TECHNOLOGICAL ARTIFACTS TO SHARE AND TRANSFER KNOWLEDGE: ETHNOGRAPHY OF A HELP-DESK DEPARTMENT

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Abstract

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Keywords: Technological artifacts, communicational routines, Communities of Practice, Help-Desk, knowledge sharing.

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Suggested track: J Knowledge and Information technology

1 Introduction

This paper aims to address issues linked with processes of knowledge sharing and situated learning as increasingly mediated and affected by technological artifacts. At the same time, this contribution is an attempt to bridge and link an analysis of technology with categories rising from the Communities of Practice approach in organization studies. The main claim I shall try to argue is that technologies and processes of technological innovation bring out both emergence and erosion of communities, repertoires and patterns through which working practice, learning

processes and knowledge sharing are glued together, performed and experienced by actors.

The empirical basis for such an attempt is constituted by the analysis of processes of knowledge sharing and learning inside the Help-Desk Department of an Italian company managing and integrating information systems in the banking and financial sector.

More precisely, starting from a Communities of Practice approach (Lave and Wenger, 1991; Wenger, 1998), categories of knowledge sharing, participation and appropriation of technology are pointed out, with particular reference to different information technologies available to the actors (among the others, an Intranet knowledge database described as 'the operator's Bible' and having the function of a 'collective memory').

The study, part of a completed Ph. D research, was conducted adopting an ethnographic approach, as well as carrying out interviews with the Help-Desk operators and managers.

Many peculiarities in this department of the company concern processes of emergence and erosion of practice associated with technological artifacts. This also confirms that no clear distinction as described in the traditional categories of training, learning and experience is present in the everyday accomplishment of the work practice of the help-desk operators.

Therefore, overcoming the 'traditional' distinction among training, learning and experience through a practice-based approach (Gherardi, 2000), this contribution tries to focus on categories of problem-solving processes as key-issues. In fact, not only such processes help to understand management and alignment of information inside the organizational setting, but they also 'unveil' and 'de-naturalize' those troubles that make the pre-existing practice visible (Suchman, 1996).

Technological innovation, represented by interfaces supporting problem-solving processes as well as by the Intranet containing online knowledge bases, is a central component of the community's identity, as confirmed by interviews. Here the 'burden' of organizational history and identity along with the corporate attitude towards technological innovation constitute a constraint on processes of knowledge sharing.

The Help-Desk department is, therefore, understandable as the more institutionalized 'Communities of Practice' inside the company. On the one hand this institutionalization is characterized by a clear, specific identity, constructed and officially validated by skills and activities belonging and referring to the department. On the other hand, such

institutionalization is contradicted by the perception of a job de-valued, de-skilled and not recognized by other departments/workgroups of the same company.

Another important issue in the analysis of the department knowledge processes concerns routines, that means the ‘shared repertoire’ (Wenger, 1998) that constitutes a Community of Practice and that is ‘enacted’, being shaped and shaping new technologies as well as communicational routines (Yates and Orlikowski, 1992; Orlikowski and Yates, 1994).

Here, complex patterns orientated to integrate old and new routines, constituting a thick network of practice, co-exist with the perception of the new technology as a complete breakdown of the older routine. Such a perception characterizes mainly representations associated with new technologies like the software aimed at sharing problems and solutions among operators, which was implemented during the ethnographic study. However, ‘older’ media (e.g. e-mail) shape the community repertoire and their use structures new communicational genres in the context of problem-solving procedures.

The remainder of the paper is articulated as follows: the theoretical framework is built up by referring to a list of sources and concepts having in common a reference to 'practice', that means 'practice' (and processes of learning, knowing and organizing) is the main unit of a joint analysis of technological artifacts and processes mentioned above.

A methodological section follows, constituted by a contextualization and description of the main ethnographic study from which the empirical data presented in the paper are excerpted.

The central part of the paper, beside the theoretical framework, is represented by three lines of investigation through which results of the ethnography in the Help-Desk department are re-ordered. Such lines concern the identity and institutionalization of the Help-Desk as Community of Practice; the array of technologies and communicational routines that are part of the community's repertoire and finally the coexistence of resistance and creativity as more general attitudes of the Help-Desk workers towards organizational life and identity. Conclusive remarks are drawn from this analysis with reference to technological artifacts and their role in shaping working practice, communicational routines and processes of knowledge transfer and sharing inside specific communities.

2 Technology, practice and routines: drawing theoretical bridges

The main and starting point in the construction of a theoretical framework able to bridge learning and knowledge with technology and their technological/mediatized dimension is rooted in the awareness that technologies are the result of processes embedding and mirroring social assets (Bijker and Law, 1992; Bijker et al., 1994; Bijker, 1995).

