1. SOCIAL CONTEXT: UNDERSTANDING THE ACTOR-ENVIRONMENT INTERACTION

The developing field of computer-supported cooperative work (CSCW) aims at producing tools "gracefully" fitting everyday environments. Many studies acknowledge that, if we want to have systems really suitable for use in ordinary situations (Bannon, Bowers, & Robinson, 1992), we have to understand social processes of communication and cooperation, which in real life include also conflict and negotiation (Bannon & Schmidt, 1991). CSCW is increasingly committed to consider people, not in general and abstract terms, but in the contexts of their normal lives (Hughes, Randall, & Shapiro, 1991).

Emphasis on contexts stimulates research attempting to overcome the persistent dualism between technical and social issues within the design of computer systems. We believe that the ongoing process of "computer socialization" (Collins, 1990; Dunlop & Kling, 1991; Kling, 1996) may profit from the contribution from the social and behavioral sciences, which could help to overcome the individualistic perspective still present in cognitive science. Artificial Intelligence itself, previously admittedly rather asocial, now deals with the social character of people's activities (Gasser, 1991).

In HCl studies, object-oriented design can encourage designers to bind design objects to scenarios of use (Carroll, 1994). Carroll, Mack, Robertson, and Rosson (1994) showed how cognitive science, usability engineering, software engineering, and experience applying object-oriented design recommended scenario-based approach to system analysis and design. We strongly agree with their claim that scenarios are basically narratives and that "narratives are an excellent medium for representing the possibilities for users embodied in a new system" (p. 246), which they illustrated through an example drawn from the evolution of spreadsheets. According to Carroll et al. (1994), system analysts and designers building an object-oriented system share with cognitive psychologists the assignment to understand how knowledge structures employed in comprehension of both stories and scenarios of system use are developed. In the following pages we will try to sketch the cultural framework encompassing social scenarios of system use.

In this article, people, groups, and organizations will be placed under the collective label of "social actors," or simply "actors," following a well-established tradition in social sciences (Ahrein, 1990; Alexander, 1988; Archer, 1988) which stresses the fact that people act—not just behave or perform tasks—with partial autonomy striving after their goals. By calling people actors, we emphasize that they respond actively to their contexts and pursue their peculiar interests by fixing their goals, exerting some discretionary powers, and using their abilities to meet the affordances they see in situations (Gibson, 1986).

Yet, in a certain sense, the metaphor of the actor acting out a somehow predetermined scenario is not completely satisfactory. Actually, actors do
not interact with fixed scenes, because situations do not exist prior to actors. They are constructed by them, both cognitively and practically, according to their interests and competences. To be in a situation means that one is committed and, hence, unable to have objective knowledge of it (Gadamer, 1975). The movie by the Japanese director Kurosawa, Rashomon, provides a vivid picture of this idea. "Actors interacting with their environments" means that they respond to situations by means of the same actions through which they explore them.

Action is double-edged. On one hand, it is a way of modifying the scheme of things and of revealing the opportunities latent in them. On the other, it is a way to alter the state of actors, their commitments as well as their priorities, because their responses to the newly revealed opportunities are sometimes unprecedented to them. Every people-environment interaction involving real actors' commitment contains some element of ambiguity that cannot be removed without losing sight of some aspect of the situation, which is just the result of the match between actors' dubious interests and the unclear opportunities offered by the situations.

Flirting is a good metaphor for exploration of both ambiguous environments and dubious actors (Sabin & Silver, 1982). Flirtation requires action in the situation (encounter with the other person taking part in the flirting) and diagnosis of "external" events (making inferences about the possible meaning of the other person's moves) while interpreting events within the actor (understanding her/his own feelings as responses to the situation) and making real-time decisions about the next moves to make. In flirting, some degree of uncertainty of goals in both actors is essential; when feelings are no longer dubious, we no longer have flirtation. The metaphor of flirting, while applying to every truly explorative human strategy, fits peculiarly the relationship between humans and the environments inhabited by the new information technology (IT) tools, because these can make working environments particularly puzzling (Weick, 1990). Increasing contextual ambiguity compels actors to enhance their sense-making efforts in order to avoid getting lost in incomprehensible situations.

Interaction is made up of patterns of activity, of "how activities come together and shape each other on different occasions" and "what structuring resources are brought to bear in a given situation to give quantitative relations their forms and meaning," (Lave, 1988, p. 97) so that qualitative differences can emerge. Lave (1988) gives us an example of these mutually structuring activities by describing how knitting helps to shape her reading activity and is in turn shaped by it. But there is more than reciprocal modification in people-environment interaction. Actors not only evaluate the opportunities they discover in the various situations while coping with them but also develop their current goals among the possibilities offered by their present situation, which is shaped by cultural and social processes, as we will see in Section 4. Action, thought, goals, and norms are equally involved in the actor-environment interaction. Understanding interaction is difficult, because what keeps changing in interaction is not just things in the world or things in the actor, but the very structure of their connection. Things change, strategies change, goals themselves change during the development of the interaction.

In a truly interactional perspective, there is no place for something like a "general" activity or a "general" way of thinking of something—although we may talk about activities this way. There are always context-specific activities and peculiar ways of thinking of something. It is increasingly acknowledged in HCI studies that computer systems should not only be assessed in the context of their ordinary use, but they should also be designed-bearing that context in mind (Carroll, 1991). Scenario-based approach is just a significant effort to put relevant features of social context inside the process of system analysis and design (Carroll, 1994). Clancey (1992) recommended to give more attention to "recurrent macrostructures in domain models" (p. 99) by constructing taxonomies of system types. Mantovani and Bolzoni (1994) applied these concurrent suggestions in their analysis of three Vocational Guidance Systems (VGS) developed in Northern Italy. They built a principled taxonomy of the three VGS interactional structures. Differences in design, communication, and outcome among VGS appeared to be the result of different types of interplay between the socio-professional figures (pupils, teachers, parents, VG officials) involved in each system's design.

Unfortunately, we still lack an integrated model of social context suitable for HCI research. This is hardly surprising, considering that multidisciplinary work is necessary for such a model to be built, but crossing barriers separating scientific cultures may prove highly effort demanding, time consuming, and sometimes distressing, requiring it as it does negotiation among researchers with different ways of speaking and thinking. Donald Norman—in his speech at the University of Padova on the occasion of his honor degree in March 1995—said that working in multidisciplinary teams is necessary to the development of cognitive ergonomics, but this is hindered by both low scientific status of social science and the fact that engineers and designers do not understand people—although they think they do. Actually, engineers resort to a spontaneous commonsense psychology which is quite distant from the scientific research on social actors. So, we have to cross strong disciplinary boundaries in order to produce really usable tools.

