16 "AN ENGRAINED PART OF MY CAREER": THE FORMATION OF A KNOWLEDGE WORKER IN THE DUAL SPACE OF ENGINEERING KNOWLEDGE AND RHETORICAL PROCESS

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> I'm involved in a field where your career is essentially based upon the writing you can produce.
>
> -- Novice Engineer, Interview, 26/07/2003

INTRODUCTION

The growing role of professional communication in the knowledge society has attracted researchers' attention for the past 20 years, starting from the 1985 publication of Odell and Goswami's *Writing in Nonacademic Settings*. The learning and knowledge of professional genres in school and workplace have been examined by such researchers as Devitt (2004), Dias, Freedman, Medway, and Paré (1999), Freedman and Medway (1994a, 1994b), and others. These scholars studied the learning and knowledge of rhetorical strategies used in various professions, for example, in architecture, economics, engineering, law, medicine, and social work (e.g., Bazerman & Paradis, 1991; Dias & Paré, 2000). The findings of some of these studies (e.g., Dias & Paré, 2000; Dias et al., 1999) indicated that communications that the students experience at uni-

versity and in the workplace are often "worlds apart." After having observed and compared traditional classroom-based professional communication instruction and workplace communication, the researchers reached the conclusions that such instruction often fails to prepare students for the world of work. These observations led the researchers to raise a question of the portability of rhetorical strategies from one context to another. While some authors (e.g., Dias et al., 1999) doubted that such portability was possible, others (e.g., Artemeva, 2005, 2008; Tuomi-Gröhn & Engeström, 2003) observed that some transfer of learning and knowledge was possible across the contexts.

As Geisler (1994) noted, for novice professionals to become experts—and, I would add, expert communicators—they need to develop expertise within the dual space of the domain-content knowledge and rhetorical process. In other words, to become a successful communicator in the knowledge society, individuals must be in possession of the professional knowledge that they need to communicate ("the what" of their profession) and the appropriate rhetorical strategies that allow them to deploy this information within their professional community or beyond it ("the how"). A theoretical notion that allows us to explore the dynamics of the dual space of professional expertise is the notion of genre. Rhetorical Genre Studies (RGS) (also known as North American genre theory or New Rhetorical genre theory) (e.g., Coe, Lingard, & Teslenko, 2002; Devitt, 2004; Dias et al., 1999; Dias & Paré, 2000; Freedman & Medway, 1994a, 1994b; Miller, 1984/1994a) provides a useful theoretical framework for research into genre learning by moving the study of genre to the analysis of the social contexts that give rise to and shape genres (Miller, 1984/1994a). However, as Freedman (2006) explains, while theories both help us understand the data and shape further studies, "sometimes the data force researchers to reconsider the theory" (p. 98), modify, and/or complement it with other theoretical perspectives. This is why Freedman (2006) argues that empirical research has proved essential for RGS. Following the empirical data and in order to better flesh out relationships between the individual and the social (cf. Berger & Luckmann, 1967), and between agency and structure (cf. Giddens, 1984; Schryer, 2000, 2002; Wegner, this volume), some researchers have successfully complemented RGS with such social theories as Bourdieu's (1972) theory of practice (e.g., Schryer, 2000; Winsor, 2003), activity theory (AT) (e.g., Le Maistre & Paré, 2004; Russell, 1997, 2005; Schryer, this volume), and theories of situated learning (e.g., Artemeva, 2008; Freedman & Adam, 2000a, 2000b).

In an attempt to understand what constitutes professional genre knowledge and how novice professionals learn to operate within the dual problem space of the domain content knowledge and rhetorical process, I conducted a large longitudinal study of novices learning genres of engineering (Artemeva, 2005,

2008, 2009). The case study presented in this chapter is part of that research project that assumed a unified theoretical framework based on RGS, thus allowing me to focus on the study of a novice's learning of engineering genres, as her perceptions of these genres and ability to use them change over time. In this chapter I briefly discuss the methodology of the longitudinal study, present a case study of the novice engineer, Rebecca (the name is fictitious), entering the world of the engineering profession, and then briefly review the main notions of the theoretical framework that I developed for the study. I then present a theoretical interpretation of Rebecca's story, discuss the implications of the case study for the research into professional genre learning, and speculate about further applications of the unified theoretical framework.

METHODOLOGY OF THE STUDY

As mentioned above, the case discussed in this chapter is part of a longitudinal study of novices learning genres of engineering (Artemeva, 2005, 2008, in press). In the study, I followed a group of ten former engineering students who took an engineering communication course (ECC) that I developed and taught in 1997-1999. The data collection continued over a period of eight years, starting with the term when the students were enrolled in the communication course. The data for the study were collected through questionnaires that students completed while they were enrolled in the course, student postings to the course electronic discussion group during the course, electronic questionnaires administered annually after the course completion, follow-up e-mail exchanges that served to clarify and/or complement responses to annual questionnaires provided by the study participants, face-to-face interviews, field notes taken during interviews and other encounters with participants, and multiple informal e-mail exchanges. The last stage of the study included collection of member checks from the participants, as a triangulation strategy (cf. Maykut & Morehouse, 1994). To analyze and triangulate the data, I used multimethod, multicase qualitative methodology.

On the basis of the participants' responses to in-class questionnaires, I designed a series of asynchronous electronic interviews that I e-mailed participants. I continued to e-mail electronic questionnaires on a regular basis over the time span of the study, regularly repeating—sometimes verbatim and sometimes in a rephrased form—important questions to trace changes in the participants' responses over time and including new questions developed on the basis of the analysis of responses received to the previous ones. In Rebecca's case, all transcribed data constituted 74 pages of single-spaced text. I analyzed the responses

immediately upon receipt and sent follow-up e-mails to the participants for clarification, if needed. All responses received from participants were analyzed qualitatively, with particular themes emerging from the analysis. As a form of representation, I adapted Individual Case Synopsis (ICS) (Fischer & Wertz, 1979) to present an individual participant's learning trajectory in her learning of engineering communication strategies, with a focus on change through time. In my study, the modified ICS produced in the process of data analysis reflected the historical—in Vygotsky's (1978) terms—development of the individual participant's learning trajectory. In this chapter, I present and discuss in sufficient detail one such individual case synopsis, that of Rebecca.

