

Detecting Interaction Patterns in Task-Oriented Small Groups: Video Analysis in Social Sciences Research

Jörg Zumbach¹, Sabine Koch¹, Gudberg K. Jonsson²

¹ University of Heidelberg, Germany, ² University of Reykjavik, Iceland

Abstract

The aim of our research is to search for communicative patterns in task-oriented small groups from videotaped interaction sequences, using the software THEME (Magnusson, 2000). Theme has been developed to detect and analyze particular types of repeated syntactical real-time patterns based on probability theory, regardless of the type of behavioral units and time scale used.

In Study One we analyzed observed gendered interaction and gender construction processes at the workplace in same-sex and mixed-sex team conversation (Koch, Kubat, Kruse & Thimm, 2001). The focus was on power-related and support-related behavior as well as on qualities of the behavior and verbal and nonverbal patterns. A turn- and sequence based coding scheme has been developed to analyze data from 20 teams that have been audio-visually taped during two or three of their routine team meetings at the workplace. Using THEME we were able to find specific interaction patterns that would not have been easily detected without the help of the software.

In Study Two we analyzed collaborative knowledge construction processes within a Problem-Based Learning (PBL) session (Zumbach & Reimann, 2000; Zumbach, Muehlenbrock, Reimann & Hoppe, 2002). In this study we found that, before and after a training phase, interaction patterns in a learning group would change in quality and quantity. Participants displayed, e.g., more complex interaction patterns in the final discussion - after an individual learning phase - than in the beginning, and this change of patterns was comprehensively visualized by the THEME output graphics.

Example 1: Analysis of power and support-related communication in team meetings

The main goal of this research project (KOCH, KUBAT, KRUSE & THIMM, 2001) is to analyze the communicative construction of gender in professional settings with methods from language and social psychology as well as linguistics.

We assume that powerful processes in face-to-face communication -many under the threshold of conscious awareness- are partially responsible for the fact that there still is no gender equality in all parts of professional life. Theory and empirical research point to an especially important role of power and support-related processes within the communicative construction of gender.

In this study Theme was used to analyze support-related behavior in our data. Table 1 shows the coding scheme developed for this purpose.

Table 1: Coding scheme for categories of support-related communication

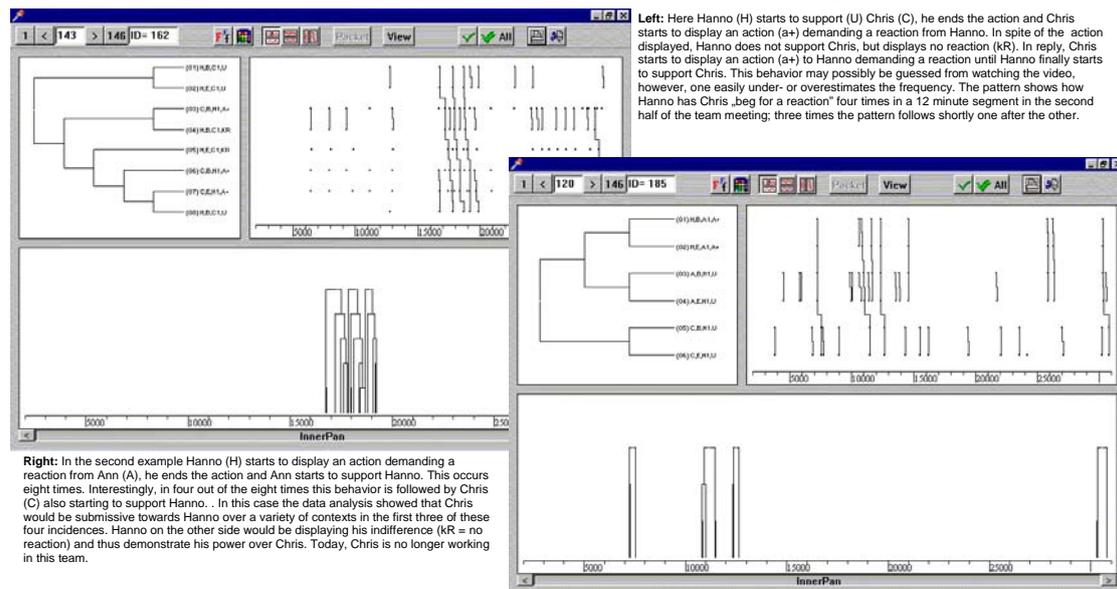
| Category | Feedback verbal & nonverbal | Support (intuitive rating) verbal & nonverbal | Complex Support verbal | Thematic Support mostly verbal | Evaluative Affect nonverbal |
|----------|--|---|--------------------------------|---|--|
| | -1 = negative 0 = neutral 1 = positive | -2 = no reaction, -1 = non support. behavior 0 = neutral 1 = supportive behavior 2 = explicit support, praise | 1 = rephrase 2 = complement | 1 = Initiation, 2 = Completion (duration) | -1 = skeptic, 0 = neutral 1 = open |

Analyzing support related communication

The following analysis has been taken from a preliminary work on the development of the support-related coding scheme looking at 2 hours out of 60 hours of material. The example shows two incidences of support-related behavior which due to their complexity could not be easily detected without the help of the Theme software.

