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A Framework for Team-Level Reliability through a Lens of Collaboration

The aim of this paper is to develop a behavioural framework for team-level reliability assessment in which different forms of collaboration are used as measures. The paper draws on current theorizing on collaboration wherein the concept is divided into a regulatory and a social dimension. This definition of collaboration is further related to research on team-level reliability, and principles and conditions for reliable collaboration are proposed. The framework is tested empirically in an explorative observation study conducted in the context of a police operational command centre during large-scale critical incident management. In the study, frequencies and variance in interpersonal collaboration are examined. Further, an assessment of team-level reliability is conducted based on the findings. The paper concludes by discussing the potential for using collaboration as an empirical framework for the assessment of team-level reliability.

Keywords: Organizational reliability, team-level reliability, collaboration, team process, critical incident management, police incident management

1 Introduction

This paper aims at developing and testing a framework for assessing team-level reliability through a lens of collaboration. In recent research literature on high-reliability organizations (HROs), calls have been made to focus “micro-level ... social processes necessary to enact organizational safety” (Barton and Sutcliffe, 2009, p. 1327; Weick, 2011). One way to approach this dimension of reliability is to focus on interaction within teams as a potential driver for reliable organizing (see Autrey and Moss, 2006; Baker, Day, and Salas, 2006; Myers and McPhee, 2006; Powers and Burns, 2010; E. Salas, Rosen, and King, 2007; Wilson, Burke, Priest, and Salas, 2005; van der Haar, Jehn, and Segers, 2008). Within the team-oriented field of research, interpersonal collaboration has been promoted as a reliability-enhancing feature of teams, as collaboration holds potential for expanding individual perspectives and increasing awareness of organizational events (Science and Mckeen, 2006; Wilson et al., 2005). Empirical studies, however, suggest that collaboration in pressing situations is not an easy undertaking. Emergency management teams (such as operational command centre crews/extreme action teams) are often put together ad hoc (van der Haar et al., 2008; Richter and Lehner, 2011), personnel are changed over time (Rake, 2003; Wybo and Madland Kowalski, 1998), and collaborating practitioners may have differing prior experiences of the work tasks at hand. Collaboration between practitioners from different response organizations has been shown to be rare, as it is coupled with uncertainty and ambiguity (Berlin and Carlström, 2008, 2011). To further complicate the matter, too-rigorous ambitions of interrelating during escalating situations may create problems of its own. Examples include “collaborative inertia” (McGuire, 2006) and overall ineffectiveness in decision-making processes, what has been referred to as “paralysis by analysis” (Bergström, Dahlström, Henriqson, and Dekker, 2010).

Given these perspectives, the notion that a collaborative approach to emergency management vouches for organizational reliability on larger scales can be problematised. Collaborative approaches to problem-solving may vary in dimensions such as length, complexity, richness, and quality (Alberts and Hayes, 2006). Different collaborative strategies can be said to create different notions of sense (see Weick, 1995) and, in extent, work in different ways to produce, sustain, or delimit reliability. With this observation as the departure point, the present article aims to 1) inquire in what ways collaboration can be said to support reliability and 2) explore the possibility of using the analysis of collaborative patterns as a framework for team-level reliability assessment. The paper is structured in two main

parts: First, the concept of collaboration is defined and a brief review of team literature is conducted in which behavioural markers of team-level reliability are summarized. Based on the review, a behavioural framework for reliability assessment is proposed wherein enactments of different collaborative patterns during different phases of teamwork can be analysed in terms of reliability. Second, the paper reports an observation study wherein the framework is tested. The study was conducted in an operational command centre during incident management training in a Swedish policing context. The Swedish Police is an organization wherein operational intra-organizational collaboration is of importance during critical incident management. In these situations, multiple reinforcing intervention capacities (such as SWAT teams or national police security forces) are called in as support for local police authorities (Nyhlén, 2006). When utilizing a joint approach in command, the police's intervention capacity increases numerically. However, this also puts strains on the management segments of an intervention, as personnel from multiple sub-units need to collaborate to direct the intervention. In a Swedish context, experiences from complex situations involving several districts and units (such as the nationally known Malexander police murders, the Gothenburg riots, and the recent Stockholm helicopter robbery) have made problems such as double-command, differences in operative approaches, and differences in nomenclatures between units apparent (Hansén and Hagström, 2004; RPS, 2001; RPS, 2011). With the potential for problems like these, the importance of working not only in collaborative but in reliable collaborative manners at the operational level of command is highlighted.

