Global Virtual Teams:
Enhancing Effectiveness

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Chapter 1

Introduction

The number of global virtual teams in practice keeps growing. Despite the investments of organizations in interaction media, global virtual teams do not always perform as was hoped for. Although many researchers point out the importance to investigate the dynamics and effectiveness of global virtual teams, up to now, only little research has been conducted to investigate this. This dissertation presents four studies in which we address issues currently missing in literature. Particular emphasis is put on behaviors in global virtual teams, the processes trust and social presence, the role of the input variables isolation and national culture, and the outcome variables team satisfaction and team performance.

Teams of people working together for a common cause touch all our lives. From everyday activities like air travel, fire fighting, and running the United Way drive to amazing feats of human accomplishment like climbing the Mt. Everest and reaching for the stars, teams are the center of how work gets done in modern society (Kozlowski, & Ilgen, 2006, p. 78). This quote, which has been derived from a recent review on processes and effectiveness in teams, demonstrates the central role of teams in our daily lives. For organizations, these groups, teams, or crews are essential for the accomplishment of goals. The divisions of labor in teams allow faster and better achievements. Moreover, in teams people with various skills, knowledge, and expertise can be working together to carry out a complex task. Previous research has consistently shown that teams are beneficial for organizations and individuals (e.g., Applebaum, & Batt, 1994).
Chapter 1

1.1 Global Virtual Teams

Today's organizations have adopted media technologies, such as e-mail, chat, and videoconferencing, that enable organization to "go virtual" by having individuals from all over the world work together in global virtual teams. Currently, there are 1,412,489,652 internet users around the world (Internet World Stats, 2008). Half of the large companies in the United States use virtual teams (Devine, Clayton, Philips, Dunford, & Melner, 1999; Kanawattanachai, & Yoo, 2002). Global virtual teams are technology mediated groups of people in various places around the world that work together on common tasks (Hardin, Fuller, and Davison, 2007). As virtual teams are cost reducing (Robbins, & Judge, 2007), help to increase the organizations' competitiveness (Bell, & Kozlowski, 2002; Driskell, Radtke, & Salas, 2003), and provide an answer to increased globalization (Hertel, Konradt, & Lehman, 2004), the number of virtual teams keeps growing.

Because the use of media technologies has increased and these technologies have become so prevalent, many researchers are now proposing that all teams should be classified as virtual to some extent (Driskell, Radtke, & Salas, 2003; Kirkman, & Matthieu, 2005; Martins, Gilson, & Maynard, 2004). Several researchers (e.g. Martins et al., 2004; Kozlowski, & Ilgen, 2006) have pointed out that research regarding virtual teams is in its infancy and much work needs to be done to understand this type of teams.

1.2 Research on Global Virtual Teams

We approach virtual team functioning under the Input-Process-Outcome framework (e.g. Martins et al., 2004; Hackman, & Morris, 1975). Inputs represent issues involving the extent of virtualness, dispersion of team members, and media technologies used. Processes are underlying constructs that emerge over time as team members interact while working towards the team task (Kozlowski, & Ilgen, 2006). Outcomes demonstrate the effectiveness or the consequences of a team's functioning. We will now provide an overview of what has been researched previously regarding inputs, processes, and outcomes in global virtual teams. Moreover, we will identify gaps, areas of agreement, and inconsistency in the literature.

Input

Inputs represent compositional and design aspects of the virtual team that influence how teams operate and perform (Hackman, & Morris, 1975). The aspect that makes a team virtual is the fact that members are located in various places around the world, and that they thus need interaction media to interact. Because interaction media are required for interaction and
processes to exist in global virtual teams, this is the first aspect that has received attention in the virtual team literature. There are two leading theories involving interaction media in virtual work groups. Overall, the theories state that interaction media should match the task that needs to be done. Media Richness Theory (Daft, & Lengel, 1986) argues that the more complicated the task, the richer the media should be. The Media Synchronicity theory (Dennis, Valacich, Speier, & Morris, 1998) is a refinement of that theory and argues that there are five different capabilities (immediacy of feedback; symbol variety; parallelism; rehearsability; reprocessability) that should be looked at before choosing the right medium.

Rehearsability, for example, is the ability to go over the message before communicating it to the sender. Lee (1994), however, concluded that a medium is not rich because of the characteristics of the media, but the richness is determined by the interaction of the users and the organizational context. This means that effectiveness of a virtual team is determined by how members interact while they are using the interaction media. Our research is in line with these thoughts, because we also focus on the interactions between people in virtual teams.

Besides interaction media, researchers have also focused on team composition. When face-to-face and virtual teams are compared, findings have consistently shown that status effects are reduced in virtual teams (Sproull, & Kiesler, 1986). As members of global virtual teams are working in various countries, national culture is another interesting input variable. Kozlowski and Ilgen (2006) and Connaughton and Shuffler (2007) both highlighted that cultural differences are a critical aspect in global virtual teams that needs to be researched.

Researchers have also been interested in the dispersion of virtual teams. Previously, it has been found that distance (in kilometers or miles) between team members influences the frequency and effectiveness of communication (e.g. Allen, 1977; Van den Bulte, & Moenaert, 1989). Another aspect, team size, has been linked to greater idea generation in virtual teams (Gallupe, Dennis, Cooper, Valacich, Bastianutti, & Nunamaker, 1992). Another aspect of dispersion is geographic configuration, which is the number of geographically dispersed sites and the relative number of team members at those sites (O'Leary, & Cummings, 2007). Within virtual teams, members can be located face-to-face in geographically defined subgroups with some of their team members, while they can also be isolated at one site with no other team members. Geographically defined subgroups have previously been linked to negative outcomes, whereas isolated team members have been linked to positive outcomes (O'Leary, & Mortensen, in press; Polzer, Crisp, Jarvenpaa, & Kim, 2006). The exact relations, however, are not clear. The underlying dynamics causing these effects are also not clear.
Chapter 1

Processes and interaction

Lee (1994) pointed out that the effectiveness of virtual teams is determined by how members interact while they are using the interaction media. In contrast with processes, which are underlying group dynamics, interaction behaviors between team members can be observed. Because inputs in global virtual teams differ from inputs in traditional face-to-face teams, it seems likely that other interaction behaviors are required in virtual teams to transform inputs into outcomes. An overview of behaviors that are important in global virtual teams, however, is lacking in the literature. Previous findings have concentrated on specific communication and participation aspects. Hiltz, Johnson, and Turoff (1986) found that communication in virtual teams is more task-oriented as compared to face-to-face teams. Also, the level of participation is more equal in global virtual teams (Bikson, & Eveland, 1990). This is probably due to reduction in status differences in virtual teams. Due to certain interaction media, such as email, it is possible to keep records of interactions. This might explain the findings that there is less social loafing in virtual teams (Shepherd, Briggs, Reinig, Yen, & Nunamaker, 1996).

To date, the majority of research regarding processes has focused on interpersonal trust, cohesiveness, and conflict. Mortensen, and Hinds (2001) found that conflict is more likely to occur in virtual teams than compared to face-to-face teams. Related to conflict, researchers have also demonstrated that uninhibited behaviors, such as swearing, are more likely in virtual teams (Siegel, Dubrovsky, Kiesler, & McGuire, 1986). The effects of cohesiveness and trust appear to be similar in virtual teams as compared to face-to-face teams (Driscoll, 1978; Martins et al., 2004). Both process variables have been associated with greater effectiveness in virtual teams (e.g. Morris, Marshall, & Rainer, 2002; Chidambaram, 1996). However, researchers have also consistently shown that virtual teams have difficulty in achieving trust (Powell, Piccoli, & Ives, 2004; Sarker, Lau, & Sahay, 2001). Several researchers have been trying to get insight into the determinants of trust in virtual teams (Jarvenpaa, & Leidner, 1999). This is especially interesting because members of global virtual teams do not see each other and therefore cues that individuals normally use in face-to-face teams to convey trust may be eliminated (Jarvenpaa, & Leidner, 1999). Kozlowski and Ilgen (2006) argued that research on understanding trust in virtual teams is underdeveloped.

Another interesting process variable that is unique to virtual teams is social presence. Team members in traditional face-to-face teams see each other and therefore experience the physical presence of their co-members. Social presence in virtual teams is the
subjective feeling that other people are perceived as physically present and with whom one feels psychologically connected (Short, Williams, & Christie, 1976; Bente, Rüggenberg, Krämer, & Eschenburg, 2008). Traditionally, researchers focused on how interaction media influenced the level of social presence. Until now, no other input variables have been taken into account that might possibly influence social presence between global virtual team members.

Outcomes

Literature on virtual teams has focused on two types of outcomes: affective outcomes and performance outcomes (Martins et al., 2004). The most addressed affective outcome is the satisfaction of the team member with the virtual team. Performance outcomes deal with decision quality. Most research has focused on comparing face-to-face teams with virtual teams with regard to outcomes. The results regarding objective performance in virtual teams and face-to-face teams have been mixed (e.g. Potter, & Balthazard, 2002; Valacich, George, Nunamaker, & Vogel, 1994; Andres, 2002). Some researchers found that virtual teams were more satisfied or outperformed face-to-face teams (e.g., Sharda, Barr, & McDonnell, 1988; Eveland, & Bikson, 1988). Some researchers found the opposite (e.g., McDonough, Kahn, & Barczak, 2001; Warketin, Sayeed, & Hightower, 1997) and even others found no difference between both types of team (e.g., Lind, 1999; Archer, 1990). More interestingly than comparing virtual teams with face-to-face teams, however, is to see how inputs and processes influence outcomes in global virtual teams. Previous studies have consistently shown that, due to the use of interaction media, the time in virtual teams to accomplish a task is increased (e.g. Hollingshead, 1996). Moreover, trust and cohesiveness have also been associated with superior performance (e.g. Morris, Marshall, & Rainer, 2002; Chidambaram, 1996).

1.3 Methodological Issues

A majority of previous empirical research concerning virtual teams has compared virtual teams with traditional face-to-face teams. Especially because virtualness is now perceived as a continuum rather than a dichotomized variable, the division between those two types of teams is artificial. Comparing face-to-face with virtual teams also limits the generalizability of findings as pure face-to-face teams are becoming rare in organizations (Griffith, Sawyer, & Neale, 2003). A central notion of this dissertation is therefore that, following Martins and colleagues (2004), we stop comparing face-to-face teams with virtual teams. Instead of making comparisons, we take virtual teams as a starting point.
Another concern regarding the current literature is that most empirical studies have been conducted in laboratory settings with student teams doing short-term tasks (e.g., Connolly, Jessup, & Valacich, 1990; McLeod, Baron, Marti, & Yoon, 1997. Martins et al. (2004) acknowledged that it is difficult to obtain data on virtual teams in field settings; however, they encourage researchers to move out of the laboratory and into the field in order to advance knowledge through the asking and answering of questions that cannot be adequately tested in a laboratory setting. To meet these concerns, we went out into the field to conduct the studies for this dissertation.

Moreover, another concern is that several studies regarding virtual teams have been subject to common method bias, in which the same rater responded to all items in a single questionnaire (Kemery, & Dunlap, 1986; Lindell, & Whitney, 2001). To overcome this concern in our dissertation, we also use split samples in Chapter 4 and 5 to retest our findings. In a split sample procedure, different randomly selected subjects respond to different variables (Lance, Noble, & Scullen, 2002).

1.4 Research Questions

The goal of this dissertation is to advance the knowledge and theory of virtual teams. This dissertation addresses five research questions that are all related to effectiveness in virtual teams. Effectiveness is operationalized in team performance and team satisfaction. The first research question concerns interaction behaviors. And in particular what interaction behaviors are critical for the effectiveness of global virtual teams. Interaction behaviors among team members can be observed and are needed to transform inputs into outcomes. Because virtual teams deal with other inputs than traditional face-to-face teams, for example the use of media technologies and time-zone differences, it seems likely that interaction behaviors differ. Researchers have started to address specific behaviors, but an overview of effective virtual team behaviors (EVTB) is lacking in literature. This is why we formulated research question one.

Research question 1: What behaviors are perceived as critical for the effectiveness of global virtual teams?

The second research question concerns the role of cultural differences in global virtual teams. National culture is an input variable that may affect processes and outcomes. Kozlowski and Ilgen (2006) highlighted that global virtual teams with members from different cultures are an emerging trend, but that theory and research are limited. Moreover, Connaughton and
Shuffler (2007) pointed out that cultural difference is an aspect, critical to the effectiveness in global virtual teams, that needs to be researched. Global virtual teams have members in various countries. The work of Hofstede (2001) showed that national cultures differ, and Hardin, Fuller, and Davison (2007) suggested that it is reasonable to believe that cultural differences influence the way people interact. To get insight into the effects of cultures within global virtual teams, we question whether behaviors that are critical for the effectiveness in global virtual teams are valued differently by team members from different national cultures. In this dissertation we address the following research question:

**Research question 2: Are effective virtual team behaviors culture specific?**

The next research question is whether EVTB can be measured. When these behaviors can be measured, it is possible to draw empirical conclusions with respect to EVTB and effectiveness in global virtual teams.

**Research question 3: How can EVTB be measured in a reliable and valid way?**

The fourth research question concerns the process variable that play a mediating role in the relation between EVTB and the effectiveness of global virtual teams. To answer this question we look at the process variable team trust. Trust is a fundamental process variable that is crucial for team effectiveness (e.g. Powell, Piccoli, & Ives, 2004). Previous studies, however, have consistently shown that virtual teams have difficulty achieving trust because members do not see each other (e.g. Powell et al., 2004; Sarker et al., 2001). To get a more profound understanding of trust, it would be interesting to investigate whether trust in global virtual teams mediates the relation between EVTB and team performance, as well as between EVTB and team satisfaction.

**Research question 4: Does team trust mediate the relation between EVTB and team satisfaction and team performance, respectively?**

The final research question concerns an input (isolation), a process (social presence), and effectiveness. According to Martins and colleagues (2004) more research is needed that examines the role inputs play in developing effective virtual teams (Martins et al., 2004. Isolated team members are members with no other team members at their site, and with the isolation index we measure the percentage of members that have no other team member at their site (O'Leary, & Mortensen, in press). Recently two researchers (O'Leary, & Mortensen, in press; Polzer, Crisp, Jarvenpaa, & Kim, 2006) have demonstrated the positive
consequences of isolation in virtual teams. The interpretation of the results and underlying processes, however, is ambiguous. Social presence or the feeling of being psychologically involved with distant team members (Bente, Rüggenberg, Krämer, & Eschenbrug, 2008) is required for interactions in global virtual teams, and on the basis of social categorization literature (e.g. Turner, Sachdev, & Hogg, 1983) we argue that social presence is positively related to isolation. When members are isolated there will be less in-group versus out-group dynamics. To get a better understanding of the role of isolation and social presence, we formulated our fifth research question:

Research question 5: Does social presence mediate the positive relation between isolation and effectiveness in global virtual teams?

1.5 Outline of this Dissertation

Each chapter of this dissertation contains an investigation of one or more research questions. Figure 1.1 provides an overview of the variables that were included.

Figure 1.1

Overview of variables in the dissertation

The chapters are related in that the first three chapters focus on effective virtual team behaviors (EVTB). Moreover, all chapters are oriented towards the outcome variables team satisfaction and team performance in global virtual teams. The goal of the dissertation was to get insight into input variables (isolation and national cultures), processes and interaction behaviors (social presence, trust, and EVT), and to investigate the effects of these variables on outcomes (satisfaction and performance). Each chapter contains an investigation of one or more research questions and provides a unique contribution to the literature. Each chapter can be read independently from the others.
In Chapter 2, we address the first research question. The Critical Incident technique (CIT) was used to interview 30 professional virtual team workers from three large multinational organizations about their experiences with critical interaction behaviors. The critical incidents that were found were clustered into behavioral categories that are critical for the success of a global virtual team. Instead of taking a face-to-face framework as starting point, we decided to start from scratch using virtual teams. To investigate whether other or additional behaviors were important in virtual teams, we compared the framework with frameworks found in face-to-face literature (e.g. Cooke, & Szumal, 1994).