Figure 1: Asking for a reaction (left) and Offering additional support /right)

Figure 1: Asking for a reaction (left) and Offering additional support /right)



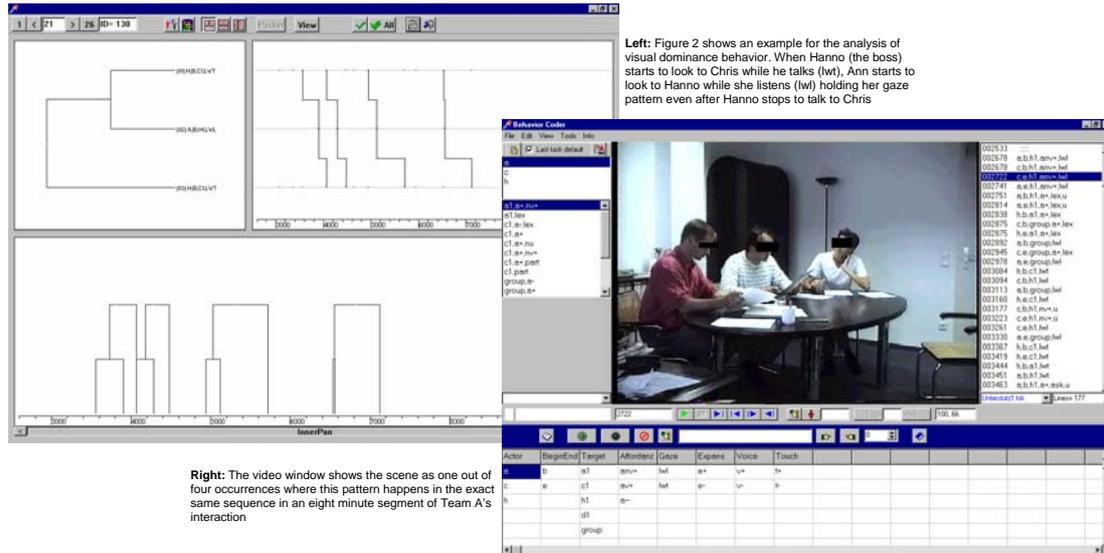
Left: Here Hanno (H) starts to support (U) Chris (C), he ends the action and Chris starts to display an action (a+) demanding a reaction from Hanno. In spite of the action displayed, Hanno does not support Chris, but displays no reaction (kR). In reply, Chris starts to display an action (a+) to Hanno demanding a reaction until Hanno finally starts to support Chris. This behavior may possibly be identified from watching the video, however, one easily under- or overestimates the frequency. The pattern shows how Hanno has Chris „beg for a reaction“ four times in a 12 minute segment in the second half of the team meeting; three times the pattern follows shortly one after the other.

Right: In the second example Hanno (H) starts to display an action demanding a reaction from Ann (A), he ends the action and Ann starts to support Hanno. This

occurs eight times. Interestingly, in four out of the eight times this behavior is followed by Chris (C) also starting to support Hanno. . In this case the data analysis showed that Chris would be submissive towards Hanno over a variety of contexts in the first three of these four incidences. Hanno on the other side would be displaying his indifference (kR = no reaction) and thus demonstrate his power over Chris. Today, Chris is no longer working in this team.

Figure 2: Analyzing visual dominance behavior

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Left: Figure 2 shows an example for the analysis of visual dominance behavior. When Hanno (the boss) starts to look to Chris while he talks (lwt), Ann starts to look to Hanno while she listens (lw1) holding her gaze pattern even after Hanno stops to talk to Chris

Right: The video window shows the scene as one out of four occurrences where this pattern happens in the exact same sequence in an eight minute segment of Team A's interaction

Example 2. Analysis of Collaborative Learning Processes Using Video Analysis

In the following example behavior was coded from digital video files in order to understand more about knowledge building processes in collaborative learning. The focus was on a specific kind of small group collaborative learning named Problem-Based Learning (PBL). Problem-Based Learning is a way of teaching and learning in a curriculum that realizes contemporary approaches of situated cognition and social construction of knowledge (e.g., LAVE & WENGER, 1991). In PBL curricula students are faced with authentic problem-scenarios, commonly presented as verbal descriptions. These problems are discussed in small groups from three up to ten students under a tutor's supervision. Our main interest at present is to understand how different phases and episodes in a PBL-process support students' knowledge construction. In order to analyze small group discussion patterns of knowledge co-construction we developed a coding scheme for analyzing our data with the THEME

software based on principles from activity recognition (MUEHLENBROCK & HOPPE, 1999; ZUMBACH et al., 2002).