2 Connecting collaboration and reliability

2.1 Defining collaboration

A general definition of the concept of collaboration is that it is social processes between interacting subjects (or groups) who work collectively on contextually defined content. A distinction can here be made between collaboration and cooperation: following a definition by Roschelle and Teasley (1995), cooperative work can be defined as dependent on the distribution of labour – task management – whilst collaboration is seen as “coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem” (Roschelle and Teasley, 1995, p. 70). With a definition like this, interactivity, dialogue, and interdependent interactions are characteristics of collaborative prob-

lem-solving. However, as previously concluded; collaboration can take on different forms and vary in complexity. One way to describe different forms of collaborative patterns divides the concept of collaboration into two dimensions consisting of a content dimension and a regulatory dimension. Volet, Summers, and Thurman (2009) and Summers and Volet (2010) differentiated collaboration along these two intersecting dimensions:

Figure 1 Different aspects of collaboration during group content processing¹

<Insert figure 1 about here>

The *level of content* dimension of the framework describes how the processing of content unfolds in a group or, in other words, what forms collaboration takes. High-level content processing is, in this sense, connected to deep cognitive processing within a group, i.e. the construction of meaning by means of elaborations, critical inquiry, inferences, and negotiation. Low-level content processing, on the other hand, refers to social processing, which is aimed primarily at information-sharing without inquiries of meaning or transformation of mental representations. In turn, the *regulation of content* dimension describes the extent to which collaborative interactions are “enacted as and guided by multiple contributors’ coordinated interactions” (Summers and Volet, 2010, p. 474). This dimension of collaboration denotes whether the content is regulated by one or a few individuals (shifting the collaborative process toward defining what to do based on a given interpretation) or if the framing of a problem is collective (shifting the collaborative process toward collectively creating an interpretation or a “sense” of a situation).

2.2 Different forms of collaboration in relation to team-level reliability

¹ Reprinted from *Learning and Instruction*, 19, 2, Volet, S., Summers, M., and Thurman, J. High-level co-regulation in collaborative learning: How does it emerge and how is it sustained? 128–143 (2009) with permission from Elsevier.

Based on the framework on collaboration presented above, questions can be asked how different forms of collaborative processes relate to team-level reliability. In general, reliability can be defined as a continuous re-accomplishment of near failure-free performance in dynamic environments (Weick, 2011). Weick and Sutcliffe (2007) proposed that this is achieved when an organization is “mindful” – that is, it is able to both *anticipate* and *contain* unexpected events. Drivers for organizational anticipation have been identified as a *preoccupation with failure*, *sensitivity to operations*, and a *reluctance to simplify interpretations*. Likewise, drivers for containment are a *commitment to resilience* and *deference to expertise* (Weick and Sutcliffe, 2007).

On a team level, a *preoccupation with failure* has been proposed to be evidenced by the use of feedback during task work (providing, seeking, and accepting feedback), by practices of team self-correction (i.e. performance monitoring), and by practices of team error-management (Wilson et al., 2005). Interpersonal behavioural patterns associated with this process are non-accusatory expressions of opposite views and challenges of assumptions (Wilson et al., 2005). In terms of collaboration, these behavioural markers imply that team members need to collaborate in a socially regulated/high-level manner to cultivate awareness and vigilance against failure, as the team-level behavioural markers presented above emphasise the multiparty analysis of team performance and joint responsibility for the avoidance of overly optimistic situation assessments.

Sensitivity to operations is, on a team level, supported by the ability to interrelate and share conceptions among team members. Notions such as team situational awareness (Richter and Lechner, 2011; Wilson et al., 2005); group cognition (Mohammed, Klimoski, and Rentsch, 2000); shared mental models (Baker, Day, and Salas, 2006; Science and Mckeon, 2006); and collective mind (Weick and Roberts, 1993) have been used to describe how teams can expand individual spheres of attention and increase sensitivity by drawing on joint understandings of the situations at hand. Communication has been promoted as important in creating these types of shared comprehensions. Examples include clear, concise information-exchange, closed-loop communications, and reoccurring discussions of “if-then” scenarios (Baker et al. 2006; Wilson et al., 2005). The development of shared mental models depends, in terms of collaboration, on high-level/co-regulative collaboration. As mentioned, this form of collaboration is aimed at the joint creation of meaning concerning understandings of a problem (i.e. what has been referred to as the creation of shared joint “problem space”; Rochelle and Teasly, 1995).

