The Human Context of Information Systems

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Abstract

In its past, IS research has focused on IT and the organizations that use IT. Human issues have been studied in HCI and the Human Factor Studies of MIS. Yet recently a new wave of attention has emerged to focus more explicitly on issues rising from the human context of information systems. Studies in this area are still scattered, but there seems to exist a common paradigmatic orientation in their basic assumptions of human beings and their interaction. The end-users of information systems should be seen holistically as physical, cognitive, emotional, and social beings, whose communication is rich and uses multiple media. These views add to and improve our understanding of information and knowledge effective in various kinds of human-oriented information systems.

1. Introduction

Information Systems is a relatively new scientific field that began to evolve in the late 1960s [6]. The main interest has long been in computer-based systems and management systems. Lately, there has emerged increasing interest in research that emphasizes the human context of information systems. This line of research view information systems as humans' communication and activity systems that use computers, information technology (IT) and information and communication technology (ICT) as a media for their performance. The current body of research is still fragmented and there is not such a distinct research stream as in IT-oriented or management-oriented information systems (IS) research. There is a growing need for human-oriented IS research as the diffusion of information systems and information technology into new areas of human life continues.

There are several studies that could be seen as part of the humanistic orientation in IS. Nurminen [23] is one of the founders of the humanistic viewpoint in IS. He states that the humanistic viewpoint pursues to see the technical artifact as a solution to a human problem, which first needs to be solved in isolation from technical solutions. Isomäki [16] has studied the prevailing conceptions of the human being in information systems development. According to her, human beings are seen as actors in the context of IS; the user is a person who uses computers. Isomäki states that the most important task of ISD is to adjust IS to meet human characteristics and behavior. This means humanization of IS. Tiainen [33] has studied information system specialist predispositions. She has found that IS specialists' view of people is superficial, and they do not see any need to expand people's freedom to act within technology. Dahlbom and Mathiassen [8] argued that the focus of education of computing professionals should be on the use of computer systems.

International Federation for Information Processing (IFIP) [14] established a technical committee for human-computer interaction (HCI) in 1989. One of the aims of the committee is to "promote user-orientation and 'humanization' in system design" [14]. ACM Special Interest Group on Computer-Human Interaction introduced curricula for Human-Computer Interaction in 1996 [13]. To promote and advance HCI, the Special Interest Group on Human-Computer Interaction within the Association for Information Systems was founded in 2001 [37].

In this paper we discuss different views of human-oriented information systems. First, we look at different paradigmatic orientations of IS and the basic assumptions that distinguish human-oriented IS from earlier orientations in Section 2. Then we study the concepts of information and knowledge in the context of human communication and interaction in Section 3.

After that, we illustrate different views of human-oriented information systems and how information and knowledge appear in them in Section 4. These views add to and improve our understanding of information and knowledge effective in various kinds of human-oriented information systems. Finally, we draw some conclusions in Section 5.

2. Three Paradigmatic Orientations to Information Systems

We suggest that there currently exists three fundamentally different paradigmatic orientations in IS research. By paradigmatic orientation we mean a set of ontological and epistemological assumptions that contribute to a common understanding within a group of scientists, in contrast to Kuhn's concept of paradigm [20]. Each orientation forwards and attempts to legitimate a certain kind of view of information systems. The orientations are not completely separated; instead, in some parts they are overlapping. The three orientations should not be mistaken as current research areas. Instead, a given paradigmatic orientation may be used in different research areas of IS and different orientations may be used in a given research area.

The oldest paradigmatic orientation is Computer-Oriented IS (CIS), which is still effective in IS research closely related to Computer Science. In the CIS-orientation, the core of systems is technology: computers, IT or ICT. Systems are technological artifacts in use. The view emphasizes application software and IT in processing, transmitting and storing data for information services. The IS field is usually viewed as an engineering or design science. A *computer-oriented information system* is mostly a deterministic system based on automated data processing. Ideally, it is designed as a fully known set of entities and their dependencies with deterministic behavior and a definite boundary. The phenomena are conjunctions of causal processes that ideally approximate a determined system. In an extreme version of the orientation, the view of the end-user may be reduced into behavior at the human-computer interface and ignored otherwise. Mismatches between technology and user preferences then tend to be interpreted in favor of well-working technology. The extreme version appears mostly in Computer Science, while in the IS field the view is moderated [3][9][15].