We feel that, at the current stage of development of HCI studies, an articulated conceptual model of social context integrating social and technical dimensions of systems may be a significant step towards producing "cognitive artifacts" (Norman, 1991) fitting real-life situations. Such a model could offer both technical and social researchers an (at least partly) shared frame of reference in order to ground communication in teams mixing experts from various disciplines, who—being imprinted by their different
professional cultures—are supposed to speak their peculiar languages and to point to discrepant goals.

In the preceding pages, we used the terms "context" and "social context" in a polysemic way. They stretched along a continuum ranging from (a) generic reference to real-life situations, to (b) acknowledgment that everyday situations contain recognizable patterns of thinking and acting, to (c) considering those patterns as social and cultural structures, and, lastly, to (d) the tacit assumption that the above structures are organized as publicly recognizable meanings pervading exchanges among actors. The latter is the sense which is nearest to our purposes in this article.

We agree with the claim of Carroll et al. (1994) that "scenarios" are a key ingredient to learning and problem-solving in general; people learn by doing, by trying to accomplish goals, and by solving the inevitable problems that arise in the course of trying to do things" (p. 255), but we think that in scenarios of use there is more than individual cognition and direct experience. There are cultural models and social norms, which have powerful influence in structuring actors' interaction with the environment. Carroll et al. (1994) described how the object-design exploratorium (ODE), a scenario-based tool developed to support self-directed learning of object-oriented analysis through the guided exploration and modeling of domain scenarios, deals with scenarios. "ODE users [they say] do more than simply identify domain entities: they assign responsibilities to these entities, and they identify and model additional entities that might not be apparent in the original use scenarios, but rather are needed to support interaction among domain objects" (p. 256). In the following pages, we wish to suggest how systems like ODE could be expanded upwards, in order to include such nonapparent and usually neglected "entities" as social norms and cultural models.

The model we present here tries to substantiate a view of social context as meaningful structure without losing touch with our experience, which strongly argues in favor of both individual uniqueness and situational complexity. People are not cultural clones (Beach, 1990): They follow scenarios, but they interpret them their own way (Cooper, 1991). Our model (Figure 1) connects theories from various disciplines and is expressed in the most general terms, in order to reach its intended audience without overtaxing their patience. It is conceived as a general sketch, or a platform resting on piles (this metaphor of science on piles comes from Karl Popper, 1968) which are driven into muddy ground in order to gain enough stability for provisional dwellings to be built on them. It is a structure open to other contributions: In such a muddy ground, every additional pile is welcome.

Level 1, social context as both a repertory of cultural models and a stage for social actors playing normative social games, is indebted mostly to the work of anthropologists and cultural psychologists like Sahlins (1985), Archer (1988), and Shweder and Sullivan (1990, 1993).

Figure 1. A three-level model of social contexts.

Level 2, interpretation of situations of everyday life, depends mainly on "Image Theory" in decision making (Beach, 1990, 1993; Mitchell & Beach, 1990), on the approach to decisions as interpretations of action taken (March, 1988, 1991), and on the "cognition in practice" perspective (Lave, 1988; Suchman, 1987).

Level 3, local interaction through artifacts, focuses on the concept of artifacts as embodied projects (Carroll, 1991; Cole, 1990, 1995; Mantovani, 1996; Norman, 1988, 1991) and on the task-artifact cycle (Carroll & Campbell, 1989).

Some of the above-mentioned terms—cultural models (Level 1), image (Level 2), projects, artifacts, and task-artifact cycle (Level 3)—will be explained within the corresponding sections of the article. Our apparently eclectic attitude does not imply disregard for the specific meaning that each concept has within the scientific community which produced and still uses it. We have here a small dilemma: If we try to define precisely the meaning of the main concepts we use, we risk overstretching the gulf of incomprehension that prevents communication across cultures. Instead, if we continue to use terms which are not exactly defined or lacking reference to their peculiar disciplinary tradition, we risk confusing and irritating our audience.
A compromise route we will follow to leave this impasse is that of giving a rather loose working definition of the concepts when we introduce them first, as we did in the case of "social actors," asking for the cooperative inference of readers.

The three levels of the model nest inside each other, so that one can run along them both bottom-up and top-down. If we follow the bottom-up route, we see what occurs at the ground level, that of artifact use (Level 3), as a special aspect of everyday situations (Level 2), in turn nesting in the more general social context (Level 1). But we must run top-down if we want to look for clues to the meaning of what happens on lower levels: The cultural structure (Level 1) supplies actors with norms which they can use to interpret situations (Level 2), which in turn prompt and circumscribe actors' goals governing local interaction with the environment by means of artifacts (Level 1).

Our idea is that actors use artifacts to carry out tasks in order to achieve projects which suit their interests, which in turn are inspired by cultural models. Context is not just physical, but also conceptual: Concepts framing actions are grounded in the individual's sense of place, role, and value. Actors perceive situations through the models made available to them by cultural order and act according to them—although they can subvert them by means of pragmatic innovations.

2. LEVEL 1—CULTURAL MODELS, ACTION, AND CHANGE IN SOCIAL CONTEXT

At level 1 (Figure 1), we consider social context as the result of the interaction between a set of cultural models, which in Figure 1 is called "structure," and the actors' decisions and actions, which we call "action." The result of their interplay is continuous change in global context, its "history." Let us consider these concepts: (a) structure or cultural models, (b) action, and (c) history.

(a) Structure (Figure 1) or cultural models—which we use as almost equivalent to "social norms"—is the key element of context at Level 1. We assume that social context is built on a cultural order preexisting every possible agreement among individuals participating in the interaction. This order makes interaction possible, and not vice versa.

We can elucidate this point by returning to the example of Jean Lave (1988) knitting and reading. We can imagine her in her living room, during leisure time on some winter Sunday afternoon, near the window of a beautiful cottage. We understand that this gentle scene can take place only in the frame of a certain organization of daily and weekly activities, of a certain distribution of space within the house, of a certain division of work between genders, and so on. The scene depends mainly—not only to be understood, just merely to exist—on cultural norms specifying which conduct is proper

for a woman of a certain social condition, status, age, education, and so on. We live in social contexts which not only consider it proper for women to knit but also encourage them to read books of their own choice in their free time. As we know all too well, similar standards are far from being universally accepted.

Cultural models can also prescribe fine details of proper action: In some contexts, reading while resting in an armchair is correct, whereas reading while lying in bed is disapproved of; reading in bed can be accepted at certain times, for example, at night, whereas it would be condemned at other moments of the day; youngsters are not allowed to read in bed, whereas teenagers and adults are, and so on. We can reasonably assume that Jean Lave's reading activity is shaped by cultural models no less than by her parallel activity of knitting. By choosing to pass a Sunday afternoon knitting and reading, instead of, for example, praying and doing the ironing, a person conforms to an available set of cultural norms. These not only prompt her current activities and direct the planning of her movements but especially shape her action by providing it with a definite and socially recognized meaning.

