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BI Norwegian Business School

Sigmund Valaker

Breakdown of Team Cognition and Team Performance: Examining the influence of media and overconfidence on mutual understanding, shared situation awareness and contextualization

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Article 1
Alignment of perceived mutual understanding and actual mutual understanding: Role of a distributed versus a co-located communication setting and overconfidence
Valaker, S., Hærem, T., & Kost, D.

Article 2
Connecting the dots in counter-terrorism: The consequences of communication media for shared situation awareness and team performance
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Overconfidence and the media, contextualization and team performance relationship: Towards a behavioral team communication model
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Article 4
Contextualization: The interactive role of overconfidence and perspective taking
Valaker, S.

Breakdown of Team Cognition and Team Performance

Examining the influence of media and overconfidence on mutual understanding, shared situation awareness and contextualization

by

Sigmund Valaker

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List of articles

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the 74th Annual Meeting of the Academy of Management OCIS division, Philadelphia, 2014.

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Review and resubmit: Journal of Contingencies and Crisis Management.

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Abstract

In several settings, such as counter-terrorism operations and aviation, avoiding breakdowns in team cognition is essential for coordination and team performance. This dissertation examines two assumptions concerning what affect teams ability to avoid breakdowns in team cognition: 1) certain media capabilities enhance team cognition more than others and 2) team members choose different media based on cost-benefit considerations to enhance team cognition. I explore the first assumption by developing and testing a more complex relation between media and team cognition, and I challenge the assumption of the cost-benefit model by examining the role of overconfidence. I focus on two specific gaps regarding the influence of media and overconfidence on team cognition. The first gap focus on the influence on mutual understanding and shared situation awareness (Gap 1), and the second gap focus on contextualization (Gap 2). I explored these gaps empirically in four articles investigating three-member teams that engage in a simulated crisis management task and individuals taking part in a survey experiment. In these settings equivocality was induced through differences in information among team members. To examine Gap 1, I investigate in article 1 the influence of media richness and overconfidence on alignment of perceived and actual mutual understanding. I found that there is a greater degree of alignment between perceived mutual understanding and actual understanding in a co-located than in an email setting. I also found a better alignment for those low in overconfidence than for those high in overconfidence. In addition, the findings suggest that people hold more shared actual mutual understanding and shared perception of mutual understanding in a co-located versus an email condition. Then, in article 2, I explore whether level 2 and 3 shared situation awareness mediate a positive effect of media richness on team performance. The findings indicate that level 2 shared situation awareness, in particular, and level 3 shared situation awareness, mediate a positive effect on team performance from media richness, and co-located media are helpful for sharedness of level 2 and level 3 shared situation awareness, and email is helpful for sharedness of level 1 shared situation awareness. To address Gap 2, article 3 discuss the relation among media richness contextualization and team performance, and suggest that higher levels of shared overconfidence will negatively moderate this mediated relation. The empirical findings indicated support for this suggestion. Finally, I also address Gap 2 in article 4 by further examining the boundary conditions of the influence of overconfidence on contextualization. Here I examine whether perspective taking reduces the possibly negative effect of overconfidence on contextualization, and found empirical support for this hypothesis. Taken together these findings could suggest that not only behavior but also the medium may be a central explanatory variable influencing teams ability to avoid breakdown in team cognition, and people's cognitive biases, overconfidence, may distort adaptation processes to avoid such breakdowns.

Contents

Introduction and purpose

Team cognition, defined as "the cognitive activity that occurs within a team" is one of the key factors enhancing team performance (Wildman et al., 2014: p. 913), and adapting behavior and thinking in response to uncertain environments is a key factor influencing teams' performance. When team members hold divergent perspectives and knowledge, developing team cognition is a particular challenge (Trevino, Daft & Lengel, 1990; Katz & Te'eni, 2007). Breakdown in team cognition concerning the situation can lead to failures in coordination and team performance (Weick, 1990; Wilson, Salas, Priest & Andrews, 2007).

In the military, there can be severe consequences from breakdown in team cognition such as friendly-fire incidents or failing to integrate intelligence reports (Snook, 2000; Weick, 2005). Such breakdowns can also be fatal in civilian organizations, as for example with air traffic control (Weick, 1990). The problem of integrating team member's divergent knowledge speaks to the centrality of communication as a key factor in developing team cognition (Burke Stagl, Salas, Pierce & Kendall, 2006). Related to this, communication media has been seen as a key influence on how team cognition develops (Maynard & Gilson, 2014; Foster et al., 2015).

Two assumptions in recent team and communication media research is that certain media capabilities enhance team cognition more than others (Dennis, Fuller & Valacich, 2008; Maynard & Gilson, 2014), and that team members choose different media based on cost-benefit considerations to enhance team cognition (see e.g. Katz & Te'eni, 2007). In this dissertation, I explore the first assumption by developing and testing a more complex relation between media and team cognition, and I challenge the assumption of the cost-benefit model by analyzing behavioral theories of decision making with respect to perceptions of situations and decisions about communication. In this dissertation, I specifically focus on how media and overconfidence affect team cognition related to an important part of team adaptability: the ongoing assessment of the situation (Burke et al., 2006). Researchers have identified a number of factors that is critical in this part of team adaptation, and I focus on three key aspects of team cognition in this phase: mutual understanding, shared situation awareness and contextualization (Cramton, 2001; Burke et al., 2006; Katz & Te'eni, 2007; Wildman et al., 2014). (These concepts are defined in "Theoretical framework" below).

Burke et al. (2006: 1193) suggest that, crucial aspects of teams' situation assessment involve "communication of cues to the rest of the team". Conveying meaning of the cues through contextualization could thus be critical, and throughout this phase mutual understanding could also be important for the team members to hold a common vantage point when they communicate about the situation. These aspects related to communication can thus be seen as critical to the situation assessment phase in addition to shared situation awareness.

These concepts also capture two key dimensions of team cognition, knowledge structure and communicative interaction, both suggested as important by Wildman et al. (2014). Knowledge structure concerns the "relatively stable, emergent team-level knowledge structures that exist within team members' heads and combine to represent the team" (Wildman et al,

2014; p. 913). Mutual understanding and shared situation awareness can be seen as such team cognition concepts as they focus on the perception and knowledge among team members. Interaction aspects of team cognition on the other hand are "the dynamic cognitive processes that occur within the team as represented by the interactions between the members of the team" (Wildman et al., 2014; p. 913) and sensemaking processes is an example of this (Wildman et al., 2014). Contextualization, a key aspect of sensemaking (Weick & Meader, 1993), can be seen as an interaction aspect of team cognition as it concerns interaction between team members and sensemaking.

The effectiveness of team adaptive behaviors, in turn, depends on whether teams have a corresponding ability to adapt their communication behaviors in response to changes in their environments. To explore how a key aspect of communication, the communication media used, may affect these team cognition constructs, I draw on the media richness tradition which suggests that media vary as to their richness, i.e. their capability to change understanding within a time interval (Daft & Lengel, 1986; Dennis et al., 2008). Rich media are characterized by high degree of cues, personalization, languages and feedback (Daft & Lengel, 1986). Specifically I focus on two extremes of media richness: teams that are co-located (high media richness) and teams that communicate via distributed email (low media richness), following previous research on media richness which have contrasted high and low media richness (Daft & Lengel, 1986; Dennis & Kinney, 1998). For simplicity, I refer to this as media richness, although the reader should be aware that I consider these two extremes when talking about media richness. Throughout the dissertation co-located and distributed email communication settings refer to the two (relative) extremes of high versus low media richness, respectively.

I also complement the exploration of media richness with consideration of how information processing tendencies of the team could affect team cognition. A feature of the team that has received less attention, but could be a crucial boundary condition for a team's adaptation, is cognitive biases (Van den Heuvel & Crego, 2012). Here I focus on one such bias: overconfidence, i.e. overestimation of one's own knowledge (Moore & Healy, 2008) as this could be a particularly important constraint on team cognition (Weick, 1990; Rudolph et al., 2009).

Media and overconfidence may have interesting consequences for mutual understanding, shared situation awareness and contextualization. For example communicating over geographic distances, in particular through email only, can potentially lead to breakdowns in team cognition (Cramton, 2001). One of the key problems observed by Cramton (2001) is that team members' perceived and actual mutual understanding is often not aligned in a distributed setting. Yet, empirical research often fails to distinguish between perceived mutual understanding and actual understanding (e.g. Katz & Te'eni, 2007) and Wildman et al. (2014) suggest a need for research to clarify the relation between actual and perceived team cognition. Wildman et al. (2014) also suggested that the perceptions of team cognition could be biased. Both the quality of the communication media, as well cognitive biases such as overconfidence,

could influence the alignment of perceived and actual mutual understanding. Yet, this remains, to my knowledge, to be empirically explored.

While some studies exist on the role of media for shared situation awareness Uitdewilligen et al. (2010) identified that more could be learned about how individual's situation awareness develops to shared situation awareness in a team. The literature on team adaptation (e.g. Burke et al., 2006) emphasizes the differences between level 1) perceiving elements 2) understanding their relation and 3) projecting there future, and communication as key in influencing shared situation awareness (Salas, Prince, Baker & Shrestha, 1995). I did not find empirical research on how communication influences these levels, although communication is seen as critical to the situation assessment phase of adaptation. Furthermore, Maynard & Gilson (2014) argued that the effects of media capabilities on team cognition are in need of more research. In the communication realm, Dennis et al. (2008) suggested that how media affect shared understanding is in need of exploration. I therefore concluded that the relation between media capabilities and the different levels of shared situation awareness could be interesting to examine further.

A recent research stream suggests that media capabilities influence the contextualization behavior (e.g. Te'eni, 2001). Contextualization has primarily been studied in a rational cost-benefit perspective. However, both sensemaking theory and the behavioral, decision-making literature suggest that overconfidence could hamper contextualization (Rudolph, Morrison & Caroll, 2009; De Dreu & Beersma; 2010). On the other hand: are there conditions in which overconfidence will not constitute a problem, such as when engaging in perspective taking, defined as "considering receivers' views and attitudes" (Te'eni, 2001, p. 13)?

Against this background, I focus on two specific gaps regarding the influence of media and overconfidence on teams' adaptive behaviors. The first gap focus on the influence on mutual understanding and shared situation awareness (Gap 1), and the second gap focus on contextualization (Gap 2). Figure 1, below, illustrate how the four articles of this dissertation relate to the research gaps.

To examine Gap 1, I investigate in article 1 the influence of media richness and overconfidence on alignment of perceived and actual mutual understanding. Specifically, I explore whether the alignment is a better in a co-located setting, than a distributed setting, and whether it is better for those low in overconfidence than for those high in overconfidence.
Then, in article 2, I explore whether level 2 and 3 shared situation awareness mediate a positive effect of media richness on team performance. To address Gap 2, article 3 discuss the relation among media richness contextualization and team performance, and suggest that higher levels of shared overconfidence will negatively moderate this mediated relation. Finally, I also address Gap 2 in article 4 by further examining the boundary conditions of the influence of overconfidence on contextualization. Here I examine whether perspective taking reduces the possibly negative effect of overconfidence on contextualization.

In the following sections, I present the theory, and develop the research gaps in more detail, overall research questions, and contribution to theory. I then describe the overall

research design, the levels of analysis, development of the lab simulations used to gather data for article 1-3 and the data collection. The theoretical review starts with a general description of the review process, and then contains a review of the team cognition research. I then review the organizational media literature and discuss it in relation to the literature on cognitive biases, specifically overconfidence. Figure 1 communicates gaps and research questions for the four articles. Figure two communicates relations hypothesized and tested in the four articles.

