

Erik STUBKJÆR

# COMMUNICATION IN CARTOGRAPHY, AND IN INFORMATION SYSTEMS DEVELOPMENT – A PLEA FOR A LINGUISTIC MODEL OF COMMUNICATION

Stubkjær Erik: **Communication in Cartography, and in Information Systems Development – A Plea for a Linguistic Model of Communication.** Kartografické listy, 1999, 7, fig. 1, 34 refs.

**Abstract:** Cartography as an academic discipline is influenced by new technology. Communication is a basic issue in cartography as well as in information systems development. A linguistic model of communication is presented and discussed relative to other communication models, and in relation to information systems development. Implications for academic teaching are stated.

**Keywords:** Communication, information systems, development, learning, linguistics, theory.

## 1. Introduction

### 1.1 The context

Cartography as an academic discipline seems to be located among the other academic disciplines in two patterns: One within geography in faculties of liberal arts, and with remote sensing as a neighboring discipline; the other with geodesy, photogrammetry, and cadastre as neighboring disciplines within faculties of civil engineering. The present author comes from the latter tradition, which may count for a possible bias of the paper. As he is not a cartographer it may be useful to chart the context of the paper explicitly.

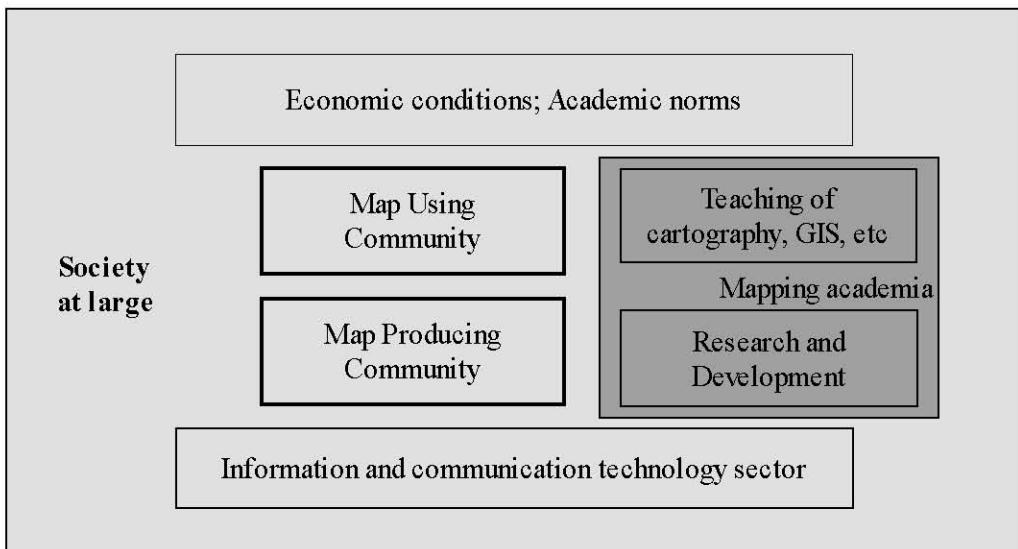


Fig. 1 A model of the cartographic community within society

A model of the cartographic community within the society at large, cf. Fig. 1, describes the context of the paper. The model is a modification of (Dahlberg, 1988, Fig. 1).

The elements of the model are related through several flows: The society at large, and more specifically the map production and map using communities put demands, and provide resources to academia. The resources include persons with teaching needs. Academia responds with graduates, and with knowledge in terms of research reports, consultancies, etc.

Besides the flow of resources and persons the elements of the model are related by information flows: The map production community provides the map using community with maps. The maps may be transmitted through several media: For example, maps for weather reports are transmitted through television, maps on battle fields and vacation sites are transmitted through newspapers, and maps for spatial planning and cadastral update are transmitted through documents according to legal prescripts. The map production community may collect data for maps by themselves, but data for maps could as well be transmitted from statistical and other bodies of the society at large.

The mentioned map information flows depend on products and methods from the Information and communication technology (ICT) sector. Generally, ICT affects the mapping communities, and mapping academia, but a few research departments provide software and methods for the ICT sector. Change of ICT demands a corresponding modification of study programs. ICT may provide a potential for improving teaching, and surely provides a means for new teaching methods, e.g. distant education.

Finally, the mapping sector, that is the mapping communities and mapping academia taken together, depend on economic conditions, and on scientific norms. The economic conditions include that in the 1980s and 1990s the dominant belief is that market forces will improve the economy. As one consequence, the governmental funding of universities is to an increasing degree supplemented by funds for research through networking with industry, e.g. map production bodies, rather than by relying on governmental financing.

'Academic norms' regards quality criteria for academic efforts. Among academic efforts are the improvements of university study programs. In (Dahlberg, 1988) the following issues are raised to improve education:

- Stronger orientation to user communities
- Linkages at other disciplines, and
- Program maintenance (that is: maintenance of computer equipment and software, as well as program content)

Other issues are mentioned by (Cauvin, 1996) who states the need to combine research and lectures so that the study program take innovations in cartography into account. The importance of teaching theoretical cartography is underlined.

