INTERCULTURAL AND INTERDISCIPLINARY ISSUES ON VIRTUAL CO-OPERATIVE ENVIRONMENTS

Raffaello LEPRATTI[1]
Petra KOEPPEL[2]

Brandenburg University of Technology Cottbus
[1]Chair of Automation Technology
[2]Chair of Intercultural Studies
Cottbus, Germany
{lepratti; koeppel@tu-cottbus.de}

Abstract: Due to the process of internationalisation, markets become more dynamic and force companies to re-organise their structures as virtual co-operative environments. In order to successfully meet new market requirements and to stabilise leadership in competition, a lot of efforts to develop strategies and to set up tools in order to allow knowledge transfer and retrieval have to be made. In this paper, considerations are made on how to spend these efforts properly. Reasons of possible obstacles and synergies in co-operation that emerge from differences in humans' cultural and professional backgrounds will be pointed out. On the basis of the man-machine interaction via natural language, it will be exemplarily shown, how the use of ontology also contributes to the enhancement of virtual co-operation in these environments.

Keywords: Interdisciplinary Design, Knowledge Transfer, Natural Languages, Cultural Aspects of Automation, Manufacturing Systems, Man-Machine Interaction.

1. INTRODUCTION

In order to aim for a production model focusing on demand and customisation of final products, the internationalisation and expansion of markets forced companies to change from a mass producing industry to a knowledge-based customer- and service-oriented one, In this context, networked and agile manufacturing systems emerge as key elements to allow the companies a long-term improvement of competitiveness (Lepratti, *et al*., 2004).
In this transition, the Virtual Enterprise with its geographically spread single organisational entities, that means a form of Virtual Collaborative Environment (VCE), gains more and more importance, since it seems to be the right answer to these market challenges as mentioned, e.g., in (Kosanke, *et al.*, 2003).
As a consequence, the contexts of collaborative engineering and manufacturing have witnessed a striking expansion in all fields of the value-added chain. However, with a view to the successful establishment of co-operative environments, there are many inefficiencies and obstacles due to a variety of professional and cultural backgrounds of the staff involved (Goossenaerts, *et al*., 2002). They still represent the major problems as regards the achievement of a suitable and efficient infrastructure which ensures the leadership in competition and innovation of the company.

In many companies, especially on shop-floor level, knowledge is not currently captured in a structured and systematic way. An approach to standardise knowledge and information is still missing.

In the following two sections of this paper some general issues of intercultural and interdisciplinary co-operation in VCEs are taken into consideration. In section 4, reflections about subjectivity in human communication using a philosophical point of view are made to clarify how to deal with knowledge and to find a possible way for its computational processing. In order to validate these theoretical premises, a case of study that uses an ontology-based approach will be introduced in section 5.

2. INTERCULTURAL AND INTERDISCIPLINARY INFLUENCES IN VCE

Virtual enterprises co-operating in different locations across the world necessarily employ staff from different cultures. In this context, people are forced to communicate not only across language borders, but especially across cultural borders, which is often neglected in the setting-up of global companies. Members of a specific culture share the same orientation system that, mostly unconsciously, guides their cognition, emotions and behaviour, so that they are not aware of underlying values and basic assumptions. This orientation system applies to all spheres of human life and therefore influences organisations and companies by forming, e.g., an own management style as well as own patterns of communication and interaction (Smith and Tayeb, 1988). International success strongly relies on the skills to observe and handle cultural differences constructively, i. e. on the intercultural competence of the staff involved.
While intercultural co-operation implies the inter-action of people from more than two cultural backgrounds, interdisciplinary co-operation refers to the interaction of people who are different in professional backgrounds. According to these definitions, interdisciplinarity could be seen as a kind of intercultural co-operation, too.

