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8. THE NEW MEANING PROCESSING PARADIGM
by Ilkka Tuomi

During the last decades, research and development of information technologies has been guided by what can be described as the *information-processing paradigm*. The information-processing paradigm has influenced theories of computer hardware and database design, organization theory, research on artificial intelligence and knowledge representation, theories of human learning and cognition, as well as economics. This chapter argues that the limitations of the information-processing paradigm are now rapidly becoming visible. The development of important new applications of information society technologies, such as instant messaging, blogging, tagging, social filtering and networking, distributed annotation, and knowledge management systems, implement ideas that cannot easily be described using the traditional information processing concepts.

The old paradigm does not work well anymore because it is built on a conceptual foundation that is not well suited to the present reality. Yet, at the present, we lack well-articulated models and concepts that would effectively move beyond the old paradigm, and guide policy, research, and design. This chapter, therefore, tries to outline the characteristics of an emerging new paradigm—the meaning-processing paradigm.

The chapter combines a brief conceptual introduction to the new paradigm with some practical examples of developments that highlight the relevance of this paradigm. It also discusses some policy approaches that emerge in the new paradigm.

In the new meaning-processing paradigm, information and communication technologies are understood as technical systems that are integrated with and embedded in social, cultural and cognitive processes. These processes consist of the ways people consume and produce goods and services, and the way they interact with other people. Information technologies are now becoming a media for socially, culturally and historically embedded meaning processing. Thus, whereas research and product development within the traditional information-processing paradigm required mainly knowledge about microelectronics, mathematics, logic, and engineering, the new paradigm can only fully be described using cultural, social, and epistemic knowledge. When new applications of information and communication technologies are taken into use, they acquire their functionality and meaning in a historical context of existing technologies and social practices. Technologies do not come into world ready-made; instead, they are interpreted and shaped by active actors who appropriate technological opportunities in serendipitious, unexpected and innovative ways. The emerging paradigm, therefore, is inherently dynamic, social, and evolutionary.

In the traditional information-processing paradigm, semantics was a major challenge and the problem of meaning was explicitly pushed beyond the limits of the paradigm. Information systems were designed based on a strict separation of syntax and semantics. This was a central design requirement for traditional computing architectures. The reason is simple: algorithmic computer programs can process data only when the meaning of data is fully represented in data structures and programs do not have to interpret it.[155] In the emerging

[155] The design rationale and limitations of traditional computer architectures in processing knowledge and meaning are discussed in Tuomi (2000), which also showed that the conventional concepts of data and information emerge as a side effect of computer system architectures and the epistemological models that they implement.

paradigm, information and communication systems do not aim at algorithmic processing of data, except in some well-defined special cases. On one hand, information systems are now increasingly used to implement abstract communication and knowledge processes where information-processing concepts become trivial and irrelevant. Bits are now becoming a similar commodity as electrons, and we do not have to talk about bits any more than we need to talk about Maxwell equations when we talk about future information society technologies. On the other hand, real advances in the micro- and nano-level information processing technologies will require that we reconsider the conceptual foundations of the information-processing paradigm. In other words, there is an increasing need to bring meaning back to computing, communication and knowledge society technologies.

At present, the traditional information-processing paradigm is being extended to include semantics. A large number of initiatives aim at developing knowledge and meta-data representation schemes that would enable automated processing of meaning. These initiatives often revisit—and sometimes reinvent—the ideas of knowledge representation that were popular in artificial intelligence research in the 1970s and 1980s. These initiatives, therefore, often rely on epistemological approaches that are known to have difficulties in handling meaning. Although brute-force computing can sometimes solve practical problems related to meaning, a paradigm that lacks conceptual rigor or relevant dimensions in describing the problem of meaning can only with great effort be scaled-up to practical meaning processing tasks. This chapter, therefore, also makes the perhaps controversial claim that initiatives such as the Semantic Web promoted by the W3C will have only limited success in the future. A truly semantic Web already exists. To understand its character and evolution, we need, however, a new epistemological approach and a new research paradigm.

Throughout this chapter, we emphasize the importance of epistemological concepts. One problem with the traditional information-processing paradigm was that it mainly relied on one specific epistemic model, empirical positivism, and often assumed it to be trivially true. Epistemic models have therefore often remained invisible and implicit in technical, economic, and policy discussions related to information society technologies. In the present chapter, we make epistemic discussion explicit. The aim is to provide concepts and language that help in articulating challenges and opportunities in the knowledge society, where knowledge, indeed, is not trivial anymore, and where the proper and theoretically robust characterization of knowledge has become an important practical problem.

The underlying claim in this chapter is that we are approaching a discontinuity that requires reframing many ICT engineering, design and policy problems. The new paradigm does not emerge ex nihilo, and the chapter tries to build bridges to research traditions that have existed for many decades. New paradigms exist in laboratory scale before their society-wide impact is felt. The elements of the new paradigm are not new; instead, the novelty is in the overall restructuring of existing knowledge. Paradigms change when we reinterpret and reconfigure existing pieces of a puzzle so that the present reality forms a coherent picture. In the first phase, we have to recognize that there is an anomaly and that the world does not fit well with our models of it. This is often difficult, as the old models typically work extremely well in many practical situations by construction. As Kuhn noted, social forces drive and constrain paradigm change, and new paradigms often emerge only after old professors die. Today, millions of people have invested heavily in skills and theoretical concepts that are directly related to the information-processing paradigm. When a new paradigm replaces the dominant paradigm, new skills and new disciplines of knowledge become relevant and old ones lose some of their relevance. This happens, however, only when the anomalies of the old paradigm

become clearly visible and practically important. Then we have to give up some fundamental assumptions and reconceptualize the world. This is a natural part and a sign of learning. Creation of new knowledge requires that obsolete truths become obsolete and that we unlearn what we learned earlier.

Competitive advantage in research and business is gained by locating discontinuities early and by linking weak signals that on the surface appear to be disconnected. This chapter, therefore, invites researchers to join the work of discovering the potential new sources of leadership in information society technologies. Instead of elaborating the meaning-processing paradigm in any great detail, the chapter aims at giving a quick glance over the emerging landscape. In particular, I try both to provide references to relevant earlier streams of research and introduce some concrete examples that could provide starting points for further discussions.

Structure of the Chapter

This chapter starts by contrasting the two paradigms of information processing and meaning processing. The aim is to first give the reader a general idea of where the focus of each paradigm lies. We do this by discussing differences between the paradigms in three areas: epistemology, the organizational model, and the socio-economic model. We then summarize some main differences in Table 1.

Then we move to a more detailed discussion that points to related research traditions and provides references that are useful for formulating the new paradigm. This exploration of conceptual foundations is intended to provide a concentrated introduction to some key ideas underlying the new paradigm, as well as links to relevant research disciplines. After this theoretical and conceptual discussion, the chapter describes some example Internet applications that highlight different elements of the new paradigm. Instead of a detailed discussion of these examples, we simply show how these representative applications look and point out some of their most relevant characteristics. The report finishes by discussing out some policy implications and areas for information society policy development.

The two paradigms: an overview

This section summarizes the main differences between the information-processing and the meaning-processing paradigms. Due to the multidisciplinary nature of the new paradigm, we first provide a very high-level overview, and then, in a subsequent section, introduce more detailed discussion and references to existing research.

Epistemology

An important difference between the information-processing and meaning-processing paradigms can be found in their epistemological starting points. The information-processing paradigm is based on empiristic and positivist concepts of information and knowledge. The meaning-processing paradigm, in contrast, is based on a constructivist approach.

The empiristic and positivist epistemologies typically assume that the world consists of perceiver-independent objects and that knowledge is accurate representation of these objects and their relations. Empirism states that only observations of the external world can lead to knowledge. Positivists, in turn, argued that reality consists of things that can be asserted by empirically confirmed facts. Various interpretations on both empirism and positivism exist. The common view that the world is “out there” and that knowledge is about empirically verified facts and laws of nature is called naïve realism. Since the 1950s, epistemologists have

generally agreed that this naïve realism has to be modified, for example, because facts depend on theoretical models within which they make sense. The main characteristic of positivist and empiristic epistemologies is the strict separation of subjects and objects of knowing, as well as the assumption that knowledge has to be independent of the social and personal context of knowing. Epistemologists in this tradition often argue that if knowledge becomes subjective, all knowledge claims become equally valid, cumulative science becomes impossible, and anything goes.

The information-processing paradigm has often relied on an epistemic position that closely resembles naïve realism. tried to represent knowledge about existing objects. This led to questions such as how to avoid logical and empirical errors in knowing the reality. An influential early example was the mathematical theory of information, developed by Shannon and Weaver. The fundamental goal of the theory was to find efficient coding schemes that would maximize the probability of correctly receiving a message selected from a predetermined set of messages. This same epistemic starting point was often adopted by researchers on artificial intelligence and human information processing, who tried to represent and process knowledge about existing objects, and model knowledge structures stored in the human brain.

The traditional information theory implicitly assumed a closed world. The constructivist approach that underlies the meaning-processing paradigm takes as its starting point an open world. This world is not simply "out there." Instead, its objects and characteristics are generated and organized by intelligent actors, who use their cognitive capabilities to structure the reality and make sense of it. In this view, humans create information and knowledge by active processing. Many alternative interpretations of the reality are possible, constrained by cultural, social and even biological factors.

The cultural and social foundations that provide the basis for interpretation of meaning also imply that the processes that produce meaning are not purely individualistic. Instead, they are grounded on historically accumulated stocks of meaning and shaped by social interaction. The accumulated stocks of meaning are not arbitrary or detached from the rest of social life. The meaning of things and events depends on social differentiation, institutions, existing conceptual and value systems, and social practices. Scientific knowledge, for example, is deeply rooted to socially shared stocks of accumulated knowledge, specific scientific practices and instruments of observing the world, and conceptual systems that make facts, theories and observations meaningful and relevant for the scientific community in question. Knowledge is constructed in a social and historical process, not as isolated universal facts or bits of information, but as coherent systems that integrate human knowing and action. Knowing, therefore, is understood in the meaning-processing paradigm as an active process and verb, not a static representation of an observer-independent reality.

Organisation model

In organisation theory, the information-processing paradigm has had a major influence during the last decades. Leading authors in organization studies argued that organizations and their structures should be understood as information processors. Often the underlying model was a hierarchy that was assumed to make decisions based on information received from the

environment.[156] In organisational information systems research, the information-processing paradigm led to extensive studies on decision-support systems, executive support systems and, for example, attempts to implement comprehensive enterprise information architectures.