REBECCA'S INDIVIDUAL CASE SYNOPSIS

Rebecca grew up on a small farm in Central Canada. She "always knew" that she would have to leave the farm eventually and decided to choose a career that would allow her to travel and see other parts of the country. When she lived on the farm, Rebecca thought that "an engineer was a mechanic" and was not aware of what the profession involved until she started university (EM, 12/09/2003) (please note abbreviations used in this chapter: EM = e-mail; I = Interview).

In the first year of university, Rebecca felt confused and could not understand practical applications of the courses she was taking. The result of this confusion was low marks in several first-year courses. Rebecca took the engineering communication course in the fall term of her second year, as she was repeating some of the first year courses in an attempt to improve her grades. At the beginning of the term, she noted in the in-class questionnaire that she considered creativity her main strength and grammar, her weakness; she expected that the communication course would improve her "ability to write and speak in regards to ... engineering courses, as well as ... humanities courses" (09/1997). At the end of the term, her reaction to the ECC was strongly negative: in response to the end-of-term questionnaire's question "Have you learned any useful communication strategies in [the ECC]?" Rebecca wrote "No" and added, "I didn't find that my grammar and language approved [sic] at all during the course" (12/1997).

A term later, Rebecca expressed a changed perception of the effects of the course. When answering a question from an electronic questionnaire about whether the ECC had helped her with her studies and other engineering-related work, she wrote,

> Yes, actually it has. Many second year subjects require the writing of formal and semi-formal reports. [The ECC] ... provided

> a basis of knowledge for these reports since they are not based on what was learned on writing reports in the first year courses. These lab write-ups include an extensive amount of documentation and written work.... Most of the concepts presented in the course _are_ quite useful. It will eventually pay off to do the work. (EM, 25/03/1998)

In the summer that followed, Rebecca worked full time for a small engineering company and then continued to work part-time at another small engineering company during the school year. When a full year passed since her strongly negative reaction to the Engineering Communication course (see the first response), she received another electronic questionnaire from me. This time, her response to the question "Did [the ECC] help you in your engineering course work?" was

> There was theoretical value in ... [the ECC] ... such as organization of long projects .... The great thing that I found quite worthwhile was the final report, and the orals/abstracts/proposals that went along with it. I found it quite a good idea to concentrate on one big subject for a course such as [the ECC] then to try and ... throw a whole lot of little things in as well. (EM, 30/10/1998)

A comparison of the three responses above suggests that at the end of the ECC Rebecca did not feel that she had learned anything useful in the course. Even though she had chosen to work on an engineering communication project based on both the Calculus course she was repeating at the time and her future engineering specialization, her negative response indicated annoyance and frustration with the course, and perhaps with the whole Engineering Program (later in an interview she said, "I was so disappointed in the first year by what engineering was and what engineering writing was" [18/03/2002]).

At the time of her graduation, four and a half years after the first response, Rebecca reflected on her original negative reaction in the following e-mail message, "I do remember thinking that [a lot] of the exercises performed in the original [ECC] lacked a 'point' or a foreseeable goal, and perhaps that was what the 'No' meant" (21/04/2002). Reflecting on her more positive second response four years later, Rebecca, who by that time had already had significant engineering workplace experience, noted in an e-mail, "Communication had very little effect on my [courses] 1st through 3rd years. I found that the professors provided 'cookie cutters' that work had to match and there was little deviation

from this rule" (21/04/2002). Nevertheless, she claimed, "After the year I believe I found ways to apply [what was taught in the ECC] ... to other course work" (21/04/2002). This claim reinforces her second response in which she speaks about her ability to use what has been learned in ECC in her other engineering courses and work.

It appears that the first year's confusion about the engineering program had a lingering effect on Rebecca. While in her second and third years, Rebecca was still going through some difficulties, including being on probation for a year. In the third year, one of the professors suggested that she should contact the University centre for students who require special academic accommodation. This suggestion proved very helpful, and, with the help that the centre offered her, Rebecca was finally able to overcome her problems and successfully complete the third year of the program (I, 18/03/2002). Nevertheless, in her final year at university she was still unhappy about her early academic experiences and indicated that only by the third year did she begin to understand purposes of and connections between courses in the engineering program.

The fourth year of the engineering program brought a dramatic change to the amount and importance of communication. According to one of Rebecca's e-mails, in the fourth year she was writing more than ever before in her life: "The amount of writing that I did was quadrupled at the very least. Term papers, essays, reports, design meetings, project meetings etc, consumed most of my days" (21/04/2002). In an interview, she noted that the following communication strategies that had been introduced in the ECC were particularly useful for the fourth year project: the group work strategies and "having to evaluate" her classmates' written drafts and oral presentations (18/03/02). However, she kept lamenting that she had not been able to apply these and other communication strategies taught in the ECC until the fourth year, by which time she claimed to have forgotten how to apply them. For example, when commenting in an interview on the understanding of the principles of technical oral presentations she had gained in the communication course ("Because without that course, we wouldn't know what to look for when a person was presenting"), Rebecca added, "But it wasn't useful in the 4th year project presentation because it was so long ago" (I, 18/03/02). In the fourth year, presentations became an important part of the final project that all students in Rebecca's program were required to complete in order to graduate, and again, Rebecca commented on insufficient experience she had had with presentations prior to the fourth year project:

> Other than [in the ECC], we never did anything [like oral presentations], and that was a long time. And we did nothing like that, absolutely. No presentations for three years .... We did

> a small tiny presentation, four minutes, four people: you just present one slide—it was negligible. It was a real challenge, the 4th year presentation. (I, 18/03/2002)

Based on this experience, Rebecca made a suggestion:

> I think [the ECC] would be a great 3rd year course. That's when you start writing all your [assignments], and doing your presentations. And 3rd year students would have more experience.... And your first year physics labs are so different from your advanced labs [in the third year] and you finally have an idea of what you learn and what you want to learn, and you finally start paying attention. (I, 18/03/2002)

The data provide evidence that Rebecca's view of the ECC became more positive from year to year: she started seeing the purpose of the course activities and claimed that, though she had "forgotten much of what was taught in the course," she felt that it was "necessary to have such a course" (EM, 21/04/2002). But even though she would repeat that the course was important, Rebecca did not seem to see it as integral to the Engineering Program, and she would not explain why the course was important for future engineers.