Such a position is well summarized by the words of Pinch and Bijker, where they state that ' the social aspects of technology do not start when a technological process or product is taken up by the wider society; rather they are always present' (Pinch and Bijker, 1994: 307).

Among the most interesting social aspects of technology, relationships and connections to the practice dimension and the contexts of its current use play a special role in understanding processes of learning and knowledge. Such processes are both enablers and constraints with reference to technology: technology is both changed by organizational contexts where it is deployed, and at the same time it changes them.

Furthermore, technology and practice are inextricably intertwined. As argued by Lave and Wenger, 'Participation involving technology is especially significant because the artifacts used within a cultural practice carry a substantial portion of that practice's heritage (…) Thus, understanding the technology of practice is more than learning to use tools; it is a way to connect with the history of the practice and to participate more directly in its cultural life' (Pinch and Bijker, 1991:101).

Therefore, beside the technology of practice, there is a *practice of technology*, that means the set of processes through which technology is put into use and becomes (or not) part of the organizational everyday life, the ways through which it supports knowledge sharing and transfer, mediating working practice.

Given that work more and more coincides with routines aimed at establishing communication and production or reproduction of information (Orlikowski and Yates, 1994; Schultze, 2000), entire organizations and working contexts are based on Information and Communication Technologies. Therefore, technology of practice and practice of technology are more and more overlapping domains, and it is theoretically urgent to analyze them through concepts able to catch the changing and transformational nature of technology as well as the complex and thick network that links it with practice and routines.

The unit of analysis proposed in this paper lies on Wenger's concept of practice 'as the source of coherence of a community (…) Practice does not exist in the abstract.. It exists because people are engaged in actions whose meanings they negotiate with one

another (…) Membership in a community of practice is therefore a matter of mutual engagement' (Wenger, 1998:73).

On other hand, the word 'practice' draws continuity between learning and work, abstractness and concreteness, knowing and acting, giving emphasis to processes (learning and organizing) rather than to products/objects such as knowledge and organizations (Gherardi, 2000; Gherardi and Nicolini, 2001).

Turning to 'learning-in-organizing' as key-concept to make sense of how organizations construct society and how discursive practices shape organizational learning, Gherardi and Nicolini (2001) identify participation and reflexivity as the two main contributions sociology has given to the debate about learning and organizations.

In this paper, I adhere to what Gherardi and Nicolini (2001) following Collins (1994), label as 'microinteractionist tradition' with reference to organizational learning as discursive practice. Therefore, organizational learning is 'the transmission of knowledge within occupational communities (...) Working, learning and innovating are not distinct practices (...) Accordingly, in a social constructionist approach organizational learning is seen as situated; knowledge is seen to stem from negotiations, breakdowns, and discontinuities; and knowing is seen as heterogeneous and fragmented' (Gherardi and Nicolini, 2001: 42-43).

Very close to, if not embedded in the practice perspective, it is the paradigm of 'situated action' (Suchman, 1987 and 1996), which maintains how 'every course of action depends in essential ways upon its material and social circumstances. Rather than attempting to abstract action away from its circumstances and represent it as a rational plan, the approach is to study how people use their circumstances to achieve intelligent action' (Suchman, 1987: 50).

Such a perspective is of help in understanding how artifacts mediate situated actions, and how such a situatedness affects the way technological artifacts are designed, constructed and enacted (Orlikowski and Robey, 1991) in current practice, how they become technology-in-practice (Orlikowski and Gash, 1994; Orlikowski, 2000).

As Middleton states, innovation as such is often a matter of improvisation as well as a mundane practice rooted into situated action, rather than an exceptional event in the context of specific organizations (Middleton, 1996).

Among the most interesting dimensions of practice and communities built up around mutual engagement, in the perspective of a joint analysis of technology in/of practice is the community's repertoire as based on routines. By routines I refer especially to the set of established communicative practices through which members of the community

state and reinforce their identity and the identity of their working practice (Yates and Orlikowski, 1992).

Electronic media enact new genre repertoires that often constitute the core of the work practice (Orlikowski and Yates, 1994). Consequently, “At any time a new communication medium is introduced into an organization, we expect that existing genres of communication will influence the use of this new medium, though the nature of this influence will reflect the interaction between existing genres and human action within specific contexts” (Yates and Orlikowski, 1992: 318). These specific contexts are characterized by the duality that the context as concept carries with it: “(…) context connotes an identifiable, durable framework for activity, with properties that transcend the experience of individuals, exist prior to them, and are entirely beyond their control. On the other hand, context is experienced differently by different individuals“ (Lave et al., 1984: 71).