'Academic norms' does thus not imply a general academic consensus. Some staff agrees with industry that graduates should master the main products of computer vendors, while other stresses the teaching of principles. Some strive for an honest search for truth through argumentation, while others substitutes debate by the clash of actions in the political field, e.g. through acquiring for research funds (cf. Ivanov, 1996: 102-5, note 8).

## 1.2 Motivation

The present paper is written as part of an ongoing effort of making explicit theory and methods for cadastral and neighboring disciplines (Stubkjær, 1996). While in the discipline of geodesy the formal aspects ('the formulas', the explanatory theories) are clearly distinguished from empirical evidence (the measurements) this can not be said of cadastral teaching which largely depend on specific prescripts of national origin.

In the history of science the ideal of a formalized science developed early in this century, as indicated by the names Hertz, Hilbert, Frege, and Carnap. After the 1960s doubts have been raised about this project (Encyclopedia Britannica, 19..). For the present purpose, however, it is not claimed that the entire content of a science can be captured in a

propositional system. It is assumed, however, that good theory is useful, and not only in a utilitarian sense. "The practical question and making holistic sense are the same" (Ivanov, 1996: 109). Consequently, it is considered useful to relate research results to conceptual structures with a view to accumulate theoretical knowledge (without denying the existence of tacit knowledge).

To illustrate the present approach reference is made to the application of communication theory for teaching purposes. The teaching of map lexicons and thematic map syntax raised map comprehension levels dramatically, according to reports on controlled experimental situations (Head, 1991: 259 with reference to Head & Elgood, 1988; Saku, 1990)

The search for explicit theory and methods for cadastral and neighboring disciplines has to extend beyond the traditional professional boundaries and include information technology. Cartography and cadastral issues are both heavily influenced by technology, - because the printing, recording and measurement technologies have during the last decades to a large extent been integrated into the computer technology. The economic potential and consequences of the computer technology has attracted intellectual resources to this new field. Early efforts were techno-centric and largely restricted to the traditional engineering disciplines. During the 1980s human and organizational aspects were included (e.g. Bjørn-Andersen et al, 1986; Eason, 1988), and in the 1990s wider social and philosophical issues were addressed (Floyd et al, 1992; Dahlbom & Matthiassen, 1993; Hirschheim et al, 1995).

The cartographic communication concept was among the dominant issues from the 1970s and early 80s. It nurtured a systems view of the cartographic enterprise and led to a more explicit recognition of map users and the importance of their contributions to the cartographic process (Dahlberg, 1988: 189). The communication concept frequently was based on the mathematical communication model of Shannon and Weaver, and the cartographic model by Kolacny, and often included a discussion of map reading, compared to the reading of texts. A survey on investigations of the interrelationships between maps and texts can be found in (Head, 1991) and (Varanka, 1991).

Recently Shannon's model has gained a renewed interest (Bjørke, 1992; Lindholm & Sarjakoski, 1992; Bjørke, 1996; Sester et al, 1998), but discussion of cartographic communication from a linguistic point of view has been scattered. The communication model of the linguist Roman Jakobson was referred to by (Schlichtmann, 1991), and in (Stubkjær, 1990) the communication model of Roman Jakobson (RJ) was applied as a means for structuring measures of data quality. The communication model of RJ includes an interesting interpretation of the concept 'code'. Stubkjær (1994) develops on this concept, and relates it to 'sublanguage', which was used by Lyutyy in cartography, and to the concept of sublanguage in linguistics. Stubkjær (1995) describes the RJ model in the context of theory development. A recent search of literature revealed (Gershmehl, 1992?) and (Saint-Martin, 1990) who according to the book title treat linguistic issues.

### **1.3 The structure of the paper**

The communication model of the linguist Roman Jakobson (Jakobson, 1958) is presented briefly, and the essential concept of 'code' is discussed (section 2). Next Jakobson's model is related to one of the more comprehensive efforts within information systems development (section 3), which leads to a discussion of the relation between theory and learning (section 4). A conclusion closes the paper.

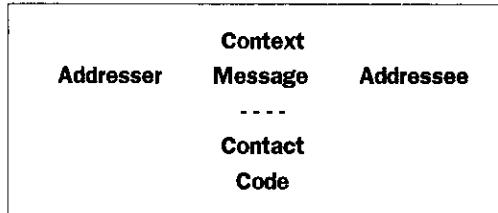
## **2. Communication models, and the concept of 'code'**

### **2.1 The communication model of Roman Jakobson**

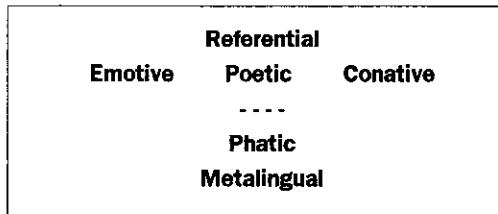
Jakobson's model is a double one. He starts by modeling the constitutive factors in an act of communication. These are the six factors that must be present to make communication possible. He then models the functions that this act of communication performs for each factor.