Only after Rebecca had worked in the field as a junior engineer, rather than a student, did her view of the role of communication in her engineering work become better defined:

> I'm involved in a field where your career is essentially based upon the writing you can produce. It would be very difficult for me to pick out one situation where I didn't use writing. Whether it is writing to my supervisor on email, or writing a final report on my projects, or presenting data to a group of people, I use writing skills every single day, all day ... I find communication an engrained part of my career, both when I was a student, and now that I am working in the engineering field. (EM, 26/07/2003)

Even though Rebecca claims in this e-mail message that she has considered communication "an engrained part" of her career as a student, never before did she articulate why it was so.

Rebecca worked in several small engineering companies and government departments throughout all the years of her university studies. In the fourth year of

the Engineering Program, she was hired by a department that later offered her a job upon graduation. As Rebecca was moving into the engineering practice as a new practitioner, she commented in an e-mail on the differences between school and workplace:

> I find University very structured, and very creatively limiting. In the workforce, I'm given free rein to try new ideas, new methods and different implementations. This I find is almost expected practice. At school, the formulas must be followed, the due dates met, and all margins must be exactly 1" around. This is the largest problem I found with moving from being an engineering student, to an employed young engineer--you have to refind [sic] creativity. (21/04/2002)

In this message the theme of creativity appears again, for the second time after it had appeared in Rebecca's response to the very first ECC in-class questionnaire ("My strengths are my creativity" [09/1997]). Never did she refer to creativity in the course of her studies at university; only after having accumulated some work experience did she return to her idea of creativity in engineering work. This may indicate either her limited view of the engineering program at the time when she was attending university or the somewhat creatively limited and over-regulated engineering program she was enrolled in. She reported that she felt confused even in the fourth year and even after having worked in engineering companies part-time for a few years. She did state repeatedly that her experience working on the fourth year project with 22 other students had been "very unique" (I, 18/03/2002) in that it made her part of a group that worked together on the same engineering task, but continued to express her frustration:

> I found it very tough at school to have your voice heard. In the 4th year project you have to go through several people [students working on different parts of the same project], and it's difficult to get the information and understand what they've done. It's hard to find the correct channel at school because there are so many people. (I, 18/03/2002)

At work, perhaps because she always worked in small organizations or departments, she started feeling part of the community of practice (CoP) faster and more easily: "Even people I speak [to] on the phone, I speak to the same

people all the time" (I, 18/03/2002). In an interview, Rebecca contrasted her communication experiences at university and at work:

> They [at work] had to make sure I had access to reports and information and knew who to ask questions .... As a student [at university] there are a lot more barriers: [at work] you can always ask a question, or knock on a door, or ask a question at a meeting—a lot of opportunities to talk to people. As a student, the doors are not always open, it's really difficult to get to professors. Some profs don't make office hours because they don't have time. At work everyone is doing their job, while at school, many people are not there to be a teacher. In school, it's very difficult to relate to people from different cultures and when you can't understand their accent. At work, it's individual and you can ask them to speak more slowly ... It might be surprising, but I find at work it's a lot more informal. You get to know each other really well. (18/03/2002)

After only a few years in the new workplace, she seemed to have a strong sense of being part of a CoP that included not only her immediate co-workers in the department but also engineers from all over the country. This identification appears to be much stronger than her identification with the academic community or with engineering students ever was. In an interview, she reflected on her work as being part of a large national network of engineering experts:

> I write [reports] for the use by ... engineers and I write them for the use by senior engineers who are trying to deal with the whole system (the whole [engineering object of her investigations]) ..., for the departments, not for somebody in particular. (18/03/2002)

At the end of the study in 2004, Rebecca's responsibilities as an Engineering Analyst involved much written and oral communication. She estimated that she was spending approximately 55% of her time at work communicating, out of which up to 90% was spent writing, because "most of the requirements of the job are satisfied by producing reports from ... engineering work" (EM, 06/03/2004). She produced reports on engineering investigation findings, internal procedure documents, formal engineering reports, memos, and letters to industry. Rebecca estimated that she was spending about 10% of her formal "communication"

time communicating orally (internal briefings or external promotional formal presentations) (EM, 15/09/2003).

THEORETICAL FRAMEWORK

To help me interpret the broad range of data collected in the study, I have applied a unified social theory of genre learning (Artemeva, 2008, in press), which integrates RGS with AT (Engeström, 1987; Leont'ev, 1981) and situated learning (Lave & Wenger, 1991; Wenger, 1998), and which I have complemented with selected notions from Bourdieu's (1972) social theory of practice. Such an integration of these complementary yet distinct theoretical perspectives has allowed me to explore the interplay between the individual and the social in the novice's trajectory in her learning to communicate engineering knowledge (Artemeva, 2005, 2008, 2009).

Within the RGS framework, genre is defined as social action in response to our construal of recurrent situations (Miller, 1984/1994a) and, at the same time, as constructing rhetorical situations (Paré & Smart, 1994). While recognizing that genres can be characterized by regularities in textual form and substance, current RGS thinking perceives these regularities as reflections of an underlying regularity in social situations (Miller, 1984/1994a). This regularity is characterized by its temporal and spatial dimensions, which can be productively explored (cf. Schryer, 2002) through Bakhtin's (1981) notion of the chronotope. For Bakhtin, time is inseparable from space; that is, temporal and spatial relationships are intrinsically connected. Schryer (1999, 2002) further extended Bakhtin's discussion of the chronotope by observing that the notion of the chronotope expresses the connectedness not only of place and time but also of human values and current social beliefs and that our knowledge of genres is inseparable from our understanding of the chronotope. The notions of chronos and kairos, borrowed from classical Greek rhetoric, complement this view of time-space by reflecting different qualities of time and proportion (Artemeva, 2005). Kairos, the qualitative aspect of time, was defined as the right moment, the opportune, the due/right measure or a proportional response; in other words, as a unity of its temporal and spatial aspects. Chronos, a quantitative, measurable, aspect of time, designated the continuous flux of time (Kinneavy, 2002; Miller, 1992, 2002), and, according to Miller (1994b), "genre becomes a determinant of rhetorical kairos—a means by which we define a situation in space-time and understand the opportunities it holds" (p. 71). The notions of kairos and chronos became important to my research as they provided a perspective that allowed me to explore and interpret the timing and sequencing of engineering genres in a university engineering commu-

nication course and to uncover how individuals responded to different forms of time in different social contexts. The view of genre that includes the understanding of its chronotopic or, in other words, its temporal and proportional qualities, highlights its dynamic nature that is both constraining and enabling for a rhetor.

