The Progressive Construction of Communication:  
Toward a Model of Cognitive Networked Communication and Knowledge Communities  

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Abstract: Networked communication allows the emergence of a new social reality: knowledge communities in cognitive networks. This paper formulates a model of cognitive networked communication and knowledge communities. This model aims to show the progressive construction of communication and is based on an integrative view of *conviviality* (participation and engagement) and *knowledge building* (intentionality, individual and social representations that shape different levels of collaboration and influence learning in interpersonal relationships). The model suggests communication can progress from lower to higher cognitive levels, and that those levels are apparent in different types of communities. Although community communication is essentially structured through cognitive procedures (*logos*), the model also suggests that it is shaped by affectivity and emotions (*pathos*), and moral and cultural values, beliefs, and opinions (*ethos*).

Résumé: La communication en réseau permet l’émergence d’une nouvelle réalité sociale: les communautés de connaissance formées grâce aux réseaux cognitifs. Cet article formule un modèle de la communication cognitive et des communautés de connaissance en réseau. Ce modèle vise à démontrer que la communication se construit de façon progressive. En plus, il se fonde sur une perspective intégrative de la convivialité (la participation et l’engagement), et de la co-élaboration des connaissances (l’intentionnalité et les représentations individuelles et sociales qui permettent la possibilité de différents niveaux de collaboration et influencent l’occurrence de l’apprentissage dans les relations interpersonnelles). Le modèle suggère que la communication peut progresser de niveaux cognitifs inférieurs à des niveaux supérieurs, et que ces niveaux sont clairement identifiables selon le type de communauté en réseau. Bien que la communication à l’intérieur des communautés soit préalablement structurée par des procédés d’ordre cognitif (*logos*), ce modèle suggère aussi qu’elle est formée par l’affectivité et les émotions (*pathos*), et par les valeurs morales et culturelles, les croyances et les opinions (*ethos*).

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Introduction
People generally take for granted the language and behaviours they have developed throughout their lives, which are, to a certain extent, transferred from previous generations. These early-learned skills allow people to communicate their ideas and feelings, to make judgments, and to function individually and socially. On the surface, language usage obeys tacit rules. These rules are learned through experience. However, language and body behaviour are also determined by genetic possibilities, such as the way we logically structure our utterances (Piaget, 1976a, 1976c, 1992) and how we show emotions and feelings through facial expression (Hauser, 1996). Since the beginning of history, *Homo sapiens* has proved to be a unique species. Pre-historical findings have shown that people were able to communicate through pictorial symbols thousands of years ago. Smoke and knot signals were developed as non-verbal forms by indigenous peoples of the Americas, and Brazilian *carajá* Indians used to tattoo their faces to indicate adulthood, and to weave various cultural messages and symbolism into bracelets. As Cassirer (1994) puts, it is more meaningful to understand our species as *Homo symbolicum*.

In the search for more articulated means of communicating, modern Western societies pushed on so-called progress. The resulting communication means went far beyond Mesopotamian cuneiform writing (used mainly for commerce) or even such complex codes as Egyptian hieroglyphic writing. After Gutenberg and “his” Bible, the first mass media publication, history has witnessed astonishing advances in the way human beings communicate their ideas to others. Books, photographs, movies, radio, and TV broadcast emerged in waves, with each new innovation sustaining the introduction of the next. Digital technologies developed steadily from the 1950s, but human communication processes only started to be supported by computers from the 1980s onward, with computers becoming more important in the 1990s (Harasim, Hils, Teles, & Turoff, 1995). Digital communication is a very recent innovation, but its advancement is dramatic enough to radically alter all previously developed communication media. For example, most new movie productions incorporate digital effects; radio broadcasts are available through Web sites; the integration of television and digital technologies is already being implemented (although not yet very successfully from a business viewpoint); and most telephones are now digital.

In spite of this progress, the complexities of the use of natural language by humans continue. Evolutionary changes such as the communication design of a given species (Hauser, 1996) take hundreds of thousands of years. Software developers and computer programmers who write code and develop tools are supposedly capable of supporting interpersonal and mass communication, yet they have not succeeded in overcoming the limitations of communicating through computers. Synchronous (real-time) systems such as chat and video-conferencing, and asynchronous systems (not in real time) such as e-mail, newsgroups, and conferencing
summarize the state of the technology to date. Networked communication is promoted as integrating different media, as making its predecessors obsolete, and as changing the world. Indeed, modern capitalism has deeply plunged into the digital “revolution,” which is changing the structure of all human social, political, economical, and cultural structures. Transformations are everywhere: the economy, education, administration . . . even organized crime! However, cognitive research reveals that people still take time to think, that passing on an idea is more than simple interaction with computer keyboards, and that understanding, reflecting, acting, and learning are still processes that do not match the speed of a computer processor. Computers take a fraction of a second to save a text document. Yet users, in general, don’t really understand how computers operate. The digital divide is not only socio-economic: it is essentially cognitive.

Although technology advances seem spectacular, understanding their integration in real life is challenging and complex. People are part of, and participate in, different communities at the same time, structuring themselves in networks (Wellman, 1988). New technologies add to the community web by offering the possibility to socialize on-line and hence create new forms of conviviality, understood as communicative processes of participation and engagement, and knowledge building. The goal of this article is to explore these new forms of conviviality from a cognitive perspective by stressing that on-line community building is progressive and can reach different cognitive levels. I adopt in this paper a communication perspective that focuses on cognition from its individual genesis to socialization (from individual to social cognition). This approach aims to highlight how people process information enabling them to make judgments according to their moral and cultural values, beliefs, and opinions. I argue that it is critical to approach communication processes from a cognitive viewpoint to get a deeper understanding of community building on the Web. My perspective is constructivist, integrating contributions from Piagetian epistemology, Vygotskyan psychology, and cognitive science theories.

The cognitive model presented is based on studies of asynchronous learning communities, research communities, and communities of practice in different countries (Campos, 2001, 2002a; Campos, Laferrière, & Harasim, 2001). It suggests that progressive communication levels can be identified in networked communities. I believe this model provides a first step in the search for understanding on-line communication processes through networked communication systems. The model assists researchers and practitioners to understand, explain, and predict community viability based on the participant level of cognitive, affective, and ethical engagement.

Theory, method, and context

The model of cognitive networked communication and knowledge communities proposed here is at the crossroads of different, although related, disciplines: communication, logic, psychology, cognitive science, and education. I adopt an interactionist epistemological approach that results in a convergent interdisciplinary explanation of networked communication and new forms of human conviviality. I
integrate the logic-based Piagetian theory of knowledge (Genetic Epistemology), aspects of the social view of cognitive activity presented by Vygotsky’s (1979) psychology, the cognitive science approach of distributed cognition when networks are at stake, and Scardamalia and Bereiter’s (1994) knowledge building theory. The result is an approach that focuses on how on-line collaboration and argumentation procedures shape communication processes in networked contexts.

This perspective aims to contribute to communication studies by authors working from a cognitive perspective, such as those who introduced the notions of collective intelligence (Lévy, 1994), connected intelligence (De Kerckhove, 1997), working intelligence (Scribner, 1984), and distributed intelligence (Pea, 1993). Cognitive network is understood as a structure enabled by the cognitive processes of the brain actualized and developed in social contexts as supported by new collaborative technologies. Cognitive networks enable the sharing of meaning configurations (Campos, 2002), which weave thinking procedures (logos), affectivity and emotions (pathos), and moral judgments (values) deriving from beliefs and opinions (ethos). In an integrative way, these configurations allow people to share meanings in their search for understanding. When meaning configurations are shaped, people connect their intelligences, cognitive networks become real, and knowledge communities emerge.

