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Chapter 2: A Definition of Digital Media Literacy Competences Required by Workers to Collaborate in Distance Work Environments

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Introduction

Over the years, information and communication technology (ICT) has become a cornerstone of the world of work, as it has for all other aspects of our lives. Digital technology is now ubiquitous in the workplace, especially for office workers. Technological and social evolutions have given way to new ways of working individually and collectively. Digital tools contribute to redefining the content of work, as much of the information workers deal with is now digitized, and comes in increasing volumes, creating risks of information overload. The context of work has also undergone major changes, with more and more people teleworking from their homes, sharing coworking spaces, or working on the go with mobile technology. Additionally, how people work together, and coordinate to do so, heavily relies on (synchronous and asynchronous) computer-mediated communication, shared information spaces, social networks and authoring tools and platforms.

In all of these domains, digital technologies create challenges for workers as much as they offer opportunities and support. As they are both the objects and the agents of these massive evolutions, workers need to develop new strategies, build new knowledge, acquire new skills. In a word: they must develop their competences. This chapter focuses on the issue of the competences related to the digitization of work, in the specific area of distance collaboration. The main question it attempts to answer is: what are the digital competences needed by workers to collaborate in distance work environments?

Rather than considering this question from the perspective of technical skills, we address it from the perspective of digital media literacy (DML). Defined as a set of interrelated informational, technical and social competences (Fastrez, 2010; Fastrez & De Smedt, 2012) involved in digital media practices, digital media literacy extends the view of the competences required to collaborate in the distance beyond technology-centered approaches, to consider how workers integrate the use of ICT into meaningful activities that articulate tools, contents and relationships.

Discourses in organizations emphasize the *need* for people to collaborate in teams and to work at a distance, to be able to share information in various formats and to cooperate in flexible ways through the mediation of technology, especially in "New Way of Working (NWOW)" contexts. In this view, workers seem required to simply follow technological transformations and adapt to the ever-changing work landscape. In comparison, we consider that digital media literacy cannot be limited to a set of skills that enable workers to comply with the evolution of organizational socio-technical systems. These evolutions of work environments also call for the ability to be critical towards them, as well as to be creative and to combine, invent and modify innovative technologically-mediated practices.

The focus of this chapter is set on the very definition of this array of competences. Contrary to most existing approaches, we chose to adopt an agnostic stance towards our object of study, by acknowledging that we did not know what competences composed the digital media literacy of distance collaboration. Consequently, rather than proposing a definition of DML competences for distance teamwork based on the opinion of experts, a literature review, or a theoretical construction, we set ourselves to define these competences from the perspective of the actors who exert them: the workers. Hence, our overall approach is an interpretive one. Our goal is to propose a map of the DML of distance collaboration based on the discourse of workers: how they conceive the work situations of distance collaboration, and to what extent they are able to deal with them in meaningful and appropriate ways from their perspective.

This chapter is structured as follows. First, we lay out the theoretical framework for our work. We introduce the concept of digital media literacy and discuss how it positions our object of study beyond a technologically-centered approach, encompasses both basic operational skills and full-fledged competences, and allows us to articulate both functional and critical aspects of these competences. We then specify the relationship between DML and the social practices that actualize them. Finally, we define categories of collaborative work that are essential to our observation of distance collaboration practices. Second, we detail the methods of data collection and analysis we used to infer a map of DML competence from the interview and observational data of sixty workers engaged in distance collaboration in ten public and private Belgian organizations. Third, we present an overview of the results of our analyses, followed by a detailed description of the domains of competence we identified, in terms of activities collaborators perform, and dimensions these activities include. Fourth, we offer an alternative, complementary

look at our data in the form of aggregated quantitative indicators. Finally, our conclusions are presented based on the discussion of the results.

Theoretical Framework

Digital Media Literacy Competences

Abilities related to the use of digital technology have been called a number of names: online skills (Hargittai, 2002), internet skills (Hargittai, 2010; Litt, 2013; Scheerder, van Deursen & van Dijk, 2017), digital skills (Curtarelli, Gualtieri, Jannati & Donlevy, 2017; Eynon & Geniets, 2016; J. A. G. M. van Dijk & van Deursen, 2014), e-literacy (Brandtweiner, Donat & Kerschbaum, 2010), digital literacy (Buckingham, 2006; Eshet-Alkalai, 2004), digital competence (Carretero Gomez, Vuorikari & Punie, 2017), to name only a few. Considering the multiple approaches to these abilities that this diversity of names reflects, digital *media* literacy[7] does not necessarily appear as the obvious first choice when it comes to choosing a concept to frame the description of how people are able to work together with and through technology. Why, then, treat the issue of distance teamwork from this perspective?

Our argument is that studying technologically-mediated collaborative work practices in terms of digital media literacy anchors our analyses in a conceptual framework that broadens the way they are viewed. In brief, it allows us to use the conceptual apparatus built to conceptualize media literacy (mostly originating in the field of media education) and specify it in the realm of digital technology (hence the expression "*digital* media literacy"). This position justifies itself by the limitations we see in the common approach to digital literacy.

Describing how the presence of media literacy in the public agenda has evolved over time, Buckingham (2009) warned that the proximity between media literacy and digital literacy, another concept that gained substantial importance in the official discourses, may have dire consequences on what is included in the concept of media literacy. His argument, to which we subscribe, stemmed from the claim that media literacy and digital literacy fostered participation:

> Participation is clearly seen here as a good thing in itself – although it is often rather loosely defined. In practice, participation seems to be largely confined to basic functions such as accessing e-government, job seeking, finding health information, online training, paying your taxes, and of course shopping. It stops quite a long way

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[7] In this chapter, we will use the phrase "digital media literacy" to name the general category of abilities in which we place the competences of distant collaboration studied in our research. These competences could arguably also be seen as related to information literacy – a perspective we have adopted in other publications (Collard, De Smedt, Fastrez, Ligurgo & Philippette, 2016; Ligurgo, Philippette, Fastrez, Collard & Jacques, 2018). Rather than viewing digital literacy, media literacy and information literacy as exclusive categories, we consider them as concepts designating largely overlapping phenomena.

short of the kinds of democratic participation that some of the more enthusiastic proponents of digital activism find so exciting. The skills that are involved here are also essentially functional or operational – "how-to" skills. (Buckingham, 2009: 17)

We identify three distinct shortcomings in the view of digital literacy denounced by Buckingham: it is technologically-centered; it is limited to basic, operational skills; and it is essentially functional and instrumental. These three shortcomings may easily be applied to the way distance collaborative work is studied. The view we advocate for constitutes an attempt at overcoming them. Let us consider them each in turn.

First, our research veers away from tool-oriented approaches that reduce digital competences to technology-related skills. Such approaches tend to define their unit of analysis based on the use of specific software or hardware tools by workers, and to focus on the individual's ability to operate them. By examining digital competences through the lens of literacy, we mean to focus on meaning-making rather than on technical operation. Literacy, traditionally defined as the ability to read and write,

is beginning to be defined as the ability to share meaning through symbol systems in order to fully participate in society. Similarly, the term "text" is beginning to be understood as any form of expression or communication in fixed and tangible form that uses symbol systems, including language, still and moving images, graphic design, sound, music and interactivity. (Hobbs, 2010, pp. 16–17).

We associate this broad view of literacy, conceived as calling "us to generate and communicate meanings and to invite others to make meaning from our texts in turn" (Knobel & Lankshear, 2007, p. 4), with a similarly broad view of media. As Anderson and Meyer defined it, "a medium is a recognizable human activity that organizes reality into readable texts for engagement" (1988, p. 316). The combination of these two definitions of media and literacy leads us to envision media literacy as the ability to share meaning in order to participate in human activities that organize reality into readable texts for engagement.

The choice of studying how people are able to use technology (for distance collaboration at work) through the lens of media literacy represent a shift from a focus on digital technology to a focus on the human activities they support, and on the meaning these activities have for those who participate in them. Referring to *digital* media literacy limits the abilities under scrutiny to those related to digital technology, or, to be more specific, to digital information and communication technology (ICT), that is, those technologies involving the production, diffusion and reception of "readable texts". In this view, digital technology is best seen as means of producing texts (calls, messages, documents, reports, job descriptions, meeting agendas, file collections, digital workspaces, ...), or as texts themselves (as a technology's interface needs to be readable and meaningful to its user).

The notions of "engagement" in Anderson and Meyer's definition of media, and of "participation in society" in Hobbs' definition of literacy, can be easily specified in the

context of the digitized world of work: digital media literacy at work enables workers to engage into meaningful work activities through the use of digital technology: meaningful for their employers, as well as meaningful for themselves and their coworkers.

A second potential shortcoming of the study of the abilities related to digital media and technology lies in its limitation to basic, operational skills, such as using a search engine to find information online, connecting to content providers (news, movies, television programs…), interacting with public or private institutions through the web, staying in touch with friends, family or colleagues through the use of mobile telephony, e-mail or social networks, or posting statuses, comments or pictures on the web for others to see.

This is where the difference between competences and skills needs to be introduced. The concept of competence emerged as an attempt to reduce a gap between formal education and the employment market, that is, between qualifications, defined as a set of techniques and know-hows recognized by a degree or a certification (Rey, Carette, Defrance & Kahn, 2012), and the reality of the job. The competent worker is able to "manage a complex professional situation" (Le Boterf, 1997). Whereas skills enable the reproduction of learnt procedures in ways and contexts that are similar to those in which they were assimilated, the concept of competence (Rey et al. 2012; Scallon, 2004) refers to the ability of the individual to engage intentionally in relevant courses of action in complex, novel and non-stereotyped situations, by drawing on their knowledge, skills and attitudes, and on the external resources available in the situation. Rey et al. (2012) mentioned four inherent properties of the concept of competence: (1) the adaptability it confers to a person, allowing her to face unexpected situations efficiently; (2) its singularity which connects it to the personality and the history of the person; (3) the fact that one cannot observe a competence directly, but only its effects through the performance of an activity and (4) the fact that it exceeds the simple possession of knowledge and know-hows to include the capacity to call upon them selectively to act in relevant ways in novels situations.

In brief, the basic skills needed to operate digital technology are only part of the resources available to the competent (media literate) individual (or in our case, worker), among which they can select, combine and apply the most relevant ones depending on the situation they are part of. Such cognitive resources not only include other skills than technical ones, but also knowledge of various types. Cognitive resources are themselves part of what Masciotra and Medzo call internal resources, which also include conative (e.g. motivational, attitudinal) and corporeal (e.g. one's dexterity, motor skills, strength, morphology...) ressources, as opposed to external (human and material) resources (Masciotra & Medzo, 2009, pp. 65–70). Confronted with a novel situation, the competent individual can intentionally choose and articulate the most relevant internal and external resources at their disposal to provide a solution to the problem they are facing. As a matter of fact, the very ability to define the problem and its constitutive dimensions (and hence how to best solve it) is part of the individual's competence (Schön, 1983). In addition to being able to act in relevant ways in the face of the unexpected, the same

authors insist that the competent individual is also able to take a reflective stance on their own actions, rather than mindlessly execute them. Intentional action and reflection both call upon the individual's metacognitive abilities, which have been associated both with competence (Westera, 2001) and with media literacy (Piette, 1996).

The distinction between skill and competence, as defined above, is what motivates us to define the digital media literacy of distance work collaboration as a set of competences. But even when one embraces the concept of digital competence (rather than skill) and integrates reflexivity in its definition, a third potential limitation concerns the general orientation of such competence, and correlatively the very purpose of its development.

Livingstone (2008) contrasted the different purposes that may be assigned to the development of media literacy. According to her, a first purpose is related to democracy, participation, and active citizenship. In this view, media literacy benefits individuals in that it allows them to be informed citizens that are well equipped to participate actively in the democratic process. The ability to access, understand and evaluate information and media allows them to inform themselves and think autonomously and critically. The ability to create media supports them in making their voice heard in the public sphere.

A second purpose cited by Livingstone et al. (2008) is related to the knowledge economy, competitiveness, and choice. Here, the individual is considered in their relationship to the economy, that is, the market economy, in two respects: as a consumer, or as a worker. As consumers, the media literate individuals are expected to be able to maximize their knowledge of alternatives in a transparent market, in order to make informed choices. For example, their ability to search for information online, coupled with their capacity to forestall the strategies of advertisers, would empower them in the choices they make regarding the products and services they wish to acquire. As workers, they are expected to put their media competences to use as part of their professional activity: accessing, selecting and evaluating the most relevant information for their job, and producing media messages in the context of work, all to achieve more on the workplace, and possibly climb up the ladder of employability. In both cases, media literacy is meant to allow people to reap the benefits of the use of media and technology to achieve their personal (or professional) goals (van Deursen, Courtois & van Dijk, 2014).

While the first purpose detailed above is historically linked to the media education movement, this second purpose is very much in line with the emergence of digital skills in the public (and particularly political) discourse (e.g. European Commission, 2009). In this context, the skilled use of digital technology (and especially the internet) is seen as essential for participation in a knowledge economy (Grant, 2007), and is considered as a way of reducing the second-level digital divide (Brotcorne, Damhuis, Laurent, Valenduc & Vendramin, 2010; Hargittai, 2002; J. van Dijk, 2005; J. A. G. M. van Dijk & van Deursen, 2014).

These two purposes delineate two horizons for digital media literacy, based on an opposition between compliance and inventivity in the uses of digital media. The first term

of this opposition is represented by the individual who develops *compliant* uses of media and technology. In this perspective, media literacy is defined as a set of functional skills necessary for being a "good citizen" or a "good economic agent" (e.g. a "good worker"). In other words, the literate individual is the one that is able to make use of technology to access information and maintain their relationships to other people and organizations. From this perspective, individuals must be able to adapt to the system. Technological innovation corresponds to an ineluctable evolution, with which they must keep up by developing appropriate uses of media and technology. As such, the citizen or economic agent is the object of change. The second term of the opposition is the individual who develops *inventive* uses of media and technology. In this perspective, media literacy is defined as a set of creative and critical competences that enable individuals to emancipate themselves from power relations and to adjust and rethink their media environment to improve their participation. In this case, the media literate individual is seen as an agent of change towards the media system they are a part of: instead of adapting to the system, they can trigger adaptive transformations of the system.