Social norms prescribe how and why actions must be performed. If in a given cultural context women were prevented from reading novels, they would develop chunks of actions different from those of overtly sitting and reading: for example, they would learn to read novels while pretending to pray, or submit to norms and comply by reading only prayer books instead of their favorite science fiction novels. The very existence of a cultural norm affects actors' responses, although it does not necessarily imply actors' compliance. Social norms also function when they are not obeyed: Compliance is not necessary to give them their strength. In real life, actors are often inconsistent: They can behave in one way and believe in a different one, this being a peculiar characteristic of actors (Smith, 1982). Nevertheless, actors often exhibit behaviors inconsistent and discrepant from current social norms, the latter do strongly influence people's conduct.

The emergence of patterns of activity is regulated by the meanings associated with them through cultural models, which dictate what it is appropriate in a given situation for a given actor to do, to think, or even to desire. Goals are context dependent, being instigated by social influence processes (Turner, 1991). Activities can of course in turn modify traditional norms by reframing them in new situations or by overtly subverting them, but this does not reduce the normative force of the context.

Cultural models have also normative, not only descriptive, force. Some social anthropologists tend to give a merely consensual foundation to cultural models. They think that the social world so completely surrounds actors that they receive a set of chunks—for instance, the social partition of time implicit in the concept of "weekend"—in such a pervasive manner that these are unquestioned and automatically accepted as social clues. "Week-
end” can make a good example: By viewing it only as a collection of descriptive chunks—that is, by defining it simply as leisure time—we lose the opportunity of capturing the finer texture of the actor–environment interaction taking place in it. If, instead, we consider “weekend” as a set of peculiar cultural norms controlling activities in order to spare time for service to God or for working people’s well-being, we can obtain clues as to how this piece of time is currently organized by its “inhabitants.” For example, if we know what Presbyterian norms state about Sundays, we can build a dependable scenario of Andrew’s moves on a Sunday morning. Attending service at church, eating certain foods, dressing in a certain manner are activities included in the normative frame of a Presbyterian Sunday which are absent in the purely descriptive idea of “weekend.” The general all-purpose container “weekend” can be very deceptive, if we fail to anchor it to its cultural foundations.

Actors refer to cultural models to identify their current interests and direct their activities (Archer, 1988; Clarke & Gerson, 1990; Sahilins, 1985). A recent theory of intuitive and automatic decision making, Image Theory (Beach, 1990, 1993; Mitchell & Beach, 1990) states that a set of social norms—called “images” or “principles”—governs the process by which people make decisions in real-life situations. The cultural order is at the base of cooperative and communicative action: “Principles are for the most part cultural products, even though each individual holds a private version that may be quite distinctive” (Beach, 1990, p. 24). Lakoff (1987) also showed, in his analysis of the classes of persons and objects provided by the Dyrbal, an aboriginal language of Australia, that current systems of beliefs—myths included—are no less important than direct experience in structuring the conceptual categories used by actors.

(b) Action (Figure 1) takes place against the background of cultural order. It is both the outcome of evaluation of the current situation and the starting-point for the construction of plans intended to cope successfully with foreseeable events. Focusing on action is reminiscent of the perspective of the Russian psychologist Vygotsky (1978, 1986), who considered practical activity and social exchange as the origins of cognitive development. The book by Lave (1988) centered on the practical use of mathematics in everyday environments offers stimulating suggestions about how action organizes context.

Action is also central to the “situated action” (SA) approach (Suchman, 1987), which aims at better comprehension of plan generation in daily situations. SA has sometimes been interpreted as directly challenging the symbolic theory of cognition, on which current cognitive science is established (Newell, 1990; for a discussion of its most sensible topics, see Clancey, Smoliar, & Stefik, 1994). SA’s ambition to stand as an alternative theory of cognition was discussed in a special issue of Cognitive Science. The article of Vera and Simon (1993a) which opened the discussion concludes: “We have examined the claims of SA without finding reasons why such action cannot be accom-

modated within the physical symbol-system hypothesis” (p. 46). This statement can be accepted.

But opposing the traditional tenets of cognitive science is not, in our view, the best side of SA. Articles by Agre (1993), Clancey (1993), and Greeno and Moore (1993) in the same issue of the journal gave more than mere pros or cons to be used in the controversy about the nature of cognition. We think one should avoid the trap of the “either–or” mentality which presented SA as an alternative to the symbolic theory of cognition. It would perhaps be wiser to think of SA as an approach which, while relying on symbolic theory, is better able to explore everyday responses to real-life situations. A balanced synthesis of the dispute is suggested by Clancey (1993), who on one hand accepts “the representational focus of cognitive science and AI” (p. 108) and, on the other, stresses the fact that “SA does suggest a different research agenda” (p. 113).

(c) History (Figure 1) of context arises from the fact that the relationship between structure and action is double and intrinsically dynamic. On one hand, the structure influences the emergence of every significant action inside itself: Actors organize their projects and attribute meanings to objects starting from the models available in their preexisting cultural order. In this sense, cultural order is constantly reproduced in people’s actions (Sahilins, 1985). On the other hand, as situations change and, in the process, may fail to match the meanings attributed to them on preceding occasions, actors are continually forced to reconceive their cultural models in a creative way.

The result of these two processes is that context is inherently unstable, because cultural models are constantly transformed by people’s actions and choices. An example of this can be found in the interplay between fashion trends and social norms about proper dressing. When first the fashion system started to persuade women to wear miniskirts or hot pants, the new look was censured by traditional models which considered it too sexually explicit and offensive to women’s dignity. So wearing hot pants or miniskirts was initially seen as a violation of the current norms of decency. But later, when the new style was well launched, and increasingly adopted by ordinary people, cultural models about proper dressing were reshaped. Miniskirts and hot pants were no longer considered as a wicked craze, but became an elegant, yet casual and sexy uniform for young women. So norms about decent social body presentation were transformed.

This is how human activity provides both reproduction and variation of accepted standards. Understanding the practical ways of interacting with computers on the part of corporate managers, psychology students, and insurance clerks can help us grasp changes in the cultural models of these categories of social actors. If actors’ responses to the suggestions of the fashion industry can reshape some important norms about body self-presentation, then the pervasive human interaction with computers is equally
likely to have a major impact on people’s cultural models. New metaphors arise, others acquire new meanings on the basis of both practical usage of computer systems and social exchanges (Lave & Wenger, 1991).

Metaphors link new practices to old norms both by orienting activities towards culturally meaningful objectives and by reconceiving cultural models so that they make some sense of the new activities. It is for this reason that HCl research does not simply end with the study of the local use of technical artifacts for performing tasks. As computer use constantly modifies the pre-existing cultural context, the environment of HCl research extends to the cultural changes caused in actors by their interaction with computers.

Context as a cultural object cannot simply be reduced to interpersonal relations, understood as the (possibly physical) environment in which the exchange of information occurs. Instead, it is the prerequisite for communication: Social actors exchange meanings—which implies the existence of shared cultural references—not simply bits of information (Tatar, Foster, & Bobrow, 1991). Actually, they negotiate their interpretations of the situations in which they are involved.

