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CANONICAL SPEECH-ACT SEQUENCES IN COMPLEX PROBLEM SOLVING ACTIVITIES: AN ILLUSTRATION WITH GERMAN AND INDONESIAN WORK-GROUP DISCUSSIONS

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Recently, questions have been raised about the universality of complex problem-solving research results that are mainly based on samples in European countries (Dörner & Wearing, 1995; Funke & Frensch, 1995; Dörner, Schaub & Strohschneider, 1999; Strohschneider, 1997). These questions have led researchers to deal with the concept of culture and to hypothesize that problem solving processes may be different across cultures. Culture is taken as a medium, which unburdens human thinking through the reduction of uncertainty, while problems are defined and procedures for solving problems are ritualized and routinized. Thus, culture consists of systems of more or less effective problem solving techniques, which have been developed and used by members to deal with natural and social conditions (Badke-Schaub & Strohschneider, 1998). Strohschneider (1996) has noted that culture influences individual thinking and action in three ways. First, culture provides "materials" for both social and material learning experiences. Secondly, culture provides living models and examples of actions. Thirdly, culture sets values, goals, norms and expectation for actions.

Dörner and his colleagues (Dörner, Schaub & Strohschneider, 1999) have conducted cross-cultural studies of complex problem solving. They took samples from Germany and India and asked students and managers from both countries to solve complex problems of *Manutex* that are simulated in a computer (Strohschneider, 1995; 1997; Badke-Schaub & Strohschneider, 1998). *Manutex* is a computer simulated small garment manufacturing company located in Malaysia. The participants' tasks are to earn profits, and at the same time, improve the staff, and increase salary levels if possible. It is reported (Badke-Schaub & Strohschneider, 1998)

that German students were significantly more successful than Indian students in earning money, that they were able to almost triplicate the total property of the Manutex. Similar results were also found in increasing the number of staff members and the salary of the staff. The German students were described as more risk-taking than Indian students. One pattern that is mentioned as a factor that brought about the success of the Germans, is that they spent more time at the beginning for discussions and exploring the problem situations before making any decisions. The Indian students made decisions and undertook actions from the beginning.

Similar results have been found by Tjitra and Zeuschel (1997; Tjitra, 2001) who compared German and Indonesian problem-solving groups. They used a computer-simulated program, called *Syntex*, which is similar to *Manutex*. Here, there were three goals that the participants had to deal with. They were to raise the assets of the company, to raise job-satisfaction of the staff, and to provide more job-opportunities by hiring new staff members. It was found that German groups were much better in raising the assets of the company and in raising the number of new staff. As before, it was also found that the German groups spent more time in the beginning to explore problem situations before making any decisions or taking actions. This pattern was also found when German and Indonesian groups with comparable effectiveness were compared.

One may notice that in these studies, the notion of culture itself is peripheral and functions only as a design parameter for comparing different complex problem solving groups (Eckensberger, 1990). Although in the definition of Dörner and his colleagues culture is much more than a design parameter, in the research practice it was not taken seriously as a central concept. In what follows, we shall try to build a cultural psychological approach in which the notion of culture has a central role in analyzing problem solving activities.

A Cultural Psychological View of Complex Problem Solving

Cultural psychology is basically an interpretive approach (Shweder, 1990). It is built upon three basic concepts: symbol, meaning, and culture (Le Vine, 1984). Symbols are things that can be grasped empirically by human senses, and stand for some other non-empirical things. Meanings are non-empirical things, for which the symbol stands. Meanings are in the

world of ideas so that they can be grasped only through symbols. Symbol and meaning should be differentiated from their referent. Referents are empirical things, for which symbols stand. The word "Suharto" for example, may have as a referent a dying old man who has ruled Indonesia for over thirty years. Both the word and its referent may have various other meanings, such as: "My grandfather," "The father of Indonesian progress," or "The dictator who has oppressed Indonesia." Culture is mainly understood as a system of meaning. As such it can be grasped only through empirical things (symbols or referent), but at the same time it makes possible their meaningful interrelations. These interrelations between symbols, referents, and their meanings, following C. S. Peirce's assertion, are arbitrary and based on consensus among members of certain interacting communities (Le Vine, 1984). As a consequence, culture as system of meaning is also a result of consensus.

