

WHY HEIDEGGER?

Critical Insights for IS Design from Pragmatism and from Social Semiotics

Ângela Lacerda Nobre

Instituto Politécnico de Setúbal, Escola Superior de Ciências Empresariais, ESCE-IPS, Portugal

Keywords: Heidegger's ontology; American School of Pragmatism; Social Semiotics; Semiotic Learning; information systems design; organisational learning; knowledge management; communities of practice; collaborative work; collaborative learning; innovation management; change management; organisational development; sustained competitiveness; knowledge processes; knowledge-intensive organisations; knowledge-worker.

Abstract: Martin Heidegger's ontology represents a landmark in terms of how human knowledge is theorised. Heidegger's breakthrough achievement is to consider scientific knowledge as a particular case of the broader *being-in-the-world* instance. Science develops without needing to acknowledge this dependence though in times of crisis, when previous approaches are no longer effective, it is the link with daily experience that enables the rethinking of earlier assumptions. This valorisation of quotidian practices and the centrality of experience and of informal knowledge – the prereflexive work – in terms of being the antecedents of formal and explicit knowledge, has profound consequences regarding the creation of organisational information systems. The American School of Pragmatism, developed by Charles Sanders Peirce, had previously argued in similar lines in terms of the non-severing of the dual relations such as theory/practice or individual/social. In later times, Social Semiotics, also developed under the same implicit assumptions, where the individual and the social dimensions of human reality are mutually determined. These arguments have been established for long as being relevant for information systems design by several authors. However, there is an obvious lack of understanding of the kernel role of such theories in current mainstream research. Concrete approaches to organisational learning - such as *Semiotic Learning* - are an example of the huge potential that lies largely unexplored under the umbrella of socio-philosophy.

1 INTRODUCTION

Heidegger's (1962) ontology, Peirce's (1931) pragmatism and social semiotics (Halliday, 1978, Kress, 1985, 2003) are independent theoretical works. However, they share a common concern and propose a unique approach to how to theorise knowledge. Their concern regards the excessive abstraction of knowledge creation, away from the ongoing practice that occurs within social contexts. Their approach radically link all knowledge creation with the actual experience, socially embedded and embodied, of participation in discursive practices.

Why Heidegger? Why is Heidegger's argument relevant for information systems (IS) design? Because it captures the essence of human rationalisation. Because it explains why contexts are important, why language matters and why participation, collaboration and signification are critical. Contexts, language, participation,

collaboration and signification may be accepted as being crucial elements in the task of requisite analysis and organisational processes design. Frequently there is no need to justify or to explain why such elements are critical because they have been naturalised, understood as being obvious.

In most of the cases, when business processes are analysed, there is a sharp distinction between the procedural and repetitive tasks that may be automatised, and the cultural specific and social related processes that are often treated with distance. Most IS design directly addresses the first and formal processes and leaves the informal processes for the intranet chat-rooms, at best. Initiatives such as sharing best-practices or Kaplan and Norton's (1996) Balanced Scorecard do mention the importance of knowledge sharing and of social capital but fail to recognise the centrality of such processes at organisational level.

The present paper rests in the following arguments, following a social science research approach:

- Social and cultural determinations take precedence over procedural and functional knowledge;
- What occurs at prereflexive level will determine and condition formal and explicit knowledge formulations;
- There is no complementarity between formal and informal knowledge - informal knowledge is primordial and central;
- Informal knowledge and social and cultural specificities have been neglected for so long because they escape the effort of standardisation and of predictability;
- IS have been wrongly assumed by mainstream research as being exclusively concerned with procedural specifications;
- There is a huge potential for IS design in terms of addressing the social, community building and meaning-making dimensions of daily organisational practices;
- Such IS challenge is directly related to the creation of unique competitive advantages, radical innovation and continuous organisational change and development;
- Social philosophy offers key insights that enable the sound grounding of crucial concepts such as knowledge sharing or collaboration and the recognition of their inescapable social nature;
- There is a longstanding tradition in computing science research that acknowledges the kernel role of such inputs, though it is non-mainstream;
- There continues to be an urgent need to directly address the facilitating and enabling role of technology in addressing collaborative work and learning concerns;
- IS design must directly incorporate ongoing organisational learning and knowledge management practices into its architecture;
- When there is a call for strategic alignment between business strategy and IS or between formal and informal knowledge it is usually already too late;
- Such alignment must be built-in into the system from the start so that there is the emergence of self-organising patterns for sustained organisational development;
- Business success critically depends on successful organisational practices that in turn depend on the effectiveness of IS design;
- IS effectiveness relies on *situatedness*, *discursiveness* and *understanding*, which are Heidegger's formulation of human rationality.