Of course, the relationship between compliance and inventivity cannot be conceived as a dichotomy. Rather, they define two alternative views of digital media literacy, one narrower than the other. In our research, we support the second, more inclusive view. The first view is functional, instrumental, and centered on the notion of compliance only. It poses that people should be able to use digital media and technology to properly function in their everyday life and not live in isolation: have access to information and entertainment media, be registered with public services, shop online, and maintain contacts with other people. At work, this means having access to the digital information required to perform one's job, using a mailbox, video calls or instant messages with colleagues, producing and distributing documents (possibly with the cooperation of others), managing one's files on storage devices, etc. This perspective also corresponds to a minimal view of autonomy, in which the individuals are able to "manage themselves" and to function within the established frames of society or work without the constant and necessary assistance of others. We call this first-order autonomy.

The second view is not opposed to the first one, but rather extends it considerably, and combines compliance *with* inventivity. Instead of limiting media literacy to functional skills, it defines it as the set of media competences that enables active citizenship (or workmanship), critical emancipation from media discourses, and creative appropriation of media devices. This means they can be both compliant and inventive, depending on the situation. This second view poses that the digital media literate person is able to (re)define, or (re)invent, the conditions of their own inclusion to society (or to the workplace), that is, how they perform their roles within the different communities to which they belong, how they maintain, nurture or alter their relationships with institutions and organizations, or how they achieve their duties as citizens or workers. We call this second-order autonomy.

Whereas the first, instrumental and functional view of digital media literacy may appear as a natural fit for the contemporary world of work, where pressure towards competitiveness and employability is high, we advocate the wider view combining compliance with inventivity. In this view, we consider workers' abilities to go beyond the mindless execution of their tasks with technology, and take a critical and reflexive perspective on the way digital media and technology supports (or hinders) their work, potentially leading to the formulation of inventive technological solutions to the problem-situations they encounter as part of their work. Of course, the level of inventivity in any worker's practices may be a function of their position, or of the organizational context in which they evolve. Still, considering inventivity as a possible horizon beyond compliance in digital media use is important. More fundamentally, our perspective on DML is centered on meaning-making rather than on technology use itself, and on competence rather than on skills.

Literacies as Competences and Social Practices: An Interpretive Approach

In the previous section, we highlighted how studying distance collaborative work *practices* from the perspective of digital media *literacy* lead us to focus on meaning-making rather than on technology use. However, the relationship between literacy and practices needs to be elaborated a little further, and this is the purpose of this section.

The very concept of literacy has been the topic of lively discussion in the scientific literature, and has lent itself to diverging interpretations. On the one hand, literacy has traditionally been defined in terms of generic cognitive skills that, in themselves, have effects on the development of the individual's cognitive life. Street (2006) cites Goody (1977) as the primary advocate for this view in the field of social anthropology. In the field of media literacy, Potter (2004) represents a notable example of such an approach, rooted in the information-processing tradition of cognitive science, and founding the definition of media literacy in seven skills (analysis, evaluation, grouping, induction, deduction, synthesis, and abstracting) and five types of knowledge structures (on media content, media industries, media effects, the real world, and oneself). As such cognitive skills are highly abstract, they are assumed to lend themselves to assessment through standardized tests independently of the specific context of their use. On the other hand, an alternative view of literacy, developed through a body of research known as the New Literacies Studies, has emerged in reaction to this cognitive view. This alternative view describes literacy in terms of situated social practices that depend on the socio-cultural context in which they develop. Street (1984) uses the terms "ideological models of literacy" to describe this approach, as opposed to the (cognitive) "autonomous models" of literacy. An important aspect of ideological models of literacy is the recognition that there is no such thing as one literacy, but rather that many different literacies exist, all tied to their respective contexts, each involving "a diverse range of skills and understandings,

for example digital literacies" (Stordy, 2015, p. 459). As a matter of fact, what counts as literacy (and who is in a position to decide it) is an essentially political question. Considering literacies as a social practices means that "some conceptions of literacy are more powerful and imposed on other cultures or classes" (Stordy, 2015, p. 457). From this standpoint, autonomous models simply reflect the western view of literacy, and impose it on other cultures without acknowledging it (B. Street, 2006).

Based on how we framed digital media literacy in terms of competence, one may believe we place ourselves in the cognitive "autonomous" tradition of literacy studies. This is not the case, for the following reasons. While we don't specifically identify with the New Literacy Studies movement, we do adopt the perspective of studying social practices in order to define digital media literacy, or, more specifically, of studying distance collaborative work practices to define the specific form of digital media literacy they are associated with. Yet, we emphasize the importance of defining digital media literacy in terms of abilities (what people are able to do) and not just in terms of practices (what people do), as any definition of (digital media) literacy includes the notion of ability, not just practice.

Still, our approach to DML *competences* is (1) situational (we consider skills as merely one type of resources that can be combined in the context of situated action) and (2) rooted in the analysis of digital media practices. Framing what workers do when they collaborate from a distance in terms of social practices emphasizes three features of their action. First, they are habitual, routinized ways of acting that both have a material and a mental dimension.

> A "practice" (Praktik) is a routinized type of behaviour which consists of several elements, interconnected to one other: forms of bodily activities, forms of mental activities, "things" and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge. (Reckwitz, 2002, p. 249)

The elements in Reckwitz's definition echo the notion of multiple (internal and external) resources combined by the competent individual in the context of their situated action. In addition to be routinized or habitual, these practices are also social, in the sense that they are shared: they represent "socially developed and patterned ways of using technology and knowledge to accomplish tasks" (Scribner & Cole, 1981, p. 236). Finally, they are inseparable from the meaning that individuals invest in them, as there is neither "practice without meaning", nor "meaning outside of practice" (Knobel & Lankshear, 2007, p. 2).

Shove and colleagues proposed a model of social practices that includes several of the elements we already mentioned. Their model connects three types of elements:

> *materials* – including things, technologies, tangible physical entities, and the stuff of which objects are made;
> *competences* – which encompass skill, know-how and technique; and

> *meanings* – in which we include symbolic meanings, ideas and aspirations. (Shove, Pantzar & Watson, 2012, p. 14)

Let us briefly examine how these different elements affect our own approach to distance collaborative practices. As far as their *material* and *social* dimensions are concerned, when documenting these practices, we examine how courses of action depend on their material and social circumstances, and consider office spaces as "ecologies where office and inhabitant co-evolve" (Kirsh, 2001, p. 308). Treating distance teamwork as shared social practices also means looking at practices in teams, and how they are constructed through social interaction between team members. This requires collecting data on how team members work together, that is, coordinate (establish routines) and cooperate (enact them). (The distinction we make between coordination and cooperation will be covered in the next section.)

The inextricable relationship between practice and *meaning* is what justifies our interpretive approach: we mean to examine the practices of distance collaboration from the perspective of the lived experience of workers (i.e. the meaning they associate with the practices they engage in), and to derive the competences of distance collaboration from this perspective as well.

As for the relationship between competences and practices, we consider it to be the following. Practices are situated performances that are shaped by the affordances and constraints of the material and social resources of the site in which they unfold. Practices make the individual's competences manifest: their ability to opportunistically make relevant use of the material and social resources available in the context in which work is achieved, along with their own knowledge and skills. In this sense, digital media literacy can be interpreted both as a set of competences and as a set of situated practices.

Hence, we examine the practices of distance teamwork to infer the DML of the individuals that perform them. Specifically, we examine how they *define* work situations that involve distance collaboration from their perspective, how they position themselves in these situations, and how they consequently *adopt relevant conducts* (Masciotra & Medzo, 2009). We will come back to these distinctions in the Methods section.

Categories of Collaborative Work

In the previous sections, we described distance teamwork as an array of activities involving the use of digital media and technology, and proposed to study it as a form of literacy, thereby focusing on meaning-making rather than on technology use. We now turn to another central aspect of our research object: its collective dimension. Two distinctions need to be introduced in order to further frame our analyses: a distinction between coordination work and cooperation work, and a distinction between articulation work and production work.

Coordination Work vs. Cooperation Work

Working with others within a team at a distance is a form of collaboration. In this chapter, we use the terms "collaboration" or "collaborative work" as the general category describing the activity of people who work together[8] towards a common goal and share the responsibility of the outcomes of their activity (see Chapter 4). Within collaborative work, we distinguish between cooperation (or cooperative work) and coordination (or coordinative work).

Cooperation[9] indicates the collective performance of work, the achievement of interdependent work-related tasks itself. As Schmidt and Bannon put it: "The term 'cooperative work' should be taken as the general and neutral designation of multiple persons working together to produce a product or service" (Schmidt & Bannon, 1992, p. 15). In brief, cooperation means doing one's job collectively. By contrast, we define coordination[10] as the activities through which coworkers produce the necessary organization of the tasks, resources and roles that allow them to perform their cooperative work together. In that respect, coordination work represents a type of "meta-work" (working collectively on how collective work is performed). The concept of coordination mechanism helps specify the role of technology in coordination.

> A coordination mechanism is a construct consisting of a coordinative protocol (an integrated set of procedures and conventions stipulating the articulation of interdependent distributed activities) on the one hand and on the other hand an artifact (a permanent symbolic construct) in which the protocol is objectified. (Schmidt & Simone, 1996, pp. 165–266)

Coordination work involves the design or re-design of coordination protocols, which, in many cases, come to be objectified into a technological artifact (hardware or software, analog or digital, possibly combining many bits of technology), which both stipulates and mediates how cooperative work is supposed to be coordinated.

Articulation Work vs. Production Work

Strauss (1985, 1988) introduced a distinction between production work and articulation work, which, at first sight, may look similar to the distinction between cooperation and coordination[11]. This distinction is based on the recognition that collaborative work

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[8] As the etymology of collaboration indicates it: from "co-" (from latin "cum", with) and "labor" (from latin, work).

[9] From "co-", 'together' (from latin "cum", with) and "operor" (from latin, to work, to produce an effect, to be efficient).

[10] From "co-", 'together' (from latin "cum", with) and "ordinare" (from latin, to order, from "ordo", order).

[11] Other authors have reused Strauss' distinction but relabeled production work as 'cooperative work' (Schmidt & Simone, 1996). For the sake of clarity, we will stick to Strauss' original choice of words.

dedicated to the production of goods or services entails, by nature, a division of labor (both between actors and between actions), and that the different tasks it involves, and the relation of actors to tasks, need to be articulated. Hence, articulation work is

> a kind of supra-type of work in any division of labor, done by the various actors (themselves accountable to others). Articulation work amounts to the following: First, the meshing of the often numerous tasks, clusters of tasks, and segments of the total arc. Second, the meshing of efforts of various unit-workers (individuals, departments, etc.). Third, the meshing of actors with their various types of work and implicated tasks. (Strauss, 1985, p. 8)

The concept of articulation work highlights the fact that cooperative work does not consist in the simple execution of coordination protocols, be they imposed by the organization or chosen and designed by the team members. "Articulation work arises as a integral part of cooperative work as a set of activities required to manage the distributed nature of cooperative work." (Schmidt & Bannon, 1992, p. 18). As Schmidt and Simone noted, coordination mechanisms do not direct action per se. They are not simply or mindlessly executed. Rather, they act as resources (either internal when they only exist in workers' minds, or external when they are objectified in an artifact) that can be called upon as part of the cooperative work. Just like a map does not control the traveler's movements, but is produced to guide travelers, and interpreted by them in context (Suchman, 2007), a coordination mechanism is designed to guide workers, but needs to be instantiated and interpreted during cooperation (Schmidt & Simone, 1996). This means that coordination protocols are by nature underspecified, and that in many cases, workers need to adapt them, circumvent them or deviate from them, and make ad hoc decisions based on the contingencies of the situation they are in. These decisions are part of the articulation work.

The relationship between production work and articulation work is a recursive one, as the management of articulation work is itself articulation work (as when team members pause a meeting to discuss the necessity to change how the meeting is managed), ad infinitum (Schmidt & Simone, 1996; Star & Strauss, 1999). It is also worth noting that articulation work is most often "invisible work" that fails to appear in job descriptions or be valorized as actual work (Star, 1991; Star & Strauss, 1999).

Articulation Work in Coordination Work and in Cooperative Work

The place of articulation work within collaborative work is subject to what appears to be different interpretations among the authors who described it. For example, Star (1991) seems to equate articulation work with real-time adjustments to put cooperative work "back on track".

