

Rather than "translate freely", the translator tries to conform to decisions made by her team members and coordinated with the help of the TM (section 4.2) and other "team tools" (section 4.3.2) or by the client when relevant references are available (section 4.3.1). On the other hand, when the translator has to search online she feels that she "is free to choose".

Because "the internet is a dangerous place", as one of the translators said, the results of online search are subject to scrutiny. Assessing the reliability of the websites that the search engine directs to, looking at the "forum discussion" and then searching online are examples of the extra steps required to

"check" translations proposed online. Additional verification is not necessary for decisions made by team members:

> when I do research online I don't know these people and they don't know my file and I want to know why they chose this term but for a project here I trust them [her team members] because they have all the information to decide

This comment was made in relation to the "team tool" collaboratively made by team members (section 4.3.2). As previously suggested (section 4.2.3), increased reach causes tensions between translators and remote actors resulting in additional checking.

4.5 If I really don't agree, we can just talk

As discussed in section 4.2, the first point of contact between the team members is the TM. When differences arise, they are resolved by talking:

> sometimes you find different terms [in the TM], if you disagree you talk, this is the importance of talking and having four people here, we talk quite a lot

Disagreements about decisions recorded in the "terminology issues sheet" (section 4.3.2) are addressed in the same way:

> if she [Team Member] and he [Team Leader] now agree to translate "device" in a certain way and I jump into the project because they are good translators I build on what they have already decided, if I really don't agree we can just talk

The translator may also consult one of her team members if her online search (section 4.4) is not conclusive:

> I'd say "can you come over when you have a minute" and I'd show him the sentence, that's also the point of working in a team because we can discuss things [...] I'd say "I've been looking here and there I found this and that but I'm not sure"

These examples further demonstrate the collaborative effort expanded on producing consistent translations. Informal communication in a co-located setting augments coordination mechanisms and work practices that are themselves not formalised. Reconciling differences greatly relies on these informal mechanisms.

4.5.1 You go and talk to people, it's not difficult

Team Members are co-located in both LSPs that we visited. In the large LSP four to six translators share one desk and sit in two rows facing each other. The physical arrangement sometimes favours face-to-face communication over computer-mediated alternatives, as several translators attested:

(i) it is easier for them to come over and see my sentence and tell me do this

(ii) sometimes because we are under a lot of time pressure it's quicker just to talk about it in a small team

(iii) in terms of time efficiency, if I had to go back and research the website to paste the link it takes time

Such communications occurred frequently in the LSP. Because translators do not always start working on the same project at the same time, questions are often directed to a team member who has "already worked on it for a while" (section 4.3.2). Less experienced team members (Junior translators) seek advice from more experienced ones (see section 4.6.1). The team leader may also be consulted (c.f. section 4.2.1): "They've been working in translation for 30 years so sometimes it's good to check with them."

Similarly to raising awareness by email about changes to the "terminology issues sheet" (section 4.3.2), there is enough shared context for the question to be asked "without me telling the project number":

this is palm for mobile phones, if I ask her [Team Member] "device for palm what do you think?" she immediately knows because it's part of her job rather than me saying project number and glossary so I don't need to tell them as much because they know in which environment I am working, with which clients etc

The team in the smaller LSP had a similar physical arrangement with the interviewed translator and her team leader sharing a desk and facing each other. During the observation, the translator had trouble with a particular segment and after working on it for a while she cried "help" over the desk. The team leader acknowledged her request and the translator sent the segment and her translation via instant messaging. Shortly afterwards they started discussing. The translator expressed that they "work very well together" and referred to instant messaging as the "tool" she uses to send questions to her team leader.

The complexity of the collaborative effort is evident in these examples. Communication and coordination needs are addressed as they come up by blending tools with informal face-to-face communication, and the awareness (of who is working on which project, of which environment is being used, etc) fostered by co-location plays a decisive role in rendering the collaboration fluid and efficient. The co-located working environment was contrasted with the situation of the freelancers:

which [asking] I cannot do at home if I worked as freelancer, it's this concept of having all these people in the same room, you go and talk to people or send them an email or whatever, it's not difficult, someone comes here and says "how did you solve that?"