This long list of arguments repeats one single *leit motif* – informal and prereflexive knowledge plays a kernel role in business success, IS design is a direct enabler of collaborative work, and socio-philosophy theory offers crucial insights for organisational innovation and sustained competitiveness.

2 SOCIAL PHILOSOPHY

Within the scientific area of computing science there is a tradition of developing and incorporating philosophical works into information systems research. Several authors have based their computing science research on social philosophy (e.g. Stamper, 1973, Golkuhl, Lyytinen, 1982, Winograd, Flores, 1986, Liu, 1993, Filipe, 2000, Clarke, 2000, Andersen 2000, Ulrich, 2001, Dietz, 2003, Bynum, Rogerson, 2004). Different areas have been explored, including ontology, pragmatism, semiotics, social constructivism, philosophy of language and philosophy of action.

«There is the need for redefining information science in terms much more comprehensive, multilevel philosophy of information, of which semiotics forms the foundation.» (Ulrich, 2001).

When designing work processes, workflows, organisational structures or information systems, the definition of these processes not only determine abstract formalisations but they also have a direct effect on the people who are to perform such work, through the actual enactment of the work practices themselves. Designing information systems is also *designing ways of being*, as Winograd and Flores argue, based on Heidegger's ontology.

«All new technologies develop within a background of a tacit understanding of human nature and human work. The use of technology in turn leads to fundamental changes in what we do, and ultimately in what it is to be human. We encounter the deep questions of design when we recognise that in designing tools we are designing ways of being.» (Winograd, Flores, 1986).

The advantage of using philosophical based approaches is that they enable a richer understanding of organisational reality and of its human interaction phenomena. «There is an urgent need in information systems definition and design for developing standards for critical reflection on practice. I believe practical philosophy can and should become a major source of such standards.» (Ulrich, 2001).

This understanding opens new perspectives and new approaches in terms of actual organisational

practices which may lead to the optimisation and increased effectiveness of organisational performance. These potential positive and economic related effects occur through a greater efficiency in terms of how sensemaking is addressed, explored and potentiated at organisational level. Sensemaking may be studied from varied disciplinary perspectives. The present paper explores the social, ontological and semiotic nature of sensemaking at organisational level.

3 HEIDEGGER'S ONTOLOGY

Probably one of the most interesting and illuminating ways to grasp meaning creation within a community is through Martin Heidegger's [1889-1976] thought. Heidegger's work *Sein und Zeit - Being and Time* (1996), first published in 1927, in which he defines the notion of 'being-in-the-world', proposing a radically innovative ontology that has changed the course of development of socio-philosophy, affecting phenomenology, contemporary hermeneutics and post-structuralist philosophy (Benton, Craib, 2001).

«If being [*Seiende*] is predicated with manifold significance, then what is the leading, fundamental signification? What does Being [*Sein*] mean?» (Krell, 1992) (Krell's notations).

Heidegger's philosophy is centred on the question of being, and it develops a complex account of our *being-in-the-world*. Heidegger believed that Western philosophy had lost touch with the important questions of human existence. He gave an urgent account of the human search for the significance of our own 'being', and of human life as a search for its own meaning and identity, unaided by any external authority or fixed values. Heidegger's "phenomenology of everydayness" works to counteract the tendency toward the "displacement of meaning into subjectivity, which began with the rise of modern science" (Guignon, 1983). By regarding the self as nothing other than its "meaningful expressions", Heidegger is able to fully break away from the Cartesian tradition. Heidegger identifies critical prejudices regarding the study of being:

«'Being' is the self-evident concept. 'Being' is used in all knowing and predicating, in every relation to beings and in every relation to oneself, and the expression is understandable 'without further ado'. Everybody understands, "The sky *is* blue," "I

am happy," and similar statements. But this comprehensibility only demonstrates the incomprehensibility. It shows that an enigma lies a priori in every relation and being towards beings as beings. The fact that we live already in an understanding of Being and that the meaning of Being is at the same time shrouded in darkness proves the fundamental necessity of recovering the question of the meaning of 'Being'.» (Heidegger, 1962).