It is worth noting that the approach to communication and the notion of networks used in this article are unrelated to network theory (Wellman, 1988). Also, to clarify, the approach is based on a cognitive perspective, as opposed to communication studies based on social theory, cultural studies, and sociohistorical approaches that are not rooted in Piaget’s and Vygotsky’s views. The studies referred to are essentially grounded on conference transcripts of social interactions through asynchronous conferencing systems (Campos, 1998, 2000, 2002a; Campos & Laferrière, 2002b). We believe that only in-depth qualitative studies of collaborative discourse can reveal the progressive construction of knowledge. However, to have a sense of the community context, we also worked with complementary data such as documents, interviews, and questionnaires with community participants, and observation of and direct participation in community building and development (Campos, Laferrière, & Harasim, 2001).

We did not use quantitative sampling methods to choose our communities because our ethical procedures demanded full informed consent from participants, something that is difficult to obtain, specially from students. We thus made a selection of representative full-consented transcripts. From post-secondary communities, we achieve variability in terms of discipline, number of students, and universities. From workplace communities, our criteria were those of having represented public and private organizations as well as professional associations (Campos, 2002b; Campos & Laferrière, 2002b; Campos, Laferrière, Messas, & Allaire, 2003). We defined community size as small (5 to 15) and medium (15 to 40). Some large groups (more than 40) were also studied, but they were broken down into smaller groups. In our medium-sized groups, the number of very active
participants tended to be around 15% of the total number, which is in line with the Wenger, McDermott, & Snyder model of community participation (2002).

The theoretical considerations of the model of cognitive networks and knowledge communities will first be presented, followed by a detailed explanation of the method developed to study electronic conference transcripts.

**Communities, networks, and connected intelligence**

Much is said about “community.” Why do people gather together? Reasons can be infinite, but the core is the need to communicate. Biological data suggest that all animals engage in communicative behaviour for the sake of mating, feeding, signalling danger, or protective behaviour (Hauser, 1996). However, humans go well beyond this: they need to feel part of the social group they identify with, apply meanings through language to create unique cultural worlds and possibilities, and create cognitive tools for communicating and evolving as a species (Johnson-Laird, 1990).

The word “communication,” *communicatione* in Latin, comes from the verb *communicare*. On the one hand, *communicare* is a word that has two meanings in Latin: *communicate* and *communion*. The relationship between the idea of “communicating” (*communicate*) and that of “being together with God through the means of the Holy Communion” (*communion*) points to the fact that the idea of “transmitting” messages (broadcast) is something unrelated to the etymological meaning of “communication.” On the other hand, “community” comes from the Latin *communitas*, which means, curiously enough, the state of being in communion.

I don’t use the word “virtual” to talk about on-line communities because “virtual” is a word that has been corrupted in its use, resulting in numerous definitions of “virtual community” (Proulx & Latzko-Toth, 2000). The word comes from the Scholastic Latin *virtuale*, meaning something that exists as a faculty but that does not actually exist. Granger talks about virtuality as an abstract concept related to scientific models that “virtually” captures the actual possibility of an event or phenomenon to come into existence (1987, 1992, 1994a, 1994b). One example of this would be Einstein’s formula of relativity (*E = mc²*). The formula expresses the *virtuality* of relativity, given that this representation is neither the relativity itself nor anything “concrete.” The current use of the compound “virtual community” is, therefore, highly misleading. It suggests that communities are in a realm of existence that is not real. Howard Rheingold, for example, makes a distinction between the “virtual” and the “real” as opposed entities (2000).

I adopt the term “network” because it expresses metaphorically, in a consistent way, the idea that meanings are interwoven, threaded and evolving through learning processes of constructive interpretation (Breuleux, 2001). “Cognition” is a term that originates from the Latin word *cognoscere*, or “to know.” “Net” is derived from the Latin word *rete*, which means knotting together loose open materials such as strings, threads, and wires. However, “network” is a modern term used to express the phenomenon of complex systems of traffic (roads, wirings, organizations, people, information, etc.). This is metaphorically more in line with
Wellman’s structural view of the “community question” (1979). I adopt the idea of “cognitive network,” combining both original and modern terms from a knowledge perspective: complex cognitive structures, affectivity, and systems of values, beliefs, and personality traits that are expressed through meanings built throughout our lives. Thus, knowledge communities are people who gather together to communicate with the goal to achieve a *communion of thought* (understanding) through complex biological systems. Levy explains this phenomenon as one of collective intelligence (1994). De Kerckhove (1997) enhances this term through the idea of connected intelligence or “webness”:

The growing synergy of networked communication is, with the exception of language itself, the communication medium par excellence—the most comprehensive, the most innovative, and the most complex of them all . . . the Net . . . gives us access to a live, quasi-organic environment of millions of human intelligences perpetually at work on anything and everything with potential relevance to anyone and everybody. It is a new cognitive condition I call “webness.” By webness, I mean the essence of any network. (p. xxiii)

**Knowledge construction and knowledge building**

My approach to computer-based communication processes could be described as an ecological approach that derives from the Piagetian model of knowledge (Piaget, 1950, 1976b, 1976c, 1977a, 1991; Ramozzi-Chiarottino, 1988, 1997). It integrates elements of Vygotsky’s learning theory (1979), an approach to distributed cognition (related to the use of computer tools) that balances the role of the individual and the social (Salomon, 1993), and knowledge building theory that explores the possibility of knowledge development within conferencing systems, enabling higher cognitive skills through a creative process of written conversation (Scardamalia & Bereiter, 1994).

Vygotsky’s epistemological origins, rooted in Hegelian post-Kantian philosophy and Marxism, can be described as constructivism in which the social environment is prevalent with regards to the individual. In contrast, but somewhat complementary, Piagetian Genetic Epistemology, rooted in an understanding of Kantism as evolutionary by integrating ideas taken from Darwin and Lamarck, describes constructivism as the genetic possibilities of brain functioning that are actualized in and through experience. The fact that Piaget did not focus on language but on a logical model of information processing created misunderstandings that led to illusory “deep” divergences about the views of both authors. This is shown by Cole & Wertsch (1996) and by Piaget himself in his comments on Vygotsky’s works (1985). Piaget wrote extensively about the indivisibility of the individual (logical systems—brain functioning) and social (meaning systems) dimensions of existence (Piaget, 1950, 1977b). In fact, even though Piaget and Vygotsky addressed the same phenomenon of knowledge acquisition by focusing on different aspects, they did not completely disagree with each other.

In spite of the contributions of Jean Piaget and Leo Vygotsky to science, philosophy, and epistemology, their works did not directly address communication. Piaget’s model of the possibility of knowledge, for example, defends the idea that
logic (form) expresses the functioning of the brain and that individual thinking procedures progressively shape knowledge acquisition. Traditional cognitive science proposed different models (such as that of the classic architecture of the mind, and connectionism), but their view on knowledge construction continued to be essentially Piagetian if we look at the weight given to procedures in cognitive processing. This view could be defined as more formal and identified as knowledge construction, where building of mental structures hosting mental schemes makes knowledge acquisition possible. This balance between the individual and the social environment is accomplished in a process derived from genetic possibilities and actualized in the action of the individual in the world.