The meaning-processing paradigm, in contrast, has been visible in studies on organisational knowledge-creation and strategic sensemaking. Research on organisational learning, organisational narratives, knowledge-based organisation and innovation management also often understood organisations as loci of meaning processing.[157]

Organisational information systems research has been conducted within both paradigms. Research that has highlighted elements of the meaning-processing paradigm has often focused on computer-mediated communication, augmentation systems and collaboration systems that support knowledge creation and innovation. Also studies on Internet communities and self-organisation have often focused on the social aspects of communication and interpretation, thus moving beyond the information-processing paradigm. Studies on user-centric design, emotional design, domestication of technologies, and, for example, ethnographies of technology use have also highlighted meaning-related factors in information and communication systems.

Research on organisational knowledge-management systems has been divided along the lines of the two paradigms. In particular, around the mid-1990s some knowledge-management scholars adopted an epistemic position that closely resembled naïve realism. Researchers rooted in computer engineering and programming, and information systems and knowledge-based technologies often understood organizational knowledge management systems to be about representing, storing and processing data. In contract, researchers influenced by studies on business strategy, innovation, organizational sensemaking, collaboration technologies, social learning, change management, and social studies on technology, often adopted a view in which knowledge management systems are facilitating tools in an essentially social process of knowledge generation, diffusion and action. In general, the first approach lead to attempts to automate knowledge processing using computers, whereas the latter tried to make people and organizations more intelligent by supporting human knowledge processes.

Socio-economic model

The information-processing paradigm has close affiliation with the mainstream schools of economic thinking. For example, in the neoclassical theory, prices have often been understood to contain information about the marginal utilities of consumers and the costs of producers. Market, in itself, has commonly been perceived as a computational machine that processes price signals. Leading neoclassical economists have explicitly argued that the distributed information processing mechanism of markets outperforms any rational planning and design. Institutional economists working within the neoclassical framework have also explained the emergence of organisations and institutions using information processing costs. In general, during the last decades information-processing models of economy have been influential and visible. Economic actors have been perceived as economic decision-makers who maximize their utilities and self-interest, perhaps with bounded rationality or with other imperfect computations.

[156] Influential examples include Tushman & Nadler, 1978; Knight & McDaniel, 1979; Egelhoff, 1988; March & Simon, 1958.

[157] For an extended review of organizational information processing research, see Tuomi, 1999.

Studies on neoclassical economics have typically adopted an empiristic and positivistic epistemology. In this epistemology, the epistemic challenge is to accurately represent and extract information about the world and its objects. Economic actors, in turn, are typically perceived as calculators who compute economic options and outcomes, and then realize options according to the calculated outcomes. In this theoretical tradition, it rarely makes sense to ask why utilities or preferences are what they are. Questions about values and meaning of products and consumption, therefore, typically remain in an opaque black box, and outside the economics proper. Whereas traditional computer system research pushed meaning beyond its domain by representing it in data structures that provided the static constraints for automated data processing, economics pushes meaning out of its equations by reducing it into a one dimensional number that has no internal structure. This approach, in itself, reflects the epistemic idea that the laws and facts of nature have to be universal and independent of subjective valuations. Modern economic theory typically assumes that values are fully subjective and personal, and therefore cannot and should not be modeled in economic theory. Somewhat paradoxically, this leads to concepts of value, utility and preference that are fully universal and agnostic concerning personal values and meaning.

Neoclassical models, therefore, are also independent of history and culture. By construction, the market is understood as a universal mechanism, which in its theoretically optimal form operates independent of time, place or social structures. In its pure abstract form, neoclassical economics understands economy as a social system that consists of individual rational decision-makers, who reveal their preferences, expectations and knowledge in their economic transactions. In this approach, economic transactions, in turn, fully represent all relevant information about values, thus consolidating histories and expectations into points in time where values are cleared. Neoclassical economic theory, therefore, typically rejects from its models information that relates to culture, contingent historical events, and social and ethical value systems. Historically accumulated, contingent, structural, and qualitative factors, such as social and organizational networks pose an important challenge to this theoretical approach. Similarly, the epistemic foundations of the neoclassical theory lead to difficulties in handling meaning-related phenomena, such as knowledge, learning, novelty, and innovation.

In contrast, economic sociologists, since Marx, Durkheim, Weber and Schumpeter, have emphasized the importance of the historical and cultural context. For example, Durkheim highlighted the role of symbolic systems that create and embed “social facts,” as well as rituals and religion-like systems of belief that underlie social and economic behavior. Weber, in turn, argued that social sciences are different from natural sciences because in the former both the researchers and the objects of study attach meaning to events. Therefore, according to Weber, researchers cannot understand social behavior without taking into account the meanings that mediate social action.

More recent research on social meaning processing has pointed out that consumers are not passive sinks of goods and services. Instead, they consume products and services in contexts where their consumption makes sense. Instead of being active only at the moment of decision-making and maximization of self-interest, consumers use material and symbolic goods to produce meaning. Producers form symbiotic relations with the users of their products, and products, in turn, are used to allow consumers to participate in social meaning processing.

Sociologists have further pointed out that meaning processing is in many ways structured. Modern societies are functionally and culturally diversified. The social infrastructure of

economy consists of communities of specialized practice and interpretation, multiple linguistic genres and a rich variety of conceptual and value systems. Practical social and economic activity often requires crossing of the associated interpretation and cultural boundaries.

In this “non-neoclassical” view, economic transactions are accompanied by knowledge that extends beyond the time and place of economic transactions. In practice, economic transactions exist only within a context of historically accumulated stocks of knowledge and other resources, including social capital, trust, structures of social practice, technical designs, as well as social institutions, including laws, bureaucracies, sanctions, and political and organizational power. The interpretation of these elements relies on communication and requires active processing by participants. The economic transaction, in this view, is therefore only a tip of an iceberg, which is complemented and combined with various other symbolic and material exchanges that facilitate production of meaning and participation in social processes. Often the economic transaction can also be bypassed in production activities, as, for example, students of open source software development have pointed out. Most important, new information and communication technologies enable new ways in which information and knowledge contexts can be built. This can reorganize both economic transactions and markets, for example, by making history, reputation, social capital, value systems, and trustworthiness explicitly visible.

The production of new meaning potentially leads to reinterpretation of meaning. The economy of meaning production is, therefore, inherently unstable. This recursive nature of meaning production implies that the underlying utilities and values are constantly being reinvented. New “needs,” “values” and “demand” can therefore also intentionally be created in the economic system. The economy of meaning production is a continuously expanding one, and not structured by the problem of acquiring and distributing scarce resources. In the meaning-processing paradigm, economy is fundamentally about creating new areas for economic exchange, not about optimally dividing existing scarcity, as the classical economists thought.

Summary: Main characteristics of the two paradigms

Table 1 below summarizes the main differences between the two paradigms.

Paradigm:		Information Processing	Meaning Processing
Epistemological model		Positivist, empirist, objectivist	Constructivist
	Knowing subject	Individual cognitive processors of mental knowledge representations	Cultural and historical actors who participate in social processes of knowing, sensemaking and intelligent action
	Concept of information	Structured facts about observer-independent reality	Socially and culturally interpreted and articulated signals and communications
Organizational model		Organizations as information processing structures	Organizations as intelligent actor systems and knowledge-creators
	Strategy	Hierarchical decision-making; strategic long-term planning	Distributed organizational learning, competence development and utilization, directed and led by shared vision, narrative, and interpretation culture; strategic management of cross-boundary knowledge, innovation and communication networks
	Information systems	Decision-support systems (DSS), Executive Support and Information Systems (EIS/ESS), Data Mining Systems, Enterprise Information Architectures (EIA)	Computer-Mediated Communication Systems (CMC), Collaboration Systems (CSCW), Cognitive Augmentation and Knowledge Construction Systems, Business Intelligence Systems (BIS), Organizational Memory Systems (OMS)
Socio-economic model		Neoclassical economy with scarce resources	Institutional and sociological system of expanding space of meaning and economic interactions
	Consumer	Individuals expressing their self-interest, needs, and preferences	Consumption as production of socially meaningful interactions and progress
	Sphere of production	Profit-maximizing individual and organizational actors	Symbiotic and co-evolving user-producer ecologies
	Sphere of economic interactions	Universal market	Diversified value and knowledge communities that act as carriers of social practice

Table 1. Main characteristics of the Information and Meaning Processing Paradigms.

Conceptual starting points

This section describes in a concentrated form key theoretical contributions that underlie the meaning-processing paradigm. This section is deeply multidisciplinary. The goal is to give the reader a set of pointers to key literature and research traditions that provide material for the new paradigm. Due to space limitations, we will not explore the different research traditions in any detail; instead, the aim is to paint a broad overview of the area.

New theoretical paradigms reorganize and combine existing knowledge in new ways. They also provide novel interpretative frameworks, in which familiar concepts may gain new meaning. Much of the meaning-processing related research has itself been multidisciplinary. In practice, this means that there is no trivial access to some key ideas of the new paradigm, and that the following snapshot of theoretical research lines necessarily remains cursory. A more detailed elaboration would require a more in-depth review of these research lines, as well as an explicitly articulated synthetic summary that would show how the mentioned research traditions complement each other. Due to practical constraints, the present chapter remains only a first step on this longer path.

A brief example may, however, help in understanding and overcoming this challenge. Concepts that look relatively straightforward sometimes need to be interpreted using specific theoretical frameworks, also in the subsequent sections of this chapter.

In sociological theory, Niklas Luhmann (1995; 1990; 1992; 2000) has in great detail developed a model of societies as meaning processing systems. In his systematical studies Luhmann elaborated a rather sophisticated and idiosyncratic theory, which argued that societies are meaning processing systems that exist as systems of communication. Luhmann built his theoretical sociology on general systems theory, phenomenological sociology, and in particular the theory of autopoietic systems. The last one was developed in the 1970s by the biologists Humberto Maturana and Francisco Varela (1980; 1988), as a non-Darwinistic theory of evolution of living systems, perception, cognition and communication. The underlying lines of research combine and synthesize epistemological work of philosophers such as Henri Bergson, Edmund Husserl, and Maurice Merleau-Ponty; the abstract study of Laws of Form by George Spencer Brown; theories of meaningful social action by Émile Durkheim, C. Wright Mills, G. H. Mead, Talcott Parsons and Kenneth Burke; and second-order cybernetics of self-referential and self-organizing systems (cf. Mingers, 1995). These literatures do not belong to basic courses on information system design, computer engineering, or information society policy, for example. In fact, relatively few researchers have used these theoretical starting points to develop information systems or models of information society.[158]

With the understanding that a full elaboration of the various research traditions and explication of their linkages is both impossible and unnecessary in this chapter, the following theoretical sections simply provide brief introductions to some main related lines of research. Furthermore, the discussion below does not try to cover all relevant research traditions. The aim, instead, is to make the reader aware of the types of relevant research that can usefully be brought together to build the foundations for the new paradigm. We focus on three areas: epistemology, society, and political economy.