Since the seventeenth century, there has been a growth in interest in knowledge and cognition which rose from the earlier development of modern science in the fifteenth and sixteenth centuries (Gorniak, 2004). Knowledge had always been important to humankind but this knowledge was previously understood as being implicitly contextualised and embedded, while in modern age it acquired as if a life of its own, independent and autonomous from the contexts from which it emerged. This process is explained by Guignon (1983), an expert on Heidegger's ontology, who claims that, with modernity, the epistemological question gained precedence above the ontological concern, and that the importance of Heidegger's monumental work is related with this shift in perspectives. «Epistemology is the philosophical discipline concerned with the nature, origin and validation of knowledge, or shortly, the theory of knowledge.» (Ulrich, 2001).

Ontological concerns are inseparable from the contexts where knowledge processes take place (Guignon, 1983). In technical terms, with modern age, the epistemological concern of "knowledge about knowledge" became priority. The ontological question of the context of such knowledge, and of who and what is this being whose knowledge is being considered, was neglected. Guignon, based on Heidegger's work, contests that any epistemology is necessarily based on certain ontological assumptions, and though these may be unacknowledged and unidentified they can never stop being present. Therefore, the argument goes that the dominance of epistemic concerns over ontological ones needs to be balanced in favour of further comprehension of reality as a whole, and of the ontological dimensions of knowledge.

Heidegger's ontology developed from Husserl's phenomenology, which explicitly calls attention not to individuals in isolation but to the individual in context. Individuals are constantly affected, determined and conditioned by surrounding circumstances (Ortega y Gasset, 1961). There is a change of perspective in phenomenological studies so that the focus of attention goes to the overall environment, and to the social embeddedness and

continuous networks of relationships which take place in such environment.

«Almost every great philosophical work carries with it a more or less explicit reinterpretation of the nature of philosophy and the methods appropriate to fulfilling its aims» (Guignon, 1983). As was referred above, Heidegger shifts his orientation from epistemology to ontology. For Heidegger, the basic theme of philosophy is 'being'. The question of being has this central position because any inquiry into one of the areas of philosophy, e.g., epistemology, logic, ethics, or aesthetics, operates within a tacit set of presuppositions about the 'being' of the entities with which it deals. What is true of the discipline of philosophy holds for the sciences as well. Every science presupposes some conception of the being of the entities that are the objects of its inquiry. The ontologies of the regional sciences, Heidegger says, have already been worked out "roughly and naively" on the basis of our "prescientific" ways of interpreting and experimenting "domains of being".

«Scientists work within frameworks that determine in advance what sorts of question are appropriate and what kinds of answer will make sense. Generally, there is no need for scientists to question the ontological frameworks in which they work. During periods of crisis in science, however, it is precisely these frameworks that are called in question.» (Guignon, 1983).

When what are at issue in the sciences are no longer questions within the frameworks of those sciences but the very frameworks themselves, the "ontological presuppositions of the regional inquiries must be made explicit" (Guignon, 1983). Heidegger believes that philosophy alone can fulfil this role. Philosophy that he sees as not itself being bound by any framework, and which is "the study of frameworks in general". The inquiry into the 'being' of entities in general Heidegger calls "ontology taken in the widest sense". It is a "science of *Being as such*", and its task is to provide "a genealogy of the different possible ways of Being". Ontology in the widest sense lays out "the conditions for the possibility of any science". And philosophy, as ontology in the widest sense, is the "science of sciences". The Anglo-American tradition of analytical philosophy, according to Guignon, generally tends to see philosophy as a set of current topics or problems that are to be discussed within pre-given frameworks. The method is "argument and counter-argument along tacitly agreed-upon guidelines." (Guignon, 1983). In contrast, Heidegger maintains that it is these philosophical frameworks

themselves that are the source of traditional philosophical problems.

«The ontological task of a genealogy of the different possible ways of Being (which is not constructed deductively) requires a preliminary understanding of "what we properly mean by this expression 'Being'". The question of Being thus aims at an *a priori* condition of the possibility not only of sciences which investigate beings of such and such a type – and are thereby already involved in an understanding of Being; but it aims also at the condition of the possibility of the ontologies which precede the ontic sciences and found them.» (Heidegger, 1962).