Complementarily, Vygotsky stressed that cognitive processing could go beyond expected possibilities because knowledge construction is socially situated and shaped in collaboration through language. Thus, through language, people are able to learn and to achieve knowledge that would be impossible without social interaction. This view could be described as more content-like. Data from Vygotsky’s experiences on science learning challenged the Piagetian theory of child development, which is derived from his model of knowledge. The first stage of knowledge acquisition defended by Piaget in his model (egocentrism) was not accepted by Vygotsky, although they were in relative agreement concerning the other phases of intelligence development. It was a question of focus: What comes first? Mental structures upon which meaning systems act (Piaget as derived from “evolutionary Kantism”) or meaning systems acting through language on mental structures (Vygotsky as derived from Marxism)? Vygotsky’s position was certainly in line with the times in which he was living. The strong bias toward language and its social function found in his theory was immersed in the collectivistic ideals of the Russian revolution. Piaget, a Swiss Christian, could not, historically, have had such an approach. However, he responded to Vygotsky, clarifying that his model was not rigid and that the stages (associated with the age of the individual) should be taken as guidelines of development given that it would be impossible for an individual to go beyond genetic possibilities (Piaget, 1985). I agree with Cole & Wertsch that both contributions are essential and complementary (1996), but adopt Piagetian epistemology as a basis because, genetically, logical functioning comes well before the inscription of language (see the sensory-motor phase in Piaget, 1977c).

Cognitive science built a research program of controlled studies—some of those designed to verify Piagetian claims—and a solid base of experimental data. However, its development is far from being strictly experimental. More recently, a number of authors working with the development of networked technologies have been integrating “hard evidence” and qualitative data in order to study cognition embedded in social practices (Bereiter, 2002; Cole & Engeström, 1993; Pea, 1993; Salomon, 1993; Scardamalia, 2002; Varela, 1996; Varela, Thompson, & Rosh, 1993). By working with both quantitative and qualitative approaches, these authors defend the idea that cognitive procedures occurring in the social context of language should be understood as “distributed.” Cole & Engeström (1993)
integrate Vygotsky’s views of activity in social contexts with the idea of distributed intelligence acting on the environment. Somewhat differently, Pea (1993) argues that computer tools and artifacts are instances of reality in which intelligence operates, leading to the social construction of knowledge. Varela and his associates interpret social as the individual’s history by proposing the phenomenological notion of enaction to explain the emergence of cognitive reality (Varela, 1996; Varela, Thompson, & Rosh, 1993). Salomon (1993), in an illuminating article, questions where the individual lies in social cognition. He argues that distributed cognition is a notion that only stands if we consider the individual, for four reasons: (1) cognitions are not at all distributed; (2) procedural knowledge cannot be distributed; (3) individual representations are still individual no matter how social language is; and (4) ignoring the instance of the individual can be highly misleading. We should, then, be able to identify and to study both individual and distributed cognitions in order to understand their reciprocal effect (Salomon, 1993).

These discussions are critical for understanding the place of cognition in communication studies, traditionally taken as strictly “social” by most social science approaches. By integrating elements of Piagetian epistemology, elements of Vygotskyan psychology, classical cognitive theories, and distributed cognition approaches signalling how the “social” blends with the “individual” in cognitive communicative interaction that occurs through computer networks, we are able to propose a cognitive approach to communication. Essentially, the focus is on the relationship between the communicative organic possibilities and the context, or between theoretical and practical thinking as being a single entity (Rogoff, 1984; Scribner, 1984) in which brain functioning is logically anterior to experience. Although knowledge derives starts with experience, not all knowledge derives from it (Kant, 1994, p. 36). In this sense, this paper adopts the emergent notion of distributed cognitive communication, which is closer to the bidirectional practices of using the telegraph and the telephone than the unidirectional ones of watching movies and television programs, listening to the radio, or reading hot news in the press (De Kerckhove, 1997). The notion of distributed cognitive communication answers, from our viewpoint, the sometimes opposing and sometimes converging views presented above, namely how technological tools support communication that leads to collaborative learning and knowledge building (Bereiter, 2002; Scardamalia, 2002).

Knowledge building theory represents a continuous process of production and improvement of ideas that is valuable for a community. The sum of individual contributions is less fundamental than what the community is able to accomplish by engaging in knowledge production, creation, improvement, and innovation. (Scardamalia & Bereiter, in press). Scardamalia & Bereiter do not adopt the structuralist framework that underlies Piagetian theory. However, they defend that knowledge building could lead to differing achievements but not to differing processes given that the latter would be “essentially the same across the trajectory running from early childhood to the most advanced levels of theorizing, invention,
and design” (in press). In other words, knowledge building goes far beyond scientific knowledge, as explored by Piaget.

Piaget explored knowledge that is necessary and universal and, thus, scientific. All other knowledge is related to meaning systems (language) and would be forcefully “popular,” as Ramozzi-Chiarottino (1988) and Breton (1996) put it. We contend that any kind of knowledge can only be achieved through and by communication. Even formal knowledge such as mathematics needs language in order to be communicated (Grize, 1991). I adopt here a knowledge building approach to communication because it allows (1) the integration of formal and content-like aspects of knowledge, and (2) the development of a cognitive theory of popular knowledge complementary to scientific knowledge. Although communicative action is essentially sharing meaning, it can only be fully understood by integrating the psychology of the individual within the social context in terms of a knowledge building process. This process cannot be restricted to the necessary and universal construction of mental schemas and structure, nor to the accumulation of contingent and particular “knowledges.” This approach is not exclusively bound to the social or natural sciences. Rather, it is interdisciplinary and has contributions to offer to communication theory by exploring how communication engenders knowledge in cognitive networked communities (that are, essentially progressive problem-solving processes) and by pointing to the integration of both quantitative and qualitative research methods.

Communication in ill-defined domains: Building knowledge through argumentation

Problem-solving processes have been studied extensively by cognitive science and psychology researchers, but in well-defined domains such as mathematics (Brer, 1994) and physics (Larkin, 1981; Larkin, McDermott, Simon, & Simon, 1980). Normally, the procedures to solve problems follow limited clear mental routes (or strategies). Understanding mental procedures enables artificial intelligence (AI) researchers to model them in software interfaces. However, because the focus of this kind of research is on well-defined domains, I argue that it remains in what could be called the realm of form or knowledge construction, i.e., the working of procedures independently of their situated content.

Scientific knowledge about problem-solving processes based on ill-defined domains (based on language) is far less developed. For example, composing the end to an unfinished story has no single or simple path. Although cognitive scientists are able to explore possible procedural strategies that people employ to solve an operation like 10 + 2 = 12, solutions for language-based problems are normally infinite. Conversely, I argue that research on ill-defined domains remains in the realm of content. It is certain that this kind of research (related to reading, writing, understanding, and interpreting language) will never reach the modelling stage of the well-defined domain. To date, ill-defined cognitive research has released limited and “unreliable” knowledge, likely because of lack of certainties in the language domain (see Bereiter & Scardamalia, 1987). However, there are cognitive science approaches that explore knowledge production in ill-defined domains with a view to integrating both realms of form and content or knowledge building. I suggest that
knowledge building theory (Bereiter, 2002) is one worth pursuing for the purpose of studying the cognitive dimension of communication processes through electronic conferencing.