Apart from language problems, cultural differences might result in misunderstandings and intercultural conflicts, if they were not recognised and managed well. There is often a lack of cultural awareness. Differences in both the leadership, the definition of team work, information flow and personal relationships are not recognised, and therefore the action of others is often misinterpreted and seen as inappropriate or even wrong, as it deviates from the own standard. Irritation or annoyance might result and lead to disturbed personal relationships (Stuedlein, 1997). Some culture-specific behavioural patterns do not fit, for example, the direct German speech and the face-concept of Chinese or Japanese which equates open criticism as a personal offence (Rothlauf, 1999).
Communication processes and the management of arising conflicts (complicated by different conflict styles of the cultures involved (Morris, *et al.*, 1998)) are time-consuming and a stress factor for the parties involved.

Most of the literature focuses on the process losses in intercultural co-operation, but indeed, there is some potential for intercultural synergies that might compensate the disadvantages and even result in increased effectivity (Koeppel, 2004).
Regarding the local environments of a VCE, the local staff can open up venues at their business partners or clients by speaking the same cultural language, - e. g. a born Taiwanese will always know better how to talk with authorities, business partners and clients compared to a German expatriate, who might not even speak Chinese. Besides, every member brings in his/her useful network for information gathering and decision making. To come back to the example mentioned before, the local Taiwanese might have personal contacts with one of the higher managers in the Taiwanese subsidiary, the German member, in contrast, is in best contact with the functional department in the German head-quarter. But the biggest advantage is the integration of international experts, who have got different perspectives and methods. This is, on the one hand, the best strategy against group think, and, on the other hand, the prerequisite for the development of new key solutions to ensure success in international competition (Ely and Thomas, 2001).
Members of one culture tend to be strong in certain behavioural areas. Thus roles emerge and tasks can be distributed according to individual and culture-specific skills (Schneider, 1993).

Virtual co-operation takes place both at the macro-level among different dispersed organisational entities and on the micro-level among managers and professionals working in a specific entity at the interfaces within the network. This implies a shift from a face-to-face form of co-operation to a virtual one, which forces the intense use of communication systems such as the Internet. On the macro-level, apart from the main reason of cost reductions by international development and production, in some branches like software development, asynchronous working hours ensure a much faster processing than ever possible at one location. The different locations are geographically close to the regional customers and can more easily absorb their needs.
Consequently, when taking intercultural synergies into account, the virtual co-operation environment becomes an advantage of particular importance with respect to the ever growing market competition by combining low cost locations with international expertise.

3. TEAM BUILDING IN VIRTUAL CO-OPERATION ENVIRONMENTS

As mentioned before, along with the recognition and identification of cultural differences, the initial lack of cultural awareness needs to be overcome as the first step in a VCE. A second step foresees the handling of these differences in a constructive and possibly synergetic way. Only if such differences are accepted and appreciated, so that a situation of mutual benefit (a win-win-relation) is established, the synergies mentioned earlier can arise (Di Stefano and Maznevski, 2000). On the other hand, if assimilation was forced onto one subgroup, this subgroup might refuse to do so, and segregation or even fights of power might be provoked (for forms of integration see Zeutschel, 1999).
Apart from the fostering of an appropriate attitude towards cultural diversity, it has to be acknowledged that the “storming phase” of a team - the time of learning about each other and creating a co-operation basis (Tuckman, 1965) - takes longer and absorbs more energy in an international team than in a culturally homogeneous one. This especially applies to virtual teams that do not often have the opportunity to meet each other *face-to-face*. This has

been an outstanding result of an investigation conducted by one of the authors. People always need to know each other personally before they can work together efficiently. They need to know the personality of the counterpart and his/her cultural background, in order to get an idea of his/her style of working and to be able to adopt own behaviour as well as to foresee the other's reaction to certain tasks and, above all, to learn about the other's competence. Only if people feel they can trust the other part, they have no inhibitions to actively step towards the other person, to give information, to speak freely about own ideas, to delegate issues or to accept and process demands of the other party. This list can be extended to almost any element of co-operation and enhances the importance of trust for a *win-win* situation resulting in group effectivity.