Further, *reluctance to simplify interpretations* has, on a team level, been argued to be evidenced by flexibility and adaptability in interactions between team members. In this view, multiple frameworks and divergence in perspectives (i.e. a repertoire of interactional patterns to utilize in task-solving) support the ability to handle complexity in the teams' task environment (Wilson et al. 2005; Weick, Sutcliffe, and Obstfeld, 2005). In terms of collaboration, flexibility and adaptability in team interactions mean that different forms of collaboration are employed depending on the situation at hand. However, it should be noted that the concepts of adaptability and flexibility presuppose high-level collaboration as individuals to actively apply other problem-solving strategies needed to share conceptions and acknowledge a mutual understanding of the situation.

Also, *commitment to resilience* depends on flexibility. Resilience has, on a team level, been suggested to consist of the flexible mobilization of response in the face of risk (Comfort, Sungu, Johnson, and Dunn, 2001). Weick (2011) highlighted that resilience is about the capacity to improvise, find workarounds, and re-direct on-going activities. These notions are consistent with research on temporal team processes wherein it has been shown that teams use different strategies of action in different phases of teamwork. During "action phases", teams tend to engage in actions directed at goal-achievement. Equally, in "transition phases", teams tend to engage in planning, evaluation of team progress, and defining objectives (Marks, Mathieu, and Zaccaro, 2001). In terms of collaboration, a commitment to resilience means that a team needs to utilize a variety of collaborative patterns during task work. Van Fenema (2005) discussed this in terms of "elasticity" in collaborative patterns. Elasticity constitutes the ability to situate different behavioural approaches that enable teams to tackle change. For instance, low-level content processing may be necessary when focus is directed at the monitoring process or in situations wherein a team runs the risk of losing operability if it devotes too much time and effort to collaboration in a high-level/co-regulative manner.

Finally, *deference to expertise* means that decisions migrate from situational expertise. On a team level, this is supported by a team climate wherein diversity in opinions and team member assertiveness are cultivated (Wilson et al., 2005; van der Haar et al., 2008). Behaviours linked to assertiveness are, in turn, provisions of performance feedback, addressing ambiguities, stating opinions, initiating action, and requesting assistance (see Smith-Jentsch, Salas and Baker, 1996). In terms of collaboration, deference to expertise relates primarily to the social dimension of collaboration. Both socially and individually regulated content-processing may be called for depending on the situation, as expertise may be held both by

groups of individuals and by single people (Weick and Sutcliffe, 2007). Individually regulated content-processing is thereby optimal in situations wherein one or a few individuals have knowledge advantages. At the same time, social regulation is chosen when it is unclear where expertise resides.

2.3 A framework for reliable collaboration

Based on the definition of collaboration and the brief review of literature on reliability, a behavioural framework of reliable collaboration can tentatively be formulated. Two principles for how collaboration can support organizational reliability are proposed:

- Reliable teams are characterized by the capacity to collaborate in high-level/co-regulative manners as a prime approach to problem-solving.
- Reliable teams display variance in collaborative patterns. That is, they are able to apply collaborative interaction patterns other than high-level/co-regulative patterns when a situation calls for it.

Suggestions on the conditions under which collaborative patterns than other high-level/co-regulative patterns are suitable:

- Temporal team action phases wherein task complexity is low. In these team phases, low-level content processing may be more effective than high-level content processing, as the team's actions are directed at the monitoring process rather than defining what to do.
- During the containment of unexpected events wherein timeframes may be short and wherein a team runs the risk of losing operability if it devotes too much time and effort to collaborating in a high-level/co-regulative manner.
- During situations wherein one or a few individuals have a knowledge advantage and individually regulated content-processing thereby is more effective in reaching an optimal assessment of a situation.