FIGURE 1:

Dissertation overview and research questions per article

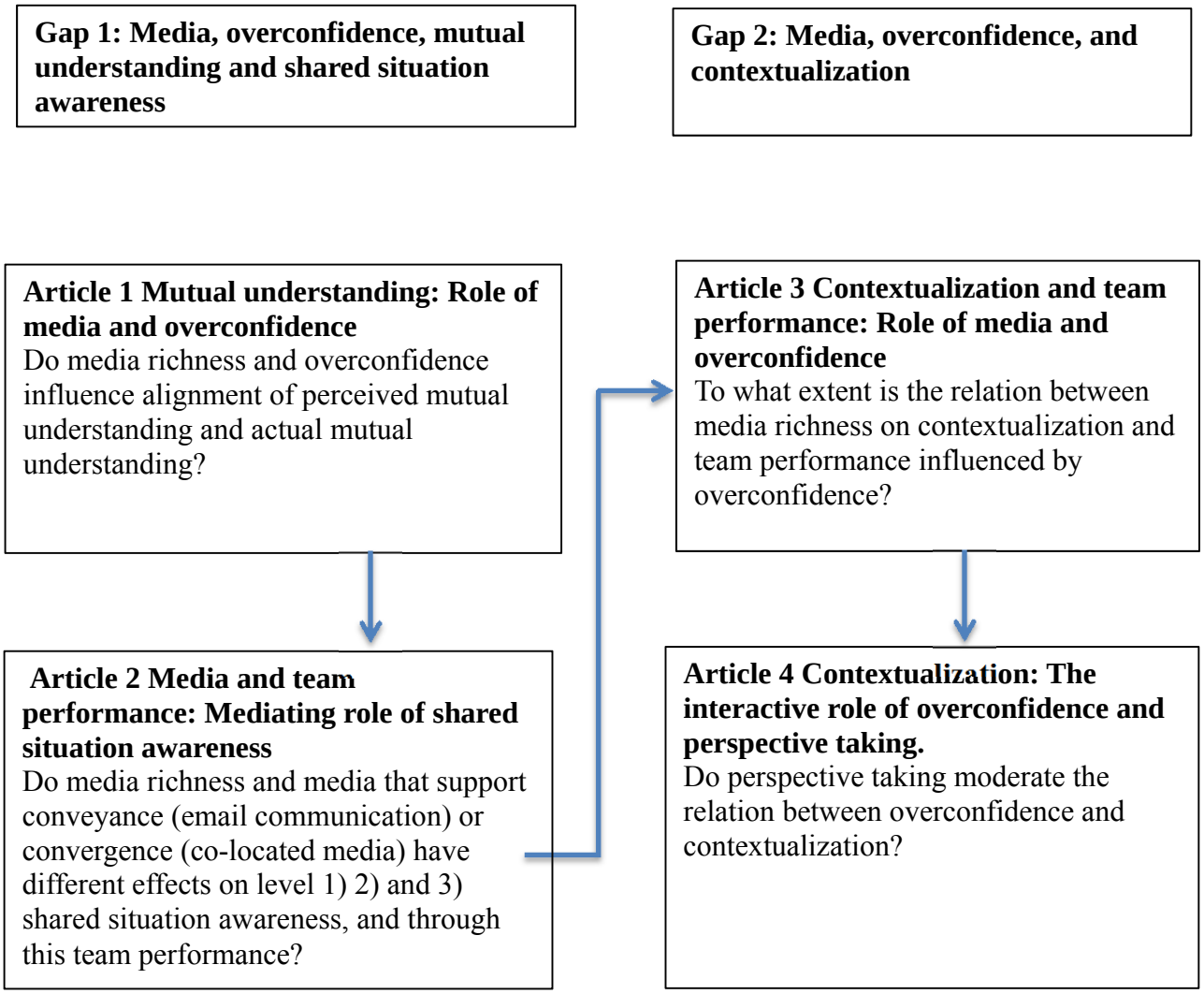
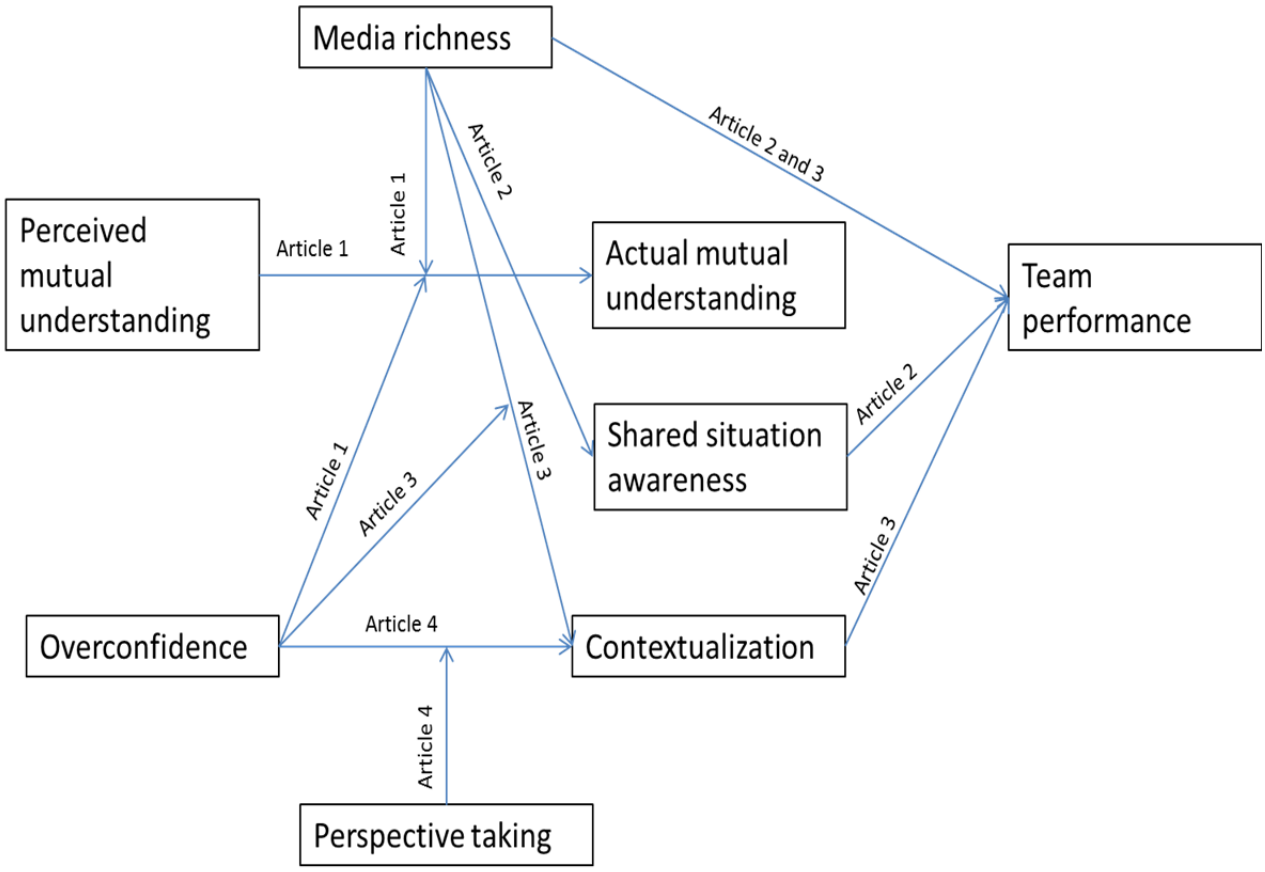


FIGURE 2:

Variables and interrelations discussed in the dissertation



Theoretical framework

To develop my research question theoretically, I took a broad approach, searching both the general team cognition literature as well as organizational research on media and cognitive biases. I first review the research on mutual understanding, shared situation awareness and contextualization. The literature on communication media and overconfidence, are then reviewed and specific research questions developed.

Team cognition

Shared cognition in teams, or team cognition, has been approached from a diverse set of research streams focusing on shared knowledge structures as well as the interaction and development of shared knowledge, both in general social psychology research and in the team cognition literature (Thompson & Fine, 1999; Wildman et al., 2014). I choose to focus on the team cognition literature as it is perhaps the one that has most systematically discussed team cognition in relation to adapting to the equivocality arising from divergences in perspectives and knowledge among team members, the focus of this dissertation (see e.g.: Burke et al., 2006). Within this literature there are several team cognition concepts. Wildman et al. (2014) for example includes the following concepts in their overview: team mental models, transactive memory system, team situation awareness, strategic consensus and team cognition as interaction.

As I am particularly interested in breakdowns in team cognition concerning situation assessment in an immediate crisis, I focus on aspects of team cognition that are proximal to this particular phase of team adaptation: mutual understanding, shared situation awareness and contextualization. Uitdewilligen et al. (2010) suggest that shared situation awareness focus on knowledge about the current situation and that this differs from for example team mental models and transactive memory system. In addition to shared situation awareness, I focus on two team cognition concepts that have mainly been studied in the communication literature: Mutual understanding and contextualization, as they capture key aspects of the knowledge development critical to situation assessment in team's adaptation (Burke et al., 2006).

Mutual understanding

Mutual understanding can be seen an indicator of the degree to which team members have a common vantage point (Burke et al., 2006). I focus on the relation between actual mutual understanding defined as knowledge that the communicating parties both share and know that they share (Krauss & Fussell, 1990: p. 112) and perceived mutual understanding defined as the perception that one hold mutual understanding (Katz & Te'eni, 2007).

Research suggests that a co-located settings and distributed settings with contextualization support increase of mutual understanding and that mutual understanding is beneficial for team performance (Cramton, 2001; Katz & Te'eni, 2007). Although for example Wildman et al. (2014) suggest that one compare subjective and actual measures of team

cognition, empirical examinations that do this comparison has to my knowledge not been conducted.

Shared situation awareness

I define shared situation awareness as the degree to which team members have the same and accurate situation awareness on their shared situation awareness requirements, and differentiate this concept by three levels 1) awareness of elements in the environment, 2) knowledge of the relationship among elements and 3) anticipation of the element's future actions (Endsley, Bolte & Jones 2003; Burke et al., 2006; Uitdewilligen et al., 2010).

Based on the few existing studies Uitdewilligen et al. (2010) found that team situation awareness, in which they also included studies of shared situation awareness, positively affected team performance, and that communication frequency positively affected team situation awareness. Difficulty in scenarios also affected accuracy of team situation awareness negatively. The type of communication interface- differentiated by the extent to which visual aids and co-located seating arrangements were used- affected team situation awareness more positively for smaller teams. Accessing information improved team situation awareness. Talking about the situation during non-routine events was positively related to ability to adapt to non-routine events. However, Uitdewilligen et al. (2010) suggest that more work needed to be done theoretically and empirically to understand how individual situation awareness translates to the team level.

Contextualization

Mutual understanding and shared situation awareness can be complemented by team cognition aspects focused on interaction (Thompson & Fine, 1999; Wildman et al., 2014). The interaction perspective highlights the ongoing sensemaking and learning processes within a team (Hutchins, 1991; Faraj & Xiao, 2006; Wildman et al, 2014; LeBaron, Christianson, Garret & Ilan, 2016). There are several ways such processes unfold (Maynard & Gilson, 2014). Here I focus on contextualization, one of the key sensemaking processes suggested as helping to integrate divergent information about a situation (Weick & Meader, 1993; Te'eni, 2001; Maynard & Gilson, 2014). Contextualization I define as providing contextual information to explain core content (Te'eni, 2001).

While mutual understanding and shared situation awareness focus on a more static state of team cognition, contextualization capture the ongoing process of explaining to others ones individually held information (Weick & Meader, 1993; Cooke et al., 2013). Contextualization can be illustrated by an individual who hold specific intelligence information in counter terrorism task that can be difficult to understand fully by others unless he or she talks about it in relation to a geographic location that other team members know of, for example that an enemy object approaches an oil-rig. Adding such specific location information can be seen as contextualizing the core intelligence content of enemy observation.