In chapter 3, we investigate whether virtual team workers from India, the USA, and Belgium perceive the same interaction behaviors to be critical for team effectiveness as the virtual team workers form the first chapter, who were all working in the Netherlands. Comparing these national cultures enabled us to address the second research question. Interviews by means of the Critical Incident Technique were held among 13 professional virtual team workers in the USA, 11 in Belgium, and 11 in India, and the results were compared to the results of the 30 Dutch participants. We examined whether these cultures differed with respect to what behaviors are seen as effective. The possible differences were interpreted with the use of Hofstede's cultural dimensions.

Chapter 4 concerns the third and fourth research question, and presents an online questionnaire study among 310 professional global virtual team workers. In this study we transformed the categories into a useful instrument to measure effective virtual team behaviors (EVTB). Next, we selected 47 virtual teams of which at least 3 members completed the questionnaire and with the use of trust theory, we tested an empirical model in which we expected team trust to mediate the relations between EVT and satisfaction and performance.

Chapter 5 addresses the final research question in which we focus on the role of isolation versus subgroups and social presence for the effectiveness of global virtual teams. From the data set that was collected for the study in Chapter 4, we again selected 47 global virtual teams (168 participants). Of all these professional global virtual teams, at least three members completed the online questionnaire. We tested whether social presence mediated the positive relation between isolation and outcomes.
In the final chapter, Chapter 6, we reflect on the results of each of the studies. Based on this reflection, we present suggestions for future research. We conclude with providing and discussing practical implications for global virtual teams in practice and organizations that have "gone virtual."
Chapter 2

Critical Interaction Behaviors in Virtual Teams: A Framework*

The Critical Incident Technique was used to interview 30 professional global virtual team workers from three large multinational organizations about their experiences with critical interaction behaviors of virtual team workers. We clustered the 413 behavioral items that we found into 13 categories that are critical for the success or failure of a team and/or satisfaction of team members. These categories are discussed and compared to previous findings. Finally, suggestions are made for future research.

Today, many organizations use virtual teams to respond to de-centralization and globalization (Hertel, Geiser, & Konradt, 2005) and to meet the challenges of market competition and turbulence (Kristof, Brown, Sims, & Smith, 1995). Hertel et al. (2005, pp. 71) say that "virtual teams consist of (a) two or more persons who (b) collaborate interactively to achieve common goals, while (c) at least one of the team members works at a different location, organization, or at a different time so that (d) communication and coordination is predominantly based on electronic communication media." In the literature, virtual teams are also referred to as dispersed or distributed teams (e.g. Polzer, Crisp, Jarvenpaa, & Kim, 2006; Cramton, & Webber, 2005; Connaughton, & Daly, 2004; Hertel, Konradt, & Voss, 2006; Yuan, & Gay, 2006). In this study we focus on global virtual teams of which the team members are located in different countries. Virtual team members use communication media to interact and collaborate to bridge the distance. Examples of these media are chat, e-mail, videoconference, teleconference, groupware systems, and other collaboration technologies like NetMeeting and Lotus Notus (Briggs, 2006; Jang, Steinfeld, & Pfaff, 2002). According to Kozlowski and Ilgen (2006) and Schiller and Mandviwalla (2007) there is limited theory and research about virtual teams, creating many research gaps and challenges. In the present study we try to start filling gaps.

Interaction behaviors among team members are needed to transform inputs that are present prior to the performance phase (e.g. knowledge and skills) of team members into outputs (results and by-products of the team activity such as performance and satisfaction) (Powell, Piccoli, & Ives, 2004; Rousseau, Aubé, & Savoie, 2006). The goal of this study is to get insight into what interaction behaviors of virtual team workers are important. Such an overview is lacking in the literature. In this exploratory study, we use the Critical Incident Technique (Flanagan, 1954) to get a framework of what interaction behaviors are critical in virtual teams.

In the next section we first provide more information about what virtual teams are and why they are becoming more common. Then we discuss what is known about interaction behaviors in general. In the last section of the introduction we talk about interaction behavior in virtual teams.

2.1 Virtual Teams
The use of virtual teams has increased dramatically in recent years, especially since the Internet enables the effortless sharing and distribution of information (Walters, 2005). The advantages of virtual teams are evident. According to Lu, Watson-Manheim, House, and Matzkevich (2005), globally dispersed teams incorporate talents from different locations. This helps organizations to compete in the global economy. Another advantage is reduction of travel expenses and time. For this study we selected team members from global virtual teams with members located in different countries.

The definition of virtual teams states that members mainly use interaction media, such as e-mail and teleconference, to interact with other team members. However, it is increasingly difficult to make a distinction between face-to-face teams and virtual teams. Most virtual teams do not only use interaction media to interact, but also meet physically sometimes. Moreover, most "traditional" face-to-face teams now also use interaction media to interact. This shows that virtualness is not a dichotomous variable, but a dimension (Hertel et al., 2005). Even though many teams are labelled global virtual team, in practice it is almost impossible to find two identically dispersed virtual teams. For example, (1) a team with two members of which one is located in Germany and one in Holland or (2) a team with thirty members of which three are located in the US, ten in India, ten all across Europe, and seven collocated in Australia, are both global virtual teams. O'Leary (2003; O'Leary, & Mortensen, 2005) and Saunders and Ahuja (2006) have acknowledged this and have started to differentiate between virtual teams. In order to categorize virtual teams, O'Leary (2003; 2005)
provides seven measures on which virtual teams can differ. One of those measures is "site index" which looks at the number of locations in which the team members are located.

Recently, Saunders and Ahuja (2006) provided a framework to understand virtual teams based on their time-span. These authors differentiate between temporary teams and ongoing virtual teams.

2.2 Interaction Behaviors

Interaction behaviors among team members are needed to transform inputs (e.g. knowledge and skills) of team members into outputs (e.g. performance and satisfaction). The effectiveness is determined by how members interact while using interaction media such as telephone, e-mail, chat, teleconference, and videoconference. Even if all the interaction media are perfect, interactions can cause a team to succeed or to fail, or, as Hulnick (2001, p. 33) nicely put it: "If technology is the foundation of the virtual business relationship, communication is the cement." Watson and Michaelson (1988) also showed that interactions of individuals within a team influence the performance of a team. In this study we focus on these interaction behaviors.

Effective interaction behaviors produce good outputs (e.g. good performance, satisfaction), whereas ineffective interaction behaviors lead to negative outputs (e.g. no solution, dissatisfaction of team members). Most research on team member interaction behavior has been conducted in face-to-face teams. This is not surprising, since research about team interaction has started long before virtual teams became common. Before we move to research that has been conducted in virtual teams, we will discuss work that has been done in face-to-face teams.

Recently, Rousseau and colleagues (2006) have given an overview of frameworks about effective behaviors in face-to-face teams. The authors pointed out that there is lack of consensus. Some frameworks are very specific with many dimensions, whereas others are broader with just a few categories. In addition, there also seems to be a lack of consensus about labels used for the dimensions. Most overviews identify three groups of behaviors during work on a task: coordination, cooperation, and information exchange. Coordination is the integration of the contributions of the different team members within deadlines (Connon-Bowers, Tannenbaum, Salas, & Volpe, 1995). Cooperation is the wilful contribution of personal effort of team members on completing a task. This dimension has been included in many frameworks (e.g. Kozlowski, & Bell, 2003; Yeatts, & Hyten, 1998; Erez, Lepine, &
Elms, 2002). Exchanging information with other team members has also been included in many overviews, and has, for example, been labelled: Information sharing (Janz, Colquitt, & Noe, 1997) and Open communication (Gladstein, 1984).

Besides these three most common categories, others have also been included in frameworks. A behavior that is executed when team members realize that they are not able to reach their goals has been labelled Team adaptability (Cannon-Bowers, Tannenbaum, Salas, & Prince, 1995; Salas, Sims, & Burke, 2005). Individual behaviors of team members include putting more effort in the task and getting additional resources. A dimension that has been mentioned in many overviews deals with helping team members to carry out their tasks and has, for example, been labelled Helping behavior (Janz et al., 1997) or Supporting behavior (Smith-Jentsch, Johnston, & Payne, 1998). Providing feedback to team members who are not performing well is another dimension that has been included in frameworks about effective team behaviors. This category was, for example, mentioned by Druskat and Kayes (1999). Besides these task-related behaviors that are about regulating the team performance, behaviors that focus on team maintenance are also important. Sometimes team members need psychological support by talking about personal issues and by being shown care and consideration (Campion, Medsker, & Higgs, 1993).

Another overview of interaction behaviors that was constructed by building on other typologies (e.g. Maier, 1967; Hoffman, 1979) has been provided by Cooke and Szumal (1994). These authors categorized interaction behaviors into three styles: constructive, aggressive, and passive. They found that constructive behaviors (e.g. open discussion, consideration of alternative viewpoints) were positively related to effectiveness of the team. Passive behaviors (e.g. quick acceptance of ideas, lack of initiative), on the other hand, were negatively related to both effectiveness measures. Finally, aggressive behaviors (e.g. suppression of ideas, suggestions criticized) turned out to be unrelated to solution quality, but negatively related to solution acceptance.

Is it possible and legitimate to expand these findings and frameworks from face-to-face teams to virtual teams? In the next section we will discuss this, and provide some findings from research that has been conducted regarding virtual teams and interaction behavior.

2.3 Interaction Behaviors in Virtual Teams

Global virtual teams deal with several challenges not found in traditional face-to-face teams. These challenges are caused by the dislocation of team members, the use of interaction media
for interaction, time differences, and cultural differences. We believe that members in virtual teams show behaviors to cope with these challenges. These behaviors are less likely to be found in face-to-face teams. Therefore we think that frameworks found in face-to-face research do not completely reflect interaction behaviors that are found in virtual team. Moreover, prior research has shown that face-to-face teams and virtual teams differ with regard to performance and processes. For example, previous research has shown that the overall amount of communication in virtual teams is less than in face-to-face teams (Hiltz, Johnson, & Turoff, 1986; Hollingshead, 1996), conflict is more likely to arise in virtual teams (e.g. Mortensen, & Hinds, 2001), and behaviors like swearing, name-calling and insults were more likely in virtual teams as compared to face-to-face teams (Siegel, Dubrovsky, Kiesler and McGuire, 1986). These examples make clear that virtual teams are different from face-to-face teams, and make it likely to believe that it is too simple to generalize frameworks from the face-to-face literature to virtual teams.

When researchers started to become interested in virtual teams, most used student teams to conduct systematic research (e.g. Lam, & Schaubroeck, 2000; Phillips, 2003; Jessup, & Tansik, 1991; Weisband, & Atwater, 1999), but it remains questionable whether student teams accurately reflect the global market with challenges in which real virtual teams operate. Therefore, more and more researchers have started to look at virtual teams in practice that most likely deal with challenges not found in experimental settings with students. A good example is the work of Maznevski and Chudoba (2000) who examined three existing virtual teams. They found that successful teams developed a rhythm in the interaction media chosen. Both face-to-face and computer-mediated communication was important. The successful team’s communication was characterized by high message frequency, a positive tone, and appropriate feedback. Kayworth and Leidner (2000) supported Maznevski and Chudoba (2000) in their finding that successful teams have a preference for a variety of communication media. It was also found that information sharing has a positive relation with virtual team performance and satisfaction (Hightower, & Sayeed, 1996; Tan, Wei, Huang & Ng, 2000; Mennecke, & Valacich, 1998).

To our knowledge, an overview of interaction behaviors that are important in virtual teams is lacking in the literature. It is interesting to see whether behaviors that are important in face-to-face teams differ from or are similar to behaviors that are important in virtual teams. Some researchers have started to give insight into this by expanding face-to-face frameworks to virtual teams. Using student teams, Potter and Balthazard (2002a; 2002b)
investigated whether the constructive, aggressive, and passive interaction styles (Cooke, & Szumal, 1994) that have effects on the performance in face-to-face teams also exist in virtual teams and whether the three interaction styles have the same effects. Results show that virtual teams are similar to face-to-face teams with respect to interaction styles. This means that performance and process outcomes of virtual teams are affected by the interaction styles in the same way that face-to-face teams are affected. Potter and Balthazard (2002a; 2002b) took an existing theory and applied it to virtual teams. By doing this, they might have overlooked issues that are found in virtual teams, but are not covered in frameworks about interaction behaviors in face-to-face teams.

In their extensive review about processes in teams, Kozlowski and Ilgen (2006) also proposed that virtual teams differ from face-to-face teams and that one has to be careful with generalizing findings from the face-to-face literature. These authors say that very little is known about interactions in virtual teams, that there is only limited theory about virtual teams and that more research, and theory are needed to get a better understanding. As we argued before, it seems likely that virtual teams differ in terms of interactions behaviors; therefore we do not want to take an existing theory from the face-to-face literature. We think it is necessary to develop a new framework covering important interaction behaviors in virtual teams. Thus, we hope to avoid that important issues and behaviors in virtual teams, in which members are usually restricted to interaction technologies to overcome separation by distance and space, are overlooked. The suggestion to start from scratch was also made by Potter and Balthazard (2002a; 2002b). Therefore, the goal of this study is to investigate exploratively what interaction behaviors are critical for the success or failure of a virtual team.

### 2.4 Method

To be able to develop a framework of interaction behaviors in virtual teams, we held interviews by means of the Critical Incident Technique (CIT) (Flanagan, 1954). The CIT procedure has been developed to collect examples of human behavior in order to solve practical problems and to develop broad psychological principles. This technique has been used extensively in job analysis, performance appraisal, and competency management (Latham, & Wexley, 1981). In this study we collected incidents of effective and ineffective interaction behaviors of virtual team workers. An incident is defined as "any observable human activity that is sufficiently complete in itself to permit inferences and predictions to be made about the person performing the act" (Flanagan, 1954, pp. 327). Flanagan states that each incident should have special significance and meet systematically defined criteria. We
followed the five steps for CIT as described by Flanagan (1954), using the detailed description of these steps offered by Latham and Wexley (1980, pp. 56-61). In step 1 "general aims", the goal of the study was described. In step 2 "plans and specifications", participants and situations that are of interest were described. In step 3 "collecting the data", the interviews were conducted. Finally, step 4 "analyzing the data" and step 5 "interpreting and reporting" were performed. In the remaining part of the method section we come back to these steps in more detail.

The goal of this study (step 1) is to collect effective and ineffective interaction behaviors of team members in virtual teams. We define effective interaction behaviors as behaviors that are perceived to be related to positive outcomes (high satisfaction of the team members and/or high performance of the team). Ineffective interaction behaviors, on the other hand, are perceived to be related to negative outcomes (low satisfaction of the team members and/or low performance of the team). We thus want to know which interaction behaviors are perceived to contribute significantly to the performance of the team and the satisfaction of team members.

Participants (step 2)

Since we wanted to gain more insight in interaction behaviors in global virtual teams, we considered professional global virtual team workers to be the most appropriate persons to be interviewed. These people are experts because they have experienced and observed many interactions in global virtual teams. We choose three large multinational companies to participate in this study, because these companies have many virtual teams and are representative of large multinational companies. Two of these companies are in the high-tech sector. One of these is Dutch and the other company is American. The third is a Dutch company in the oil sector. All three companies have several locations on all continents and rely heavily on global virtual teams to compete. We interviewed 10 global virtual team workers from each company (a total of 30 interviews). Twenty four interviewees had a Dutch nationality, two were American, one was Finnish, one was Danish, one was Indian, and one was British. Twenty seven of the interviewees were male and three were female. The participants held a variety of positions and represented a variety of departments in their organizations, including information systems, production, R&D, service, sales, and human resources. Sixteen interviewees indicated to be the leader of their virtual team. The virtual teams of all interviewees used interaction media, including e-mail, telephone, teleconference,
forum, and chat. For most teams, teams got together with frequent conference calls. Videoconference was not often used. The majority of the teams had regular face-to-face meetings. The team's main tasks varied, some mainly existed to exchange information while other teams had a higher rate of mutual decision making. Most interviewees were member of more than one virtual team, but usually they had one main team for which they had regular meetings. Experience with working in virtual teams ranged from 1 year up to 30 years.