Such a duality accounts for the relationships between practice and technology: the context as framework constitutes the setting where technology is deployed and appropriated, it is a set of institutionalized constraints and rules through which technology *becomes* what it is; on other hand, the context as individual, repeated and varying experience is the creative side of practice, therefore of practice of technology as well.

This deep connection between context as dual and technology is well described by Lave and Wenger, in the following passage:

‘The significance of artifacts in the full complexity of their relations with the practice can be more or less transparent to learners. Transparency in its simplest form may just imply that the inner workings of an artifact are available for the learner’s inspection. The black box can be opened, it can become a “glass box” (…) Knowledge within a community of practice and ways of perceiving and manipulating objects characteristic of community practices are encoded in artifacts in ways that can be more or less revealing. Moreover, the activity system and the social world of which an artifact is part are reflected in multiple ways in its design and use and can become further “fields of transparency”, just as they can remain opaque. Obviously, the transparency of any technology (…) cannot be viewed as a feature of an artifact in itself but as a process that involves specific forms of participation, in which the technology fulfils a mediating function (…)’ (Lave and Wenger, 1991: 102). This interaction and interplay based on different degrees of transparency/opacity as well as visibility/invisibility (Lave and Wenger, 1991: 103) depends upon characteristics of the artifact as socially constructed, inscribing (Akrich, 1992; Akrich and Latour, 1992) patterns of use as well

as significant portions of practice performed by relevant social groups (Bijker, 1995) involved in the artifact construction and appropriation.

Transparency/visibility as metaphor for explaining the 'inner' working of the artifacts is also intertwined with qualities and characteristics of practice and everyday life, as based on 'thinking as usual' and routinized, semi-automatic procedures suspending doubt (Schutz, 1964). With respect to the interplay between flexibility/stabilization of artifacts (Bijker, 1995) and their (in)visibility, the metaphor of the black box and its opening accounts for the disclosure of technology's understanding and of practices of social construction inside organizations. Given that organizations are more and more based and built up on discursive practices centred on connections between learning and new technologies, it becomes crucial to enquire how and why artifacts mediate or do not mediate practice, and what practices are mediated/inscribed into artifacts.

The concept of participation to a practice and of technology as based on participation is summarized by the process of learning as 'legitimate peripheral participation' (Lave and Wenger, 1991), which means to understand how newcomers and old timers interact with each other in the context of a specific community, and also how artifacts play a role in this process of learning and apprenticeship.

To sum up, the theoretical bridges I propose as references and starting point for a joint analysis of technology and organizational contexts are based on the following points:

- awareness of the socially constructed 'nature' of technology (Bijker, 1995);
- practice as continuity between learning and work, abstractness and concreteness, knowing and acting; emphasis on processes (learning and organizing) rather than on products/objects (Gherardi, 2000; Gherardi and Nicolini, 2001);
- learning and knowledge as result of situated action and mutual engagement inside Communities of Practice based on negotiations (Wenger, 1998); problem-solving processes as accomplishment and visibility of situated action (Suchman, 1987 and 1996);
- transparency and invisibility of artefacts as processes of participation (Lave and Wenger, 1991);
- communicational routines as part of the community's repertoire and identity; routines as part of a genre repertoire changing because of technological artifacts and electronic media (Yates and Orlikowski, 1992; Orlikowski and Yates, 1994).

Before illustrating the ethnographic study of the Help-Desk department as Community of Practice and assembly of practices mediated by multiple technological artifacts, I propose the following formulation of concepts and processes I am going to analyze on an empirical basis:

Learning and knowledge are situated practices stemming from specific communities where ongoing negotiations structure identity and culture of their members; both identity and culture are constructed by discursive practices, communicational routines and assemblies of technological artifacts, which both embed and change practices rising from processes of learning and knowledge.

The case study illustrated in this paper offers an example of how a 'seamless web' (Bijker and Law, 1992) can be drawn not only between technology and society in its multiple forms, but also among practice, routines, organizational contexts, learning and organizing as mediated by technology, and technology as result of practices of inscription and bypassing (cf. Pellegrino, 2003).

3 The Help-Desk department as a 'world apart': Case and Method description

The data corpus I refer to in the present paper was collected in the context of a wider comparative ethnographic study in an Italian and a British company, both of them operating in the sector of testing, integration and maintenance of IS for banking and finance industry. The two companies started in 2001 a process of implementation of Intranet technology, with different characteristics, constraints and goals, as well as different organizational peculiarities. In fact, the Italian Intranet was built up internally even if constantly referring to a previous Intranet belonging to the parent group, owner of the company; the British firm instead chose to buy the Intranet software from an external vendor, specialized in designing and delivering knowledge management systems.