Theoretical and empirical research has pointed to contextualization support in media as

increasing contextualization and contextualization has been seen as helpful for team performance (Boland & Tenkasi, 1995; Te'eni, 2001; Katz & Te'eni, 2007). However, research remains to be done as to what might underlie contextualization, such as when team members fail to contextualize as expected from a rational cost-benefit perspective (Katz & Te'eni, 2007).

Organizational media theories and the literature on overconfidence

Maynard and Gilson (2014), as well as Foster et al. (2015) suggest that the way team members communicate need to be incorporated more in research as a factor affecting team cognition. This suggests that various aspects of the team cognition aspects I focus on could be examined in more detail with respect to media. To form research gaps and research questions for empirical studies I now draw on the aforementioned team cognition literature and combine it with the organizational media literature. I also include cognitive biases, specifically overconfidence, as a potential determinant of team cognition, since this can be a key bias in affecting how people communicate (Rudolph et al., 2009), and a factor challenging some of the assumptions in both media and team research.

There are several different theories on media use in organizations (Schiller & Mandwiwalla, 2007). Dennis et al. (2008) review suggests that most research has focused on the media-task fit (e.g. media richness theory by Daft & Lengel, 1986) in contrast to other streams of research that have focused on how communication technology may structure action and how technology itself can be changed through action (DeSanctis & Poole 1994). I choose to focus on theories that examine how media affects the resolution of equivocal tasks, such as those for which people hold divergent perspectives, and therefore concentrate on the research tradition related to the media task fit. In addition, I focused on theories that are concerned with team performance, and are discussed in the team cognition literature (e.g. Maynard & Gilson, 2014). Against this background, I choose to focus on media richness theory (Daft & Lengel, 1986), the cognitive affective model of organizational communication (Te'eni, 2001) and media synchronicity theory (Dennis et al., 2008), all of which focus on the effect of media capabilities on the resolution of equivocal tasks as well as team performance, although in slightly different ways as I will expand on below.

In order to extend further the knowledge of antecedents of team cognition and how the communication media affects team cognition, which has primarily been seen in a rational perspective, I draw on other literature that has explored in depth how people deviate from rational decision making. People's deviation from rational decision making has been approached from diverse angles both from a social psychology perspective focusing on limitations on sensemaking, and from a behavioral decision-making perspective (Weick, 1990; Payne, Bettman & Johnson, 1993). I incorporate theorizing from both these fields of research and draw on sensemaking theory and the judgment and behavioral decision-making literature. The sensemaking field of research has for example suggested how strongly held beliefs, such as overconfidence, may limit communication (Weick, 1990; Blatt et al., 2006). While the behavioral decision making literature have suggested that overconfidence may inhibit peoples

elaborate and systematic decision making.

Kruger et al. (2005) suggested that individual's overestimation of whether others understood their messages, could be more prevalent in a distributed setting than a co-located setting. But they also noted its prevalence in a co-located setting. With respect to the effect on communication behavior, Krauss and Fussell (1991) found that people were biased in the direction of own knowledge with respect to how easy they thought others would understand a description. This could suggest that team members may also be prone to misjudge mutual understanding and the need for contextualization, in particular when they overestimate their own knowledge. By combining such insights on biases in communication with the central tenets of the media richness stream of research, I aim to extend organizational research on team cognition.

Media richness theory

Media richness theory was developed in the mid-1980s by Daft and Lengel (1986), and is based on the assumption that organizations are information processing systems, with limited information processing capacity, drawing on the work by March and Simon (1958), Perrow (1967) and Weick (1979). By drawing on among others Huber (1982), media richness theory also sought to integrate in one theory both formal and informal modes of communication: i.e. both technologically oriented perspectives and social information processing perspectives (Lengel & Daft, 1984).

Media richness theory drew on Weick's (1979) social psychological theory of sensemaking to understand what decision makers do in an equivocal situation. It is believed that it is peoples' enactment of understanding that can solve the problems that arise from equivocality (see also Daft & Weick, 1984). An important origin for this perspective is the notion that a team member's individual and shared cognition develops in a dynamic interplay (Mead, 1934). It is assumed that one of the crucial aspects of how people relate is through their communicative activity, in which individuals internalize socially established roles. This is similar to the core idea underlying the sensemaking perspective, in which organizing is based upon communicative action (Weick, 1995). This idea is central both to the enactment of interpretations of a situation as suggested by the sensemaking perspective, and to the reduction of equivocality through providing symbols and meaningful interpretations in media richness theory and media symbolism theory (Daft & Weick, 1984; Trevino et al., 1990).

In equivocal situations, rather than gather more information, the challenge is to agree on a solution among the team members (Trevino et al., 1990). This process, Daft and Lengel (1986) suggest, is one that is not rational but rather is subjective. Apart from the process of reaching agreement, this subjective aspect of the communication process could also pose a challenge, in that people can choose to use media for other and different purposes than developing shared meaning.

Reduction of task uncertainty and equivocality is seen as the primary information-processing function of organizations. High equivocality means that different interpretations of a

situation are possible and even likely. Equivocality is therefore linked to breakdowns in team cognition, especially in the form of assuming that one shares the same information when actually one does not. Uncertainty, on the other hand, refers to situations in which a better understanding can be reached by collecting more data in formal ways.

Media in this theory is defined as the channel through which messages are transmitted (Daft, Bettenhausen & Tyler, 1995). Rich media are needed to reduce equivocality, while less rich media may be equally or even more efficient in reducing uncertainty (Daft & Lengel, 1986). Rich media is seen as better for reducing equivocality through, for example, contextualization, i.e., adding explanations to a core content (Weick & Meader, 1993). Through the ability to convey rich information and rapidly exchange information, differing viewpoints can be discussed and rapid turn taking among communicators can be facilitated. Uncertainty, on the other hand, can be reduced by less rich media, such as text, since such problems require the gathering of already defined data in order to reach an answer. Daft and Lengel (1986) further suggest that organizations may undertake a mix of uncertainty and equivocality tasks, and, in such cases, a mix of less rich and richer media is needed.

Although it was acknowledged that different individuals could choose and use media differently (see e.g., Lengel & Daft, 1984), the degree to which such factors influenced media choice was not much discussed in the early work on media richness theory. Such perspectives became more prominent in later research (Trevino et al., 1990; Weick & Meader, 1993).

Early criticism of media richness theory

In Dennis et al.'s (2008) review of the media research they suggest that media use and perceptions of media became important as a criticism of media richness theory. One of the early criticisms is that media use may in itself have a symbolic aspect. For example, a medium may denote formality or informality (Trevino, Lengel & Daft, 1987). This challenged the notion of richness as the most important feature of media with respect to task resolution, and suggested that people's perception of the medium was an important determinant of its use. For example, people may choose to discuss equivocal issues via email rather than by communicating face to face. In line with this theorizing, social information-processing theory suggested that media richness was partially socially constructed (Fulk & Boyd, 1991). Experience using a medium could influence whether a medium was perceived as rich (Carlson & Zmud, 1999). For example, written media could be considered richer if one had experience of using this media.

The results from empirical research were mixed with respect to media richness and task fit. In particular, it was not clear that matching equivocality and uncertainty to media increased performance (Dennis & Kinney, 1998). Recent meta-analysis indicates that being co-located, versus distributed, increases communication and performance, but also suggests that the effect of media may become less over time (deGuinea, Webster & Staples, 2012). This suggests that media may exert influence on communication and team performance through their use and the norms for communication that develop over time. Also, as suggested above, cognitive biases may mean that there is less than rational judgment of the communication situation and therefore

a failure to adapt (Cramton, Orvis & Wilson, 2007).

The cognitive affective model of organizational communication and media synchronicity

Te'eni (2001) draws on media richness theory but seeks to develop a more balanced view of media use that focuses also on the motivation of the sender and the enhancement of distributed media, e.g. through contextualization support. Both cognitive and affective aspects are seen as essential for people's strategies as to what messages to send and which media to use. Cognitive communication complexities, created by the distance between communication partners, motivate the use of contextualization, for example, to bridge the gap between perspectives. Perspective differences motivate use of media to adapt behaviors in order to reach mutual understanding. But Te'eni (2001) and Katz and Te'eni (2007) suggest that there are costs involved in using rich media and contextualization, in situations in which there are no perspective differences. They also briefly suggested that cognitive biases may explain the less than optimal use of media (see e.g. Te'eni, 2001), without elaborating this further.

Dennis et al. (2008) suggest in their media synchronicity theory that the focus of organizational communication research should be on the communication processes rather than on the requirements of the task. Media synchronicity is defined by Dennis et al. (2008, p. 575) as "the ability of media to support synchronicity, a shared pattern of coordinated behavior among individuals as they work together". They see media richness theory as not appropriately accounting for media use as it focuses more on task resolution than the communication process. Dennis et al. (2008) see communication processes as more directly influenced by media than task resolution. The idea is that all interdependent tasks need communication with a varying degree of conveyance, transfer of information and convergence, to agree on the meaning of information. They suggest that combining media that facilitate convergence and conveyance contributes to high communication performance and through this influences performance. Thus an equivocal task may need both conveyance processes, which may function better through lean media, and convergence processes, which could benefit from rich media. On the other hand, they suggest that using many types of media may lead to cognitive overload. Thus people may choose media wrongly and fail to acquire a high level of understanding.

Research gaps

Both Te'eni (2001) and Dennis et al. (2008) noted situations in which people could fail to communicate efficiently, even when they had the means to do so. For example, they suggested that people may not systematically evaluate the costs and benefits of using media to develop shared understanding and contextualization (Katz & Te'eni, 2014). With the aim of contributing to this discussion, I firstly delineate a gap related to the consequences of media for mutual understanding and shared situation awareness. I then delineate a research gap related to contextualization, focusing on gaps related to how media and overconfidence influence this behavior.

Te'eni (2001) noted that mutual understanding is a central aspect of a communication process, and having the same vantage point has been seen as critical in team adaptation (Burke et al., 2006). Katz and Te'eni (2007) furthermore suggest that, if distributed media are used to contextualize, it can improve mutual understanding. Yet, they only investigated how team members perceived their communication and did not investigate their actual communication, even though these may differ. Also the relation between subjective and actual measures of team cognition has to a less degree been refined in the team cognition literature (Wildman et al., 2014). Cramton (2001) suggested that mutual understanding of a situation would be problematic in a distributed setting, and called for research that could better examine this. An emerging stream of research suggests that high levels of overconfidence can limit people's information processing (Rudolph et al., 2009). This stream of research suggests that people may select either a systematic elaborate information processing style or a style based on heuristics (De Dreu et al., 2008). Weick (1993) argue that people's information processing can be limited by strongly held beliefs, e.g. overconfidence. Yet there exists a gap in the research in relation to examining whether team members can be biased in how they use media to aid mutual understanding. The need for a more thorough examination of how media and overconfidence influence mutual understanding constitutes the first part of research gap 1, related to knowledge structures of team cognition.

The next part of research gap 1 concerns another aspect of the relation between media and team cognition: the consequences of media for shared situation awareness and team performance. Prior research has suggested communication as an important factor helping to develop shared situation awareness (e.g. Salas, Prince, Baker & Shrestha, 1995), but has to my knowledge not discussed the possibility that different capabilities of media influence the different levels 1-3 of shared situation awareness differentially. In particular, theory is unclear as to whether specific aspects of shared understanding of the situation are influenced by media capabilities that facilitate convergence, agreeing on meaning of information, or conveyance, transmission of information, and how that may influence task performance. Dennis et al. (2008: 595) specifically noted that: "additional research is needed to examine communication performance outcomes in more detail, notably the development of understanding." Research has developed theory on how shared mental models are related to media capabilities (see e.g. Hayward, 2012; Maynard & Gilson, 2014). However, the media requirements for situational understanding in tasks of high equivocality have to my knowledge been less examined.