3 Empirical application

To test these principles of reliable collaboration, an empirical observation study was conducted during scenario-based police operational incident command training. The targeted training exercise consisted of a full-scale simulated scenario wherein one of Sweden's three national nuclear power plant sites was targeted by a non-state-organized, armed assault (RKP, 2009). By simulating a coercive terrorist assault on a full scale, police response and incident command were put to the test in a high-risk CBRNE setting. Training for situations like these is one dimension of the Swedish National Police Board's (RPS) national strategy for crisis preparedness (Ehrlin and Bodelius, 2007). The need to train in these settings has also been raised in national risk and vulnerability analyses by the Swedish National Bureau of Investigation (RKP, 2009).

The exercise was designed to train the local police authority where the power plant was physically located and the collected Swedish police intervention resources [Sweden's three specialized SWAT teams and the national counter-terrorist unit (NI)]. Hierarchically, the exercise aimed to train the police operators conducting the intervention and a "minute operational" level of the police incident command (Johansson, 1995; Nyhlén, 2006; RPSFS, 2006, p. 14). This level of police response is comparable to the U.K. police response referred to as "silver-level command" or, using NATO vocabulary, a "tactical level" of command (Arbuthnot, 2008). The objectives for command crews working on this level of police operations are to coordinate and develop strategies for leading assigned resources, implement orders, work with common operational pictures (COP), and support local operational commanders, (RPSFS, 2006, p. 14; Nyhlén, 2006).

These factors made the training mission suitable for data-gathering in several respects: most importantly, the drill was a full-scale simulation of a terrorist-spawned hostage standoff with actors filling the roles of perpetrators and hostages. These aspects made the situation dynamic, cumulative, and realistic. In the specific exercise, the field command centre consisted of representatives from five different organizational sub-units and police counties, making the staff a mixture of people with differing skills and experience in similar situations. The operational command centre comprised the functions and sub-organizations shown in Figure 2.

Figure 2 The operational command centre: Personnel and functions, sub-organizations within parenthesis

<Insert figure 2 about here>

4 Method

In the observation study, the data-gathering methods consisted of direct observations of staff work in the operational field command centre combined with informal interviews with representatives participating in the drill. The observation lasted for 9 hours – the duration of the police intervention. With regard to the security directions posted by the participating practitioners, the observation relied on field notes. Furthermore, only one observer was allowed to be present in the command centre (the author) for data-gathering. With these limitations of the data collection, the risk of unrecognized distortion during collection is present (Adler and Adler, 1994). As a way to make observations understandable for a sole observer, an observation protocol with predefined operationalised descriptors was used as support for the observations. The protocol was structured on time indications, agent interactions, and phases of teamwork. To complement the observations and minimize the risk of observer distortion, short informal interviews (10-15 minutes) were conducted at the scene of the drill. The interviews served mainly to put the observations in context and, in this sense, functioned as a basic form of respondent validation (see Lincoln and Guba, 1985). The interviews targeted the respondents' takes on observed turns of events, clarifications of terminology, and interpretations and elaborations of episodes during the exercise. This form of respondent validation has been contested, as observations made by an outsider may cover aspects of an interaction that are not recognized by participants (see, for example, Hammersley and Atkinson, 1995). However, used with awareness of this notion and in combination with the observation protocol, the method was employed as a means to put the observed behaviours and the researcher's interpretations of the group processes in context.

In the analysis of field notes, a coding system was employed wherein interaction patterns were coded based on the dimension *regulation* of content and the *level* of content during teamwork (see Figure 1). In the analysis, the level of content dimension was divided into high- and low-level content processing. Likewise, the regulation dimension was divided into two main categories consisting of a “social regulation” approach on the one side and individually accented “other regulation” on the other hand. This analytical strategy meant that interaction patterns were coded along the two intersecting dimensions to inquire what collaborative

strategies were preferred by the staff and in what situations these could be observed. At the same time, interaction patterns that did not qualify as collective content-processing in regard to task-solving were coded into categories such as task-management, coordination, and parallel work.

5 Results

5.1 Frequencies and patterns of collaborative interaction

In total, 17 occurrences of collaboration were coded during the exercise. These ranged from simple content-processing on a one-to-one basis to more complex patterns of interaction involving a multitude of the operational command staff. Frequency coding was done to examine patterns of different forms of collaborative interactions. Figure 4 shows the breakdowns of observed interactions by the low/high level and individual/social regulation dimensions.