Hoping that replacing human personal by technical communication is a dead end, as it is always humans that operate the technical systems and therefore the problems persist. Apart from the question of trust, they have different perspectives as regards the time and the reason for the use of technical equipment. Thus the human factor again arises at this interface (Aneas, *et al.*, 2004). Communication systems, e.g., are used differently across cultures, so if a German employee on shop-floor required information by e-mail from his Polish counterpart he might expect a short, but direct reply with precise information. It can be easily drawn from this example that the Polish partner might have other ideas of replying adequately (which does not only refer to the content of the reply) and inferred that exchange by communication systems is just another human and therefore cultural interaction with both challenges and strengths.

Continuing with the example of handling communication systems, but now on the professional or age level, equivalent inferences can be made. Socialisation is more different for a blue-collar worker than for an academic, was different in the past than nowadays. Thus a highly educated engineer, recently recruited from university, has got another attitude towards the use and need of elaborated technical systems than an elderly blue-collar worker who might find it difficult to adapt him/herself to the ever faster change of technology.

As shown, personal contact cannot be substituted by telecommunication and has always to be organized in parallel to business trips, exchanges, common workshops, etc. and especially with some form of kick-off meeting at the very beginning.

4. PHILOSOPHICAL ISSUES IN NATURAL LANGUAGE COMMUNICATION

Central focuses of this section are considerations about a possible, shared model which shows how distributed knowledge can be collectively situated, aligned and restructured advantageously. As described in the sections before, such a model should enhance the exchange of knowledge by means of natural languages in an intercultural and interdisciplinary VCE

In order to follow this thesis, one should share the assumption of Winograd's theory (1980), which assumes that a natural language can be handled as a formal language.

But before starting to speak about natural language issues, an important distinction needs to be clarified. Any further discussion on knowledge transfer will remain too abstract as long as there is no reasonable distinction between *knowledge* and *information*. While the second one, bound to a material carrier, is a quantifiable, measurable concept which can be transported, transferred, stored, annihilated, the first one seems to be bound to a human carrier. It describes the result of humans' own cognitive acts (Kornwachs, 2000). However, different people are inclined to perceive and mentally process the same real world situations in different cognitive ways using already existing mental models which were derived from various own experiences. In this process, natural languages (NL) represent the most important form of communication to express the results of these human-bound cognitive acts - of course, both in a verbal or written way. Thus, the use of natural languages can be seen as a means of translation that allows quantifying abstract *knowledge* contents into *information*.

As already emphasised in sections 2 and 3, too many complications still evolve when trying to find a common denominator that allows both standardisation of mental models and *knowledge* contents across a scenario of homogeneous and heterogeneous cultures. But a reasonable way to do this consists in making research to develop tools that computationally process *information* expressed by natural language.

In international co-operation scenarios, English is generally used as lingua franca. However, this does not avoid misunderstandings. In fact, just like the human ways of thinking, e.g., cognitive perceiving and processing which cannot be standardised, also their ways of speaking, e.g., forms of expression cannot be formalised easily. While humans recognise and formulate sentences according to common rules of syntax, the terminologies used normally differ from each other as they are strictly connected to subjective mental models. Indeed, vocabulary terms represent merely one's own coined etiquettes of specific cognitive categories.

In general, also two co-operation partners speaking the same lingua franca and using a common terminology can misunderstand each other as they refer to different mental models (see Figure 1).

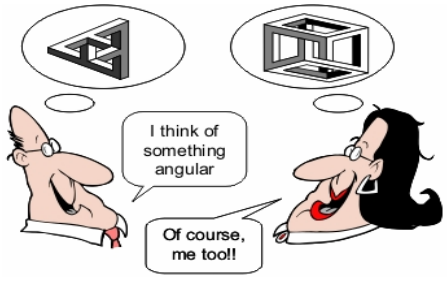

Fig. 1. Although speaking the same language with shared terminologies two interaction partners could misunderstand each other as there could be discrepancies in their mental models.