3. LEVEL 2—THE MATCH BETWEEN OPPORTUNITIES AND INTERESTS PRODUCES THE EMERGENCE OF GOALS

At Level 2 (Figure 1), in which we deal with everyday experience, context is broken down into specific situations. Here too we find an environmental pole, which we call “opportunities,” interacting with an actor’s pole, “interests.” The result of the interplay is the definition of actors’ goals. Let us consider these three concepts: (a) opportunities, (b) interests, and (c) goals.

(a) Opportunities (Figure 1) do not precede interest but are recognized as starting from it. Each opportunity is only a virtuality which comes into being when it encounters a corresponding interest. At the same time and place at which Actor X identifies an opportunity to learn an algebra task, Actor Y sitting next to him or her sees an opportunity to watch Actor Z, who has long blond hair and an enchanting smile. Z’s hair and smile are elements of that particular space–time continuum which is the situation and which can be identified only by starting from Y’s interests at that moment. They represent an opportunity for Y at that moment, in Y’s particular mood, and perhaps X cannot even see that same opportunity because he or she is following the algebra task. Daily situations contain multiple opportunities, some of which cannot even be imagined unless we see them identified by other actors.

Situations, like social contexts, are constructed (Gergen, 1996; Lazarus, 1991) by means of the different interpretations which actors give them. They are intrinsically ambiguous (Gutek, 1990), in the sense that they are rarely completely structured as traditional research on decision making once assumed. Thus, they can be framed and faced differently. Studies on judg-
opportunities influence the priority of interests. Second, interests recognize in situations opportunities which may be grasped. This is what we mean by "interpretation of the situations," both diagnostically and pragmatically. The first stage, which is only virtual and which may be viewed as the set of opportunities implicit in the situation, is the premise of the second in which, from the many conflicting interests surrounding and inhabiting the social actor, a dominant interest appears, which momentarily controls the diagnosis of the situation and the corresponding course of action.

Traditional theoretical models of decision assume that decisions are made by enumerating and weighting the possible alternative choices available. Image Theory instead splits decision into two separate moments. The second, choice among a restricted set of possibilities, is adequately explained by traditional models. The first, which is a sort of filter admitting to the final selection only the alternatives fitting the actor's standards, bears most of the responsibility for the development of decision-making processes because it is there that each possible alternative choice occurring to the actor is evaluated with respect to her or his system of norms and is consequently accepted or rejected. This is why the decision maker is sometimes left with no options available, because all occurring alternatives violate her or his accepted social norms or "images" (of course, this term does not refer here to any sort of visual process).

According to Image Theory, social norms are crucial in the process of making decisions as they provide actors with the most relevant points of reference when making decisions. Beach (1990) stated that decision makers possess three types of related images: "value image"—consisting of standards, ideals and beliefs which "serve as guides for establishing the 'rightness' or 'wrongness' of any particular decision" (p. 6); "trajectory image"—consisting of the decision maker's agenda for the future fixing goals corresponding to the actor's hopes and desires; "strategic image"—consisting of the plans produced to achieve the selected goals. In Image Theory, as in our model, cultural models and social norms govern actors' goals, which in turn generate appropriate projects, which finally prescribe a set of contingent tasks.

Action modifies situations and produces new occasions for interpretation, because "one of the primary ways in which individuals and organizations develop goals is by interpreting the actions they take, and one feature of good action is that it leads to the development of new preferences" (March, 1991, p. 100). As a consequence, we should accept that "the meaning of yesterday's action will be discovered in the experiences and interpretations of today" (p. 100). Goals, interests, and interpretations are identified by reflecting on action taken. It is not only the "objective" situation which is changed by action, but also the actor who progressively defines his or her preferences by means of action. Actually actors' interests are not usually consistent: "Preferences are constructed through a confrontation between preferences and actions that are inconsistent with them and among conflicting preferences. Though they [humans] seek some consistency, they appear to see inconsistency [italics added] as a normal and necessary aspect of the development and clarification of preferences" (p. 100).

The adaptive value of the plurality of interests and of their precarious order is clear. The ensuing instability and inconsistency in actors' priorities and preferences is the main factor responsible for both the ambiguity of situations and the ongoing changeability of actors' goals. This second level of our model supplies elements of principle, and not only of fact, in favor of the tendency—now making headway in CSCW—to avoid constructing over-restrictive models of cooperation.

4. Level 3—Artifacts in Use: Beyond the Task—Artifact Cycle

At Level 3 (Figure 1), we consider the local human-computer interaction taking place every time an actor uses a computer system as a tool to perform his or her task. This user-system interaction nests within everyday situations, as situations within social context. Let us comment on these three concepts: (a) tools, (b) users, and (c) tasks.

(a) Tools (Figure 1), or "artifacts"—or "cognitive artifacts" as Norman (1991) calls computer systems—refer to objects created to serve a purpose, which is inscribed in them. Artifacts are designed, implemented, and used in view of their context so that, for example, the types of knives for table use depend on social norms dictating rules for properly selecting, cooking, presenting, and consuming proper food. Ordinary things can contain knowledge (Norman, 1988; Zhang & Norman, 1994). In daily life, actors' purposes are expressed more in the terms of broad courses of action called "projects" (McGrath, 1990; McGrath & Hollingshead, 1994) than in the narrow terms of the tasks to be performed. Actors' goals arouse the production of projects (higher level of organization of actors' activities), which in turn call for appropriate plans (medium level), which in turn prescribe a series of tasks (lower level) to be accomplished in order to have the plans executed, the project realized, and the goal happily achieved.

A dinner service is intended for use in a situation starting with an actor's goal ("I would like to meet Anne"), which produces a project ("I will invite her to dinner as soon as possible"), which calls for appropriate plans of action ("in the afternoon I will ring her, then . . . "), which can be broken down into many separate tasks. What can we possibly gain by shifting the focus of our attention from tasks to projects? Talking of goals, projects, and plans compels us to go beyond the apparent neutrality of tasks. Although similar tasks are usually assumed to be the same even in different contexts,
goals and projects are different among actors and need constant negotiation, each actor cultivating different interests, developing different priorities, and giving different interpretations to the situations (Mantovani, 1994b).

A social situation, like a dinner, is an arena in which actors can have, actually not avoid having, different and often conflicting goals, projects, and plans: My goals in dining with Anne may not be the same as those of Anne in dining with me; we may often reach agreement, but hardly goal identity. Artifacts mediate social and cultural games taking place in the social context. These are not inert things, and the tasks which actors perform in order to have plans executed and projects realized are not neutral operations. Artifacts respond to their context of use, which shapes them. Tasks respond to projects, which select certain courses of action in preference to others, favoring certain actors over others.