Heidegger devoted a lot of time to the idea of "being-with", and talking and communicating was one way to be with others: «Discoursing or talking is the way we articulate "significantly" the intelligibility of being-in-the-world.» (1927). Discourse, for Heidegger, is broader than talk, including all our inner and outer expression which plays the same role as talking. According to Guignon, in Heidegger's perspective, talk and discourse «do not have the purpose of transmitting messages of information, are not ways of getting things we want more efficiently, and do not give expression to "me-I"». Rather, talk and discourse have the purpose of "finding significance and of sharing understanding, and give expression to human *being-in-the-world*.".

Heidegger (1962) refers to *discursiveness*, *situatedness* and *understanding* as the basic elements of rationalisation, i.e. how human beings spontaneously use their rationality in everyday situations, therefore including philosophical and scientific reasoning circumstances as special cases within this everyday use. Heidegger's ontology is profoundly marked by this common use of rationalisation processes.

«If we are to understand the full import of Heidegger's conception of 'meaning', then, we must avoid seeing it as referring to something inner in any sense (...). Heidegger identifies three existentialia of what is called 'Being-in as such': situatedness, understanding, and discursiveness (...). Meaning is that which makes possible that projection of possibilities in understanding (...). What is the source of this most primordial level of intelligibility? Heidegger says that it is 'discursiveness'. The concepts of 'discursiveness' and 'meaning' are closely

related, so to clarify one is at the same time to illuminate the other.» (Guignon, 1983).

Heidegger's concepts allow for a rich interpretation of the critical role of community life for human beings' organisation within a society, a culture and a civilisation (Guignon, 1983). Life in the knowledge and network economy of the information age continues to be grounded in the same network of communities, and of social and cultural embedded meaning creation processes. Castells' (2000) notion of the "networking logic" and his assertion that Western society is technologically overdeveloped and socially underdeveloped, is consistent with Heidegger's work.

Heidegger sees the world as expressing the aims and interests of a culture. This implies that the concepts of "discursiveness" and of "meaning" are closely related. Social subjectivity becomes a central concept:

«To be Dasein is essentially to be a nexus of the socially constituted relations of a culture... Heidegger's phenomenology of everydayness works to counteract the tendency toward the displacement of meaning into subjectivity which began with the rise of modern science.» (Guignon, 1983).

Guignon (1983) states that his own work, by highlighting the historicist and hermeneutic dimensions of Heidegger's work *Being and Time* (1962), there is a break with standard interpretations of Heidegger's thought as "mainstream existentialism". According to Guignon, only when Heidegger's historicist and hermeneutic orientation has been brought to light can the moves of followers such as Gadamer (1975), or critics such as Derrida (1978) and Foucault (1972) be seen as significant in a larger philosophical context.

At organisational level, the relevance of the social context might be highlighted through Heidegger's work. The development of communities of practice theory (e.g. Brown, Duguid, 1991, Lave, Wenger, 1991) and situated learning (e.g. Streibal, 1991, Savery, Duffy, 1994, Ritzer, 1998) implicitly draw key notions from Heidegger's philosophy. Ontological and phenomenological perspectives are particularly relevant to the study of IS. These social perspectives critically influence IS design. Once such social concerns are taken into account, there is a stronger chance that there will be an adequate climate for the promotion of knowledge sharing and of collaborative work and learning at organisational level.

4 SEMIOTIC LEARNING

«Semiotics is currently the most complete and sophisticated theory of meaning and culture.»
Lagopoulos (1993).

Semiotic Learning is defined below through a set of propositions. This organisational learning methodology aims at clarifying how socio-philosophy theories may be applied in practice. Following a qualitative methodology typical of social science research this approach was applied in practice with positive results in three different high-tech software companies. Individual interviews and a sequence of small group meetings formed a learning cycle that was implemented and tested.

Proposition 1: Learning. *Learning is the action of exploration, use and possible expansion of a certain potential, ontologically defined and community level contextualised.*

This proposition concerns the process of manifestation of reality, of *being*, and thus corresponds to a socio-ontological perspective on learning; this action of making concrete a certain potential is a ubiquitous process fundamentally grounded on experience and on practice, which occurs within specific cultural and social contexts and through particular webs of relationships that play an active role, the contexts and the relationships, in determining the learning process itself.

Proposition 2: Organisational Learning. *Organisational learning is the process of gaining awareness to the social and ontological organisational dimensions - the social embeddedness and embodiedness of organisational practices and of knowledge processes - thus valuing quotidian community level meaning-making.*

This corresponds to the process of meaning creation which occurs within organisational communities; these community level daily practices are themselves constitutive of learning at organisational level; this socio-ontological perspective on organisational learning addresses the exploration of the potential of organisational reality at a concrete and practical level.