Chomsky's first argumentations on the possibilities of computationally processing natural languages represent the most important milestone in this field of research (Chomsky, 1965). Ever since, large efforts in parsing syntax structure of natural languages have been made. Significant steps have been accomplished and validated in various applications in the *Artificial Intelligence*. At present, a set of well-known tools (see e. g. www.cyc.com) allows NL text understanding with different degrees of syntactic and semantic complexity. Unfortunately, there is still no way, at least with the formal means available today, which allows driving human linguistic behaviour, i. e. to formalise used conceptual meanings.

In order to improve understanding, one needs to explain the meaning of *meaning*, i.e. the *theory of meaning*. The focus hereby lies on the linguistic meaning, e.g., the meaning that words, sentences, and other items of language have, as well as the meaning that human beings bear in mind in using these specific terminologies. Because *meaning* is highly ambiguous, it has lots of different senses.
This depends on how it is associated to the sense-making process, i.e. how humans consider all physical word objects and categorise them according to their form and the assumption of these terms as abstractions derived from sensory experiences.
Many areas of philosophy have been concerned with this topic, each one contributing to an own understanding of meaning and reference object.
Among the most relevant treatises the thesis of G. Frege (1969), R. Carnap (1947), W. V. O. Quine (1964) and L. Wittgenstein (1958) are of particular interest. All of them use a different terminology that is listed in table 1.

Table 1 Different terminology which is to be found in the philosophical works mentioned

Meaning	**reference**	**author**
Sense	*meaning*	G. Frege
Meaning	*denotation*	B. Russel & L. Wittgenstein
Intension	*extension*	R. Carnap
Meaning	*reference*	W. V. O. Quine

Gottlob Frege's *On Sense and Reference* (1892) is a philosophical essay, which deals with the question of how the sense or mode of presentation of a sign is related to the meaning or thought expressed by the sign. Frege defines a term as "any name, word, combination of words, or expression, which may be used to designate a specific physical object of the world" - in the following simply considered as *object*. "The *sense* of a term is understood to be part of its *meaning* that depends on its mode of presentation. The *meaning* of a term is to be distinguished from the object to which the term refers. The mode of presentation of a term and the mode of reference of the term to an object may correspond to each other, but the *sense* of a term may change without changing the identity of the object, to which the term refers. The identity of the object, to which a term refers, may be independent of the way, in which the sign is presented".

In other words, Frege points out that every object may be designated by many different terms, and those different terms, which designate in turn the same object, may have different meanings.
Frege also emphasises that the designation of any object by a particular term may be arbitrary, and that any name or expression may be arbitrarily chosen to designate a particular object. Terms are themselves objects, and thus may themselves be designated by other terms. The connection between a term and the object which it designates should not necessarily be explained by any quality of the object. According to Frege, the discovery that different terms should be used to designate the same object may, in some cases, allow to express additional *knowledge* of the object designated by these terms.
Thus, one can deduce that, in order to attain all additional and comprehensible *knowledge* about an object, it is necessary to discover and collect all possible terms which may be used to designate that object. However, these are two main complications that increase the difficulty of this task. On the one hand, terms could have different degrees of abstraction in their meaning (so-called *granularity*). Some words are more general in their form of expression, while others can have a very specific meaning. On the other hand, the existence of different levels of language competence, accents and dialects, further enlarge the spectrum of possible expressions used for the same object.

As a consequence of the considerations made in this section, one can affirm that a commitment at the level of mental models among partners operating within VCEs is only possible, if the heterogeneous cultural and professional backgrounds of the involved persons are taken into account under a linguistic point of view. This, of course, represents a necessary but not sufficient pre-requisite.
In order to capture and cover the major number of *knowledge* about an object, the importance to collect different terms and expressions that can be used as reference for that object in natural language communication has to be stressed as the most important factor for sharing mental models.
Thus, research efforts and development technology on information infrastructures are to be seen as ongoing, computational methodologies, addressing information architecture and advanced scenarios which permit a constraint or at least an approximation of the intended meaning of specific human-bound *knowledge* to a "standard", i.e. pre-defined and shared model.