> Articulation work is work that gets things back "on track" in the face of the unexpected, and modifies action to accommodate unanticipated contingencies. The important

thing about articulation work is that it is invisible to rationalized models of work. (Star, 1991, p. 275)

We do not share this view, which positions articulation work solely as a part of what we called cooperative work. In contrast, we consider coordination work to be another type of articulation work, as explained in this description of coordinative protocols by Schmidt and Simone:

> A coordinative protocol is a resource for situated action in that it reduces the complexity of articulating cooperative work by providing a precomputation of task interdependencies which actors, for all practical purposes, can rely on to reduce the space of possibilities by identifying a valid and yet limited set of options for coordinative action in any given situation. (Schmidt & Simone, 1996, p. 174)

Figure 2.1 depicts how we conceive the relationship between coordination work, cooperation work, articulation work and production work.
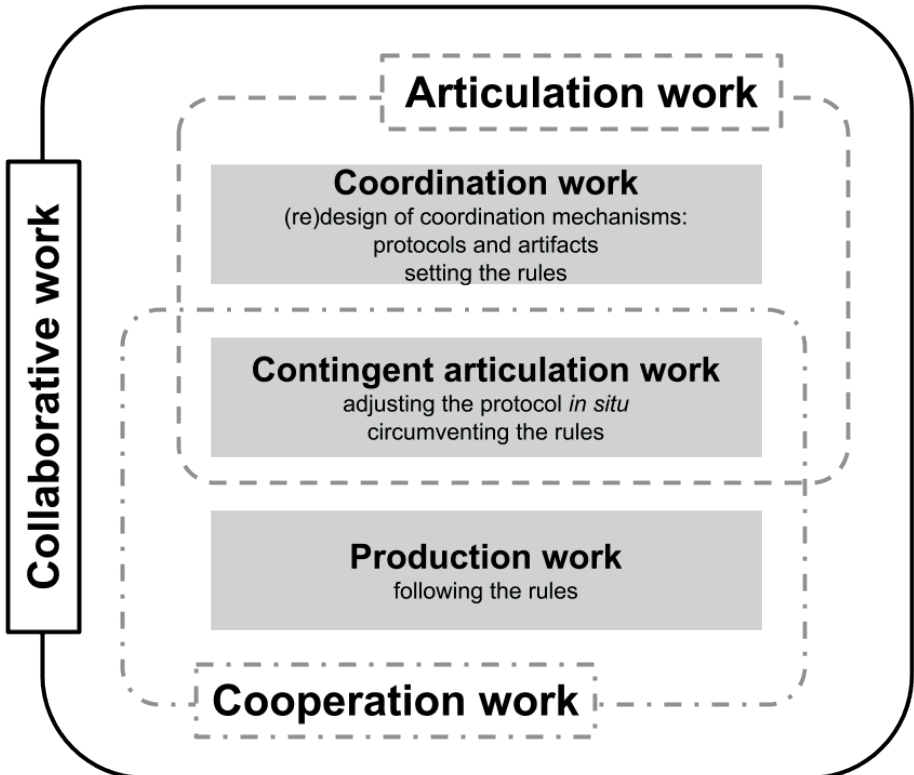

Figure 2.1: Categories of collaboration: coordination and cooperation, articulation and production.

Hence, we examine how office workers perform articulation work both as they design coordination mechanisms and as they adapt their execution of coordination protocols to accommodate the "unanticipated contingencies" of the distribution of their work (Star, 1991, p. 275). Whereas research on computer-supported cooperative work (CSCW) has devoted its attention to the design of systems that adequately support cooperative work by providing coordination mechanisms in the form of "artifactually imprinted protocols" (Schmidt & Simone, 1996), we look at the workers' ability to design their own coordination mechanism using technology, and use and adapt them as part of their collaborative work. Of course, this assumes that team members are actually in a position to design anything at all (either by developing their own technologies, or □in most cases□ by adopting and assembling existing and available technologies), which critically depends on the organizational context they work in. To the extent that they have the possibility to do so, our observations include, for example, how workers are able to combine systems, create specific tools or bypass the devices implemented by their employers, all of which may be required by the workers' team activities to achieve their objectives. In all of such instances, workers switch from complying with an established coordinative protocol involving the use of digital technology, to inventing ways of adapting the protocol to the current situation.

The use of the concept of articulation work allows us to emphasize how workers are able to develop a mindful posture towards the role played by technology in their work, as articulation work is necessarily a process of conscious thought, whether in the form of precomputation produced by coordination work, or in the form of ad hoc adaptation of the designed procedures. This mindful posture, that exceeds the routine application of technological know-hows, is in line with the idea that competence involves intentional, conscious behavior (Westera, 2001)[12].

Method

Data Collection Instruments and Process

Our data collection process primarily involved interviews with office workers, complemented by observations in their everyday work environments. Two teams were selected within each of the ten organizations participating in the research program, which each introduced changes in the way their employees work in team and at a distance. In each of these teams, one manager and two team members were interviewed, making up a total of forty-one workers[13] and twenty managers.

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[12] Westera notes that even if competent behavior can be highly routinized and automated, its routinization necessarily starts from intentionally elaborated action sequences.

[13] The configuration of one team, which included a project manager in addition to the team members and team leader, lead us to interview and observe four participants instead of three, leading to a total of 41 workers.

Our informants' work practices were documented through interviews which turned into guided tours of the informants' workspaces (Malone, 1983; Barreau & Nardi, 1995), led by the informants. Our interview protocol was based on a set of collaborative activities identified by reviewing the computer-supported cooperative work (CSCW) literature (Olson & Olson, 1997, 2012; Grudin & Poltrock, 2012, 2013), a subfield of the Human-Computer Interaction dedicated to the design of collaborative technologies, based on observational research on collaborative work practices. We used the CSCW literature to identify the activities related to distance teamwork that could be supported by digital technology. The following eleven activities (Collard et al., 2016) were selected as an initial, tentative inventory of technologically-mediated distance collaborative activities:

1) Making collective decisions regarding task distribution, team governance and roles, and overall team functioning
2) Managing one's tasks in relation with others
3) Planning the team's activity
4) Planning a meeting
5) Working synchronously in the distance with other team members
6) Organizing one's workspaces for collaboration
7) Managing incoming information
8) Managing outgoing information
9) Using others to find information
10) Sharing a collection of documents
11) Authoring a document collectively

Our interview guide detailed each of these eleven activities into up to eight dimensions of distance teamwork, which were systematically accounted for in our data collection. These eight dimensions allow for the fine-grained analysis of how workers are able to perform these activities. The necessary redundancy between activities and dimensions accounts for the intricate relationships between the technologically-mediated activities of distance teamwork. These dimensions are the following:

1) Task management
2) Information management
3) Time management
4) Awareness
5) Space and distance management
6) Collective decision making
7) Réflective tool use
8) Comprehension of "sociomatics"[14]

Not all eight dimensions are relevant for all eleven activities. Table 2.1 represents which dimension was explored for which activity. Each dot in the table corresponds to a (set of) follow-up question(s) in our interview guide.

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[14] Understanding the social consequences of technology use.

Table 2.1: Eleven Activities and Eight Dimensions Covered
by the Interview Guide

Activities \ Dimensions	Task management	Information management	Time management	Awareness	Space and distance management	Collective decision making	Reflective tool use	Comprehension of sociomatics
Making collective decisions regarding task distribution, team governance and roles, and overall team functioning		●	●	●	●	●	●	●
Managing one's tasks in relation with others	●	●	●	●	●		●	●
Planning the team's activity	●	●		●	●	●	●	●
Planning a meeting	●	●	●	●	●	●	●	●
Working synchronously in the distance with other team members	●	●	●	●			●	●
Organizing one's workspaces for collaboration	●	●	●	●	●	●	●	●
Managing incoming information		●	●	●			●	
Managing outgoing information		●		●	●		●	●
Using others to find information		●		●	●		●	●
Sharing a collection of documents		●		●	●		●	●
Authoring a document collectively	●	●	●	●	●	●	●	●

The categories detailed above acted as the basic structure of our interview guide, therefore orienting our data collection process and the initial phases of analysis. However, ultimately, these categories were questioned and revised through the analysis process. The revised categories are presented as part of our results.

Data Analysis Process

From Deductive to Inductive Coding

As stated above, we consider competences as not being limited to generic sets of attributes that workers possess and use (e.g. knowledge and skills), defined independently of their context. Indeed, "two workers may be identified as possessing identical attributes but may accomplish work differently, depending upon which attributes they use and how they use them" (Sandberg, 2000, p. 11).

Consequently, we aim at defining competences based on the "lived experience of work" (Sandberg, 2000), that is, the relationship between the worker and their work environment, taken as inextricably related. In this context, phenomenography (Marton, 1981, 1986), which has already yielded abundant discussion in the field of information behavior (see for example Bruce, 1997; Limberg, 2000, 2005; Yates et al., 2012), came as an important inspiration for the construction of our method, as it proposes "a research method for mapping the qualitatively different ways in which people experience,

conceptualize, perceive, and understand various aspects of, and phenomena in, the world around them" (Marton, 1986, p. 31).

Adopting an interpretive approach to the workers' perspective on distance teamwork calls for inductive analysis. However, a first "deductive scan" was applied to the interview transcripts and observation notes, in which we coded each part of the material according to the eleven activities and eight dimensions that structured of our interview guide, which were used as a tentative list of activities in which distance collaboration may arise and call for digital media literacy competences. This list allowed us to ensure that a variety of work practices were covered in our data. It also distributed the object of the investigation on several practices and allowed for a fine description of each of them (and possibly for a grouping of some of them based on the data). This represents an alternative to existing phenomenographic inquiries in information science, where researchers have tended to focus on the way people understand a single broad concept, as Bruce (1999) did with information literacy, Sandberg (2000) with competence in engine optimization, or Smith & McMenemy (2016) with political information. In our case, instead of explicitly asking our informants to describe their conception of a general category, such as "distance collaboration" or "digital media literacy for collaboration", we asked them to describe an array of specific collaborative practices they engaged in, and we used these descriptions to infer what the digital media literacy of distance collaboration is (see below).

The application of the deductive activity categories was followed by the inductive coding of the informants' experiences, with codes describing their practices. At this stage, our analyses used principles from the grounded theory method to build a theoretical understanding of the studied experiences (Charmaz, 2006; Glaser & Strauss, 1967). Our informants' discourse and our observations were coded to identify "properties of the subjectivity of actors" (Lejeune, 2014), which are gradually articulated to define conceptual categories. The categories account for the variation in the different conceptions of distance team-work practices, in accordance with the principles of phenomenography (Marton, 1981).

Inferring Competence Definitions from Descriptions of Practices

How we infer competences from this coding is not a straightforward process. Two principles of phenomenography define how we initiate this step of our analysis. First, our unit of analysis is the practice, not the individual. Distance teamwork practices are coded based both on the informant's discourse on them, and on their traces in the guided tours and in our observations. Second, the coded practices are pooled across our whole sample of informants, so that practices can be compared, contrasted, or grouped both within each informant and between different informants.

Our objective of competence definition imposes at least two requirements on our analysis: we should be able to describe the objects of competence (in terms of problem

situations workers are able to deal with) as well as the nature of a competent conduct (in terms of situated intentional action).

By describing their practices, our informants provided descriptions of the problem situations they need to address as part of their work, which constitute the objects of their competence. We used these descriptions as a basis for our analysis to build an inventory of typical problem situations that call for DML competences from the perspective of workers. Our focus on practices (not individuals) as the basic unit for analysis allowed us to pool descriptions of practices across all informants, so that we could group together descriptions that referred to the same problem situations. These problem situations are components of what we called activities in the description of our interview guide. For example, one activity labeled "organizing team meetings" contains several different components (which we will call "actions" later on) including "identify coworkers availabilities", "informing coworkers about one's own availability", or "making information available for the meeting participants". Each of these actions point to a different problem situation (e.g. "how can I make my own availability visible for my coworkers?"), which is addressed in different ways (i.e. through different situated social practices) by different informants. Hence, in our analyses, practices stand as alternative ways of performing actions as part of activities. In the process of constructing the inventory of problem situations, we used the list of eleven activities we surveyed in our interviews as a guide that was constantly challenged and questioned. The grouping of practice descriptions redefined the scope of these activities, and broke them down into smaller activity components (actions) corresponding to problem situations.

Additionally, the way our informants describe these situations depends on their competence. Indeed, a key aspect of professional practice is the ability to properly frame the problem situations that are constitutive of one's work: setting its boundaries, attending to its most relevant features, and imposing a coherence upon it. What Schön (1983) calls the "reflective practitioner" is able to frame known situations, and to construct new frames to face novel situations based on their experience. Our inductive coding documents the way our informants frame the work situations they describe, that is, how they identify and articulate different aspects, or dimensions of these situations and of the conduct they adopt to address them. Based on this coding, for any given problem situation, we group together descriptions that correspond to qualitatively similar conceptions of that situation.

Essentially, our analysis works towards both the identification of the set of distance collaboration situations that call for DML competences, and the identification of the different conceptions of (i.e. different ways of framing) each situation.

As Limberg (2000) noted, different conceptions of the same phenomenon can often be hierarchically ordered in terms of their increasing complexity. "More complex ways of experiencing means that the categories comprise more dimensions and a simultaneous awareness of these dimensions." (Limberg, 2000, pp. 58–59). The analytical process through which we define competences relies on this hierarchical ordering. As one's

ability to frame a situation in more or less complex ways is indicative of their competence (Sandberg, 2000), the ordered conceptions of distance teamwork partly define levels of DML competences.

However, our analysis does not stop at describing how workers understand (i.e. frame) their experience of work in qualitatively different but increasingly complex ways: it must also encompass how they are able to develop relevant conducts in the work situations they encounter. Here, our analysis shifts its focus to the intentional actions performed by our informants based on their understanding of the situation. In this case, competence is not necessarily indicated by the complexity of actions, but rather by their matching with their conception of the situation.

Of course, framing a problem situation and developing a conduct in it are related: "a capability for *acting* in a certain way reflects a capability of *experiencing* something in a certain way. The latter does not cause the former, but they are logically intertwined. You cannot act other than in relation to the world as you experience it." (Marton & Booth, 1997, p. 111). We consider the relationship between these two terms to be a conditional one, with framing being a necessary but insufficient cause to conduct.

Results

A Matrix Definition of Competences Required by Workers to Collaborate in Distance Work Environments

The results of our analyses take the form of a matrix of the competences required by workers to collaborate in distance work environments. This matrix of competences crosses activities involved in distance collaborative work with dimensions workers take into account when they think about and engage in these activities. This matricial definition allows for a fine grained description of the competences analyzed and has the advantage to display the relations between the different components of these competences which are deeply intertwined (Jacques & Fastrez, 2018).