In order to build knowledge, people must reason, engage in common discussion, and argue. As Breton explains, argumentation is, above all, communication, and to argue is to build an intersection between the mental universes of the individuals interacting (1996). Or, more appropriately said, argumentation involves moulding the meaning configurations of people engaged in communication processes (Campos, 1998). Studies of asynchronous electronic conferencing tend to confirm this view. There is qualitative evidence that people naturally use the basic structure of an argument when communicating on-line: the logical form If-Then (Campos, 1998, 2000, 2002a). In addition, argumentation structures can be used as scaffolds for structuring communication processes in ill-defined problem-solving contexts when the community is implemented around knowledge building principles (Campos, 2002b). Furthermore, conference transcript data and direct observation of networking processes support the view that solving ill-defined problems can advance people’s understanding about the subject matter and that argumentation processes are at the core of communication processes leading to knowledge building (Campos, 2002b). Three progressive dimensions of knowledge are involved in the communication process: logos, pathos, and ethos. Logos represents cognitive procedures that are at the base of human reasoning and the capacity to infer. It can be identified through the subjacent logical instance of action (sensory-motor, operatory, as well as discursive). Pathos represents feelings and emotions that are embedded in people’s actions, including the act of communicating through discourse. Ethos represents the moral values derived from beliefs upon which we conceptualize opinions and ideas as a result of the psychological traits we develop throughout our lives.

Until the 1950s, argumentation was strictly identified as an instance of logos, namely for those adopting Aristotelic, or even propositional perspectives (mathematical logic, for instance). However, it is not meaningful to try to understand argumentation in isolation from real use and practice (Toulmin, 1958). Arguments embed feelings and emotions (pathos), and moral values (ethos) build upon a cognitive structure and its subjacent natural logic (Grize, 1991). Therefore, the situated content of argumentation cannot be understood strictly from a Toulminian epistemological perspective but as being enabled by logical procedures, i.e., a constructivist epistemological approach in which logos underlies pathos and ethos and whose evidence could be assessed through the study of objects of knowledge (Popper, 1994; Scardamalia & Bereiter, 1994), such as conference transcripts. In other words, arguments are embedded instances of logic as well as rhetoric moves (persuasion). Argumentation and rhetoric are at the core of any communication process, independent of the medium. I argue in this article that networked (many-to-many) communication has unique cognitive characteristics that are bound to collaborative argumentation.
Communication through asynchronous conferencing software

I apply the notion of knowledge building to analyze the processes of people networking and connecting their intelligences through conferencing systems to study how communication progresses. The data sources are post-secondary, research, and workplace networked communities using asynchronous conferencing software. The software used by the communities that we studied was not designed specifically to support the knowledge building principles identified by Scardamalia (2002), which are (1) real ideas, authentic problems; (2) improvable ideas; (3) idea diversity; (4) rise above; (5) epistemic agency; (6) community knowledge, collective responsibility; (7) democratizing knowledge; (8) symmetric knowledge advancement; (9) pervasive knowledge building; (10) constructive use of authoritative sources; (11) knowledge building discourse; and (12) embedded and transformative assessment. Nonetheless, we applied those principles to understand communication progression: However, many of the above-mentioned principles can be identified in cognitive networked interaction independently of the software used for communication.

Much has been said about asynchronous conferencing systems, and mostly with optimism. Asynchronous conferencing systems allow time for individuals to reflect and edit before responding. Cognitive research suggests that this "editing" practice enhances reasoning skills (for a brief review, see Bruer, 1994). Some electronic conferencing systems also afford the integration of multimedia such as sounds, images, and video. In addition, it is common to hear people comment that working any place and anytime is an advantage.7

Concrete setbacks also exist. Most conferencing systems, because of the tree-like nature of message organization, create difficulties for convergent thinking (Feenberg, 1999, 2001; Campos, 1998). Idea organizing, structuring, and linking are critical for higher communication skills such as knowledge building (Harasim, 1990). However, the challenges of convergent thinking are being addressed. Figure 1 illustrates the problems with misuse of threaded message systems. For example, in one study, I found several instances where participants used the reply function indiscriminately, without necessarily focusing the content of discussion within a given thread, but discussing the same subject using multiple threads at the same time (Campos, 2000).

Technical problems can have a negative impact on the networked cognitive experience. Furthermore, the lack of visual cues limits the way people interpret the meanings of others. Research suggests that lack of proper preparation, adequate hardware and software, training, and planning can cause fear of computers. In addition, studies have shown a correlation between computer anxiety and computer experience: anxiety levels are higher when users have less experience (Dyck & Smither, 1994), contributing to the development of strategies for lowering anxiety (Bohin & Hunt, 1995; Carlson & Wright, 1993; Crable, Brodzinski, Scherer, & Jones, 1994; Maurer & Simonson, 1993-94; McInerney, McInerney, & Sinclair, 1994).
Although on-line asynchronous communication has been addressed by a large number of scholars from different fields, the literature is particularly scarce with regards to the role of cognitive processes. Most claims are either anecdotal (Kim, 2000; Pallof & Pratt, 1999) or exclusively based on educational (Harasim, Hilts, Teles, & Turoff, 1995) or workplace data (Wenger, McDermott, & Snyder, 2002). Many organizations that have integrated networked technologies to gather people together have been confronted with mixed results (Brown & Duguid, 2000), ranging from reports of successful practices (Leavitt, 2001) to studies with less optimistic conclusions (Xin, Bakardijeva, Campos, Fisher, & Wang, 1999). Recently, in a review of the literature on transcript analysis, far-reaching inconsistencies were unveiled related to (1) the methods used to study participation and interaction in electronic conferencing; and (2) the claims—positive and negative—that were made based on those research methods (Rourke, Anderson, Garrison, & Archer, 2001).

**Figure 1: Screen capture of electronic conference in which the reply function was not always used to continue discussion**

Assessing the progressive construction of communication through conference transcripts

*Transcript analysis methods*

Studies on conferencing interaction are common, but there are major concerns about the reliability of most of them. In addition, the studies reviewed to date do not form a consistent ensemble: goals are often very different as well as theoret-
ical perspectives. The result is a very heterogeneous corpus of inconsistent scientific research. Most methods developed to study on-line discourse rely on quantitative measures (Anova, Manova, percentages, etc.) of qualitative categories. Studies focus on a variety of methods and theories, including vague definitions of sociocognitive processes (Henri, 1992), critical thinking processes (Anderson & Garrison, 1995; Newman, Webb, & Cochrane, 1995), analysis of patterns of participation (Howell-Richardson & Mellor, 1996; Bullen, 1998), content analysis of different sorts (Hara, Bonk, & Angeli, 2000; Mowrer, 1996), teaching styles (Ahern, Peck, & Laycock, 1992), social construction of knowledge (Gunawardena, Lowe, & Anderson, 1997; Kanuka & Anderson, 1998), notions related to Vygotsky’s zone of proximal development (Fahy, Crawford, Ally, Cookson, Keller, & Prosser, 2000), and even argumentation (Marttunen, 1997).

In addition, the unit of analysis varies from the phrase to a whole text (Rourke, Anderson, Garrison, & Archer, 2001).

Following several years of experience with transcript analysis and searching for reliable tools to study both the content of electronic conferencing discourse and argumentation procedures (subjacent logic), I developed a qualitative method that uses quantitative indicators to understand the progressive construction of communication. The method relates form and content of knowledge to respond to the theoretical challenges presented above (in the section titled “Knowledge construction and knowledge building”). These developments must be understood in the context of a constructivist in media res perspective evolving from Piagetian constructivism and cognitivism integrating some contributions from Vygotsky’s socioconstructivism. According to this perspective, learning is individual as well as social (Piaget, 1950; Vygotsky, 1979), and the interface between these realms is identified through Salomon’s interpretation of “distributed” cognitions (1993). The context of the method combines the study of how practice enables natural logically structured discourse (Grize, 1991; Toulmin, 1958), how people make sense of meanings shared by applying argumentation procedures (Piaget, 1950; Vygotsky, 1979), and how the progressive communication evolves in concrete objects of knowledge (Popper, 1994; Scardamalia & Bereiter, 1994).