The basic line of thought is thus the same as the well-known communication model by Shannon: An 'addresser' sends a 'message' to an 'addressee'. Jakobson recognizes, however, that the 'message' has to refer to something other than itself. This he calls the 'context'. The 'message' has to be transmitted from 'addresser' to 'addressee'. This he calls the 'contact', by which he means the physical channel as well as the psychological connections between 'addresser' and 'addressee'. The final factor is the 'code', a shared meaning system by which the message is structured. In computer science 'code' has a rather narrow meaning, referring to code tables and binary figures. Here 'code' is used in a broader, linguistic sense.

The constitutive elements of the model are visualized by Jakobson as follows:



This scheme serves as a structuring principle for six functions of communication. Each of these functions is related to one of the six constitutive elements:



For a full treatment of these functions the reader is referred to (Jakobson, 1960) or (Fiske, 1982). The core of Jakobson's communication theory is that the six constitutive elements are necessary and sufficient for the performance of a communication.

The Referential function refers to the reality orientation of the message. If the 'message' is a topographic map then the referential function of the message is to convey information on the landscape that is depicted on the map. This function is of top priority in objective, factual communication, like the communication of geographic data, or the application for a building permit.

Jakobson's point is that the six different functions are all present in communication. A love letter has a referential function too, but the priority function is the Emotive function: The potential of the communication to convey the addresser's emotions to the addressee. The effect of the message on the Addressee is in Jakobson's concept set the Conative function: The Conative function is dominant in, for example, a prescript as it intends to affect the behavior of the addressee.

The Metalingual function is that of identifying the code being used for communication. A map frequently includes a legend. If such a map is considered a 'message' then the legend is the part of the 'message', which serves the most important metalingual function. The title and other information in the map on its purpose may also convey information to the 'addressee' on how the map ought to be interpreted.

The main difference of Shannon's and Jakobson's models should be noted: Jakobson's model allows for linguistic analysis of 'open', ambiguous texts as well as computer source code, whereas Shannon's model is restricted to communication expressed through a closed alphabet.

Difficulties in understanding, in the conveying of meaning, may be caused by 'noise', but Jakobson's model, especially the 'code' concept, allows for a fuller treatment of these difficulties.

culties. Shannon's and Jakobson's models have essential elements in common: sender, message, channel, and receiver, although the denotation of these elements is different. For example, Jakobson's 'contact' is not only a physical device, but also a psychological connection between addresser and addressee.

## 2.2 The concept of code

The key problem of communication is to transfer meaning from 'addresser' to 'addressee'. The 'code' concept is important because it deals with the meaning of the message. In the context of the computer a 'code' is a one-to-one relationship between a sign and its coded representation by a bit combination, say the ASCII code. The number of signs is finite, so the alphabet is closed. Shannon's mathematical theory of communication is based on such closed alphabets. Roman Jakobson uses, however, an open, linguistic denotation of the concept: A code is a system of meaning common to the members of a culture, or a community within a culture, like the community of cartographers or land surveyors. The 'code' consists of both signs and rules or conventions for their combination. The 'sign' is a physical, sensuous entity that stands for something other than itself. A sign can be marks on paper, or pulling ones earlobe. The sign depends upon recognition by its users that it is a sign. The conventions, i.e. the code, determine what the sign refers to, how and in what contexts these signs are used, and how they can be combined to form more complex messages (cf. Fiske, 1982: 20). To emphasize the problem of transferring meaning from addresser to addressee the 'code' might alternatively be illustrated as the intersection of the different codes of the 'addresser' and the 'addressee'.

## 2.3 Comparison with earlier communication models

The main difference between Shannon's mathematical model of communication and Jakobson's model has been mentioned above. Roman Jakobson's model has much in common with Kolacny's diagram (Kolacny, 1968; Robinson & Petchenik, 1976:28+, Ogrissek, 1988): The 'reality' of the cartographer and of the map user corresponds to Roman Jakobson's 'context'. 'Map' relates to 'channel', the paper base of the map, and to 'message', the configuration of the map or the map face. Kolacny's 'cartographic language', i.e. a system of map symbols and rules for their use, corresponds to Jakobson's 'code', i.e. a shared meaning system.

Kolacny's diagram could be simplified by removing the double occurrence of the L-box: the cartographic language, from the diagram and placing only one L-box in the diagram, say in the way Jakobson does it. You may well argue that the cartographer and the map user only to a certain extent have a common language or code. This point seems not developed by Kolacny or his followers, even if his diagram suggests it. On the contrary, Kolacny expects that the map will create "in the mind of the peripient ... the conception held by the cartographer" (stage 6 of the communication process, cf. Robinson & Petchenik, 1976:30).

Freshmen's struggle with textbooks testifies that the conception of reality of the author of a demanding textbook is not at all easily transmitted to the reader. The author of this paper was concerned with this problem in the early 1980s, and looked for relevant linguistic methods and techniques for reading comprehension. Jakobson's communication model was the outcome of this search.