Freelancers were seen by a company executive as hard to get in touch when a problem comes up. While email and instant messaging are seen to work well in the co-located setting, communication with freelancers is viewed as problematic. Similarly to the assessment of the freelancer's contributions to the TM (section 4.2.3), these views are indicative of the tensions caused by

increased reach, in this case manifested as an absence of cross-cutting ties and a related lack of informal communication.

Problematic issues are not only about terms but may extend to the construction of the whole segment (the instant messaging example above is such a case). Translators stated that when technical writers use a restricted grammar and vocabulary, documentation is easier to translate. The degree to which standard terminology is adhered to within the authoring process was also seen as strongly influencing the difficulty of translation. However, providing fine-grained feedback on issues related to authoring is not viewed as the translators' responsibility. Consequently, technical writers may not be aware of the full range of issues and their downstream effect on translation effort.

4.6 I need to email the project manager about my query

Tensions caused by increased reach can also be observed in the communication patterns across organisations. Translators do not contact the client directly (section 1.1). They add queries to the "Querylog", a spreadsheet created for each project. The project manager "has a look at the Querylog at the end of the day and sends queries to the client in batches".

Awareness about queries is raised and maintained in an ad hoc manner, exploiting mechanisms outside the official communication protocol. A translator was observed working on a project that was due on the following day. She added a query to the Querylog and sent an email to the project manager:

> Often the project manager doesn't look at the Querylog [...] this query is urgent and I cannot finish the job otherwise so I need to email her

The task sheet may also be used to raise awareness about queries (c.f. section 4.3.1). Once, the team leader passed a job on to a translator for review by handing over the task sheet to her (c.f. section 4.1). The translator noticed that the word "queries" was handwritten on it, opened the Querylog, looked at it and commented: "They have not responded yet".

4.6.1 It's better to solve problems on your own than to ask the client

Differences between team members are reconciled smoothly in a collaborative effort greatly facilitated by co-location, informal communication and shared context (section 4.5). On the other hand, several translators stated that they use the option of raising an issue with the client with great discretion:

> (i) I always try to limit the number of queries I am going to enter, if I can avoid entering one then I avoid it, it's better to solve problems on your own than to ask the client
> (ii) we don't want to do that too often because translating is our job so we only go back to the client in extreme situations when we really need their confirmation
> (iii) I have not made any queries today, I make queries when required, not often

A team leader mentioned that "adding queries is not our main job, the client does not expect to see many queries either". Refraining from querying the client was observed in several occasions. In a characteristic example, a translator was trying to find out whether the term "Edit Attribute dialog" is a dialogue name. She searched the concordance, the glossary and her other references but "did not find what I wanted". At the end:

> I decided to translate in the descriptive manner [...] I could have added a query but I chose not to because this is a good solution and saves time

The impact of work segregation is reflected on such accounts in which translators express a preference for solving the problem on their own and regard asking for clarification as not their main job. Communication with the client is viewed as a last resort, contrasting with the more collaborative practices that may precede this step such as asking a team member:

> if it's a term I can do research online, if this does not help me I'll ask my colleagues, there are cases where you can't really find it or don't understand what it means in which case we make a query

The following example is an instance of this practice:

> [looking at queries in the Querylog] here is another example, these variables, [Name of Junior translator] who sits there did not know whether they should be translated or not, she asked me because I have already been working on the game for two days, I said that I chose to translate them but I am not sure so you can ask a query to be sure

This account accords to previous remarks on how physical co-location ("who sits there" i.e. opposite the interviewee) facilitates informal interactions "over the desk". A question from a Junior translator is directed to a more experienced team member who had "already been working on the game for two days" (c.f. section 4.5.1). The collaborative attitude observed between team members does not appear to transfer to cross-organisational interactions as smoothly. The client may receive queries but the full scope of problems is not revealed.