Data sources (step 3)
Our main data source was interviews conducted according to the Critical Incident Technique (Flanagan, 1954). But first we asked some background questions about the interviewee's job and organization, his or her virtual team, his or her experience with working virtually, and what and how frequent interaction media were used. The main part of the interview was about the critical incidents. We used the work of Latham and Wexley (1980) as a guideline. After explaining the general concepts, the interviewee was asked the following question to think of as many critical incidents as possible: "Now I want you to think back of specific incidents that you have seen occur in the last year. Can you think of an incident in which a member of your virtual team showed a critical interaction behavior? Would you describe for each example: (1) what were the circumstances surrounding this incident? (2) What exactly did the team member(s) do that was critical, and (3) How did the behavior affect the satisfaction of the team members and/or the performance of the team?" The interviewer had to make sure that for each incident the following criteria were met: (a) actual behavior needed to be reported; (b) behavior needed to be observed by the reporter him or herself; (c) relevant factors of the situation needed to be given; (d) the observer needed to make a judgment of the criticalness of the behavior; and (e) the observer needed to make clear why he believes the behavior was critical (Flanagan, 1954). If the interviewee had anything important to add, he or she was invited to do so. Also, if a critical incident that an interviewee mentioned was less clear or specific than desired, the interviewer would ask for clarification.

A week prior to the interview, the interviewees received an overview of the interview. This way they were able to prepare themselves. In order to standardize the interview, all interviews were conducted by the first author. Each interview lasted 45 up to 60 minutes and was conducted in a face-to-face setting. The interviews with the Dutch interviewees were conducted in Dutch; the other ones were conducted in English. Prior to the interview, the interviewees were (a) informed that the conversation would be kept confidential to the research team; (b) informed that their name, or the names they mentioned would not be used
in any published article; and (c) asked permission to record the interview (all interviewees gave permission). The digital records of the interviews were transcribed and a list of detailed descriptions of all critical incidents was compiled from these transcriptions.

Data analysis (step 4 and step 5)

Each interviewee reported between 7 and 16 critical incidents; 12.2 on average (s.d. = 3). This indicates that responses were evenly spread over the respondents and none of them was overrepresented. We transformed the all critical incidents into at total of 423 behavioral items. A behavioral item is an observable act. This was important since all items needed to be phrased in a useful way (Latham, & Wexley, 1980) or because some critical incidents contained multiple behavioral items (Peeters, van Tuijl, Reymen, and Rutte, 2007). The behavioral items were written on cards and used as an input for the categorization process. We then randomly took out 10% of the items which we later used to establish content validity (Latham, & Wexley, 1980). The remaining 90% of the items was used to develop a categorization framework. Two raters independently created categories using the behavioral items. After comparing the two individually derived frameworks both raters agreed on thirteen categories of critical interaction behaviors in virtual teams. Then the two raters independently distributed the behavioral items across the thirteen categories (Kappa = .84). After discussion both raters agreed on a distribution across the thirteen categories. Next, a third independent rater was asked to put the cards into the 13 categories. Cohen's kappa between the original distribution and the third rater was .85. According to Landis and Koch (1977) this means that the strength of agreement between the two raters is "almost perfect". Some minor adjustments were made to the original categorization after discussing the differences.

Then 10% of the cards that were left out initially were categorized into the framework. If, based on this categorization, a category had to be added to the framework, content validity would not yet be attained and more incidents would have to be collected. In our case, the behavioral items could be distributed in the thirteen categories without a problem.

2.5 Results

Table 2.1 shows the framework and the number of behavioral items that we categorized in each category. For example, category 13 "Social-emotional communication" contains six
effective behavioral items and four ineffective behavioral items. The categories are numbered in such a way that the category at the top of the framework has been mentioned most often and the category at the bottom least often. Next we will take a closer look at each category by describing it and giving examples.

**Media Use**

The interviewees mentioned 56 behaviors in which team members used media in effective or ineffective ways. Ineffective behaviors included behaviors in which the wrong medium was chosen for interaction. An ineffective example is "My colleague, who was located in India, showed ping-pong behavior with e-mail." With ping-pong behavior the interviewee meant that he and his colleague kept sending each other e-mails with small questions. They clearly used the wrong tool, because if they had picked up the telephone for interaction the issue

<table>
<thead>
<tr>
<th>No</th>
<th>Category</th>
<th>Number of behavioral items</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Effective</td>
</tr>
<tr>
<td>1</td>
<td>Media use</td>
<td>33</td>
</tr>
<tr>
<td>2</td>
<td>Handling diversity</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Interaction volume</td>
<td>25</td>
</tr>
<tr>
<td>4</td>
<td>In-role behavior</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>Structuring of meeting</td>
<td>26</td>
</tr>
<tr>
<td>6</td>
<td>Reliable interaction</td>
<td>13</td>
</tr>
<tr>
<td>7</td>
<td>Active participation</td>
<td>17</td>
</tr>
<tr>
<td>8</td>
<td>Including team members</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>Task progress communication</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>Extra-role behavior</td>
<td>17</td>
</tr>
<tr>
<td>11</td>
<td>Sharing by leader</td>
<td>12</td>
</tr>
<tr>
<td>12</td>
<td>Attendance</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>Social-emotional communication</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>216</td>
</tr>
</tbody>
</table>
Critical Interaction Behaviors in Virtual Teams: A Framework

would have been clear sooner. Interviewees mentioned the importance of choosing the right medium to match the task or message. It was seen as effective that if a medium did not work, one switched to a different medium, for example a more advanced medium. Interviewees also said that if there were problems it was effective to use a more direct medium. Another effective behavior was to vary the medium used. Several specific effective and ineffective behaviors were mentioned about the use of media. For example, chat was useful to ask a short, practical and direct question like "are you in the office?", telephone was preferred over chat and e-mail as a medium to solve problems, and for knowledge sharing, the virtual team workers preferred forums. Overall, interviewees felt satisfied if their colleagues used the telephone to ask something, or if they felt able to call that colleague themselves. Interestingly, almost all interviewees said that they felt more comfortable to use the phone after having seen the team member face-to-face.

Handling diversity

This category of interaction behaviors deals with language, time zone, and cultural differences of virtual team members. Shortly said, this category is about not assuming the same circumstances for all team members and was mentioned 54 times by our interviewees. The first thing that is important to take into account is language differences. Most virtual teams used English as their primary language. According to our interviewees, it was effective that virtual team members behaved in such a way that they were willing to speak that language. An interviewee said: "I have a German colleague in my team who refused to talk English. This is not effective since English was the common language in the team." Another interviewee found it effective that a colleague who was a native English speaker, adjusted the level of English to the level of the non native English speakers.

Several interaction behaviors that were mentioned dealt with time zone differences. Our interviewees said that it was effective to take into account the time zones when scheduling a meeting. Also it was seen as fair and satisfying for all team members to switch around who had to wake up early or to stay up late. One team member said that his American colleague effectively adjusted her working hours to her Dutch team members. She started working at 5 a.m. in the US. This way she was able to spend more time with her Dutch colleagues. An ineffective behavior, on the other hand, was to schedule a meeting on an impossible time for some team members.
The last behaviors in this category concerned cultural differences. For instance, an interviewee said "My Dutch colleague effectively adjusted his question to an Indian colleague because he knew that the Indian \textit{yes} could mean something different from the Dutch \textit{yes}. An Indian \textit{yes} could mean something similar to \textit{I heard you}." More examples of specific cultures were mentioned by the interviewees. Overall, when working in a virtual team, it is important to know what cultures the members have and how one should deal with these. Cultures and jargon can also differ between organizations. According to the interviewees it was important to be careful when using jargon. Interviewees mentioned incidents in which virtual team members from different organization used jargon language of which other team members were not aware. Therefore, one should never assume that team members share the same jargon.

\textit{Interaction volume}

Critical behaviors that fell into this category were mentioned 51 times by the interviewees. This category is about how much interaction is effective. Shortly, interaction that is compact and to-the-point was perceived as effective, whereas \textit{too} much interaction was perceived as ineffective. An effective behavior was "My colleague specified his expectations. If he needed an answer before noon, he told the team that he expected an answer back before noon." On the other hand, written or verbal messages with an overflow of information and no clear expectation or message were seen as ineffective. It was seen as ineffective when team members talked too long in a virtual meeting: "When my colleague talked too long in a conference call I got distracted and did not get the message" or when the actual message got lost in a long e-mail. An extreme, but common, example of too much interaction is \textit{surplus interaction}. Surplus interaction was perceived as very ineffective. Examples of surplus interaction are: sending unnecessary forwards of an e-mail, sending unnecessary e-mails to the entire team, using the "reply-to-all" button too easily, and copying too many people into an e-mail conversation. For instance, an interviewee said: "One of my colleagues kept sending cc's of his e-mails to me, I have no clue why he did that because the subject did not concern me, and it filled up my inbox and annoyed me." Behaviors that \textit{dealt} with surplus interaction also fall into this category. These behaviors can be seen as effective or ineffective solutions against surplus interaction. Examples of these behaviors were filtering CC-mails out of e-mail inbox, which means that e-mails on which the receiver is copied automatically go to the "junk e-mail" folder, and will most likely not be read by the receiver.
The final behaviors that fall into this category deal with the frequency of interactions of the team. Overall, it was seen as effective to have frequent meetings with the team, using for instance teleconference. Also it was seen as effective to communicate frequently with team members using telephone and e-mail. One interviewee said: "All the team members were busy in their local countries and as a result we did not have contact. I think this was very ineffective." It was seen as effective to have weekly or biweekly conference meetings with the team. One virtual team worker called this "the heartbeat" of the team.

**In-role behavior**

Forty four critical behaviors fell into this category. Effective behaviors included taking the task of the group seriously, complying with obligations, and working on the task towards the goal of the team. One interviewee mentioned an ineffective incident in which a team member was working on personal goals instead of team goals. Another interviewee who works in time shifts said "at the end of our workday my colleagues give the work to the next time zone. Once a colleague had a difficult problem he didn't want to do, and in stead of finding a solution to the problem, he did not take the responsibility but pushed it to the next time zone."

A behavior that was mentioned quite often, especially by team members working together with Indians was proactive behavior. According to our interviewees, Indian people often failed to behave in a proactive way when working on tasks. An interviewee mentioned: "I was on a holiday, when I came back it turned out that my Indian colleague had been waiting for me to give new instructions."

**Structuring of meeting**

During the interviews, interviewees said that it was important that meetings are structured. A total of 34 items were distributed into this category. Also planning in advance was seen as important. For example, "in a virtual team meeting, in which I dialled in, a colleague started showing something to the people around him. I could not see what our team members saw. Our colleague failed to share visuals with us prior to the meeting." It was ineffective that his colleague did not do this in advance.

Our interviewees mentioned that using an agenda during the meeting was effective to structure the meeting. Also keeping track of things that have been said, and making clear decisions at the end of the meeting were seen as effective. Another effective behavior was that "decisions that were made in the meeting, were confirmed through an e-mail after the
meeting." Usually behaviors regarding the structure of a meeting were carried out by the team leader, whereas there was also one effective incident in which the team members took turns for being responsible of technical aspects of the meeting.

Reliable interaction
Behaviors from category were mentioned 34 times and are about being predictable and responsive to messages. One ineffective item was about responsiveness: "it was frustrating that my colleague did not reply to my e-mail. Besides being frustrating, it also caused a delay in the project that we were working on." An effective item, on the other hand, was "Two months ago I sent an e-mail to a colleague who replied immediately that he did not have time to look at the e-mail now, but that he would respond to me in 4 hours." It was more effective to reply without an answer, than to not reply at all. Without a reply, the sender could still be waiting for the reply, otherwise the sender could have looked elsewhere to solve his or her problem. Other behaviors that had to do with predictability were, for example, sharing calendars so team members knew where team members were and how they could be reached. Another example that was mentioned was being available at times that are known by your virtual team members: "when I need something from my colleague, I know I can contact between 8am and 5pm." The final behaviors dealing with predictability that fall into this category are about using an interaction medium daily, for example a shared space. When team members posted something, they knew that the other team members would see it.

Active participation in meeting
Twenty seven items were about open communication and behaviors showing active participation in meetings and were distributed into this category. Behaviors in this category include talking and giving opinion in a meeting or giving. An example of an ineffective behavior was a team member who did not give his opinion on a certain topic, even though he had a strong opinion about it. This caused that the team did not come up with a solution that was based on all opinions. It was seen as effective to interrupt other team members when a team member wanted to add something to, for example, a discussion. Asking questions was mentioned very often as an effective behavior. These questions included: asking for clarification and asking for feedback. It was also seen as effective to correct team members. One interviewee said: "A team member did not do the task properly; he tried to do it easy and quickly. One of the team members commented on this. I found this very effective."
Including team members

The 26 behaviors that were distributed in the eighth category are about involving all team members. Ineffective and effective behaviors seemed to arise particularly when there was a core of team members in one place and one or two isolates located elsewhere. One interviewee mentioned that she felt left out during meetings in which she was the only person that dialled in from elsewhere. The core team talked with one another, and seemed to forget that the isolated member dialled in. It was perceived effective when team members were included when making decisions by, for example, by asking them for input during a meeting. However, these behaviors are not only important in meetings. Also outside of meetings several items were mentioned in which team members who were not around the coffee machine were forgotten. For example, one interviewee said "a colleague was working a task concerning my expertise, he forgot to include me because I was located in another country and not visible."

Task progress communication

Behaviors that are concerned with communicating deadlines, actions and progress of a task that team members are working on, fall into this category. Twenty five behaviors were mentioned by our interviewees. Because members are located in different places in virtual teams one cannot see what colleagues are working on. Therefore, things that are normally seen when walking through the hallway need to be communicated. For instance one interviewee said "One colleague informed me through an e-mail how much progress he made on his task. This was effective, because I knew what he was doing and I could indicate whether we were still on schedule."

It was seen as important that virtual team members communicate timely that things are not finished, or that deadlines cannot be met. However, interviewees mentioned incidents regarding the failure to communicate on time. For example, an interviewee said that his colleague did not give signals when something was not going to be finished before the deadline.

Also clear and honest communication is important about what one is willing and able to do. One interviewee mentioned that he said he would do a task, to finish the discussion. This was very ineffective, since he did not have time to do the task.
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Extra-role behavior

The behaviors in this category can be defined as the willingness of individuals to invest effort and energy in their social environment beyond any formal requirement and with no expectation of any formal reward (Vigoda-Gadot, 2006). Extra-role behaviors were seen as effective by virtual team workers and were mentioned 19 times. For example, "my colleague saw that another team member was busy and therefore he helped him." Also helping a team member who had a difficult or complicated task was perceived as effective. Another example that falls into this category is about voluntarily sharing knowledge. An interviewee mentioned "a colleague figured out how an application worked, but he did not share this with the rest of the team because." This was ineffective because this was knowledge that each team member eventually discovered or figured out, but time would have been saved when the team member shared this knowledge. Another incident was "a team member voluntarily made a wiki site that we could use to share information." The interviewee found it very satisfying that people volunteered to do more than just the assigned task.

Information sharing by leader

This category contains behaviors that deal with sharing information and decisions with the team by team leaders or managers. Eighteen behavioral items fell into this category. For instance, when a management team made a decision about a team’s task, it was important that this was communicated to the entire team in a conference meeting. It was ineffective to not share information and decisions with the team. One ineffective behavior of the manager was "Our team leader started telling us what we had to do; we had no idea why the task suddenly changed. The team leader failed to communicate decisions to us. I was very dissatisfied, because I did not feel included."

Attendance

The twelfth category was mentioned 15 times and is about being physically (or virtually) and mentally present in meetings. Some examples were given in which team members did not dial in while there was a meeting scheduled or that people dialled in too late. This was not effective, according to the virtual team workers. It was seen as effective to show up on time in a meeting. Another issue that several interviewees mentioned was about isolated team members who were doing other things during the meeting. These members were virtually present but not mentally. An isolated virtual team member is a member who is in a location without other virtual team members physically present around him or her. One interviewee
said: "I had one isolated team member in my team, and during meetings he often checked his e-mail. This was very ineffective, because sometimes he had no idea what the rest of the team was talking about." Other interviewees mentioned similar behaviors of colleagues that were isolated. An interviewee said that she could hear an isolated colleague writing an e-mail.