Participant observation, semi and unstructured interviews along with analysis of company and project documentation and of the two Intranet sites were used to understand how and why the Intranet was used and appropriated with reference to relevant social groups, interpretations they attributed to such technology, communicational routines and previous communities of knowledge and practice inside the two organizational contexts.

In this paper I will focus on the Italian company and more particularly on its Help-Desk department (20 members) as peculiar setting where technological artifacts changed working practices, processes of problem solving as well as communicational routines.

In the context of almost three months of discontinuous stay in the company, ten observational sessions and ten interviews were carried out in the Help-Desk department of such a company, which was structured according to different

workgroups/department, corresponding to different parts of the banking IS. The company, a 150 staff firm located in Southern Italy, was characterized by a difficult history of dependence from a privileged bank customer and repeated crises due to mergers and acquisitions of this customer. Furthermore, since 1995 the company has been part of leading group in the sector of banking and finance IS, therefore subject to ownership and control from this leading group. The main Intranet implementation and appropriation process I studied is deeply rooted in this relationship with the owner group, to the extent that the company Intranet was born as 'community' inside the previous Intranet of the parent company.

Whereas the 'official' Intranet was projected and launched by the “System and Technologies” workgroup, the most web-skilled and advanced workgroup of the company, the Help-Desk department was using a completely different array called or identified as ‘Intranet technology’. Therefore, observation and interviews I could carry out in this department were particularly interesting and insightful with reference to what the Intranet was and how it was used inside the company. At the same time, the Help-Desk Intranet, called ‘TD on-line’, was the most interesting example of technological artifact changing working practice and affecting informing and problem-solving processes inside the department. Also, the Help-desk department as organizational setting especially devoted to solve problems to customers and other departments of the company, made visible that tacit and informal dimension called ‘Community of Practice’.

Therefore, the Help-Desk department was to my eyes of ethnographer a sort of ‘world apart’ in comparison with the rest of the company. The multiplicity of the Intranet was particularly evident, in the context of a history of organizational and technological change. Such a history started with ‘pen and paper’, as operators told me, until reaching the substance of a thick technology-based work, made of different interfaces aimed at supporting problem solving processes. All these interfaces manifested different degrees of embeddedness and integration with the organizational context and its constituting practices.

The strong and explicit component of problem-solving in the Help-Desk everyday work made this department particularly interesting from the viewpoint of processes through which current practice is established and accomplished. In fact, starting from troubles interruptions and breakdowns that ‘suspend’ practice arrangements temporarily, such arrangements are made visible to the stranger as well as to the insider.

Other elements distinguished the Help-Desk department from all the other workgroups of the company: its *open space* setting, with interesting consequences in terms of

communicational routines and information exchange and sharing; and the presence of a group of apprentices or newcomers in a highly stabilized context of work. Given the average career time of the company staff (more than six years), the temporary presence of younger external consultants constituted a very important event in the history of the Help-Desk as Community of Practice. Learning processes enacted around this group of actors concerned, among other things, the emergence of a new database of problems and solutions, which after the newcomers' return to their consultant company was integrated in the pre existing knowledge bases of the Help-Desk department.

4 Results

In this section I shall illustrate the main findings of my short ethnographic study, by arguing the coexistence of three main dimensions in the Help-Desk department, sometimes conflicting each other: the Help-Desk as Community of Practice, having a specific identity and mutual engagement with respect to the rest of the company; the Help-Desk as assembly of technological artifacts changing problem solving and knowing processes significantly over time; eventually the dialectical relationship between resistance and creativity, as part of a complex set of negotial and conflictual attitudes towards both the company history and the client needs.

4.1. Mutual engagement and identity: the Help-Desk as Community of Practice

According to Wenger (1998: 72), three elements or dimensions link Community to Practice, that is “mutual engagement, a joint enterprise, a shared repertoire”. In giving such a definition, the author emphasizes that a Community of Practice is different from an informal network of relationships (see also Wenger and Snyder, 2000), whereas these Communities ‘create a point of stability in a world of temporary, distant relationships’ (Wenger et al., 2002: 136).

During my ethnographic research, I came across different types or levels of “mutual engagement, joint enterprise and shared repertoire”, aimed at sharing some profile of knowledge. The Help-Desk department was characterized by high levels of mutual engagement, and a clear identity as occupational community. The following interview excerpts are illuminating in this respect:

‘This is not a call center. Some levels of work are not of our competence, but we do them and this means we have a very good level’ (operator 1).