Vera and Simon (1993b) claimed that “we live in a very complex world, but for some purposes we can single out and deal with very simple problem spaces abstracted from it. We tie our shoelaces in the same complex world in which global warming is (or isn't) taking place, but in accomplishing the former task we need take account of far fewer of the world's complexities than in trying to solve the problems of energy and environment” (p. 82). It is true that we do not need a precise idea about global warming in order to tie our shoelaces. But it is also true that when we wear shoes, we usually have some project in our mind regarding some activity which is relevant with respect to our current interests and which requires wearing shoes. Thus, tying laces and wearing shoes are simple activities which depend on actors' cultural models, for example, models of healthy behavior which generate broader projects like keeping fit by running in the park in the morning.

There is always a link between simple, apparently separated tasks and the more general plans and projects which govern them, although occasionally this link may not be obvious to observers or even absent in actors' attentional processes. Global warming and conditions of the atmosphere are not, in themselves, matters of immediate interest for ordinary actors (climate scientists excluded). This is why actors do not usually worry about global warming while tying their shoelaces. Actors usually have enough problems just focusing on their immediate environment: If sneakers are worn to go jogging in the park before breakfast, actors may worry about bad weather, lack of time, poor ground conditions, right leg aching, and so on. Hoping, all the same, to meet Anne in the park (a major and connected project, we assume).

Usually the interests of actors in real-life situations are more like jogging and meeting Anne than worrying about global warming and similar remote problems. Computer systems have goals and projects which are incorporated in them by designers and control them through their internal structure, and other goals and projects which are assigned to them by their users and function as external forms of control adapting them to the environment. Plurality of points-of-view and goals is intrinsic to artifacts, if they are considered in context. This idea is beginning to be acknowledged in HCI studies: for example, the previously mentioned system ODE (Carroll et al., 1994), consisting of software tools to help learners structure and develop scenarios, presently provides students with different “point-of-view” (POV) scenarios. Point-of-view shows the scenario no more from the user's point-of-view, which has been displayed in an “Overview” interface previously presented, but rather from each particular object's point-of-view: When a learner selects one particular POV scenario, he or she is presented with an animation of the POV object interacting with other objects in the scenario. Our suggestion is that we might resort to some similar device to model the different social norms which differentiate actors' relevant “point-of-view” in shaping context of system real use.

For a closer examination, we could further break down the classes of actors involved in the design, implementation, and use of cognitive artifacts. For example, users of a CSCW system designed to share information and hold organizational memory in a hospital (Schneider & Wagner, 1993) should be differentiated into doctors, nurses, hospital managers, office staff, and patients, each of these figures having different interests inspiring distinctive goals, projects, and plans. Because artifacts are structured by plans incorporated in them by their designers (Carroll, 1991; Carroll & Campbell, 1989) or attributed to them by users, and because these plans are produced by different and possibly conflicting actors, we can understand that artifacts are not just neutral "things" instrumental to execute equally neutral tasks, but become meaningful pieces of the previously mentioned "funny soccer game."

(b) User (Figure 1): It is the most highly visible figure considered in HCI, whose main themes are new users, novice versus experienced users, learning methods, and mental models. The relationship between artifact and user consists of two phases. The first designates the influence that the project of the system's designer, as it is incorporated in the artifact, exerts on the user's project. The second indicates the determination of the effective use of the artifact, made to work by the user in order to realize his or her projects within the confines fixed by the structure that the artifact has received from its designer.

Research on "artifacts in use" reveals potentially conflicting projects between users and designers of computer systems and urges development in HCI of a more extended participation of users in the design process and the invention of appropriate procedures of negotiation (Bannon & Bodker, 1991).

(c) Task (Figure 1): The dynamic character of computer systems use derives from the fact that use is not simply the execution of a program, human or automatic, but implies a certain amount of unpredictability, due to the properties of the relationship between situations and actors. Every practice activates and at the same time modifies the project embodied in the artifact.
Doheny-Farina (1991) showed that the gap between designers and users—and the related idea that technological innovation invariably flows from the former towards the latter—fails to take into account situations in which use produces genuine innovation.

There is another source of complexity in computer system use, which Carroll and Campbell (1989) called the “task–artifact cycle” (Carroll, Kellogg, & Rosson, 1991; Carroll & Rosson, 1991). People performing tasks using given tools are the starting point for the invention of new tools—within the limits of the available technology—which are created to improve the quality and quality of output, alleviate effort, reduce stress, and so on. These new tools, when adopted, modify the tasks for which they were designed and alter the situations, affecting both their technical and social characteristics. The new tasks and their environment in turn call for improvement by a new task analysis, new tool inventions, new ways of doing things, and so forth. A circular process is put in motion, setting up continuous priming from tasks to artifacts and vice versa.

Emphasis on the “task–artifact cycle” has the merit of connecting technical to social innovation, but it confines innovation processes within too narrow a frame. Actually, not only new tasks but also new plans, new projects, and new goals are activated by the invention and use of new artifacts. New activities spring, new patterns of actor–environment interaction are developed, and hence new norms about the correct way to do things arise. We should be aware of the fact that everyday living and working situations do not exhaust themselves in a series of tasks, but start from actors’ more or less explicit projects. Tasks are contained within plans which are in turn contained within projects, as in our example of tying shoelaces to going jogging in order to keep fit. Considering people’s activity merely as task execution hinders full understanding of the multidimensionality and flexibility of daily conducts.

5. A NEW PERSPECTIVE

FOR HCI RESEARCH ON MENTAL MODELS

HCI has dealt mostly with the direct use of computer systems for performing tasks (Level 3), with the result that current studies on actor–artifact interaction lack both specifications on the links between artifact use and situations (Level 2) and links with the general context which inspires in actors their projects (Level 1). But neglect of the two higher levels implies losing sight of both the functional characteristics of the task and the system’s real use. Emphasis on tasks in HCI is in itself a cultural artifact, inspired by the organizational theory put forward at the beginning of this century under the label of Scientific Management (Taylor, 1911). Taylorism maintained that work in organizations could be broken down into a cascade of tasks and

![Diagram](image)

**Figure 2. Current HCI research on user mental models.**

subtasks, each to be entrusted to separate operators controlled by an omniscient and omnipotent center (i.e., corporate direction).

Recent organizational research has rejected the basic ideas of Taylor’s (1911) approach. There is no omnipotent center, nor an exclusively “scientific” way of managing people and things (or people as things). Actors (managers as well as office staff and blue-collar workers) in organizations are filled with unreconciled objectives, compete for control of strategic resources, shift alliances following the opportunities offered by changing situations. Interpretation, negotiation, and action—as a way to discover both preferences and opportunities—are the tenets of the new organizational theories, which are themselves increasingly considered as social constructions (Bannon & Bødker, 1991; Jirotka, Gilbert, & Luff, 1992; March, 1991).

Figures 2 and 3 compare our perspective with the present HCI approach to the relationship between computer system use and the generation of the corresponding users’ mental models. Although standard HCI studies (Figure 2) follow a bottom-up route starting from artifact use, our top-down approach (Figure 3) suggests considering higher levels to clarify what happens at lower ones.