**Social-emotional communication**
Interactions about social-emotional issues were seen as effective. Ten behavioral items were distributed into this category. One interviewee said that it caused dissatisfaction that their team did not have "coffee-machine-like" schedules to talk about social-emotional things. Another interviewee mentioned that things went wrong because the team never talked about social-emotional issues. For this reason, the manager of this team was not aware of the personal situation of a team member and this caused problems when the manager got angry when things were not finished on time.

An interviewee mentioned an effective incident in which "one of my team members used humor and made jokes in meetings." Interviewees found it also effective to have an ice-breaker at the beginning of a meeting: "In a conference call, a colleague said that he went to a movie last night. He thought it was the best movie he had ever seen. Then he asked about our favorite movies. This way everybody had a say, and I felt comfortable to start talking in the meeting because I already had said something." Another example of effective social-emotional communication was a team in which a "soccer pool" was organized during the soccer world championships.

**2.6 Discussion**
The aim of this study was to investigate what interaction behaviors are critical in virtual teams. We have presented a framework with 13 categories of important interaction behaviors, using professionals from practice who deal with virtuality every day. In this section we will first discuss why we believe that our framework about interaction behaviors in virtual teams is different from previous frameworks. Secondly, we will discuss the strengths and weaknesses of this study as well as implications and suggestions for further research.

We want to start with comparing our findings with the findings of Cooke and Szumal (1994), that were later expanded to virtual teams by Potter and Balthazard (2002a; 2002b). Potter and Balthazard (2002a; 2002b) provide the principal components that make up the constructive, aggressive, and passive group interaction styles found in virtual teams. These
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Principal components are typical behaviors that are shown by groups that fall into a specific interaction style. Potter and Balthazard (2002a; 2002b) gave twelve constructive items, twelve aggressive items, and nine passive items. When we distribute these behaviors across our 13 categories, we see that some of our virtual team interaction behavior categories remain empty. This may imply that interaction behaviors found in face-to-face teams do not cover all the interaction behaviors found in virtual teams. Seven categories from our framework are not covered in the works of Cooke and Szumal (1994) and Potter and Balthazard (2002). These are: Media use, handling diversity, reliable interaction, task progress communication, attendance, and social-emotional communication.

We have developed a framework about interaction behaviors in virtual teams. However, even though the teams are virtual, we are still dealing with teams in which members have to work together on completing an interdependent task. Therefore it is not surprising that some behaviors that are covered in our framework on interaction behaviors in virtual teams, are also found in face-to-face frameworks. Behaviors in the category in-role behavior were discussed in the work of Cooke and Szumal (1994), and in the overview of Rousseau et al. (2006). All teams (face-to-face or virtual) have goals that need to be achieved, otherwise there would be no reason for a team to exist. The category Structuring of meeting has also been described in face-to-face literature (e.g. Rousseau et al. 2006). Managing, planning, and structuring the work process are very important for effective team functioning. In virtual meetings, members do not see each other. Probably, more so than in face-to-face teams, structuring is very important. For example, for presentations, people always need to bring slides. However, in a virtual meeting, one also needs to prepare how the slides are shared with people in other locations. Behaviors in the category Active participation in meeting are shown when a team member behaves actively. The behaviors in this category are similar to the behaviors in the category contributing answers and questions of the framework by Bales (1950), Information exchange by Rousseau et al. (2006) and feedback in the framework of McIntyre and Salas (1995). It must be noted that our category is more specific because it only captures behaviors that show active participation in a team meeting. Regardless of whether a team is virtual, behaviors from the category Active participation seem to be important. The category including team members is about including all the members of the team. Teams exist because a group of individuals can usually achieve more than a single individual, therefore these behaviors are important both in face-to-face teams and virtual teams. To get the best solution or discussion, it is important to involve all team members. In virtual teams this is even more important because it happens that people are
"forgotten" when they do not speak up themselves. Behaviors from the category *Extra role behavior* have previously been labeled citizenship behavior (Bateman, & Organ, 1983; Organ, 1988) or boundary spanning behavior (Bettencourt, & Brown, 2003). Behaviors from the category *Sharing by leader* were seen as very effective since people felt involved and motivated when the leader shared relevant information. In the work by Rousseau et al. (2006) these behaviors fell into the category *Information Exchange*, which included all behaviors that involve transmitting information to one another. Our category is more specific, because it concerns the leader of the virtual team sharing information with the other team members.

Behaviors from the category *Social-emotional communication* were not included in prior work of Potter and Balthazard (2002a; 2002b) and Cooke and Szumal (1994), but have been researched before in face-to-face teams. In the overall framework of Rousseau et al. (2006) behaviors that deal with the well-being of team members were found under *Psychological support*. These behaviors increase the performance of the team since people are more comfortable to ask for help and have more positive feelings. Prior research, however, has shown that virtual teams spend less time on social-emotional issues (e.g. Carlson, & Zmud, 1999; Jarvenpaa, Rao, & Huber, 1988). Therefore, more so than in face-to-face teams, attention should be paid to these behaviors.

**Unique categories in our framework**

Behaviors from the category *Media use* have not been mentioned in previous frameworks. In our study, behaviors from this category were mentioned most often, and therefore perceived as very important. Because traditional face-to-face teams do not use interaction media, it is not surprising that these behaviors are not found in face-to-face frameworks. In the overview article of Rousseau et al. (2006) it was acknowledged that team members may use different means to transmit information to one another in their category labelled *Information exchange*. However, this category is much broader than our category and focuses on the extent to which team members share task-related information among themselves. In virtual team literature, several theories about the use of interaction media exist. Overall, the theories state that an interaction medium should match the task that needs to be done. Media Richness Theory (Daft, & Lengel, 1986) argues that the more complicated the task, the richer the media should be. The Media Synchronicity theory (Dennis, & Valacich, 1999) is a refinement of this theory by saying that there are five different capabilities (immediacy of feedback; symbol variety; parallelism; rehearsability; reprocessability) that should be looked at before choosing the
right medium. For example, *rehearsability* is the ability to go over the message before communicating it to the sender. The preferences of our interviewees were in accordance with the Media Richness Theory and the Media Synchronicity theory. In accordance with the findings of Kayworth and Leidner (2000), the professional virtual team workers that were included in this study also think that it is effective to vary the communication media used.

The category *handling diversity* consists of interaction behaviors that deal with differences in culture, time-zone, and language. Comparing our work with the framework of Cooke and Szumal (1994) and the overview of Rousseau et al. (2006), we can conclude that behaviors from this category have not been covered in previous frameworks. Compared to face-to-face teams, there is a much greater chance that global virtual teams consist of members from different cultures and value systems. To be an effective virtual team, it is very important to deal adequately with diversity in the team. From our results, we can conclude that it is important to be aware of these differences, and to behave accordingly. Another issue in this category deals with time-zone differences, something not found in traditional face-to-face teams, in which everybody is located in the same time zone. In virtual teams, on the other hand, some members are waking up, others are ready to go to bed, while others are in the middle of their working day. O'Leary (2002; 2006) also took this aspect into account when defining and measuring virtual teams. He looked at the number of hours that people actually worked together, the average distance (in hours) to the team leader, and the average distance (in hours) to headquarters. The behaviors in *Handling diversity* show that people should take these issues into account when interacting with their virtual team members. The final topic that falls into this category is language. A result of being a global virtual team is dealing with people who most likely have different native tongues. The virtual teams of our interviewees all choose English as the common language.

The category *Interaction volume* includes behaviors dealing with the size of the message content and the number of interactions. Especially forwarding unnecessary messages to the entire team is seen as ineffective. It is important to note that this behavior is pretty effortless to perform in a virtual setting and therefore happens often. In a face-to-face setting, on the other hand, running through the hallway and forwarding messages to all team members is less likely to happen because it takes a lot of effort to do so. Because this is unlikely, it is has not been included in previous interaction behavior frameworks. Having frequent meetings, on the other hand, was seen as effective. Since virtual team members do not run into each other like traditional teams, it seems more important in virtual teams to stay in touch with the team members on a regular and frequent basis.
Behaviors from the category **Reliable interaction** were not found in the work of Cooke and Szumal (1994) and other earlier frameworks. These behaviors seem to be especially important in virtual teams, as opposed to face-to-face teams, because virtual team members cannot see each other. When interactions in virtual teams are not reliable, it is hard to work together and team members get frustrated when they get no response. Cramton (2001) also mentioned aspects of this category in her research on virtual teams. She talked about "silence" after writing an e-mail to somebody without getting a reply. She argued that virtual team workers have trouble with interpreting the meaning of silence and that it is usually interpreted as a personal failure of the team member. In face-to-face teams, on the other hand, one can see that a colleague is not in the office, and therefore knows why this person does not reply.

Behaviors from the category **task progress communication** are not included in the framework of Cooke and Szumal (1994). When, in a face-to-face setting, one shares with team members one can see what they are working on and whether a project is going to be finished on time. In a virtual team, on the other hand, it is not possible to observe the process directly, and therefore, it is so important to communicate everything. Things that are seen in a face-to-face setting need to be communicated in a virtual setting. Communication about the progress of the task is important for the coordination of team members' activities. In order to integrate and plan the activities, it is important to know how well tasks are progressing.

The category **attendance** was not covered in previous frameworks. This category is about being present in meetings without doing other things. This concerns two aspects. The first behavior that falls into this category is about being physically (or virtually) present. In a virtual conference meeting this means, for example, that a person has to dial in. The second aspect that falls into this category is about being mentally present. Being mentally present is necessary in order to be able to perform behaviors from, for example, the category about **Active participation**. When a team member is physically present in a face-to-face team meeting, this person is most likely to be also mentally present. However, when somebody is virtually present in a virtual team, team members are usually not visible for the others and therefore it might be more tempting to do something else, and thus not being mentally present. For example, checking one's e-mail during a meeting or having another telephone conversation while the microphone one uses in the meeting is muted. In a face-to-face meeting, on the other hand, it is visible when one does multiple tasks, therefore it is less
likely to happen. To our knowledge this category has not been covered in previous face-to-face frameworks, but it includes important behaviors that are found in virtual teams.

Implications and suggestions for future research

Frameworks from literature on face-to-face teams cannot be generalized to virtual teams, as we showed that some behaviors that are critical in virtual teams have not yet been mentioned in previous frameworks. It is important to note that of the top 6 categories, only two overlap with categories found in previous overviews. This is striking, because the behaviors concerning these categories were mentioned most often. A framework of important interaction behaviors in virtual teams, like the one provided in this study, was lacking in literature.

For future research it would be interesting to investigate why the behaviors that are covered in our framework are important. We argued that interaction behaviors between team members transform inputs into outputs. According to Kozlowski and Ilgen (2006) processes are constructs that emerge over time as team members interact and the team develops. Thus, in line with this reasoning, (in)effective interaction behaviors are related to (in)effective group processes. It would be very interesting to see which interaction behaviors are related to what processes. Thus it might be possible to explain why certain behaviors are effective and others are ineffective. There has been a lot of research on processes in groups, but because these processes are usually complicated, more research is needed. This is especially the case when considering virtual teams (Kozlowski, & Ilgen, 2006). In their article, Kozlowski and Ilgen, gave an overview of processes that exist in teams. Most knowledge that we have about processes in teams is based on research that has been conducted in face-to-face teams. However, findings show that processes differ in virtual teams (e.g. Kozlowski, & Ilgen, 2006; Bell, & Kozlowski, 2002; Kirkman, Rosen, Tesluk, & Gibson, 2004). In this research we looked at global virtual teams, which might even be more complicated because teams are not only virtual but also multicultural. However, more and more global virtual teams are emerging; therefore it is important that we get more insights into the relation between interaction behaviors and processes, as well as how this is all related to performance and satisfaction.

A strength of this study is that we have used a methodology that has proven its worth in previous research, namely the Critical Incident Technique, to study interaction behaviors in global virtual teams. For developing the framework, we have used professional virtual team workers. These people are the experts of the field. A weakness is that the research was based on perceptions and memories of experts. For future research we suggest to have objective
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observations. In addition, it would be interesting to get a better understanding of the relative importance of the categories. In this study we interviewed people, and assumed that examples of behaviors that were mentioned most often would probably also be most important. This, however, does not have to be the case. Observations and questionnaire studies can provide a deeper understanding. Another interesting option is to do a longitudinal study in which interaction behaviors in teams are observed. This way it will be possible to get a better understanding of whether virtual teams improve automatically, or whether interventions are necessary in badly functioning teams.

Practical implications
People in practice can use this framework to improve the performance of their virtual teams and the satisfaction of team members. Outputs can be improved when team members behave as effectively as possible. Members of virtual teams should be made aware of these behaviors. Teams that do not function like they should or newly developed teams can take advantage from this framework, so they do not have to discover everything themselves.

High tech companies have started to developed software that helps virtual teams to perform some behaviors that are covered in this framework. With respect to Structuring of meeting, some applications enable and support teams to share screens, minutes, and presentations during a meeting. It is possible to show who is talking, who is invited, and to post an agenda. To help virtual team workers deal with reliable interaction software makes it possible to share a personal agenda to see how to reach team members. With regard to Task process communication, some collaborative systems can help to enhance the awareness of what other virtual team members are doing (Jang, Steinfield, & Pfaff, 2002). Some versions of software have possibilities to share progress on tasks by means of a time-line on which individuals can indicate their progress. It must be remembered, however, that interaction media are only the foundation of teamwork, as Hulnick (2001) put it, and that interactions between people make the team successful or not.

With regard to the generalizability of this framework it should be noted that, even though all virtual team workers that were interviewed worked in global virtual teams, all interviewees were living in the Netherlands. For future research, it would therefore be interesting to further investigate whether the same categories are found when people with other national cultures are interviewed. Looking at the work of Hofstede (2001) on how cultures influence the values in the workplace, the behaviors that our interviewees mentioned
might have been influenced by Dutch values. For example, The Netherlands score low on the variable *power-distance* (acceptance of power inequality between people). This might explain that people in teams with a Dutch core find it effective that all team members give their opinion in a meeting and everybody should be involved. In countries with a higher power-distance this behavior might not be interpreted as effective at all. Therefore, it could be that teams with, for example, Indian or American virtual team workers mention other behaviors to be effective or ineffective.

**Conclusion**

In conclusion, in this study we found thirteen categories of interaction behavior that are critical in virtual teams. When comparing our framework to prior face-to-face frameworks, and taking virtual teams as a starting point we showed that members in virtual teams show unique interaction behaviors. Future research should continue to explore to what extent existing theories on face-to-face teams are generalizable to virtual teams and to what extent new and unique theories should be developed for virtual teams. Extensive research is lacking and we hope our study is a step in the right direction. Empirical research on virtual teams has a tremendous promise for the future. Especially since virtual teams are a new form of organization that is here to stay, research should focus on making this a successful form of organization.
Cultural Differences in the Perception of Critical Interaction Behaviors in Global Virtual Teams*

We investigated whether members of virtual teams from the U.S., India, and Belgium perceived the same interaction behaviors to be critical for team functioning as Dutch members from an earlier study. Thirteen virtual team workers from the U.S., 11 from India, and 11 from Belgium were interviewed by means of the Critical Incident Technique (Flanagan, 1954). The total number of critical incidents from all countries was 493 and most incidents could be grouped into the same 13 categories as those found in the original Dutch study. However, the results showed that the distributions of the critical incidents from the American, Indian, and Belgian respondents differed from those of the Dutch. Indian and Belgian respondents also mentioned a new category of critical incidents: Respectfulness. The cultural differences were interpreted by means of Hofstede’s cultural dimensions (Hofstede, 2001).

Due to globalization, global virtual teams are commonplace and the number of virtual teams keeps growing. In their extensive overview of research on team processes, Kozlowski and Ilgen (2006) highlighted that global virtual teams with members from different cultures are an emerging trend, but that theory and research on the subject are limited. Connaughton and Shuffler (2007) pointed out that cultural difference is an aspect, critical to the effectiveness of global virtual teams that needs to be researched. The present study offers insight into interaction behaviors that are viewed by members from different cultures to be critical for effective team functioning. Our study investigates whether a) a category system of critical interaction behaviors in virtual teams developed in a previous study of Dutch professional virtual team workers (Dekker, & Rutte, 2008) needs to be extended when participants from

other cultures are investigated, and b) whether team workers from different cultures attach the same values to the categories. These findings are important because virtual team members, to be effective, need to understand one another’s culture-driven expectations.