Schryer (1993, 1994, 2002) developed an argument about the temporary stability of genres by proposing to use "genre" as a verb: we genre our way through social interactions, choosing the correct form in response to each communicative situation we encounter—and we are doing it with varying degrees of mastery. At the same time "we are genred" (Schryer, 2002, p. 95), that is, we are socialized into particular situations through genres. Building upon the notion of constellation introduced by Campbell and Jamieson in 1979 and drawing on Bourdieu's (1972) social theory of practice, Schryer (2000) redefined genres as "constellations of regulated, improvisational strategies triggered by the interaction between individual socialization ... and an organization" (p. 450). This view of genre as stabilized only for now, allowing for change, and forming the rhetor's behaviour within the organizational context not only provides insights into Rebecca's learning trajectory but also illuminates how she is "genred" into the rhetorical situations she encounters in various settings.

As powerful as RGS has proved to be in the study of workplace genres, used alone it does not seem to allow for a productive analysis of the role of individual agents involved in the process of learning genres of their discipline and profession, and particularly, of the role of the agent's background. Some selected notions of Bourdieu's (1972) social theory of practice provide necessary tools for such an analysis (e.g., Artemeva, 2005). One such notion is the notion of capital. Bourdieu's capital may take both material and nonmaterial forms that can be converted into each other (for example, monetary capital may be used to pay for, or be converted into, education). Among other forms of capital, Bourdieu introduces social capital (for example, hierarchical positions within an organization) and cultural capital, which refers to particular cultural knowledge (e.g., engineering knowledge) or competency (e.g., professional engineering competency) (Winsor, 2003). Cultural capital is defined as "a form of values associated with culturally authorized tastes, consumption patterns, attributes, skills and awards" (Webb, Schirato, & Danaher, 2002, p. x) and thus, for example, includes the ways people communicate within particular situations or, in other words, use certain genres (e.g., engineering genres). The appropriation of this type of capital by an individual depends on the sum of cultural capital that her family possesses, the appropriateness of this capital in a particular socio-historical formation, and the forms and time of its implicit transition from the family to the individual. In this study of Rebecca's trajectory in learning engineering genres it is particularly important to remember that cultural capital can be converted into social capital:

for example, one's education and background in a particular discipline can lead to, or be converted into, a position within an organization.

Although RGS recognizes and celebrates dynamism, the unpacking of the precise mechanisms through which genre learning and execution occur requires additional compatible theoretical perspectives, as has been demonstrated in a number of studies (e.g., Bazerman & Russell, 2002; Dias et al., 1999; Russell, 1997). Theories of activity and situated learning have successfully expanded and complemented the RGS framework (e.g., Artemeva, 2008, in press; Le Maistre & Paré, 2004; Russell, 2005; Winsor, 2001). Elsewhere (Artemeva & Freedman, 2001), we have argued that, when compared to RGS, AT provides a higher level of theorization to account for change as well as resistance and conflict and offers a complementary perspective on "social motive, and on the action aspect of genre" (Dias et al., 1999, p. 23). AT (Engeström, 1987, 1999a, 1999b; Leont'ev, 1981; Wertsch, 1981, 1985, 1991) and theories of situated learning and communities of practice (Lave & Wenger, 1991; Rogoff, 1990; Wenger, 1998) share common origins in the cultural-historical theory of the development of human psychological functions proposed by Vygotsky in the 1920s-1930s (Engeström & Miettinen, 1999; Vygotsky, 1978). The important aspects of Vygotsky's theory that served as the starting points for the development of AT and theories of situated learning are the concepts of the mediating role of tools, signs, and symbols in human development and Vygotsky's understanding of "the mechanism of individual developmental change [as] rooted in society and culture" (Cole & Scribner, 1978, p. 7). These concepts are equally important for both AT and situated learning. One of the important concepts proposed by Vygotsky (1935/2003) was the concept of the zone of proximal development (ZPD) based on the notions of the actual and potential levels of child development. Vygotsky suggested that instead of using the actual developmental level as a determinant of a child's mental development, one should use the potential level, determined by the difficulty of the tasks that the child can solve in collaboration with an adult or a more capable peer. From this perspective, individual cognitive change is seen as effected by the social. One of the developmental outcomes of learning leading development in the ZPD is that the learner becomes able to engage in developmental activity with conscious awareness rather than merely spontaneously.

Both theories of activity and situated learning consider the social context in which human activity takes place as an integral part of human activity rather than just the surrounding environment. Activity and situated learning theorists agree that "every cognitive act must be viewed as a specific response to a specific set of circumstances. Only by understanding the circumstances and the participants' construal of the situation can a valid interpretation of the cognitive activity be made" (Resnick, 1991, p. 4). This view of human activity is close to the current

RGS perspective on the reciprocal relationship between genre and its social context (Bawarshi, 2000; Paré & Smart, 1994).

Leont'ev (1981) developed his theory of human activity from Vygotsky's idea of mediated human action. Leont'ev saw work as mediated by tools and performed in conditions of collective activity. The three-level model of activity proposed by Leont'ev provides distinction between collective activity, individual action, and operation. The uppermost level of collective activity is driven by an object-related motive; the middle level of individual (or group) action is driven by a conscious goal, and the bottom level of automatic operations is driven by the conditions and available tools (Leont'ev, 1981; Wertsch, 1981). I would like to speculate that the three-level model of human activity with the radical changes occurring at the points of change from operation to action to activity is, in fact, rooted in the "Hegelian nodal line of measure relations—in which quantitative change suddenly passes at certain points into qualitative transformation" (Engels, 1877/1947, para. 29). To illustrate this phenomenon, Engels uses Hegel's example of the aggregate state change of water from the liquid into solid state at 0°C and from the liquid into the gaseous state at 100°C, under normal atmospheric pressure, thus demonstrating "that at both these turning-points the merely quantitative change of temperature brings about a qualitative change in the condition of the water" (para. 29). In other words, in the Hegelian nodal line of measure relations, the accumulation (not necessarily in the numerical meaning of the word) of one factor leads to a sharp qualitative change in another. Similarly, in the three-level activity model, repeated performance of actions at the conscious level leads to their transition to the subconscious level; that is, to the level of operations. In other words, a qualitative change in the nature of the activity component occurs, following the accumulation of experience at the action level. These concepts have proved to be revealing in the study of changes that occur in novices as they accumulate engineering knowledge and learn genres of their profession.