Figure 3 Overall distributions of the observed collaborative patterns:

<Insert figure 3 about here>

As the figure indicates, the observed command crew exhibited an overall ability to engage in content-processing in several different ways, though with some apparent preferences. Noteworthy is that high-level/individually regulated collaboration was the most frequently observed pattern of interaction, exhibited in 41% of the occurrences. Likewise, high-level socially regulated content was the rarest process of collaboration, observed on only two separate occasions. To explain this variance in patterns, a categorization of the contexts of collaboration was conducted wherein situations that were significant for each of the four main patterns are exemplified.

5.1.2 Individually regulated/low-level content processing

The individual regulation of low-level content was observed during the exercise mainly in face-to-face interactions wherein one participant was active in delivering basic information or updates on current developments to others within a group. Examples include the provision of geo-

coordinates, news, orders, reminders, etc. This collaborative pattern concerned the provision, clarification, and acknowledging of information between individuals (or between an individual and a group) through communication of interpretations that were not challenged by other participants but taken for granted as input to work from. Examples included reciting and forwarding information, reporting developments, and conveying information between different parties. This collaborative pattern was observed mainly in phases of teamwork wherein interaction processes were targeted at achieving goals. One illustrative example of this collaborative process occurred when several groups of police operators were to intervene simultaneously during the exercise; the activity within the operational command centre was directed at making this coordination possible:

Information is communicated through reporting of positions and facts concerning the positions, first in the compound and then through respective tactical commander[s] to their subsidiary units. Information then comes back by radio on what current developments on the field are. With this reporting system they seem to avoid the question “[I]s everything all right[?]” as well as double-check [...] that everything is going according to plan.

To provide situational info to the units on the field, the group of tactical commanders communicated with their subordinates, updating each other verbally on the current movements of the respective units. The collaborative process was characterized by turn-taking in providing situational information to each other.

5.1.3 Individually regulated/high-level content processing

This collaborative pattern was characterized by situations wherein one (or a few) individuals have a mandate in framing or interpreting a task or problem, thus “other-regulating” other participants’ understandings of the situation. During the incident command exercise, this interaction pattern was observed mainly in situations where the social setting clearly defined who “owned” different questions; a reoccurring example was collaborative interactions that took place during staff meetings. The command crew staff meetings were briefings in which information was shared between different colleagues and functions among the staff. The mandate to define problems or communicate interpretations was based greatly on formal positions, preconceived spheres of responsibilities, knowledge monopolies, or functional division of labour. These factors tilted the focus of col-

laboration toward processing content based on a defined framing (rather than collaborating to define a specific problem). One example from the field notes describes a staff meeting wherein the common operational picture (COP) was presented as input to elaborate on in further staff work:

The meeting is initialized by the chief of staff[,] and it starts with a representative from the information centre, who shares developments and new intelligence [...] new since the last staff meeting. He says that they expect [that] three missing persons (power plant staff) still are in the buildings. Information about a turbine-hall is shared with the point being that they can expect to meet dissidents in this location."

In this manner, the staff personnel who assembled information about COP also had a mandate in presenting the common operational picture to their fellow colleagues. Based on their responsibility for creating COP among the staff, they had a prime position in interpreting the overall picture of the staff's environment when they engaged with fellow colleagues, thus "other-regulating" the input for further discussions. This and resembling situations were coded as high-level, as the communications between practitioners dealt with the explanation, inferences, reasoning, presentation, and discussion of interpreted content.

5.1.4 *Socially regulated/low-level content processing*

The social regulation of low-level content was observed within the command compound mainly in situations characterized by two conditions: 1) when the task-solving process depended upon several participants' contributions and 2) when these contributions were based on common ground or familiarity. These conditions geared the interactions toward a "choice of paths" or the weighing of pre-known alternatives under somewhat equal conditions. Examples of this collaborative pattern were discussions informed by resembling experiences, by consensus regarding "best practices" for procedures, and methods for task-solving. One example occurred when the staff was to organize in the beginning of the exercise and several individuals engaged in the command centre staff arrangements:

7:35... Staff personnel discuss [...] how to organize the field compound. They decide to use two whiteboards for common operational picture (COP) ... The decision is also reached to initially organize 1) in a tactical node or "centre" and 2) in an information node or "cen-

tre[.]” They also decide to work according to timelines describing past, present[,] and future.