'All of us have more knowledge and qualities than managers believe. Three years and a half ago people defined the help-desk operator as someone answering the phone. They still think so but it's not true at all' (operator 2).

It is worth noting in the excerpts above that there is, first of all, the emergence of a 'we' level, a collective sense of belonging to the Help-Desk as specific community inside the company, as well as the contrast with other departments: 'people' are all the other workers in the company. To oppose the Help-Desk to the rest of the company in order to define the community's identity is a strategy I could observe also in other company's workgroups (especially the 'Systems and Technologies' where I carried out the longest and more detailed observational study). However, conversations and talks I had with the Help-Desk operators were even more characterized by a deep sense of mutual engagement as well as by the awareness of doing a very interesting and specific work. As I shall point out, such dimensions are not void of a sense of conflict towards the rest of the company, and the perception of a work seen as de-skilled or de-skilling by company managers reminded me of what Orr (1996) noticed about Xerox photocopier technicians, whose work is mainly made of diagnosis and problem-solving passing through narrative practices and instrumental use of 'talk at work'.

Mutual engagement and the sense of a joint enterprise are also evident in this excerpt:

'The group's philosophy is that nobody works by himself, because by working in group difficulties can be overcome. Of course there is still some jealousy, and competition: I don't tell you what I know otherwise you won't come to me... But you have to try to change this situation, by showing that in a call center knowledge transfer counts more and makes a difference' (operator 3).

The last part of the excerpt, which emphasizes the presence of an intra-departmental conflict having to do with knowledge and power, is in contrast with the operator 1's statement. They describe the Help-Desk department in the opposite way: 'This is not a call center'. Such a statement implies a de-skilled, under valued view of call centers and their workers, whereas such organizational settings have revealed a thick network of accomplished knowledge and collaborative strategies (see Kuhn, 2003).

In the context of the Help-Desk department, I could observe the presence of well identified micro-communities. In particular, the most interesting 'emergent' Community of Practice was constituted by a group of newcomers in the Department. The group was formed by five young external consultants, who joined the Department to carry out a specific project linked to the introduction of the Euro as official currency.

The Help-Desk's newcomers were among the youngest people in the company, immediately identifiable because of 'the paper around them', as a consultant told me.

'As you can see there is more paper around here than on other desks. And other paper still comes in. Mainly it is consultation stuff, e-mail, contacts, references… Internal communications are paper-based, whereas from outside they arrive through email' (newcomer 1).

This last excerpt refers directly to the community's shared repertoire, that means 'the set of genres that are routinely enacted by members of the community' (Orlikowski and Yates, 1994: 542). Such a repertoire has to do with explicit/tacit knowledge of a set of rules concerning communicative practices as well as shaping the community's identity.

The Help-Desk repertoire was based on a complex and intertwined array of technological artifacts and communicative practices both supported and changed by them (see par. 3.2.).

However, repertoire and practice of knowledge sharing enacted inside the department cannot be understood without referring to two elements. The first one is the fact that all the micro-communities and informal networks I could observe in the whole company were associated with emergent, contingent and 'improvised' solutions in the context of a problem-solving process.

As Suchman (1996: 37) points out, '(…) a routine trouble (…) represents the kind of contingency to which the normal order of operations is perpetually subject. As such, it discloses the accomplished nature of that order (…)'. Therefore, focusing on everyday practice around and inside technology, I tried to understand its 'accomplished nature'.

At a more general level, the emergence (or, correspondingly, the erosion) of Communities of Practice I observed has to do with changing and reinforcing of communicational routines, which are core elements of the community shared repertoire.

The second element that shapes processes of knowledge transfer and sharing inside the Help-Desk concerns its existence into an open space (the only open space of the company). Such an element cannot be separated from current practices shared and established among the Help-Desk operators in their everyday work. As Lucy Suchman noticed, 'the absence of interior walls or other fixed boundaries within the room maximizes mutual access and defines this as a space designed not for private refection or confidential conversation, but rather for the joint work of the company. Within the room, boundary markers, or objects that mark the line between two adjacent territories, are notable for their absence, boundaries being defined more by the placement of persons and equipment, and by the dynamic structuring of activity, than by the presence of explicit designators of ownership. Despite the absence of walls, however, members of operations establish spaces within the room that are in a sense

personal and private, delineated into what Goffman terms *use space* (…)' (Suchman, 1996: 38).