A number of researchers (e.g., Engeström, 1999a; Witte, 1992, 1999) criticized Leont'ev's version of the theory for a major contradiction that lies at its heart: the use of object-oriented activity both as an explanatory principle of the psychological theory and the object of the study. In an attempt to resolve the ambiguities of the three-level model, Bracewell and Witte (2003) proposed an alternative interpretation. They suggested that Leont'ev's construct of activity—and the motive associated with it—"should be regarded as having the status of a general explanatory principle (in Vygotsky's terminology), and the constructs of action/goal and operation/condition should be regarded as having the status of objects of study" (Bracewell & Witte, 2003, p. 526). In this context, Bracewell and Witte introduced the construct of task, "the set of goals and actions that implement these goals, which are developed in order to achieve

a solution to a complex problem within a specific work context" (p. 528). Another attempt to overcome the ambiguities of Leont'ev's three-level model was made to some extent in the so-called second generation of AT (University of Helsinki, n.d.) with the introduction of a new unit of analysis, "the concept of object-oriented, collective, and culturally mediated human activity, or activity system" (Minnis & John-Steiner, n.d.). Engeström (1987) proposed to expand Leont'ev's basic mediational triangle, subject-tool-object, to represent an activity system. He suggested that the triadic structure of the basic mediational triangle should be extended to account for the socially distributed and interactive nature of human activity, that is, for rules, community, and division of labour. As I have noted elsewhere (2006), the expanded view of AT may be interpreted as an attempt to overcome the dualism of collective and individual units of analysis. Presenting human activity as a systemic function is one way to overcome this dualism.

Sharing its origins with AT, the view of learning as situated in the social is based on the Vygotskian understanding of higher mental functions in the individual as being derived from social life (Wertsch, 1991) and on his recognition of the social as primary. Theorists of situated learning see "knowledge, and not just learning, [as] situated" (Brown, Collins, & Duguid, 1989, p. 37). Central to the literature on situated learning are the notions that learning and knowing are context-specific; that learning is active and accomplished through coparticipation; and that cognition is socially shared (Freedman & Adam, 1996, 2000a, 2000b). Vygotsky developed his theories on the premise that individual intellectual development of higher mental processes cannot be understood without reference to the social milieu in which the individual is embedded and without consideration of the social roots of both the tools for thinking that novices are learning to use and the social interactions that guide their use of these tools (Rogoff, 1990). The unit of analysis in Lave and Wenger's (1991) version of the theory of situated learning is a community of practice and its central analytical viewpoint on learning is legitimate peripheral participation (LPP) (Lave, 1991; Lave & Wenger, 1991; Wenger, 1998). Wenger (2005) defined CoP as a group of people who work on something together—not necessarily at the same location—and interact regularly to learn how to do it better. For CoPs, "learning is not a separate activity. It is not something we do when we do nothing else or stop doing when we do something else" (Wenger, 1998, p. 8). Each CoP is constituted by distinct intellectual and social conventions, and the development of one's ability to engage in situated learning occurs through participation in a CoP. As situated learning theorists (e.g., Lave, 1996a, 1996b; Lave & Wenger, 1991; Wenger, 1998) note, a primary, and most effective form of the development of one's increasing engagement in situated learning is appren-

ticeship (see Russell, 1998 for the discussion of limitations of the apprenticeship model in writing studies). By apprenticeship they understand a process in which newcomers to a CoP learn the expert practices used in that community by being actively engaged in these expert practices and by taking "an active part in authentic but ancillary community tasks, under the guidance of more experienced 'oldtimers' and with only limited responsibility for the outcome" (Smart & Brown, 2002, p. 119). The notion of apprenticeship includes so called cognitive apprenticeship (Brown, Collins, & Duguid, 1989), a way of novices' enculturation into authentic practices of knowledge work through a process similar to craft apprenticeship. The concept of CoP as a unit of analysis acknowledges the importance of mediational means as does the concept of activity system in AT.

Lave and Wenger (1991) introduced the concept of LPP as an analytical perspective on, or a descriptor of, situated learning that focuses on the action itself and on its social outcome. LPP describes a range of social practices that situated-learning theorists refer to as apprenticeships. LPP views learning—a characteristic of all communities of practice—as taking place in the process of creation or action and as accomplished through coparticipation (Lave & Wenger, 1991; Rogoff, 1990). Newcomers and oldtimers in a community of practice learn during their cooperative activities, which they both want to finish successfully. The LPP model describes the situation of newcomers trained by oldtimers in the process of cooperative activity. Peripheral participation in this view gradually leads to full participation and full membership in a community of practice. Under the condition of LPP, apprentices are initiated into the communities of practice by participating in authentic tasks that are not invented as opportunities for getting them to learn (Freedman & Adam, 2000b; Hanks, 1991). Lave and Wenger's theory of situated learning often contrasts learning that occurs as a process of social participation in communities of practice and the classroom, or curriculum, learning that is expected to occur as a result of teaching. Learning in the framework of Lave and Wenger's theory is viewed as gradually increasing participation in a community of practice. Through their engagement in practice, peripheral participants (newcomers) can develop a view of what the whole enterprise is about, and what there is to be learned. Learning is, therefore, seen as an improvised practice. The proposed key mechanism of learning within communities of practice is a gradual movement of a newcomer from peripheral to full participation (Lave, 1991; Lave & Wenger, 1991; Wenger, 1998). Moving from peripheral toward full participation in practice requires from a newcomer a deeper involvement in the life of community, increased commitment of time, gradually intensified efforts "but, more significantly, an increasing sense of identity as a master practitioner" (Lave & Wenger, 1991, p. 111). As Lave

and Wenger noted, the process of becoming a full practitioner, a master—or an expert, to use Geisler's (1994) term—in a CoP involves concurrent production of continuity within the CoP. In addition, Lave (1996b) claimed that part of what it means to be engaged in a practical learning activity "is extending what one knows beyond the immediate situation" (p. 12).