Proposition 3: Organisational Learning Facilitation. *Facilitation is the process and action of promoting open social and discursive practices thus enabling and nurturing organisational learning, through interpreting organisational communities as the central setting for the creation of sustainable core knowledge processes.*

The environment, the channel and the medium through which organisational learning processes are

facilitated and promoted are highly relevant and may contribute in a decisive way to the end goal of helping to raise awareness towards the socio-ontological dimensions of learning and knowledge, present in daily organisational practices.

Proposition 4: Social Semiotic Processes. *Social semiotic processes are meaning-making and signifying actions: they are actual, concrete and ongoing social and discursive practices which intrinsically carry the capacity, contain the potential and enable the production, expression, interpretation and exchange of signs and of symbolic reasoning.*

All social processes are interpretable, i.e. are possible of a signification process, thus have an inherent semiotic nature; social processes transport and are the vehicles of signification and of meaning-making capacity; this signification is continuous, collective, provisory and dynamic and it takes part within specific communities, which, in turn, are characterised by specific social discourses and discursive practices, including non-oral forms of communication.

Proposition 5: Semiotic Learning. *The concept of semiotic learning is defined as the meaning-making process of acknowledging, empowering and valuing the centrality of the organisational community and of the social and discursive practices, semiotic and ontological, that it hosts, thus sustaining core knowledge.*

Community-level practices are fundamental meaning creation settings and actions which condition and determine core knowledge processes, affecting overall organisational formal procedures and structures at a prereflexive and informal level; the semiotic learning concept uses a socio-ontological and social semiotics perspective in order to enable the exploration of each organisation's potential; semiotic learning is one possible interpretation and is one specific proposal of an approach to facilitate organisational learning.

Proposition 6: Semiotic Learning Method. *The Semiotic Learning method is a social process, composed of a learning cycle, which facilitates organisational learning through the proposal of specific social and discursive practices based on free association, thus enabling the experimentation of different perspectives and relationships and the interpretation of issues related with daily organisational reality.*

This facilitation occurs in a way that raises awareness towards the ongoing meaning-making processes and it leads to the valorisation of such

processes as core and fundamental aspects of organisational learning itself; the application of this method and learning cycle is performed by a specialised facilitator.

Proposition 7: Semiotic Learning Cycle. *The Semiotic Learning cycle is an iterative and interactive process that stimulates the creation of new organisational practices, processes and settings, which enable the exploration of each concrete situation and of each organisation's potential in a dynamic way.*

A learning cycle implies that there is no predefined target to be achieved but rather that learning is a continuous, ubiquitous and unavoidable process; this learning cycle, composed of four steps, is performed at small group level, within knowledge-intensive organisations, through the proposal of open dialogue and reflexive discussion on theoretical and practical issues related with management and philosophy theory and with the daily context of organisational reality.

Proposition 8: Knowledge - Intensive Organisations. *Knowledge-intensive organisations are those which are centred on and organised around their core knowledge processes and are based on the community level social and discursive practices that constitute, create and sustain such knowledge processes.*

Knowledge-intensive organisations are the Semiotic Learning method's addressees; as a distinguishing criteria, this method is directed in particular at three specific characteristics of such organisations: (i) knowledge processes have an important collective dimension; (ii) knowledge processes are non-repetitive and therefore are impossible to be predetermined and predefined; and (iii) there is an explicit interest and commitment towards questioning and improving current knowledge processes and organisational practices.

5 CONCLUSIONS

The present paper has served three main goals: (i) raising awareness to the crucial role of social philosophy for IS research; (ii) highlighting possible links and synergies between IS design and organisational learning; and (iii) stressing the importance of IS as enablers and facilitators of collaborative work and learning, and of knowledge sharing at organisational level.

Probably the over ambitious nature of such goals leads to the need to follow these themes in future

work. Nevertheless, there is an urgent need to create a critical mass of computing science researchers interested in sharing work related with these topics. The urgency in creating such pool of researchers is a crucial motivation of the present paper.

The present paper is based on research that was triggered at the first ICEIS conference, through Ronald Stamper, as keynote speaker, and his team, Joaquim Filipe and Kecheng Liu. The present research has followed the root-thinking of organisational semiotics to its social philosophy basis. Social philosophy offers highly challenging, sophisticated, effective and productive perspectives for IS design. The full potential of social philosophy to the improvement of IS design thus still lies largely unexplored.