The above quotation mirrors very closely the situation that characterized the shared practice of the Help-Desk department. Since space is constituted in itself as a shared element of working and organizational settings, knowledge sharing and transfer, as well as genre repertoire are strongly shaped by it.

As an operator told me during an interview,

'If you get the right environment it [the open space] can be stimulating… But it becomes more and more difficult and stressful, it's not a matter of manual work, but of concentration (…) One room to share in two or three would be better than one room only. I worked in a smaller room before, it was so peaceful… I was out of everything, but there was e-mail. Often some knowledge passing through word-of-mouth did not arrive, but I managed that differently' (operator 4).

Two elements emerge from this excerpt: the substitutive function of technology (namely e-mail) and the lack of a type of knowledge (labelled by the operator as 'word-of-mouth') linked to physical proximity and the existence of a shared working space as constitutive of work practice. Even if Wenger (Wenger, 1998: 74) highlights that such proximity is not enough to identify a Community of Practice, it can be said that shared work spaces are very important in organizational settings such as the Help-Desk department I analyzed.

Going back to the newcomers' micro-community, it is very interesting to note that the result of their temporary apprenticeship process was the accomplishment of a database of problems and solutions linked to the use of the main technological dialogue interface (ACD – Automatic Call Distribution technology). As the young engineer who projected this data base told me during an interview,

'I had this idea to make work simpler for us. There was a high number of problems and I thought of it to make work lighter. I am satisfied about the fact that others exploited it' (newcomer 2).

First of all, the informality and spontaneity of the learning process emerge from the excerpt above. Furthermore, this kind of process has been recognised by the larger organisation, since the reification of the newcomers' apprenticeship (the data base) is currently used by the company.

The Help-Desk manager confirmed that

'The Access database will integrate Remedy [the ACD interface] with reference to categorization of problems'.

Even if the temporal trajectory of the Community was not long enough to enable the consolidation of it in a more stable entity (the consultants left the company after a few months), the passage and presence of this micro-community inside the organization was embedded into a technological artifact. Such an artifact 'translated' the interests and mutual engagement of the five newcomers, enacting at the same time a process of integration and learning – participation to the life of the Help-Desk community. The newcomers' database was, however, only one of the multiple technologies (and associated communicational routines) characterizing the Help-Desk working practice.

4.2. The Help-Desk as assembly of technological artifacts

18th December, 2001 12.40 a.m.

The first person I sit down beside is M. She talks very fast, taking notes is difficult.

'We help the bank branches. Anomalies on applications are transferred to the second level [located in another Italian region]. We solve everything that concerns technological issues. In turns we connect to a T50 application, we check if there are general blocking anomalies. We can visualize errors, we can't memorize everything. The TD network ((the Help-Desk Intranet)) is used to get on-line news, the list of T50 functions for example (…)'.

M. describes the everyday routine as follows:

'Our service starts at 7.30 in the morning. Who comes first has to check all the network so to avoid problems. When all the branches are blocked the command "all the branches blocked" appears. First thing to do then is to check if the server works well. If the input is this one ((indicating on the screen)) it means the two servers are blocked. Let's see if somebody tries to solve it. Well, let's do it. We've started with this procedure ['Remedy', the new ACD software] recently, so the solutions tree is still incomplete. Meanwhile I save the current call. This is for statistics on calls and solution times (…) The problem is that there is a block of the whole branch [system]. I go to the solutions tree. Do it a ping again'.

Meanwhile she does another check. 'From the production environment I control the router to which the branch is connected. The line is active, all the workstations are disconnected. I can try to disactivate and reactivate it '.

At this point she writes in the notes on the Remedy note section that "'nobody answers, servers do not accept the ping, ACTIV router, workstations INCONCIT". She tells me that 'it means the line does not work, it's like the servers were off. The