At Brandenburg University of Technology Cottbus/Germany, a concept for such a model has been developed. The German automotive companies show an increasing interest in the development and setting-up of standard machining tools that allow shop-floor staff to complete programming tasks at different machines by means of own expressions of the natural language without having any special technical know-how. A prototype has been developed and exemplarily validated within an experimental environment in the Department of

Automation Technology. In the next section, a brief description of this research activity is given.

5. AN ONTOLOGY-BASED APPROACH FOR ENHANCING CO-OPERATION EFFECTIVITY

The ontology - a concept coined 1730 by the philosopher C. Wolff from the Aristotle's concept of *Metaphysic* (Ritter and Gruender, 1984) - has been taken into consideration, as it provides an objective description of a world scenario, in which objects have *a priori* determined roles and defined features as well as relationships among each other.
An increasing interest in the use of ontology is also due to the attention paid, above all, to *Artificial Intelligence* during the last decade. It offers an effective representation model which can be illustrated as a graph, where the world objects are hierarchically ordered in levels according to their degree of specification as well as to the object they refer to. They are symbolised by circle elements, and the relationships between them by arrows (Figure 2).

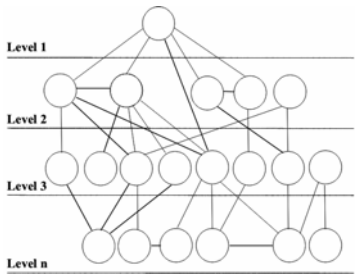

Fig. 2. An exemplary graphical representation of an ontological network as a net of terms (circles) and relationships (arrows).

This structure coupled with a set of complementary data like, e.g., object semantic categories, features or axioms as well as further restrictions could be easily employed to other domains of use, even for technical purposes. The use of ontology has proved to be suitable in supporting developments in areas like *knowledge management*, *information access*, *natural language processing*, *intelligent agents* or *knowledge basis* (see Fensel, 2004; Duineveld, *et al.*, 1999).
An adaptability of the ontology to each *domain of discourse* - i. e. application domain - is also possible. When considering, for instance, a natural language *L* with a specific vocabulary of terms *W*, one can rearrange the structure illustrated above by assigning elements of a further specific domain of use *L'* to symbols of *W*. Likewise, this structure also supports the purposes described here.

The ontology considered in this paper also includes the processing of natural languages, which in turn supports the knowledge exchange in virtual co-operative environments. By means of Fig. 2, the so-called *Ontological Network* (ON) is made up, a kind of semantic network which represents the core element of a developed prototype called the *Ontological Filtering System* (OFS). Conjoined with further information stored in a *Knowledge Base* such as semantic classes and relations of terms as well as axioms and restrictions concerning the particular domain of use, the ON provides the OFS with the necessary "knowledge" to process the semantic contents of natural language. The OFS prototype has been exemplarily tested on the basis of machining programming tasks.
On the one hand, the ON consists of the set of terms used as *key terms* with formalised meanings that ensure the standardisation of information contents for the processing of machine data. On the other hand, it foresees a set of *additional terms* which could be used by different people in their natural language communication.
According to the specification levels assigned, all terms - *key terms* as well as *additional terms* - are linked together in this network by means of semantic relationships such as *hypernymy*, *hyponymy*, *synonymy* and *antonymy*. The OFS main programme includes a parser that allows processing of semantic contents of natural language sentences. The terms used to make up these sentences are parsed in the ON. When found, their meanings are led back to the matched meanings of the pre-defined set of *key words*. Successively, on the basis of the semantic and syntax classes and rules as well as a library with machine-specific translation rules enclosed in the KB, programming instructions could be given and sent to the corresponding machines.
The advantage in the use of this prototype is given by the possibility to use natural language as a means of programming. Furthermore, it allows the use of a disparate terminology of the natural language. In this way every person -even without any special technical background - should be able to instruct machines to carry out more or less complex tasks. However, problems could arise if the terminology used was not embedded in the ON. In this case, a further developed tool should permit the enrichment of terminology in an easy manner. In the same way, also when two communication partners want to exchange *knowledge* as *information* contained in messages or documents, the meaning of sentences used from the first partner could be formalised and re-transformed into these meanings that should be understood by the second partner (Fig.3).