It could be suggested that, for example, convergence is particularly important for high level types of situational understanding, e.g., understanding a task environment (Weick, et al., 1999), based on integrating information from various team members, yet this has not been empirically investigated. That is, levels 2 and 3 of shared situation awareness could relate more to convergence than level 1 shared situation awareness, which may rely on conveyance. In summary, this suggests a gap in the research with respect to how media affect shared situation awareness.

The second research gap focuses on gaps in the understanding of what influences team

members contextualization. Although Katz and Te'eni (2007) suggest that distributed communication with contextualization support improved contextualization, they also asked what underlies failures to adapt contextualization adequately to the communication situation. Team members may contextualize when it is not needed, such as when perspectives are similar, or not contextualize when it is needed, such as when perspectives are dissimilar, yet the underlying reasons for this have to my knowledge not been examined. The influence of media on contextualization behavior may be biased (De Dreu & Beersma, 2010), although both the media literature and some team cognition research do not discuss whether the media contextualization relation is distorted by cognitive biases (Te'eni, 2001; Maynard & Gilson, 2014). Payne et al. (1993) suggest that overconfidence can hinder elaborate decision-making strategies because they are perceived as requiring too much effort. Contextualization, which requires extra effort to construct, may also be limited by overconfidence for this reason. This may also lead team members to overlook the benefits of high rich media for contextualization.

In summary, this suggests that, for example, failure to contextualize may in part be explained by overconfidence. However, overconfidence has to my knowledge not been examined as an influence on the relationship between media and contextualization. Furthermore, there has, to my knowledge, been no examination of what may moderate such negative influences on contextualization, despite the calls for research that include factors such as perspective taking when examining contextualization (Katz & Te'eni, 2014). The need to examine further the underlying reasons for failure (and success) in contextualizing constitutes the second research gap.

Taken together, this dissertation focuses on examining two gaps in the literature related to: (1) how media richness and overconfidence influences the alignment of perceived and actual mutual understanding and how media richness influence shared situation awareness; and (2) the problem of what underlies team member's success and failure in contextualizing and whether media richness and overconfidence influence this. In the next section, I present four studies that address these two research gaps and delineate the research questions I will use to examine these gaps empirically.

Summary of research questions

To address the two research gaps, I will explore four distinct research questions:

- Do media richness and overconfidence influence alignment of perceived mutual understanding and actual mutual understanding? (article 1);
- Do media richness and media that support conveyance (email communication) or convergence (co-located media) have different effects on level 1) 2) and 3) shared situation awareness, and through this team performance? (article 2);
- To what extent is the relation between media richness on contextualization and team performance influenced by overconfidence? (article 3);
- Do perspective taking moderate the relation between overconfidence and contextualization? (article 4).

I now present the main background for each of these questions for each article.

Article 1: Alignment of perceived mutual understanding and actual mutual understanding: Role of a distributed versus a co-located communication setting and overconfidence

Despite the discrepancy between perceived and actual mutual understanding, researchers often use perceptions of mutual understanding as a proxy for actual mutual understanding (e.g. Cornelius & Boos, 2003; Katz & Te'eni, 2007). Perhaps even worse, practitioners still rely on what they believe is their common understanding and do not establish their actual common understanding. Wildman et al. (2014), in their review on measuring cognition in teams, emphasize that the distinction between measures of perception and objective measures is a critical one. Perceived measures may, for example, not translate into actual knowledge because people's recollection is imprecise and prone to hindsight bias.

In article 1, I investigate two factors that may influence the correspondence between actual and perceived mutual understanding. In previous studies of dispersed collaboration, media richness has been suggested as a key factor in achieving a common understanding (Clark & Marshall, 1981; Cramton, 2001). Previous studies have also found that, on an individual level, what we believe about others' knowledge is biased by our existing knowledge (e.g. Camerer, Loewenstein, & Weber, 1989; Krauss & Fussell, 1991; Epley, Keysar, Van Boven & Gilovich, 2004). Recent studies within the field of individuals' social judgment indicate that there is a higher degree of overconfidence on the accuracy of decisions or predictions in a lean media setting than in a rich (e.g. Kruger, et al., 2005; Cramton et al., 2007). However, a crucial hindrance that has been observed for communication is people's strongly held beliefs in a co-located setting also (Weick & Meader, 1993). In article 1, I will therefore explore the following research question: Do media richness and overconfidence influence alignment of perceived mutual understanding and actual mutual understanding?

Article 2: Connecting the dots in counter-terrorism: The consequences of communication media for shared situation awareness and team performance

Inconclusive empirical findings have prompted a search for possible mediators of the relation between media capabilities and team performance (Dennis & Kinney, 1998). It has been argued that the effect of media capabilities on team performance can be mediated by shared understanding (Dennis et al., 2008). In particular, shared mental models for understanding the requirements of tasks and how to accomplish such tasks have been examined (Maynard & Gilson, 2014). Yet shared understanding also comprises rapidly changing knowledge of the situation: i.e. situation awareness (Thompson & Fine, 1999; Wildman et al., 2014). I suggest that examining the role of shared situation awareness can lead to a more nuanced understanding of the media–team performance relation.

I suggest that it is primarily level 2 and level 3 of shared situation awareness that help teams benefit from using rich media that support convergence, with respect to their team performance. I suggest that level 1 shared situation awareness concerns a broad perception of a task environment which can be fostered by media that supports conveyance; I argue that levels 2 and 3 are more important to direct adaptive action and achieve team performance. Specifically, these levels could help team members integrate their resources and be proactive (Weick et al., 1999; Burke et al., 2006). Based on these considerations, the following research question is investigated in article 2: Do media richness and media that support conveyance (email communication) or convergence (co-located media) have different effects on level 1) 2) and 3) shared situation awareness, and through this team performance?

Article 3: Overconfidence and the media, contextualization and team performance relationship: Towards a behavioral team communication model

While the two previous studies focus on knowledge structure aspects of team cognition, the third article focuses on an interaction aspect of team cognition: contextualization behavior. In this article, I examine the extent to which teams working with communication media that differ in their level of richness also differ in their contextualization. The decision to contextualize is commonly viewed in cost–benefit terms: contextualization occurs when its benefits (e.g., reduced misunderstandings among team members) exceed its costs (e.g., the time and cognitive effort required to contextualize) (Katz & Te'eni, 2007). Some recent research, however, notes that people may fail to contextualize even when the net benefits from contextualization appear positive (Te'eni, 2001; Katz & Te'eni, 2007, 2014). This departure from rational choice may be explained by bounded rationality and behavioral theories of decision making (e.g. Kahneman, 2002). Specifically, the decision to contextualize may be contingent on a variety of behavioral factors; identifying such factors may lead to a better understanding of when and why people decide to contextualize (George, Carlson & Valacich, 2013).

This article draws on the sensemaking and behavioral decision-making literatures to suggest that overconfidence is an important factor influencing the contextualization decision. These literatures suggest that overconfidence may not only distort the rational cost–benefit

calculations associated with contextualization (March & Simon, 1958; Payne et al., 1993), it may also lead to a premature decision about the definition of a problem. This, in turn, can diminish the perceived need for contextualization (Weick, 1993; Weick & Meader, 1993). Overconfidence can thus lead to a failure to contextualize, even when it is beneficial and cost-effective for teams to do so, thereby having a negative impact on team performance. Against this background, I ask the following research question: To what extent is the relation between media richness on contextualization and team performance influenced by overconfidence?

Article 4: Contextualization: The interactive role of overconfidence and perspective taking

The fourth topic concerns potential influences of the role of overconfidence on contextualization. Previous research has called for investigations that examine contextualization in relation to other communication strategies, such as perspective taking (Katz & Te'eni, 2007 & 2014). In article 4, I explore the relation between overconfidence and contextualization further by including perspective taking as a moderator of this relation. I suggest that overconfidence leads to less contextualization; however perspective taking may enhance contextualization. By investigating these factors, a more refined model of what underlies contextualization can potentially be developed.

Perspective taking can be a particularly important moderator of the overconfidence–contextualization relation, because it can instigate more elaboration. Perspective taking has previously been argued and observed to have a debiasing effect because of these properties (Todd, Galinsky & Bodenhausen, 2012). Similarly, perspective taking can be argued to make people make more effort to tailor their messages, even when being overconfident. In article 4, I examine empirically the following research question: Do perspective taking moderate the relation between overconfidence and contextualization?

Contribution to theory

Taken together, the four studies aim to enhance knowledge of what influences important indicators of team cognition in team's adaptation: mutual understanding, shared situation awareness and contextualization, and the consequences for team performance. This dissertation contribute to the understanding of how communication media and cognitive biases affect team cognition, two factors suggested as important antecedents to team cognition by recent research (Van den Heuvel & Crego, 2012; Maynard & Gilson, 2014; Wildman et al., 2014; Foster et al., 2015). More specifically, it contributes to the research on team cognition by providing a more refined understanding of how media richness influences mutual understanding, shared situation awareness and contextualization. Furthermore, the dissertation shows how overconfidence may moderate the influence of communication media on contextualization behavior and the relation between perceived and actual mutual understanding. The studies also contribute to the development of organizational media theory by suggesting how overconfidence is an important determinant of information processing. Moreover, the studies aim to develop further knowledge of the boundary conditions on media use in media richness theory, the cognitive affective model of communication and media synchronicity theory (Daft & Lengel, 1986; Te'eni, 2001; Katz & Te'eni, 2007; Dennis et al., 2008). These contributions are further discussed in detail at the end of each article.

Methods

Overall research design

Empirical research on team cognition may be done in several ways ranging from a qualitative inductive approach aimed at developing the concepts and theory of team cognition in a field context (e.g. Hutchins, 1991) to testing causal relations among defined variables (Wildman et al., 2014). The aim of this dissertation was not to develop new concepts, but rather to investigate the interrelations of some already conceptually defined variables, and through this develop theory. The present dissertation, base itself on prior qualitative work. For example the work by Weick and Roberts (1993) developed notions of team cognition and Weick and Meader (1993) conceptualized contextualization. In this dissertation I developed hypotheses of causal relations and this suggested that I employed an experimental research design as a way of testing the hypotheses (Shadish, Cook & Campbell, 2002).

When investigating causal relations one of the choices was between field experiments and lab experiments. There are trade-offs in choosing between field experiment and lab experiments (McGrath, Martin & Kulka, 1982). Field experiments have the advantage of having a high external validity. And it can be possible to observe the variables I have an interest in and indeed test the hypotheses. However, it can be difficult to isolate the effects of the variables in a field setting. On this basis, I chose to use a lab experiment and a survey

experiment as a logical way to investigate the deducted hypotheses. A lab experiment made it possible to differentiate clearly between media conditions (high versus low media richness), and expose respondents to similar stimuli in the two media conditions. The controlled lab-environment also allowed recording indicators of team cognitions, such as measures of mutual understanding, shared situation awareness, and contextualization behavior. In the lab experiment I used a computer game, which simulated a crisis management situation. This was designed so that it should be motivating and intriguing enough for the participant to feel that they are performing meaningful tasks (Salas, Wildman & Piccolo, 2009). Below I describe the unit and level of analysis and the lab setting in more detail, as well as the data collection.

Unit and level of analysis

Apart from article 4, which investigates the underlying individual antecedents of contextualization, all studies use the team level as the level of analysis. I define a team as "a bounded and stable set of individuals interdependent for a common purpose" (Wageman, Gardner & Mortensen, 2012). I have concentrated on investigating my research questions using three-member teams.

The team level phenomena I consider emerge from individual level behaviors and cognitions. Concentrating exclusively on an individual or group-level analysis would have restricted the degree to which individual and group level effects are accounted for simultaneously (Mathieu & Chen, 2011). A multilevel analysis, on the other hand, simultaneously takes into consideration individual and group-level effects (Hox, 2010). I therefore use a multilevel analysis to investigate the research questions at the team level (articles 1, 2 and 3).