Another paradigmatic orientation is Management-Oriented IS, which currently is perhaps the most common one. It is effective especially in business schools. In the MIS-orientation, the core of systems is organization: business or otherwise. Systems are organizational work systems or activity systems that are reliant on computers, IT and ICT. The view focuses on the production, delivery and management of information services intended to facilitate work flows and business processes. The IS field is usually viewed as a business-oriented social science [2]. Thus it may emphasize either business or social issues. A *management-oriented information system* is mainly a contingent system based on organizational and inter-organizational information networks. Ideally, it is designed as a set of contingent organizational entities and their dependencies with contingent behavior and an open boundary. The phenomena are conjunctions of contingent processes operating in an open system. The view of the end-user is often reduced into social behavior in a work role as a source of various human factors. Due to its prevalent management rationale, deviations from ideals in system operation are expected but considered as issues to be controlled and managed. Mismatch between technology and user preferences is interpreted in favor of management and economical preferences.

We contend that there is currently also a third paradigmatic orientation emerging. We call this Human-Oriented IS (HIS). In the HIS-orientation, the core of systems is the human being. Systems are humans' communication and activity systems that use computers, IT and ICT as a media for their performance. The system emphasizes the human beings and their personality and their actions, communication, and cooperation mediated with technology. In the view of the IS field, the social and humanistic sciences are emphasized. A *human-oriented information system* is mainly an emergent system based on human beings sharing knowledge and their different ways of communicating and working. The phenomena are networks of entities and their dependencies with emergent properties. The system cannot be isolated from its context, not even provisionally. Therefore any specification of a boundary is artificial and any specification of the system only highlights a certain part of it. The human being is seen holistically as a physical, cognitive, emotional, and social being [16]. Due to a prevalent humanistic rationale, deviations from ideals in system operation are not a problem of system operation but of the idealistic expectations, i.e., expectations deviate from operation not vice versa. Mismatch between technology and user preferences are interpreted in favor of human preferences.

All the three aspects are necessary in IS research, but there is a need for them to integrate and take each other better into account. Unbiased integration is difficult, because the different preferences may genuinely contradict each other. Yet we need to consider technical, economical and human feasibility of information systems as a whole, not only from one or two viewpoints.

3. Scrutinizing Concepts: Information and Knowledge

The essence of an information system in semiotic terms is data, information, and knowledge. The other elements and the system dependencies and rules may vary, but unless information is considered among them one cannot speak of information systems. The computer-oriented view of information concentrates on physical data with which information is delivered, while the management-oriented view concentrates on information flows and the meaning that end-users give to the information. From the human perspective, both these views are very narrow. First of all, we need to study information in all its forms, not only explicit information. Secondly, we need to understand both the individual and the collective forms of knowledge. Furthermore, we need to recognize the role of meta-knowledge and meta-information within communication.

3.1. Beyond Explicit Information

Information is knowledge that human beings extract from the world and communicate among themselves. Yet knowledge is not information nor vice versa [30]. Although it is customary to speak of information and information flows, these conventions are merely convenient abstractions. Information cannot be mediated in any other way than transforming it into some symbolic and physical format. Neither can it be stored in any other way than as physical data or mental knowledge. What we understand as information – the "meaningful flow of messages" [22] – is fundamentally a sequence of transformations between mental and physical formats. Making accurate distinctions between the concepts of knowledge and information on one hand, and information and data on the other is therefore quite artificial. Information "appears" only in the context of mental-physical transformations. However, "information" is a useful abstraction, since it makes it easier to us to discuss about the relevant abstract phenomenon – communication – that emerges from these transformations. The term "knowledge" is often used in a similar manner but usually as a higher level abstraction than "information". In this way of speaking, information and knowledge are viewed independently from the knower (cf. [28][31][7]).