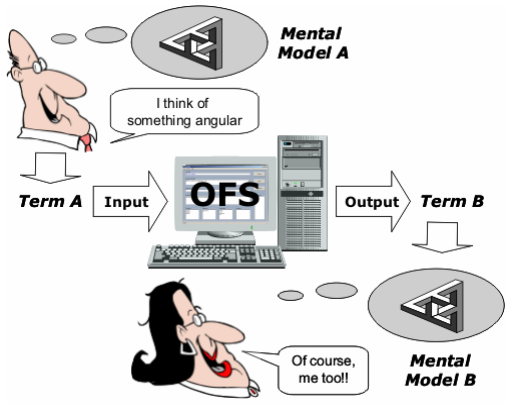

Fig. 3. Employing the ontology-based tool (OFS) for the knowledge exchange in VCEs.

As already emphasised, the process described pre-requires both the embedding of the specific terminologies used from both partners into the ON, and of specific syntax and semantic rules as well as

the commitment of the domain of discourse into the OFS Knowledge Base (KB).

5. CONCLUSIONS

At present, the OFS has been developed with two further tools which permit to adapt characteristics of the OFS at every time, when, e.g., a new domain of use or further application constraints is required. First tests have been carried out with an industrial robot (Berger, *et al.*, 2004) and in a PLC-based pilot plant (Lepratti and Berger, 2004) with satisfactory results. If provided with a systematic dynamic learning behaviour, the concept presented contributes to provide a first step towards a holistic solution to a knowledge-based manufacturing architecture that can support international companies in their transition process toward the *knowledge-based* company.

REFERENCES

Aneas, A., C. Cosgrove, A.S. Harper, A. Niesen, E. Reich and G.F. Simons (2004). *Tools for global virtual teams*. In: www.diversophy.com. Access: 01.06.2004.

Berger, U., R. Lepratti and H. Erbe (2004). Human-Robot Collaboration in Automated Manufacturing. In: *Proceedings of the IFAC-MIM 2004, October, Athens.*

Carnap, R. (1947). *Meaning and Necessity. A Study in Semantics and Modal Logic*. Chicago.

Chomsky, N. (1965). *Aspects of the Theory of Syntax*. Cambridge, Mass.

Di Stefano, J. J. and M.L. Maznevski (2000): Creating value with diverse teams in global management. In: *Organizational Dynamics,* **29 (1)**, pp. 45-63.

Duineveld, A. J., R. Stoter, M.R. Weiden, B. Kenepa, and V.R. Benjamins (1999). WonderTools?: A Comparative Study of Ontological Engineering Tools. In: *Proceedings of the 12th Workshop on Knowledge Acquisition, Modeling and Management* (KAW), Banff, Alberta, Canada, October 16-21.

Ely, R. J. and D.A. Thomas (2001). Cultural diversity at work: The effects of diversity perspectives on work group processes and outcomes. In: *Administrative Science Quarterly*, **46(2)**, pp. 229-273.

Fensel, D. (2004). *Ontologies: A Silver Bullet for Knowledge Management and Electronic Commerce.* Springer Verlag, Berlin-Heidelberg.

Frege, G. (1969). On Sense and Reference. In: *Funktion, Begriff, Bedeutung* (Frege, G. (ed.), re-print in G. Patzig (ed.), pp. 40-65. Goettingen.