The practices documented through the workers' interviews were grouped according to their nature into generic categories within a three-level activity structure. This hierarchical structure is the result of an inductive reorganization of the deductive categories used to structure our interview guide, leading to the formulation of original conceptual categories. These three levels can be described as follows, from the most abstract to the most specific:

• *Activity areas* are defined in terms of general objects that are essential components of distance collaboration: the team's tasks, team meetings, remote communication between team members, shared information spaces, and co-authored documents. These areas stand as meaningful units in the collaborators' conceptions of collaborative work.

- *Activities*: for each activity area, we identified two activities that complement each other. In each case, one activity is aimed at performing cooperation work (working together), and the other is aimed at performing coordination work (collectively producing the organization of the tasks, resources and roles necessary to work together). As explained in the first part of this chapter, the coordination activity is a kind of "meta-work" with respect to its cooperation counterpart. For example, shared information spaces call for both "organizing shared information spaces" (coordination) and actually "sharing information in dedicated spaces" (cooperation).
- *Actions*: activities can be divided into actions, "conscious processes directed at goals" (Kaptelinin, 2013) that contribute to the fulfilment of the activity's motive. These actions correspond to the problem situations we mentioned in the previous section. For example, organizing team meetings requires to identify the availabilities of team members, to schedule meetings, to make information available for the meeting participants, etc.

In our analyses, the same generic action corresponds to different specific *instrumented practices* performed (and described) by different informants: these practices are alternative ways of using ICT to perform or coordinate collaborative distance work in a given problem situation and given contextual conditions. In other words, our analyses grouped all the instrumented practices described by our informants into actions based on the kind of goal they contribute to achieve. Whereas the activity areas, activities and actions are abstract generic constructs, the instrumented practices represent specific instances of the action categories in which an informant makes use of digital tools to address the problem situation at hand. These practices are instrumented in the sense that the technological artifacts that are being used are associated with a personal or shared utilization scheme that assigns it a signification and a function (Rabardel & Bourmaud, 2003) that are specific to their contextual practice[15]: the same artifact can potentially be used differently either by different informants, or by the same informant in different problem situations (and hence correspond to different instruments). By describing their practices, each informant not only describes their instrument of choice, but how it is part of a meaningful, habitual, and sometimes shared way of achieving a given goal in the context of collaborative work. As previously stated, the description of the practice by the informant reflects both their conception of the problem-situation and the way they act to address it.

In this chapter, only the first two levels (activity areas and activities) will be used to define competences required to collaborate at a distance. Specifically, we will present each activity in a dedicated section. The actions composing each activity will be listed and referred to, but will not be presented separately, in order to underline the connections between them. Specific instrumented practices will be used to illustrate each activity. Table 2.2 outlines these three levels and their associated dimensions. The complete list

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[15] In Rabardel's theory of instrumental genesis, an instrument is defined by the combination of an artifact and a utilization scheme.

of activity areas, activities, actions and alternative instrumented practices for each action is available in Appendix I.

Table 2.2: Five Activity Areas, Ten Activities and Six Dimensions Defining the Digital Media Literacy Competences of Distance Collaboration

Area	Activity	Tasks	Time	Space / Distance	Informa-tion	Techno-logy	People
Interdependent Tasks							
	Collectively allocating tasks (coordination work)						
	Implementing tasks interdependency (cooperation work)						
Team Meetings							
	Organizing team meetings (coordination work)						
	Meeting with the team members (cooperation work)						
Remote Communication							
	Organizing means of communication (coordination work)						
	Communicating with coworkers (cooperation work)						
Information Spaces							
	Organizing shared information spaces (coordination work)						
	Sharing information in dedicated spaces (cooperation work)						
Document Production							
	Organizing the collective authoring of a document (coordination work)						
	Authoring a document collectively (cooperation work)						

In our matrix, the activity areas, activities and actions are crossed with six dimensions of work situations individuals take into account when collaborating at a distance: tasks, time, space and distance, information, people, and tools. Each dimension relates to a set of characteristics of the activities (e.g. "tasks complexity", "tasks recurrence"), grouped under an overarching category (e.g. "tasks") workers perceive and understand in order to take action when they collaborate. As for the activities, these dimensions stemmed from a grouping of the inductive codes into abstract categories that constitute a revised version of the deductive categories formulated at the beginning of this research. The process of grouping the inductive codes into dimensions highlighted the tight interconnection between these dimensions: two thirds of the categorized inductive codes were actually assigned to more than one dimension (most often two). For example, the code "avoiding

delays in the execution of tasks" was assigned both to the "tasks" and the "time" dimensions.

In the next section, we provide an overview of each of the six dimensions, before moving on to the description of the different activity areas, activities and actions documented in our data.

Dimensions of Activities

Tasks

Task management is a crucial process when collaborating: team members have to understand the qualitative and quantitative aspects of the different tasks attributed to the team as a whole and to each member of the team. First, task management is related to the nature and scope of the tasks. Workers have to understand what has to be done to be able to collaborate. They also have to qualitatively evaluate the tasks' importance, complexity, usefulness, urgency, regularity, etc. Second, task management is a process dealing with the amount of tasks and associated shared workload. Workers have to manage the team's tasks with the resources they have to complete them as a team. Third, when managing tasking, workers also have to deal with the interdependency of the tasks, as the execution of the tasks involves different intertwined steps, sometimes assigned to different colleagues, and the result of some tasks directly impact the completion of others. Some tasks also have to be completed synchronously and imply the expertise and actions of several workers.

This dimension addresses how workers make use of digital media to address all of these aspects in the way they manage their tasks both at team and individual levels. At the collective level, it consists in the technologically-mediated management of the distribution of tasks among team members. At the individual level, it involves the use of technology to adjust one's task execution to the others' activity.

Time

As the creation of shared sense of time is an important aspect of collaboration, workers have to take a series of complex time-related issues questions into account. Time is a shared resource for work, but it is by essence difficult to grasp and organize. Time management touches upon how team members make use of information technology to manage the time allocation, frequency, scheduling, and synchronicity of both the team's activity and the individual's activity in relationship to the activity of the team (Blandford & Green, 2001). Individuals and teams have to set time objectives and deadlines in order to organize the time they share in order to reach their goals. To do so, representations of time-related decisions have to be shared for members of teams. These representations make time visible and apprehendable, and are tools for action. They can serve for example to assess progress of tasks completion and avoid delays. They can also be used

to identify suitable time periods for specific collective action like meetings, for example. Time management also includes the management of interruptions (O'Conaill & Frohlich, 1995), that is, managing both the extent to which one interrupts others, and the extent to which one is accessible and can be interrupted by others (Reder & Schwab, 1990).

Space and Distance

When collaborating, team members have to understand the implications of spatial configurations and distance between them. Similarly to time, creating a common sense of space is an important aspect of collective work. Space and distance management thus pertains to the management of the spatial properties of one's work environment at different scales. It affects the spatial layout of one's local workspace (Kirsh, 1995), the proxemics of one's workplace (e.g. who is working closest to whom), and the separation between work sites in teleworking (Olson & Olson, 2000). It's important for workers to know where they can find their collaborators, and what are the efforts needed to reach them physically or through digital tools. Indeed, the opportunity and/or obligation to share space is a complex issue. On the one hand, collaboration often rely on the co-presence of team members to facilitate the sharing of information and take synchronous collective action. Despite the development of digital mediating tools, direct interactions remains for many a better way to deal with complex issues. The importance of direct human contact has also been often mentioned by interviewees as a way to humanize work relations. On the other hand, being co-present in shared space often implies efforts for the workers. Shared work spaces can also lead to frequent interruptions and distractions. Isolation possibilities, either for individuals or groups, are therefore needed to facilitate concentration, to make meetings possible, and to prevent the disruption of the work of others. All these reasons make the ability to understand the implications of space and distance configuration on collaboration crucial for workers.

Information

Collaboration is built upon collections of shared information between team members. Team members have to understand and collectively decide and act on the management of this information.

Workers have to understand the meaning of information, but also its forms and formats. They have to manage information in order to remember and re-find information. The exactitude and value of information, its contribution to what is already owned or known, have to be assessed to avoid mistakes and redundancy. The security and privacy of information is also an important aspect to think about in organizational contexts. At the individual level, an important characteristic is the private or professional nature of information.

When sharing information, workers also have to bear in mind its social dimension, assessing its value and accessibility for other workers, for example. The ability to

discriminate between information useful for oneself and information useful for other specific coworkers or a team in general is a core aspect of information management. This ability then allows workers to share and find ways to make information available for others team members. Finally, they need to take into account the collective dimension of digital information production, as well as the contribution of individual information authoring for the team, and the processes through which information is shared (including the timing of sharing, the organization of shared resources, and the management of accesses to shared information).

Technology

Collaboration at a distance implies the use of a wide range of digital tools which supports the activities of workers, their communication and the way the exchange information. Considering the technological dimension of distance collaboration activities involves the individual's ability not only to use information technology as part of their professional activity, but also to reflect on the way information technology affects their work, which necessarily interweaves technology with other dimensions.

At the individual level, this includes identifying one's technological needs for distance collaboration, evaluating how the affordances of different technologies meet them, selecting tools accordingly, appropriating them (i.e. tailoring them to one's needs – Dourish, 2003), and assessing their efficiency *post hoc*. Another important aspect is the role of digital tools in the management of work/life balance as these tools they may accompany the workers in the different context of his life and not only when working at the office during work hours. For example, the impact of being always "reachable" and its implications on daily life have to be considered.

At the collective level, this involves what we call the comprehension of "sociomatics". The term "sociomatics" refers to the fact that information technology has gone from enabling the automatic processing of information (or informatics) to including the automatic processing of social interactions (or sociomatics). The comprehension of sociomatics corresponds to the understanding the individual has of the social entailments of technology use. For example, this includes understanding how the choice of one tool for sharing information with the team impacts how each team member may access information, or considering how the affordances of shared tools will support the collaborative work of smaller or larger teams. It also involves understanding how one's activity is made visible to different people by technology, and how others can negotiate access to one's time through the use of a given tool (Hollan & Stornetta, 2000).

Users also need to understand how shared tools are used by others, the place they have in their activities and the competences they have to use those tools, in order to ease the collective operation of such applications.

The reflexivity towards tools may lead workers to test alternative technological options to assess their efficiency and efficacy in the context of their work activities. It may also push them to adapt their work processes to the tools they have at hand.

People

The ability to understand others is central when collaborating with coworkers. In the CSCW literature, the concept of awareness has emerged as a critical factor for successful collaboration and coordination: the understanding of the activities of others, which provides a context for your own activity (Dourish & Bellotti, 1992). Schmidt (2002) highlighted how awareness was a (too) broad concept that spans from a general awareness of the respective knowledge, expertise and social standing among team members, and of their respective location and availability (or social awareness – Tollmar et al. 1996), to a much more specific awareness pertaining to tightly coordinated team activities, namely the practice and ability to coordinate by monitoring others and making one's own activity visible to others.

Mutual awareness allows each member of the team to adapt their activity to the activities of the others. Understanding the roles of coworkers within a project or the organization also facilitates the collective course of action. Knowing when others are available and where they are is also essential. Workers working in teams frequently have to share information about availabilities and locations of team members to organize meetings, for example.

However, the dimension of "people", as used in the context of this study, goes beyond the sole perception of the activities of others. To collaborate, workers also have to take into account the complexity of humans characterized by their different levels of expertise, competences, goals, aspirations, personalities, etc. Therefore, our informants note how team members have to develop a deeper comprehension of others, exceeding what they are doing or supposed to do. For example, workers could anticipate the arrival of a new collaborator with little experience by creating occasion to collectively share experiences between senior and junior team members. The people dimension also touches upon the well-being and the involvement of the team members, which are related to the stress and/or satisfaction coworkers may experience.

The importance of the "people" dimension has been widely emphasized by our informants, making it a particularly complex and important dimension of distance collaboration. This dimension was frequently connected to the other dimensions (e.g. the availabilities of team members as a relation between time and people) which shows a central role of this dimension in the way workers frame collaboration at a distance.

Activity Areas, Activities and Actions Involved
in Distance Collaborative Work

The following sections will describe the activity areas, activities and actions used to define the digital media literacy competences of distance collaboration. Examples from the interviews will be used to anchor the definition of these three levels in actual work practices described by our informants.

Interdependent Tasks

A core issue when teams collaborate at a distance is to be able to work together on the advancement and completion of different types of tasks. The process is complex and implies that individuals and teams put efforts into coordinating and monitoring interdependent tasks. Tasks are interdependent when their execution depends on one another, causing the necessity for the joint interaction of several team members (e.g. several team members working on different aspects of a single project, each according to their own competences). The level of task interdependence may vary greatly across teams, as a function of the division of labor in the productive tasks, in the regulatory tasks, and the technical system supporting production and regulation within the team (see Chapter 3).

This process is two-fold: on the one hand, individuals have to coordinate to set the conditions of the collaboration. They have to prepare work that will be done by more than one individual by attributing the tasks to teams and workers, setting the objectives, deciding for deadlines, etc. On the other hand, they have to cooperate on collective tasks by monitoring the progress of coworkers and by sharing their progress to keep them informed. Therefore, following the distinction between coordination and cooperation actions, two activities comprised in this activity area are proposed: collectively allocating tasks (coordination work), and managing tasks interdependency (cooperation work).

Collectively Allocating Tasks (Coordination Work)

When colleagues are working partially at a distance, an important activity for teams resides in providing and planning out a series of tools allowing the distribution of tasks that are dependent on a given group. Groups can be composed of the whole team or of smaller groups of coworkers which can vary according to the nature of incoming projects and workers' available time. This variability is also an element that encourages teams to set up coordination tools regarding interdependent tasks. Individuals work with a large range of digital tools to coordinate collective tasks allocation (e.g. shared spreadsheets, online collaborative platforms, ticketing systems, kanban-style boards, shared e-calendars, etc.). These tools allow workers to record their decisions and multiple information about the tasks so that these data remains available for the team and doesn't depend on the physical presence of workers to be reached.