One might think that information can be mediated only in the form of codified data but this is not correct. There is a wide range of different forms in which information can be received and transferred. Codified data is explicit data and its purpose is to mediate explicit information to the receiver. *Explicit information* is, thus, explicit to interpretation: there are explicit syntax and semantics, possibly also pragmatics, for this task. The more precise the syntax, the more explicit the information one receives. Most explicit form of information – formal information – can be elicited from formally codified data. Less formal information can be elicited from a wide variety of linguistic and symbolic data such as written and spoken language, or traffic signs. Some forms of data may have a weak or ad hoc syntax. For example, the location of a folder on an office shelf may tell the office workers whether a certain task is finished or not. Information may be intentional but not necessarily. A person may receive information unintentionally – he or she just happens to see or hear something. A person may receive information as well by way of something that does *not* exist or does *not* happen in some situation. There is also information that is mediated with fuzzy syntax: e.g., art works, facial expressions, and bodily manners. Such *tacit information* is tacit to interpretation: there is no explicit syntax that needs to be agreed or learned prior to receiving or sending information. Information is received merely by observing. A person might not even necessarily be aware of the information he or she produces or receives.

3.2. Individual and Collective Knowledge

The flexibility of human information transfer and thereby communication is possible because of the flexibility of human use of knowledge. Some of our knowledge is readily at hand to explain, while some is not. It is common to speak of explicit and tacit knowledge [26][22][7], yet there is no common understanding of these two terms [30]. Part of the problem is not noticing that knowledge is explicit or tacit, only in relation to someone or something. In the following section we speak of knowledge in relation to individuals and communities.

Individual knowledge is a mixture of personal experiences, values, familiarity and expertise that forms a mental framework for assessing, combining, and internalizing new information. It may be conceptually more or less structured. *Individual explicit knowledge* is well structured in a person's mind and therefore it can be easily expressed in speech and writing. It is explicit to the knower: we know what it is that we know [10]. What makes individual knowledge explicit is not that it is articulated but that it is conceptually structured enough to be easily articulated if needed. When it is prepared for articulation it becomes information and when it is actually articulated it becomes data and a physical phenomenon. *Individual tacit knowledge* is weakly structured in a person's mind and therefore difficult to express in words. It is tacit to the knower: we are aware that we know and we can use the knowledge exactly in our everyday life, but when asked we are not able to explain what it is that we know [10]. Although tacit knowledge difficult to express, its consequences can be investigated and tested empirically [18].

All knowledge has a tacit component [34][30], but the difference between tacit and explicit knowledge is the amount of conceptual structure that gives awareness of the contents of knowledge. For example, expertise is about an ability to adapt to unforeseeable, non-explicated situations that is difficult to explain to others, but most of the time an expert is also able to explain much of what he or she knows. Tacit and explicit knowledge may appear together, but the latter may be more or less explicit. Thus we rather speak of a continuum instead of two contrasted types of knowledge [30]. Yet explicit knowledge may also be inconsistent with tacit knowledge [27][30][34], which implies that they are not simply two aspects of the same knowledge either. Explicit knowledge may help acquire tacit knowledge [7] and vice versa.

In communities and societies individuals socialize themselves to a particular tradition of knowledge and interpret their experiences within this tradition. The members of a community develop shared problem-solving methods, narratives, beliefs and procedures. They may also develop a "collective memory", i.e., the members share knowledge of what a particular member knows and therefore others need not know themselves. They also form shared knowledge of what kind of issues and things are significant and worth remembering in the first place.

Collective knowledge is knowledge that is shared among the members of a community. While people as a community possess a common body of knowledge, as individuals they know only bits and pieces [7]. At individual level, the knowledge may be shared explicit or shared tacit knowledge. The former includes, e.g., knowledge of routines, norms, standards and other explicit procedures, as well as common goals and visions. The latter may include, e.g., shared know-how and familiarity with collective practices and culture. Individuals act knowledgeably as a routine part of their everyday activity [25]. *Collective explicit knowledge* has been shared in a collective by articulating it. It is explicit to the community: the members know what other members know, since the knowledge has been articulated to inform them. What makes collective knowledge explicit is yet not that it is in an articulated *format*, but that the knowledge has sometime been shared in the community. Some speak of documents as encoded knowledge [5][32], but we find them rather sources of information [30][36], with which collective knowledge can be formed and maintained (cf. [11]). Shared and communicated documents are collective resources for knowledge. Instead, knowledge that has not been articulated is tacit to the community: the members may be aware of the knowledge and the knowledge adds to their collective efforts. This *collective tacit knowledge* is knowledge that is not shared among the members or knowledge that is shared but tacit to the individuals. Such knowledge is difficult to identify and transfer within a community [24].