Epistemology

The ways in which we conceptualize and understand knowledge and information implicitly define the ways in which information and communication systems are analyzed, studied, and designed. Scientists and engineers, therefore, use epistemological models extensively in their everyday work. These models are sometimes implicit, but they have practical implications.

[158] An important and well-known exception is the now classic computer-mediated collaboration system, the Coordinator, developed by Terry Winograd and Fernando Flores. In their Understanding Computers and Cognition, Winograd and Flores (1986) integrated some of these theoretical traditions with speech act theory. Their work had major impact also because Winograd—one of the leading pioneers in artificial intelligence research—essentially argued that AI researchers should reconsider their traditional approaches.

We can therefore ask which models provide a good basis for the design of technologies, theories, and policies. In the knowledge society, epistemology, therefore, is not just a peripheral issue; instead, it is one of the core issues, and requires explicit analysis.

As was noted above, positivist and empiristic epistemologies have strongly influenced the information-processing paradigm. When researchers working within the information-processing paradigm quote philosophers, they often refer to philosophers such as Bertrand Russell and Karl Popper. The priority of empirical observation is well present in the quote that starts Popper's (1981) classic work, Objective Knowledge. The quote is from Russell, and it reflects the basic positivist worry that truth and knowledge can be destroyed by making them relative and less than universal:

> *"The growth of unreason throughout the nineteenth century and what has passed of the twentieth is a natural sequel to Hume's destruction of empiricism."*[159]

Empiricism underlies the information-processing paradigm by providing a model of knowledge where knowledge is accumulated by observing facts about the reality. This view assumes that true knowledge is independent of any particular knowing subject and that it represents a universal reality. Facts, therefore, cannot be contradictory; knowledge cannot depend on knower's history or context; world follows a logic of simple truth-values; and knowledge cannot exist without a unique reality. In this model, knowledge is accurate representation of reality, which, perhaps, for the time being remains only partially known.

Researchers working with questions related to meaning processing have, in contrast, adopted philosophical positions that are close to phenomenological, hermeneutic, constructivist, and pragmatic traditions. Whereas empiricism started from the assumption that the reality exists "out there," and that the main epistemological problem was to represent it accurately, phenomenological, constructivist and pragmatic philosophers have asked, how the "reality" becomes what it is, already before we start to explicitly "represent" it. In these philosophical traditions, questions concerning the nature of objects that constitute the world, in other words ontology, provide the foundation for epistemological considerations.

This primacy of ontology has been one of the key characteristics of the phenomenological philosophies of Edmund Husserl (1982), Martin Heidegger (1968; 1977) and Maurice Merleau-Ponty (1962). Their work, in turn, has influenced hermeneutic philosophies. Hermeneutics, the theory of the interpretation of meaning, has been developed by authors such as Hans-Georg Gadamer, Paul Ricoeur and Jürgen Habermas (cf. Bleicher, 1980).

Henri Bergson (1988; 1983) developed around the turn of the last century a radical and original epistemological position that was based on a fundamental critique of the empiristic epistemology. Bergson started by analyzing the emergence of cognition and perception in

[159] Popper does not give the source of the quote but it comes from Russell's History of Western Philosophy, 1945, p. 672. Russell believed that giving up empiricism would mean that: "The lunatic who believes that he is a poached egg is to be condemned solely on the ground that he is in a minority, or rather—since we must not assume democracy—on the ground that the government does not agree with him." Russell perhaps wrote this while eating English breakfast. In some cultures, normal people, however, categorize themselves, for example, as green parrots. This has puzzled anthropologists, who have tried to figure out whether people actually think they are green parrots, or whether they only symbolically associate themselves with green parrots. Russell, of course, faces the same problem when someone asks whether he thinks he really is a philosopher, or whether he is a philosopher only because other people really think so. From the pragmatic point of view, however, claiming that one is a poached egg is lunatic, for example, if with the claim one risks ending up on Russell's breakfast plate. In general, the lunacy of claiming to be a green parrot, a poached egg, or a philosopher depends on what the speaker and her audience mean by green parrots, poached eggs, and philosophers.

living beings. Bergson, for example, asked how the possibilities for perception emerge and change in the course of evolution, and how the physiological possibilities of action shape the ways in which reality is perceived and constructed. In particular, Bergson described how reality necessarily becomes structured into objects and located in space and time for intelligent observers. In other words, Bergson also explained why the realist and empiristic views of the world are natural for living and acting beings. At the same time, Bergson showed how the very functioning of intelligence necessarily hides parts of reality and how the natural attitude of intelligence makes some important phenomena, such as the key processes of life and knowing, unintelligible for the human system of cognition. To understand human cognition and knowing, we have to first understand the natural limits of cognition that lead us to the common-sense naïve realism, and then adopt a broader interpretative framework that moves us beyond these limits.

Bergson further argued that the possibilities for human action underlie the human capabilities of making distinctions in the world. The capabilities of cognition are, therefore, deeply connected with the possibilities of action. In contrast to disembodied minds, epistemologists, therefore, should focus on embodied and acting living beings if they want to understand perception, cognition, and knowledge. According to Bergson, reality, as such, can never be known, as the human system of perception and intelligence necessarily constructs the world in a way upon which it can act. As biological living beings, humans, however, may expand the boundaries of their intelligence and knowledge using an alternative form of cognition which Bergson called intuition. By intuition, he meant those cognitive processes that access the reality at a pre-conceptual level.[160]

American pragmatists William James, John Dewey and George Herbert Mead also often appear in studies related to meaning processing. The pragmatic method, according to James (1977:425-43), is based on interpreting the practical consequences of epistemic claims. Truth and facts, in other words, are not abstract; instead, they depend on whether we interpret them in a way that makes sense, given the practical implications of our claims. Pragmatists thus brought the questions about knowledge back to practical and concrete environments, where the knower tries to do something with knowledge. Mead (1967) linked this pragmatic view with theory of symbolic and linguistic systems, arguing that the human mind is fundamentally social and produced by communication. Mead's views have also been characterized as "objective relativism," as according to him knowledge emerges as a relation between the knowing subject and the known world. His view was "relativistic," as knowledge was dependent on the particular position and capabilities of the knower, yet "objective," as it conceptualized knowledge as generalized invariants about reality which different knowers experienced in a similar fashion. Knowledge can become "objective" when it expresses events that are perceived as similar by "generalized others" internalized in the human thought. Both knowledge and the knowing mind, therefore, are social, and knowing can only be understood in the context of social psychology.

[160] Bergson had a major influence on social, cultural and scientific movements in the beginning of the 20th century, and his thoughts created major political, philosophical and religious controversies (cf. Antliff, 1993). Since then, his contributions have to a large extent been deleted from mainstream works of history of philosophy, especially in the Anglo-American philosophical literature. This is partly because his analysis made the key starting points of the mainstream analytical and empiristic traditions questionable. Russell (1979:765), for example, stated that those "to whom action, if it is to be of any value, must be inspired by some vision, by some imaginative foreshadowing of a world less painful, less unjust…will not find in this philosophy nothing of what they seek, and will not regret that there is no reason to think it true." (cf. Tuomi, 1999: 87-95). I have argued before that many failures in artificial intelligence research resulted from the fact that researchers followed Russell instead of Bergson in their epistemological assumptions (Heinämaa & Tuomi, 1989).

In parallel to American pragmatists, Soviet developmental psychologists, led by Lev Vygotsky, created a sophisticated theoretical framework for understanding the linkages between social and cognitive development. This Vygotskian research tradition—also known as cultural-historical or socio-cultural activity theory— has since the 1920's had a profound influence in particular in the domain of education and developmental psychology (cf. Kozulin, 1990; Wertsch, 1985; van der Veer & Valsiner, 1994). Due to the fact that the seminal writings of this school became widely available in English translations only after the 1970s, the full impact of the socio-cultural activity theory has become visible only relatively recently, however. Important early proponents of the Vygotskian ideas in the English speaking countries include Jerome Bruner (1986; 1990), Sylvia Scribner (1997) and Michael Cole (1986).

In his Thought and Language, originally published in 1934, Vygotsky argued that the development of the mental capabilities of the adult human mind can only be understood as a process that relies on accumulated social and cultural resources. Historically, three different and parallel developmental processes enable this development of human thought processes (Luria & Vygotsky, 1992). The first is the slow and gradual "ontogenic" evolutionary process that creates the biological capabilities of perception and functioning. The second is the historical process of cultural evolution that accumulates cultural, symbolic and technical resources and artifacts, which humans can then use in their cognitive action. Vygotsky, for example, described how material artifacts such as knotted ropes become cognitive tools that are used to augment human memory and cognitive capabilities. Humans, therefore, can "outsource" some of their mental functioning to technical devices and conceptual symbol systems. This idea has become influential in studies on distributed cognition (e.g. Hutchins, 1995; Salomon, 1993; Rogoff, 1990). According to Vygotsky, the theoretic systems of science represent the most advanced form of this evolutionary process.

The third developmental process, which was the main focus of Vygotsky and his followers, was the mental development of the child. Vygotsky asked, in particular, how individuals gain their mental capabilities and become able to participate in social and cultural processes as competent adults and, for example, learn scientific models of the world. Vygotsky's answer was that this development occurs in a close interaction between adult members of the culture and the child. In particular, the child develops advanced mental capabilities in a "zone of proximal development," where he or she can perform advanced mental functions with the help of an adult. After the child learns how to accomplish such feats, the cognitive and practical "scaffolding" becomes unnecessary, and the child starts to be able to perform advanced mental functions on his or her own. In this process, the mind of the child becomes infused with cultural resources and capabilities.