If one could think that the distribution of interdependent tasks is traditionally shouldered by team leaders, our observations show a more nuanced situation, with team members being in charge of tasks distribution inside restricted groups. However, the initial setting up of the digital media apparatus that supports the coordination protocol is nearly always a team leader's initiative, if not an initiative coming from a superior hierarchical level, or from the IT department. In any case, the formal inscription of this coordination work within tools is necessary but can be experienced as time consuming. Time spent on these activities is paradoxically often not considered by our informants as actual work, and reminding themselves to fill out the digital documents they use for tasks distribution generally requires a conscious effort on their part. We note that if the coworkers discuss tasks allocation together willingly, collective discussions and decisions about how to formalize it within tools is rarely on the agenda despite the constraints it can generate.

The work of interdependent task coordination is *de facto* closely linked to its "cooperation work" counterpart, that is to say the implementation of tasks interdependency (see next section). But this activity is also highly intertwined with team meetings activities (see below), especially in their cooperation part. Members of teams participate in tasks organization preferably when they are gathered, either by being physically co-present in the same room or by taking part in a meeting remotely through a videoconference system.

An example that reflects these interconnections can be found in a practice spotted in a team (MediumTerritory) where the procedure leading to task distribution has been clearly established. Each week, the team meets physically in a room and a significant part of the time is devoted to the presentation of new projects by members of the team. The arrival of a new project in that organization implies to form a temporary group of colleagues deciding to play a role in it, depending on their attributions and availabilities, the person presenting the project becoming its official and temporary leader. To prepare this process, workers that have a project to present must publish information the week before the meeting on the organization's social network (Microsoft Yammer) to advise their coworkers and ensure those who are interested to participate to be physically present during the meeting. The digitally shared information will in that case help mobile workers decide whether they have to be physically present or not at that moment of task distribution and prepare in case they decide to join in the project. In addition to this formal process, future project leaders may also target coworkers that might be interested and meet with them informally on the workplace to tell them more about their project in advance.

This complex practice, in addition to involving both digital and non-digital artifacts, involves many of the dimensions we identified in our analysis. It combines considerations about tasks, information, people and tools that enable the group to identify the nature of potential tasks in order to make arrangements about their distribution.

Collectively allocating tasks (list of related actions)

- Identifying coworkers working time and work responsibilities
- Identifying the nature of tasks
- Making the team's tasks and deadlines visible
- Identifying the workload related to tasks treatment
- Ensuring a balanced collective workload
- Ensuring one's individual balance toward collective workload
- Identifying constraints of media apparatus for interdependent tasks allocation

Implementing Tasks Interdependency (Cooperation Work)

Team members who collaborate in the distance spend significant time using digital media on a day-to-day basis to make the progress of their tasks visible, to monitor others while they execute their tasks, and to reconfigure the allocation of the tasks within their team as they progress. This specific activity seems to constitute one of the key aspects of collaboration as it is associated to a wide range of other activity areas we describe in our findings. One of the challenges for the team is to maintain a shared awareness of the progress of interdependent tasks without losing time or causing information overload.

Implementing task interdependency is characterized by the use of a profusion of tools ranging from shared online documents and spreadsheets, shared e-calendars, project management systems to ticketing systems and collective e-mailboxes, to name a few. This abundance can sometimes lead to situations of confusion between coworkers and problems of compatibility between team members' work habits can appear, raising questions of appropriation and competence levels. Our informants sometimes describe the procedures this activity calls for as "heavy" but necessary. They especially stress the need to share meaning between coworkers with clear shared processes, in order to avoid misunderstandings. Missing information about task progress can lead to overlook operational problems and thus to the inability to solve them. We observed many ways of preventing the loss of information on tasks advancement in distant teams, such as simply CCing the other members by e-mail or adding comments in a shared document to ensure others receive an e-mail notification, for example. The necessity to know the progress of coworkers in common tasks emphasizes the particular salience of the mutual awareness dimension we described earlier as part of the people dimension.

Maintaining mutual awareness at a distance seems to be a demanding activity, which calls for what some informants call "discipline". They highlight how they find it difficult to remember and find time to update and inform others about the progress of their tasks. That could explain why it happens often during team meetings. One solution adopted in several organization is to organize frequent team meetings as a way for workers to share updates about their work. Another option is to rely on digital tools to automatically support the implementation of task interdependence. Especially when it comes to time management, technology is being used and programmed to remind workers of tasks deadlines, to see if there is a delay in their execution and to decide if the work distribution

requires adjustments. This activity stays somehow problematic when people don't have much control on the workload that is automatically assigned to them.

In some cases, it is the team leader's role to use technology to control the collective workload. This seems to be the case when coworkers have lower levels of collaboration with their colleagues (e.g. within IT support teams, with workers mostly dealing with customers individually). For instance, team leaders who formalized a coordination protocol to manage task interdependence can then assess its efficiency and further adjust the task distribution process, which would amount to a contingent phase of articulation work. A telling example from our data is the way one team (SmallIT) uses a digital kanban board in order to have an up-to-date overview of ongoing tasks. Each task has a determined duration which is encoded in the system by workers. The system records the period of time the task is supposed to run until its term. The task gets an initial color that changes automatically as it comes closer to its deadline. The team leader pays particular attention to this kind of information and estimates if the team gets overwhelmed and if adjustments in the workload need to be done. In another organization (BigInsuranceOne), with a background of increasing tensions due to cost cuts and staff restructuring, such formalized processes cause serious concerns among coworkers. Adopting a more critical perspective, these workers perceive such explicit information about their tasks as a resource that could be used by their hierarchy and jeopardize their employment.

Finally, we note the need to match the tools' degree of complexity to the organization's own degree of complexity, size and degree of tasks interdependency and collaboration between coworkers. In this respect, some digital tools were pointed out for their relative "rigidity", and especially for their inability to be used synchronously by several members of the team without risks of data loss. When addressing task interdependence issues, the synchronicity of tools came back repeatedly in the interviews, because it allows colleagues to adjust together in real time and to save time by receiving instant feedback.

Implementing tasks interdependency (list of related actions)

- Making content of tasks available for team members
- Inquiring about collective progress on tasks
- Identifying changes in a collective task progress
- Identifying other's degree of availability to exchange about tasks progress
- Informing other on one's own availabilities to exchange about tasks progress
- Collectively evaluating tasks progress
- Identifying daily work load
- Identifying coworkers' work overload
- Balancing time dedicated to collective and individual tasks
- Making oneself localizable for coworkers
- Identifying a convenient moment to work together at a distance
- Identifying constraints of media apparatus to work synchronously

Team Meetings

Collaborative office work is steadily punctuated by team meetings. Bringing people together is an imperative when collaboration and, consequently, the success of task interdependence are at stake. In our data, team meetings occur mainly face-to-face, but increasingly at a distance.

Organizing Team Meetings (Coordination Work)

Generally in the hands of a single person, and more occasionally in the hands of a group, organizing a team meeting through digital tools raises questions about the visibility of everyone's schedules. Organizations tend to make their employees' calendars more visible to each other to facilitate this process, with shared e-calendar politics for example. This aspects of meeting organization takes a significant place in the success of this activity and asks for specific competences.

Between members of a team, we find a uniformity of shared digital tools, generally calendars, which seem necessary to set up moments to meet. The interface structure and especially the "automatic" features included in tools such as e-calendars allow certain information or tasks to be handled by the machine. This reduces the cognitive effort workers have to make when planning meetings (encoding them, inviting a group of people, guaranteeing direct access in the case of distance meetings...) or canceling them. Automatic "planning assistants" are used to find suitable moments for the whole team and to inform team members about the meeting's program, particularly in distant teams, where coworkers don't have the occasion to see each other.

Managing such shared calendars can be complex as they often include different overlapping kinds of data: collective professional information (mainly meetings or collective events), individual professional information (time spans blocked for tasks, work location, holidays...) and individual private information. To be able to clearly identify the differences between them is important to inform others about one's availabilities and, on the other hand, to visualize easily others' availabilities. We found many problematic situations regarding availabilities identification on the field. For example, a project coordinator (BigHealth) experienced great difficulty to organize meetings with coworkers and already failed several times. She used a planning assistant and shared e-calendars. According to her, information about others' availabilities was not correct: calendars were not up-to-date and travel time was not encoded when they had other meetings out of the office. For her, this situation can be explained by the fact that her coworkers are senior, very busy colleagues who have been in the organization for a long time, meaning they have anchored habits corresponding to more traditional ways of working. Her framing of the situation takes into account the "people", "tools", and "space and distance" dimensions on which she relies in order to find a solution to her problem. In another attempt to organize a meeting, she encouraged them to update their calendars and suggested the possibility to organize teleconferences, with or without video, to

ensure they feel at ease with this. However, she sees that it remains a problem for her coworkers to work that way. Her conduct shows an emphasis on reflective tool use and mutual awareness in the sense that she tries to find a solution consistent with her view of "the good way to use shared calendars" and the activities and habits of her coworkers.

These shared e-calendars can also have different degrees of openness regarding writing and access rights. In some cases, workers can directly place meetings in their colleagues' calendar, skipping the invitation step. This could be seen as a risky practice, and indeed it can rapidly lead to meetings overload, but we've observed strategies to prevent its excesses. To avoid being overwhelmed by meetings, workers might set limits to the number of people with writing access or block time spans absolutely dedicated to individual work to indicate unavailability.

Organizing distance meetings through videoconference is a way to spare work time and unnecessary travel to coworkers and is seen in this regard as an efficient way to meet with remote colleagues. However, this practice appears to be less frequently adopted when team leaders perceive the meeting's topics as sensitive, causing them to require the physical presence of the whole team (or of a specific coworker). When meeting with external teams or partners, physical presence may facilitate the discussion if people don't know each other yet or don't see each other frequently. For some people, it can really become uncomfortable to take part to a meeting while working at home or from a distant place. These kinds of remote meeting through videoconference can block their feeling of participation and using a webcam can make them uncomfortable. Knowing and discussing these preferences and feelings between coworkers supports meaningful coordination actions that foster a sense of comfort (following a chosen way of working is easier) and allow workers to identify suitable times to telework. The technical aspects such as choosing appropriate rooms, tools and connection take also a substantial place when organizing remote meetings as well as coworkers' knowledge about technical aspects. It guarantees that the group will benefit from aforementioned time saving.

Some teams that need to meet frequently put great efforts into formalizing recurrent meeting times in shared calendars, in order to secure them. These particular teams with high levels of collaboration have their own preferences and habits regarding the possibility to meet face-to-face or remotely. In some cases, team members have formally insisted that participating in a remote meeting should be considered as natural, and become the norm for meeting with colleagues.

Finally, the number of participants plays a great role in the decision to make a distance meeting. In most cases, remote participants are limited to ensure mutual understanding, to avoid speech interruptions and inattention.

Organizing team meetings (list of related actions)

- Scheduling team meetings
- Identifying coworkers availabilities
- Informing coworkers about one's own availabilities

- Making information available for the meeting participants
- Identifying appropriate media apparatus for team meetings

Meeting with the Team Members (Cooperation Work)

Even if it is necessarily linked with the previous one, the activity of meeting with team members (cooperation work) is of a very different nature, calling for distinct competences. Meeting times are frequent and are occasions mainly dedicated to implement various other actions constituting collaborative work.

Getting together around a table at the office or behind a screen from one's home in order to achieve cooperative work implies activities alternatively related to the proper conduct of the meeting itself (e.g. accessing the link to the remote meeting, or checking whether everyone can hear them) as well as activities related to, as mentioned above, the execution of interdependent tasks and the collective assessment of tasks progress (e.g. updating a shared file about interdependent tasks). Meeting time is also dedicated to collective workload distribution and planning. Teams review and update digital monitoring documents stored on different kinds of information spaces to control their work pace and if adjustments are needed. These adjustments coincide with contingent articulation work that can also encompass improvements of distance collaboration processes, like collective authoring of a shared document for example.

The person in charge of the meetings organization (see previous section on coordination work) is, in most cases, recognized as its supervisor and responsible for its handling. He or she is often the person who will amend the documents that are used during the meeting. However, some teams are trying to work with tools that allow synchronous writing, as online shared documents for example.

Meeting participants use a great range of digital and non-digital tools (online shared documents, paper notes, shared spreadsheets and calendars, project management software, etc.) to support the performance of aforementioned activities. The e-calendar is the main tool used to be reminded of the meeting time although the use of other tools can serve as reminders (e.g. keeping meeting invitation e-mails up in the mailbox).

In most cases, the majority of the team is at the office in a face-to-face setting and a minority of coworkers join in from a distance. Participants generally use their own laptop computers to take notes and look together at a bigger screen where relevant documents are projected. Teleworkers follow the course of the meeting thanks to a camera, and sometimes a shared screen mechanism. To our informants, the possibility to share a common view and the ability to actually see one's colleagues, and thereby seize their feelings and affects during the discussions, are of particular importance.

In remote meetings, participants have to deal with the risk of attention loss fostered by the distance between the coworkers. In this context, the appropriateness of the media apparatus and the number of people gathered need to be taken into account. The balance between the right number of people in the office and people at a distance is not easy to

find. When too many people are in the office and the digital equipment is not adapted, the feeling of participation and satisfaction can decrease because of misunderstandings, the microphone and the camera being too far from some participants to hear and see them properly from a distance. One organization (SmallIT) found a way to deal with this issue by organizing very short (fifteen minutes) daily "standing" meetings dedicated to tasks monitoring with a large number of team members at the office, and several distant ones appearing on a big screen through videoconference. When someone's turn to talk comes, the person steps in front of the camera so she can be heard by all (remote and local) participants. This example highlights how the success of a given collaborative practice rests on an intricate combination of dimensions: short meetings with a routine agenda, a perfectly functioning equipment, an excellent internet connection, a known-by-all operating method, and shared habits of remote meetings developed as a consequence of having different company sites and regular homeworkers. This system is, for example, less adapted to longer meetings, with complex and tense topics.