3.3. Meta-Knowledge

Usually as people speak of knowledge, they tend to focus solely on the part of knowledge that concerns factual information and knowledge that is delivered between people. However, there are also several pragmatic forms of knowledge that address not the information content communicated but the mediated information entity itself and its context. This kind of knowledge is called meta-knowledge. It is knowledge that is not directly communicated but is anyhow required for to understand the meaning and purpose of the information entity actually delivered.

There are forms of meta-knowledge that concerns the pragmatics of information. *Social knowledge* concerns the role of information in human and social worlds. It includes, for example, knowledge of the human and social intentions and their implications on human and social worlds, and the fundamental human assumptions and belief and value systems, in regard to which a piece of information is relevant. It includes also knowledge of discourses and communication, in which a piece of information is relevant, and the

personal and social emotions to which a piece of information relates. *Working knowledge* deals with the ways of human processing and use of information. It includes, for example, knowledge of the environment and actual conditions, in which information is dealt with, and the way how they affect the use and processing of information, and knowledge that helps to create new knowledge to use and process information in a given situation. It includes also historical knowledge of the life-cycle of a piece of information.

There are also forms of meta-knowledge that concern the codification and delivery of information entities through different media. *Content knowledge* deals with the actual information content of information and information entities. It includes, for example, knowledge of the purpose of information entities, the intended meaning of concepts and conceptual relationships used in an information entity, and the structure of an information entity. *Symbolic knowledge* deals with the way of representing information entities. It includes, for example, knowledge of how certain symbols should be interpreted and how different information entities are represented. *Computational knowledge* concerns the way how information entities are technically and physically implemented and processed. It includes, for example, knowledge of how information entities are implemented and processed as signals and signal flows, and knowledge of the concrete technical implementation and processing of information entities as physical objects.

The flexibility of information delivery between human beings is based on the strong role of meta-knowledge in communication. Meta-knowledge appears and functions tacitly so that we can focus on the delivered messages. Meta-knowledge itself comes into focus only when reflecting upon it: e.g., while studying means of communication and ways of performing.

3.4. Information and Knowledge in Human Communication

Stenmark [30] argues that the definitions suggested for data, information and knowledge have been vague and imprecise and that the relationships between them are not sufficiently dealt with. He notes that it is common to view the relationships as a one-way, linear relationship between three entities; implying that the effort required moving from one entity to another is the same and that the movement proceeds from data through information to knowledge. He stresses that data, information, and knowledge are interwoven and interrelated in more complicated ways.

We see that the problems arise when the concepts are studied outside a proper context: communication as human interaction. Human communication is not simple information transfer from a sender to a receiver through some information channel. Words cannot fully transfer knowledge [30], not even information. To articulate and understand information, a human being needs to perform a complex interpretation task using his or her meta-knowledge related to the message, the other party, and the situation. The interpretation task is aided with additional information. This *meta-information* is used to modify the way how the actual message is interpreted. The ways to convey meta-information are different channels of non-verbal communication: facial expressions, tone of voice, etc. Meta-information may also be explicit and thus transferred through speech or writing. Information transfer with meta-information is illustrated in Figure 1. Meta-information is delivered simultaneously with factual information (i.e. the literal meaning of the message). This meta-information is used to communicate the necessary meta-knowledge for interpreting the factual information. If the person who receives the message understands also the meta-information, he or she may then understand the message more easily.

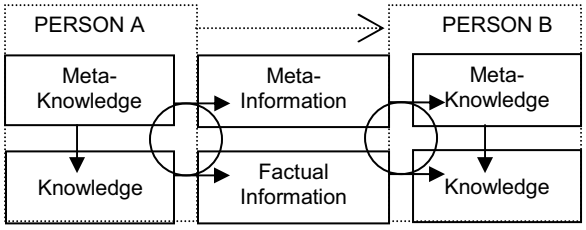

Figure 1. Information transfer with meta-information.