activation/reactivation did not work. Why don't they answer? Let's put the call as to recall, save it, write an email to my colleagues, to all the Help-Desk operators'.
She goes into Outlook, writing the following e-mail message: "The branch in question is out. The two servers do not reply to ping but nobody answers". 'This is to avoid – she tells me – somebody else takes the call on. Let's check the line. Now I take the call on because I'm busy with other stuff'. Meanwhile she writes another note: "contacted the provider to check the router". Then she talks on the phone: 'Branch blocked, 510, it's not a problem about the router, we should check the branch so they shut the servers off and re-start them. I put it to recall and hang up'. (Fieldnote).
The fieldnote above is particularly interesting in order to reconstruct some of the most important dimensions of the Help-Desk: as intertwined assembly of technological artifacts, and as set of automatized, routinized procedures based on different media and communicational routines, highly specific to the work setting. As it emerges from the fieldnote, such work is based on ACD (Automatic Call Distribution) technology, which was implemented a few weeks before my study in the Help-Desk department. This technology 'embeds' all the phases and activities of the operators: everything they do is put into the notes section of this interface. It follows that, among other things, the operators' work is highly controlled through this technological interface. An example of such a control is offered by statistics on the calls received and solved, a characteristic perceived as source of stress and discomfort by some operators (cf. par. 3.3.). From the short observation summarized in the fieldnote, moreover, it emerges that a wide range of media and communicational routines associated with problem-solving procedures is performed by the single operator (control on the T50 environment; surfing of the Intranet network; phone call to the branch; notes into Remedy; e-mail to the colleagues). In this respect, as in other observational sessions I carried out, technology is the first anchor to solve problems and help users. The e-mail sent by M. to the colleagues represents a routinized communication, which before e-mail introduction and use passed through 'yelling at each other', as another operator told me with reference to the Help-Desk technological and organizational history.
M. so describes such a history:
'The Help-Desk was founded about five years ago. It started with phone, pen and paper. I wasn't here at the beginning. They took notes and went to the responsible for procedures (…) New technologies changed everything also in the bank branches. The branch itself is a bank connected to all the others via the Internet/Intranet (…) This made the work easier on the one hand. On the other hand it cut work down. Now there are automatic checklists without operator. Pros and cons of technology… (…) Before

everything was done by remote command, you needed an elephant memory. Remote commands were written down on a paper sheet. Now they're saved here [in the Intranet] (…) Technology improved our work'.

M. is particularly aware of changes associated with technology, also because she

'worked in the Administration and Accounting department for 13 years (…) Before the pc was just a machine to put data into. To move to a technological environment was very confusing for me. Here it's a battlefield, you've to solve problems by phone call and lacking information (…) Training courses do not work, experience is on the field. You never say "I know it all", technology evolves continuously (…) You've to be like Speedy Gonzalez, clicking and clicking (…)'.

The routinized and iterative substance of the Help-Desk work emerges with reference to the problem solving processes, so described by M. :

'80% of problems are repetitive. The most important thing is to understand well where is the user. 90% of messages are repetitive. Sometimes users explain the problem well, but there are many environments and it can be confusing (…) The problem can be trivial but it has to be solved (…) The Help-Desk rule is to solve everything on-line or by the day'.

Here, the relationship between innovation and reproduction passes through the enactment of representations of the users' competence (cf. Akrich, 1995), as well as of the accurate use of different technological environments and interfaces. Among them, e-mail and the Internet accompanied the Help-Desk since its foundation, as the head of the department noticed:

'The Help-Desk started in a stage of advanced Information Technology. The big change coincided with the use of e-mail and the access to the Internet. Remedy, which is a standard for the Help-Desk, was developed thank to the Internet (…) Before there were the experts, now if you have some minimum skills you can find information and solutions. Without access [to the Internet] the alternative was to ask a friend, an expert or to read something'.

The last part of this excerpt concerns modalities of knowledge transfer and sharing before and after the Internet and e-mail. Transformations associated with web-based technologies and new practices of knowledge sharing and transfer are well summarized by the following interview excerpts:

'Now everything has to pass through it [TD On line], everything new is updated here . It's like a database. Our official tool is TD on line network. It's our Bible (…) If you forget something there are lots of instructions. It's the soul of our work, created here' (M.)

'Our Intranet is perfectly integrated. It's the operator's Bible, you know everything from accessing it (…) It' s the set of all the experiences. I define it as the key-element where you can find all the operations useful to the evolving situation' (P.).

It is very interesting to note that two operators defined the Help-Desk Intranet in the same way, as 'the operators' Bible'. From the excerpts above, both the Intranet as OPP (Callon, 1986b) and its value as support to work process and problem solving are evident. Such a centrality also means that the Intranet represents a privileged knowledge tool to accomplish everyday working practice:

'Relationship with problems is more direct. I like interpersonal relations but it's still true you can write down almost everything. This tool enables knowledge transfer (…)' (operator 3).

'Before there wasn't the Intranet, it makes a clear difference. Beside the possibility to have a face-to-face dialogue, you could work even not being here. I guess the work I do in the company could be done at home. Communications pass through e-mail' (operator 5).

Competences and procedures are more and more delegated to technology, represented as an 'extension' of the operator's memory.

'You can compare information and knowledge through the Intranet. Before there were tons of paper. If you don't remember something, access the TD and you know soon where to find good information (…) We can't retain all by memory. This aims to avoid the operator's memory failures: the operator has to be able to identify the problem (…)' (operator 7).