Development of the experimental simulation lab

The team studies are based on experiments conducted through a computer simulation lab, the Mindlab software. As a research assistant at BI (the Norwegian Business School) from 2005 to 2007, I worked on developing early versions of this software with respect to the scenarios, i.e., the preformatted tasks and environment of the simulation. These studies were focused on simulating a national joint headquarters. As a researcher at the Norwegian Defence Research Establishment, I continued the collaboration with BI on developing scenarios for smaller-scale experimental research.

Essentially, the lab consists of two interfaces: a computer map and an email interface. In the map, the scenarios are played out with some objects representing the team's own resources, and other objects representing objects that need protection, and finally a set of objects that have ambiguous identity, and some of which are hostile. The essence in this counter-terrorism scenario is for the three participants in the team to hinder hostile objects from attacking oil rigs. In the email interface, participants receive preformatted tasks and information concerning objects. The team members have the ability to communicate with each other through this interface. In a co-located setting, email is used in combination with face-to-face interaction. In

the simulation the participants could play three scenarios that had the same underlying structure, i.e. hinder terror attacks. The geographic location of the attack as well as the type of friendly and enemy objects was changed from scenario to scenario. The number of friendly and enemy objects was the same in all scenarios. And for data collection purposes actions and messages are being logged.

The focus in the tasks is not on high fidelity tactical task resolution, nor on strategic decision making, but rather on the management of resources in solving an ongoing crisis. The simulation is thus a mid-level simulation focused on the operational level and specific parts of this level's decision-making process (Bakken, 2013).

I developed small-scale experimental scenarios for pilot testing in 2007 and 2008. This included a first implementation of these scenarios involving three team members. Each of the three members operated one capacity, Patrol with capacity to do information search, Orion with high capacity to detect and Frigate with capacity to attack. This created dependencies among the team members role as they had to coordinate where they used their resources to carry out these tasks, as well as exchange information pertaining to each subtask. Detection, information search and attack had to be carried out to solve the team tasks of hindering terror attacks, and one had first to detect in order to infosearch and then read infosearch messages in order to attack the right object.

More specifically, the team needed initially to direct the Orion to detect potential enemies in the right area. In the area that the Orion had surveilled, one had to direct the patrol to information search objects to find out if the objects were enemy or not. The team members had to pass information on location and status to the Frigate, at the same time the Frigate should proactively ask where he should place his boat so that he can attack the infosearched object before it would attack an oil rig. In Figure 3, below, the complementarities creating interdependence is illustrated by indicating the capacity the different roles had for detection, information search and attack.

FIGURE 3:

The level of capacity possessed by each role illustrating complementarities and interdependencies among the team members.

	Team members roles:		
Capacities below:	**Orion**	**Patrol**	**Frigate**
Detection	**High**	Low	Low
Information search	No	**High**	No
Attack	No	No	**High**

In addition to this interdependence, as part of the coordination task, different preformatted information was sent to each participant. This sought to resemble an established way of inducing differences in the information held by each participant, in order to investigate how the team solves communication problems, and potential breakdowns in team cognition,

when they hold different perspectives (Schober & Brennan, 2003; Katz & Te'eni, 2007). The 2007 and 2008 pilot studies indicated that this simulation could be a feasible way of examining the team's integration of diverse knowledge.

Data collection for the four articles

Through 2008 (dataset 1), 2010 (dataset 2), 2012 (dataset 3), 2012–13 (dataset 4) and 2013 (dataset 5), I participated in data collection using this experimental lab. In 2014–15 (dataset 6), individual survey data were collected for article 4. Dataset 1 was collected to provide an initial opportunity to judge whether the media conditions reflected high and low media richness, and to gather data from a military sample for measurement validation. Dataset 2 was collected to gather more precise data on the contextualization variable. Then dataset 3 was collected with experienced military personnel to further refine the development of the shared situation awareness measure. Dataset 4 and 5 were collected to improve the ability to test hypothesis regarding mutual understanding and shared situation awareness and a student sample was used, while dataset 6 was exclusively gathered to investigate in a different context, i.e. individual respondents, the relation between overconfidence and contextualization and perspective taking.

For the military personnel participating, this was part of their leadership development, and constituted a low risk, yet motivating exercise for training. For the students the lab simulations were a voluntary part of their regular studies. Using college students, or military cadets, as participants in experiments as part of their education, could however pose ethical problems, in particular with respect to them feeling obliged to participate. Prior to each data collection, informed consent was acquired from the participants by way of informing them about the data collection and the opportunity to withdraw from the study without giving a reason. In the experiment, the participants could leave if they wanted to. The participants could contact me to get data removed if they had participated in the experiment. This was handled similarly for all participants in each study. No participant asked not to be part of the simulation or data analysis. The Norwegian Centre for Research Data manages the approval related to data privacy issues for social science projects in Norway and a formal approval from the Norwegian Centre for Research Data (NSD) was acquired for the data collected (see: Appendix on page 172). Articles 1 and 2 use overlapping data, but not for similar research questions (Dataset 5). Dataset 4 was also used for research on transactive memory systems by another Phd student, but that research did not overlap with the variables used in this dissertation. Figure 5 below shows the data collection, the six datasets for the four studies, and the variables researched for each article:

FIGURE 5:

Overview of data collection

Variable:	**Article 1**	**Article 2**	**Article 3**	**Article 4**
	Datasets 4 and 5	Datasets 1, 3 and 5	Dataset 2	Dataset 6
Media richness	X	X	X	
Shared situation awareness		X		
Perceived mutual understanding	X			
Actual understanding	X			
Overconfidence	X		X	X
Contextualization			X	X
Perspective taking				X
Team performance		X	X	

The articles included in this dissertation (pages 32-156) are not available open access, due to copyright matters. This also includes the tables and figures presented on these pages.

Article 1
Alignment of perceived mutual understanding and actual mutual understanding:
Role of a distributed versus a co-located communication setting and overconfidence
Valaker, S., Hærem, T., & Kost, D.

Article 2
Connecting the dots in counter-terrorism: The consequences of communication media for shared situation awareness and team performance
Valaker, S., Hærem, T., & Bakken, B. T.

Article 3
Overconfidence and the media, contextualization and team performance relationship:
Towards a behavioral team communication model
Hærem, T, Valaker, S., Bakken, B. T., & Rau, D.

Article 4
Contextualization: The interactive role of overconfidence and perspective taking
Valaker, S.

General discussion

My general objective in this dissertation was to extend the research on the influences and outcomes of team cognition, when teams are faced with a potential breakdown of team cognition during their situation assessment. In four empirical articles, I develop the argument that media richness and overconfidence influence team cognition, specifically mutual understanding, shared situation awareness and contextualization, and through this have consequences for team performance. I now discuss the findings from the four empirical articles with respect to its implications for the organizational research literature on team and media use, limitations and prospects for future studies, as well as practical implications.

The influence of media and overconfidence on mutual understanding and shared situation awareness

In article 1 (Valaker, Hærem & Kost, 2014), I examined the influence of media richness on mutual understanding. I found that there is a greater degree of alignment between perceived mutual understanding and actual understanding in a co-located than in an email setting. I also found a better alignment for those low in overconfidence than for those high in overconfidence. In addition, the findings suggest that people hold more shared actual mutual understanding and shared perception of mutual understanding in a co-located versus an email condition.

These findings extend the knowledge of the conditions for alignment of perceived and actual mutual understanding, by showing that people have trouble aligning their actual and perceived mutual understanding in a distributed email setting, and when they have high overconfidence. This follows up on Cramton's (2001) previous empirical examinations in a distributed setting, which noted the challenges of developing mutual understanding in a distributed setting, and the suggestions in the team cognition literature to more clearly differentiate between perceived and actual team cognition (Wildman et al., 2014).

The findings contribute to the research on mutual understanding (e.g. Katz & Te'eni, 2007), by pinpointing that, in a distributed email setting, people are less able to perceive correctly whether they have good knowledge of each other's information, and that they have less shared perception of mutual understanding and less shared actual mutual understanding. The empirical findings also go beyond the previous empirical research by including overconfidence in own knowledge as a contingency on the relationship between perceived and actual mutual understanding. This extends the current literature on the effect on mutual understanding by including an important cognitive bias as a determinant of when teams are able to align their perceived and actual mutual understanding.

Article 2 (Valaker, Hærem & Bakken, 2016) contributes to a more refined knowledge of how media richness and media synchronicity affect shared situation awareness and team performance, for which there has been calls for research (Dennis et al., 2008; Maynard & Gilson, 2014). The findings indicate that media that media richness and media that support

convergence (co-located communication media) and media that support conveyance (email) help different aspects of shared situation awareness. The findings indicate that level 2 shared situation awareness, in particular, and level 3 shared situation awareness, mediate a positive effect on team performance from media that have a high degree of richness and synchronicity, specifically co-located media. The findings also indicate that co-located media are helpful for sharedness of level 2 and level 3 shared situation awareness, and that email is helpful for sharedness of level 1 shared situation awareness.

This extends the knowledge of what types of shared understanding and situation awareness could be affected by some media that support convergence and conveyance, and what type of shared understanding mediate effects from media to team performance. Whereas some literature had seen synchronicity as positively related to shared understanding (Dennis et al., 2008), the article sheds more light on which types of shared understanding may or may not be helped by synchronicity.

The two studies (Valaker, Hærem & Kost, 2014; Valaker, Haerem & Bakken, 2016) in combination indicate that knowledge structure aspects of team cognition can be influenced by cognitive bias, specifically overconfidence, as well as the degree to which people properly use media that support conveyance and convergence, specifically email and co-located communication, to develop distinct aspects of team cognition. This builds on the current discussion on the role of cognitive bias in communication and the consequences of media capabilities for different types of team cognition (Kruger et al., 2005; Dennis et al., 2008). These findings also contribute to empirical tests of theoretically suggested relationships with respect to mutual understanding (Cramton, 2001), as well as provide more nuance to a rational perspective (e.g. Katz & Te'eni, 2007) on development of mutual understanding by introducing a cognitive bias, overconfidence.

The findings refine prior team cognition research by emphasizing that some media (co-located media) rather than others (email) are better at developing mutual understanding, a critical element of a situation assessment process (Burke et al., 2006), as well as highlighting how mutual understanding can be hindered by overconfidence. The findings also provide more nuances on how media influence a key team cognition construct: shared situation awareness, by suggesting that different media contribute to different aspects of this construct, following up prior calls for research on the development of shared situation awareness (Uitdewilligen et al., 2010).

Overconfidence and contextualization

Article 3 (Hærem, Valaker, Bakken & Rau, 2014) examined the influence of overconfidence on the media richness, contextualization and team performance relationship. The findings from this article indicate that overconfidence negatively moderates the media richness and contextualization relation, so that, for those high in overconfidence there is less contextualization irrespective of media condition. For those low in overconfidence there is more contextualization in a co-located, versus a distributed email setting. Overconfidence also

negatively moderated a positive mediation effect of media richness on team performance via contextualization. This suggests that contextualization may be hampered not only by lack of contextualization support, but also by cognitive biases with negative consequences for team performance. The findings crucially found overconfidence to be shared at the team level and more so in a co-located setting. This suggests that overconfidence may be viewed as a group-level phenomena influencing communication behaviors that are aimed at reducing misunderstandings.

The findings extend the cost–benefit model of contextualization by suggesting that overconfidence can lead people not to contextualize, even when perspectives are different and there is a low cost in doing so, i.e. one is communicating in a co-located setting. This answers calls for research on what may underlie team members' failure to adapt their contextualization correctly (Katz & Te'eni, 2007) as well as calls for empirical research on the effect of media capabilities on contextualization in the team cognition literature (Maynard & Gilson, 2014). The findings suggest that decision-making biases crucially influence communication behavior, and may be an alternative to a rational way of evaluating the cost and benefits of contextualization, in line with the judgment and behavioral decision-making literature and sensemaking theory (Weick, 1991; Payne et al., 1993).