We propose a layered view of data, information and knowledge in a framework of communication. The framework is illustrated in Figure 2. Communication between two persons emerges from two-way mental-physical transformations. One-way transformations occur also when a person extracts information from the physical world through observation. Social interaction occurs through the physical world. In the transformation from mental to physical, information is extracted from knowledge and encoded into data. In the transformation from physical to mental, data is interpreted as information that is then internalized as knowledge. The mental-physical transformations

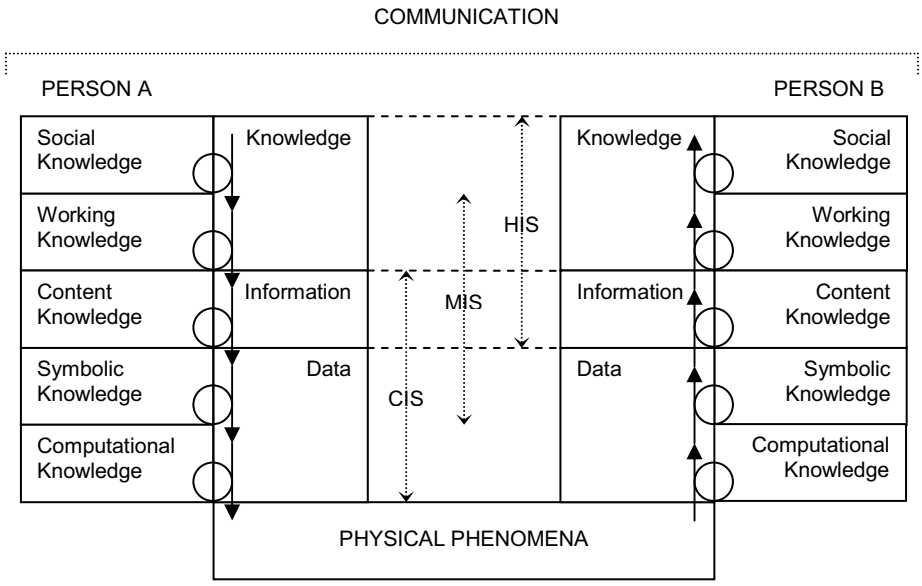

Figure 2. A layered view of data, information, and knowledge. Meta-knowledge enables the transformations between different layers, from which communication emerges.

consist of a series of smaller transformations that occur within and between the different layers. These smaller transformations are produced by using the various types of meta-knowledge illustrated in Section 3.3.

It is impossible to say in any non-artificial way, when knowledge becomes information, information data, and vice versa. It is a question of degree similar to colors: When does yellow become green and green become blue? In different contexts a given color may be seen either yellow or green. Yet yellow is not green.

Figure 2 also helps to clarify what is actually meant by "information" in the different paradigmatic orientations of IS. In the CIS-orientation, the focus is on processing, transferring and storing information as data, while in the MIS-orientation the focus is on the value and usability of information for organizational actors in their tasks and the organizational information flows that deliver this information. In the HIS-orientation, the focus is on human communication, through which information is mediated to share knowledge among the members of a community. According to our framework, all the three views of "information" should be understood as abstractions of the two-way mental-physical transformations, but the layers they emphasize are different.

4. Human-Oriented Information Systems

Human-oriented information systems emphasize the characteristics of humans, the end-users of information technology, and therefore tend to take a richer view of information and knowledge than in CIS or MIS. In this section, we attempt to draw together some issues that are relevant in human-oriented information systems. We find there are at least four types or rather aspects of human-oriented information systems: societal IS, organizational IS, interpersonal IS, and personal IS. Our view has some similarities with Grudin's [12] levels of Computer Supported Cooperative Work (CSCW) and groupwork, but not entirely. Grudin identifies individual, small group, project and organization level. We find information systems also outside organizational boundaries.

4.1. Societal Information Systems

Societal information systems project the societal knowledge shared among societies, communities, and groups aiming at advancing different types of information societies. People feel the need to create their own space for their existence and likewise feel the need to communicate, participate, and share. Starting from short message exchanges and advancing to more demanding forms of e-discussion and interaction,

humans express their sympathy, empathy, concern and demonstrate their needs to communicate and ability to support other humans.