Building upon Vygotsky's (1978) understanding of learning through internalization and externalization, Engeström (1987, 1992, 1999a) introduced the concept of expansive cycles that describes the process of a novice's acculturation into an activity system. Expansion is Engeström's metaphor for transformative processes and outcomes (Minnis & John-Steiner, n.d.) and an "expansive cycle is a developmental process that contains both internalization and externalization" (Engeström, 1999a, p. 33). The concept of expansive cycles is remarkably similar to the process of the movement from peripheral to full participation in a CoP as described by Lave and Wenger, and, thus, provides a link between the activity theory perspective, the situated view, and the RGS view that includes both constraining and enabling features of genres.

In my study of students' trajectories in accumulating engineering knowledge and becoming professional communicators, I have closely investigated the origins, theoretical grounding, and methodologies of the perspectives reviewed above—RGS, AT, and situated learning—and developed a unified theoretical framework for the study of professional genre learning (see Artemeva, 2008, for a more detailed discussion). This unified framework allows one to explore genre learning in a professional activity system as a component of the novice's movement from peripheral to full participation, accomplished under the mentorship of oldtimers. Having presented the overview of the theoretical framework, I proceed to the theoretical interpretation of Rebecca's story.

INTERPRETATION OF REBECCA'S STORY

Selected notions from Bourdieu's social theory of practice complement the unified theory of genre learning in this analysis of Rebecca's journey through school to workplace. At the centre of my inquiry is Rebecca's learning trajectory as she was developing into a full-fledged communicator within the dual space of engineering content knowledge and rhetorical process. While RGS has provided a perspective that situates professional genre learning within authentic and timely activities, the three-level model of human activity and the relationships between subject, mediational artifact, and object within an activity system has helped me trace causes of Rebecca's changing perceptions of the role and place of communication in engineering and her developing sense of her professional identity as an

engineer and engineering communicator. The situated learning perspective has helped me illuminate Rebecca's integration into the engineering workplace CoP and her realization of herself as an engineer and engineering communicator, while the discussion of the ZPD has allowed me to better understand Rebecca's positive experiences learning to communicate with her colleagues and superiors in the workplace. The combination of RGS with AT and situated learning within a unified framework has been particularly helpful in the analysis of Rebecca's case as this combination has aided me in unpacking a learning trajectory of an engineering student as she gradually becomes a professional engineering communicator.

The three-level model of activity is one of the theoretical tools that allows me to explore changes in Rebecca's perceptions of the ECC usefulness for her engineering studies and work. For example, when she reacts negatively to the whole course and says that a lot of activities seem to have lacked "a 'point' or a foreseeable goal" (EM, 21/04/2002), Rebecca is providing us with a fairly common novice's perception of an academic course in an unfamiliar discipline (such responses were often given by students at the end of the ECC). Rebecca's cultural capital did not appear to include the expectations of the engineering profession and she had not been exposed to the field before taking the ECC; she took the communication course at the beginning of her engineering studies when her domain content knowledge was practically non-existent. All these factors made it unfair and unrealistic to expect that she would gain the understanding of the integral role of communication in engineering from an introductory communication course.

Generally, the ECC instructors comment that they perceive the course as part of the activity of introducing students to the foundations of engineering communication and, hence, of preparing students for the engineering profession. These instructors are aware of the course's connections to other courses, the engineering curriculum as a whole, and industry expectations. Instructors design specific course tasks to provide input to students' learning of engineering genres and perceive these tasks as connected and forming a coherent series of pedagogical tools. As the three-level model of human activity suggests, inexperienced students do not and cannot engage with each exercise at the operation level because every "exercise" for them has its own goal and becomes an action that requires full conscious attention. That is, what for the instructor is a mediational artifact, for a student is an object. In other words, as Dias et al. (1999) put it,"The two activities, teaching and studenting, seemingly complementary and operating in parallel, represent different perspectives and generate actions whose goals are often at odds with one another" (p. 67).

Students entering the ECC often approach every course task as a separate action in itself, while for the instructor, separate course tasks are operations that contribute to the action of completing the course project, which in turn contrib-

utes to the activity of introducing students to engineering communications and teaching them how to communicate in response to particular rhetorical situations in the context of an engineering program. One may speculate that later, as the students become more and more immersed in the context of the engineering discipline and/or engineering practice, these separate tasks of performing in particular genres (such as writing a cover letter, writing a progress report, or preparing and delivering an oral presentation of completion report) in a sense drop down to the level of operations, and the students start seeing a "larger picture" of the professional communication and its role in the engineering profession. That is, the action becomes completion of a project, rather than writing a report. On the other hand, one may argue that acts of writing are never routinized so that they become Leont'ev's operations (cf. Dias, 2000). In this case, Bracewell and Witte's (2003) construct of task, introduced earlier in this chapter, becomes helpful: for the course instructor the course is a task (i.e., "the set of goals and actions that implement these goals" [p. 528]), but for a student, each goal and corresponding action represent a task in itself. Eventually, for some students, depending on the time that passed, experience in the course, prior experiences, and so on, these tasks become goals and the students become able to see a "larger picture." Some routinization occurs at this stage, but what actually becomes an operation is a matter for further research (Bracewell, personal communication, November 18, 2005).

Only with time and after having experienced situations that require the use of strategies learned in the course for other purposes, i.e., other courses and/or at work, some students start realizing that discrete exercises were not as randomly discrete as it appeared while students were enrolled in the course (as Rebecca demonstrated in the third response). It is significant that, as the time passes and as Rebecca becomes more involved in the context of engineering—both as an academic discipline and as a profession—her view of the effects of the ECC change from the abrupt "No" in her first response, to the recognition of the usefulness of particular course activities in the second response (e.g., writing formal and semi-formal technical reports, lab write-ups, and so on) to the view of the course as a whole ("one big subject") in which all discrete activities find their place, as reflected in her third response. In other words, to learn a genre, one needs to use it "to get things done" in an authentic setting for a particular purpose (Dias et al., 1999). Or, to return to the parallel I drew above between the three-level activity model and Hegel's nodal line of measure relations (1812/1969), the accumulation of experience of a genuine activity that consists of numerous actions leads to a sharp qualitative change in the student's perception of the whole activity, in this case, learning and using genres of engineering.