The excerpt targets a collaborative process that is based on a common language between the participants. In this way, the collaborative process was shifted toward deciding on different seemingly pre-defined alternatives recognized from the participants’ prior experiences of staff work.

5.1.5 Socially regulated/high-level content processing

Examples of high-level co-regulative processing were observed when the staff faced unforeseen chains of events and when there were timeframes allowing the analysis and interpretation of these events. One illustrative example occurred when knowledge from outside the staff room was needed to manage the technical aspects of the operation. When the staff had to define the situations they were facing (emphasizing where to depart from in task-solving),

Power-plant technicians dressed in green overalls start to arrive at the command-centre. Communication between the head technician and the different tactical commanders start up regarding different locations and parts of the plant. Content[-]wise[,] 4 places in the plant are crucial for avoiding meltdowns and 4 technicians are needed to man these control rooms. It does not seem organized who’s talking to whom at this stage and in what order.

This phase of group interaction was characterized by disorganization and a lack of frame when observed. The process depended upon both parties’ contributions. The collaborative activities were directed at creating a synchronized understanding regarding where and how to intervene in the buildings, which shifted focus to the question of what to do. The solution reached was based on both police-specific and technical knowledge. The content of the collaboration had a high degree of complexity in that several different approaches, considerations, and solutions were possible. To summarize the contexts in which different collaborative processes were observed, Figure 3 shows the “whats” and “whens” of different collaborative patterns:

Figure 4 Variance of situations in which different collaborative patterns were observed

<Insert figure 4 about here>

6. Assessment

The presented data exemplifies both the frequencies and patterns of collaboration in a dynamic and demanding setting. When relating the results of the study to the earlier presented framework for reliability assessment, a few points are apparent.

The first principle of reliable collaboration stated that co-regulative/high-level content processing should be frequently utilized given that a team functions optimally in a dynamic setting characterized by both unexpected events and transition phases between events. This form of collaborative pattern was concluded to be associated with a preoccupation with failure and with sensitivity to operations. Among other conclusions, it was determined that high-level co-regulative collaboration enables a team to draw on shared mental models, to “pick up” and make sense of cues from the environment, and to avoid simplified or overly optimistic evaluations of the team process.

The findings in the observation study show that the staff had the ability to engage in high-order meaning construction, as high-level content processing accounted for 9 of a total of 17 observed occurrences of collaboration. However, of these 9 occurrences, socially regulated/high-level creation of meaning occurred on two separate occasions, making this the least frequently observed pattern in the material. This indicates that the staff had difficulties in regulating high-level content socially and that this process of collaboration thereby was utilized as a “last resort” rather than as a resource utilized for creating shared situational awareness, planning for future developments, and evaluating current directions in teamwork.

In the place of high-level/socially regulated collaboration, the findings show that individually regulated high-level collaboration was the most frequently observed pattern in the material. When examining the situations in which this form of collaboration occurred, it was concluded that the process was characterized by differentiation in knowledge and in mandate (i.e. different individuals “owned” different questions). This form of collaboration was also observed in social settings that favoured individual framing of content (e.g. meetings and briefings). Collaborating based on individually regulated content means that the interaction process is tilted toward examining the implications of pre-established interpretations rather than jointly creating shared comprehensions of a situation (Volet et

al., 2009). The inherent risk of this form of collaboration is that content-processing is, to a large extent, based on abstractions and labels (i.e. someone's preconceived conception of a situation) rather than the participating collaborators' joint perceptions of a situation. In regard to social setting, the observed staff was functionally differentiated and had a clearly defined role structure. The staff also utilized the practice of reoccurring meetings that favoured individual regulation of content. These factors can be argued to delimit reliability if they constitute deference to rank, authority, or procedure in the place of expertise. However, reliance on predefined structures for collaboration is two-sided: a predefined structure and procedure of collaboration may also contribute to reliability by directing group interactions toward meaningful communications regarding how to solve problems. This duality has been addressed previously (Roux-Dufort, 2009; Weick, 2011) and is related to aspects of balance in organizing. It has been argued that reliability depends upon the ability to both draw on labels (as drivers for action) and question these labels (as drivers for awareness) (see LaPorte, 2006). In the observation study, the tendency to utilize the individual regulation of high-level content indicates that the command compound staff was devoted more toward action than awareness.