Another risk for attention in videoconference meetings is the management of interruptions. When one worker participates in a videoconference meeting from their desk, other workers who are not invited to the meeting are likely to be unaware of its planning and to interrupt it with requests. This phenomenon is especially likely to occur in mixed companies, where office workers are not separated from operative workers (who do not use the same digital communication tools). Such companies tend to tolerate more meeting interruptions due to this inability to openly share their planning with every worker.

Finally, finding a concerted way to keep a shared record of meetings seems very hard for workers who prefer to keep their own personal notes. Taking formal notes during a meeting is demanding and they are most of the time not read afterwards. Sometimes team leaders send an e-mail after the meeting to remind the team about the content and decisions that were taken. Digital tools offer numerous ways to keep track of collective decisions and remarks by allowing to insert comments and notes directly next to the concerned task or project. Still, we observed that there is a real challenge in terms of information management to avoid creating additional confusion and overload when documenting collective decisions.

Meeting with team members (list of related actions)

- Recalling the chosen moment to meet
- Interacting with coworkers
- Distributing collective tasks and workload
- Scheduling team's collective tasks
- Establishing collective authoring processes
- Inquiring about each other's progress
- Managing interruptions
- Keeping track of shared information during the meeting

Remote Communication

Working in geographically distributed teams raises the question of communication and information transfer between colleagues. As the range of available digital tools and types of use is quite large, there is a need to think collectively about their use in order to prevent issues like information overload or misunderstandings between colleagues. Balanced arrangements must also concern homeworking policies to control the implications of online communication that can cause potential encroachment on workers' private life, suggesting concerns about time and information management.

Teams also need to decide and distinguish between interactions which require face-to-face interaction from the ones that can take place at a distance. Such decisions rely on mutual awareness and sociomatics concerns, based on the elusive perception that technology modifies social contact within a variety of communication situations.

Organizing Means of Communication (Coordination Work)

In the context of distributed teamwork, organization of communication means consists in finding ways to configure the technological environment to support mediated interactions between team members preventing potential pitfalls related to distance communication. The complexity of this process resides in the selection and implementation of an array of tools adapted to the team's activity and most importantly in their harmonious collective use. As distance collaborative work practices imply continuous access to communication means in different kinds of locations (abroad regardless of time difference, at home, from another site of the organization, on another floor of the building,...), a series of issues must be addressed to avoid problems linked to information transmission, mutual understanding, informational load, private life preservation and social bonds maintenance.

Distance tends to intensify the need for communication between coworkers and contributes to an increase in the amount of messages transiting between them. The e-mailing system is the most common tool used for message transmission and is by far causing the most trouble. Intense e-mail use is associated with information overload and with a feeling of continuous connection with work that can be exacerbated by contemporary mobile means of e-mail consultation enabled by laptops or smartphone apps. Controlling the intensity of these two phenomena represents a complex question for organizations. Although it seems mainly considered as an individual competence of personal information management, team leaders can play a role in spreading common guidelines that support a shared awareness of problematic situations. This process is not easy as shown in the following example from the field, where a team leader (MediumTerritory) notes a disturbing inflation of after-hours useless e-mails in her organization. She explains that such e-mails often contain several recipients and generate multiple answers that are poor in terms of content, but act as a way to visibilize one's reactivity, even during the evening or at night. She says this compulsory need to show one's presence generates "pollution" of mailboxes and private time. She advised

her team to ignore after-hours messages but she recognizes that she's part of the problem by maintaining such practices herself. She discussed the issue with other managers and asked for the implementation of filters to block incoming mails at late hours. Eventually, they didn't adopt this measure because it could have restrained worker with different preferences regarding working hours. So far, the team leader has been unable to change this situation that still represents a great problem for her coworkers. In this case we see that despite a complex framing of the problematic situation made by the respondent, her conduct does not lead to the situation's solving because of the pre-eminence of external and simultaneous framings competing with hers.

As far as information overload is concerned, we found other examples of conducts that resulted in a decreasing number of e-mails and in a better control of information. Such teams have organized their set of digital tools dedicated to internal communication in accordance with their own work activities and set up concerted guidelines for their collective use (common use of e-mail filters, CC policies, "out of office" messages, etc.). In these cases for instance, e-mails are often identified as means to transfer succinct and official messages. For other forms of informal communication, these teams found alternative tools, such as instant messaging apps, that allow a more direct way of communicating, closer to traditional face-to-face discussion. Participants describe instant messaging (e.g. Skype messenger, Slack) as an easier alternative to e-mail for ad hoc interactions with a large number of employees working in the same workplace, and for maintaining contact with teleworking colleagues. The use of instant messages also serves teams in maintaining a quiet work atmosphere within busy work environments.

Once again we see the importance of collective adjustments regarding technology adoption. With an instant messaging tool like Skype for example, the management of people's availability through personal statuses (green dot for "available", orange for "busy", etc.) is subject to discussion as it allows workers to define themselves as reachable or not, conditioning the circumstances of remote collaboration. When working remotely from one another, the way team members express their availability for direct interaction must meet two kinds of requirements. One the one hand workers must strike a balance between staying available and care for limiting interruptions that impede the progress of work. On the other hand, they must be able to use the information regarding their colleagues' availability to their benefit at the appropriate moment. The complexity of this process encompasses a various range of dimensions team members have to take into account to find a balance between the team's and individual workers' interests.

Team leaders generally manage communication means organization, but team members also take collective decisions in order to define personal limits, like private/professional life boundaries. Members of a team (BigInsuranceOne) we interviewed refused to link their instant messenger (Skype) to their private mobile phone. They already use instant messages or teleconference when they are not co-present and don't own a professional mobile phone. They consider that adding this additional communication mean could overstep the boundaries of their private life.

Moreover, the ability to set one's communication means to limit interruptions due to collaborative activities is also valued as a means to take control over one's work pace and planning. When every single tool used on the workplace is designed to ease communication and connection between coworkers, teleworking can be seen as a way to regulate the density of exchanges with colleagues and to gain concentration on one's tasks, particularly on complicated ones. This distance tends to increase the efforts workers have to make when they want to reach their colleagues, leading to a reduction of interruptions. However, decisions can be taken at the team level to reduce (or not) this distance by finding agreements on the settings of shared communication tools.

Finally, and as mentioned in the previous activity about meetings, teams where operatives and office workers collaborate sometimes need to find other systems to adapt communication tools to the different kinds of work environments. Remote operative workers don't necessarily have access to a computer and to a professional e-mail address. In that case, simpler tools can be developed to allow official message and documents transmission between coworkers in such mixed teams as smartphones app.

Organizing communication means (list of related actions)

- Accessing one's communication tools
- Avoiding interruptions
- Controlling information load to be treated
- Segmenting private and professional life
- Identifying appropriate media apparatus for communication means organization

Communicating with Coworkers (Cooperation Work)

One of the benefits but also one of the challenges organizations encounter with interpersonal communication resides in the presence of a multiplicity of digital tools allowing interactions with coworkers. This technological richness therefore requires specific competences to cope with its complexity and to find a balance between the maintenance of social needs and the risk of increasing information overload. In this respect, the activity of communicating with one's coworkers seems highly linked with the "people" dimension (mainly through aspects of sociomatics and mutual awareness) and the "information" dimension, as interacting involves the transfer of different kinds of information within a group. This circulation of information is precisely what requires consideration from workers when they work remotely from each other. Copresence generally facilitates the possibility to gather valuable information opportunistically, without the planning required by mediated communication. Even if digital tools now include features that decrease the effects of distance (e.g. videoconference, smileys, feedback signs within an instant message, etc.), they face the difficulty to overcome the barrier they form to social interaction. This explains the need a lot of workers express to keep co-present activities to preserve social relationships with their colleagues.

We observed situations where team members (MediumIT) were encouraged to use asynchronous mediated communication (i.e. instant messages or email) as the norm, as if they were conducting face-to-face discussions, both when working at a distance or in copresence. Such recommendations may cause unexpected problems. On the one hand, when at a distance, encouraging to use messaging tools to maintain social and collaborative interactions could create a risk of perpetual interruptions. As team members don't see their colleagues, they need to find ways to estimate others' availability to avoid contributing to an overwhelming information flow. On the other hand, the use of messaging tools was encouraged when team members sat together in the same workspace, in order to reduce noise and support concentration. In those cases, we observed that technology can not totally compensate for a lack of social bonds, and habits of face-to-face discussions come back quickly.

Work visibility (in other words, making the progress of each team members' work visible to the whole team) represents also an issue experienced by team leaders and team members that seems to lack prior consideration in terms of coordination. As a consequence, problems of time management and stress can appear when working from a distance. These phenomena can arise in the absence of prior common discussions regarding trust. The risk for the workers is then to internalize apprehension and adopt counterproductive conducts that complicate the way they deal with interactions with other colleagues.

> My difficulty is that I'm scared that others think I'm not working. It's mental patterns, it's stupid because no one never blamed me about this. It's myself. If I see that I receive e-mails, I answer immediately to show people that I sit well behind my computer. On Skype too, I answer right away. I couldn't help answering. (Team leader, MediumTerritory)

The fear to be perceived as not working urges this person to always appear available for her colleagues through her multiple communication means and causes disrupted conducts towards work achievement. Moreover, it maintains a feeling of guilt likely to damage teamwork atmosphere and performance. On the other hand, keeping away from others' sollicitations from a distance can be hard because of the large number of communication means available (telephone, e-mails, instant messaging, corporate social networks,...) and sometimes because of the impossibility to show one's unavailability to others. Being able to anticipate such implications of one's own distance and of the distance of colleagues is a key to gain control over permanent connection.

The choice of a specific communication tool to send a message to colleagues can also be made in anticipation of its reception. An example from our data shows an informant (MediumIT) who will select either an instant message (Slack) or an e-mail (Gmail) depending on the urgency of his request. The instant message will ensure his message will be treated faster and he will be able to see if its recipient has seen it. The e-mail offers him less precision about the moment his coworker will react. Another respondent

(BigHealth) presents the same way of working with Skype instant messages but he adds two elements: he will send an instant message to a colleague only if his or her status is set on "available" and he suggests the idea that it's less intrusive for the recipient than a phone call or a face-to-facer encounter. The answer will be faster than with an e-mail but he will not disturb his coworker. We see here two conceptions of a situation that present the same kind of basic assumptions: the two informants take into account the time and the sociomatics dimensions when framing their actions. However, the second one, by mentioning the potential disturbance of his own actions, is proposing a broader and slightly more complex way to consider the way he chooses his communication means. To be able to frame these dimensions accordingly between team members is important to manage and balance collective information load.

Communicating with coworkers (list of related actions)

- Identifying coworkers availabilities
- Locating one's coworkers
- Making one's activity visible for coworkers
- Avoiding disturbing others' work
- Forwarding information to coworkers
- Identifying information coming from coworkers
- Avoiding information overload from other members of the team
- Communicating with coworkers to find information

Information Spaces

Another core component of collaborative work practices in organizations resides in their information storage systems, containing a variety of documents, increasingly in a dematerialized digital form.

Organizing Shared Information Spaces (Coordination Work)

A significant part of employees' collaborative work is based on digital document use and/or production. These documents are located on both individual and common information spaces on workers' computers. They represent an important and valuable source of information for organizations but their management can become a source of trouble, given their breadth and complexity. Difficulties that often arise concern information retrieval, data loss due to versions conflicts and confusion due to information overload and duplication. The multiplication of similar tools (corporate servers, Microsoft SharePoint platforms, Google Drive online storage, e-mail archives...) to store information can also cause documents duplication and overlap or version conflicts and therefore cause trouble for workers in the absence of coordination support from the team.

The coordination process about organizing shared information spaces to prevent these risks is rarely addressed at the team level and therefore seldom appears in our data. These problems are often put in the hands of external experts or IT services of organizations with

sometimes relays within teams. They have to face the recurring issue of the coexistence of competing sorting and use logics between workers, amplified by the abundance of documents. The challenge is to take into account the multiplicity and the evolution of these sorting logics, as teams and organizations can restructure themselves frequently. Standardized solutions and harmonization measures of information spaces can also lead to micro-agreements between work groups organizing information spaces according to their habits. These informal shared rules allow workers to function locally but increase the risk to add complexity to an already complicated information environment.

This activity seems therefore to require long-term coordination work while taking into account multiple levels of team organization. Coordination is needed within teams but also between teams to foster awareness about information management. This activity represents nevertheless a complicated issue because it needs dedicated time and procedures that are hard to remember and to maintain on the long run. Besides, sharing information can also be a delicate topic considering confidential aspects of information, involving implications concerning workers accesses and rights and regarding mutual trust in the use of these spaces.

Although it's not a widespread activity operated by distributed coworkers, we observed that the organization of information spaces encompasses the anticipation of a series of key elements. First, the necessity, when colleagues are geographically distant from each other, to support effortless information retrieval, for oneself and for members of one's team. This can alternatively be materialized by clear shared sorting rules (a common way to name documents, limitations of folders levels, etc.) or by the use of desktop shortcuts to access the most frequently used files, as well as the use of a powerful search tool with multiple search criteria, to mention just a few examples. Consequently, we note the importance of unambiguous information visualization to avoid informational "shock" when navigating in environments with few or unclear reference points (e.g. a long list of undifferentiated files in a SharePoint folder). This issue can come from a lack of technology affordances or from inadequate collective use of information spaces. Selecting and implementing tools that provide workers with features that allow visual sorting of information and share awareness of their concerted use is a way to improve information retrieval abilities.

Lastly, we noted that shared information spaces often exceed the context of a given organization to include distant external partners involving varied types of workers or groups. In accordance with cybersecurity principles, IT services in charge of information spaces generally restrict accesses for external people. As a result, such limitations can create a tension regarding the compatibility of information spaces and their uses with external partners, both interested parties being forced to find a compromise to share documents. Coworkers then need to adopt strategies to bypass technical constraints and be able to work with their partners. This adaptive way of working requires specific competences in order to differentiate one's uses according this arrangement, avoiding confusion and confidentiality pitfalls.