Rebecca's changing responses to the ECC and her growing understanding of the engineering profession as rooted in the inseparable unity of engineering

knowledge ("the what") and engineering communication ("the how") reflect both the importance of time (chronos) and timing (kairos) in students' perceptions of communication in engineering and the importance of the domain content knowledge in the process of becoming an expert (cf. Geisler, 1994). It also reflects Rebecca's "movement" through Engeström's (1987) expansive cycle from the time she was internalizing the knowledge of the discipline to the time she started to externalize it through engineering genres. Her growing understanding of the engineering program chronotope (Bakhtin, 1981) and the importance of timing and preparedness in terms of students' engineering content knowledge is reflected in Rebecca's insistence that the communication course should be offered at the third year level because only by the third year can the majority of students start understanding "what's happening" and have a real need to apply the communication strategies that they experienced in the communication course. Rebecca provided this suggestion at the end of her last year at university, by the time things had fallen into place and she had become able to see connections between courses in the program. At this point in time, the real need becomes a clear driving force for the learning of engineering genres; in other words, it is a clear kairotic moment in the engineering program. This is the time when Rebecca starts looking at the curriculum critically and says that it would be more beneficial for students to have such a communication course later in their academic careers.

Genres of engineering communication that Rebecca was trying to master while in the ECC (the objects of the learning activity in the course) became mediational means during her fourth year project and at work, just like lab reports and log books that serve as objects in engineering laboratory courses become mediational artifacts in the fourth-year project and in the workplace. For example, Rebecca named progress reviews and the project completion report as most important and memorable components of the ECC: "The progress reviews ... were probably the best things to learn" (I, 18/03/2002) simply because these genres were necessary for her to communicate the progress and results of her engineering work. While she was enrolled in the communication course, these genres constituted the object of the learning activity; later, in the fourth year of university and at work, Rebecca had to use them again and again as a mediational means when working on different projects (for example, the object of Rebecca's activity in the fourth year project was to find a solution to a real engineering problem that a group of 22 students was given by their engineering professors). From her various comments, it follows that Rebecca did not find the university chronotope comfortable and did not adapt to it even by the end of her studies: she never felt like a full member of the engineering student community at university.

However, her development as a knowledge worker and integration into the workplace chronotope appeared to have been much smoother, and she seemed

to be in control of her integration into the workplace CoP. In an interview, she described strategies that she had developed to ease her transition into this workplace CoP: a) At the beginning, she heavily relied on her boss's advice, as she wrote in an e-mail, "to make sure that the work I do ... is correct for the situation" (18/09/2003). In this e-mail she referred to the situation as the context to which her written work must respond, which reflects a developing rhetorical genre perspective on engineering communication, from types of documents to the contexts to which such documents respond. b) Because Rebecca was not a licensed Professional Engineer (P. Eng.) yet, she told me that she would give all her reports to her boss, who had a P. Eng. designation,

> because I ... can't sign them. He reviews them and then I fix ... them up and they go up the chain.... Now [I receive] a lot less feedback than before. At the beginning, [I had to do] a lot of editing; [I] had to rearrange my whole style. (EM, 18/03/2002)

c) Not only did she have to rely on her boss's evaluation of her written work while working in her ZPD with him, she had to change her writing to ensure that the boss would feel comfortable signing it. That is, the style she had developed at school and at her other engineering jobs had to be adapted to the context of the new workplace (cf. Anson & Forsberg, 1990/2003; Dias et al., 1999). d) Rebecca seemed to have become a skillful reader of the local CoP's chronotope. Since she had been a student, she developed a strategy to let her co-workers know that she was a newcomer to the CoP, signalling to them that she might need more information than an oldtimer:

> In the past, I would say I'm a student so they knew who I was and not get wrong impressions.... [I am] a bit more comfortable now, but I still make sure they know I'm a student.... [Now that I am an employee] I'll make sure they know that I'm a junior engineer. (EM, 18/03/2002)

These strategies were apparently considered legitimate in Rebecca's workplace CoP as they helped Rebecca both to learn more about her job, get her job done, and become accepted as the CoP member. Thus, while being socialized into an organization, Rebecca was able to adapt workplace genres so that they served her purposes and remained accepted by the oldtimers (cf. Artemeva, 2005).

In an interview, she said that she had learned much in the workplace, and this gave her confidence and allowed her to gain co-workers' respect (I, 18/03/02). This observation and her ability to devise effective communication strategies

reflect the development of Rebecca's professional identity as a knowledge worker and a legitimate member of her CoP. Rebecca also seems quite successful in using at work the knowledge and communication practices she learned elsewhere. In an e-mail, she once noted,

> I'm lucky that I get to do the same work [in the workplace] as what I took in University--I'm using the vast majority of my education to help me with my job.... All the skills I've learned on the job have been practical applications of what I learned at school. (EM, 18/09/2003)

This quote appears to indicate that much of what Rebecca draws on at work, including genres, was, in fact, taught outside of the local workplace context, and later transferred by Rebecca to other, more complex, contexts (cf. Artemeva, 2005).

In addition, Rebecca's self-evaluation of her strengths and weaknesses as an engineering communicator has changed from a vague one provided at the beginning of the ECC ("my strengths are my creativity ... my weaknesses are my grammar" [Q, 09/1997]) to a very specific one provided a year after graduation ("I know that I am a good report writer, but a poor public speaker" [EM, 14/09/2003]). In 2003, six years after having taken the ECC, she was not only able to identify her strong and weak points as a mature communicator but also capable of identifying ways of using the strengths to her advantage and dealing with her weaknesses: "I tend to choose tasks that display my strengths. I also believe, however, in trying to improve areas in [communications] where I have demonstrated that I am relatively weak" (EM, 14/09/2003). This self-evaluation reflects a level of maturity and professional confidence and a good grasp of what is important to be a functioning member of her CoP.

REBECCA'S MEMBER CHECKS

At the end of my longitudinal study, I asked all study participants to read my reports on their individual cases and send me their member checks (cf. Winsor, 1996). These member checks provided additional validation of my interpretation of the data collected over the years. In an e-mail, Rebecca reflected on her case based on 74 single-spaced pages of questionnaire responses, e-mail messages, and interviews,

> I never kept track of my responses to your questions/interviews over the years, and I find it incredible how I've changed, and

> how my responses have changed. 74 pages! I didn't even realize it. The study is very interesting. (EM, 13/09/2004)

> I've had a chance to thoroughly review the document and I can find no errors. In fact, I quite enjoyed reading your analysis of my case. As I mentioned in my previous email, I did not keep track of my own responses to your questionnaires, but all the quotes sound exactly as what I would have said over the years. Thank you again for the opportunity to review my case. (EM, 1/10/2004)

CONCLUSIONS AND IMPLICATIONS

The study of written and oral professional communication allows us to better understand the workings of a contemporary knowledge society. The development of professional expertise (or, as Geisler, 1994, defines it, a dual problem space of the domain content knowledge and rhetorical process), as reflected in genre knowledge is one of the key issues of the current research into the formation of professional identities of knowledge workers. In this chapter, I presented a case of a young engineer's trajectory in her development as a professional and a professional communicator. I introduced and discussed a theoretical framework that allowed me to closely analyze the development of her professional identity as a member of an engineering CoP. The unified social theory of genre learning based on the integration of RGS with AT and situated learning theories, coupled with selected concepts from Bourdieu's social theory of practice, has proved effective in the analysis of Rebecca's trajectory in learning engineering genres, as the trajectory unfolded in time and space.