In regard to the observed processes of low-level content processing, these collaborative patterns were observed mainly in situations characterized by familiarity and common knowledge (socially regulated/low-level content processing) as well as in team action phases wherein timeframes were short (individually regulated/low-level content processing). Other studies of team-interactional patterns support the notion that effective problem-solving does not necessarily amount to high complexity in social interactions (Stachowski, Kaplan, and Waller, 2009). In the framework for reliable collaboration, it was concluded that low-level content processing may be more effective in situations characterized by low degrees of task complexity and in situations characterized by limited time. The observations of low-level content processing are congruent with the framework on this point, as the staff engaged in low-level content processing mainly in "action phases" wherein the collaborative activity was directed at supporting goal fulfilment.

An assessment of reliability based on observations of collaboration indicate the following:

- In regard to the level of content, it can be concluded that the staff had an ability to process both high-level and low-level content. When analysing the contexts of collaboration and the distribution of low-level patterns, the findings indicate that the staff had an

ability to situate their approach. (i.e., not “over-doing it” in situations characterized by low task complexity or limited timeframes). However, when dealing with complex situations involving high-level content, a pattern emerged regarding how content was regulated.

- In complex situations wherein the team dealt with high-level content processing, it was concluded that the team members did not utilize co-regulated collaboration in an optimal way. In these situations, the staff geared the collaborative process toward individual regulation that thereby functioned as the prominent pattern of collaboration. When examining the contexts in which these patterns were observed, it was concluded that the social setting among the staff promoted individual regulation. The implications of this are that the staff runs the risk of becoming action-oriented at the cost of awareness. As concluded in the framework for optimal reliable collaboration, high-level/co-regulated content processing should be the first pattern of collaboration. The results in the observation study indicate that this was not the case for the specific team under investigation.

7 Concluding remarks

The present study describes how frequencies and variance of collaborative task-solving relate to team-level reliability. It also offers an empirical application of a behavioural framework for reliability assessment in an organizational setting of a police field compound. By using different forms of collaboration during different phases of teamwork as empirical measures of reliability, the paper serves to bridge the gap between macro-oriented principles of organizational reliability and empirical analysis of the micro-level interactions, which builds reliability. It is the author's belief that collaboration is a concept that holds potential as a practically applicable tool for reliability assessment, as reliability at large is an emergent and socially enacted phenomena (Barton and Sutcliffe, 2009). As concluded in the introductory parts of the paper, the concept of collaboration in the context of emergency management is surrounded by partly contradictory claims. On the one hand, the discourse of collaboration in emergency management has had a tendency to over-emphasise the potential of the concept, promoting it as a “universal solution” to an array of problems coupled with emergency management (for a critique, see Berlin and

Carlström, 2011). On the other hand, empirical studies have showed that collaboration in itself may evoke problems in organizing (see McGuire, 2006). By conceptualizing collaboration as an array of behavioural patterns and by connecting these patterns with the concept of reliability, this paper offers a framework that explains why the concept has this “double-edged” nature within command contexts.

With this said, it should be recognized that the present study is explorative, aimed at conceptual development, and is based on a small empirical application. To expand the presented framework and thoroughly test its utility, a more empirical material and further theoretical development is needed. One suggestion for further research is to explicitly relate the theoretically derived principles of reliable collaboration to team performance measures. This would require a quasi-experimental research design wherein high-strain situations could be induced and collaborative patterns in several teams could be observed and related to each other.

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Figures and tables

Figure 1

Figure 2

Leadership	Tactical Centre	Information Cen- tre	Other Functions
Local operational incident commander (county)	Intervention leader (SWAT Gothenburg)	Intelligence coordinator (NI)	Negotiation coordinator (NI)
Assistant operational commander (county)	Intervention leader (SWAT Malmö)	Common operational picture (NI)	Police helicopter personnel (police flight)
Compound leader (NI)	Intervention leader (SWAT Stockholm)	Technical support (SWAT)	Advising technicians (nuclear power plant)
	Intervention leader (NI)		

Figure 3

Figure 4