It was obvious to develop Jakobson's model with regard to the 'code' concept in the context of education of freshmen. By emphasizing the commonness as well as the difference between the code of the 'addresser' and the 'addressee' you make it visible to the students, why they had problems: Their code was different from the code of the author, especially at the beginning of reading the textbook. The solution of their problem (in principle at least) was to use the common code to grasp the yet incomprehensible parts of the text. The technique developed was re-reading (Stubkjær, 1986:150+, 278-280).

Illustrating communication by means of overlapping codes of the addresser and the addressee have certain qualities relative to Kolacny's partly overlapping 'cartographer's reality', and 'map user's reality'. Both illustrations express the fact that the same reality

is differently perceived. Jakobson's 'code', however, allows us to explain why it is so: It is not because there are two 'realities', but because of the two partly different codes of the cartographer and the map user.

## 2.4 Formalization, or prespecification

Formalization is a means of achieving efficiency. Our society has grown formalized through the use of technology, and our concepts are greatly influenced by this formalization process. The purpose of standardization efforts is to reduce uncertainty in communication by defining concepts and terms. According to John Fiske an 'arbitrary code' is made up of signs and supersigns, with stated and agreed relationship between the sign, the signified concept, and the object to which it refers. When such 'arbitrary codes' have been defined, the meaning of a message is not a matter of interpretation. The meaning is expressed in the message, and all that is required is to learn the code. Science, conceived as the objective, impersonal, universal study of natural phenomena, attempts to communicate its findings in arbitrary codes (Fiske, 1982:85).

When the signs and the concepts are not analyzed or standardized, you have the common code of a culture. These conventional codes are open-ended. This open structure allows for change, for growing, and for vanishing from use; it allows for playing with words, for connotations, and for hidden meanings that are first revealed after the reader's interpretation of the message.

## 3. The issue of communication in information systems development

Information systems development (ISD) is here conceived of as the analysis, design, construction, and implementation of information systems (Hirschheim et al, 1996). (Hirschheim et al, 1996) refers to several perspectives from which ISD can be addressed, and mentions that organizational implementation has been examined as technical implementation, functionalist planned change, political theories, action learning, Marxist economic theory, and institutional economics. Several authors have addressed such wider social and philosophical issues (Floyd et al, 1992; Dahlbom & Matthiassen, 1993; Hirschheim et al, 1995; Hirschheim et al, 1996). The following is based only on (Hirschheim et al, 1996), quoted as HKL, and only as far as language and communication is directly concerned. More general comments to the article by HKL can be found in the Special Issue: Research on Systems Development - Position and critiques (*Accounting, Management and Information Technologies*, Vol. 6, No 1/2).

In order to clarify the interrelation of different perspectives, and to structure the information systems field HKL establish a 'federated framework' based on a reading of Habermas' Theory of communicative action (1984, 1987), and of Etzioni's The active society (1968). From Etzioni HKL derive three 'domains of change', namely technology, language, and organization. From Habermas they derive four 'orientations' of mind sets of participants of ISD.

The three domains and the four orientations span out an array, the federated framework. No attempt is being made here to comment on the framework as such. Among the three domains only their treatment of language is referred to below. The four orientations: Instrumental orientation, strategic orientation, communicative orientation, and discursive orientation are presented and discussed next, again only as far as the orientations regard language.

### 3.1 Language as a 'domain of change'

Language is conceived as "any form of symbolic representation .. that conveys meaning". This includes ordinary conversations, but also "the sign systems of conventional data processing". The messages of conventional data processing "are more rigorously prespecified than in natural language." HKL notes "that some form of 'protocol' also exists for natural language. Besides grammar and usage conventions the contents of messages might be restricted as most evident in diplomacy. Organizations and professions tend to develop their own professional languages with acronyms and specially coined ter-

minology. This requires the definition of special sign systems in which messages can be presented." HKL finally note that through ISD the structure, content, and intentions of messages in an organizational setting become more prespecified (Hirschheim et al, 1996: 16).

HKL thus conceives utterances of ordinary conversations, statements made in professional languages, and forms, etc of computer systems as variations of the same concept, message, within the same discipline of linguistics. This agrees with the position presented above in the context of communication models. The term 'sublanguage' has been coined to address the study of language use by an identifiable social group within a restricted domain. (Stubkjær, 1994) relates communication codes to the concept of sublanguage in linguistics. The sublanguage concept has been introduced in information systems development by (Liddy, 1993).

It should be noted that the prespecification of communication did not originate from ISD, as bureaucracies - and specifically taxation and accounting systems - rely on pre-specified forms, and paradigms for messages.