According to Vygotsky, the most advanced forms of thought rest on a linguistic foundation. He distinguished the concepts of meaning and sense, arguing that "meaning" has to do with words and their conceptual relations, whereas "sense" depends on the context of speech. The sense of communication could, therefore, never be inferred from the meaning of the words that constitute a sentence. In the same ways as it is impossible to infer the meaning of a word by studying the letters that form the word, it is impossible to infer the sense of a sentence by adding up meanings of words. Word meanings and communicative sense simply live in different phenomenological universes.

Based on Vygotsky's ideas and their refinement, his colleague and student A. N. Leont'ev (1978) further developed a general theory of symbol-mediated action. Leont'ev's activity

theory distinguished three conceptually independent levels in human behavior: activity, action and operation. The level of "activity" was socially and culturally constituted performance that aimed at fulfillment of a motive. For example, people can engage in activity of constructing a building or hunting for game. Activity is accomplished through a sequence of goal-oriented "actions," such as erecting the walls, or making noise that frightens the game so that it becomes visible and can be killed.

Human action, in turn, is performed through "operations," that implement actions in specific concrete contexts. Most importantly, available operations depend on available technical tools. For example, the action of "killing the game," can be implemented in various ways, for instance, by throwing stones or spears, or by using a sling or a gun. The appropriate operations depend on the context where the action is performed, as well as accumulated technologies and skills. For example, it may be easier to hunt fish using spears than with stones, and it may be easier to hunt flying birds with a shotgun than with a spear. The possibilities to implement actions as operations therefore depend on the concrete situation at hand, but also on culturally accumulated resources. In a culture that does not have shotguns, you cannot use shotguns.

The work of socio-cultural activity theorists has highlighted several important points that have been relatively invisible in the information-processing paradigm. First, advanced mental activities are deeply rooted in culturally and historically accumulated stocks of meaning. Knowledge production and interpretation, therefore, depend on context, social learning processes, and memory. When, for example, a scientist observes an electron in a laboratory he or she always sees it through a complex system of socially shared and learned theoretical concepts and technical artifacts that implement these concepts and enable and constrain their meaningful interpretations. Second, the stocks of meaning are socially diversified, continuously evolving, and related to social practices carried by communities formed by social division of labour. Vygotskian ideas, therefore, have also become important in making the "community of practice" one of the key concepts in recent discussions on knowledge creation and learning (Lave & Wenger, 1991; Wenger, 1998; Brown & Duguid, 1991; Brown & Duguid, 2000). Third, humans rapidly integrate new technical and symbolic resources into their meaning-making processes, and use technological artifacts as cognitive tools, effectively extending and augmenting their cognitive capabilities with material and symbolic artifacts. This last idea, of course, has also influenced the development of the Internet and modern user interfaces (cf. Licklider, 1960; Engelbart, 1963; Licklider & Taylor, 1968; Johnson, Roberts, et al., 1989).

In psychological theory, key authors of these constructivist ideas—in addition to Vygotsky—include Jean Piaget. Piaget's ideas have also been widely used within the information-processing paradigm. In his later writings, Piaget, however, comes close to Vygotsky, emphasizing the social and cultural foundations of knowing. Piaget, for example, noted that scientific knowledge and systems of thought evolve in a continuous process. "More specifically," he noted, science "is a process of continual construction and reorganization." (Piaget, 1970:2)

The construction of meaning and knowledge was a major theme also for Michael Polanyi (1998; 1967). Polanyi specifically pointed out that knowing always requires a context that necessarily has to remain unarticulated and subsidiary for the knower. Human perception can only operate by focusing on something particular in a field of factors of which it has to remain unaware. Such "from-to" knowledge Polanyi called tacit knowledge, and described how tacit

knowledge also provides the foundation for scientific knowledge. Polanyi, therefore, argued, for example, that the positivist dream of knowing the future by computing the trajectories of all the atoms in the universe was futile. To get to the level of meaning of things and events, tacit knowledge is needed as much as explicit knowledge. All the relevant knowledge cannot be made explicit at the same time, however. As Polanyi (1975: 36) put it: "you cannot use your spectacles to scrutinize your spectacles." Even if the Laplacian dream of knowing the future by calculating the positions of all particles in the universe would one day be fulfilled, the results of the computation would be unable to tell us anything of interest, as the meaning would have been left out of the computation from the beginning.

The meaning of human acts also needs to be interpreted as acts that are reflexively performed for others who try to make sense of them. The context of meaning is a narrative context, which tells where things come from, where they are, and where they are heading. As Bruner pointed out, human action become meaningful through communication that integrates acts into meaningful stories:

> *"Indeed, the meaning placed on most acts by the participants in any everyday encounter depends upon what they say to one another in advance, concurrently, or after they have acted." (Bruner, 1990:18)*

Whereas phenomenological and constructivist epistemologies are now quite frequently referenced in information system research, a relatively little-know source of epistemological ideas is the Kyoto School of phenomenological existentialism (Nishida, 1987; Nishitani, 1991; Carter, 1997). This school has since the beginning of the last century combined in a unique way European continental phenomenology, American pragmatism, and Buddhist philosophical thinking. Recently, it has had an important impact on theoretical models on knowledge-creation and innovation. Contributions of this school have remained somewhat underutilized, however. Partly this is because the Asian approach to philosophy tends to discuss philosophical questions in the context of religion, which is an unfamiliar context for most Western epistemologists. When ontological questions are understood to be the basis for epistemology, the linkages between Buddhist thinking and Western philosophy become clearer, however.[161]

The Kyoto School is interesting for a number of reasons. Its early starting point was a critique on the basic tenet of most Western philosophical thinking: the idea that philosophy and knowing rests on the fundamental separation of the subject and object. In contrast to this apparently obvious starting point, the founder of Kyoto School, Kitaro Nishida, argued that we need to understand cognition as a process where objects and subjects mutually construct themselves in the act of cognition. The separation of subjects and objects is therefore a wrong starting point for epistemology. The rejection of this starting point, however, also implies that we need to develop "a logic of paradoxes," where we can describe phenomena that are at the same time inside and outside of the active perceiver. The reality, according to Nishida, "is" and "is not" at the same time, and we need a logic that matches with the reality if we want to describe it well.

As the Kyoto School starts from a well-informed critique on the fundamental assumptions of the conventional Western philosophy, it has the potential to introduce new elements to

[161] The Kyoto School, in fact, has been called the only philosophical school in Japan. This is because, even when the members of the Kyoto school were discussing traditional conceptual issues that in Japan have normally been categorized as religious issues, the thinkers in the Kyoto School explicitly related their work to Western philosophical traditions, including Bergson, James, Husserl, and, for example, Heidegger.

sophisticated epistemological thinking. In practice, it has influenced Japanese technology policy makers and provided starting points to one of the most influential models of organizational knowledge management (Nonaka, 1994; Nonaka & Konno, 1998). It has also been used to derive an architecture for a "semantic" computer (Shimizu & Yamaguchi, 1987). Although the semantic computer project was abandoned for various reasons, it still represents an interesting example of how a computer system can be built on an epistemology which is different from the one used to design conventional algorithmic computers. In particular, it seems to be the only existing attempt to design a self-organizing system that could automatically process meaning.[162]

The above-discussed theoretical traditions share the idea that "reality" is actively "constructed" by humans. The experienced and known "world" is not simply "out there" to be more or less correctly perceived, as empiricists thought. Instead, it is the result of active cognitive work of the perceiver. This basic insight was the core of the Kantian revolution, but it was put into a dynamic context when it was combined with evolutionary considerations and individual cognitive development. The categories through which humans perceive and know the world, became then the present end-points of evolutionary and developmental processes, and deeply integrated with technologies at hand. Furthermore, technologies, themselves, become part of the human process of knowing. Information is not innocent or objective; it does not wait us behind the veil of reality and it cannot be extracted from the world. Instead, information is produced in the act of bringing together the constraints and possibilities of the human mind, technologies of observation and action, and the world where the "outside" and the "inside" are inseparably connected.

Social meaning processing

Polanyi emphasized the importance of personal history and experience in the process of generating scientific knowledge. Others have focused on the social infrastructure of knowing and knowledge. An early pioneer in this area was Ludwik Fleck (1979), who used the history of medical sciences to show that systems of scientific knowledge are produced and maintained by specialized communities. Fleck called these "thought communities." According to Fleck, the meaning of scientific observations and data was rooted in specific diagnostic practices and technologies, and propagated in the society when young researchers adopted existing views of the world. Fleck, though, remained little known until Thomas Kuhn popularized the idea that scientific knowledge exists in the context of scientific "paradigms," which are maintained and guarded by scientific communities. The ideas of Fleck and Kuhn have become particularly productive when they have been combined with empirical and historical studies on human categorization and learning. For example, starting from Fleck's ideas, Mary Douglas (1987; 1996) described the ways in which human thinking, individual preferences and collective memories depend on social institutions. The role of social and institutional power structures in shaping categorization was a central theme to Michel Foucault (1970) and his followers. George Lakoff (1987), in turn, emphasized the cultural and linguistic aspects in the way realities are constructed, whereas Karin Knorr Cetina (1999) focused on practical epistemic settings in scientific laboratories. The earlier theoretical work of Mikhail Bakhtin (cf. Morson & Emerson, 1990) on linguistic genres and the communal foundations of meaning has also become increasingly visible in information sciences in the recent years. These lines of thought appear in several recent studies on information systems, including Nardi (1997), and Bowker and Star's (1999) study on the consequences of

[162] The associative memories and self-organizing maps of Kohonen (1980; 1984) could perhaps also be described as "meaning processing systems." To my knowledge, Kohonen has not made this link.

classification for the society and for information infrastructures. All these authors have essentially argued that knowledge is a communicative process that occurs within communities or cultures, where social forces shape the structures of knowledge.