3.1 Critical interaction behaviors in global virtual teams

Global virtual teams are technology mediated groups of people from different countries that work on common tasks (Hardin, Fuller, and Davison, 2007). Team members use interaction media such as chat, e-mail, audio conference, and video conferencing to interact with one another without needing to meet face-to-face. The more a team relies on media for interaction, the more virtual it is (Hertel, Geiser, & Konradt, 2005). Global virtual teams enable companies to combine skills, talents, and other advantages from people across the globe. Previous studies have shown that teams with members from different cultures outperform homogeneous teams (e.g. Lovelace, Sharpio, & Weingard, 2001; Watson, Johnson, Kumar, & Critelli, 1998; Watson, & Kumar, 1992). The reasons for the growing number of virtual teams are obvious: reduced travel expenses, CO₂ emissions, and less working time wasted on traveling. In order to be able to compete in the global economy, organizations are almost forced to work with global virtual teams (Lu, Watson-Manheim, House, & Matzkevich, 2005).

To make virtual teams effective, it is important to focus on behaviors that are critical for effective team functioning. In a study among professional virtual team workers, Dekker and Rutte (2008) designed a framework of 13 categories that contain behaviors that are critical in global virtual teams (see first 13 categories in Table 3.1). The categories contain behaviors that were perceived to be critical for the satisfaction and performance of the team. A comparison with frameworks from the literature on face-to-face interactions (e.g. Bales, 1950; Rousseau, Aubé, & Savoie, 2006, Cooke and Szumal, 1994; Potter and Balthazard, 2002a; 2002b) showed that most of the 13 categories were exclusive to virtual teams. Some categories partly overlapped with behaviors described in face-to-face frameworks, but the emphasis in virtual teams was different.

The 13 categories were derived from interviews with 30 professional global virtual team workers by means of the Critical Incident Technique (CIT) (Flanagan, 1954). However, all interviewees were working in the Netherlands, which means that the findings might be culture specific. The first question that the present study addressed was whether the 13 categories developed in the Dutch study could be generalized to other cultures, or whether new categories would emerge if virtual team members from other cultures were interviewed.
Table 3.1

13 categories of interaction behavior in virtual teams and how team members should behave per category (Dekker, & Rutte, 2008)

<table>
<thead>
<tr>
<th>No.</th>
<th>Category label</th>
<th>Interaction behavior:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Media use</td>
<td>Effectively matching the media to the task and effective use of media.</td>
</tr>
<tr>
<td>2</td>
<td>Handling diversity</td>
<td>Taking into account language-, time zone-, and cultural differences when interacting and behaving accordingly.</td>
</tr>
<tr>
<td>3</td>
<td>Interaction volume</td>
<td>Communicating short, to the point, and only when necessary.</td>
</tr>
<tr>
<td>4</td>
<td>In-role behavior</td>
<td>Taking task and goal of the team seriously and complying with obligations.</td>
</tr>
<tr>
<td>5</td>
<td>Structuring of meeting</td>
<td>Planning and structuring of meetings.</td>
</tr>
<tr>
<td>6</td>
<td>Reliable interaction</td>
<td>Being predictable in behavior and responsive to messages of team members.</td>
</tr>
<tr>
<td>7</td>
<td>Active participation</td>
<td>Showing active participation in meetings by contributing and listening.</td>
</tr>
<tr>
<td>8</td>
<td>Including team members</td>
<td>Including and inviting team members for contribution.</td>
</tr>
<tr>
<td>9</td>
<td>Task-progress communication</td>
<td>Communicating deadlines, actions, and progress of a task to the team.</td>
</tr>
<tr>
<td>10</td>
<td>Extra-role behavior</td>
<td>Showing pro-social behavior towards team members.</td>
</tr>
<tr>
<td>11</td>
<td>Sharing by leader</td>
<td>Sharing of information and decisions with the team by team leader.</td>
</tr>
<tr>
<td>12</td>
<td>Attendance</td>
<td>Being involved in the meeting and not showing up late or not at all. No multitasking.</td>
</tr>
<tr>
<td>13</td>
<td>Social-emotional communication</td>
<td>Talking about non-task-related subjects.</td>
</tr>
<tr>
<td>14</td>
<td>Respectfulness</td>
<td>Behaving in accordance with the hierarchy of the team.</td>
</tr>
</tbody>
</table>
The second question was whether members from different cultures would attach the same values to the different categories. In the next paragraph we will argue why we think that the framework may be culture specific.

3.2 The impact of cultures

Global virtual teams consist of people from different national cultures with different native languages and different value systems. Hofstede defined culture as "the collective programming of the human mind that distinguishes the members of one human group from another" (1980, p. 25). Harding, Fuller and Davison (2007) argued that it is reasonable to believe that cultural differences at the national level influence the way people interact in virtual teams and that, in turn, may influence team outcomes. These problems are difficult to solve because people may not realize how influenced they are by their culture until they meet people from other cultures and conflict occurs (Adler, 1983).

Janssens and Brett (2006) described three models of how teams can cope with cultural differences. An assumption that underlies these models is that people from different cultures have different cultural precepts. Cultural precepts are sets of norms or standards of how to interact with one another. Cultural differences in precepts, often unrecognized by the team members, can create inaccurate attributions, which lead to conflict and affects team performance (Janssens, & Brett, 2006; Cramton, Orvis, & Wilson, 2007).

In the dominant coalition model, one culture dominates over other cultures. The culture of the corporate headquarters, as well as the common corporate language, usually stem from a single culture that is chosen as the dominant culture (Canney Davison, & Ward, 1999). Dominant culture members may make up the majority of the team, but may also be a minority, or an individual. A second model, the integrative/identity model, stresses cooperative collaboration based on a common identity. Members of a team have adopted a common identity and superordinate goals. Janssens and Brett (2006) argued that this model is more culturally intelligent than the dominant coalition model because it generates fewer process losses. However, according to these researchers, the fusion model, in which culturally diverse teams have to accept and respect the coexistence of differences and utilize the unique qualities of those differences, produces the best team outcomes. According to Janssens and Brett, teams that have adopted the fusion model incorporate the best knowledge available across cultures. To be able to do so, it is necessary to know what behaviors in virtual teams are viewed as critical in different cultures.
Cultural Differences

In this study we used Hofstede’s (2001) cultural dimensions. There are several other frameworks about culture (for an excellent overview see Tsui, Nifadkar, & Ou, 2007), but Hofstede’s work has been widely accepted and used by researchers to compare cultural groups (e.g. Leong, 2007). Moreover, Hofstede conducted his research in a high-technology organization that employed mainly highly skilled professionals and managers, an environment that is similar to that of the virtual team workers in our study. Hofstede provided five cultural dimensions that differentiate national cultures: power distance, uncertainty avoidance, individualism, masculinity, and long-term orientation. In the next section we will discuss how, based on these cultural dimensions, one could expect differences in preferences for interaction behaviors by virtual team members from different cultures.

Power Distance

Power distance (PD) is the acceptance of inequality between a less powerful and a more powerful individual, where both belong to the same social system (Hofstede, 2001). In other work, PD has also been referred to as hierarchy (e.g. Adiar, Okumura, & Brett, 2001; Tinsley, & Brett, 2001; Glazer, & Beehr, 2005). An example of a low PD cultural norm is that all members should have equal rights, and that subordinates and superiors are equal (Hofstede, 2001). Earley (1999) found that subordinates in low PD teams expect to be consulted by their manager before decisions are made, and that the judgment of each team member is perceived as important. Subordinates in high PD countries, on the other hand, prefer a manager who tells them what to do. Javidan and House (2001) found that input and feedback from subordinates in high PD countries are seldom solicited and that such solicitations would be seen as impolite and disloyal. Hofstede's work (2001) showed that the Netherlands scores low on PD. This score may be related to interaction behaviors perceived as critical in the framework of Dekker and Rutte (2008). It seems reasonable to believe that behaviors from the category Including team members are perceived as more important by low PD cultures, as compared to high PD cultures, because the input of all team members is appreciated. Therefore it could be that behaviors in this category are mentioned more often by virtual team workers from low than from high PD cultures.

In their study about media choice, Richardson and Smith (2007) found that high PD cultures prefer face-to-face communication over e-mail when contacting supervisors. Maybe the latter is seen as too informal to bridge the distance between the self and the supervisor. In Dekker and Rutte's framework, the category Media use is about choosing an appropriate medium for interaction. Because people from high PD cultures are more concerned about
what medium to use, it could be that this category will be mentioned more often in high than in low PD cultures.

**Uncertainty Avoidance**

The uncertainty avoidance (UA) dimension scores countries on how much uncertainty and ambiguity is tolerated and how much is perceived as comfortable. High UA cultures try to minimize uncertainty by, for example, strict laws and rules. Cohen, Pant, and Sharp (1996) argued that high UA cultures are inclined to support rules and regulations, to avoid risks, and are intolerant of persons with divergent ideas. Low UA cultures, on the other hand, are more tolerant of different opinions and have fewer rules (Hofstede, 2001). In a study across 62 countries (the GLOBE study), Javidan and House (2001) found that UA influences the communication process. In high UA cultures, communication needs to be clear, explicit, and based on facts. Work in low UA countries is oriented toward relationships, whereas work in high UA countries is oriented towards the task (Hofstede, 2001), and therefore the degree of UA in a culture may be related to what interaction behaviors are seen as important. One of the categories, *Social-emotional communication*, emphasizes discussing personal issues to improve relationships. Behaviors from this category were mentioned by the Dutch, who score low on UA (Hofstede, 2001). Previous findings have suggested that countries scoring high on UA might perceive the behaviors from this category as less important for effective team functioning. Thus, team members in low UA cultures, could mention behaviors in the category Social-emotional behavior more often than those in high UA cultures.

**Individualism versus collectivism**

On the low side of the Individualism (IND) dimension, we find collectivism. Collectivism is the degree to which individuals are integrated into groups. In high IND cultures, the ties between individuals are loose, people are expected to look after themselves, and the individual's rights are seen as very important. In low IND cultures, we find people that are integrated into large, strong, and cohesive groups. Strong associations with friends and family are considered of great importance.

More than the other dimensions, individualism has been related to attitudes, values, norms, behaviors, team processes, and outcomes (Sarker, 2005; Connaughton & Shuffler, 2007; Paul, Samarah, Seetharaman, & Myktyn 2005, Kaushal &Kwantes, 2006). Previously, the IND dimension has often been used as the operationalization of culture (e.g. Kessapidou, & Varsakelis, 2002; Stedham & Yamamura, 2004, Schwartz, 1999). Earley (1989) stated that
individualism potentially affects communication and coordination patterns among individual team members, as well as their expectations. This gives us reason to believe that Dekker and Rutte's framework may be affected by the fact that the Netherlands scores high on IND (Hofstede, 2001). In high IND cultures, the focus is on individual performance and responsibility (Hofstede, 2001). This might be related to Reliable interaction, which includes being responsible for one's communication and being reliable in general. Low IND cultures might find this less important and therefore members from low IND cultures could mention behaviors in this category less often.

With regard to behaviors in teams, McLeod, Lobel, and Cox (1996) found that low IND people are more willing to help others, make personal sacrifices, and cooperate more than people from individualistic cultures. Paul et al. (2005) also concluded that a collective orientation is related to enhanced collaboration. Unlike the Netherlands, which scores high on IND, low IND cultures believe in collective decisions (Hofstede, 2001) and may prefer behaviors in the category Active participation because issues need to be discussed over and over again until everyone agrees with the decision. Therefore it could be that behaviors from the category Active participation will be mentioned more often by virtual team workers from low than from high IND cultures.

**Masculinity**

The masculinity (MAS) dimension refers to the division of emotional roles between males and females. In low MAS (feminine) cultures, like the Netherlands, men and women have similar values. In high MAS cultures on the other hand, there is a larger gap between the values of males and females in high MAS cultures, even though females are more assertive and competitive as compared to females in low MAS cultures. To our knowledge, no differences between low and high MAS cultures have been found with regard to virtual, or face-to-face, teams. Researchers who did study masculinity mentioned no significant results (e.g. Mjøs, 2002; Smith, Peterson, & Schwartz, 2002). However, we think that the low score of the Netherlands on this dimension may have influenced what Dutch virtual team workers perceive to be critical interaction behaviors. The categories Task-progress communication and Extra-role behavior seem to be categories that contain behaviors more important in low MAS cultures. Task-process communication is usually about showing one's weakness (admitting that one cannot finish something before the deadline), something not very likely done in a more masculine environment. Also caring for others and helping them seem to be behaviors more valued in a feminine culture. Therefore it could very well be that behaviors in
Chapter 3

the categories Task-progress communication and Extra-role behavior will be mentioned more often by team members from low than from high MAS cultures.

**Long-term orientation**

The final dimension of Hofstede’s model was identified in a subsequent international study with Chinese employees and managers, and was originally called Confucian Dynamism (Hofstede, & Bond, 1988). On the lower end of the dimension we find short-term orientation and on the higher end we find long-term orientation (LTO). This dimension deals with virtue regardless of truth (Hofstede, 2001). Values associated with high LTO are thrift, ordering relationships by status and observing its order, having a sense of shame, and perseverance. Whereas values associated with low LTO are respect for tradition, personal steadiness and stability, protecting one's "face", and fulfilling social obligations (Hofstede, 2001). In earlier research it has been argued that this dimension is difficult to apply and understand (Fang, 2003). The Netherlands scores average on this dimension. However, higher or lower scores may possibly influence what behaviors are seen as important. We have no specific expectations with regard to LTO.

In conclusion, the discussion about Hofstede’s cultural dimensions makes it likely that members of virtual teams who have different national cultures differ with respect to what interaction behaviors they perceive to contribute to the team outcome. This could first and foremost lead to entirely new categories of behaviors besides the categories already found by Dekker and Rutte (2008). Second this could lead to differences in the values attached to the 13 original categories. It is important to investigate whether team members from different cultures differ on behaviors that are critical for effective teams, because according to the fusion model of Janssens and Brett (2006), these differences should be accepted and respected. As a minimal condition, global virtual team workers should be aware of these differences. Before we move on to the method section, we would like to restate our hypotheses with regard to different values attached by different cultures to the categories:

Hypothesis 1: Global virtual team workers from low PD cultures, compared to high PD cultures, attach greater value to Including team members.

Hypothesis 2: Global virtual team workers from high PD, compared to low PD cultures, cultures attach greater value to Media use.
Hypothesis 3: Global virtual team workers from low UA cultures, compared to high UA cultures, attach greater value to Social-emotional communication.

Hypothesis 4: Global virtual team workers from high IND cultures, compared to low IND cultures, attach greater value to Reliable interaction.

Hypothesis 5: Global virtual team workers from low IND cultures, compared to high IND cultures, attach greater value to Active participation.

Hypothesis 6: Global virtual team workers from low MAS cultures, compared to high MAS cultures, attach greater value to Task progress communication.

Hypothesis 7: Global virtual team workers from low MAS cultures, compared to high MAS cultures, attach greater value to Extra-role behavior.

3.3 Method

Selection of cultures

To determine whether national cultures influence what interaction behaviors are perceived as critical, we selected professional virtual team workers from countries with national cultures that were different on some cultural dimensions but similar on others (maximum variation sampling) (Miles, & Huberman, 1994). We did not pretend to study the average perceptions within the countries because for this we would have needed a representative sample of the total population. We did, however, compare perceptions between countries of individuals who work in similar jobs under similar circumstances. Selecting contrasting countries enabled us to explain whether the category pattern of the original 13 Dutch categories is culture specific. We chose the U.S., India, and Belgium because their cultures are very different from one another and from the Dutch culture. As can be seen in Table 3.2, each national culture is unique and in contrast with the other national cultures with regard to Hofstede’s dimensions. Table 3.2 shows that India has a high PD, resulting in a top 10 ranking in the world. Belgium scores higher than most other European countries with a score of 65. The U.S. and the Netherlands score similar and have a PD that is lower than the world average. India and the U.S. score low on UA whereas The Netherlands has a moderate score. Belgium, on the other hand, has one of the 5 highest ranked national cultures (Hofstede, 2001). The Netherlands and the U.S. score high on IND. Both cultures are in the top 5
Chapter 3

ranking of the world. Belgium also scores high. India scores similar to the world average score. The Netherlands has a very low MAS culture, whereas the U.S. scores high on MAS and Belgium and India have average MAS scores. As can be seen in the table, the U.S. has a short-term orientation, whereas India scores high on long-term orientation. The scores of the Netherlands and Belgium are close to the world average.