ACKNOWLEDGEMENTS

I am grateful to Roger Tagg's comments, from the University of South Australia.

REFERENCES

- Andersen, P., 2000. What semiotics can and cannot do for Human Computer Interaction. In Proceedings of *Computer-Human Interaction (CHI) Workshop on Semiotic Approaches to User Interface Design*, The Hague, The Netherlands.
- Benton, T., Craib, I., 2001. *Philosophy of Social Science*. Hampshire, UK, Palgrave.
- Brown, J., Duguid, P., 1991. Research that Reinvents the Corporations. *Harvard Business Review*. Jan-Feb.
- Bynum, T., Rogerson, S., 2004 *Computer Ethics and Professional Responsibility*. Oxford, UK, Blackwell.
- Castells, M., 2000. *The Rise of the Network Society. The Information Age: Economy, Society and Culture*. Volume I. Malden, Blackwell.
- Clarke, R., 2000. *An Information System in its Organisational Contexts: a Systemic, Semiotic, Longitudinal Case Study*. Ph.D. Thesis, University of Wollongong, Australia.
- Derrida, J., 1978. *Writing and Difference*, (trans.) Alan Bass. London and New York, Routledge.
- Dietz, J., 2003. The Atoms, Molecules and Fibers of Organizations. *Data and Knowledge Engineering*, 47(3).
- Filipe, J., 2000. *Normative Organisational Modelling Using Intelligent Multi-Agent Systems*, Ph.D. Thesis, University of Staffordshire, UK.
- Foucault, M., 1972. *The Archaeology of Knowledge*. London, UK, Tavistok [Fr 1969].
- Gadamer, H.-G., 1975. *Truth and Method*. London, UK, Sheed and Ward [first published in 1965].
- Goldkuhl, G., Lyytinen, K., 1982. A language action view of information systems. Proceedings of the *3rd International Conference on Information Systems*, Ann Arbor.
- Guignon, C., 1983. *Heidegger and the Problem of Knowledge*. Indiana, USA, Hackett.
- Halliday, M., 1978. *Language as Social Semiotic: The social interpretation of language and meaning*. London, UK, Edward Arnold.
- Heidegger, M., 1962. Being and Time. (Translated by J. Macquarrie and E. Robinson). New York, Harper & Row [Original publication in 1927].
- Hodge, B., Kress, G., 1988. *Social Semiotics*. London, Springer-Verlag.
- Kaplan, R., Norton, D., 1996. *The Balanced Scorecard: Translating Strategy into Action*. Boston, Harvard Business School Press.
- Krell, D., ed., 1992. *Martin Heidegger Basic Writings*. New York, Harper & Collins Publishers.
- Kress, G., 1985. *Linguistic Processes in Sociocultural Practice*. Victoria, Australia, Deakin University.
- Kress, G., 2003. *Literacy in the new media age*. London, Routledge Falmer.
- Lagopoulos, H., 1993. Postmodernism, Geography and the Social Semiotics of Space. *Environment and Planning Series D: Society and Space*. 11(3).
- Lave, J., Wenger, E., 1991. *Situated Learning: Legitimate and Peripheral Participation*. USA, Cambridge University Press.
- Liu, K., 1993. *Semiotics Applied to Information Systems Development*. Ph.D. Thesis, Twente University, The Netherlands.
- Peirce, C., 1931. *Collected Papers*. (eds.) C. Hartshorne, P. Weiss. Cambridge, USA, Belknap Press of Harvard University Press.
- Rorty, R., 1979. *Philosophy and the Mirror of Nature*. Princeton, N.J., USA, University Press.
- Savery, J., Duffy, T., 1994. Problem based learning: an instructional model and its constructivist framework. In B. Wilson (ed.) *Constructivist learning environments: Case studies in instructional design*. Englewood Cliffs, NJ, Educational Technology Publications.
- Stamper, R., 1973. *Information in Business and Administrative Systems*. John Wiley & Sons.
- Streibel, M., 1991. Instructional plans and situated learning. In Anglin (ed.), *Instructional technology, past, present and future*. Englewood, UK, Co. Libraries Unlimited.
- Ulrich, W., 2001. A philosophical staircase for information systems definition, design and development. *Journal of Information Technology Theory and Application*. 3(3).
- Winograd, T., Flores, F., 1986. *Understanding Computers and Cognition – a new foundation for design*. Reading, MA, USA, Addison-Wesley.