Table 2: Coding scheme used for assessing patterns of knowledge co-construction.

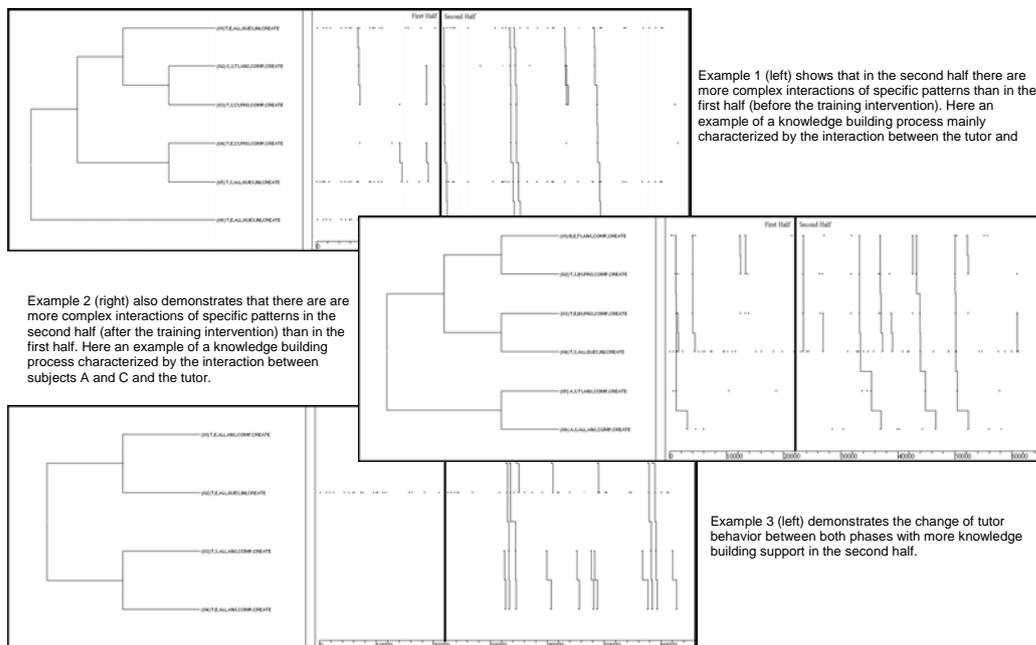
Table 2: Coding scheme used for assessing patterns of knowledge co-

| Subject | Start/End | Object | Communication Phase | Phase of knowledge building | Knowledge Creation/Destruction |
|-----------|-----------|-----------|---------------------|-----------------------------|--------------------------------|
| Learner A | S | Learner A | Answer | Initiate | Create |
| Learner B | E | Learner B | Question | Complete | Destroy |
| Learner C | | Learner C | Pro | | |
| Tutor | | Tutor | Contra | | |
| | | Group | Else | | |

Within a 45 minute video sequence 716 events have been coded overall depicting 358 actions. In the initial discussion of about 20 minutes there have been 242 events (121 actions), in the problem solution discussion of about 25 minutes we found 474 events (236 actions). Theme, using a minimum of 4 repetitions (related actions) at a significance level of $p < .005$, detected 190 significant patterns from the 716 coded events.

Figure 3: Changes in complex interaction patterns during treatment

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Example 1 (left) shows that in the second half there are more complex interactions of specific patterns than in the first half (before the training intervention). Here an example of a knowledge building process mainly characterized by the interaction between the tutor and subject C.

Example 2 (right) also demonstrates that there are more complex interactions of specific patterns in the second half (after the training intervention) than in the first

half. Here an example of a knowledge building process characterized by the interaction between subjects A and C and the tutor.

Example 3 (left) demonstrates the change of tutor behavior between both phases with more knowledge building support in the second half.

Summary and Discussion

The results from our studies show how the Theme analysis of data can be used context independent in two different fields of research, analyzing laboratory as well as field data. In our opinion the software is useful for any kind of analysis dealing with social interaction and communication processes independent of the unit of the behavior under observation. Theme allows the detection and analysis of both intra- and inter-individual patterning of behavior as well as analysis of interaction between human/animal and machine/object. One can imagine that investigations of dynamic natural phenomena could benefit from the use of the software.

Analysis of the intra- and inter-individual patterns, detected by Theme, show in an exemplary manner how the tool enables the researcher to uncover hidden dynamic patterns of behavior that one might miss without the support of the software.

Theme allows a flexible handling of collected data (i.e. integrated or separate analysis of verbal and non-verbal data) and each file can be analyzed separately or in relation to other files belonging to the same research project.

We believe that the tool has a high potential in social sciences research as it is applicable to a wide variety of research questions and phenomena and it can be used in a context independent and in a flexible manner.

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