Table 3.2

Scores of the Netherlands, the United States, India, Belgium and the world's average on Hofstede's dimensions (Hofstede, 2001)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Netherlands</th>
<th>U.S.</th>
<th>India</th>
<th>Belgium</th>
<th>World average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power distance (PD)</td>
<td>38</td>
<td>40</td>
<td>77</td>
<td>65</td>
<td>55</td>
</tr>
<tr>
<td>Uncertainty avoidance (UA)</td>
<td>53</td>
<td>46</td>
<td>40</td>
<td>94</td>
<td>64</td>
</tr>
<tr>
<td>Individualism (IND)</td>
<td>80</td>
<td>91</td>
<td>48</td>
<td>75</td>
<td>43</td>
</tr>
<tr>
<td>Masculinity (MAS)</td>
<td>14</td>
<td>62</td>
<td>56</td>
<td>54</td>
<td>50</td>
</tr>
<tr>
<td>Long-term orientation (LTO)</td>
<td>44</td>
<td>29</td>
<td>61</td>
<td>38</td>
<td>45</td>
</tr>
</tbody>
</table>

Participants

To compare the different cultures, we interviewed 36 professional virtual team workers from large multinational corporations in the U.S., India, and Belgium. The samples from these national cultures were similar with regard to size, company, team structure, job, years of experience, and interaction media used. These samples were also similar to the sample from the original Dutch study by Dekker and Rutte (2008).

Using snowball sampling (in which participants helped us to recruit other participants from different global virtual teams), we interviewed 14 virtual team workers (seven males, seven females) from the U.S., 11 (nine males, two females) from India, and 11 (nine males, two females) from Belgium. All interviewees (except one American who worked for a scientific organization) worked in a Fortune Global 500 (2006) or Forbes Global 2000 (2006) company. The companies were oil or software oriented. The years of experience with working in a virtual team in the American sample ranged from one to 10 years (m = 5.3, s.d. = 2.7), in the Indian sample from six months to 10 years (m = 5.2, s.d. = 3.6), and in the Belgian sample from 10 months to 15 years (m = 5.1, s.d. = 4.9). The teams had comparable
sizes with an average of 5 locations, usually including the U.S., Europe, and Asia (mostly India). From the 14 American interviewees, nine indicated that theirs team also had several locations within the U.S. Thus they not only interacted virtually with people from other countries, but also with people located elsewhere in the U.S. The participants held similar jobs in their organizations: in information systems, services, sales, and human resources. Eight American, five Indian, and eight Belgian participants indicated that they were the leader or manager of their virtual teams.

The teams used e-mail, chat, telephone, and teleconference to interact. Teleconference meetings were usually scheduled on a regular basis (e.g. daily, weekly, biweekly, monthly). A tool like Net-meeting or Groove was often used in combination with the teleconference. Only one interviewee from India used videoconference as a medium to interact, and only when a virtual team member had to physically demonstrate something. Seven American, five Indian, and five Belgian interviewees had face-to-face meetings with their virtual team members on a regular basis, ranging from once a month to once a year. Three Belgian interviewees had never seen any of their team members. The other American, Indian, and Belgian interviewees had seen virtual team members during training sessions.

Procedure

We chose an open interview method because it was not known beforehand what categories would be found for the different national cultures and because we did not want to bias the results. By taking an explorative method, we left the possibility open that we would find new categories or that some categories would be more or less important than those in the study by Dekker and Rutte (2008).

In this study, examples of important positive or negative interaction behaviors were collected by means of the Critical Incident Technique (CIT) (Flanagan, 1954). The CIT is ".... a set of procedures for collecting direct observations of human behavior in such a way as to facilitate their potential usefulness in solving practical problems and developing broad psychological principles "( Flanagan, 1954, pp. 327-358). Previously, this technique proved its use in job analysis, performance appraisal, competency management (Latham, & Wexley, 1981; Wiersma, van den Berg & Latham, 1995), dual career couples (Wiersma, 1994), and cross-cultural studies (e.g. Arthur, 2000; Driskill, & Downs, 1995). Outcomes that we focused on in this study were: satisfaction of team members and the performance of the team.

An incident is considered to be critical if the observer believes that the observed behavior contributed significantly to the outcome. The interviewees were told that the
incidents needed to be reported in such a way that it was as if the interviewer herself observed the incident. With this in mind, the interviewer needed to make sure that for each incident the following criteria were met: (a) actual behavior needed to be reported; (b) the actual behavior needed to have been observed by the interviewee; (c) the interviewee needed to provide relevant factors of the situation; (d) the interviewee needed to judge the criticalness of the behavior (contributed to a positive or negative outcome); and (e) the interviewee needed to make clear why he or she believed the behavior had been critical (Flanagan, 1954).

A week prior to the interview the interviewees received an overview of the interview by e-mail so that they could prepare themselves. To obtain background information about the interviewee, the interview started with questions about (a) the interviewee's job and organization, (b) the virtual team of which the interviewee was a member, (c) the experience of the interviewee with working virtually, (d) the interaction media that were used in the interviewee's virtual team, and (e) how frequently these media were used. If the interviewee had anything important to add, he or she was invited to do so. After explaining the general goal of the study, the interviewee was asked the following questions: "Now I want you to think back to specific incidents that you have seen occur in the last year. Can you think of an incident in which your virtual team members showed a critical interaction behavior? Would you describe for each example: (1) what were the circumstances surrounding this incident, (2) what exactly did the team member(s) do that was critical, and (3) how did the behavior (positively or negatively) affect the satisfaction of the team members and/or the performance of the team?"

The interviewer asked the interviewees to recall as many critical incidents as possible in which they had observed critical interaction behaviors about themselves or team members. If an incident was less clear or specific than desired, the interviewer would ask for clarification or for further details. In order to minimize interviewer bias, all CIT interviews were conducted by the first author. All interviews were conducted in English, except for nine interviews with Belgian interviewees that were conducted in Dutch. In the beginning of the interview, the interviewees were (a) informed that the conversation would be kept confidential to the research team; (b) informed that their name or the names they mentioned would not be used in any published article or made public in any other way; and (c) asked permission to record the interview. One interviewee did not give permission to record the interview. This interview was written down during the interview. Thirty-two interviews were conducted by telephone. Four interviews with Belgian virtual team workers were conducted
in a face-to-face setting in Brussels. All interviews took 30 to 60 minutes. The digital records of the interviews were transcribed into a list of critical incidents.

**Categorization process**

The list of critical incidents from the three countries had to be transformed into behavioral items that were used as input for the categorization process (Latham and Wexley, 1980). This was important because all items needed to be phrased in a useful way (Latham, & Wexley, 1980) and because some critical incidents contained multiple behavioral items (Peeters, Van Tuijl, Reymen, & Rutte, 2007). Each behavioral item consisted of one "observed act" and was written on a card. We had separate piles of behavioral items for the Indian, American, and Belgian samples. Next, for each group we randomly took out 10% of the items, which we later used to establish content validity (Latham and Wexley, 1980). We categorized the remaining 90% of the items from each culture using the thirteen categories of the prior categorization (Dekker, & Rutte, 2008).

From the critical incidents reported by the interviewees from the U.S., 208 behavioral items (average per interviewee = 14.9, s.d. = 2.14) were derived. From the interviews with the Indian virtual team workers 122 behavioral items (m= 11.1, s.d. = 2.30) were derived, and 163 (m = 14.8, s.d. = 1.66) behavioral items were derived from the critical incidents that were reported by the Belgian interviewees. For the U.S., 67% of the items were critical behaviors believed to have contributed to a positive outcome, for India this was 80%, and for Belgium this was 65%. Per country we distributed 90% of the behavioral items over the 13 categories of Dekker and Rutte (2008). Two raters independently distributed the items over the 13 categories. Cohen's kappa between the two raters for the behavioral items was .82 for the U.S., .80 for India, and .79 for Belgium. According to Landis and Koch (1977), strength of agreement of .79 or .80 is substantial and strength of agreement above .80 is almost perfect. Next, the two raters discussed the distribution until they reached agreement about the distribution of all behavioral items. We attained content validity with the 10% of the behavioral items per country that had initially been left out. Per country these items could be categorized without a problem.

**Analysis of data**

By means of a Chi-square it was possible to investigate whether the distributions of the cultures differed significantly. To test our specific hypotheses concerning the values attached to categories by different cultures we conducted a log linear analysis. This analysis
provided insight into which cells caused significant differences between the cultures by providing a significant deviance value. The first hypothesis would be supported if the Netherlands and the U.S. (low PD) mentioned more items than the Indian and Belgium sample (high PD) regarding Including team members. The Netherlands and the U.S. should have a significantly deviance value, indicating that the cell contained more items than would have been expected. The second hypothesis stated that high PD cultures, represented by India and Belgium in our sample, should have more items regarding Media use, compared to the Netherlands and the U.S. In this case the log linear analysis should show significant higher values for India and Belgium in this category. The third hypothesis dealt with UA, stating that low UA cultures mention more items regarding Social emotional communication compared to high UA cultures. For the hypothesis to be supported, the sample from the Netherlands, the U.S. and India (low UA) should have mentioned a higher number of items than expected. Hypothesis four and five concerned IND. High IND cultures, in the current study represented by the Netherlands, the U.S., and Belgium, should have mentioned more items than expected regarding Reliable interaction for hypothesis four to be supported. This should not be the case for Active participation, because here the Indian sample (low IND) should have mentioned more items than the Netherlands, the U.S., and Belgium for hypothesis five to be supported. For hypothesis six and seven to be supported, the Dutch sample (low MAS) should have a significant deviance value, which indicates that this sample mentioned significantly more items regarding Task progress communication and Extra-role behavior than expected according to the log linear analysis.

3.4 Results

Table 3.3 gives an overview of how the behavioral items for the different cultures were distributed. As can be seen, for India and Belgium an extra category "Respectfulness" was added. This means that the category system developed previously (Dekker and Rutte, 2008) turned out to be incomplete after participants from India and Belgium were investigated. The new category contained behaviors like: not trivializing work of remote team members, taking hierarchy into consideration, and not concentrating on someone who made a mistake.

According to the Chi-square test, the cultures differed significantly on the distribution of the categories \( \chi^2(39, N = 906) = 219.647, p = .000 \). This means that the various categories were mentioned to a different extent among the cultures. To see whether the distribution of the Netherlands differed significantly from the distributions of the other cultures, we compared the distribution of each national culture that was found with the
distribution that had been found for the Netherlands. To calculate $\chi^2$ between the American and the Dutch samples we had to eliminate category 14 because this category was not found in these cultures, which would lead to an expected value below 1, which is not in accordance with the rules of Cochran (1952). For each table, at least 80% of the expected values were larger than 5, which is in accordance with Cochran's rules. We found significant differences between the Netherlands and the U.S. ($\chi^2(12, N = 621) = 79.125, p < .001$), the Netherlands and India ($\chi^2(13, N = 534) = 86.367, p < .001$), and the Netherlands and Belgium ($\chi^2(13, N = 582) = 65.925, p < .001$). This suggests that interaction behaviors perceived to be critical in virtual teams are culture specific.

To get a complete overview, we also compared the distributions of the U.S., India, and Belgium interviewees. To compare the distributions of India and the U.S., we combined the categories 9, 10, and 11, on which both countries scored low, to meet the criteria of Cochran. We found that the distributions of these two countries were significantly different ($\chi^2(11, N = 329) = 63.410, p < .001$). The distributions of the U.S. and Belgium were also significantly different ($\chi^2(12, N = 377) = 77.113, p < .001$). These overall significant $\chi^2$ values indicate that the observed frequencies were not simply chance deviations from the expected frequencies. When we compared the distribution of Belgium and India, we saw that, after combining categories 10, 11, and 12 and categories 6 and 9, these distributions did not differ significantly ($\chi^2(10, N = 290) = 11.097, p = .35, n.s.$).

Next, we performed a loglinear analysis. This test gives the deviance per cell between the observed and expected frequencies, and enabled us to see which cells caused the significant $\chi^2$. For the cells that had an observed frequency of zero, the deviance measure could not be calculated. Table 3.3 shows which cell frequencies were significantly different from the expected frequency. With regard to the first hypothesis in which we expected that global virtual team workers from low PD cultures would mention more behaviors regarding Including team members. The U.S., a low PD culture, did indeed have a higher observed frequency than the expected frequency for this category. However, even though the Dutch sample had a higher frequency as compared to India and Belgium, the frequency was not significantly higher as compared to the expected frequency. The first hypothesis is thus partially supported. For the category Media use, we see that the frequencies of the Netherlands and the U.S. were significantly lower than the expected frequencies, according to the loglinear analysis. The frequencies of India and Belgium, on the other hand, were significantly higher as compared to the expected frequencies. This provides support for the
Table 3.3  
*Distribution of behavioral items for The Netherlands, U.S., India, and Belgium.*

<table>
<thead>
<tr>
<th>No</th>
<th>Category Label</th>
<th>Number (and %) of critical behavioral items</th>
<th>The Netherlands</th>
<th>U.S. (n=14)</th>
<th>India (n=11)</th>
<th>Belgium (n=11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Media use</td>
<td>56 (14%)*</td>
<td>25 (12%)*</td>
<td>31 (25%)*</td>
<td>47 (29%)*</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Handling diversity</td>
<td>54 (13%)</td>
<td>39 (19%)*</td>
<td>13 (11%)</td>
<td>18 (11%)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interaction volume</td>
<td>51 (12%)*</td>
<td>12 (6%)</td>
<td>8 (7%)</td>
<td>17 (10%)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>In-role behavior</td>
<td>44 (11%)*</td>
<td>4 (2%)</td>
<td>10 (8%)</td>
<td>16 (10%)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Structuring of meeting</td>
<td>34 (8%)*</td>
<td>31 (15%)*</td>
<td>7 (6%)</td>
<td>10 (6%)</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reliable interaction</td>
<td>34 (8%)*</td>
<td>15 (7%)</td>
<td>4 (3%)</td>
<td>3 (2%)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Active participation</td>
<td>27 (7%)*</td>
<td>17 (8%)</td>
<td>24 (20%)*</td>
<td>14 (9%)</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Including team members</td>
<td>26 (6%)</td>
<td>27 (13%)*</td>
<td>5 (4%)</td>
<td>4 (2%)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Task-progress communication</td>
<td>25 (6%)*</td>
<td>2 (1%)</td>
<td>0 (0%)</td>
<td>7 (4%)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Extra-role behavior</td>
<td>19 (5%)*</td>
<td>1 (0%)</td>
<td>0 (0%)</td>
<td>3 (2%)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Sharing by leader</td>
<td>18 (4%)*</td>
<td>0 (0%)</td>
<td>1 (1%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Attendance</td>
<td>15 (4%)*</td>
<td>16 (8%)*</td>
<td>3 (2%)</td>
<td>6 (4%)</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Social-emotional communication</td>
<td>10 (2%)</td>
<td>19 (9%)*</td>
<td>6 (5%)</td>
<td>8 (5%)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Respectfullness</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>10 (8%)*</td>
<td>10 (6%)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>413</td>
<td>208</td>
<td>122</td>
<td>163</td>
<td></td>
</tr>
</tbody>
</table>

* Cell has significant Deviance measure between observed and expected frequency ($\chi^2(1), p < .05$).


second hypothesis, as we expected that high PD countries would mention more items regarding Media use. With regard to the third hypothesis we found that the U.S. had a higher observed frequency than the expected frequency for the category Social emotional communication. Because the U.S. has a low UA culture, this is according to the hypothesis, as we expected virtual team workers from low UA cultures to mention more items in this category. However, the Dutch and Indian cultures also have a low UA, but these do not mention more items than the Belgian participants, who have a high UA. The third hypothesis has thus been partially supported. In the fourth hypothesis, we expected that global virtual team workers from high IND cultures would value reliable interaction. As expected, the Dutch sample, scoring high on IND, had a higher than expected frequency for the category Reliable interaction. The U.S. also had a higher frequency than expected, but this was not significant. The U.S., however, scores higher on IND than the Netherlands. In addition to this, we found that the Belgian sample had a very low frequency, instead of a higher than expected frequency. The fourth hypothesis has thus been partially supported. The data fully support the fifth hypothesis, as we found that India, a low IND culture, had an observed frequency that was significantly higher than the expected frequency for the category Active participation. The sixth hypothesis has also been fully supported as the findings show that the observed frequency for the Dutch sample (low MAS) was higher than the expected frequency for the category Task-progress communication. Finally, because the Extra-role behavior had been mentioned most often by the Dutch sample (low MAS), the seventh hypothesis also has been fully supported.