From these, three other concepts can be developed: action, speech act, and discourse. Human movements, utterances, and human-made objects can be conceived of as symbols that stand for certain meanings. Action is human movement that is bestowed with certain *pragmatic* meanings or intentions by the actor and is potentially intelligible for interlocutors (Bruner, 1990; Boesch, 1991; Schutz, 1967). Raising one's hand in a seminar, for example, may be interpreted as intending to ask questions. A speech act is a human utterance that is bestowed with certain pragmatic meanings by the actor and is potentially intelligible for interlocutors (Searle, 1969). A question, for instance, is a type of speech act that has the intention to get the interlocutor to utter a statement. Discourse is a meaningful sequence of actions or speech acts (Polkinghorne, 1988; Clark, 1994; Van Dijk, 1980). Like speech acts, discourse is also bestowed with certain pragmatic meanings that are more global/ abstract than those of the speech acts that comprise it. Discourses vary in length. Longer sequences usually have more abstract intentions. A discourse may take the form of two adjacent speech acts like question and answer, it may also take a longer form that usually constitutes activities such as games, lectures, discussions, etc. A discourse is not just any sequence of actions, it should be meaningful. As such, an action or a speech-act in a sequence should be considered relevant in the light of actions or speech acts that occurred earlier.

Since the relations between utterances (symbols) and their pragmatic meanings are based on consensus, a speech act sequence is said to be

canonical for members of certain interacting communities (Bruner, 1990). This implies that there are no "objective" speech act sequences. They are simply sequences that are taken for granted as reasonable ways of running an activity. Members of the community may not be aware of this. For them it would not be a question why certain canonical action sequences are taken in certain contexts of activities. To the contrary, it would be considered silly or strange to ask such questions. This is demonstrated in a simple experiment about narratives conducted by Lucariello (Bruner, 1990). She demonstrates the canonical nature of narrative as a sequence of events. She tells her young subjects two kinds of stories: one, which is in accord with, and the other, which violates canonicity. An example of one that violates canonicity is a story of a boy who has a birthday. In his birthday party, he runs into his bedroom, locks himself inside, and cries. The young subjects are asked why the boy acts like that. They spontaneously respond to the story by constructing various, more elaborate, narratives to make sense of the boy's actions. A different kind of responses is found when they are told a canonical narrative. A boy has a birthday. His mother makes a party for him. He is very happy. If the subjects are asked why the boy is happy, they will give a more or less uniform answer: that he is happy because he has a birthday party. Some may ask why such a question is being posed.

Complex problem solving activity (CPS) can be conceived of as a form of discourse, a meaningful speech-act sequence. It is conducted to realize its global intention/ pragmatic meaning, that is, to solve a complex problem. It consists of certain speech act sequences that are considered reasonable for the participants. Based on such a conceptualization, interesting questions may be asked: What speech act sequences comprise the activity of CPS in work groups? Which culture-general and culture-specific speech act sequences can be found in CPS activities?

An Approach to Analysis

The speech act sequence analysis (SASA) is a cultural psychological approach to analysis. It was constructed to preserve the pragmatic meanings, intended and interpreted by group members, practiced in certain activities, in certain interacting communities. The aim of such analysis is to describe the global pragmatic meaning structure of human activities.

Table 1

An Example of SASA

Utterances	Individual SA	Local SA
In my opinion, it is good to talk about advertisement	Giving positive opinion on talking about advertising	Justifying the hypothesis of advertisement-influenced demand
Since the production amount was decreasing	Giving orientation concerning the decreasing productivity	
The sales was also decreasing	Giving orientation concerning the decreasing sales	
And the demand didn't seem to be so big	Giving orientation concerning the low demand	

Units and Levels of Analysis

The unit of analysis used is the speech act *sequence*, which consists of, at least, two adjacent speech-acts. Table 1 illustrates a sequence that consists of four adjacent individual speech acts. To preserve its intended pragmatic meaning, the sequence is described by its local intention that is interpreted from its constituent individual speech acts. It is described as a whole, as the act of justifying the hypothesis of advertisement-influenced demand. One may say that the speech act sequence of justifying the hypothesis consists of individual speech acts. One cannot say, however, that it is defined by its constituent individual speech acts alone. It is also defined with reference to its position in the global pragmatic meaning structure.