New media, namely e-mail, are part of the process of problem identification as well as of the 'community's genre repertoire as set of established communicative practices' (Orlikowski and Yates, 1994: 546). Changes arising in these repertoires are especially associated with the appearance of e-mail in the everyday work of the Help-Desk operators:

'We use e-mail to communicate internally among us. Instead of yelling we write e-mails for general problems and to avoid somebody gets a call that has already been examined (...) Depending on the problem we use both e-mail and phone call or e-mail only... More recently we have started using sms…' (operator 2).

'E-mail is very used. As a service, it was born to get general news from other institutions. In its evolution it has become a tool to make communication more stable' (operator 1).

The e-mail as medium is also aimed at *'avoiding duplicates of what's happening (…) Collective e-mails help managing customers' calls in a dynamic way' (operator 3)* as

well as *'to sort things out (…) I created a tree of all the messages (…) Much better than paper (…)' (operator 2).*

4.3. The help-desk as resistance and creativity

Identity and mutual engagement in the Help-Desk department are not only related to the array of technological artifacts through which work is accomplished, but also to a dimension of control and stress that characterizes the everyday working life of the operators. Such a dimension is meaningful with reference to the relationship between the Help-Desk and the other departments of the company. Moreover, this dimension can be interpreted as a mixture of resistance and creativity: resistance to the representation of the Help-Desk as a de-skilled community; creativity in seeing the potential of the Help-Desk as highly skilled workgroup and identifying the innovative and non-routinized aspects of its everyday work practice.

The following interview excerpts are exemplary of these two attitudes, in which references to technology are recurrent :

'Some days you can't even talk to you neighbour. When you know that you're controlled and have to deliver a certain speed, you can't stick in a call too much time. The Help-Desk operator must understand the problem, it's a matter of speed (…) Young people work better together (…) You get mad after a couple of years doing this work if you don't have inputs (…) To make people understand you did all good is difficult. You need a break, reset your mind (…) You need time even to write an e-mail well' (operator 7).

"Here is the impact with the problem that rises your tension. When it [the phone] rings you never know what's gonna be. After three years of experience you understand the subject, you need a lot of self-control, which I often don't have' (operator 2).

'Many times you don't have time to check information and give an answer (…) We're obliged to explain transactions and implementations they [the bank clerks] should know. They see the Help-Desk as the anchor (…) It's easier to dial a number than reading documents' (operator 3).

'Everything is tracked and we know we're controlled, we've to be careful (...) I think each of us manages 30 calls per day. But when things get difficult, you can count up to 80-100 calls. Then you're completely shattered, almost dead, the group has to work out, in order to managed 700-800 calls. You can't even check e-mails, we exchange information by voice, to make things easier' (operator 5).

The following and last interview excerpt is a kind of summary of the attitudes of the Help-Desk operators toward the company, of the mixture of resistance and creativity and of the awareness of the 'difference' between this community and all the other workgroups:

'We solve 80% of the problems because there is an attitude not to be mere executors. We take on a lot of responsibilities, it's a Help-Desk different than others. Whereas others have a codification of the activity, here we stop or activate a bank branch. It's not a routine service. We offer almost a consultancy service… This commitment is not recognized, *they [company management] don't see that you aren't a simple operator*, *that you're offering more than a codified answer (…) We're self-organized, self-determined (….) The problem becomes yours (….) This is a service that is not evaluated as it should be'.*

Statements as those reported above underline interesting aspects of the Help-Desk operators' identity and their perception of the Help-Desk as a 'world apart' with reference to the rest of the company. Perceptions of what is routine and what is not, as well as of the creativity of the operators' working practice contribute to situate the process of learning and knowledge experienced by this category of workers with reference not only to technological artifacts but also to wider organizational processes of belonging, identity and control.

5 Conclusions

Technology is part of practices of participation inside specific communities. To become experts means more and more to gain knowledge about specific technological artifacts and to learn producing and reproducing information by using information and communication technologies.

With reference to a Help-Desk department, an analysis of identity, engagement and communicative practices has been illustrated in the paper, to underline how information and knowledge are increasingly mediated/embedded in complex technologies and problem-solving processes are delegated to a set of technological artifacts/media.

In this sense, it can be said that technological artifacts in their different forms and manifestations are part of the constitution of the Help-Desk department as Community of Practice.

On the one hand, pre-existing practice leads to the appropriation of these artifacts as components of the ongoing working practice. On the other hand, new communities as well as informal networks aimed at sharing/transferring knowledge can emerge, or old

communities be eroded by the implementation and integration of new media bringing out other communicational routines.

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