Analyzing the progressive construction of communication

I analyze the progressive construction of communication through a unique approach to argumentation. Grize (1991) explains that argumentation is usually understood as a process in which an individual provides reasons to defend a thesis through reasoning, justification, and synthesis making (hard-core argumentation). However, it could also be understood as a process, emerging naturally from human cognitive structure through language (conversation), that threads opinions about attitudes and behaviours (soft-core argumentation). I broadly define an argument as a natural conditional structure (If-Then) that engenders a number of premises leading to a conclusion (Hegenberg, 1991), and whose content should be understood in the context of its practical use (Toulmin, 1958). In the context of practices supported by electronic conferencing, arguments need to be co-constructed (Grize, 1991) and communicated (Breton, 1996). The argumentation
The transcript analysis method I developed consists of capturing a number of logical operations commonly applied in written text, which, depending on its use, could point to major trends in on-line discourse. First, the method enables the identification of (1) logical procedures that reveal the nature of the inquiry. Logical procedures are the main logical operations subjacent to human thinking. Thereafter, the method captures the (2) instances of arguments that manifest how thoughts are structured in the context of their practical use. Some of these instances are adapted from Toulmin (1958). The method also (3) seeks to establish relationships between instances of arguments as carried across messages, with a focus on thematic content and conditionals, which reveal inferencing, considered by Piaget to be the gist of reasoning (1976). The first and second steps stand for logos. The third step stands for pathos and ethos and their imbrication with logos.

In order to explore the cognitive nature of collaborative conversation, the method adopts the phrase as the coding unit. However, to capture the progressive construction of knowledge through argumentation in collaborative on-line discourse, the relationships between meanings expressed within the coding units of the messages become the units of analysis.

The first step (1) consists of identifying some logical operations underlying the discourse, such as affirmations, negations, conditionals, and disjunctions. My previous studies have shown that while affirmations do not usually trigger more engaging conversation, negations and conditionals do, leading to collaborative learning and knowledge building.

The second step (2) consists of identifying the main components of arguments, with a view to natural conversation, such as:

Claim: introduction of a contextual situation that expresses concerns or difficulties of the practice, affirming something;

Data: introduction of facts, statistics, scientific data, research results, or other works from authoritative sources that have an influence on the practice and would support the claim;

Hypothesizing: engagement (1) in a process of hypotheses formulation that might provide an answer to the claim put forward, or (2) in questioning (which is, mostly, an inverted process of hypothesizing).

The goal here is to understand how people structure their thoughts in order to present ideas and build knowledge.

The third step (3) consists of identifying the meanings (ideas) or themes that are central to the messages, and how instances of arguments between messages interrelate. The rationale for this step is that meanings are carried through implications. This technique is derived from the
meaning implication analysis, applied in earlier studies (Campos, 1998, 2000, 2002a). Implications among meanings are expressed by the following formula: if a meaning C is part of a meaning B which is part of a meaning A, then A implies C in terms of meanings (Piaget, 1976b, 1977a, 1991). I proceed by building a conceptual map to demonstrate how conceptual change occurs through meaning implications (which is essentially learning from a Piagetian viewpoint) and the process of collaborative problem-solving in progressive communication.

The first two steps are a micro-logical coding that yields quantitative and qualitative cognitive information. Quantitative data inform the trends to consider in the qualitative analysis of the progressive construction of communication. This enables the researcher, in the third step, to draw a picture of possible conceptual change and hence collaborative learning and knowledge building that emerges from the relationship between logic and meanings in the discourse. The application of this technique to my dataset enabled me to draw the model presented here.

**Toward a model of cognitive networked communities**
The model that I present here takes into consideration the following notions: conviviality, participation and engagement, knowledge building, and collaboration.

**Conviviality**
Cognition is understood as emerging from the social practice of on-line conviviality. Conviviality in computer networks is defined through (1) participation and engagement, and (2) knowledge building. Communicative interaction through conferencing systems occurs in symbolic “places” that can be recorded in textual and multimedia databases. These are referred to as objects of knowledge (Popper, 1994; Scardamalia & Bereiter, 1994). These symbolic places are understood as the mental spaces in which intelligences interconnect (De Kerckhove, 1997) or as configurations of meanings (or mental universes, according to Breton [1996]) that do not have fixed limits and are created and re-created in the act of collaborating (Campos, 1998). Borders between meaning spaces constructed interaction in conferencing systems are not fixed but rather fluid. When those meaning spaces interconnect, they shape conviviality according to the level of engagement among participants and to the knowledge built.

Grize’s cognitive model of verbal communication (1991) helps us to understand this process of construction and building of meanings. In his model (see Figure 2), two individuals discuss a given theme T (ideas, concepts, notions, stories, etc.). Each person builds an image of this theme. An image supposes intentionality (finality, goal), the moulding of a representation, and a mental context built from cultural constructs, cultural beliefs, and traits that are actualized through a dyadic process of written and/or oral verbalization. In this interactive process, the interlocutor A builds an image A of theme T as a result of the interpretation of image B of interlocutor B. B rebuilds the image B of theme T as a result of the interpretation of image A of interlocutor A. Building and rebuilding—or schematization—is a progressive process of reconstruction in which interlocutors help to interpret each other’s world.
I adopt this model, consistent with Piagetian epistemology, but apply it to a multiple-actor, multiple-language (verbal and non-verbal) and progressive context. Although Grize studied written texts to understand how readers and writers communicate, I apply this model to the dynamic situation in which many people interact asynchronously through discussion lists and electronic conferencing. I adopted an epistemic approach to analyzing communication: discursive interaction is seen as a function of a knowledge building process in which discourse (logos, form), affectivity, and values (pathos and ethos, content) are expressed as its dimensions. From the viewpoint of form, the symbolic places in which interlocutors build images of each other and of a theme through a discourse are projections of the activity of individual neuronal structures in collaborative contexts. Neuronal structures shape logical thinking and grammar possibilities, and they provide the emergence of a cognitive scheme (the word that gave origin to the term “schematization”). Logo is, in this organic sense, form. From the viewpoint of content, those symbolic places are the meaning configurations of people’s discursive actions. Meanings cannot be understood in isolation but as dynamic configurations—ensembles that only make sense in context and that are intrinsically related to the organic structure of the mind. Meanings express feelings and emotions as well as judgments. Pathos and ethos are, in this sense, content. Electronic conferencing system databases contain objects of knowledge, or the written and multimedia traces of the process of conviviality (participation and engagement, and knowledge building).

Figure 2: Grize’s cognitive model of verbal communication
from a distributed perspective. The interrelated notions of (1) participation and engagement are related to the interests, needs, and goals (and hence intentionality) involved in a practice of networked communication exchange. They define the nature of community participation. Participation and engagement cross logos, pathos, and ethos. On the other hand, the notion of (2) knowledge building is related to the elaboration of thinking objects such as ideas, reflections, and arguments. It is a process leading to changes in the state of knowledge of people involved in a communication exchange, resulting in creation and innovation. Knowledge building also crosses logos, pathos, and ethos. I understand conviviality, at the same time, as both the participatory action leading to a level of engagement and as the progression of knowledge building through the communication process.