Bowker and Star were also influenced by actor-network theory (cf. Law & Hassard, 1999). The highlights of the actor-network theory include the idea that human activity is performed in material contexts where material objects gain meaning and become integrated in networks of communication and knowledge. Actor-network theory, thus, moves beyond traditional semiotics that focuses on linguistic meanings, and links to studies on technical and cultural artifacts. In particular, actor-network theory dilutes the boundaries between human and nonhuman actors. Human relations and power structures, for example, can potentially be translated into material structures and technical functioning. In Bruno Latour's (1993; 1999) terminology, a speed-bump, for example, can be described as a "sleeping policeman." This is because the nonhuman actor —speed-bump— plays roughly the same social role as the human actor, a policeman in controlling the speed of cars. In a similar fashion, complex social resources and institutions, such as "the British government" can become represented through public servants, paper forms, or computer systems (cf. Law, 1992; Tuomi, 2001). Latour also proposed a tactic for discovering the complementary meaning of social structures and material structures:

> *"This explicit principle is: look for nonhumans when the emergence of a social feature is inexplicable; look to the state of social relations when a new and inexplicable type of object enters the collective." (Latour, 1999:209)*

In the last two decades, Peter Berger's and Thomas Luckmann's The Social Construction of Reality has also been a seminal contribution to social theory. Berger and Luckmann argued that the traditional focus on "history of ideas" in the sociology of knowledge was misplaced. Systematic knowledge, be it scientific, philosophical or even mythological, forms only a part of the human stocks of knowledge used in the everyday life. Social theory, therefore, should take also pre-theoretic and practical knowledge into account when it describes how societies become possible. Common-sense knowledge, according to Berger and Luckmann (1966:27) "constitutes the fabric of meanings without which no society could exist."

The idea that societies are collectively constructed through communication and made real by fixing and representing socially shared meanings through social institutions, symbols and material artifacts has become extremely popular in social and cultural studies in the last two decades. Researchers have studied the social construction of a broad set of things and ideas, such as gender, facts, identity, the child viewer of television, quarks, and statistics (Hacking, 1999). The idea that social stocks of meaning also provide the foundation for the emergence of new knowledge and innovations has also become important in social studies of technology. One point of departure in the social constructivist studies on technology was the observation that technological artifacts are open to sociological analysis, not just in the usage but also with respect to their design and technical functionality (Bijker, Hughes, & Pinch, 1987). Technical systems—for example, a computer program for managing financial accounts—can only be understood in a context where historical processes and power struggles have led to specific practices and rules of representing human and economic activity in numbers and signs. Such "subjective" and "imagined" social orders become then embedded and materialized in technical systems, making them "objective," "path dependent" and sometimes difficult to change.

Social studies on how technological worlds are constructed have also lead to a renewed interest in the role physical artifacts and space has in meaning processing. Both material artifacts and the structures of physical space constrain and enable human activity, and embed and sediment social meaning. For example, Lefebre (1991) has explored the linkages between physical and mental spaces. Castoriadis (1998) tried to elucidate how the society and its institutions are created by its members and the society itself in a socio-historical process. Pacey (1999), in turn, has studied the individual, social and political meanings of technology.

Societies are structured at many different levels. Cultural-historical activity theory allows us to describe societies as systems of specialized activity. Fleck's thought communities, in turn, emerge around specialized groups of practitioners. Actor-network theorists, in contrast describe the world as heterogeneous systems of humans and technologies. On a more abstract level, Luhmann and Castoriadis introduce the level of cultures. In the modern world, all these different levels of diversity and analysis are real and important.

The information-processing paradigm, however, has only limited capacity to describe such historically and socially grounded and structural phenomena. As Bruner noted fifteen years ago:

> *"Insofar as information in this dispensation can deal with meaning it is in the dictionary sense only: accessing stored lexical information according to coded address. There are other 'meaning-like' operations such as permuting a set of entries in order to test the resultants against a criterion, as in anagrams or Scribble. But information processing cannot deal with anything beyond well-defined and arbitrary entries that can enter into specific relationships that are strictly governed by a program of elementary operations. Such a system cannot cope with vagueness, with polysemy, with metaphoric or connotative connections…Information processing needs advance planning and precise rules. It precludes such ill-formed questions as 'How is the world organized in the mind of a Muslim fundamentalist?' or 'How does the concept of Self differ in Homeric Greece and in the postindustrial world?'" (Bruner, 1990:5)*

One can, of course, argue that information processing, electrons, and bits are the foundation for all modern communication and meaning processing systems. At the same time, one needs to remember that the information-processing paradigm brings with it not only bits but also a broad set of theoretical assumptions. These include the assumptions that the world is a closed world, that different interpretations of the world do not matter in practice, and that precise rules can be described to operate technical systems. One might then ask, however, whether the world really is closed, whether different interpretations do actually matter, and whether, indeed, we need bits for meaning processing. Perhaps bits, after all, were only artifacts created by the mathematical theory of signal compression and the era of either-or semiconductor switches?

The political economy of meaning production

One way of understanding meaning in information systems is to study information society technologies in the context of production, consumption, and exchange. Such an economic context, however, need to be extended beyond purely economic and monetary transactions. In particular, some of the fastest growing Internet applications can be found in the area of identity production, as the following sections illustrate. One may ask, for example, how we appropriate resources, things, symbols and communications in our environment to produce a

meaningful life. Research on anthropology of fashion, for instance, has shown that people use clothes to make social distinctions and signal memberships in particular social groups. Fashion, in this sense, is a communication and meaning processing technology. People also customize and personalize products they buy. The economic importance of this phenomenon has led, for example, to flexible manufacturing systems that support customized mass-production and product varieties. Manufacturers have also started to design products that allow personalization and user-created modifications and, as the examples in the next section show, much of the production on the Internet now occurs outside conventional systems of production.

In this section, I briefly discuss research on the production and exchange of meaning, and provide links to research that could be used to describe distributional issues in the economy of meaning. I start with meaning embedded in material objects, consumption, and fashion, and quickly highlight some important contributions between ethical theory, communication, narrative studies, socially-grounded value systems, and political theory. This section then finishes with a short discussion on Amarya Sen's capability-based theory of economic development. Due to space limitations, I will, again, leave many unconnected threads, and provide only a rapid glimpse on the relevant research lines.

Csikszentmihalyi and Rochberg-Halton (1981) were among the first to empirically study how people use material objects in defining who they are, who they have been, and who they wish to become. They argued that people use man-made things to organize their attention and cultivate personal and social goals. Material objects, thus, become invested with psychical energy. This psychical energy is critical for the survival of social systems, as without structured awareness social order would not be possible. Csikszentmihalyi and Rochberg-Halton, in particular, studied how people invest household objects with meaning.

McCracken (1988), in turn, described the ways in which meaning is manufactured in modern economic systems. He argued that the cultural systems of categorization provide the basis for constructing the self, and that the modern consumption economy to an important extent exists as a system that transfers cultural meaning from the world of communication to the world of things, and vice versa. Consumer goods, according to McCracken, are key locations of meaning:

> *"Clothing, transportation, food, housing exteriors and interiors, adornment, all serve as media for the expression of the cultural meaning according to which our world has been constituted." (McCracken, 1988:83)*

Simmel's (1990; 1971) classic studies on economic exchange, value and fashion also linked material goods and their social meaning. Social circulation of goods as a source of meaning, trade and taste has also been studied by social and cultural anthropologists (e.g., Appadurai, 1986). In the context of business strategy and product marketing, several authors have recently emphasized the importance of meaning as a driver of consumption and source of value (e.g., Friedman, 1986; Fournier, 1991; Richins, 1994; Helfenstein, 2005). Pine and Gilmore (1999) presented an influential variation of this theme by arguing that we should forget the idea that information is the foundation of the New Economy. Instead we should focus on informationalized services and experiences. They further argued that mass customization transforms goods into services and services into experiences. The future growth area in the economy was, according to Pine and Gilmore, in creating meaningful experiences. Thus, they recommended that business strategists consider themselves as "dramaturges" who stage narratives and transform commodities into valuable experiences.

If specific ways of perceiving the world depend on historically accumulated stocks of meaning and on diversified systems of social practice and activity, it is natural to assume that different views of the world also imply different systems of value. When we analyze "value systems" as systems that provide the basic distinctions that make meaning and value judgments possible, different communities can be expected to have different and perhaps incompatible ways of valuing things. Values, therefore, are not just individual preferences. Instead, they are culturally learned, as complex interdependent systems of meaning. More fundamentally, the systems that enable basic distinctions also guide the ways in which the reality is perceived and interpreted. This creates a model of a society in which a plurality of value systems co-exists and where communities with different value systems negotiate their interests. As a result, questions about political decision-making, social distribution, and theory of justice become linked with questions about knowledge and social meaning processing.

Hannah Arendt put the implications of this pluralistic model into the context of the historical development of the modern economy. Arendt also highlighted the point that humans become "real" through action. As biological beings they can stay silent and disengaged from action, but they reveal their identity and who they are only when they engage in action. As the consequences of action are fundamentally unpredictable in a social world where the effects of action propagate in the web of social interactions, all action is risky for the actor. Thus every free human action becomes a statement and a claim for the need for intervention. Human acts, therefore, also create an ongoing narrative of "who" the actor is. Although pure instrumental action is also possible, the specifically human way of being is to participate in the web of social interaction:

> *"The disclosure of the 'who' through speech, and the setting of a new beginning through action, always fall into an already existing web where their immediate consequences can be felt. Together they start a new process which eventually emerges as the unique life story of the newcomer, affecting uniquely the life stories of all those with whom he comes into contact. It is because of this already existing web of human relationships, with its innumerable, conflicting wills and intentions, that action almost never achieves its purpose; but it is also because of this medium, in which action alone is real, that it 'produces' stories with or without intention as naturally as fabrication produces tangible things. These stories may then be recorded in documents and monuments, they may be visible in use objects or art works, they may be told and retold and worked into all kinds of material." (Arendt, 1998:184)*

This importance of interwoven narratives as the basis for making sense of the world and in making distinctions in it was a key theme also in Alasdair MacIntyre's (1981) analysis of the development of ethical theories and the concept of modern identity. MacIntyre noted that value systems are rooted in communities of practice. He argued that man is, "in his actions and practice, as well as in his fictions, essentially a story-telling animal."

> *"Deprive children of stories and you leave them unscripted, anxious stutterers in their actions as in their words. Hence there is no way to give us an understanding of any society, including our own, except through the stock of stories which constitute its initial dramatic resources." (MacIntyre, 1981:216)*

To understand the meaning of a thing or an action, we have to know where it came from, and where it is going. Meaning, thus, cannot be represented in a dictionary definition. It emerges only as a part of a story.

The pluralistic model of society underlies also Charles Taylor's (e.g., 1989) studies on the historical roots of modern ideas about identity, ethics and the self. Taylor, in particular, has emphasized the point that although different communities in the society have different value systems and ways of interpreting the world, this does not imply that we should give up the idea that we can make rational choices in ethical problems. In given practical contexts, values can be compared, even when there are no absolute and universal values.