In SASA, different levels of analysis are employed. On each level, different units may be used. The whole picture of levels and units in SASA is described in Figure 1. One may see that the same individual speech acts may occur in different contexts. The individual speech acts of giving an orientation in Table 1, for example, occur in the context of justifying the hypothesis. This context provides the speech acts with the meaning structure, in terms of which they are interpreted. The act of justifying the

hypothesis itself in turn occurs in the context of a more global speech act, that is, retrodicting the states of affair that define the problem situations. One way to interpret certain individual speech acts is to relate them to the higher unit using the phrase "in order to." For example, the individual speech-act 'giving orientation concerning the decreasing of sales amount' is conducted *in order to* "justify the hypothesis of advertisement-influenced demand" on the local level (1). The local speech act of "justifying hypothesis of advertisement-influenced demand" in turn is conducted *in order to* "retrodict the company's loss" on the local level (2). Finally, the act of retrodicting itself occurs *in order to* solve the problem of running the Syntex clothing mill.

Sequential Analysis

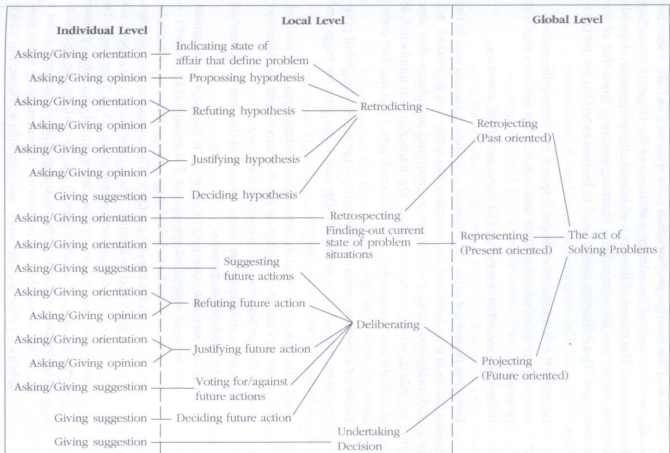
The sequential analysis is conducted to arrive at the global pragmatic meaning structure of a complex problem solving activity. This analysis can be illustrated with a cookbook or a manual for operating certain devices. A manual, for example, for operating a personal computer would normally consist of several important components. First of all, there should be a title, which indicates to the reader the global intention of the book as a whole. This is comparable to the global intention of the complex problem solving activity. The next component is the sentences that constitute the body of text. This is comparable to the individual speech acts or actions that comprise a complex problem solving activity. There must also be a table of contents that makes it easier for the reader to understand what it is about. This table of contents consists of the titles of chapters or sections that comprise the whole book. The chapter titles in the table of contents should correspond to the titles that one would find in the text. The global pragmatic meaning *structure* is comparable to the table of contents of the book.

Thus, the aim of the sequential analysis is to construct a table of contents that would help a reader, who is unfamiliar either with the manual, or with the device itself, to understand what is meant and to use the device as instructed by the book. The table of contents should also consist of page numbers that would help reader to find the corresponding titles in the text.

Procedure for Conducting Sequential Analysis

The procedure for conducting sequential analysis consists of three parts: stock-of-knowledge preparation, data preparation, and the construction of "the table of contents."

Figure 1. Levels and units of SASA.



Stock-of-knowledge preparation is the stage in which the researcher "calibrates" his stock of knowledge with those of the targeted interacting communities. The extent of the stock-of-knowledge preparation depends on how far remote the researcher's meaning system is from that of the participants.' The following points need to be conducted for the preparation.

1. Learning the language that the participants use among themselves.
2. Learning the rules that constitute and regulate the activities that will be studied.
3. Informing oneself about the global intention of the activities.

Data preparation is the recording of activities. It should enable the researcher to access details of the activities whenever this is needed. Audio- and video-recording instruments are required to achieve this aim. After recording, activities are transcribed. The transcripts are numbered, in accord with the succession of individual speech acts. Each number corresponds to one individual speech acts.

Table-of-contents construction is the stage where the global pragmatic meaning structure is constructed. The following steps are suggested for conducting the sequential analysis:

1. Watch the video and read the transcripts without trying to analyze. The aim is to examine whether or not the activity and the language used by the participants are comprehensible.
2. Read the transcript the second time. The aim of this step is to construct the local speech act sequences.
 - a) The first step is to interpret the first or the first several pragmatic meanings of individual speech act that initiate(s) the activity. A question that may be helpful for the interpretation is: "what is he up to (Y) with his speech act (X_1)?" The answer to this question may be formulated as follows: 'He is conducting the speech act (X_1) in order to realize certain intentions (Y).' There may be various possible intentions that can be equally reasonably interpreted from the individual speech act. They all can be treated as *hypothetical* local pragmatic meanings. The reader may make a list of all reasonable interpretations. In formulating these possible local pragmatic meanings, one may refer to Figure 1 in which several categories of speech acts on the local level are proposed.