3.5 Discussion
An important finding, after analyzing the data from the Belgian and Indian samples, is that an extra category: Respectfulness should be added to the framework. This indicates that the category system of critical behaviors for virtual teams (Dekker, & Rutte, 2008) was not yet complete. According to Hofstede (2001), both India and Belgium score high on PD. This means that people in these cultures accept a difference in power between a less powerful and more powerful individual, as can be seen in behaviors that support hierarchical differences between individuals. In Belgium and India it is important to take into account status differences when interacting with team members. These behaviors are most likely viewed as critical because they support the hierarchy that was created to protect and control the working relationship in the team, which in turn influences the outcomes of the team. In the Netherlands and the U.S. no behaviors regarding Respectfulness were mentioned. Individuals
from these cultures may not take this into account because they live in a low PD environment. Therefore, individuals need to be aware of these differences, because members from high and low PD countries in global virtual teams need to collaborate in order to succeed.

We asked interviewees to describe positive and negative interaction behaviors that contribute significantly to the satisfaction and performance of their virtual teams. Results show that the Indian sample mentioned more critical behaviors that lead to positive outcomes. This is not surprising, because these virtual team workers are from a collective culture and therefore less likely to offer opinions that do not support the in-group or cause disharmony (Hofstede, 2001).

Our results also suggest that the values that cultures attach to the different categories differ. Behaviors regarding Including team members were mentioned most often in the U.S., a low PD culture. The Dutch virtual team workers, low on PD too, also mentioned these behaviors more than the Indian and Belgian interviewees, but the difference was smaller. In low PD cultures the opinion of all team members is important because status differences are minimized and individuals are viewed as being equal. In high PD cultures, on the other hand, people that are higher in status are viewed as superior. Therefore, including all team members might not always be seen as something that is necessary. Maybe the reason that the US respondents mentioned relatively more items than Dutch respondents is because the Netherlands has a feminine culture, whereas the U.S. has a masculine culture. Including team members might be a behavior that is related to the more assertive/leadership role of high MAS cultures. Therefore, it could be that the combination of low PD, in which everybody is equal, combined with high MAS, in which assertive, firm, and just behaviors are appreciated, caused virtual team workers to mention more items regarding Including team members as important behaviors.

Richardson and Smith (2007) found that people from high PD countries regard certain media appropriate to use whereas other media inappropriate. People from high PD cultures are more concerned about what medium is appropriate to use and this might therefore explain why high PD countries think these behaviors have a greater influence on the outcomes of a virtual team. This reasoning is in agreement with the finding that behaviors in the category Media use were most often mentioned by virtual team workers from India and Belgium, as compared to virtual team workers from the Netherlands and the U.S.

In the introduction we suggested that high UA cultures, such as Belgium, would mention less items regarding Social-emotional communication. We found, however, that
Belgians mentioned a same number of items as Indians (low UA). Interviewees from the U.S. mentioned more items. The latter finding was according to our expectations, because the U.S. scores low on UA. The reason that the Dutch (low UA) mentioned only a small number of items compared to the other cultures might be because the Dutch are direct. Unlike in other cultures, Dutch people find it normal to come straight to the point. Other cultures first want to get to know someone, if possible go out for dinner, before getting down to business (Breukel, 2007).

The findings that behaviors from the category Reliable interaction were most often mentioned by virtual team workers from countries high on IND may be explained by the fact that in high IND countries the emphasis is on the individual, therefore individuals are responsible for reliable interactions with others. Failing to do so is viewed as being ineffective. Low IND countries emphasize the individual less and therefore these behaviors might be seen as less important.

It is not surprising that active behaviors in meetings are seen as very important in collective cultures, such as India, because everybody needs to ask and talk so that a collective decision can be made. This category is similar to the Contributing answers and questions category of Bales (1950). Bales' category also deals with active behaviors that show participation in meetings. We add to the literature that IND has influence on how effective these behaviors are perceived.

The finding that Extra-role behavior and Task-progress communication were mentioned most often by the Dutch was expected. Additionally, we found that Sharing by leader was mentioned more often by the Dutch as well. Contrary to the other countries that were included in this study, the Netherlands is a feminine country. Behaviors that are included in Extra-role behavior and Sharing by leader are about caring for team members, sharing information, and doing extra things to help them. These behaviors are unlikely in the more competitive, hard, and assertive cultures of the U.S., India, and Belgium. Task-progress communication is extremely important when one is not able to reach the goals on time and concerns showing one's weaknesses when not being able to meet a deadline. Showing one's failure is something not likely to be seen in more masculine cultures. Therefore, a Dutch virtual team worker who shows, for example, behaviors from the category Task-progress communication could be viewed by other Dutch virtual team workers as very effective. However, these behaviors might be viewed as neutral by team members from other cultures.

There were two additional findings with regard to the American global virtual team workers. Behaviors regarding Structuring of meeting were most often mentioned by the
Chapter 3

American interviewees. The American culture scores high on MAS. The Netherlands, India, and Belgium had less and all three a relatively equal number of items, even though the Netherlands scored very low on MAS. It could be that a combination of high MAS and a low PD is important. In the U.S. the seemingly masculine behaviors that fall in the category Structuring of meeting might be seen as effective behavior that needs to be present in a virtual team and is viewed as effective when it is performed by any virtual team member, regardless of status. Another additional finding was that behaviors regarding Handling diversity were mentioned most often by the American virtual team workers we interviewed. We cannot find a logical explanation for this with Hofstede’s dimensions. Perhaps equal opportunity legislation in the U.S., requiring equal consideration of applicants, may explain this difference. To be politically correct, Americans might feel the need to mention issues related to this category. Handling diversity may also be a behavioral item among American interviewees because of the rapidly changing demographics in the U.S. and the market-driven need to pay attention to the differing needs of these new groups. On the other hand, the work of Hannerz (1990) suggests that some societies and cultures may be more willing to respect different cultures.

Theoretical and practical implications

Previous work of Dekker and Rutte (2008) showed that some behaviors that are found in virtual teams have not yet been covered in frameworks of face-to-face interactions (e.g. Bales, 1950; Cooke and Szumal, 1994; Rousseau et al. 2006). In the present study we note that behaviors that are perceived to be critical for the satisfaction and performance of the team are culture specific. In line with the assumptions of Janssens and Brett (2006), we find that cultures differ with respect to what behaviors are perceived as critical. This means that behaviors viewed by virtual team workers from one national culture as contributing significantly to the output are not necessarily viewed similarly by virtual team workers from other cultures. In other words, the precepts of the cultures are different. Additionally, Hofstede’s dimensions (2001) could explain some of the significant differences.

The fusion theory of Janssens and Brett (2006) suggests that the qualities of different cultural percepts should be combined. The coexistence of cultural differences in teams can only be achieved when virtual team members recognize and respect each other's cultural differences. If, however, other strategies are followed such as dominant coalition or Integration/identity, the advantage of being cultural diverse is not fully utilized. We found that people from different cultures have different opinions on what behaviors are critical for
Cultural Differences

effective team functioning. Members of virtual teams have to be aware of these differences in order to take advantage of the fusion model.

Cramton et al. (2007) highlighted the importance of situational differences in virtual teams. In their study, the authors argued that three aspects of virtual teams trigger members to make dispositional rather than situational attributions; (a) different locations, (b) situation invisibility (lack of opportunity to observe), and (c) the use of communication technologies. Virtual team workers are usually unable to observe relevant situational information and therefore there will be no situational correction when making an attribution. The present study expands the theory concerning interpersonal relations in virtual teams by providing insights into cultural differences in global virtual teams. People from different cultures have different perceptions of what interaction behaviors are critical in virtual teams. Attributions that people make influence outcomes such as cohesion (Brawley, Carron, & Widmeyer, 1987) and satisfaction (Wang, 1994). In order to make accurate attributions, one should take the culture of team members into account. For instance, we illustrate a situation in which a Dutch team member behaves differently than the Indian virtual team worker would have expected. In this situation, a Dutch colleague introduces the names of all the team members that are present in the meeting and does so in random order. The Indian colleague, however, interprets the person that was mentioned first as being the most important. Instead, he prefers that introductions are done in alphabetical order. If the Indian knows nothing about the situation or culture of the Dutch colleague, then he will make a dispositional attribution which will most likely negatively influence the collaboration in the future (Gilbert, & Malone, 1995). Thus cultural as well as situational (such as a broken down network) information is important in order to construct accurate attributions. We suggest that, besides situation information sharing (Cramton et al., 2007), information about cultures should be shared in virtual teams.

As Tsui et al. (2007, p. 427) noted "cross-cultural studies in cross-national context are more complex than domestic cross-cultural studies". It is even more complicated in studies about virtual teams because these cross-cultural studies, which cover cross-national contexts, research individuals who share a common goal and work together. Even though global virtual team members have shared experiences, similar work environments, and deal with other cultures on a regular basis, we found differences among virtual team workers from different national cultures. This would indicate that integration of cultures among virtual team members is limited (Berry, 1997) and virtual team workers from different cultures have unique precepts, as is suggested in the fusion model (Janssens, & Brett, 2006).
To deal with the consequences of different cultures, we believe that it is important for global virtual teams to engage in activities to explore and understand the cultures and the consequences of cultures of other team members. These can be activities that highlight differences in frames of reference, that focus on the interpretation of English words (or other common language), or that concentrate on cultural norms. These activities help members of global virtual teams understand the cultures of other members and the way that team members from different cultures collaborate. Organizations can incorporate these activities in training sessions.

The countries selected in this study have practical relevance because they have many virtual team workers. Much work that was previously done within Europe or the U.S. is now outsourced to India, mainly because the quality of the work done in India is high and the costs are low. Due to its high level of education, India has many gifted engineering, computer science, and software talents (Friedman, 2005). Of the American Fortune 1000 companies, 250 outsource part of their business to India (Eastern enterprise, n.d.). Outsourcing is still growing according to the Indian National Association of Software and Services (NASSCOM) (Automatiseringgids, 2007). Future research should take into account other national cultures, such as China, countries in South America, or countries in Eastern Europe, because these countries are becoming more popular as outsourcing destinations and therefore people from these countries will increasingly become members of virtual teams.

Even though we collected a large number of critical incidents, a limitation of the present study is the small number of participants. Another limitation of this study is that the CIT is based on the memory of interviewees. We tried to minimize this by asking interviewees to recall critical examples that had happened in the last year. For future research it will be interesting to have an overview of what behaviors are performed by whom and whether they are perceived as critical. For example, in this study Americans indicated that behaviors from the category Handling diversity are critical; however, we do not know who performed these behaviors. More insight can be provided through questionnaires or observations.

**Conclusion**

The conclusion of this study is that perceptions of critical interaction behaviors within global virtual teams differ across cultures. Cultural awareness of differences is very important. Paul et al. (2005) called this *cross-cultural capital*. Virtual team workers need to become aware that their views of what behaviors are important are not automatically shared with people
Cultural Differences

from other cultures. People from different national cultures thus have different expectations with regard to the behavior of others, which may result in misunderstandings and inaccurate attributions (Cramton et al., 2007). The fusion model (Janssens, & Brett, 2006), suggests that superior outcomes in global virtual teams are achieved when qualities of the different cultures are combined. Because virtual teams are becoming more common, we hope that this research is a step in the right direction towards enhancing satisfaction and productivity in such teams.
Chapter 4

Effective Virtual Team Behaviors and Outcomes:
The Mediating Role of Trust

This study investigates whether trust in global virtual team members mediates the relations between effective virtual team behaviors (EVTB) and team performance as well as between EVTBR team satisfaction. On the basis of critical incidents, an instrument was developed to measure EVTBR a sample of 310 professional virtual team workers. Members of 47 global virtual teams completed the EVTBR questions and the questionnaires measuring team trust, team performance, and team satisfaction. Results showed that the relations between EVTBR and team performance, as well as between EVTBR and team satisfaction, were partially mediated by trust.

It is more the norm than the exception for global organizations to have virtual teams, as they try to use expertise from all over the world, reduce travel expenses, and provide flexibility to employees. However, there is hardly any literature providing insights into processes, behaviors, and outcomes in global virtual teams (Martins, Gibson, & Maynard, 2004). Because virtual teams are common and their number is growing, it is important to understand the conditions for successful collaboration. To get more insight into behaviors in virtual teams, Dekker and colleagues (Dekker, & Rutte, 2008; Dekker, Rutte, & Van den Berg, 2008) developed a framework for effective virtual team behaviors. According to experienced professional members of virtual teams, these behaviors are related to team performance and team satisfaction. In this study we will validate this finding. In addition, we will try to explain why the behavioral categories are related to the effectiveness of virtual teams by means of the mediating role of trust. Previously it has been found that trust plays a major role in the effectiveness of virtual teams (e.g. Costa, Roe, Taillieu, 2001). Because members of virtual

teams are less able to evaluate the abilities, motivation, and work patterns of their co-
members, compared to traditional face-to-face teams, it is more difficult for virtual teams to
develop trust. However, several researchers have argued that trust is required for effective
performance and is especially important in a virtual environment (Handy, 1995; Cohen, &
Bailey, 1997). Therefore, we investigated whether team trust mediates the relation between
effective virtual team behaviors (EVTB) and outcomes.

The contribution of this study is twofold. The first contribution is the development
and validation of an instrument to measure EVT. No such instrument exists yet. Secondly,
this instrument will then be used to empirically investigate the effectiveness of EVT and the
mediating effect of team trust in global virtual teams.

4.1 Global virtual team effectiveness

Global virtual teams are groups of people in different countries that work together on a
common goal while using interaction media to collaborate (Hardin, Fuller, & Davison, 2007).
Examples of interaction media are chat, email, teleconference, and telephone. Satisfaction
and performance are outcome variables that are often used to investigate the effectiveness of
virtual teams. Most early studies compared virtual teams with traditional teams, but, results
were mixed. Some studies found that virtual teams had a higher performance or showed
greater satisfaction than traditional teams (e.g. Sharda, Barr, & McDonnell, 1988; Eveland, &
Bikson, 1988; Martins et al., 2004), some studies found the opposite (e.g. McDonough, Kahn,
& Barczak, 2001; Warketin, Sayeed, and Hightower, 1997), and other studies found no
difference between the two types of teams (e.g. Lind, 1999; Archer, 1990). In the present
study, we followed Martins et al.’s (2004) suggestion that researchers should move away
from comparing face-to-face teams with virtual teams. In our view it is more valuable to
know what distinguishes effective from ineffective virtual teams.