Translators stated that it is almost always necessary to query something with the client but they try to find out within the team first. They try to interpret the material, suggest a translation and ask for confirmation, rather than simply asking for clarification. Several actors may get involved in this process as the following example shows (reconstructed by a translator's emails):

> A freelancer emailed the project manager a query even though she had access to the Querylog. The project manager then forwarded the email to the team leader who checked the TM but did not find an answer. The team leader emailed the project manager back and the project manager then passed the query on to the client. After the client replied, the project manager emailed the interviewed translator to check the Querylog. The freelancer who originally raised the query was not notified because by the time that the query was resolved the job was passed on to the translator for review.

Mechanisms outside the official protocol are again in play in this process. On another occasion, a translator who was reviewing a job emailed the project manager a question. The project manager emailed her the reply, also skipping the Querylog. "It's faster that way" commented the translator.

The Querylog has columns for "Department", "Name" of translator adding the query, "Date" that the query was added, "Source" (related segment or file) and "Problem" (a description of the query) that the translator has to fill in. On certain occasions, however, sending an email to someone who knows "what I am talking about" (section 4.3.2) may be more straightforward. Similarly to face-to-face interaction, the translator "doesn't need to tell them as much" (section 4.5.1).

Translators stated that some queries may not be answered on time (the second example in section 4.6 is one such case: "They have not responded yet") or even acknowledged at all. Translators and the other actors involved need to raise and maintain awareness about queries but updates may be too coarse and opaque to them.

4.6.2 The querylog is our local forum

In the following incident, the translator was working on a game together with two other team members:

> I had this question, "bottle of weather", I didn't find it in the game, I didn't know what that was, there wasn't anything in the memory because it was a new game, we didn't have reference material, we had the game itself but because I hadn't seen it in the game itself I thought I'd ask a query

A team member saw her query in the Querylog and told her the answer:

> Someone else opened the query sheet and saw my query and answered it for me, someone else from the team, they had the answer because they saw it in English in the game, they told me that this is a bottle you use to change the weather

This example demonstrates a more general use of the Querylog by the co-located team. "It's our local forum", as another translator said.

Additional informal work practices for raising and maintaining awareness are required when team members interact around the Querylog. After the translator was told what "bottle of weather" refers to, she "had to come up with a translation" (i.e. decide exactly how the term can be translated to express that the bottle is used to change the weather). The next step is to make other team members aware by telling them the answer:

> Normally we ask queries and if we get an answer then we close the query, the person who asked looks at the answer and tells everyone else

The Querylog includes a column titled "Status" in which the translator can flag a query as "closed". The column is used to "filter queries by status". The translator left the query open to make other language teams aware about this issue:

> It was already solved, I should have closed it, sometimes it is good to leave it for the other language teams because we don't tend to communicate much with them, we do it but not very regularly, normally we communicate with people from our department

The combination of (a) the Querylog to mediate communication between the translator and her team member (b) the team member telling the translator the answer (c) the translator making other team members aware and (d) leaving the query open to alert other language teams is another example of bricolage. The official protocol is again not strictly adhered to while collaboration also relies on informal interactions and subtle contextual cues.

Translators from one language team cannot see the work of another team. The teams are segregated from each other and communication between teams is less frequent than communication between team members. Given that some problems are not language-specific, segregation may be leading into duplication of effort. This may be particularly true for the work practices described in sections 4.2 to 4.5 which are not visible across teams.

From an organisational perspective, the Querylog was introduced to mediate the interactions between the translator and the Project Manager on the one hand, and the project manager and the client on the other. Additionally, it serves as the "local forum" of each language Team and as the main mechanism for maintaining awareness between language teams. Electronic and face-to-face communications augment the use of the Querylog in a number of ad hoc ways.

5 Discussion

In this section, we summarise the main findings of our study, state our contributions and discuss opportunities for better supporting work that has been impacted by increased reach.

5.1 Coordinating to achieve consistent translations

Although translation is usually seen as an individual activity, producing consistent translations and maintaining the appropriate quality level is shown to be a collaborative task involving several translators. A range of ad-hoc coordination mechanisms support this activity. The TM makes the work of co-located members visible to each other and enables them to discriminate it from contributions by remote actors (section 4.2). "Team tools" collaboratively created by the co-located team are also used to coordinate their work (section 4.3.2). The Querylog, an artefact introduced to the setting to formally mediate cross-organisation communication, serves as their "local forum" (section 4.6.2).