Advanced information societies can be permanent infrastructures, co-existing with the physical world or temporary virtual spaces in order to support the functions of a non-virtual space. For instance, permanent infrastructures could be perceived as free public networks, public access media, independent or private media and Internet cafes. Temporary infrastructures of online nature could be the support provided for governmental and organizational programs [19]. Technological support for citizen participation began in the 1970s, in the form of electronic town meetings and televoting. These experimentations aimed at building new channels to influence the citizens to participate in decision-making processes. Societal changes seem to evolve slowly and electronic forms of democracy are still discussed as an issue of the future information society.

Advanced information societies have inevitably been linked to knowledge sharing, which, in turn, is considered to provide a guide for the next form of organizations and societies, the virtual community. Knowledge-sharing processes are the background of any physical community in order to access virtual maturity, participation and inclusivity. It seems that inclusivity is the most serious problem of information societies; according to Werry and Mowbray [35] everybody should be able to participate. Notwithstanding, it is the rule of exclusivity that seems to apply rather than that of inclusivity.

4.2. Organizational Information Systems

Organizational information systems concentrate on supporting different work processes within and between organizational structures. Different technologies are utilized to facilitate organizational learning and development as well as groups and coalitions with their communication and decision making. The investment in learning as a lifelong process and in knowledge as intellectual capital has become an important part of organizational culture. Organizational information systems coupled with technological support, are promoted as the values and the means for organizations to achieve maturity, quality of work, and effective organizational communication for enabling tacit and explicit knowledge transfer.

The idea of individual and collective organizational memory has shaped the concepts of Educating and Learning Function [17] and Organizational Memory Information Systems (OMIS). The needs of a learning organization can furthermore be facilitated in organizational settings with suitable groupware platforms for collaboration, co-ordination, communication and knowledge sharing.

The Educating and Learning Function of IS promotes and supports a whole range of end-users' skills, individual organizational memory and tacit knowledge. These transform pure system data into information and knowledge and work that form within organizational communities of practice. Here, the knowledge lifecycle becomes clearer: starting from knowledge creation and becoming more obvious when technology assists in sharing the organizational individual and collective knowledge, and utilizing OMIS to share explicit knowledge. The successful transformation of tacit, that is personal, local, analog or subjective knowledge to explicit, universal, global, digital or objective knowledge and its storage in suitable OMIS are the first steps to knowledge creation and management in organizations. This, in turn, empowers various types of organizational learning to be facilitated and enable further knowledge creation and sharing among humans by new tasks and responsibilities allocation.

4.3. Interpersonal Information Systems

Interpersonal information systems vary from computer-mediated communication to web-based communities and groupware systems to personal mobile devices. In most interpersonal systems knowledge (individual or collective) is shared and knowledge (tacit and explicit) transfer is a trust-based relationship. Primarily concerned with the communication process in a variety of real and virtual settings such as web-based communities, video-conferencing, nowadays interpersonal information systems pervade work, social and private life.

There is a need for a methodological advancement in the study of interpersonal communication before discussing advancements of Interpersonal Information Systems. Recent research examines influences, rules and structures for communication, conversational variation and communicative competence among individuals and groups [19].

For instance, online communities have affected the communication patterns and indicated alternative ways to construct, evaluate and apply working methods and ICT. Internet, in particular, has changed the boundaries of information systems and facilitated new ways of

synchronous and asynchronous working through the multi-use of web-based work environments. The new class of knowledge and virtual workers, unlike traditional workers, require to efficiently locate resources and repositories in the cyberspace for the effectiveness of their work. The already existing metadata and meta-knowledge repositories created the need for the construction of the Semantic Web, being an extension of the World Wide Web.

4.4. Personal Information Systems

Personal information systems combine the hard (technical) and soft (human) issues in multi-agent systems, study their engineering evolution patterns and examine human factors complexity and how this affects technology utilization and usability. Sometimes the need to analyze, synthesize, formalize and integrate in order to make both soft and hard issues understandable through a widely accepted platform leads to the combination of subject-specific knowledge from different disciplines [4].

Nowadays research is carried out to establish the missing links of computability and social evolution, interaction and entropy in societies, cultural factors and process modeling, language, cognition and computability [4]. Ubiquitous Computing (UbiComp) is a generic meta-knowledge framework that can be considered as a new organizational challenge. Scientifically it unites and integrates explicit knowledge from computer science, social sciences, anthropology and philosophy. In addition, it imposes a new organizational and societal infrastructure, where computing is almost invisible or at least, as invisible as possible, and implies the emergence of flexible personal and interpersonal systems and individual devices.