### **3.2 The four orientations of mind sets**

The four orientations that follow Habermas' action types were: Instrumental orientation, strategic orientation, communicative orientation, and discursive orientation. They are described by HKL as follows:

- a) Instrumental orientation is concerned with the achieving of given ends, treating everything in the domain as controllable objects
- b) Strategic orientation is concerned with achieving given ends, treating humans in the domain as independent, conscious agents with a will of their own
- c) Communicative orientation is concerned with achieving a common understanding, and
- d) Discursive orientation is concerned with the achieving of clarification and justification of claims by providing reasons and evidence

It is evident that (a) is different from (b), (c) and (d), because in (a) humans are treated as objects, while for the latter three a kind of human communication takes place. A system development method of orientation (b) takes into account that humans can react against efforts to achieve the stated ends. The Communicative orientation (c) put emphasis on sense making. "Sense-making is an emergent process that transcends literal meaning" (: 12). A family conversation to seek a consensus on how to spend their vacation is provided as an example of (c). The Communicative orientation breaks down if a member of the conversation disagrees openly or otherwise cannot follow what was said. Asking other to justify their view or background knowledge brings in the Discursive orientation (d).

The mentioned orientations are not considered mutually exclusive by HKL, rather the same situation can be analyzed or 'read' from the different orientation point of view. The orientations are further described with reference to the three domains of change. These developments are included in the following as appropriate.

### **3.3 Discussion of similarity with Roman Jakobson's communication model**

The position is taken that the approach by Roman Jakobson (RJ) to the study of communication has merits for the purpose of analyzing system development methods, compared to the presented reading of Habermas. RJ's approach is simpler, and counts for a substantial part of the issues addressed by the reading of Habermas.

RJ's Referential function of communication corresponds to the Instrumental orientation (a) in that the domain concerned is formalized, predictable and 'quiet'. RJ's Conative function corresponds to the Strategic orientation (b) in that an effect is intended on the addressee, who is able to react. RJ's Metalingual function relates to the Communicative orientation (c) so far the issue is literal meaning, "agree[ment] on the interpretation of representations" (: 18), or "extension of communicative space" (: 28). This does not cover the essence of the Communicative orientation which may be interpreted as a specific de-

cision process (consensus seeking 'palaver', cf. HKL's Consensual Communication Development strategy, Fig. 5 and p. 35f). Decision processes could, whether they are consensual or based on 'rational' description and evaluation of alternatives, better be related to other cells of HKL's federated framework where organizational issues are dealt with. Furthermore, in HKL's reading the mutual agreement by a gang to blow up a kindergarten is (locally) as sense-making as the mentioned family conversation, and this level of terminological precision makes it difficult to see the relevance of the orientation (c) within the language domain of change.

The Discursive orientation (d) regards the analysis of communication strategies, rather than analysis of the basic elements and functions of communication. The mastering of communication strategies is needed for expression and understanding, and may thus be conceived - like vocabulary/lexis and grammar - as part of the RJ conception of code. RJ's model thus provides for a basis for understanding Discursive orientation (d), but is not claimed to cover the Discursive orientation.

In the context of Discursive orientation HKL mentions the need for warrants for the correctness of data in reports (: 21). This concern is now to an increasing degree addressed by adding 'metadata' to the data of a report or a database, that is data on the meaning, origin and quality of the recorded data. This issue could also have been treated in the context of the meaning aspect of (c) Communicative orientation.

The following develops on the comparison outline above by commenting on statements by HKL on language issues.

HKL relate the Instrumental orientation to Shannon and Weaver's communication theory, "the principle theoretical basis for analyzing this object system class" (: 19). They note that the mathematical theory of communication does not include the consideration of meanings, and therefor draw upon abstract logical theories and Tarskian truth-theory.

The grave problem with this approach is, however, that data processing must be treated as well defined inference rules. Alternatively, the RJ approach does provide for meaning, and the code concept allows for a variable degree of formalization and consistency. HKL refer (: 41) to an approach by (Goldkuhl & Lyttinen, 1982, 1984) who view the specification of code systems of information systems in a way which may be close to RJ's code concept.

HKL discuss formalized, compact codes versus codes, which are easier for the user to understand, but requires more computer resources (: 18). The RJ concept of code provides for a slot to record these kind of considerations, which could take place under several considerations (Instrumental: Tradeoff between human and computer costs; Strategic: User friendly codes introduced due to user pressure; Communicative, the only one mentioned by HKL: Emphasis on intentions and meanings).

Manipulative communication design is the development strategy that applies for the Strategic orientation (b) and the change domain of language. HKL find that the basic theoretic foundation of this field is found in political science and transaction cost theory (: 32-33), that is they find the basis outside linguistics. The relevance for language lies in the fact that ISD affects the terminology and 'organizational reality'. "Hence ISD provides an arena for a struggle over the meaning of terms and their correct uses." (: 33).

Consensual communication development is the strategy that applies for the Communicative orientation (c) and the change domain of language. Symbolic interactionism, hermeneutics, phenomenology, and other philosophical references are mentioned as theoretical foundations. This appears to be beyond the scope of the present paper.

Rational argumentation design is the strategy that applies for the orientation of argumentation (d). It is mentioned that through ISD "it may be possible to construct formal messages that eliminate unintentional ambiguity and are better to capture the meanings of professional languages than natural language" (: 41). This is an important issue to pursue, but the ISD approach, e.g. in terms of object oriented modeling, may benefit from parallel approaches within (computational) linguistics, and research within the individual professional branches.