**Participation and engagement**

Our studies show that participation and engagement vary according to a multiplicity of factors such as the goals of the community, the tasks agreed upon by the team members, the activities in which participants engage, and moderating strategies such as organization of the exchanges, presence or absence of rules, etc. (Campos, Laferrière, & Harasim, 2001). The combination of these factors defines progressive levels of participants’ engagement and, thus, indicates the level of collaboration. We categorized our data around three levels of sociocognitive engagement:

1. *Vague (compania):* We verify vague engagement when evidence shows that participants have a weak intention to contribute or to continue a collaborative written dialogue. Vague collaboration is close to the idea of company (etymological meaning of the Latin word compania), which denotes being with someone but not necessarily participating in a given activity/task. Examples of this kind of behaviour are found in lecture-based courses and telework conferences used to publish content.

2. *Modest (cooperation):* We verify modest engagement when there is evidence that participants have a reasonable intention to contribute and to continue a collaborative written dialogue. At this level, participants may comment on common topics of interest. However, they do not demonstrate an intention to build knowledge together. Modest collaboration could be identified as co-operation (etymological meaning of the Latin word cooperatio), meaning acting together. Examples of this behaviour were identified in courses in which learners engaged in theme development, text structuring, case studies, and sharing teaching experiences. It was also found in totally online telework conferences in which participants discussed themes of interest, although my data focus on mixed-mode processes.

3. *Strong (collaboration):* We find strong engagement when participants show intentions to actively contribute and to build on each other’s contributions in order to solve ill-defined problems. Strong engagement is collaborative (etymological meaning of the Latin word collaborare), which denotes working
together, weaving each other’s thoughts with the goal of solving problems and building knowledge. Examples of strong collaboration were found in project-based and simulation-based courses, and in communities of teleworkers searching for solutions to problems that they face in their practices.

**Knowledge building**

Our studies also suggest that conviviality advances progressively in the asynchronous context of electronic conferencing. Our interest in how people reason, argue, formulate ideas, and express them through arguments, formulate hypotheses, and search for possible solutions to problems led to the identification of four levels of learning and paths of knowledge building (Campos, 1998, 2000, 2002b; Campos & Laferrière, 2002b). These processes are related, and involve, at the same time, the dimensions of **logos**, **pathos**, and **ethos**:12

1. **Intentionality (degree):** When we compose a message, we are motivated by goals, be it to communicate an idea or to inform someone about something. There is no symbolic exchange without at least the intention of making contact with someone. There are different degrees of intentionality. Intentions can be (a) mainly egocentric (centred on an individual’s wishes); (b) egocentric but accepting others (by integrating intentions expressed by the communication interlocutor to fulfill egocentric needs); or (c) mainly centred on others (ability to negotiate intentions to achieve a common goal).

2. **Individual and social representations (nature):** Representations are the means through which intentionality operates. They are both individual and social, but either can be prevalent depending on the context. Examples of prevalent individual representations are a child crying for her mother or the recognition of the smell of a flower from childhood. Even a person talking to him or herself is making use of a social tool, language, to express something. However, the representations, in this case, have an egocentric function. Examples of prevalent social representations are meanings that are communicated by language (and thus become social given that language is a social tool) and are shared by a community (Moscovici, 1994). Examples of social representations are the appreciation that French people have for cheese and wine, the soccer obsession that Brazilians share, or the love that Americans devote to their flag. The data that I studied suggest that representations introduced in networked conversation can (a) be mainly individual when egocentrism prevails; (b) combine in a more balanced way individual and social elements when the individual is not fully engaged in the interaction with others; or (c) be mainly social when negotiation of meanings and exchange of ideas are prevalent.

3. **Interpersonal relationships (type):** There are different types of interpersonal relationships. They can be a function of (a) just contacting somebody without expecting any further action; (b) maintaining a cordial or competitive relationship by being polite or even “politely” aggressive; or (c) going further and implicating mutually with others.
4. *Learning (level)*. Depending on the interpersonal relationships, different learning levels can be achieved. Learning is the process through which mental neuronal structures of knowledge are assimilated and accommodated in communication interaction that emerges as conceptual change (Campos, 2000; Piaget, 1992). Assimilation stands for information processing but accommodating stands for reflective interpretation, analysis, evaluation, and conceptual change. In conferencing systems, learning can be (a) mainly assimilatory. At this level, people assimilate knowledge without building upon existing structures, and hence, process information superficially. Learning can reach an intermediate level in which (b) knowledge can be just the superficial result of assimilation. However, sometimes the result can be more profound because mental structures are accommodated. In high-level collaborative processes, learning tends to be (c) mainly accommodatory. Accommodation is the cognitive process by which knowledge is integrated to the previous structures of the mind, providing a change in the previous state and leveraging the individual to another path of understanding.

The following table (Table 1) presents an interpretation of the progressive levels of conviviality in cognitive networked communication. It must be noted that the phases presented are not rigid and that a knowledge community can be at different phases at the same time according to its needs and context. The goal here is to provide a framework to enable a cognitive analysis of networked communication.

<table>
<thead>
<tr>
<th>ENGLAGEMENT</th>
<th>Vague Coñjunción</th>
<th>Modest Cooperación</th>
<th>Strong Collaboración</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentionality (degree)</td>
<td>Mainly egocentric</td>
<td>From egocentric to accepting others</td>
<td>Mainly centered on others</td>
</tr>
<tr>
<td>Representations (nature)</td>
<td>Mainly individual</td>
<td>Sometimes individual, sometimes social</td>
<td>Mainly social</td>
</tr>
<tr>
<td>Interpersonal relationships (type)</td>
<td>Contact</td>
<td>Cordiality or “cordial” competitiveness</td>
<td>Mutual implication</td>
</tr>
<tr>
<td>Learning (level)</td>
<td>Mainly assimilatory</td>
<td>Sometimes assimilatory, sometimes accommodatory</td>
<td>Mainly accommodatory</td>
</tr>
</tbody>
</table>
Levels of collaboration
By relating levels of participation and engagement, and knowledge building, we are able to identify progressive networked communication modes (main phases in which participants engage). Campos, Laferrière, & Harasim (2001) show that there are three main kinds of relationships that can be established among knowledge community participants: (1) co-presence, (2) co-operation, (3) collaboration.

Co-presence, co-operation and collaboration cannot be found in isolation. Exchanges among members of the same knowledge community can reflect all levels. However, our classification aims to describe what is prevalent in a given asynchronous communication context in order to understand the level of intentionality and its consequences to community building.

1. Co-presence: Networked co-presence is in line with vague engagement in contexts in which intentionality is mainly egocentric, representations are mainly individual, interpersonal relationships do not go beyond making contact, and learning is mainly assimilatory. In such a context, the level of communication could be classified as lower, given that exchanges do not trigger further reflection. The level of co-presence characterizes the publishing mode.

2. Co-operation: In a networked context of co-operation, intentionality is still egocentric but self-centred goals are reached through activities with other participants. As a consequence, representations are at times more individual and at other times more social. Interpersonal relationships are “cordial,” even when competitiveness is at stake. In other words, they do not depend on the others but on the recognition of the presence of working partners. Learning in a co-operative situation is in line with the other cognitive dimensions, alternating between more assimilatory and more accommodative patterns. Co-operation characterizes the collegial mode.