In his communicative "discourse ethics," Jürgen Habermas (1993) attempted to define the universal principles according to which incompatible worldviews can be "reasonably" negotiated. John Rawls (1999) has further tried to outline a theoretical system of justice that would be perceived as a legitimate basis for regulating relations between societies and states where people do not share the same moral, philosophical, religious assumptions. Rawls' earlier theory of justice has had a broad influence in the discussion on political theory and democracy. In this more recent "The Law of Peoples," he, in effect, sketches a philosophically grounded constitution for a multicultural global world.

These contributions highlight the point that human action is fundamentally communicative and social. Information society technologies, therefore, enter the core processes of social life. As different communities perceive their worlds using different stocks of accumulated narratives and meanings that emerge from their specific social practices, the modern world is a pluralistic world of communications. People do not live in a global village, where shared values would provide the foundation for making distinctions and producing well-aligned interpretations of the reality. Instead, the global world is a loosely coupled federation of overlaid, overlapping and also incompatible interpretative communities.

Russell's dream of finding a unique and objective reality that would make politics redundant was, therefore, at its core a totalitarian dream. Contrary to what Russell expected it would not lead to "a world less painful, less unjust, less full of strife."[163] Instead, as Arendt argued, humans become humans when they face the dilemma of being individual actors in a community, without which they or "free acts" could not exist. This makes humanity, society and culture essentially "political" phenomena. Individuals create meaningful lives and identities by living in a fundamental tension between being creative, innovative and original actors and at the same time being members of society. In the Arendtian terms, people become humans when they organize themselves in the polis. In the modern world, the agora, of course, is implemented using information and communication technologies. In this sense, information society technologies are more than just tools for making democracy possible or effective; instead, they are the platform which makes politics possible in the first place.

Information and communication technologies radically change the visibilities of communities in the society at large, and also increase their interdependencies in the global space of communications. The political challenge, therefore, is not only to negotiate interests; instead, it is also to translate the various discourses in the society so that interests can be processed by the society. Furthermore, if the social order is to be perceived legitimate by the members of the society it has to be legitimized in ways that are independent of specific cultural practices. Thus, the theoretical questions about meaning processing inherently link with questions of political models and ethics.

[163] See footnote 160.

This political and ethical dimension remains outside the traditional information-processing paradigm, as the epistemological starting point of this paradigm was that information can be processed without knowing the cultural or historical context, or the factors that create specific ways of understanding the world and making distinctions in it. From the point of information society foresight, the implication is that "politics" in the future does not only mean lobbying existing interests as they relate to technical architectures and standards, for example. Instead, information society technologies are deeply political themselves. The society exists as ongoing communication and meaning processing, and politics, in the Arendtian sense, is about rules of participation in this public sphere. Information society technologies are not just used to implement politics; instead, information society technologies are the infrastructure of politics. Decisions about technical architectures, therefore, are fundamentally political, and require sophisticate understanding about the political models that different technical architectures make possible and impossible. Although this political dimension remained relatively invisible in the early phases of the computer revolution, it is becoming now clearly visible as computers are networked and people start to use them in their everyday life.

An economic model of development that fits this pluralistic world has been elaborated by Amartya Sen (1992; 2000). Sen argued that the expansion of human capabilities and freedoms should be understood as the basis of development. The relevant freedoms, however, depend on cultural and individual factors. Sen therefore positioned the theory of economic development into a context of theory of justice and democracy. Sen's capability-based model has had broad influence and it underlies, for example, the Human Development Index published by the UNDP. The capability-based model can be linked in a relatively straightforward way to questions about the capabilities of new technologies to expand human possibilities for meaningful action. The capability-based model, therefore, could also provide the missing link between economic theory, political theory, ethics and the theory of social diversification. It could also be used as a basis for evaluating new technologies. In other words, using the capability-based model, we could better answer the core policy question why and when some technical advances can be associated with social and economic development.

Meaning processing in the Internet: Some example applications

Semantic Web

A well-known attempt to add semantics to the web is the W3C activity on Semantic Web (**http://www.w3.org/2001/sw/**). The W3C Semantic Web represents "the meaning" of concepts by links to metadata and associated thesaurus definitions. The basic motivation for the semantic web is to add descriptive metadata to web content so that it can be automatically processed. The W3C initiative tries to move from "words" to "concepts," with the assumption that the metadata descriptions add the level of semantics to the net.

There is considerable effort underlying this "next-generation web" project. With some exceptions, the various initiatives still implicitly rely on the traditional information-processing paradigm. For example, in the Scientific American article that popularized the W3C Semantic Web activity, Berners-Lee, Hendler and Lassila explain the goal of the activity in the following terms:

> *"The Semantic Web is an extension of the current web in which information is given well-defined meaning, better enabling computers and people to work in cooperation." (Berners-Lee, Hendler, & Lassila, 2001)*

This description, of course, is problematic in constructivist epistemologies, which start from the observation that meaning cannot be well-defined. From a constructivist point of view, the idea that well-defined meanings would enable computers and people to work together looks similar to Laplace's claim that by knowing the positions of all the particles in the universe we can determine all its futures. As was pointed out above, even if that would be the case, the futures so discovered would be of little interest of humans. To put it simply, as the original conceptualization of the Laplace's problem essentially leaves meaning out of the picture, it would have great difficulties in determining whether a specific location in the universe consists of a chicken or a bowl of chicken soup.

Similarly, from the meaning-processing perspective, the description of the goals of the Semantic Web simply leaves out those aspects of the problem that relate to meaning. The description is particularly confusing, as the concept of "meaning" is used instead of the technical term "semantics," and because even the latter term would only make sense in the context of computer science. This specific technical sense of the word "semantics" actually has very little to do with semantics, as it is understood outside computer science. Also the idea that people would somehow require well-defined meanings before they can cooperate, or course, represents a simplified picture of social and cooperative behavior.[164] One could therefore argue that the Semantic Web activity promises to solve the problem of meaning by first getting rid of it.

More accurately, the W3C Semantic Web activity can be described as a set of projects that aim at making web content more accessible using machine-readable meta-data. Specifically, it defines standards for representing particular application domains using the Resource Definition Framework (RDF) and the ontology definition language OWL. The challenges for adding "semantics" to the Web have generated a large number of proposals how, actually, this should and could be done. For example, some authors (e.g. Bouquet, Giunchiglia, et al., 2004) have argued that domain-specific ontologies need to be combined with user-specific contexts. Epistemologically, this approach implements Mead's "objective relativism," discussed above. Other approaches are closer to the meaning-processing paradigm. For example, the bottom-up computer supported peer-to-peer negotiation of user-specific ontologies proposed by Aberer, Cudré-Mauroux and Hauswirth (2004), generates translations between different user ontologies by a mechanism that resembles the spreading of rumors.

The problems associated with using knowledge and ontology representation systems have been widely discussed during the last two decades in the artificial intelligence literature (e.g., Pylyshyn, 1987). One major problem is the fact that context and history makes a difference in getting the meaning right (Suchman, 1987). Indeed, the discussion above on the epistemological basis of meaning processing actually implies that the basic assumptions of the W3C semantic web project has fundamental weaknesses. The project is mentioned here because the visibility of the W3C may give the impression that the problem of semantics actually has been addressed by the consortium.

The Semantic Web project will perhaps succeed in adding some semantic processing in controlled micro-worlds, in a similar way as the traditional artificial intelligence applications did. The epistemological problems of the semantic web project will, however, become visible when micro-worlds need to be combined, when the conceptual system evolves, or when the

[164] In fact, ambiguity and equivocal concepts have been argued to be highly important for innovation, learning, and social change (e.g., Schon, 1963; Weick, 1995; Bougon, 1992; Tuomi, 2002).

same content is used in alternative interpretative and practical contexts. The W3C goal of creating ontologies that, for example, enable automated processing of purchase data and supply-chain management, of course, is a relatively simple problem of micro-world semantics.[165] It is, therefore, important to note that, although the W3C initiative talks about "semantics" as the major missing element of the present World-Wide Web, its approach is still deeply grounded in the information processing-paradigm of computing.

Yet, the World-Wide Web has been extremely successful. To a large extent this was because it allowed computers to be used for meaning processing. This was possible as the World-Wide Web basically provided a repository for human language, images and sound, without any assumptions about how meaning should be represented. The web, thus, remained perfectly agnostic about the meaning of the content and activities it was used for, enabling an efficient distribution of labour between human cognitive capabilities and technology. This is one of the main factors explaining the extremely fast propagation and proliferation of web applications.

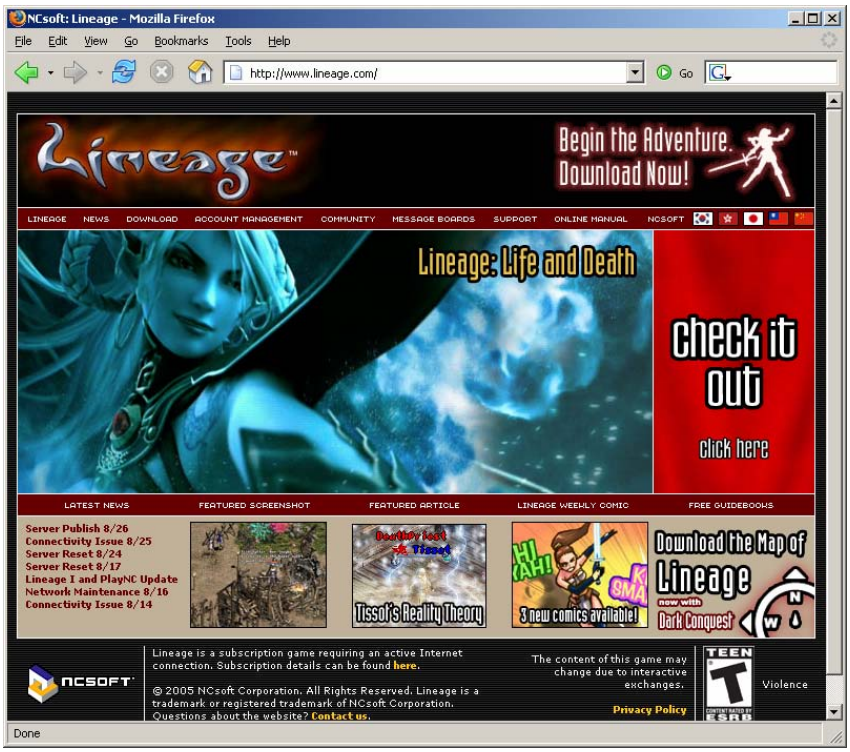
In the next sections, some example applications are briefly described, where the social and cultural aspects of meaning are explicit. From an engineering point of view, they may look trivial. From a socio-economic point of view, they represent some of the fastest growing uses of the net.