Figure 2 illustrates three paths often followed in current HCI studies: (a) from local use to the production of mental models of the system used; (b) from local use to the orientation in computer systems currently used (Carroll & Rosson, 1991); (c) from local use to the development of new social norms and conventions (Sproul & Kiesler, 1991). Figure 3 shows how a context-dependent approach may modify the research agenda on generation of users’
mental models and opens new directions which are complementary to those pictured in Figure 2: (a) from actors—observing cultural order and incessantly modifying it—to mental models of the tools (Payne, 1991), (b) from actors to orientation in systems (Spears & Lea, 1992), (c) from actors to social norms directing system design and use (Mantovani & Bolzon, 1994).

Social norms are central to the approach illustrated in Figure 3: Payne (1991), for example, in his study of the generation of mental models by users of cash dispensers, stressed the opportunity of considering social representations (SR; Moscovici, 1984) conveyed by media as capable of orienting users’ attitudes and behaviors towards computer systems. Due to their lack of experience, novice users can be expected to rely more on SR than on local use, whereas the reverse may be true for experts.

In general, different levels of context may prompt different types of mental models, in users as well as in designers of computer systems. The meaning attributed here to the expression “mental models” is more general than that of Gentner and Stevens (1983) and Johnson-Laird (1983), because we intend it to contain also normative social processes.

Figures 4 and 5 show the connections we see between the levels of context we consider and the generation of mental models by systems designers and users. Figure 4 depicts the current HCI explanation of generation of users’ mental models: Emphasis is placed on the third level; the second level may prompt by third and reacts on it; the upper level is ignored. Figure 5 displays the production of designers’ and users’ mental models according to our model: All levels can be taken into account; each of them influences and is in turn influenced by the next—fluence processes running both bottom-up and top-down.

The message the two figures aim to convey is that the use of artifacts changes our everyday environment, also affecting it at its cultural level. Studies like those of Zuboff (1988), Sproul and Kiesler (1991), and Spears and Lea (1992) not only provide assessments of the impact of new technologies on people’s behavior at work but also highlight the changes that systems’ use can produce in actors’ ways of deciding, communicating, and thinking—activities that are not restricted to the local use of systems.

What does going beyond the task-artifact cycle really mean? Figures 4 and 5 suggest that it means using not only the metaphor of tools, which governs HCI analysis at Level 3 (local interactions), or the metaphor of maps, which inspires studies of Level 2 (orientation in systems), but also other metaphors capable of capturing processes occurring at Level 1 (actors negotiating socially recognized meanings for their actions, plans, and projects).

Social norms are always present in computer system use, although it is often not easy to distinguish the functional aspect of the new technologies from their cultural meaning: An electronic engineer may feel obliged to use E-mail even for activities, such as keeping in touch with a colleague working in an office next door, in which a less IT-committed person would use other channels, for example face-to-face conversation. The engineer may feel that E-mail is just the right channel to exchange information with colleagues because s/he thinks it is the most appropriate for modern scientists to use.
6. CSCW: SHARED INFORMATION OR SHARED MEANING?

Our model partially explains the origin of cooperation's most interesting but most problematic characteristic: Multi-agent environments do not have only multiple actors but also, and especially, multiple viewpoints about reality (Schmidt, 1991). Differences among actors' views cannot be conceived as affecting only narrowly circumscribed domains, like a difference limited to the correct way of performing a task, but involve actors' whole cultural order. Actually, in their normal lives, actors have different normative standards affecting all three of the aspects mentioned by Image Theory (i.e., values, goals, and plans).

Thus, for example, differences between a system designer and a novice user, or between one novice user and another, may not be restricted simply to the interaction with the system, but can involve larger systems of representations and assessments which are constructed at Level 1 and developed at Level 2. Wianiewski and Medin (1994), in their studies on the interaction of theory and data in concept learning, demonstrated that "learning involves having an expectation [italics added] about the intended function of an object and figuring out how to carry out (i.e., instantiate) that function" (p. 267). Our claim is that such expectations have not only individual but also cultural bases consisting of principles and values.

The values which electronic engineers attribute to technologies lead them to interpret differently from other professionals situations in which technological artifacts are physically present—and even situations in which these are not physically present but are referred to in some meaningful way. Geertz (1983) emphasized the role of professions in generating cultural differences and stated that a profession is not only a job we do but a way of viewing the world in which we live. Whatever the influence that we are prepared to grant to professions, they are clearly not limited to the development of technical competences; they also express moral judgments and policy assessments.

Modern professions may be considered as distinctive cultural worlds in their own right. Dunlop and Kling (1991) and Kling (1996) showed how people committed to scientific and technological research construct a moral foundation (ethos) of science and technology which makes them act as true "moral agents," such as our electronic engineer whose media choice is inspired by the belief that CMC is "better" than traditional communication channels in a social normative way. Even when cognitive artifacts are not physically present, they can be culturally present in social context.

In studies on cooperative work, it is acknowledged that we must take cultural differences into serious consideration. We can no longer think of coordinating actors from above, or reducing them to a consistent set controlled by an omnipotent and omniscient center, as the hierarchical theories of organization suggested (see previous section). There is no omnipotent center (Schmidt, 1991), either in organizations or in cooperation, except in the imagination of Scientific Management, now obsolete in both theory and practice. In today's working environments, often multinational, individuals and groups use different vocabularies, have different motivations, represent organizations of different cultures. In these environments, the referents of the transactions may vary from extremely abstract concepts to concrete products (Williams & Gibson, 1990) so that problems arise not only in reconciling differing viewpoints but even simply in trying to identify them.

Natural language allows actors to communicate by using reciprocally accessible utterances in order to reach some degree of mutual understanding about the ways in which current situations are framed. Because all representations are inherently open to interpretation, communicating implies constant negotiation of the meaning attributed to words and expressions (Bruner, 1990). This ongoing negotiation process takes place within the patterns made available by actors' cultural order.
It is by means of the iterative process of verbal exchange, with repeated feedback and reformulation of questions, that actors can try to reach an acceptable degree of reciprocal recognition of the other actors' visions (Bradbury, 1978). This requires each actor to expend considerable effort in a double recursive activity: on one hand, formulation of hypotheses on the nature of other world views and, on the other, continual reinterpretation of the answers received. CSCW systems demand a space for negotiation between actors, so that possible different perspectives may be recognized and interpreted in ways similar to those taking place in negotiation through natural language (Robinson, 1991). Cooperative systems which, like COORDINATOR of Flores, Graves, Hartfield, and Winograd (1988), restrict users to predetermined procedures in order to communicate have been criticized (Suchman, 1993) as reducing the human ability to play the cooperation-conflict-negotiation game.