Organizing information spaces (list of related actions)

- Adopting procedures for collective file management
- Sorting documents according to coworkers access
- Avoiding coworkers' information overload
- Identifying constraints of media apparatus
- Identifying appropriate media apparatus for information space organization

Sharing Information in Dedicated Spaces (Cooperation Work)

As explained above, the challenges of digital information sharing, especially when people don't work in the same physical space, are numerous: sorting and finding information in multiple information spaces, adding new information and ensuring its subsequent re-use, coping with teams and corporate structures' evolution, etc. Sharing information within teams is plainly linked with the previous (coordination) activity and also mainly calls for tool, information and people management dimensions, especially in the sense of mutual awareness and sociomatics. As a result of what we observed on the coordination work side of information spaces management, we note that understanding a shared folder's architecture in its globality is very complicated, particularly within complex large-scale organizations. Workers often use digital information spaces without having participated to their structuration and implementation. They easily locate files and documents they use daily or share with their team but they need to deploy a lot of efforts and alternative strategies to find information or documents they more rarely work with, for example.

We noticed that when the coordination and the rules to sort information are unclear or nonexistent within the team, many messages and interactions are needed between team members, especially to locate and to be aware of the addition of a document. The management of these messages and interactions then plays a big part in this activity, as the available digital tools do not fulfill the team members' needs. For example, in cloud storage service (such as Google Drive or SharePoint), the author of a new shared document, can send a notification to their colleagues. In one of the teams (MediumIT) we observed, team members decided to duplicate these notifications by posting the link of the document in their instant messaging tool (Slack), in the group (called "channel" in Slack) related to the associated project. In doing so, information posted on the channel is immediately associated to a topic and less likely to be lost in mailboxes filled with undifferentiated e-mails.

Information search in an informational environment where people don't have control on the architecture and don't understand its logic can be very time-consuming. We observed numerous strategies developed by our informants to reduce this time loss, involving the re-creation of a personal information space (within a personal disk or e-mail folders for instance) where workers save or copy the documents they need but struggled to find beforehand. The coexistence of multiple information spaces organizing the same resources, each by its own logics, can help individual workers but may also increase

the complexity of collaborative information management. Indubitably, this activity raises questions about boundaries between personal and collective information management.

Workers decrease complexity of information spaces by maintaining a high degree of mutual awareness, which means providing the team with a good knowledge of what information spaces contain and how they evolve through time. In our data, informants seemed to distinguish between information spaces containing "moving" information and information spaces containing "fixed" information. Moving information is related to working documents that are dedicated to follow the course of projects, of day-to-day work follow-up and are frequently used and updated. On the other hand, "fixed" information relates more to support documents and procedures that are less often mobilized and act as reminders. It would seem very time-consuming, useless and troublesome to inform the team about every changes occurring to "moving" information as these documents are likely to change every day, unlike when changes occur to "fixed" information. However, coworkers find it sometimes useful to update their colleagues on some working documents, generally the "hottest ones" which there are very busy with at a determined moment. With people not necessarily close to each other, the e-mail is the main way to let colleagues know about updates in information spaces.

Information duplication and document versioning problems represent a great concern in the day-to-day processing of information, because of the multiplicity of information storage devices, the multiplicity of actors operating them and the multiplicity of modifications a document can undergo. An important aspect of competence lies in the awareness of the consequences of one's actions in the shared system on the others' understanding of the available information. In this matter, the use of an intermediary space which is more personal to temporarily isolate a working document from others seems to represent a common way to work, given the fact that informants predominantly use tools and documents that don't allow synchronous authoring.

As stated earlier, sometimes this difficulty even extends the perimeter of the usual work team. Information spaces can also be shared with external partners of the team. The collaboration can then suffer from problems concerning compatibility of the digital tools ordinarily used by both parties. Compromises must be found to get past this issue while taking into account organizational constraints and requirements related to data access and digital security. A particularly competent practice addressing the problem of both tool compatibility and document duplication was found in our data and is worth looking into. A worker (MediumTerritory) formed a temporary team with external partners and they needed to share documents. Her partners were used to function with Google Drive whereas she worked with a traditional internal file server. She decided to go with her partners' preference but she knew her organization and team would need an access to the documents on their internal shared server. She identified the risk that duplicating the documents would lead to difficulties, especially regarding the identification of their latest versions. To avoid this, she adopted a method she followed whenever she was confronted with this situation. She created a special folder on her partners' Google Drive online

storage to centralize documents her team would need to access, to facilitate its further duplication on her internal server. But she waited until her project with the partners was completed to guarantee that people had access to the latest versions of documents only. She stuck rigorously to this method and even applied it subsequently to other projects in her own team, working on documents on her individual disk and transferring them only when they were finalized on the shared disk of the internal server. In this context, it turns out that her complex framing of the situation (articulating time, information, people and tool dimensions) and her reflective conduct lead to a successful way of working.

Sharing information in dedicated spaces (list of related actions)

- Finding information
- Informing coworkers of shared information space's update
- Sharing up-to-date versions of documents
- Preventing data loss

Document Production

Authoring documents together without being in the same location, either synchronously or asynchronously, does not represent a widespread activity in our dataset. However, as far as document manipulation is concerned, employees work most of the time individually on documents that support their different tasks and objectives. As we have seen previously, these documents are gathered on information spaces and require specific accesses, operations and management. As far as document production goes, the collective character of work is limited to the compilation of individual achievements. Of course, teamwork isn't actually that fragmented, and includes collective accomplishments that imply the concerted edition of a variety of contents. The conditions of this integrated way of working are specifically at stake in the following section.

Organizing the Collective Authoring of a Document (Coordination Work)

Practices of organizing the collective authoring of documents hardly appear in our data, and are mostly described by our informants through rudimentary technical considerations. These often relate to the workers' adaptation to a digital tool (Microsoft Word, SharePoint, Google Doc, etc.) with identified editing affordances.

The most significant issues we encountered in our data regarding this activity are: issues of access and authoring authorizations for shared documents, working significantly on a document without being able to save changes in the end because someone else has it open on their computer, and not being able to locate the modifications introduced by colleagues within a shared document, which can lead to mistakes. In this regard, we notice the predominance of the technological dimension: if people have difficulties to work together remotely on a document, it is mostly identified as a result of the technical constraints of the tool. Workers often overcome these constraints by working together

face-to-face in front of a computer, with one designated individual editing the document while their colleagues discuss modifications.

When new digital tools dedicated to support collaboration are introduced (e.g. Microsoft SharePoint, coordination can come from external experts in charge of directing the transition. But in general, individual initiatives appear and spread informally (and partly) among work groups. For example, as one team member (MediumTerritory) started using the "track changes" option in her word processing tool to make her modifications visible to others and allow them to validate them, her colleagues left the "track changes" mode activated when they sent these documents back, making their own changes visible. In addition, she finds it an effective way to gain experience and learn from the others as she's also able to see the nature of her colleagues' modifications afterwards.

Such practices only circulate inside restricted groups and can unintentionally mismatch with the habits of other coworkers. An alternative we observed consists in training team members as local experts, who are put in charge of surveying and reporting on the available tools, preferences and skills of their colleagues, in order to help decide on appropriate coordination protocols. But this approach only seems to occur at particular moments, when "new ways of working" and new digital tools are introduced within organizations. This role is generally played by volunteers inside teams and not necessarily by a team leader. This coordination effort fades away in many cases and is being hampered by a variety of difficulties such as conflicting user habits or unclear fears towards digital technology.

The risk of data loss is viewed as a consequence of the "rigidity" of the tools (e.g. not allowing several users to modify and save their work synchronously), or because of the amount and complexity of the information a document can include. As the risk of errors leading to data loss increases with the size and complexity of shared documents, coordination becomes a necessity for the team. In one such instance, a team (BigInsuranceOne) that used a very complex shared Excel sheet had to establish rules for its collective encoding. First, they limited the access to this document to a minimum of team members to reduce the risk of human errors. Correlatively, they met in person to discuss the appropriate way to apply modifications, to unify the procedure and to avoid conflicting personal logics. From then on, when they are face-to-face, only one person can open it and encode new information. When they work remotely and the sheet is open on another computer, two situations can occur: either they just need to read certain parts of the document and can cope with a "read only" authorization, or they need to edit it. In the latter case, they must send an e-mail to the team to notify the others about their need to modify the document and to be warned when it will be available again. The remaining problem is that it is hard to estimate when they will be able to complete the document exactly. This example shows a quite large framing of the problem-situations related to collective document authoring (situated within this team) and a competent (because relatively successful) conduct to face them.

Obviously here, all these precautions come also from a lack of matching between the tool they use and the way they want to work. Tools which offer synchronous authoring begin to spread among organizations to overcome temporality problems and risks of data loss. But adopting such tools is not a panacea for all organizations. These different technical choices imply specific information management strategies and a great coordination support to ensure their appropriation by teams and that they are tailored to fill in teams' objectives. Some workers can function with the mutual sending of successive e-mails to complete a document for example, if they estimate that it let people more hindsight and time to react. Others will find that this way of working is problematic within bigger groups and that it is a source of document versions error and thus will prefer tools that carries multiple users synchronously. These decisions can be supported by the description of specific dimensions teams define as their preference.

Organizing the collective authoring of a document (list of related actions)

- Making a document available for its collective authoring
- Defining the document's authoring roles
- Protecting a document from coworkers' modifications
- Identifying constraints of media apparatus
- Identifying appropriate media apparatus for organizing collective document authoring

Authoring a Document Collectively (Cooperation Work)

Like its coordination counterpart, the activity of authoring a document collectively is greatly linked with the tool use dimension mainly articulated with the people dimension. Document production seems to represent a complex activity in both its cooperation and coordination aspects resulting in a lot of face-to-face moments to adjust everyone's framing and comprehension. As far as mutual understanding is concerned, we note that traces left on digital documents, like comments, tracked changes and explanations cannot all be addressed and understood by colleagues. Complex projects (especially including novel tasks) or newcomers within the team need face-to-face time to be sure people share the same vision of a problem and adjust to each other. To be side by side can help clarify information and help coworkers for their own writing tasks. This activity can also occur in sort of face-to-face "simulation" as in a videoconference, with screen sharing to be able to speak and point out parts of the document several coworkers are interested in.

Distance can also have effects on the coworkers' implication within a project and lead to similar kinds of obstacles or misunderstandings. A team leader (SmallBusiness) experienced it when she asked significant contributions by e-mail to her team members. She received imprecise and vague feedback that, according to her, didn't help the project. She learned through an external expert that her way of working with distant teams and the tool she used implied to formulate more precise requests in order to receive better feedback and contributions. These kinds of misunderstandings can also emerge in very advanced tools allowing synchronous and multiple authoring like Google Docs, with

coworkers leaving comments for their colleagues they need to explain face-to-face to reduce ambiguities and clarify their meaning. These observations reinforce the idea that cooperating at a distance to produce a collective document is a complex task, takes times and requires high level of mutual awareness and sociomatics competences. Articulation work is here contingent to the beginning of a collective writing task and appears only as informal agreement on authoring tasks distribution.

Other challenges when people co-create a document but don't share the same location include identifying the contributions of coworkers, understanding the overall text, identifying the others' progress, and avoiding manipulation errors leading to data loss. Another way of doing it was found in the data: workers (MediumIT) who used to work in team on a Microsoft Word document tried to collectively edit it but met many versioning problems. They decided to work individually on separate documents on their parts and to re-assemble their achievements only in the end. This strategy worked, but on the long run they finally chose to use Google Drive which is, according to this team, even easier for collective authoring. This way of working seemed to be framed as simpler for this team but it is not necessarily the case for every team. It can be highly dependent on the size of the work group for example or on the workers' tool preferences. Another worker (MediumTerritory) from our field of research uses also Google Docs with her team to co-create documents but she claims that she's unable to see clearly others' modification and prefers the "track changes" system of Microsoft Word documents. This example highlights the potential hampering nature of technology and the importance of taking into account the technical dimension when it comes to collective authoring.

Competence related to metacognition and reflexive tool use can help solve these kinds of compatibility uses problems: workers who are aware of their own advanced mastery of a given technology can anticipate difficulties of less skilled coworkers and adapt their conduct, given the shortcomings of others. An example from our data shows a worker (BigInsuranceOne) knowing that track change systems are not easy for everyone on her team. Whenever she works on a collective document, she ponders on her colleagues' preferences and adapts her way of showing her modifications to them (colored highlights in the texts or automatic track change, for example). When appropriate, and if she doesn't know about their usual way of working, she asks them explicitly to avoid bottlenecks.

Generally, tools dedicated to distance collaborative production contain a lot of features supporting the awareness of others' inputs: changes history, changes notifications, comments, instant messaging, etc. Their goal is to provide co-authors with a lot of meaningful information making collective authoring more readable and expand situations framings to direct appropriate editing actions. This process can be taken care of by technology which tries to "speak for itself" and helps by automatizing features (like automatic e-mails when a change occurs for example). In that case, we remark that this process could need support because their "self-evident" and user-friendly character don't seem to allow workers to overcome difficulties of collective authoring at a distance. This activity benefits from very few considerations meanwhile technology-supported

cooperation practices requires habits building and strong concerted communication to be shared and profitable to everyone.