MMOGs and virtual worlds

Massively multiplayer online games (MMOGs) are interesting examples of the way people now use the Internet to construct identities, communities, and stories. Whereas they are often perceived simply as "entertainment," modern multiplayer games are large and continuous expanding universes, where also users participate in the construction of the game.

Currently, NCsoft, headquartered in Seoul, South Korea, is the world's largest independent online game company. Established in 1997 as a systems integration company, NCsoft became the leading online game software company with its Lineage game (**http://www.lineage.com**), introduced in 1998. Lineage was one of the key drivers of broadband diffusion in Korea. Currently there are more than four million active subscribers worldwide playing Lineage.

[165] Indeed there exist many successful initiatives in creating semantic structures for business transactions and information exchange in controlled micro-worlds. The World-Wide Web itself was based on the SGML standard, a main early application of which was in the U.S. Department of Defense's Computer-aided Acquisition and Logistic Support (CALS) initiative.



A somewhat different approach is adopted in the EVE Online (**http://www.eve-online.com**). It is set in an unknown part of the universe, and includes several thousands of solar systems, many of which are settled by the players. The players can inhabit worlds, create organizations and alliances, accumulate wealth and build economies, much as they would operate in a simulated real world. The system provides a persistent and continuously evolving world that runs on servers in London. In August 21, the system recorded 13.993 simultaneous players. In August, a team of players also successfully constructed the first user-created outpost in the system, including a strip club, where they offered cold drinks and hamburgers to celebrate the event.

Neopets (**http://www.neopets.com**), in turn, is a community of over 70 million virtual pet owners across the world who feed and play with their pets and adventure around Neopia with them. The system has a free membership and it includes over 160 games, trading, auctions, greetings, and messaging.

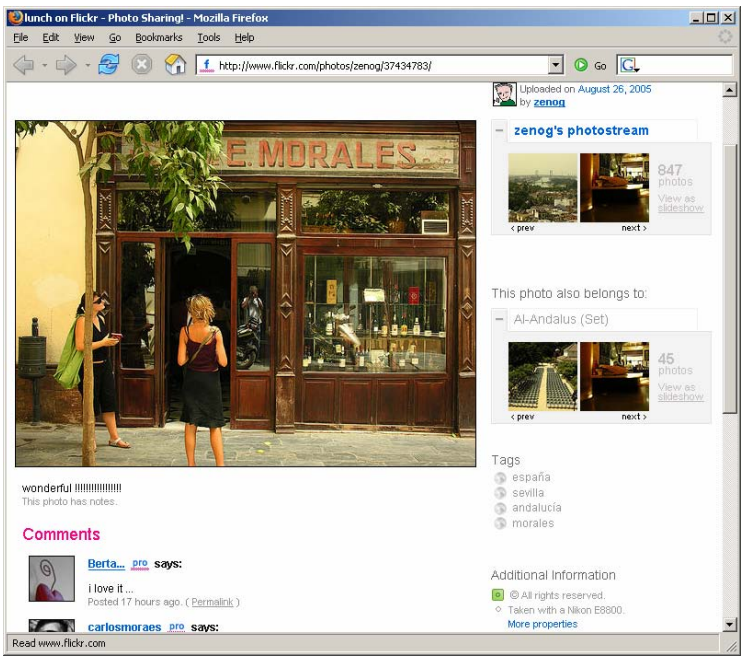
Habbo Hotel (**http://www.sulake.com**) is a virtual "hang-out" where people can walk, dance, eat, drink and chat in cafes, restaurants, swimming pools and games rooms. The users can also decorate rooms, chat with other users, host parties, etc. In July 2005, the system had over 4 million users. The participants can use credit cards and SMS to buy "habbo coins" that they can then use to buy decorations for their rooms, gifts to their friends, and to play games. The participants, represented as user-tailored "habbo characters" (avatars), therefore, construct personalized virtual spaces for themselves and structure their interactions around the virtual architecture of the five-star Habbo Hotel.

Flickr

Flickr (**http://www.flickr.com**) has been called "massively multiplayer online photo sharing" and a media for "visual conversations." It allows people to post their photographs on the web using Internet-connected PCs and mobile devices. The photographs can be tagged and commented by the people to whom the poster gives access rights. Often access rights are

given to anyone using the Internet. People can also embed pop-up comments directly on the images, highlighting specific details, providing information on the image content and, for example, telling their personal stories associated with the picture.

Flickr, therefore, creates an image-sharing platform where members of a social network can access images, collaborate in organizing and categorizing them, and tell stories about them. It also allows photographs to be made visible to everyone connected to the net, thus providing visibility to people who publish their images. The images stored in Flickr can also be used in personal blogs. They are also used in location-based applications that link pictures with addresses and GPS points. In the beginning of year 2005, about 80 percent of the over 5 million images stored in the system were accessible to all web users. Professional photographers who use the open Creative Commons licensing also distribute photographs using the system. Flickr has now over 1 million members, and over 4000 images are uploaded to the service each second. Flickr, which is still in beta, was recently acquired by Yahoo!



Social software and journals

Today, several free blog services combine digital representation of their users with social networking and aggregation of diary and discussion entries. For example, LiveJournal (**http://www.livejournal.com**), an early blogging system, based on open source software and launched in 1999, allows registered users to keep diaries, post photographs and join public and restricted groups. Users can also read aggregated journals of their friends and the people belonging to specific groups. LiveJournal has now some 2.5 million active users, and about 250.000 users updating their pages during the last 24 hours. The number of blogs registered in the Technorati service doubles now every 5.5 months and the system registered about one new blog every second.[166] In mid-November 2005, the total number of blogs was estimated to be over 100 million, and Technorati tracked 21.3 million blogs.

[166] http://www.technorati.com/weblog/2005/08/34.html

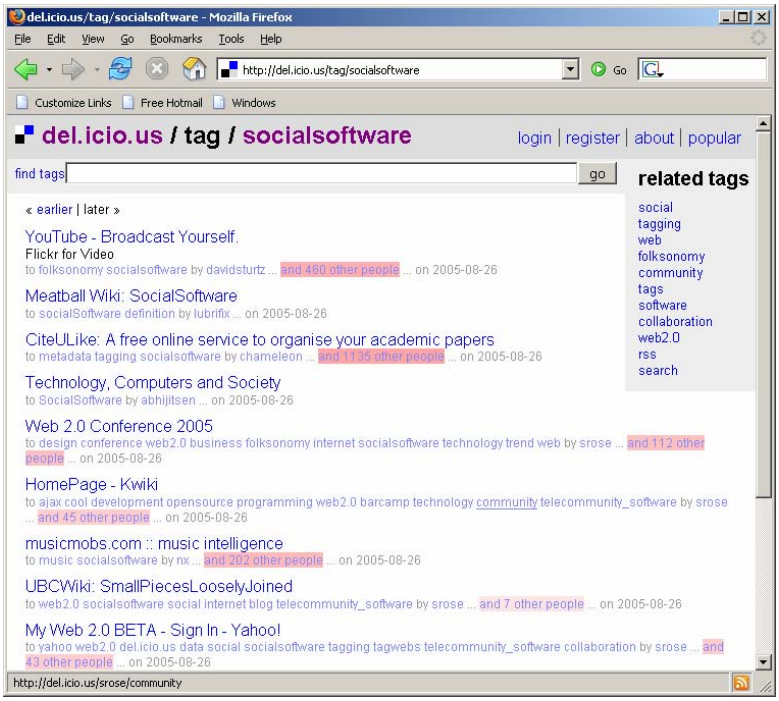
Some newer social software systems are rapidly gaining popularity. For example, MySpace (**http://www.myspace.com**) has now some 27 million members. The system allows the members to maintain profiles and links to the profiles of friends, join forums and participate in groups, rate and listen music, keep blogs, and contact people with email or instant messaging. The users can also send text messages through the system, as well as "bulletins" to all friends to inform them about what is happening in your life or, for example, invite them to a party. The system is free to use, and uses banner advertisement for funding. There are now, for example, about 9.600 music-related groups, ranging from High School Goths and electric bass players to Linkin Park, the last one with some 40.000 members. Users can also sign up as artists and post up to four MP3 songs of their music free. At present, artists can also upload videos for editorial review. The best videos are featured in the system.

Yahoo 360° (**http://360.yahoo.com**), now in beta, has similar functionality. It also allows you to publish a "radio station," which your friends can listen to. Yahoo 360° also links to the user's mailbox and Flickr, allowing the users to manage large annotated picture collections and slide shows.

Del.icio.us

del.icio.us (**http://del.icio.us**) is a social bookmarks manager. It is a free service that allows the users to add web pages to their personal collection of links, to categorize those sites with keywords, and to share collections among browsers, machines, and with other users.

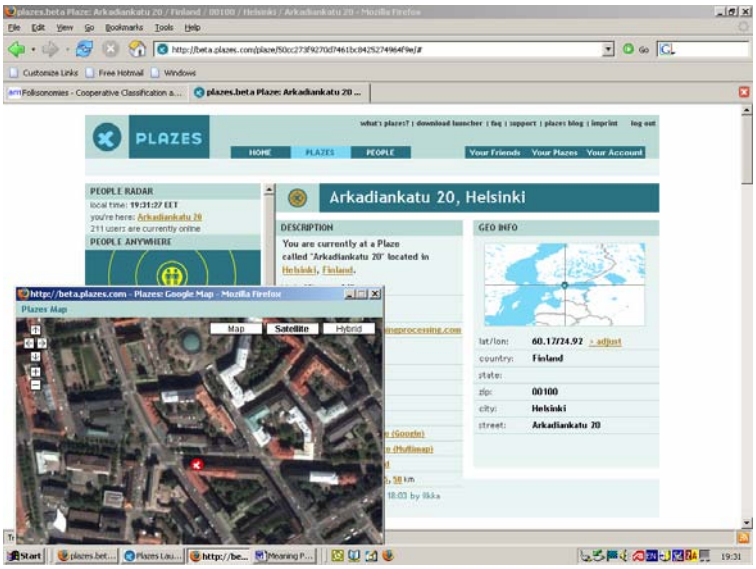
The users add a simple bookmarklet to their browsers. When they find an interesting web page they simply select the del.icio.us bookmarklet, and the application asks for information about the page. The user can add descriptive terms to group similar links together and add notes. The list of links can be accessed from any web browser. The users can view their links by date, or by specific keywords, which are dynamically defined, as needed. Del.icio.us has become widely popular as it also allows the other users to see the links that others have collected, as well as show who else has bookmarked a specific site. People can also view the links collected by others, and subscribe to the links of people whose lists they find interesting. Del.icio.us shows how many people have bookmarked a specific page on the web, and allows people to search and browse bookmarks based on categories that the users themselves have defined. The system shows also a dynamic list of most popular tags and, when the user browses a specific tag, related tags, a list of which is automatically generated by analyzing the associations between tags. In practice, by using del.icio.us, the dynamic tags and their relationships self-organize and categorize the content on the web. The system, for example, gives a good indication of emerging new hot topics on the web.