3. Collaboration: The networked situation of collaboration is achieved when community participants engage intentionally in joint efforts to achieve higher understanding of a given subject matter. Participants solve problems together to advance the present state of knowledge. As a result, intentionality is centred on others, representations are mainly social, interpersonal relationships suppose mutual implication, and learning is mainly accommodatory. Participants engage in metacognitive reflection, or in-depth understanding of the thinking procedures activated in the communication process. The level of communication is, in this case, higher. Collaboration characterizes the interpretive or knowledge building mode.

Understanding the progressive construction of communication
When we communicate, we put into action configurations of meanings. Configurations of meanings are representational structures activated by the brain in interactive dynamic contexts, or schematizations (Grize, 1991). Cognitive networked communities are shaped according to the general constitution of the resulting interaction of people’s configurations of meanings. Networked conviviality (par-
participation and engagement, and knowledge building) is structured by cognitive procedures (logos). However, the shaping of communities is done through affectivity and feelings (pathos), and the moral and cultural values of participants (ethos). These three dimensions imbricate one another, and they can never be found in pure form. All communication forms have (1) cognitive structures subjacent to discourse and behaviour (neurobiological processes that shape the possibility of language, grammar, gestures, and speech). Cognitive structures are also expressed by (2) emotions and feelings that have roots in the past and are created and re-created in interpersonal exchanges (the impact that bodies, gestures, attitudes, and discourse have on others, why, and how). Finally, often overlooked, communication forms have (3) values that are formed through education (moral) and shaped within a culture, and are permanently under the proof of the real situations and contexts in which people exercise or express them according to their characters.

We argue that we can categorize networked collaborative written communication through thinking phases. Phases are contexts in which a cognitive networked communication mode is prevalent. They are indicative, not rigid, and aim to understand what is more visible in a given process. The progressive communication of communication is not a stage-like process. Rather, different levels of communication conviviality components coexist; we can find individuals that participate in a reflective manner through in-depth inquiry in certain situations, while just broadcast information in other situations. Boundaries between phases of communication are fluid. Notwithstanding, many collaborative knowledge communities also pass through a publishing phase that evolves progressively to a co-operative situation before reaching collaboration, at which point trust is estab-

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<table>
<thead>
<tr>
<th>KNOWLEDGE BUILDING</th>
<th>ENGAGEMENT</th>
<th>Co-presence: Weak</th>
<th>Cooperation: Modest</th>
<th>Collaboration: Strong</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intentionality</td>
<td></td>
<td>Broadcasting Mode</td>
<td>Collegial Mode</td>
<td>Interpretive or Knowledge Building Mode</td>
</tr>
<tr>
<td>Representations</td>
<td></td>
<td>Lower level of communication</td>
<td>Middle level of communication</td>
<td>Higher level of communication</td>
</tr>
<tr>
<td>Interpersonal relationships</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
lished among members. A community is characterized by understanding and properly identifying the context, and by correctly extracting the main features of cognitive networked communicative interaction. Phases are, in this sense, just a limited theoretical tool to evaluate and understand communities.

**Cognitive networked communities**

On-line communities have traditionally been categorized in a descriptive way as *communities of interest, learning communities, and communities of practice*. Networked communities are groups of people linked through the Internet or intranets that communicate either for informal or formal reasons. Informal communities (NCi — *networked communities of interest*) have been forming since the advent of BBSs and listservs. Now these communities fulfill all kinds of human needs (dating, mutual support, e-therapy, e-commerce, e-religion, etc.).

*Networked learning communities* (NLC) and *networked communities of practice* (NCoP) are groups of people that gather together either for the sake of formal learning (Bracewell, Breuleux, Benoit, Abdous, & Laferrière, 1998; Laferrière, Breuleux, & Bracewell, 2000; Laferrière, Breuleux, Fitzsimons, & Baker, 1999) or for informally reflecting about their professional practices (Benoît, 1999, 2000). Learning community is a notion that has been used indiscriminately to describe any kind of community involving people in learning environments (such as school), and community of practice to describe any kind of community involving people in the workplace in which learning is involved (Wenger, 1998).

Categorizing communities in a descriptive way (learning, practice, or interest) does not allow researchers to generalize and understand the cognitive phenomenon of knowledge communities as a whole. We argue hereunder that all these communities can progress from a lower to a higher communicational level. Thus, a cognitive progressive classification contributes to understanding and explaining processes in all types of knowledge communities.

**Types of knowledge communities**

Consistent with our notion of conviviality, and of modes of networked communication, we propose a progressive cognitive typology of knowledge communities based on the level of communication and the nature of knowledge. In this typology, cognitive processes of reasoning or *logos* (see Table 3) define the community, but other dimensions of the nature of knowledge also have an influence on the process of community conviviality. Affectivity and emotions (*pathos*), and values and culture (*ethos*) are embedded in cognition and influence the communication process of collaborative reasoning. This typology allows us to identify the main phase in which any given traditionally categorized community (learning, practice, and interest) is. The types are (1) broadcasting communities; (2) collegial communities; (3) interpretive or knowledge building communities.

In *broadcasting communities* the level of communication is low and intentionality is at a cognitive primary level. At this level, individuals recognize the words and sentences but do not reflect upon them (Gibbs, 1994). The intentional acts are mostly restricted to reading superficially or writing without expecting continuation. This type of community does not engage in extensive conversation.
because no common ground is negotiated. In addition, there is a lack of affectivity: identification with the group is poor. From the viewpoint of values, the participants’ profiles can be either heteronymous or autonomous. By establishing a heteronymous or an autonomous relationship, values will be communicated differently. It is very common to see unproductive communities in on-line courses and professional communities following this line of behaviour (Campos, Laferrière, & Harasim, 2001). Examples include communities that start up and die very quickly, e-lecturing in which professors use conferencing just to publish notes and provide links to information, and work communities that do not have authentic problems to solve.

In collegial communities, the level of communication is regular and intentions are at the level of cognitive comprehension. Individuals understand more profoundly the words and sentences recognized but do not engage in a cycle of knowledge development (Gibbs, 1994). Mainly individual and social representations each take a turn in the negotiation processes. However, these relationships are somewhat accidental and weak, resulting in a lack of clear dominance. Members of collegial communities might take advantage of the opportunity for “egocentric” publishing as well as for more or less incipient attempts to connect with people. Consequently, affective ties between participants tend to be cordial even when the context is competitive. Participants are not defining common goals and common work but rather they are achieving a collegial level of communication exchange, normally under heteronymous circumstances, i.e., in which there is a ruling authority. Most communities studied remained at the collegial level. Examples are communities that share information of common interest with a minimum level of consultation and agreement, networked classrooms in which participation in electronic conferences is mandatory, and work groups that use conferencing for the sake of organization or collective tasks needed to implement an activity.

Interpretive or knowledge building communities are characterized by a higher level of communication. These communities are rare, and difficult to build. People intentionally search for ways to shape and advance ideas. Here, participants are able to evolve a topic by moulding in-depth social representations in collaboration (Gibbs, 1994). This process of building collective and distributed knowledge is usually done through sustained argumentation. As explained above, arguments, in ill-defined domains, are If-Then structures in which hypotheses are demonstrated through premises that lead to reasonable conclusions. Toulmin argues that argumentation in practice (in ill-defined domains) does not offer the certainty of formal logic procedures (1958). Grize defends the idea that a simple conversation could be understood as an argumentation process. Indeed, in collaborative argumentation participants search for the logical structures behind the meanings to identify premises, to formulate hypotheses, and to propose solutions to the problems. In other words, building knowledge together is interpreting in collaboration, is creating a community of interpretation (Breuleux, 2001; Breuleux & Laferrière, 2000; Laferrière, Breuleux, & Bracewell, 2000). More
importantly, arguing and interpreting are a function of improving ideas that lead to creation, transformation, and innovation (Bereiter, 2002; Scardamalia, 2002; Scardamalia & Bereiter, in press). In this context, we find deeper affective processes, ones in which nurturing mutual implication and solidarity become essential for problem-solving and, thus, for community nurturing. Although interpretive communities might start up from heteronymous situations, they lean strongly toward autonomy and independence. Examples of interpretive or knowledge building communities can be found in learning (see Campos, 2000) or in workplace contexts (see Benoit, 1999, 2000; Campos & Laferrière, 2002b) where hypotheses formulation is at the core of conferencing activities such as collaborative projects and problem-solving challenges.