Authoring a document collectively (list of related actions)

- Identifying document's accessibility for collective authoring
- Visualizing coworkers' modifications
- Making one's modifications visible for coworkers
- Managing the progress of collective authoring
- Avoiding versioning conflicts

The Relative Importance of the Dimensions in the Ten Activities

The previous section offers a detailed overview of how our informants conceive their own work practices related to distance collaboration, mapped out as ten activities in five activity areas. Each of these instrumented practices calls upon different aspects of the problem-situation it addresses. As it was explained in the methods section of this paper, these aspects were coded inductively, and the codes were grouped into generic dimensions of activity (tasks, time, space and distance, information, technology and people). In order to further the exploration of our qualitative data, the full list of inductive codes and their corresponding dimensions were tabulated for half of the coded instrumented practices[16], and then aggregated for each action, activity and activity area. The resulting count of codes by practices allowed us to compute different quantitative indicators that approximate the relative prevalence of the six dimensions in each of the ten activities documented by our analyses. Table 2.3 presents the results of this analysis.

Unlike in most quantitative analyses, the results presented in Table 2.3 cannot be fully interpreted on their own. Rather, they need to be interpreted in the light of the qualitative description of instrumented practices that preceded. The validity of their interpretation relies on this contextualization.

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[16] These instrumented practices correspond to the data of the five first organizations that were coded as part of our analyses (i.e. SmallBusiness, SmallIT, MediumIT, MediumTerritory and BigHealth). These organizations were coded first because their teams had developed higher degrees of distant collaboration compared to the rest of our sample.

Table 2.3: The Relative Importance of the Six Dimensions of Distance Collaboration in its Ten Activities (Based on 50% of the Coded Data)

Area / Activity	N Pr	Tasks		Time		Space/Distance		Information		Technology		People	
		% Pr	Mean N Dim	% Pr	Mean N Dim	% Pr	Mean N Dim	% Pr	Mean N Dim	% Pr	Mean N Dim	% Pr	Mean N Dim
Interdependent Tasks	71	83 %	3,8	20 %	4,1	35 %	3,8	58 %	4,1	65 %	4,0	93 %	3,6
Collectively allocating tasks (coordination work)	29	90 %	3,7	10 %	4,3	41 %	3,8	59 %	4,1	59 %	3,9	97 %	3,6
Implementing tasks interdependency (cooperation work)	42	79 %	3,8	26 %	4,1	31 %	3,8	57 %	4,1	69 %	4,0	90 %	3,7
Team Meetings	69	62 %	3,6	32 %	3,5	33 %	3,6	38 %	3,8	57 %	3,7	94 %	3,2
Organizing team meetings (coordination work)	38	55 %	3,8	39 %	3,2	34 %	3,4	39 %	3,8	55 %	3,7	95 %	3,3
Meeting with the team members (cooperation work)	31	71 %	3,5	23 %	4,0	32 %	3,8	35 %	3,8	58 %	3,6	94 %	3,2
Remote Communication	78	49 %	3,9	31 %	3,8	45 %	3,9	65 %	3,4	53 %	3,8	79 %	3,6
Organizing means of communication (coordination work)	37	54 %	3,7	24 %	3,4	41 %	3,4	68 %	3,3	51 %	3,7	70 %	3,5
Communicating with coworkers (cooperation work)	41	44 %	4,3	37 %	3,9	49 %	4,3	63 %	3,5	54 %	3,9	88 %	3,6
Information Spaces	51	61 %	3,6	4 %	5,0	2 %	3,0	96 %	3,1	69 %	3,5	67 %	3,5
Organizing shared information spaces (coordination work)	19	42 %	3,8	5 %	5,0	5 %	3,0	95 %	2,8	53 %	3,6	74 %	3,2
Sharing information in dedicated spaces (cooperation work)	32	72 %	3,5	3 %	5,0	0 %	0,0	97 %	3,2	78 %	3,5	63 %	3,7
Document Production	30	83 %	3,8	10 %	4,3	27 %	4,5	73 %	4,0	67 %	4,1	93 %	3,6
Organizing the collective authoring of a document (coordination work)	11	82 %	3,8	9 %	5,0	18 %	4,5	73 %	4,1	73 %	4,1	100 %	3,5
Authoring a document collectively (cooperation work)	19	84 %	3,8	11 %	4,0	32 %	4,5	74 %	4,0	63 %	4,0	89 %	3,6

N Pr Number of instrumented practices documented in 50 % of our data, for each activity and activity area

% Pr Percentage of documented practices that involve a given dimension
The gray gradient indicates the prevalence of a given dimension in each activity (or activity area). Darker shades of gray correspond to dimensions that are present in a higher proportion of (our informants' conceptions of the) practices grouped in the activity (or activity area). In other words, a higher percentage and a darker shade of gray indicate that more informants consider this dimension when they describe practices related to that activity.

Mean N Dim Mean number of dimensions in the documented practices involving the dimension
This indicator corresponds to the average number of dimensions in the conceptions of the practices related to a given activity that include the considered dimension. Lower numbers indicate dimensions that tend to be included into simpler conceptions, with less different dimensions. Higher numbers indicate dimensions that tend to be included only into more complex conceptions, with more different dimensions.

The last two indicators allow us to distinguish between three ways in which the different dimensions may be included in our informants' conceptions of the ten activities. On the one hand, for any given activity, dimensions that are commonly considered by the majority of our informants have higher values for the second indicator (% Pr), and dimensions that tend to be overlooked by most of our informants have lower values for this indicator. On the other hand, the third indicator (*Mean N Dim*) is used to distinguish between dimensions that are only included in the most complex conceptions (i.e. conceptions that include more different dimensions), and dimensions that are included in simpler conceptions (with less different dimensions) held by a minority of informants (who seem to conceive the activity in alternative ways, compared to the majority). Table 2.4 summarizes these three cases.

Table 2.4: Three Ways in which Dimensions are Mobilized into Conceptions

Dimension mobilization	*% Pr*	*Mean N Dim*
Common dimension in most conceptions	*higher*	*lower*
Rare dimension included in complex conceptions	*lower*	*higher*
Rare dimension included in rare alternative conceptions	*lower*	*lower*

If competence lies in the ability to articulate many aspects of a given problem-situation and to act accordingly, these quantitative indicators may allow us to distinguish between dimensions that are apparently part of most workers' conceptions of the different activities related to distance collaboration (i.e. the most competent as well as the least competent) and dimensions that are only articulated by a minority of most workers (which could be considered more competent than others). However, the relative weight of the different dimensions in the conceptions our informants hold of collaborative activities can indicate different things, which must lead us to interpret the indicators used in Table 2.3 with great care. More prevalent dimensions point to aspects of these activities that are central to them and are or should probably be considered by anyone, regardless of their level of competence. Less prevalent dimensions indicate aspects that are considered either only by those informants with more elaborate conceptions of the collaborative activities they engage in, or by informants who think differently from the majority. Depending on context, this can point either to peripheral aspects of the activity that are less worth paying attention to, or to aspects that are neglected by most people, and should be considered with more care.

With this in mind, we will only offer a brief comment on the main trends that Table 2.3 seems to reveal. Of course, the quantitative indicators presented above can only tell us what dimensions the conceptions include. Understanding *how* these dimensions are connected and articulated into any given conception calls for a qualitative description of this conception, as presented earlier in this section.

Table 2.3 lends itself to at least two ways of looking at its indicators: by examining activities (by line), or dimensions (by column). On the one hand, if we compare activity areas, a difference appears in the way they include the different dimensions. For example, the conceptions of practices in the "information spaces" and "document production" activity areas (and to a lesser degree the "interdependent tasks" area) seem less likely to involve all dimensions. Specifically, the "time" and "space/distance" dimensions appear less frequently in these three areas. In comparison, the conceptions of practices in the "team meetings" and "remote communication" activity areas seem to include more diverse combinations of all six dimensions.

On the other hand, irrespective of the activity area, our informants tend to consider some dimensions more frequently than others (e.g. "people" and "tasks", compared to "time", or "space and distance") when they describe their technologically-mediated collaborative practices. In some cases, the prevalence of a given dimension in an activity is tautological ("tasks" in "interdependent tasks", "information" in "shared information spaces"): it is simply the result of the overlap between our activity and dimension categories. Those cases aside, the "people" dimension appears as the most frequently referred to in most activities. This observation is consistent with our qualitative analysis which shows that the (physical or digital) presence of others and social contacts between coworkers are considered as central issues by our informants. Collaborative activities are above all anchored in bringing people together around projects, this fundamental principle resulting in unavoidable and multiple interdependencies between workers.

The "tasks", "information" and "technology" dimensions come next in terms of frequency. Among these, the "tasks" dimension appears less frequently in conceptions of practices related to remote communication activities, and more frequently in document production activities. This seems to indicate a difficulty to consider communication means as the object of specific management that could involve task and role distribution. Communication can be seen as a more instinctive process and therefore can lack collective shared understanding. By contrast, these processes tend to be more significant when it comes to collective document authoring.

The "technology" dimension appears as the most evenly distributed across activities: it is never the most frequently considered dimension, but neither is it the least. This trend can be associated with at least two phenomena. The first one is of methodological nature, and lies in the way we constructed our interviews, in order to bring instrumented activities as an entry point. Our interest in the broader context of such activities, and its actual relevance for our results, explain the presence of the other dimensions, and why "technology" is not a predominant dimension either. The second interpretation could be related to organizational discourses, insisting on the collaborative potential and support of technology, pushing workers to adopt and/or question them through their own discourses on their practices.

The "information" dimension appears less frequently in conceptions of practices related to team meeting activities than in other activities. This is consistent with a

recurring difficulty mentioned by our interviewees to find a balance between the creation of meetings records and the information overload these document may contribute to create. This tension seems to discourage most teams to adopt formalized and systematic strategies to document and keep track of their meetings. This may also be explained by a general lack of time to produce, organize and later use such information.

The remaining dimensions ("time" and "space/distance") are much less apparent in our informants' conceptions. For example: the "time" dimension is practically ignored in activities related to information spaces and document production. When it is considered, it appears to be only part of the most complex conceptions of these activities (as indicated by higher *Mean N Dim* scores). Comparatively, time is most often considered as part of team meeting coordination and use of remote communication. Finally, the "space/ distance" dimension appears in less than half of the described practices in all activities. Specifically, it is virtually absent from the conceptions associated with shared information spaces activities. However, compared to time, in the rare cases when it is considered, it seems to be part of simpler "alternative" conceptions held by few informants. This may be partially explained by the fact that information spaces activities and document production activities are emerging practices in some teams, and that they concern a smaller number of workers compared to the other activities. Thus, we could formulate the hypothesis that the reflexivity is monopolized by the other dimensions which seems more easily apprehended by workers, as stated in the table by higher scores for the "tasks", "information", "technology" and "people" dimensions. Moreover, it's also interesting to highlight that these two activities rely heavily on digital spaces and applications which may contribute to tone down time and physical constraints compared to the tangible world. This may be an obstacle for some workers that may experience difficulty to connect these digital spaces and projects with the material world and its constraint. Finally, this may also be explained by a general lack of management strategies of information spaces and of projects of collaborative document production. Once again, this may be explained by a lack of time, but also by a lack of visibility and consideration for these tasks which seems nevertheless crucial in the contemporary world of work.

Conclusion

In this chapter, we presented a qualitative analysis of the work practices of sixty office workers engaged in distance collaboration, based on interview and observational data. This analysis allowed us to propose a competence framework for the digital media literacy of distance collaborative work. This framework takes the form of a matrix, which crosses the types of activities workers have to perform to work together at a distance with dimensions they have to take into account when performing these activities.

The activities listed in the matrix are grouped into five activity areas, corresponding to five distinct objects of competence: the interdependence of tasks within the team, team meetings, remote communication between team members, shared information spaces,

and documents produced collectively. For each of these activity areas, we distinguished between two types of activities, based on the distinction between cooperation (working together) and coordination (collectively producing the organization of the tasks, resources and roles necessary to work together). Each activity thus either points to coordination competences dedicated to the preparation of collaborative work, or cooperation competences mobilized during actual collaborative work situations.

This distinction highlights the active part many workers take not only in actually collaborating in the distance with their teammates, but in setting the stage for collaboration, by designing the procedures, choosing the tools, determining the roles, or preparing the resources that make collaboration possible. Complementarily, the notion of contingent articulation within cooperative activities emphasizes how coordination protocols that are assumed to direct collaborative interactions routinely need to be adapted, modified or circumvented in situ as people cooperate.

The notion that this type of articulatory work is seldom acknowledged as real work, and often invisible in the work arena has long been recognized in academia (Star & Strauss, 1999). Yet, the ability to perform such work does not seem like a common feature of job descriptions or evaluations. We argue that articulating cooperative activities as they unfold corresponds to a form of competence that calls upon the workers' inventivity. It implies to critically evaluate the collaborative situation one is engaged in, and to proceed to the ad hoc selection of knowledge, skills or external resources one has at their disposal to creatively respond to that situation. In that respect, contingent articulation work requires being competent, and not just skilled.

Our findings suggest three types of digital media literacy competence indicators: the degree of complexity of the way workers frame typical distance teamwork situations, the success or failure of one's conduct towards a typical problem-situation, and the match between this conduct and workers' objectives. At all three levels, these indicators point to how the conceptions and conducts of workers integrate different dimensions of the problem-situation they face, which we grouped into six categories: tasks, time, space and distance, information, technology, and people. Although representing our proposed competence framework as a matrix may lead some to consider each cell of the matrix in isolation, this is not its intended use. As a matter of fact, our analyses highlight the deep interconnection between dimensions in each type of activity. Among other things, the examination of how these dimensions appear in the way our informants describe their work reveals the centrality of the "people" dimension, and the fact that, as for any of the six dimensions, technology is but one part of distance collaborative work practices, and it is tightly integrated with all other aspects of it.

Incidentally, and even though we positioned our analyses at the (infra-)individual level, our results show how distance collaboration not only calls for the ability of individual workers to frame a situation in more or less complex ways and to act accordingly, but also for the ability of a team as a whole to do so. In other words, in addition to develop an adequate *personal* understanding of the work situations they are engaged in, teammates

need to develop a collectively *shared* understanding within the team, and consequently develop collective courses of action (that may crystallize into coordination protocols). This topic will be explored more extensively in Chapter 4.

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