- b) The second step is to narrow down the number of and/or to revise the above possible pragmatic meanings. This is conducted through evaluating their *coherence* with the subsequent individual speech acts. One question that may be useful is: "how may this hypothetical local pragmatic meaning be realized or served through conducting the subsequent individual speech acts?" The assumption underlying this question is that subsequent individual speech acts must serve to realize the local pragmatic meaning intended by the participants. The above-mentioned formula (X in order to Y) may once again be employed to answer the question. In this case, however, X stands for the subsequent individual speech acts, thus is abbreviated X_2 . If the application of this formula results in a statement that is not reasonable and intelligible, then the Y term should be dropped from the list of hypothetical local pragmatic meanings. This procedure, in principle, can be applied for all hypothetical local pragmatic meanings on the list ($Y_{1 \rightarrow n}$) and for all subsequent individual speech acts ($X_{1 \rightarrow m}$).
 - c) The third step is to find "unit border utterances" or "transition sequences." The process of evaluating the coherence at the previous step will be terminated when unit border utterances are found. Ideally at this stage, there is only one possible local pragmatic meaning left from the list. This will then be established as *the* local pragmatic meaning of the sequence. There may also be several possible local pragmatic meanings left on the list. If this is the case, then the list should be preserved as it is.
 - d) The fourth step is to repeat the first three step: a, b, and c for the next local speech acts.
3. Read the transcript once again to construct higher local sequence (on the local level 2) based on both the individual speech-acts and the already-established local speech-acts (on the local level 1). The procedure described at step 3 above, can in principle be applied for constructing the higher local sequences until the most global speech act is reached that represents the intention of the activity itself.

Cross-sequence Analysis

In cross-sequence analysis, sequences at more or less the same level, either in the same or in different groups, are compared to find similarities and variations. This analysis may be conducted at several levels. At the global level, the global speech acts "to solve complex problem" of different work groups are compared. Analysis at lower levels is conducted through comparing local speech acts that have similar intentions; for example, how different groups deliberate and take decisions, to find out problem situations, etc.

Method

Participants

The current study employs data generated in Zeutschel and Tjitra's research work (Zeutschel & Tjitra, 1996). Sixteen German and eighteen Indonesian groups of students took part in the research. Each group consists of three or four students. Of these groups, only four are selected for our current study. Two groups are the most effective German and Indonesian; and the other two are the most ineffective German and Indonesian groups. Syntex Computer Simulation The complex problem is simulated by a computer program. Syntex is the name of a clothing mill. The task of the work groups is to run the Syntex successfully as general managers in two sessions. The group members are told that the former general manager, the owner, has suddenly died, so that nothing is prepared for the successors. They are to take over the task from him, and are told that basically there are three goals to be reached: to maximize the capital, to create more employment, and to raise work satisfaction. To achieve these three goals, the group members must work together. After reading the participants' manual, they can discuss any topic needed to run the company. They can also ask more information from an experimenter who operates the computer. To take decisions they can give orders to the experimenter, who enters them into the computer for processing.

Design

In order to find patterns and variations of problem solving activity, work groups were divided into four categories based on two dimensions:

culture and effectiveness. On the cultural dimension, two cultural populations were chosen: Indonesian and German. Effectiveness scores of each group can be computed as high or low on the basis of three goals.

This allows the researcher to make several comparisons to find common factors and differences of action sequences. First, problem solving activities may be compared in terms of cultural differences in general, regardless of their effectiveness. Secondly, they may also be compared in terms of effectiveness in general, regardless of cultural differences. Thirdly, they may be compared to find factors that constitute effectiveness in each culture group.

Results

The result of sequential and cross-sequence analysis is illustrated in Table 2. It can be seen that both German groups have conducted retrodicting speech act sequence (I). This is followed by routine finding-out, deliberating and taking sequence (IV). The two groups differ, however, in the long sequence of finding-out (II) and deliberating (III). In the effective German group, one finds a long sequence of finding-out in which group members seem to conduct a kind of exploration of the new situation. This is followed by a long sequence of deliberating. In the ineffective German group, it is found that, after the sequence of retrodicting, the group members move on directly to the routine sequence of finding-out, deliberating and taking decisions.