Article 4 (Valaker, 2016) builds on and extends article 3, by using a non-conversational individual-level vignette method. Whereas in article 3, contextualization was studied at a group level, in article 4 the focus is on the individual's decision to contextualize. Similarly to article 3, it finds that overconfidence hampers contextualization. However, this negative effect is moderated by a perspective taking intervention that encourages people to take into account the perspectives of others, so that the effect of overconfidence on contextualization is less negative when people participate in such an intervention.

This finding suggest that the negative influence of overconfidence on contextualization can be reduced by attuning people to others' views and attitudes, at least with respect to individual's decision to contextualize. This extends knowledge of when people may have trouble contextualizing, i.e. they have high overconfidence, and under which conditions such a negative influence may be reduced, i.e. they engage in perspective taking. Thus this article provides more nuances to what underlies contextualization, for which there has been calls for research (Katz & Te'eni, 2014).

These two articles (Hærem et al., 2014; and Valaker, 2016) in combination suggest that the research on the antecedents of contextualization could benefit from including decision-making biases, specifically overconfidence, as important influences. Furthermore, the findings from article 3 suggest that the considerations underlying people's decisions to contextualize and ultimately the influence of contextualization on team performance, when perspectives are initially dissimilar, are impacted by the interaction of media richness (co-located versus distributed email) and overconfidence.

Taken together the findings may extend the research on team cognition by empirically testing the proposition in Maynard and Gilson (2014) of what media capabilities influence

contextualization. The findings suggest that media that help transmission velocity and symbol sets (i.e. co-located media) help contextualization, in line with Maynard and Gilson (2014). However, the effect of media may be contingent on overconfidence, nuancing a rational account of medias influence on contextualization, and thus answering calls for research on whether contextualization may not be solely influenced by a simple cost–benefit calculation (Katz & Te'eni, 2014), but could be biased. The finding that perspective taking may lessen the negative effect of overconfidence on contextualization, suggest that at an individual level, interventions could be made to increase contextualization. Perspective taking interventions could potentially help develop contextualization, and perhaps team cognition in general, although this needs further research since this was an individual level study.

Overall contribution

The overall contribution to theory of the four studies is to extend the research on team cognition and teams adaptability when faced with a breakdown in team cognition, with respect to the role of media richness (specifically co-located and email settings) and overconfidence. Both early and later theorizing on organizational communication have suggested that several factors related to communication may inhibit or help team cognition (Daft & Lengel, 1986; Krauss & Fussell, 1991; Cramton, 2001; Kruger et al., 2005; Burke et al., 2006; Katz & Te'eni, 2014; Maynard & Gilson, 2014). There have been calls for research that scrutinizes in more depth the situations in which people fail to develop team cognition, both from the team cognition literature as well as the organizational communication literature (e.g. Cramton, 2001; Burke et al., 2006; Katz & Te'eni, 2007; Maynard & Gilson, 2014). My intention in examining the research questions for studies 1–4 has been to contribute to this ongoing discussion about determinants of team cognition and through this team performance.

The influence of distributed email media on team cognition suggests that the consequences are not only those of less perceived mutual understanding or less shared situation awareness viewed as one undifferentiated construct. By distinguishing between perceived and actual mutual understanding and different levels of shared situation awareness, the relation between media capabilities and certain types of team cognition can potentially be seen in a more nuanced way. This follow up suggestions from Wildman et al. (2014) to increase the knowledge of perceived and actual team cognition, as well as from Uitdewilligen et al. (2010) to refine the understanding of shared situation awareness.

The findings could explain why some teams may have trouble adapting their shared team cognition related to ongoing assessment of a situation. While previous research has suggested that media richness may increase team cognition (e.g. Dennis et al., 2008; Maynard & Gilson, 2014), it has to a lesser extent pinpointed its effect on mutual understanding and what elements of shared situation awareness it supports. The findings from my research could provide some nuance to the effect of media on team cognition. The findings could also suggest some trade-offs with respect to developing shared situation awareness, as certain

aspects are better developed in a co-located setting than in a distributed (level 2 and 3). This nuances the role media play in developing at least some aspects of a teams shared cognition.

Taken together this follows up suggestions to include communication media as a determinant of team cognition by for example Maynard and Gilson (2014) and Foster et al. (2015). However, the findings also suggested that an important aspect of teams information processing tendencies, their overconfidence, could influence mutual understanding and, in interaction with media, contextualization. Considering overconfidence as an additional determinant of when people are able to align perceived and actual mutual understanding and contextualize, the findings could refine the understanding of what underlies development of team cognition. Including overconfidence as a predictor of team cognition, could imply that a less than rational developmental process is taking place. Overconfidence, originating individually and emerging as shared in the team, may perhaps be an overlooked cognitive "trap" in team adaptability.

These studies suggest that the underlying mechanisms leading to contextualization could be more complex than hitherto suggested in the theory or empirically tested (Te'eni, 2001; Katz & Te'eni, 2007). This could mean that a cost–benefit model of contextualization (Katz & Te'eni, 2007) could be complemented by important contingencies regarding the influence of biases on information processing, such as overconfidence. While the findings with respect to overconfidence lends support to earlier suggestions in the communication literature that biases could influence what one believe about the communication and how much explanation one add to messages (Aune, Levine, Park, Asada & Banas, 2005; Kruger et al., 2005), study 3 extend this suggestion to a team level.

Taken together, the four studies extend the research into team cognition and media by elucidating media (co-located versus distributed email) and overconfidence as boundary conditions for mutual understanding, shared situation awareness and contextualization.

Limitations and research directions

Notwithstanding its possible contributions, this dissertation has several limitations, and highlight potential avenues for future research. The manipulation and measurement of communication settings could be expanded in future research. While the studies reported here differentiate between media with a low and high variety of cue and feedback, the breadth of different communication media, in both distributed and co-located settings, could be expanded in future designs. Media richness can be seen as a continuum with this dissertation focusing only on two extremes: co-located (high media richness) and email (low media richness). Also, a more precise measurement of media as well as communication setting could be undertaken, for example by measuring the degree of virtuality (Boyer, O'Leary & Cummings, 2007; Foster et al., 2015). Such extensions of the present studies could perhaps more clearly pinpoint whether the detrimental effect of distributed media on team cognition could be offset by communication support in distributed communication (Majchrcazk,

Malhotra & John, 2005; Katz & Te'eni, 2007). Related to media is the measurement of a broader set of behaviors aimed at correcting misunderstandings, such as noticing that misunderstandings have taken place (Blatt et al., 2006).

An interesting avenue for future research could be to consider which aspects of media and media use may enhance or limit overconfidence. The findings indicate that high rich media (a co-located setting) leads to more shared overconfidence than a low rich media (distributed email setting). This study is however limited in that it studied two extremes of the media richness continuum. It could thus be interesting to explore: what aspects of the media condition or media use enhance this sharedness of overconfidence? Is it richness of cues or is it ability to rapidly exchange information that is the key driver of sharedness of overconfidence? Exploring the mechanisms in media use that may lead to one or the other outcome with respect to sharedness could be an interesting and important investigation.

One limitation of the dissertation is the choice of how overconfidence was operationalized in studies 3 and 4. For example, it could be important to compare the role of overestimation of others' knowledge with the influence of overestimation of one's own knowledge (Krauss & Fussell, 1991). Blatt et al. (2006) found that talking about errors to superiors could be inhibited by lack of confidence in one's own opinion, and so exploring whether extreme levels of under-confidence may also inhibit contextualization could be interesting.

With respect to other core constructs of the studies, both mutual understanding and shared situation awareness measurements could be refined. Article 1 used a measurement of perceived mutual understanding consistent with that used in prior research by Katz & Te'eni (2007). However, perceived mutual understanding of specific information could be measured. In addition, there could be a more precise measure of shared situation awareness than was used in article 2, perhaps measuring it during and not after scenarios. This could perhaps more precisely avoid the confounding effects of memory and performance feedback on shared situation awareness (Endsley, 2000).

The studies examined in isolation how knowledge structure aspects of team cognition and interaction aspects of team cognition could be influenced by media richness and overconfidence. Future research could combine the implications from the different studies to form hypotheses about the linkages between for example shared situation awareness and contextualization. For example, the role of contextualization with respect to the relation between media richness and shared situation awareness could be examined further to trace in a perhaps better way the adaptation process (Rosen et al., 2012).

Related to the overall contribution of the dissertation, future research could expand the investigation of the underlying reasoning with respect to contextualization and development of team cognition. The degree to which people "consciously" design or rationally consider their communication could be further examined. This could be done both by investigating perceptions of messages and by measuring eyesight and clicking behavior related to the making and reading of messages. Related to this idea for future studies, examining situations

with perspective differences (i.e. different information among team members) and perspective similarities (i.e. similar information among team members) could be important. This could pinpoint the failure and success of adapting communication in these two situations.

This research used lab simulation and vignette studies to collect data, both of which have strengths and weaknesses. The strengths common to both methods are the possibility to repeat scenarios and the simplicity of the underlying task, allowing the pinpointing of specific behaviors and perceptions with a high degree of internal validity. The game in studies 1–3 was developed based on military officers' experience and thus resembled crucial real life tasks (see e.g., Bakken, 2013), and the vignette design built upon similar studies for examining real world problems in a stylized manner. Yet the external validity will always be problematic in such designs. Future studies could thus examine the research questions in field settings.

This could be done by taking into consideration measures of media used, contextualization behavior, mutual understanding and shared situation awareness, using longitudinal designs. By doing so, routines for information sharing could be examined as an additional and important variable that may crucially influence the limitations on use of media as discussed here. Related to this future studies could examine the role of overconfidence and media for team cognition in other organizational forms, such as multiteams (Davison et al, 2012). The need and types of shared cognition may be different in a multiteam versus a team, perhaps one that is more loosely combined, and hence new questions may be interesting, such as: Do the media used by those team members who are at the boundary between teams influence their shared cognition with persons in other teams, in the same way as for team cognition? And more generally: How is media and overconfidence helping or constraining coordination in the multiteam system?

It could be important to vary important features of the setting in future research. Research suggests that mixed motives can be present in team tasks (Johnson et al., 2006; De Dreu et al., 2008). There was no collective reward, except solving the team task successfully, and no internal competition within the team in the task. However, incentive structures could perhaps influence willingness to contextualize and interest in developing shared team cognition with other team members.

Furthermore the setting was short term, acute, and highly equivocal. Longer duration and different levels of equivocality could yield different results. Shared situation awareness at levels 2 and 3 may also be easier to develop in a distributed setting if there are low levels of equivocality; contextualization may then be less needed. However, for teams in such settings, a sudden shift to a highly equivocal task and high speed could lead to problems developing shared understanding and contextualization, as it may require procedures other than those that they have been accustomed to.

This could hold implications for future theory development, regarding the effects of media on team cognition. With respect to development of team cognition related to ongoing situations of misunderstanding within a team, communication media and overconfidence seem to be particularly important boundary conditions. Future research could take these to other

aspects of team cognition, and look at the relation between media and cognitive biases. For example, when exploring the influence of media on team cognition, such as team mental models it could be beneficial to consider overconfidence (Burke et al., 2006). Is it, for example, the case that overconfident team members have more difficulty developing accurate shared mental models, even when placed in a co-located setting? Under what conditions does a co-located setting setting help uncover cognitive biases and thus help develop shared mental models?

Implications for practice

One of the crucial challenges for teams is to ensure accurate team cognition of the issues that are relevant to accomplishing team tasks. This motivated the present articles. Many tasks have such requirements: for instance, complex teamwork in hospitals and military settings (Snook, 2000; Blatt et al., 2006; Faraj & Xiao, 2006; Wilson et al., 2007). Consequently, it is particularly important to ensure that the communication among team members enables accurate information sharing. The findings of the studies may particularly increase knowledge of the pitfalls in developing team cognition, and I make three suggestions as to specific practical implications:

Firstly, the perception one has concerning a communication may not be accurate in a distributed context. Special care should therefore be taken in a distributed context to inquire whether messages have been perceived accurately. Additionally, care might be taken in distributed contexts to enquire whether one holds the most up-to-date information from others. Also, lowering overconfidence could contribute to better alignment of what one believes to be communicated with what is actually communicated.