### Table 3: Three progressive types of knowledge communities and how they relate to logos, pathos, and ethos

<table>
<thead>
<tr>
<th>COMMUNITIES</th>
<th>Broadcasting communities</th>
<th>Collegial communities</th>
<th>Interpretive communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURE OF KNOWLEDGE</td>
<td>Lower level of communication</td>
<td>Regular level of communication</td>
<td>Higher level of communication</td>
</tr>
<tr>
<td>Logos (reasoning)</td>
<td>Mainly egocentric cognitive process: Recognition</td>
<td>Egocentric and social cognitive processes: Comprehension</td>
<td>Mainly social cognitive process: Interpretation</td>
</tr>
<tr>
<td>Pathos (affectivity)</td>
<td>Lack of affectivity Distance</td>
<td>Collegial affectivity Cordiality</td>
<td>Deep affectivity Attachment</td>
</tr>
<tr>
<td>Ethos (values)</td>
<td>Either heteronymous or autonomous</td>
<td>Heteronymous</td>
<td>Autonomous</td>
</tr>
</tbody>
</table>

### Conclusion

Networked communication allows the emergence of a new social reality: the constitution and development of knowledge communities. This paper presented a model of cognitive networked communication and knowledge communities that I believe is in line with the deep constructivist proposal (Scardamalia & Bereiter, in press). This model has its roots in the progressive cognitive processes that take shape in communication contexts, specifically those of networked communication. It aims to contribute to communication theory by integrating notions from biology, psychology, education, and cognitive science, i.e., integrating nature and culture (Meyer, 2001).
Community building is a natural human need. It is not accidental that the Latin word *communicare* shares the same root of the words *communication* and *community*. New technologies allow new forms of community building, in which negotiated configurations of meanings are distributed. Today, people share life histories that have degrees of complexity that would have been unimaginable among primitive tribes. They participate in many communities, negotiating meanings and sharing life stories, lessons learned, and knowledge built in other contexts. In this way, humans broaden universes of meanings and shape configurations in a dynamic, permanent, and progressive way in order to make sense of their lives.

The consequences of the changes that networked technology has brought forward are far from being unveiled. We have just started to study this new phenomenon from a communicational cognitive perspective. My research suggests that cognitive networked communication develops progressively, in line with the cognitive evolution of brains thinking together in context. Much is said about the “knowledge-society,” “knowledge-based economy,” and “knowledge communities.” Research data suggests that networked knowledge can only be understood as a function of its progression. Knowledge advances. This is, essentially, a cognitive process that involves intentionality, representations, interpersonal relationships, and learning. In addition, to be built, knowledge must be shared. Advances are related to the level of participant engagement in the knowledge sharing process. These levels are vague (from the Latin word *compania*), modest (from the Latin word *cooperation*), and strong (from the Latin word *collaboratio*). Furthermore, these levels allow us to identify three progressive types of knowledge communities: broadcasting (characterized by co-presence and a lower level of communication), collegial (characterized by co-operation and a regular level of communication), and interpretive (characterized by collaboration and a higher level of communication). Communities are essentially structured by cognitive procedures (*logos*), but are also shaped by affectivity and emotions (*pathos*), and moral and cultural values (*ethos*). More research is needed to deepen our understanding of cognitive networked communities. We hope that this paper sheds light on networked processes through the notion of progressive construction of communication.

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term to define a knowledge-building community in the context of the proposed
model. Last, but not least, I would like to thank Niki Messas, Jonathan Petit,
Mathieu Chaput, and Marcela Quesada, graduate students of the Université de
Montréal, as well as the postdoctoral researcher Judith Lapointe (McGill Univer-
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leading to this paper came from the Université de Montréal, the SHSRC—Social
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de recherche sur la société et la culture), and the CEFRIO—Québec (Centre fran-
cophone d’informatisation des organisations).

Notes
1. I invite the reader interested in a more detailed explanation of part of our dataset related to
learning communities to refer to these articles.
2. I invite the reader interested in a more detailed explanation of part of our dataset to refer to these
articles.
3. I thank James Crombie (Université Sainte-Anne, Nova Scotia) for clarifying the Latin origin of the
word.
4. It is impossible for an individual to go beyond his/her genetic possibilities, as Piaget noted.
Vygotsky, as a psychologist, was well aware that the development that could be advanced in col-
laboration was within the limits of genetic possibilities of an individual.
5. Latin languages differ from Anglo-Saxon ones in the way to introduce the word “knowledge.” In
those languages, like the French used by Piaget, when presented in its singular form, knowledge
denotes necessity and universality, whereas when presented in its plural form, “knowledges,” it
means the content of different disciplines, known things, etc.
6. The research that confirms this view, a partnership between universities and a dozen public and
private organizations, was implemented and funded by the CEFRIO–Centre francophone d’infor-
matisation des organisations. Additional funding came from the SSHRC to study argumentation
in nursing networked practices.
7. In principle it might be, although sociologists and political scientists might also be interested in
studying the consequences of those features for an extended exploitation of the workforce by insti-
tutions, for example.
8. Studies on synchronous conversations using this framework do not exist. However, I understand
Grize’s model to also be applicable to those contexts.
9. According to Piaget, a scheme is a trait that, in a given action, can be generalizable. Grize (1991)
adopts this term, applying it to the discursive action.
10. I do not use the notion of co-operation in the Piagetian way. Co-operation here refers to networked
activities that are sometimes competitive.
11. The notion of collaboration must be understood here as Piagetian co-operation (Piaget, 1977b).
12. A knowledge building approach has many other dimensions, but I focused on those relevant for
understanding the relationships between communication and cognition.
13. We have found qualitative evidence of learning (4) in collaborative asynchronous communication
processes (Campos, 2000). However, to be achieved, learning depends on (1), (2), and (3).
14. Also, it is likely that these relationships could be identified in any kind of community, not just on-
line asynchronous communities from which the data that I studied come.
15. According to Piaget, cognition is the engine of action but its fuel is affectivity (1954).
16. When describing processes of attributing meanings to communicational objects such as words,
Gibbs identifies four sequential levels: (a) comprehension—immediate process through which we
identify objects like words; (b) recognition—the act of signifying objects that we identify, create,
or choose; (c) interpretation—aware in-depth reflection on the meanings of those objects; and (d) aesthetic appreciation (Gibbs, 1994).

17. Heteronomy refers to contexts in which authority (be it de facto or believed) defines the relationships by establishing a power constraint. Autonomy stands for contexts in which individuals are free from authority constraints (Freitas, 1997; Kant, 1994.). For an in-depth discussion of the heteronomous and autonomous relationship, see Campos, 2002a.

18. I thank Alain Breuleux (McGill University) and Derrick de Kerckhove (McLuhan Program, University of Toronto) for suggesting the use of this term.

References