Goossenaerts, J. B. M., E. Arai, K. Shirase, J.J. Mills and F. Kimura (2002). Enhancing Knowledge and Skill Chains in Manufacturing and Engineering. In: *Proc. of DIISM Working Conf.*

Hentze, J. and A. Kammel (1994). Erfolgsfaktoren im internationalen Management. Zur Bedeutung der interkulturellen Personalfuehrung in der multinationalen Unternehmung. In: *Die Unternehmung,* **48 (4)**, pp. 265-275.

Koeppel, P. (2004). Synergien in multikulturellen Arbeitsgruppen. In: *Interkulturelles Handeln in der Wirtschaft. Positionen – Perspektiven – Modelle* (Bolten, J. (ed.)), pp. 126-138. Sternenfels.

Kornwachs, K. (2000). Data – Information – Knowledge: A Trial of a Technological Enlightement. In: *Věda, Technika, Společnost, IX(XXII)/1,* pp. 5-27.

Kosanke, K., R. Jochem, J.G. Nell and A.O. Bas (2003). Enterprise Inter- and Intra-Organisational Integration. Building International Consensus. Proceedings of the ICEIMT03, *April 24-26, Valencia, Spain.*

Lepratti, R. and U. Berger (2004). Enhancing Interoperability through the Ontological Filtering System. In: *Proceedings of the 5th IFIP Working Conference in Virtual Enterprises, Toulose, France, August 23-26* (Camarinha-Matos, L. M. and H. Afsarmanesh (eds.)), pp. 183-190. Kluwert, Boston-London.

Lepratti, R., C. Jing, U. Berger and M. Weyrich (2004). Towards the knowledge-based Enterprise. In: *Proc. of the Intern. Conference on Enterprise Integration and Modelling Technology, Toronto, Canada, 9-11 October*.

Morris, M.W., K.Y. Williams, K. Leung, R. Larrick, M.T. Mendoza, D. Bhatnagar, M. Kondo, J.-L. Luo and J.-C. Hu (1998). Conflict management style: Accounting for cross-national differences. In: *Journal of International Business Studies*, **29 (4)**, pp. 729-748.

Quine, W. V. O. (1964). *World and Object*. Cambridge Mass.

Ritter, J. and K. Gruender, (1984): *Historisches Woerterbuch der Philosophie*. Schwabe & Co. AG Verlag, Basel-Stuttgart, 1984.

Rothlauf, J. (1999). *Interkulturelles Management. Mit Beispielen aus Vietnam, China, Japan, Russland und Saudi-Arabien.* München.

Schneider, A. (1993). Synergiepotentiale in interkulturellen Projektteams. In: *Synergie-management. Komplexität beherrschen - Verbundvorteile erzielen* (Hirzel, Leder & Partner (ed.)), pp. 217-230. Wiesbaden.

Smith, P. B and M. Tayeb (1988). Organizational Structure and Processes. In: *The Cross-Cultural Challenge to Social Psychology* (Bond, M.H. (ed.)), pp. 151-164. Newbury Park.

Stuedlein, Y. (1997). *Management von Kulturunterschieden: Phasenkonzept fuer internationale strategische Allianzen*, Wiesbaden.

Tuckman, B. W. (1965). Developmental sequences in small groups. In: *Psychological Bulletin,* 63 (6), pp. 384-399.

Winograd, T. (1980): What does it mean to understand language?. In: *Cognitive Science* **4**, 1980, pp. 209-241.

Wittgenstein, L. (1958). *Philosophische Untersuchungen* (Anscombe G. E. M. and R. Rhees (eds.)), Oxford.

Zeutschel, U. (1999). Interkulturelle Synergie auf dem Weg: Erkenntnisse aus deutsch / U.S.-amerikanischen Problemloesegruppen. In: *Gruppendynamik,* **30 (2)**, pp. 131-159.