Secondly, the dissertation highlights the need to pay special attention to developing shared situation awareness concerning the relation among elements in the environment and their future status, in order to enhance team performance, for example in a counter-terrorism context. This could be particularly challenging in a distributed context, so extra care could then be taken to develop this and to develop communication support that specifically aids development of levels 2 and 3 of shared situation awareness.

Thirdly, the fact that overconfidence could be detrimental to contextualization, suggests that team members benefit from knowing the inherent dangers in assuming that one's subjective knowledge is self-evident, when communicating to others. Being open to others' information, perhaps helped by thinking about the perspectives of others, as well as being ready to clarify and to provide additional explanations about the message one sends could therefore be crucial.

Overall, in order to apply these suggestions, training that makes team tasks more alive to practitioners can be important (Salas et al., 2009). To have one or more of the three areas suggested as learning goals might be a way of organizing such training. Participants could, for example, play out scenarios that include trigger points that could make these topics vivid.

Performance feedback and debriefing could be an opportunity for reflection. Following such reflection, participants can try out ways to improve their abilities and set more refined learning goals. The learning goals can be tied specifically to the behaviors needed to reduce misunderstandings in a particular setting to increase relevance for specific tasks (Rosen, Wildman & Salas, 2012).

Overall conclusion

Taken together this dissertation has sought to refine the research on development of team cognition when team members hold divergent information, by examining the role of media richness and overconfidence and its consequences for team performance. It has found that co-located media that are rich and support convergence in particular have a positive influence on alignment of perceived and actual mutual understanding and shared situation awareness concerning understanding of elements in a situation, (level 2), and projecting their future status, (level 3). Furthermore, overconfidence can be one mechanism that hinders alignment of perceived and actual mutual understanding, and hinder the use of co-located media for contextualization. On the other hand, perspective taking may moderate negative effects of overconfidence on overconfidence. These findings refine prior team cognition research by suggesting important factors affecting situation assessment processes and adapting to potential breakdowns in team cognition. In communication, not only behavior but also the medium may be central explanatory variable, and people's cognitive biases may distort adaptation processes commonly viewed as rational.

References

Aune, R. K., Levine, T. T., Park, H. S. P., Asada, K. J. K. & Banas, J. A. (2005). Tests of a theory of communicative responsibility. *Journal of language and social psychology*, 24(4), 358-381.

Bakken, B. T. (2013). *Intuition and analysis in decision making On the relationships between cognitive style, cognitive processing, decision behaviour, and task performance in a simulated crisis management context.* Bi Norwegian Business School Series of Dissertation 09/ 2013.

Bell, S. T. 2007. Deep-Level Composition Variables as Predictors of Team Performance A Meta-Analysis. *Journal of Applied Psychology*, 92, 3: 595-615.

Blatt, R., Christianson, M. K., Sutcliffe, K. M., & Rosenthal, M. M. 2006. A sensemaking lens on Reliability. *Journal of Organizational Behavior,* 27, 897-917.

Boland, R. T. Jr., Tenkasi, R. V. 1995. Perspective making and perspective taking in communities of knowing. *Organization Science* 6: 350-372.

Boyer O´Leary, M., and J. N. Cummings. 2007. The Spatial, Temporal and Configurational Characteristics of Geographic Dispersion in Teams. *MIS Quaerterly* 31(3) 433-452

Burke, C. S., Stagl, K. C., Salas, E., Pierce, L., & Kendall, D. (2006). Understanding Team

Adaptation: A Conceptual Analysis and Model. *Journal of Applied Psychology, 91*(6), 1189-1207. http://dx.doi.org/10.1037/0021-9010.91.6.1189

Camerer, C., Loewenstein, G., Weber, M. (1989). The Curse of Knowledge in Economic Settings: An Experimental Analysis. *The Journal of Political Economy* 97(5), 1232-1254.

Carlson J. R., and Zmud, R. W. 1999. Channel Expansion Theory and the Experiential Nature of Media Richness Perceptions,*Academy of Management Journal* 42(2), 153-170.

Clark, H. H. 1996. *Using Language.* Stanford: Cambridge University Press

Clark, H. H., & Marshall, C. R. (1981). Definite reference and mutual knowledge. In A. K.

Joshe, B. Webber, & I. A. Sag (Eds.), *Elements of discourse understand- ing.* Cambridge: Cambridge University Press.

Cooke, N. J., Gorman, J. C., Myers, C. W., Duran, J. L. (2013). Interactive team cognition. *Cognitive science*, 37, 255-285.

Cornelius, C., Boos, M. 2003. Enhancing Mutual Understanding in Synchronous Computer-mediated communication by training Tradeoffs in judgemental tasks. *Communication Research*, 30(2), 147-177

Cramton, C. D. 2001. The Mutual Knowledge Problem and Its Consequences for Dispersed Collaboration. *Organization Science,* 12(3), 346-371.

Cramton, C. D., Orvis, K. L., Wilson, J. M. (2007). Situation Invisibility and Attribution in Distributed Collaborations. *Journal of Management,* 33(4), 525-546

Daft, R. L., Weick, K. E. (1984). Toward a model of Organizations as Interpretation Systems. *Academy of Management Review, 9*(2), 284-295.

Daft, R. L., & Lengel, R. H. 1986. Organizational Information Requirements, Media Richness and Structural Design. *Management Science, 32(5),* 554-571.

Daft, R. L., Bettenhausen, K. R. & Tyler, B. B. 1995. Implications of Top Manager`s Communication Choices for Strategic Decisions. In Huber, G. P. & Glick, W. H. (eds.) *Organizational Change and Redesign: Ideas and Insights for Improving Performance,* New York, Oxford University Press.

Davison, R. B., Hollenbeck, J. R., Barnes, C. M., Sleesman, D. J., & Ilgen, D.R. (2012).

Coordinated action in multiteam systems. *Journal of Applied Psychology, 97*(4), 808-824

De Dreu, C. K. W., Nijstad, B. A., van Knippenberg, D. (2008) Motivated information processing in group judgement and decision making. *Personality and Social Psychology Review,* 12, 22-49

De Dreu, C. K. W. & Beersma, B. (2010). Team confidence, motivated information processing, and dynamic group decision making. *European Journal of Social Psychology* 40, 1110-1119.

deGuinea, A. O., Webster, J., Staples, D. S. 2012. A meta-analysis of the consequences of virtualness on team functioning. *Information & Management* 49, 301-308

Dennis, A. R., and Kinney, S. T. 1998. Testing Media Richness Theory In The New Media:

Cues, Feedback, and Task Equivocality, *Information Systems Research* 9 (3), 256-274.

Dennis A. R., Fuller R. M. & Valacich J. S., 2008. Media, Tasks, and Communication Processes. A Theory of Media Synchronicity. *MIS Quarterly*, 32, 3, 575-600.

DeSanctis, G. & Poole, M. S. 1994. Capturing the complexity in advanced technology use: adaptive structuration theory. *Organization Science*, 5,2, 121-147.

Endsley, M. R. 2000. "Theoretical underpinnings of situation awareness: a critical review" in Endsley, M. R. and Garland D. J. (Eds.) *Situation Awareness Analysis and Measurement,* Mahwah, NJ: Lawrence Erlbaum Associates.

Endsley, M. R., Bolte, B., Jones, D. (2003). *Designing for siuational awareness: an approach to user-centered design*. Boca Raton.:Taylor Francis Group.

Epley, N., Keysar, B., Van Boven, L, Gilovich, T. (2004). Perspective taking as Egocentric Anchoring and Adjustment. *Journal of Personality and Social Psychology* 87(3), 327-339.

Faraj, S. &Xiao, Y. (2006).Coordination in Fast-Response Organizations. *Management Science, 52*(8), 1155–1169, http://dx.doi.org/10.1287/mnsc.1060.0526

Foster, M. K., Abbey, A., Callow, M. A., Zu, X., & Wibon, A. D. (2015). Rethinking virtuality and its impact on teams. *Small Group Research*, 46, 267-299.

Fulk, J., and Boyd, B. 1991. Emerging Theories of Communication in Organizations, *Journal of Management,*17,2: 407-446.

George, J. F., Carlson, J. R., Valacich, J. S. 2013. "Media Selection as a Strategic Component of Communication," *MIS Quarterly*, 37, 4, 1233-1251

Hayward, P. A. 2012. Technology-mediated collaboration, shared mental model and task performance. Journal of Organizational and end user computing, 24(1), 64-81

Hox, J. 2010. *Multilevel Analysis. Techniques and Application.* London: Routledge

Huber, G. 1982. Organizational information systems: Determinants of their performance and behavior. Management Science. 28(2), 138-155

Hutchins, E. H. (1991). *Cognition in the wild.* Boston: MIT Press

Hærem, T., Valaker, S, Bakken, B. T. & Rau, D. (2014). Overconfidence and the media, contextualization and team performance relationship: Towards a behavioral team communication model. Paper presented at the 74th Annual Academy of Management Meeting.

Johnson, M. D., Hollenbeck, J. R., Humphrey, S. E., Ilgen, D. R., Jundt, D., Meyer, C. J. (2006). Cutthroat Cooperation: Asymmetrical adaptation to changes in team reward structures. *Academy of Management Journal 49*(1), 103-119.

Kahneman, D. (2002). Maps of bounded rationality: A perspective on intuitive judgment and choice. Retrieved 10 January, 2015, from http://www.nobelprize.org/nobel_prizes/economic-sciences/laureates/2002/kahnemann-lecture.pdf

Katz, A., Te´eni, D. 2007. "The Contingent Impact of Contextualization on Computer-Mediated Collaboration." *Organization Science, 18(2),* 261-279.

Katz, A., & Te'eni., D. (2014). The Role of Communication Complexity in Adaptive Contextualization. *Ieee Transactions on Professional Commununication. 57*(2): 98-112. doi: 10.1109/TPC.2014.2312454

Kellermanns, F. W., Walther, J., Lechner, C., & Floyd, S. W. (2005). The lack of consensus about strategic consensus: Advancing theory and research. *Journal of management*, 31, 719-737.

Krauss, R., S. Fussell. 1990. Mutual knowledge and communicative effectiveness. In J. Galegher, R. Kraut, C. Egido, (Eds.) *Intellectual Teamwork: Social and Technological Foundations of Cooperative Work*. Lawrence Erlbaum, Hillsdale, NJ 111–146.

Krauss, R., S. Fussell. 1991. Accuracy and bias in estimates of others' knowledge. *European Journal of Social Psychology,* 21, 445-454.

Kruger, J., Epley, N., Parker, J., & Ng, Z. W. 2005. Egocentrism over e-mail: Can we communicate as well as we think? *Journal of Personality and Social Psychology*, 89(6): 925-936.

LeBaron, C., Christianson, M. K., Garrett, L., & Ilan, R. (2016). Coordinating flexible performance during everyday work: An Ethnomethodological study of handoff routines.*Organization Science*, 27, 514-534. DOI: 10.1287/orsc.2015.1043

Lengel R.H., Daft, R. L. 1984. Organizations as Information Processing Systems. An Exploratory Analysis of the Relationship between Media Richness and Managerial Information Processing. *Office of Naval Research Technical report series*, TR-ONR-DG-08

Lewis, K, (2003), `Measuring transactive memory systems in the field: Scale development and validation´, *Journal of Applied Psychology*, Volume 88, Number 4), pp. 587–604.