Summing up it can be stated that Roman Jakobson's approach, especially the concept of code, does provide for a relevant and consistent contribution to information systems development (ISD) research, as reviewed by HKL. This supports the claim that the communication issue deserves attention in the fields of cartography, cadastre, and neighboring disciplines, as they are very much influenced by ISD.

The wide framework of HKL has been investigated from the point of view of language. The four orientations based on reading of Habermas seem from this point of view not to be an obvious structuring principle. The federated framework of HKL does, however, call attention to the important issue of the Discursive orientation (d), communication repair, etc. Such issues are addressed within linguistics, as indicated by the following short introduction.

### **3.4 Communication strategies**

The term communication strategies refer to mental plans, which are implemented as response to inadequate means for achieving a particular communicative goal (cf. Kasper & Kellerman, 1997). The research context has been the acquisition of the second language, but it is argued that non-native speakers' communication strategies are just special cases of a wider class of strategic behaviors that characterize all language activity (: 15). Furthermore, it is discussed whether the plans have to be shared between the communication partners, or the plans are applied for individual speech production.

The communication strategies can be classified as reduction strategies, and achievement strategies, respectively (: 18f). Reduction strategies are associated with avoiding, changing or abandoning a communicative goal. Achievement strategies, also called compensatory strategies, are characterized by the use of alternative communicative resources, e.g. approximation by means of 'neighboring' terms, circumlocution by means of examples and explication, and word coinage. Compensatory strategies can either use a substitute for the referent (holistic), or describe properties of the referent (analytic). Examples of shared communicative strategies are mime, gesture, and the appeal for assistance.

This taste indicates research that could be included within Discursive orientation (d), communication repair, etc. HKL's Discursive orientation includes inquiries into basic beliefs, norms, and values; these aspects are not explicitly addressed by the above mentioned. The reference above points, however, to a field that is also briefly mentioned by HKL (e.g. by reference to Hikkila (1995)), namely learning.

## **4. Theory and learning**

As mentioned above, the research field of communication strategies takes its point of departure in second language learning. Returning to cartography it is a surprising coincidence to note that C. Grant Head, in the context of language learning, makes a distinction between learning the mother tongue, and learning the second language. "Mapping as seen here has enough similarities with human language to be teachable as a second language" (Head, 1991: 259).

It remains to be investigated whether research in second language learning can support learning the language of maps (cf. Gershmehl, 1992). This way of reasoning is in line with C. Gauvin who find it "impossible to separate lecture content from research" (Gauvin, 1996: 27).

Research findings can be collected, organized, and presented to students in several ways, one being the comprehensive textbook. The subject matter of textbooks can again be organized according to diverse principles: One is to make implicit reference to theory, and provide sparing reference to research. 'Map use - Reading, Analysis, and Interpretation' by (Muehrcke & Muehrcke, 1992) is an example of that. The textbook is intended for college freshman level, and it includes sections on 'Map Communication' and 'Mental maps', yet without explicit reference to communication models and the code concept. The graphic elements of a map are presented (p. 89 and p. 139) in a way which is integrated into the authors' organization of the subject matter, and without reference to Bertin's

original presentation (reference to Bertin is provided at the end of one of the sections concerned, p. 147).

The statements above are meant as observations. It is surely supporting the pace of learning that the material presented is as familiar to the learners as possible. This way of presenting research outcome is in accord with R. Gerber who states as a 'fundamental position' that children and maps should not be removed from the context in which they are operating. However, Gerber find it "very important for map designers to refer back to the guidance offered by cartographic theorists such as Bertin (1981, 1983), Dent (1985), and Keates (1989) on map design, ..." (Gerber, 1993: 157).

Gerber is not specific how explicit the reference to theorists should be. Even the presentation by Gauvin of a theoretically based teaching of cartography is silent as far as theory development is concerned (Gauvin, 1996). An indication appears from the fact that a communication diagram with the well known entities: Author, Map, Reader, etc is presented with reference to a work from the field of mass communication, namely H. Lasswell, 1966. Alternatively, the original works by Shannon, Kolacny, and others could have been referred to.

The present author holds (as an academic norm, you may say) that academic studies should include reference to the history of science within one's own discipline. This is motivated by the wish to acknowledge our dependence of those researchers who influenced the present problem conceptions, and to have a resort for reflecting the present day problems.

## 5. Conclusion

Roman Jakobson's linguistic model of communication was presented. Reasons were stated that communication theory is a consistent, unifying element of academic teaching in cartography, cadastre, and neighboring disciplines. The reasoning was based on a thorough discussion with one of the major surveys of research in information systems development. Finally, the role of theory in academic teaching was assessed.

## References

Andrews, J.H. (1990). Map and Language - A Metaphor extended. *Cartographica*, 27, (1) 1-19.

Bjørke, Jan Terje (1992). Towards a formal basis for cartographic generalization. In: Bjørke, J.T. (Ed.) *Neste generation GIS*. Institutt for Kart og Oppmåling, Norges Tekniske Høgskole, 7034 Trondheim, 101-109.

Bjørke, Jan Terje (1996). Framework for Entropy-based Map Evaluation. *Cartography and Geographic Information Systems*, Vol. 23/2, 78-95.