The mechanisms are blended with informal communication. Physical arrangement and shared context favour face-to-face communication but this can be augmented with computer-mediated exchanges (section 4.5.1) and unanticipated uses of artefacts such as the task sheet (sections 4.1 and 4.3.1).

Reconciling differences greatly relies on these informal practices (section 4.5). These mechanisms are also crucial for raising and maintaining awareness about changes in the setting (sections 4.3.2 and 4.6).

Important aspects of these mechanisms have received little attention previously by stakeholders in the setting. The TM, for example, is primarily viewed in terms of its use to recycle translations (Somers 2003; Wittner and Goldschmidt 2007); its role in coordinating teamwork and in establishing trust are not documented. Likewise, the typical, transaction-based, view of the localisation process (Esselink 2003) does not consider how informal practices help maintain awareness and resolve conflicts locally. Cross-organisational communication patterns in this domain have not been studied in significant detail either.

5.2 Tensions caused by increased reach and segregation

Mutual trust built on shared context and coordination plays an important role as shown by the translators' trust assessments of contributions in the TM (section 4.2) and their "team tool" (section 4.3.2). Co-located translators appear to share a collaborative attitude and reconcile differences smoothly (section 4.5).

Increased reach was found to cause various tensions. A freelancer's work is trusted less than that of a co-located member and the official process is adjusted in various ways in response to this (section 4.2.3). While email and instant messaging work well in the co-located setting, communication with freelancers is problematic (section 4.5.1).

Segregation also causes tensions in relation to the resources that the translator works with. Despite efforts by other actors involved, sometimes the translator is not provided with "everything she needs" (section 4.3.1). Searching online is one strategy for overcoming such limitations but additional checks are required for contributions by remote actors (section 4.4).

Communication with the client is constrained to occur via the project manager but this may cause bottlenecks (section 4.6). While the translators can bypass the official process to raise an issue with the project manager, progress beyond that point is largely opaque to them.

Conversely, the work of the translator is not particularly visible to the client. Many of the reported work practices rely on ad-hoc mechanisms for coordination and awareness (including direct verbal communication) and are not represented in the official process. Providing feedback about the process and the available resources is not seen as the translator's job (sections 4.3.1 and 4.6.1). Consequently, resources created by the translation team are not shared with the client (section 4.3.2).

While the formal handover process segregates decisions about terminology and translation (section 1.1), many of the examples that we report involve collaborative decisions about terms. The terminology manager and the linguist may receive queries but the full scope of problems is not revealed since translators view contacting the client as a last resort (section 4.6.1). Providing feedback to technical writers is not seen as their responsibility either (section 4.5.1). In these cases, increased reach has put severe constraints

upon collaboration across organisational boundaries. It also reduces the information available for optimising and evolving the process.

The work is also segregated into language departments without particular consideration of issues that may not be language-specific. The Querylog serves as the main mechanism for maintaining awareness between language teams, causing further deviations from the official process (section 4.6.2). However, decisions which are made within a team with the explicit purpose of not adding queries are not visible across teams, which may cause effort to be duplicated.

5.3 Opportunities for improved support

Our study has revealed a number of dependencies, a considerable level of informal communication, and a need for supporting coordination and awareness at a finer level of granularity than is generally acknowledged in the setting. At present, these needs are met through informal communication and the, largely unsupported, creation of organisational resources (Hartswood et al. 2008).

Cross-cutting ties help soften disputes arising between translators. There is evidence that computer mediation might, over time, help distributed groups develop levels of trust similar to those of co-located workers (Wilson et al. 2006). It is therefore possible that the barriers created by the distribution of work could be minimised through the introduction of technologies that support the establishment of less formal communication channels, which are currently absent from workflow systems.