The common speech acts between ineffective and effective Indonesian groups are indicating the states of affair that constitute the problem, and routine sequence of finding-out, deliberating and taking decisions. The two groups are different in the sequence of deliberating the topic of discourse. In the effective group this deliberating sequence was prolonged since the group members did not reach agreement concerning what should be discussed to solve the task until an intervention by the experimenter. After this topic-deliberating sequence, the group members then move on to a routine finding-out, deliberating and taking-decisions sequence.

In the ineffective group such a deliberating sequence did not occur; after a very short sequence in which the problematic state of affairs was indicated, the group members directly moved on to the routine sequence of finding-out, deliberating and taking decisions.

Table 2

Comparison of Local Speech Acts in Four Groups

Local speech acts	German-Effective		German-Ineffective		Indonesian-Effective		Indonesian-Ineffective	
To deliberate discourse topic ¹					I	1-5		
To indicate the states of affair that constitute the problems ²	I	4; 15	I	7a; 16	II	6-166 I	3-4	
To retrodict the states of affair that define the problem	I	5-99 ³	I	7-44				
To find out states of affair relevant for future actions	II	100-378						
To deliberate decisions	III	379-452						
To take decisions ⁴					III	167-226		
Routine ⁵ sequence of (related to certain topics)	IV	453-819	II	45-773	IV	228-525	II	5-428

a) Finding out the states of affair that are related to the possible future action	a)	619-621 (number of workers) ⁶	a)	45-59 (utilization level of workers)	IV a	228-239 (advertisement)	II a	22-55 (number of machines)
b) Deliberating decisions	b)		b)	60-120 (relocate workers from storage to sales dept.) ⁷	IV b	240-265	II b	56-90
c) Taking decisions	c)	622-650 (increase number of workers) ⁸	c)		IV c	266-269a	II c	196-197

¹ Deliberating what should be talked about, instead of what should be done

² This speech act is part of retrodicting speech act in German groups

³ Ordinal numbers of individual speech acts in the sequence

⁴ The decisions are taken without consensus from all workgroup members. The decision did not work since it tried to change the organization structure of Syntex, which is not made possible by the computer program.

⁵ Routine sequence consists of relatively short, adjacent finding-out, deliberating, and taking-decision speech acts, which are conducted repeatedly on various themes in the global sequence.

⁶ Example of theme of finding-out routine sequence

⁷ Example of theme of deliberating routine sequence

⁸ Example of theme of taking-decision routine sequence

The effective German and Indonesian groups both have a similar sequence of indicating the state of affairs that constitute the problem and a *routine* sequence of finding-out, deliberating and taking decisions. Other sequences are different; the Indonesian group does not conduct the *long* sequence of retrodicting the state of affairs and deliberating decisions. On the contrary, in the Indonesian group one may find a long sequence of deliberating discourse topics, which is present only in transition sequences within the German group.

Table 2 also shows similar speech acts of indicating states of affairs that constitute the problem and routine sequence of finding-out and deliberating in both ineffective Indonesian and German work groups. The Indonesian ineffective group does not conduct any retrodicting sequence. Thus after indicating the problem, it moves on directly to the routine sequence of finding-out and deliberating.

From the above comparisons culture-specific and culture-general speech act sequences of complex problem solving can be derived. At the global level, the only difference between Indonesian and German groups is the act of retrodicting. After indicating the states of affair that constitute the problem, the Indonesian groups move on directly to the routine sequence of finding-out and deliberating; whereas the German groups conduct first the retrodicting act. The retrodicting act emerges in this study as the German culture-specific speech-act sequence in problem solving activity. There are two speech-acts that emerge as culture-general speech act sequences in problem solving activity: the act of indicating the problem; and the routine acts of finding-out, deliberating and taking decisions.

Concluding Remarks

The main aim of this study was to show how to put the notion of culture in the center of both theorizing and research process. It was asserted that the conceptualization of culture as a pragmatic meaning system is useful for building theories of complex problem solving and of various human activities in general. The speech-act sequence analysis (SASA) was presented as an approach that is able to preserve pragmatic meaning structures of complex problem solving activities. The approach was illustrated with an analysis of the discourse in two Indonesian and two German work groups. In principle, with certain modifications SASA can be used for analyzing any human activity.

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