Cauvin, Colette (1996). In favour of teaching theory in cartography - Suggestions for an academic program. *Cartographica*, Vol. 33, # 3 (Fall), 21- 8.

Dahlberg, Richard E. (1988). Reformation of Conceptual Models for Teaching Cartography. *International Yearbook of Cartography*, Vol. 28, 187-201.

Dahlbom, B. & Mathiassen, L. (1993). *Computers in context - The philosophy and practice of system design*. Oxford, Blackwell Scientific.

Eason, Ken (1988). *Information technology and organisational change*. London, Taylor & Francis. 247 p.

Floyd, C., Zullinghoven, H., Budde, R. & Keil-Slawik, R. (Eds) (1992). *Software development and reality construction*. Berlin, Springer Verlag.

Fiske, J. (1986). *Introduction to communication studies*. Methuen, London, 1982, reprinted 1986. 174 p.

Frank, Andrew U. & Mark, David M. (Eds) (1991). *Cognitive and Linguistic Aspects of Geographic Space*. NATO ASI Series D, Vol. 63. Dordrecht, NL, Kluwer Academic. 519 p.

Gerber, R. (1993). Map Design for Children. *The Cartographic Journal*, Vol. 30/2, (December) 154-158.

Gershmehl (1992?). The language of maps. [Cited in *Cartographica* (1996) Vol. 33, No. 3 (Fall) p. 10].

Head, C. Grant & Elgood, Richard (1988). Impacts of Teaching on Cartographic Language Acquisition: Applying the Linguistic Paradigm to the Process of Map Use. *Report on the First North*

American Working Seminar on the Concepts of Cartographic Language. Typescript. Wilfrid Laurier University, Waterloo, Canada. 16 p.

Head, C. Grant (1991). *Mapping as a Language or Semiotic System: Review and Comment*. Pp. 237-262 in: Frank & Mark, 1991.

Heikkila, J. (1995). *The diffusion of learning intensive technology in organizations - The case of PC technology*. PhD diss. Dept. of Computer Science, University of Tampere.

Hirschheim, Rudy, Klein, Heinz K. & Lyttinen, Kalle (1995). *Information systems development and data modeling - Conceptual and philosophical foundations*. Cambridge University Press. 289 p.

Hirschheim, Rudy, Klein, Heinz K & Lyttinen, Kalle (1996). Exploring the intellectual structures of information systems development - A social action theoretic analysis. *Accounting, Management and Information Technologies*, Vol. 6, No. 1/2, 1-64.

Ivanov, Kristo (1996). Presuppositions in Information Systems Design - From Systems to Networks and Contexts. *Accounting, Management and Information Technologies*, Vol. 6, No. 1/2, 99-113.

Jakobson, Roman (1960). Closing statement - Linguistic and poetics. In: Seboek, T. (Ed): *Style and language*. MIT press, Cambridge, Mass.

Kasper, Gabrielle & Kellerman, Eric (Eds) (1997). *Communication Strategies - Psycholinguistic and Sociolinguistic Perspectives*. London, Longman. 398 p.

Liddy, et al. (1993). A sublanguage approach to natural language processing Information. *Processing & Management*, 29 (5), 633.

Lindholm, Mikko & Tapani Sarjakoski (1992). User models and information theory in the design of a query interface for GIS. In: Frank, A. et al. (Eds). *Theories and methods of Spatio-temporal reasoning in geographic space. Lecture Notes in Computer Science*, Springer-Verlag, Berlin. Vol. 639, 328-347.

Muehrcke, Phillip C. & Muehrcke, Juliana O. (1992). *Map Use - Reading, Analysis, and Interpretation*. Madison, WI, JP Publications. 631 p. (1st edition 1978).

Saint-Martin, F. (1990). *Semiotics of visual language*. Bloomington, IN, University Press.

Saku, James (1990). *The Impact of Teaching Cartographic Lexicon and of Geographic Experience on Map Use*. Unpublished M.A. Thesis, Wilfrid Laurier University, Waterloo, Canada.

Salminen, A. & Tompa, F. (1999). Grammars++ for modeling information in text, to appear. In: *Information Systems*, 24 (1).

Schlichtmann, Hansgeorg (1991). Die Intervention der Sprache in der Karte. *Kartosemiotik*, Vol. 2, 41-53.

Sester, Monika, Anders, Karl-Heinrich & Walter, Volker (1998). Linking Objects of Different Spatial Data Sets by Integration and Aggregation. *Geoinformatica*, Vol. 2/4, 335-358.

Stubkjær, Erik (1986). Kommunikationsmodel og sprog (Communication model and language). In: Algreen-Ussing H., Fruensgaard N. O., Nørgaard Nielsen J., og Stubkjær E.: *Metoder i projektarbejdet ved teknisk-naturvidenskabelige uddannelser (Methods for project work at science faculties)*. Aalborg Universitetsforlag, Aalborg. 290 p.