UbiComp seems to have the potential to adapt to domain and application knowledge, which can be utilized while modeling end-users' requirements. Furthermore, UbiComp utilizes personal knowledge for interaction - cognition taken into account, end-user's creativity, innovation, and feelings, which are significant issues to evaluate human needs in a scientific way. End-users' tacit knowledge needs to be captured and assist interaction and personal design features but how far UbiComp and personal systems could advance without being open models of interactive knowledge? Unlike virtual reality, where technology is at the center of interaction, UbiComp aims at putting humans at the center of interaction minimizing the technology impact.

On the other hand, virtual reality and ICT in particular are the means for universal accessibility of IS and for the internationalization of knowledge. This being the case, IS development should not be an extension of either computer or cognitive or social science only. It should neither be a channel to the most modern technology from the technological determinism's point of view. Co-operation and synergy are necessary when several persons with different tacit knowledge and diverse cultural backgrounds are involved in the developmental and organizational processes of IS.

5. Conclusive Remarks and Future Research Considerations

The emergence of a knowledge-based society and the shift to the learning and virtual organizations are indicators for the changes in the roles of knowledge workers *(empowerment)* and of work processes in general. Integration and improvement of data, methods, tools, services and processes are key issues for human ICT within human-oriented IS. The growing demands and trends on advanced ICT in the process of knowledge acquisition, learning skills and competencies, and structural changes in workplaces require human-technology interaction and new theoretical domains and limits to explore meta-learning concepts.

Information and knowledge providers are in need of reaching many people from diverse cognitive backgrounds and with different ways of conceptualizing information and knowledge. Therefore, meta-knowledge repositories and IS designers must resort to modeling concepts, which are widely shared and therefore easier to grasp than more unfamiliar concepts [29][4]. Modern ICT can assist in knowledge acquisition for learning organizations in a knowledge-shaped economy and society, considering that new types of virtual workers and learners have differences in cognition and interaction from traditional ones.

The scope of the traditional IS research needs to be widened in order to consider IS and ICT as knowledge and meta-knowledge providers. This requires more than what has traditionally been in the field and in related subject fields. From software, to groupware and peopleware, the cognition of interaction needs to further be explored as a theme within particular organizational cultures and cyber cultures. On the other hand, meta-knowledge systems repositories engineering should unify human development,

software development and product development with scientifically acceptable rules in order to provide human technologies. That *meta-cognitive knowledge* could give improved ways to evaluate and model end-users' learning, emotional and communication needs.

Apart from being used to assist disseminating data and information, modern ICT such as groupware application platforms (i.e. e-mail, virtual room chats, e-bulletin boards), combined with dynamic hypermedia and multimedia facilitate communicating and sharing meta-knowledge. Facing the demands of internationalization and personal needs expression, ICT and UbiComp have a powerful role by considering the end-users' active participation and by counting on the human *interaction with* and *perception of* information and knowledge.

Changes in IS applications from transaction processing and co-ordination systems towards systems that support collaborative work and human communication marked a new era of tacit and explicit knowledge transfer.

ICT is inherently a dynamic conceptualization of interaction. Being of such a nature, it requires communication skills, self-oriented learning, functionality and usability, and, in particular, facilities for meta-knowledge allocation to be built in software and groupware that is used by end-users. Inevitably these concepts should be combined with subject knowledge from other relevant areas and disciplines such as Cognitive Science, Social Science, Psychology, Anthropology and Philosophy to name just a few.

In this paper we introduced three paradigmatic orientations to the information systems: computer-oriented IS, management-oriented IS, and human-oriented IS. We see that all of them are necessary in IS research, but there is a need for them to integrate and take each other better into account. At this time the studies in the area of human-oriented IS are still scattered, although the other two orientations have gained a lot of attention. We wanted to emphasize the need for research in the area of HIS. First we brought into the conversation that the essence of an information system is data, information, and knowledge. In our opinion these different aspects of information should be understood as abstractions of the two-way mental-physical transformations, but the layers they emphasize are different. Meta-knowledge enables the transformations between the layers, from which communication emerges. Second we discussed four types of human-oriented information systems that put the emphasis on humans, end-users of information technology. Finally we made some suggestions for the future research.

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