Maitlis, S., & Christianson, M. (2014). Sensemaking in Organizations: Taking Stock and Moving Forward. *Academy of Management Annals, 8*(1), 57-125. doi: 10.1080/19416520.2014.873177

Majchrzak, A., Malhotra, A., & John, R. 2005. Perceived Individual Collaboration Know-How Development Through Information Technology-Enabled Contextualization: Evidence from Distributed Teams. *Information Systems Research, 16(1),* 9-27.

March, J., Simon, H. 1958. *Organizations*. Cambridge MA: Blackwell

Mathieu, J. E., & Chen, G. 2011. The etiology of the Multilevel Paradigm in Management Research. *Journal of Management*, 37, 2: 610-641.

Maynard, M. T., Gilson, L. L. (2014). The Role of Shared Mental Model Development in Understanding Virtual Team Effectiveness. *Group & Organization Management*, 39(1), 3-32.

McGrath, J. E., Martin, J. & Kulka, R. A. (1982). *Judgement calls in research.* London: Sage

Mead, George. H. (1934). *Mind, Self, and Society: From the Standpoint of a Social Behaviorist.* Chicago: University of Chicago Press.

Moore, D. A., & Healy, P. J. (2008). The Trouble With Overconfidence. *Psychological*

Review. 115 (2): 502-517

Payne, J. W., Bettman, J. R., Johnson, E. J. (1993). *The Adaptive Decision Maker*. Cambridge: Cambridge University Press.

Perrow, C. 1967. A Framework for the Comparative Analysis of Organizations. *American Sociological Review*, 32, 2: 194-208.

Rosen, M. A., Wildman, J. L., & Salas, E. 2012. Measuring Team Dynamics in the Wild. In Hollingshead, B. & Poole, M. S. (Eds.), *Research Methods for Studying Groups and Teams A Guide to Approaches, Tools and Technologies*, London, Routledge.

Rudolph, J. W., Morrison, J. B., & Carroll, J. S. (2009). The Dynamics of Action-Oriented Problem Solving: Linking Interpretation and Choice. *Academy of Management Review, 34*(4), 733-756. doi: 10.5465/AMR.2009.44886170

Salas, E., Prince, C., Baker, D. P. and Shrestha, L., (1995), `Situation awareness in team performance: Implications for measurement and training´, *Human Factors*, Volume 37, Number 1, pp. 123–136

Salas, E., Wildman, J. L., Piccolo, R. F. 2009. Using Simulation-Based Training to Enhance Management Education. *Academy of Management Learning & Education*, 8, 4, 559-573

Schiller, S. Z., Mandviwalla, M. (2007). Virtual Team Research An Analysis of Theory use and a Framework for Theory Appropriation. *Small Group Research*, 38(1), 12-59.

Shadish. W. R., Cook, T. D. & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference.* Boston: Houghton Mifflin Company

Schober & Brennan, 2003. Processes of interactive spoken discourse: The role of the partner. In Graesser, A. C., Gernsbacher, M. A., Goldman, S. R. (Eds.) *Handbook of discourse processes* (pp. 123-164). Hillsdale, NJ: Lawrence Erlbaum.

Snook, S. A. (2000). *Friendly Fire. The Accidental Shootdown of U. S. Black Hawks Over Northern Iraq.* Princeton: Princeton University Press.

Te'eni D. (2001). A Cognitive-Affective Model of Organizational Communication for Designing IT. *MIS Quarterly 25 (2), 251-312*

Thompson, L., Fine, G. A. 1999. Socially shared cognition, affect, and behavior: A review and integration. *Personality and Social Psychology Review*. 3(4), 278-302

Todd, A. R., Galinsky, A.D., & Bodenhausen, G. V. (2012). Perspective Taking Undermines Stereotype Maintenance Processes: Evidence From Social Memory, Behavior Explanation, And Information Solicitation. *Social Cognition* 30(1): 94-108

Trevino, L. K., Lengel, R. H., and Daft, R. L. 1987. "Media Symbolism, Media Richness, and Media Choice in Organizations: A Symbolic Interactionist Perspective," *Communication Research* (14), pp. 553-574.

Trevino, L. K., Daft, R. L., Lengel, R. H. 1990. Understanding Managers' Media choices: A Symbolic Interactionist Perspective. In Fulk, J. & Steinfeld, C. (Eds.), *Organizations and Communication Technology* (71-94). London Sage Publications.

Uitdewilligen, S., Waller, M. J., & Ziljstra, F. R. H. (2010). Team Cognition and adaptability in dynamic settings: A review of pertinent work. In G. P. Hodgkinson, G. P., Ford, J. K. (Eds.), *International Review of Industrial and Organizational Psychology.* (Vol. 25, pp. 293-353*)*. Chichester UK: Wiley.

Valaker, S. (2016). Contextualization: The interactive role of overconfidence and perspective taking. Paper presented at the 76th Annual Academy of Management Meeting.

Valaker, S., Hærem, T. & Kost D. (2014). Alignment of perceived mutual understanding and actual mutual understanding: Role of a distributed versus co-located communication setting and overconfidence. Paper presented at the 74th Annual Academy of Management Meeting.

Valaker, S., Hærem, T., Bakken, B. T. (2016). Connecting the dots in counter-terrorism: The consequences of communication media for shared situation awareness and team performance. Paper presented at the 76th Annual Academy of Management Meeting.

Van den Heuvel, A. K. & Crego, J. 2012. How uncertainty and accountability can derail strategic sae life‘ decisions in counter-terrorism simulations: A descriptive model of choice deferral and omission bias. *Journal of behavioral decision making*. 25: 165-187.

Wageman, R., Gardner, H., Mortensen, M. 2012. The changing ecology of teams: New Directions for teams Research. *Journal of Organizational Behavior*. 33,3: 301-315.

Weick, K. E. 1979. *The Social Psychology of Organizing.* New York: McGraw-Hill.

Weick, K.E. (1985). Cosmos vs. chaos: Sense and nonsense in electronic contexts." *Organizational Dynamics,* 14(2), 50-64.

Weick, K. E. 1990. The vulnerable system: An analysis of the Tenerife air disaster. *Journal of Management, 16*(3): 571-593. doi: 10.1177/014920639001600304

Weick, K. E. (1993). The Collapse of Sensemaking in Organizations - the Mann Gulch Disaster. *Administrative Science Quarterly, 38*(4), 628-652. doi: 10.2307/2393339

Weick, K. E. (2005). Organizing and failures of imagination. *International Public Management Journal, 8*(3), 42-238.

Weick, K. E., & Meader, D. K. (1993). Sensemaking support systems. In L. M. Jessup & J. S. Valecich (Eds.), *Group support systems: New perspectives* (pp. 230-252). New York: Macmillan.

Weick, K. E. (1995). *Sensemaking in Organizations*. Thousand Oaks CA: Sage.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (1999). “Organizing for High Reliability: Processes of Collective Mindfullness.” *Research in Organizational Behavior*, 21, 81-121.

Wildman, J. L., Salas, E., Scott, C. P. R. (2014). Measuring Cognition in Teams : A Cross-Domain Review. Human Factors, 56(5), 911-941.

Wilson, K. A., Salas, E., Priest, H. A., & Andrews, D. (2007) Errors in the heat of battle:

taking a closer look at shared cognition breakdowns through teamwork. *Human Factors, 49*(2), 243-56. http://dx.doi.org/10.1518/001872007X312478

APPENDIX: Letter from Norwegian Social Science Data Services

Norsk samfunnsvitenskapelig datatjeneste AS
NORWEGIAN SOCIAL SCIENCE DATA SERVICES

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0484 OSLO

Vår dato: 02.10.2012 Vår ref:29459 / 3 / MSS Deres dato: Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 19.01.2012. All nødvendig informasjon om prosjektet forelå i sin helhet 27.09.2012. Meldingen gjelder prosjektet:

29459	*Beslutningstaking og felles situasjonsforståelse på individ og gruppenivå.*
Behandlingsansvarlig	*Handelshøyskolen BI, ved institusjonens øverste leder*
Daglig ansvarlig	*Sigmund Valaker*

Personvernombudet har vurdert prosjektet og finner at behandlingen av personopplysninger er meldepliktig i henhold til personopplysningsloven § 31. Behandlingen tilfredsstiller kravene i personopplysningsloven.

Personvernombudets vurdering forutsetter at prosjektet gjennomføres i tråd med opplysningene gitt i meldeskjemaet, korrespondanse med ombudet, eventuelle kommentarer samt personopplysningsloven og helseregisterloven med forskrifter. Behandlingen av personopplysninger kan settes i gang.

Det gjøres oppmerksom på at det skal gis ny melding dersom behandlingen endres i forhold til de opplysninger som ligger til grunn for personvernombudets vurdering. Endringsmeldinger gis via et eget skjema, http://www.nsd.uib.no/personvern/forsk_stud/skjema.html. Det skal også gis melding etter tre år dersom prosjektet fortsatt pågår. Meldinger skal skje skriftlig til ombudet.

Personvernombudet har lagt ut opplysninger om prosjektet i en offentlig database, http://pvo.nsd.no/prosjekt.

Personvernombudet vil ved prosjektets avslutning, 31.12.2017, rette en henvendelse angående status for behandlingen av personopplysninger.

Vennlig hilsen

Vigdis Namtvedt Kvalheim

Marie Strand Schildmann

Marie Strand Schildmann tlf: 55 58 31 52
Vedlegg: Prosjektvurdering

Avdelingskontorer / District Offices
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Personvernombudet for forskning

Prosjektvurdering - Kommentar

Prosjektnr: 29459

Formålet med prosjektet er å utvikle og belyse problemstillinger i forhold til beslutningstaking og felles situasjonsforståelse på individ og gruppenivå.

Prosjektet gjennomføres i samarbeid med Forsvaret og andre institusjoner som arbeider med krisehåndtering. Det er ikke avklart på nåværende tidspunkt hvilke andre ann BI og Forsvaret som er deltakere. Handelshøyskolen BI er behandlingsansvarlig institusjon. Personvernombudet forutsetter at behandlings-/ansvarsfordelingen formelt er avklart mellom institusjonene. Vi anbefaler at det utarbeides en avtale som omfatter ansvarsfordeling, ansvarsstruktur, hvem som initierer prosjektet, bruk av data og eventuelt eierskap.

Ifølge prosjektmeldingen skal det innhentes samtykke basert på muntlig informasjon om prosjektet og behandling av personopplysninger. Personvernombudet forutsetter at det gis muntlig informasjon om følgende for at samtykket skal være gyldig i henhold til personopplysningsloven:

- formålet med prosjektet
- hvilke metoder som vil bli benyttet
- hvilke opplysninger som samles inn
- hva opplysningene skal brukes til
- hvem som vil ha tilgang på opplysningene
- at opplysningene vil bli behandlet konfidensielt
- at det er frivillig å delta
- at man kan trekke seg når som helst uten å måtte begrunne det
- dato for prosjektslutt og hva som da vil skje med datamaterialet (se kommentar vedrørende prosjektslutt)
- kontaktopplysninger til forsker.

Confirmit er databehandler for prosjektet. Personvernombudet forutsetter at det foreligger en databehandleravtale mellom Confirmit og Handelshøyskolen BI for den behandling av data som finner sted, jf. personopplysningsloven § 15. For råd om hva databehandleravtalen bør inneholde, se Datatilsynets veileder på denne siden: http://datatilsynet.no/verktoy-skjema/Skjema-maler/Databehandleravtale---mal/

Prosjektslutt er 31.12.2017. Dersom datamaterialet ikke skal anonymiseres ved prosjektslutt, skal utvalget ved forespørsel om deltakelse motta informasjon om endelig dato for anonymisering av innsamlede opplysninger, samt hva som er formålet med lagring ut over prosjektslutt (oppfølgingsstudier). Anonymisering innebærer at verken direkte eller indirekte personidentifiserbare opplysninger fremgår, verken hos Confirmit eller forsker. Adresser og logger slettes.

Ombudet ber om at forsker gir oss en dato for anonymisering av data.