Stubkjær, Erik (1990). Communication Theory - A basis for data exchange and for measures of the quality of data. *Proceedings, Third Scandinavian Research Conference on Geographical Information Systems*, November 14-16, 1990, Helsingør, Denmark. Hermansen B., Balstrøm T. & Frederiksen P. (Eds). Danmarks Geologiske Undersøgelser, Miljøministeriet. ISBN 87-88640-66-3. Vol. 2, 213-229.

Stubkjær, Erik (1994). Employing the Linguistic Paradigm for Spatial Information. In: *Advances in GIS research: Proceedings, Spatial Data Handling Conference*, Sept. 1994, Edinburgh/Waugh, Thomas C.; Healey, Richard G. (Eds). Edinburgh, University of Edinburgh. Vol. 1, 572-587.

Stubkjær, Erik (1995). Analyse der Entwicklung kartographischer Begriffe und Konzeptionen (Analysis of the Development of Cartographic Terms and Concepts). In: Pravda, Jan, Wolodtschenko, Alexander & Schlichtmann, Hansgeorg (Eds). *Kartosemiotik*, Vol. 5, 160-171.

Stubkjær, Erik (1996). A Theoretical Basis for Cadastral Development. In: *ELIS' 94 European Land Information Systems. Proceedings, Third Seminar of the European Co-operation Network for Education and Research in Land Information Systems (EUROLIS)*, Sept. 1994. Delft; Delft University of Technology, 1996. 0.9-0.23.

Varanka, Dalia (1991). *An Approach to Map/Text Interrelationships*. Pp. 285-294 In: Frank & Mark (1991).

## R e s u m é

### Komunikácia v kartografii a v rozvoji informačných systémov: obhajoba jazykového modelu komunikácie

Kartografia, ako akademická disciplína, má svoje miesto medzi inými akademickými disciplínami v dvoch kombináciach: na fakultách slobodných umení s geografiou, dialkovým prieskumom Zeme a ďalšími príbuznými disciplínami, na inžinierskych (stavebných, polytechnických ap.) fakultách s geodéziou, fotogrametriou, katastrom a ďalšími príbuznými disciplínami. Na obr. 1 je schéma pozície kartografie (kartografickej komunity: vyhotovovania máp, využívania máp) v spoločnosti - v jej širokom chápání, no so zvláštnym zreteľom na výučbu a rozvoj kartografie. Problém kartografickej komunikácie dominoval v teoretickej kartografii v 70. a 80. rokoch, ale diskusia k nemu bola roztrúsená. Niektorí autori sa však ku kartografickej komunikácii vracajú aj v 90. rokoch.

Príspevok sa zaobere komunikačným modelom lingvistu Romana Jakobsona (kapitola 2), možnosťou jeho využitia v rozvoji informačných systémov (kapitola 3), ktorá vede k diskusii o vzťahoch medzi teóriou a učením/výučbou (kapitola 4).

Jakobsonov model je dvojity:



Jeho základom je úvaha, že odosielateľ posieľa správu príjemcovi. Správa však nesie aj kontext, t.j. aj niečo iné ako samu seba. Prenos správy je kontakt a štruktúra správy je kód. Z prvej úvahy (schémy) vyplýva druhá, týkajúca sa šiestich funkcií: vzťahovej, citovej, poetickej, vôľovej, osudovej a metajazykovej. Všetky tieto funkcie sú (podľa Jakobsona) prítomné v komunikácii.

Pri aplikácii Jabobsonovho modelu v kartografii, "kód" je to isté, čo v Koláčného koncepcii kartografickej komunikácie "kartografický jazyk", t.j. systém znakov a pravidiel ich používania. Koláčného model chápe "univerzum kartografa" ako sčasti prekryvajúcu sa, ale v podstate odlišnú od "univerza čitateľa". V zmysle Jakobsonovho modelu, v ktorom "kód" sa chápe širšie ako Koláčného "kartografický kazyk", nejde o dve reality, ale o dva sčasti odlišné kódy: kartografov a čitateľov. Tým sa vysvetľuje rozdiel v chápaní správy - teda aj vo výsledku čítania mapy.

Príspevok sa ďalej zaobere miestom komunikácie v rozvoji informačných systémov a súčasne diskutuje o vzťahu medzi šiestimi Jakobsonovými funkciami a štyrmi orientáciami v Habermasovej "teórii komunikatívnej činnosti (action)", ktorými sú: inštrumentálna, strategická, komunikatívna a diskurzívna orientácia. Inštrumentálna orientácia sa týka dosahovania cieľa traktujúc všetko v oblasti kontrolovatelného objektu, strategická orientácia sa týka dosahovania cieľa traktujúc ľudstvo ako nezávislý uvedomely činiteľ, komunikatívna orientácia znamená dosiahnutie porozumenia a diskurzívna orientácia znamená potvrdenie dôvodom a dôkazom.

Komunikačná teória sa stala konzistentnou súčasťou akademického vyučovania kartografie a príbuzných disciplín.

Obr. 1 Model kartografickej komunity v spoločnosti.

**Lektoroval:**

**Ing. Ján PRAVDA, DrSc.,  
Geografický ústav SAV,  
Bratislava**