A major ongoing development in the area of translation is the more widespread introduction of Machine Translation (MT) technology (Karamanis et al. 2011). In MT projects, the translator post-edits machine-translated text, rather than translating from scratch. While significant preparation work by the client would accompany any commercial use of MT, the quality of the output can vary widely, and MT development, preparation and tuning activities are generally segregated from the rest of the authoring and localisation process. However, the effects (good or bad) of this preparation and tuning work are seen for the most part within the translation process, and the identification and resolution of problems with the MT engine or quality of MT glossary preparation would require that complex information regarding problems in translation post-editing be passed back from the LSP to a range of responsible staff within the client and MT provider, in addition to the existing information. Given the range of issues already encountered in the performance of localisation work, the cross-organisational articulation work surrounding the monitoring and tuning of the MT and metawork of identifying desirable changes to surrounding activities (including authoring) can be expected to put further strain on the coordination mechanisms described above, and explicit support for these would be interesting to consider. For example, the use of a restricted grammar and vocabulary ("Controlled Language") can enhance the performance of MT, but optimisation of this process would require coordination between LSP (where the effects are seen), the client (in whose interest the optimisation is carried out), the MT provider

(who must be able to take advantage of Controlled Language), and the authors (who might benefit from awareness of the effects of non-adherence).

Obtaining more visibility to the work of the translator by other related actors (and vice versa) may also improve cross-organisational and inter-departmental interaction. Following the questions posed by (Schmidt 2002, p.294-5), there are a range factors to consider in such efforts to improve awareness. What information on translation effort should be provided to actors such as authors? How can we help the actors to make sense of this information? Do the authors have enough context on the downstream localisation process in order to understand this information? What support and tools can be provided to the actors for maintaining awareness? How can we support actors in seeing the relevance of this information with respect to their own goals, and those of the organisation? Integrating feedback on translation effort into authoring and terminology management tools would be one potential avenue for support.

Other more effortful and direct communications could also be helpful. Encouraging the discussion of terminological issues, for instance, could form the basis of a more dynamic and collaborative approach to resolving problems. Supporting the cross-organisational creation and maintenance of shared artefacts related to terminology (an informal practice which currently takes place within each language department but does not cross organisational boundaries) more explicitly would be one way of achieving this. Such artefacts would be augmented by the informal communication channels mentioned above. These activities could be further enhanced by being linked with entities and artefacts which are currently part of the formal workflow. For example, segments in the TM which give rise to a terminological issue could be flagged and linked with the related entry on a shared terminological artefact and the communications which occur to address the problem. This would make the effort expanded on resolving such problems more visible to the various actors involved and support awareness more directly when new issues emerge. It will also make more information available for optimising the process.

6 Conclusion

Through this study of cross-organisational work in the localisation industry, we have made the case that increased reach and segregation have placed a strain on the mechanisms to support local articulation and metawork. Using the concepts of coordination mechanisms, awareness mechanisms, and communication patterns, we have provided a timely and concrete illustration of the issues raised by Gerson (2008), supporting the relevance of this work to cross-organisational studies in CSCW, and explored the impact of increased reach upon cross-organisational work in a localisation context. The creation and use of ad-hoc coordination mechanisms in the LSP is not visible to the client, and this lack of awareness acts as a barrier to the effective operation and evolution of the work system. The cross-organisational boundary also acts as a barrier to communication, and this is exacerbated by the segregation of activities and the embedding of this segregation within

course-grained workflow management tools. The impact of reach can also be seen in the way freelancers are effectively excluded from many of the co-located coordination mechanisms used to achieve goals such as producing consistent translations, and related difficulties with communication, awareness, and trust. Many of these issues may arise in the performance of other types of cross-organisational work, and as such the study may be of interest to those studying domains with similar characteristics with respect to organisational and workflow-based segregation and increased reach. It may also be of interest to those developing technologies which aim to facilitate collaborative work, and enhance cross-cutting ties between remote collaborators. The challenge now posed to CSCW is not only to further develop our understanding of cross-organisational work, but to explore organisational and technological actions to mitigate and counteract the disarticulation of work along the identified dimensions. At a concrete level, we have identified a variety of mechanisms used to support the work, some of which have not previously been recognised as significant within the domain, and shown how these have come under pressure as reach has increased. We have also identified a number of unmet needs within the domain along with opportunities for improved support.

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