In CSCW, it is now recognized that any attempt to confine human conduct within prescriptive formal models is not only impracticable but also impossible in principle. Schmidt (1991, p. 1), in his opening speech to the Second European Conference on CSCW, stated: "The innocence and familiarity of cooperative work is deceptive. Cooperative work is difficult to bridge and coerce into a dependable model. And anyone trying to incorporate a model of a social world in a computer system as an infrastructure for that world is as reckless as a daredevil mounting a Bengal tiger." Research in DAI also recognizes that "two agents in principle cannot have identical representations" (Gasser, 1991, p. 119). This occurs "simply by virtue of different commitment histories and local circumstances" (p. 117). History and situations are precisely the categories used in Levels 1 and 2 of our model.

As a consequence of the presence within actors of irreconcilably different views, we cannot assume that CSCW systems are cooperative simply because they make available to many potential users stores of information in the form of "shared space" or "community handbooks." Gasser (1991) stated that "shared knowledge, as I think we normally conceive it, is impossible" (p. 117). What really happens is that "we have ways of pragmatically aligning our activities and acting as though we share knowledge" with other people.

This "tuning in" allows actors to make sensible assumptions about how both they and their interlocutors react to current situations (Level 2) and on which standards actors' interpretations depend (Level 1). This is why "much of the social interaction that precedes group decision making is devoted to ironing out differences in the participants' frames through the sharing of information and through negotiation" (Beach, 1990, p. 64). It is this work on values, rather than the mere availability of information on the interlocutor's problem-solving state, that allows informal conversation to create a framework favorable to cooperation. These "moral" aspects are often dealt with indirectly (e.g., by humor) and casually in face-to-face conversations but are much more difficult to manage explicitly, both because of each actor's need to "save face" in front of interlocutors and because of the possible presence of the "strategic" use of information.

Cooperation without negotiation cannot be achieved: It is important "to realize that one cannot just produce a common information space, that it does not automatically appear as the result of developing a common dictionary of terms and objects, as the meaning of these terms and objects must still be determined locally and temporarily" (Schmidt & Bannon, 1992, p. 28). The idea that information is something neutral which can be stored in a kind of warehouse common to several different individuals, groups, or organizations is deceptive. Information is gathered and interpreted by actors according to its source, presumed aim, and internal organization: Its reliability and importance depend on this interpretative work.

The so-called "electronic altruism," which would encourage people linked to a network to answer questions of the type "who knows...?", thus gradually creating a database open to everyone (Sproull & Kiesler, 1991), is an over-simplified view of practices that deserve better explanations. March (1991) was right when he said that "information is rarely innocent." Today, in advanced organizational cultures which emphasize competences in accessing and handling knowledge as the prime factor in problem solving and decision making, information is the foundation of legitimacy and power in organizations: "a signal and a symbol of competence" of decision makers and, therefore, a source of legitimacy of their power (March, 1991, p. 110). Little room remains for "shared spaces" or "community handbooks" storing pretended "objective" inert information: "A uniform, complete, consistent community handbook is simply a chimera" (Schmidt, 1991, p. 12). What is shared, on the pragmatic plane, and what allows cooperation to exist is not raw information but its meaning:

Collaboration creates a shared meaning about a process, a product, or an event. In this sense, there is nothing routine about it. Collaboration may occur by mail, over the phone, and in person. But the true medium of collaboration is other people. Real innovation comes from this social matrix (Schrage, 1990, p. 169).

It is precisely this social matrix that we have articulated in our three-level model.

Cooperation in its strong sense, that is, understood as the pursuance of a common goal, is only possible in privileged and circumscribed moments of peculiar good luck. In everyday life, actors rarely have a common goal, as the "funny soccer game" shows. In such a confused scenario, what does "cooperation" mean? There are no fixed schemes, no stable teams, no
coaches to be obeyed. Each agent fights for some goals and against others, changing his mind every time the internal or external situation presses him to do so, switching alliances continuously. If we accept that organizations are arenas for agents' messy games, and social contexts are even looser webs of conflicting interests, then what are the implications for the models we can adopt in CSCW systems?

The first is that we have to accept the most suitable models for CSCW those allowing "precarious use," that is, models that "users can appropriate, explore, modify, negotiate, reject, circumvent or execute according to the contingencies of the situation" (Schmidt, 1991, p. 14). In this way, users can keep the system under control. The second is that we can see now that cooperation requires creating a partially shared sociocultural framework, and at the same time recognizing both the conflict which inevitably accompanies it and the need for ongoing social negotiation (Robinson, 1991). Cooperation originates in a socially negotiated meaning for situations enabling different actors to find both a way of working together and a way of working towards agreed descriptions of situations.

7. CMC: A CULTURAL VERSUS A "PHYSICAL PRESENCE" PERSPECTIVE

Our conceptualization of the context provides a framework for understanding some aspects of the current discussion on the nature of CMC.

On one hand, we have researchers who share the approach of Sproull and Kiesler (1991), who credit CMC with both a great innovative potential for enhancing democracy in organizations and a substantial drawback consisting in impulsive and even overly crude behavior, manifest in the phenomenon of "flaming" (of which both the existence and the interpretation are questioned by Lea, O’Shea, Fung, & Spears, 1992). These mixed effects are said to be produced by the lack of "social context cues," causing irresponsibility, de-individualization, and weakening of social norms in actors.

On the other hand, we have the approach to CMC championed by Spears and Lea (1992). They disagree with the tendency, still prevailing in CMC studies, to view the social context in terms of "social presence," that is, the set of interpersonal relationships occurring between individuals interacting inside a common physical framework. The "social presence" approach considers the physical copresence of people communicating face-to-face in the same room as the communication situation which is richest in stimuli and which can be, for this reason, assumed as paradigmatic. This is why research inspired by the "social presence" theory constantly compares CMC with the face-to-face conversation, in a setting emphasizing that electronic communication does not provide much information on how interpersonal relationships develop.

It is quite obvious that many of the social cues occurring in face-to-face conversation are missing in CMC. This does not mean that social context is absent in it. When Sproull and Kiesler (1991) asked how people linked "only" by computer can communicate with each other, they seemed to forget that people are connected by what they know of the current social situation and by what they guess about the interpretation that other actors give of it. They are connected also by what they know about their own purposes, what they can guess about other people's intentions, and by social norms governing their interaction and making it mutually understandable. A low-level clerk communicating by E-mail with the corporate vice president evokes, while sitting alone in his office, the hierarchical structure of the company and looks for some common ground for negotiation and possibly profitable action. S/he is playing a highly sophisticated social and organizational game and is fully aware of the strategic nature of that game.

When Sproull and Kiesler (1991) stated that, sitting in front of a computer screen and using CMC, individuals are removed from a social context, they seemed to view context as merely a set of relationships between individuals who are physically close to each other. This view is not only unacceptable in general terms, because it reduces social relationships to some form of physical connection between individuals (it is correct to mention here that our Level I, cultural order, in a certain sense precedes the actor, being the background against which actors' actions are set). It is also singularly inappropriate for an understanding of the peculiar environment which is CMC. Spears and Lea (1992) rightly emphasized that CMC does not lack social context, provided we know where to look for it, that is, in normative social processes. These authors based their premise on the theories of social identity (Tajfel & Turner, 1986) and on self-categorization (Hogg & McGarty, 1990; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987).