Plazes

Plazes (**http://www.plazes.com**) is a grassroot approach to location-aware interaction. It aims at global collaborative effort to annotate physical locations, so that they can be linked to web content and used to link the "virtual" world with the physical world. The system creates a location "fingerprint" using the signature of the router that is linked to a specific local Internet access point. The user can then register this fingerprint as a specific "plaze." The users can then add notes to the plaze. A plaze contains information about the actual location like pictures from Flickr, comments and mapping information, as well as the people currently online at that plaze. Plazes also allows you to share your location with the people you know and to discover people and services around you. For example, the user can link herself and her blog entries with specific physical locations. Similarly, the users can add physical location to their instant messages. Users can also track their friends in physical space. The service is free and in beta.

At present, the system has over 8000 registered plazes in 91 countries. These include universities, private and public WiFi access points, hotels, airports, homes of people, market squares, museums, etc. The places can also be combined with satellite images and maps that are accessed through the open Google Maps interface. Users can smoothly zoom in from a global satellite image to a close up of the location, show it on a map, and see information about people and comments associated with the place, as well as look for other nearby places.

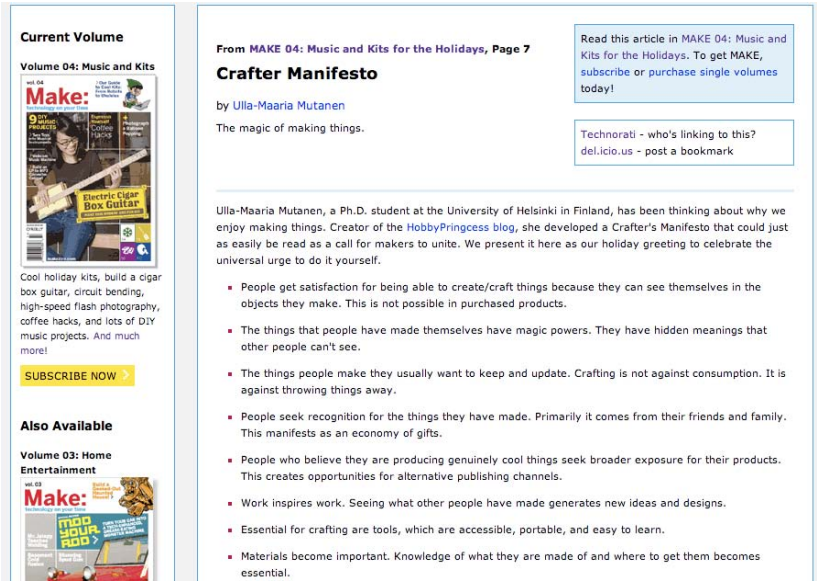


Annotation of objects and the Crafter's Manifesto

New services, for example Microsoft's Aura,[167] enable people to annotate physical objects with information on the web. Objects such as clothes, accessories, furniture, and computers can be linked to specific Internet-addresses that are associated with the object. For example, hobbyprincess.com has used RFID tags to annotate objects and places.[168] The tags can be read and written by RFID-enabled mobile phones, which then link the user to the desired address on the web. Using this approach, objects such as hand-made fashion items can "tell their story" and become "extended objects." In this way, they can also become part of the emerging recommendation-based online markets.

Ulla-Maaria Mutanen, the author of hobbyprincess.com, argues that there is currently a very large latent market of locally produced, non-mass manufactured products.[169] This includes most of art, design, and craft. Also, an increasing number of people are interested in creating fashion, music, movies, and text products, modifying the products they buy, and sharing or trading their creations online, for example, using eBay or etsy.[170] The realization of the economic potential of this activity, however, will require the development of information systems that can use unique identification and metadata of products (e.g. musicbrainz.com).

167 http://aura.research.microsoft.com/
168 http://ullamaaria.typepad.com/hobbyprincess
169 www.makezine.com/04/manifesto/
170 www.etsy.com/. Etsy is an online marketplace for buying and selling all things handmade. It supports searches by color, place, time and material.



Voice over IP

One obvious, theoretically interesting and yet rarely noticed meaning-processing application on the Internet is voice telephony. The underlying technology application simply moves bits so that people can talk to each other. The application does not interpret the processed meaning in any way. As the speakers typically generate all the content in real-time, the Internet can simply provide a “pipe” for moving bits. Economically, VoIP is also interesting as the users create the content. This “free content” has also been the basis for the development of the traditional telephony networks. Skype, the leading VoIP provider, has accumulated some 51 million registered users since its launch and on average about 3 million users log on it at any given time. PC-to-PC telephony is typically available free, and connections to and from traditional telephony networks at low cost. OECD now estimates that the revenues from VoIP double in the next two years, to 6.5 billion euros. An important reason for this rapid growth is the fact that most of content does not generate revenues or require agreements on intellectual property rights. Spoken language on traditional telephony networks has been one of the socially and economically most important applications of information technology, and it will most probably remain so also in the foreseeable future. VoIP, however, will also highlight major social and cultural issues, such as questions related to the ownership and reuse of traditionally non-persistent speech.

Policy implications

A new paradigm implies a different view of the world. It requires reframing the problems we are tackling, new priorities, and new strategies and tactics for problem solving. It also leads to new technical architectures that implement solutions to the perceived new challenges and opportunities.

It is impossible to fully draw out the implications of the emerging new paradigm in the present report. In some areas the practical impact may be low. It does not really matter whether the sun rotates the earth or the earth rotates the sun when we enjoy the sunset. It does matter, however, when we study greenhouse warming or launch satellites. The conventional information-processing paradigm already has adapted itself to some practical demands that fundamentally have their origins in the challenge of deploying computer systems in meaningful cultural and social settings. For example, telephony services are already

implemented using current computer and Internet architectures. To understand how such applications will evolve and could be improved, we, however, need new concepts.

For research policy, the new paradigm points to the importance of linking cultural and social dimensions to information technology development. Information technologies often implement social, cultural and cognitive models that are based on common-sense theories. These theories are not universal and in the global information society they need to be made explicit.

For example, social stocks of knowledge are typically organized around social practices and communities that reproduce those practices. Different communities use different models to perceive the world, they make different distinctions, and they prioritize and value things differently. They have value systems that are tightly linked with the demands of the practice in question, as well as to historically routinized and socially institutionalized interactions between the community and its social environment. In the modern world, people belong to many different communities and these communities often extend beyond organizational and national boundaries. This diversified social structure underlies meaning-making processes in the society, and it provides the foundation for economic exchanges, political interaction and, for example, the construction of identities. Technological architectures that can support communication and interaction within and across such social structures will be important in the extremely diversified global world. “Technologies of translation” that specifically address interoperability at a cultural and social level are becoming important. The traditional question of technical interoperability need to be perceived as a special case of a much broader question related to socio-technical interoperability. Standardization, for example, is not a technical question, or a question of lobbying economic interests. It is a deeply cultural issue that requires explicit models of social change and distribution of power and risk.

Robust implementations of information society technologies in such diversified socio-cultural environments also need to be socially and culturally acceptable. This means that the underlying political models need to be made explicit. Current technical architectures hardwire social processes and beliefs in ways that are sometimes culturally simplistic. Overly simplistic architectures make innovation and change difficult, and limit the potential of global diffusion of new technologies and applications.

The social, cultural and historical emphasis of the meaning-processing paradigm also points to the fact that the present conceptualization of intellectual property is not well-aligned with the new paradigm. Meaning processing is inherently a social and communicative process, where individuals participate by incremental contributions. The locus and origin of innovation cannot easily be located in such socially distributed processes. The ownership rights to user-constructed spaces, such as those found in MySpace and Habbo Hotel, will also be a theoretically demanding area of research. Fundamentally, the current intellectual property right regimes assume a world of scarce resources, whereas the economy of meaning is continuously expanding. To support economic growth and socio-economic development, intellectual property rights need to be redesigned.

In very concrete terms, one implication of the new paradigm is that a criterion in evaluating technical research proposals could be that the proposal shows awareness of the cultural and social dimensions of technology development. If these dimensions are becoming increasingly important, policy-makers could require that attention is paid to them and they could sponsor research that puts Europe at the leading edge of the new paradigm. When project proposals

explicitly have to address the social and cultural dimension of technical designs and development roadmaps, the projects can more easily realize the opportunities of implementing project results in a global world and in the socially and culturally diversified Europe. Such a competence of integrating social and cultural dimensions to technology development could eventually become a core competence in the European Research Area.

At a more fundamental level, the emerging paradigm requires that we reconsider some current justifications for developing information society technologies. For example, at the present there are no conceptually robust approaches in measuring the socio-economic impact of information technology applications. Although it is clear that ICTs have a fundamental impact on society and economy, for example, the current national statistics or measures of economic productivity do not capture these impacts well. As a part of the new meaning-processing paradigm we, therefore, also need a new productivity paradigm (cf. Tuomi, 2004).

Europe exists on a unique foundation of social diversity, where a rich mosaic of languages, thought styles and historically rooted cultures provide a model of the emerging globally connected world. This social diversity reflects a historical process that has generated diversified systems of meaning. Information and communication technologies are now reorganizing these systems of meaning, and making theoretical and practical understanding of meaning processing increasingly important for policymakers, product developers, and researchers in the European Research Area. Europe can build its future by turning this historical inheritance into a competitive advantage. It can do this by explicitly integrating social, cultural and cognitive dimensions into information and communication technology development and research, at the same time moving these technologies into their next evolutionary generation. Through such integration, it can also better develop technologies that lead to true socio-economic development. This, however, requires that we reconsider some of the very basic epistemological and conceptual starting points of the information-processing paradigm, and enrich the research on information society technologies with new sources of theoretical ideas and knowledge.

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