I applied the unified social theory of genre learning to the analysis of her learning and use of engineering genres in various contexts in an attempt to understand what constitutes professional genre knowledge and how novice knowledge workers learn to operate within the dual problem space of the domain content knowledge and rhetorical process. From the analyses that I presented in this chapter and elsewhere (Artemeva, 2005, 2008, 2009), it follows that genre knowledge consists of multiple ingredients (Artemeva, 2005, 2008), which go far beyond audience awareness and knowledge of the textual features of genres. The study has shown that novices can learn particular ingredients of genre knowledge both in the classroom and in the workplace; they can later modify and adapt these ingredients to more complex communication contexts. Hence, the question of the portability of rhetorical genre knowledge may now be viewed in a different

way. For example, on the basis of recent findings, researchers (e.g., Tuomi-Gröhn & Engeström, 2003) do not necessarily interpret the portability of knowledge in traditional terms, that is, as the effect of a prior task on the subsequent task of the same level of complexity. They, rather, see it as a continual learning from one changing situation to another, a more complex one. In the latter case the portability of knowledge and learning plays an important role in one's successful performance in more and more complex tasks. Rebecca's ability to successfully cross boundaries (Wenger, 1998) between different activity systems, i.e., school and various workplaces, reflects her ability to carry learning and professional knowledge—in particular, genre knowledge—from one social situation to another.

Säljö (2003) suggested that cooperation with other activity systems and the provision for rich boundary-crossing between them should be encouraged, and that novices should have an opportunity to analyze, contribute to, and modify daily practices as a means to develop knowledge. In other words, learners should act as agents of change, rather than copy the knowledge and skills of expert members. As Rebecca's Individual Case Synopsis has shown, she developed her own strategies to comfortably deal with the workplace situations, rather than attempting to copy what she referred to as "cookie-cutter" strategies that had been offered in many of her university courses. In other words, she was able to creatively apply her knowledge of engineering genres learned at university and use it in workplace situations.

The use of the unified social theory of genre learning allowed me to uncover complex processes in Rebecca's learning trajectory. Thus, the integration of RGS and the three-level model of human activity permitted me to analyze teaching and learning in the communication classroom as two independent activities. Rebecca's case provides additional evidence that activities of teaching and studenting (Dias, 2000) are radically different and that Bracewell and Witte's (2003) notion of task allows us to unpack these differences: While the course instructor sees the whole course as a task, for a student, each goal and corresponding action represent a task in itself.

One of the questions that arise then is how a student can assess the quality of teaching while still being enrolled in a professional communication course. As Rebecca's case and other cases investigated in the longitudinal study (Artemeva, 2005, 2008, 2009) demonstrate, the ability to see the course as a whole comes to students only much later, once the course experience becomes contextualized within the university and/or workplace activity systems. This observation raises a concern about the timing of traditional teacher evaluations in professional courses that usually come at the end of the course. Another related question, which I have already raised elsewhere (Artemeva, 2005), is the question of the assessment of students' professional genre knowledge. Rebecca's case supplies additional evidence that such an assessment may provide accurate information

only much later, after the course has been completed and the professional identity has been formed. Detailed answers to these questions require further research.

Rebecca's case indicates that there are important connections between genre knowledge and the novice's ability to develop into a successful professional and professional communicator in the contemporary knowledge society. This genre knowledge is necessary for a smooth integration of novices into workplace CoPs. In Rebecca's case, genre knowledge was accumulated later in her academic and professional career (unlike in the cases of two other students in my longitudinal study who had accumulated their cultural capital from their families [see Artemeva, 2005, 2008]) and included her academic experiences in engineering classes, the ECC, and workplaces. Rebecca's case provides evidence that the engineering communication course had supplied her with a foundation in professional generic practices that she was able to draw and build upon throughout her subsequent academic and professional experiences. It is notable that, contrary to the findings presented in Anson and Forsberg (1990/2003), Dias et al. (1999), Dias and Paré (2000), and MacKinnon (1993/2003), Rebecca had no difficulties drawing on genres learned in one context when applying them in another (cf. Artemeva, 2005, 2008). This observation allows me to speculate that the knowledge of genre ingredients, which she had possessed by the time she needed to draw on genre flexibility and adapt genres learned in one context to another (cf. Schryer, 1993), provided her with the confidence and ability to do so. It also appears that by that time, for Rebecca, the genres of engineering no longer were the objects of the engineering activity—they had long turned into mediational artifacts (cf. Le Maistre & Paré, 2004).

Rebecca's case indicates that if a student has not yet accumulated the necessary ingredients of genre knowledge, it may be futile to expect her to learn even the basic domain-specific communication strategies in a single communication course. Comments provided by other longitudinal study participants (Artemeva, 2005, 2008) and Rebecca's movement through activity levels, in particular, suggest that offering a domain-specific communication course in the first or second year may not be optimal for those students who have not accumulated "the critical mass" of domain content, genre knowledge, and relevant cultural capital, which may allow them to perceive a communication course as a coherent whole rather than a mosaic of discrete actions. It appears that for such students, the third year of the engineering program serves as the kairotic moment in their accumulation of domain content expertise and other genre ingredients necessary to focus their view on the communication course and see connection between knowledge, genres, and practice of engineering.

The case study discussed in this chapter sheds light on one of the important processes involved in the education of knowledge workers, i.e., the formation of

their professional identities as they learn to occupy the dual space of domain-content knowledge and rhetorical process. As we have seen, this education goes beyond the years spent in a university program. Further studies of this process are needed to locate new evidence of the portability of rhetorical strategies between the education and workplace contexts and to identify conditions that make such portability possible.

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