Social context is present in CMC because powerful social processes are at work in it: categorization of the self, of other people, of one's reference group, of the current situation (Mantovani, 1994a, 1996). Processes like categorization and identification are the load-bearing structures of social structures. The poverty of the interpersonal relational framework in CMC may, in certain conditions, even amplify the influence of the normative aspects of the context resulting from processes of membership and identification, as the example of the low-level clerk trying to get in touch with the vice president through E-mail makes apparent. In our model, social contexts may function even more strongly on the basis of pure symbols of power, status, authority, and so on, when these social cues are not mitigated by interpersonal signals such as a friendly expression, an irritated tone, or a casual gesture betraying tiredness.

Using E-mail to communicate with the corporate vice president can amplify the perception of social distance and status barriers. Thus, in CMC,
the influence of social context may be even stronger than in face-to-face conversation, depending on which aspects of personal and social identity are made salient by the specific situation (Lea & Spears, 1991). This would also explain the strong group polarization found in CMC—a typical effect of social influence—which is surprisingly high precisely in decision-making processes within networked groups (Spears & Lea, 1992). As we do in our model, Spears and Lea (1992) identified the social dimension first with the cultural models structuring context:

The social identity approach rejects the individualistic meta-theory of interdependence, viewing social categorization and social identification as the critical mediators of group processes. In these terms, the group is conceptualized in socio-cognitive and not first and foremost in structural or relational terms. This allows for the impact of group influence independently of the copresence of others, and also for the influence of more general social categories defined independently of individuals per se (p. 54).

The clerk contacting the vice president (or vice versa, of course) may provide a good occasion to show what it means to conceptualize social groups in sociocognitive instead of interpersonal and relational terms. The approach which we share with Spears and Lea considers the clerk as well as the vice president as actors connected by something more than just a computer network. They are connected by the fact that they belong to a common social environment which can be defined not only in physical terms (as would happen if focus were put on the fact that they work in the same building, on the same floor, sometimes meet each other in the elevator, and so on) but especially in social and normative terms (they have some common reference points making possible mutual recognition: a partly shared idea of which their status is, what their roles and expectations are, which biases their information is expected to convey, etc.).

Cultural social context, rather than physical copresence in itself, makes possible everyday communication, cooperation, and the very existence of complex organizations, which are made more of abstract relationships of power, authority, and coordination governing actors' strategies, alliances, and negotiation than of face-to-face interactions of clerks working in the same office or meeting vice presidents in the elevator. High levels of context (referring to our model) supply both the clerk and the vice president with a ground for the development of their relationship by enabling each of them to infer the presence and possible nature of the others' goals. Thus, conflict can be anticipated and managed, and differences between actors come to be negotiated.

Actors are intrinsically social in our perspective that considers social dimension as no longer restricted to the physical presence of other people. Context constantly supplies actors with values, goals, and projects which orient them in shaping self-images, referring to particular physical or ideal groups, choosing a course of action in everyday situations. It is not enough to be physically alone in a room to be outside the social context. Within the terms of our model, this may seem obvious, but the individualistic models based on the theory of "social presence" insist on identifying social context with physical copresence. In their work on CMC, Fulk, Schmitz, and Schwarz (1992) noted that "researchers are subtly encouraged to draw relatively rigid conceptual boundaries between the individual and the social context. Social context thus becomes something outside the individual" (p. 9). From an individualistic stance, social context may seem as irritating as an unsolved puzzle, a persistent but elusive source of external influence on people. Conversely, according to our model, social context not only surrounds people but also resides within them as an essential part of their very identity. In this respect, the individualistic perspective on conceptual knowledge (mental models) may be adapted to improve upon the discourse of social analyses.

The social is at the same time inside and outside actors: "It is misleading to think that cultural conceptions must be located either outside the person or inside the person [italics added]. In an authentic culture, cultural conceptions are likely assembled or reproduced in both places at once, and probably for good psychological reasons" (Shweder & Sullivan, 1993, p. 511). In cognitive science, Agre (1993) took a converging position when he argued against the misleading system of metaphors "marking out a firm distinction in kind between the mental Inside and the worlds Outside" (p. 66). Thinking of context is thinking of the relationship between inside and outside, between actors and their social scenarios.

8. CONCLUSIONS: SOCIAL CONTEXT MAY PROVIDE A USEFUL FRAMEWORK FOR HCI, CSCW, AND CMC

We will limit ourselves to three final considerations. The first is recognition of the fact that construction of the model presented here has been stimulated by increasing attention of HCI research to context-centered approach to artifacts (Carroll, 1991, 1994), by the march of DAI towards dissolving the distinction between open and closed systems by considering all systems as essentially open (Gasser, 1991), by the need to develop Cognitive Ergonomics as a multidisciplinary research field (Norman, 1991), and especially by recent developments in scenario-based systems (Carroll et al., 1994). The extent to which our model is indebted to such researchers as Beach, Carroll, Clancey, Lave, Lea, March, Norman, Schmidt, Spears, and Lea is only too apparent.

Second, it should be noted that our model, unlike that tacitly adopted in current HCI research, emphasizes the need for awareness of the social dimensions lying beyond the task-artifact cycle. These dimensions originate in the
interaction between action and cultural order (Level 1) and develop in the ongoing processes of interpreting situations and actors’ interests (Level 2). This awareness implies introducing context into HCI studies not only as a physical–interpersonal environment but also as a normative social order directing actors’ interpretations and actions (cf. symbolic interactionism, Mead, 1934). This should lead HCI to extend its research field, coupling the prevailing bottom-up orientation with a complementary, top-down route which we advocate in this article.

The third point emphasizes the change that our model implies in the conception of the relationship between actors and context. In our view, social context lies also within actors and does not simply surround them. Actors act in the world through their bodies, but they are not confined within their physical limits—which, for groups or organizations, can be their tangible structures of walls, doors, telephones, and computers. Individual actors may identify with their gender, age, country of origin, profession, and so on. Their social context is made up of cultural and normative references which take them far beyond their own skins. The mental models they use when interacting with computer systems are created not only by their direct experience of artifacts and tasks but also by the set of general beliefs which orient their choices. Groups and organizations also have their own values, projects, ways of handling information and negotiating agreement.

We cannot know actors without their context, in the same way that we cannot know context without its actors: Cultural order is achieved by action, which allows situations to be interpreted, which in turn allows artifacts (computer systems included) to be used in specific applications. We believe that our model—arguing in favor of the direction top-down, from people’s system of beliefs to their everyday practice—can prove a useful framework in HCI studies on mental models, cooperation, and communication and might stimulate development of scenario-based tools taking into proper account cultural models and social norms.

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SCHILLER 317