Dekker and Rutte (2008; Dekker et al., 2008) have provided an overview of effective
virtual team behaviors. This overview includes behavioral categories such as interaction
volume, e.g. dealing with the size and number of emails, and including team members, e.g.
actively inviting people to contribute in meetings. Table 4.1 gives an overview of the
categories and a behavioral example per category. The research of Dekker and associates
suggests that effective virtual teams show these behaviors to a greater extent than ineffective
teams. The behaviors in this framework were compared to frameworks from the face-to-face
literature, which revealed that most of the behavioral categories were unique to virtual teams
(Dekker, & Rutte, 2008).
Table 4.1

Critical interaction behavior categories and examples in virtual teams (Dekker, & Rutte, 2008)

<table>
<thead>
<tr>
<th>Category label</th>
<th>Interaction behavior example:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media use</td>
<td>Using chat to ask a quick question.</td>
</tr>
<tr>
<td>Handling diversity</td>
<td>When setting a meeting with someone in a different time zone, taking time zones into account.</td>
</tr>
<tr>
<td>Interaction volume</td>
<td>Not forwarding unnecessary impersonalized emails.</td>
</tr>
<tr>
<td>In-role behavior</td>
<td>Working on the assigned task.</td>
</tr>
<tr>
<td>Structuring of meeting</td>
<td>Working with an agenda during the meeting.</td>
</tr>
<tr>
<td>Reliable interaction</td>
<td>Responding timely to an email from a team member.</td>
</tr>
<tr>
<td>Active participation</td>
<td>Listening carefully in a meeting.</td>
</tr>
<tr>
<td>Including team members</td>
<td>Inviting a distant team member to give his or her opinion.</td>
</tr>
<tr>
<td>Task progress communication</td>
<td>Communicating when a part of the task has been finished.</td>
</tr>
<tr>
<td>Extra-role behavior</td>
<td>Taking over a task of a team member that is busy.</td>
</tr>
<tr>
<td>Sharing by leader</td>
<td>Sharing of information with the team.</td>
</tr>
<tr>
<td>Attendance</td>
<td>No multitasking during a team meeting.</td>
</tr>
<tr>
<td>Social-emotional communication</td>
<td>Informing the team of a personal issue.</td>
</tr>
</tbody>
</table>

The Time, Interaction, and Performance (TIP) theory of McGrath (1991) states that effective groups need to engage in three functions. These functions are critical in teams that have challenging problems and technological and environmental uncertainty, as is the case in global virtual teams. The critical behaviors in the framework of Dekker and Rutte (2008; Dekker et al., 2008) are behavioral components to execute these functions. The first function is production and is executed when team members work on the task, as, for example, in active participation. The second function is member support. Behaviors from the framework that illustrate this are for example including team members, and reliable interaction. The final function is group well-being, which can be executed through extra role behaviors, and information sharing. The TIP theory (McGrath, 1991) helps to explain why EVTBP should be related to outcomes, as was suggested by professional virtual team workers in the work of Dekker and associates (Dekker, & Rutte, 2008; Dekker et al., 2008). One goal of this study is to empirically test whether EVTBP are directly related to team outcomes.
Hypothesis 1: Effective virtual team behaviors are positively related to (a) team performance and (b) team satisfaction in global virtual teams.

4.2 Team trust

In addition to the behaviors described in the previous section, research has shown that trust is a fundamental process that is crucial for team effectiveness (Powell, Piccoli, & Ives, 2004; Sarker, Lau, & Sahay, 2001; Costa et al., 2001). A process is "a construct that emerges over time as members interact and the team develops" (Kozlowski, & Ilgen, 2006). Team trust is the belief of an individual that the team "(a) makes a good-faith effort to behave in accordance with any commitments both explicit or implicit, (b) is honest in whatever negotiations preceded such commitments, and (c) does not take excessive advantage of another even when the opportunity is available" (Cummings, & Bromiley, 1996). Any successful relationship, from a marriage to a business transaction, depends on the degree of trust between individuals (Arnott, 2007). In the literature, scholars agree that team trust is related to high performance (Costa et al., 2001; Powell et al., 2004; Butler, 1991; McAllistar, 1995) and satisfaction (Matzler, & Renzl, 2006; Morris, Marchal, & Rainer, 2002; Costa et al., 2001). For example, Smith and Barclay (1997) found that satisfaction is a dimension of effectiveness that has been predicted by trust. Saunders (2000) also stated that successful virtual teams have high levels of trust.

There is thus plenty of empirical support showing that trust is linked to effectiveness in teams. It is, however, less clear why trust is linked to positive outcomes. In their overview paper on processes in teams, Kozlowski and Ilgen (2006) argued that research on understanding trust is underdeveloped. Moreover, Martins et al. (2004) and Costa et al. (2001) noted that there is little insight into the effect of trust in virtual teams. In virtual teams, members depend on each other for completion of the task. Consequently, team members are vulnerable with regard to the actions of others. It is important that team members trust each other.

Behaviors that develop trust

Social Exchange theory defines a social structure (in this instance a virtual team) as a process of exchange between members with the expectation that actions will result in positive returns (Gouldner, 1960). For example, in a virtual team, one member sends an email with a question to another team member. The sender of the email depends on the action of his team member
and is therefore vulnerable. The sender expects an appropriate response and if the action results in a positive return (an email with an answer to the question), the sender can trust the team member. He or she can trust because the team member handled potential vulnerability as expected and not opportunistically (Jarvenpaa, & Leidner, 1999; Kingshott, & Pecotich, 2007). Because of the positive returns, members are willing to increase their vulnerability towards others and take risks again (Costa et al. 2001; Kingshott, & Pecotich, 2007). These risks are positive actions towards the effectiveness of the virtual team. This, in turn, is crucial for team effectiveness. Trust motivates people to work with the team, and increases the willingness to commit.

If the sender of the email, on the other hand, had not received a reply (negative return) he or she might not be willing to take risks again because the team member did not handle the senders vulnerability in a good way. Team trust is essential for reducing uncertainty in teams (Jarvenpaa, & Leidner, 1999). If trust is absent or low, uncertainty may cause team members to share less information, to be less involved, and to impose controls (Zand, 1972). These behaviors are, according to TIP theory (McGrath, 1991), negative for completion of the three functions. Absence of these behaviors will affect collaboration and coordination (Costa et al., 2001). Members that have low team trust do not feel committed and are not motivated to engage in effective behaviors. Following this reasoning and findings of previous research we formulated

Hypothesis 2: Team trust is positively related to (a) team performance and (b) team satisfaction in global virtual teams.

Researchers have consistently shown that virtual teams have difficulty in achieving trust (Powell et al., 2004; Sarker et al., 2001). Jarvenpaa and Leidner (1999) argued that computer-based communication may eliminate cues that individuals in face-to-face teams normally use to convey trust. Within the virtual team literature there are two streams that explain how trust comes to exist in virtual teams. Firstly, the "swift" trust theory of Meyerson, Weick, and Kramer (1996) suggests that trust is imported in virtual teams because members are unable to develop expectations. The theory builds on the Media Richness Theory (Daft, & Lengel, 1996; Daft, Lengel, & Trivino, 1987), which questions whether virtual teams are able to develop trust because interaction media hinder teams to do so. Originally the swift trust theory was developed for temporary teams with members from different organizations in which teams only had limited face-to-face interaction and lacked time to develop
expectations of others. According to the theory, these teams imported expectations of trust from other settings. Because virtual teams can exist for a longer period of time, we think it is unlikely that this theory is generalizable to virtual teams. Moreover, this theory also implies that trust is stable and not likely to change after it has been adopted.

The second view that explains how trust comes to exist in virtual teams is a developmental view (Lewicki, & Bunker, 1995). This means that trust in virtual teams might be created, rather than imported, via behaviors (Jarvenpaa, & Leidner, 1999). Martins et al. (2004) also stated that trust is developed and maintained through behaviors, and concluded that trust should be reexamined in global virtual teams from the developmental point of view. Our reasoning regarding the importance of behaviors to explain the relation between trust and effectiveness also supports this. In our research we used the second view.

Several researchers, who have adopted the developmental view, have defined positive actions or behaviors that are related to trust in virtual teams. An example is Suchan and Hayzak (2001), who found that trust in virtual teams may be established as a result of early face-to-face meetings. As discussed before, the framework of Dekker and colleagues (Dekker, & Rutte, 2008; Dekker et al., 2008) contains behavioral categories that enhance productivity and satisfaction in virtual teams (see Table 4.1). In one of the categories, media use, it was also noted that having early face-to-face meetings is an effective virtual team behavior. Powell et al. (2004) also described several other factors that facilitate the development of trust in virtual teams, such as shared social norms, repeated interactions, and shared experiences. Repeated interactions are included in the category interaction volume in the framework of Dekker and colleagues. This category deals, for example, with behaviors concerning the frequency of interaction, such as initiating and having regular interactions. Moreover, Jarvenpaa and Leidner (1999) also concluded that having major lapses in communication was found to be related to low trust in virtual teams. Jarvenpaa and Leidner (1999) adopted the developmental view and examined what behaviors in virtual teams are related to trust. They found that trust was related to social communication, communication of enthusiasm, coping with technical uncertainty, individual initiative, predictable communication, substantial and timely responses, successful transition from social to procedural task focus, positive leadership, and phlegmatic response to crisis. Some of these behaviors are included in the framework of Dekker et al. (2008). Social communication is included in the category social-emotional communication. Other researchers also found that relational information sharing is important for the development of trust (Walther, 1992; Adler, 1995; Chidambaram, 1996). Individual initiative is covered in the category in-role
behavior. Predictable communication and timely responses fall into the category reliable interaction, which deals with sharing availability and being responsive. Responsiveness in virtual teams is very important since virtual interactions deal with greater uncertainty than face-to-face interactions. Responding means that another individual takes the risk to interpret the message and suggests involvement, which conveys attraction, intimacy, and affection (Jarvenpaa, & Leidner, 1999; Pearce, 1974). Another category from the Dekker et al. framework is information sharing. This category covers behaviors in which important information, decisions, and team standards are shared with the team by the team leader. The work of Jarvenpaa and Leidner (1999) showed that a negative leader caused low trust in virtual teams. Piccoli and Ives (2003), two other researchers who adopted the developmental view, found that the use of behavioral controls (assigning tasks and making members complete weekly forms) in virtual teams was related to low trust.

Behaviors that are found in the EVTB framework show that virtual team workers work on the task and collaborate in a good way. The behaviors correspond to reduced uncertainty, thereby resulting in greater team trust. Early research on trust (Zand, 1972; Mayer, Davis, & Schoorman, 1995) proposed three underlying facets of trust. The first is ability, which enables a team member to have influence on the task. This means that the team member should be perceived as having expertise. In virtual teams, individuals usually become members because they have expertise. The second and third facets, benevolence and integrity, are about not taking advantage of the vulnerability of others, and about acting out of a set of principles that are acceptable for the team. The Dekker et al. framework (Dekker, & Rutte, 2008) contains behaviors that are in the best interest of all team members. Because the behavioral categories in the framework of Dekker et al. (Dekker, & Rutte, 2008; Dekker et al., 2008) overlap with behaviors that are positively related to trust (e.g. Jarvenpaa, & Leidner, 1999; Martins et al. 2004; Hayzak; 2001; Powell et al., 2004), we predict that Dekker’s EVTB are also positively related to trust.

Hypothesis 3: EVTB are positively related to trust in global virtual teams.

Taken together, we propose that EVTB are directly related to performance and satisfaction (hypothesis 1a and 1b) because these behaviors directly improve effective team functioning by influencing, for example, the speed and accuracy of collaborations in global virtual teams. Previous research has demonstrated, and theory explains, that team trust is positively related to the effectiveness of virtual teams (hypothesis 2a and 2b). In addition to this, we argue that
EVTB are related to trust (hypothesis 3). By showing EVT, team members demonstrate that they exert their best efforts when collaborating in their virtual team, which should be related to an increase in team trust among global virtual team members. This means that team trust, which has been developed through EVT, will be positively related to the effectiveness of global virtual teams. Therefore, we reason that effective virtual team behaviors have a direct relation with the outcomes because they improve effective team functioning, as well as an indirect relation through trust.

Hypothesis 4a: Team trust mediates the relation between effective virtual team behaviors and performance in global virtual teams.

Hypothesis 4b: Team trust mediates the relation between effective virtual team behaviors and satisfaction in global virtual teams.

4.3 Method

Participants
Our main source of data was from an online questionnaire among professional virtual team workers. We used snowball sampling, in which existing respondents were used to recruit more respondents for the study. Participants were invited by email to participate in a study about global virtual team working and they were provided a URL link to the online questionnaire. In the invitation, participants were told that it would take about 20 minutes to complete the survey. After deleting two incomplete records, 310 records were included in the data analysis.

Of the 310 respondents 246 were male and 64 were female. The average age was 39.8 years (s.d. = 7.9). The group consisted of 28 different nationalities, and the respondents were working in 24 different countries. One-hundred and sixty one participants worked in Europe, 45 in the U.S, 22 in India, and others came from various countries including Australia, Rwanda, and China. The global virtual teams had an average of 20.95 (s.d. = 42.53) members. Ninety-one percent of the respondents worked in teams of less than 30 members and 53 percent worked in teams with 10 members or less. The average number of years that our respondents were working in their current virtual team was 1.9 year (s.d. = 1.93). The average overall experience of working in a global virtual team was 5.9 years (s.d. = 5.0).
**EVTB scale development**

In a previous study, 413 behavioral items that had been retrieved from critical incidents (Flanagan, 1953), were categorized into 13 categories (Dekker, and Rutte, 2008). To measure the behaviors within the field of EVTB in an efficient way and to ensure that participants were willing to complete the entire questionnaire accurately, it was important that the questionnaire be as short as possible. Therefore, we trimmed the number of items per category in two steps (cf. Peeters, van Tuijl, Reyman, & Rutte, 2007). Firstly, multiple items were collapsed into a single item if the content was similar. Secondly, the first two authors and a subject matter expert selected the most relevant and applicable items per category by mutual agreement. This resulted in a 71-item questionnaire that was anchored with seven-point Likert scales from strongly disagree (1) to strongly agree (7).

According to Latham and Wexley (1994), factor analysis can be conducted when there are at least three to five times as many individuals to be rated as there are items - we had 4.3 times as many respondents as items. To measure the individual perceptions of virtual team behaviors, we performed an exploratory factor analysis (Principal Component Analysis, Varimax Rotation with Kaiser Normalization). An item belonged to a factor if that item (a) had a factor loading of >.40, (b) did not have a cross-factor loading of >.40, and (c) had a factor loading that differed by >.20 with the second highest loading on another factor. Items that did not meet these criteria were stepwise deleted. Because we wanted to develop an instrument with usable scales, we aimed to have at least three items per factor. Scales in which Cronbach’s alpha was less than .60 were removed. Items that lowered Cronbach’s alphas were also deleted.

Eight scales explained 64 percent of the variance in effective virtual team behaviors (see Table 4.2). The first scale contained five factor items that covered behaviors in which the leader of the global virtual team shares necessary information with the team (*information sharing*). The second five-item scale, *interaction volume*, included behaviors that concern email practices. An effective behavior, for example, is to specify why an email is being forwarded and to avoid burdening people with too many emails. The third scale was about *Interaction frequency* and contained four items dealing with the frequency of meetings. The fourth scale contained five items that cover behaviors that show active participation such as asking for clarification during a virtual meeting (*Active involvement*). The fifth scale, regarding *handling diversity*, consisted of five items focusing on cultural, language, and time-zone differences. The final three scales, concerning *extra-role behavior*, *reliable interaction*, and *including team members*, had three factor items each. *Extra-role behavior* deals with
behaviors that are required for completion of the task, but are beyond someone's formal task. **Reliable interaction** concentrates on sharing one's agenda in such a way that other team members know where and when one can be reached. **Including team members** contains behaviors that concentrate on actively involving other team members in, for example, a virtual discussion. All scales consist of items that were originally grouped in that category, with the exception of the scale **active participation**, which had one item: "We work in a proactive way" that was not originally grouped in that category. We included the item in this scale because the content fits well with the other items. Also, the items that make up **interaction frequency** were originally categorized under **interaction volume**. The factor analysis, however, showed that this category contained two distinct factors.

**EVTB measurement**

The exploratory factor analysis was conducted at the individual level so that we could fully utilize our database of 310 participants. Although the scales were constructed at the individual level they were assumed to measure the constructs at the group level. However, before we could aggregate the perceptions of the team behaviors, they first needed to be reliable at the individual level. The aggregated scores were team behaviors. All other variables that were included in this study were also measured at the group level. For this reason, the remaining part of the analysis was conducted at the group level. From the database, we selected global virtual teams of which at least three members had completed the questionnaire. This led to a total of 168 individuals from 47 global virtual teams. The global virtual teams that were selected had members in various countries, with most coming from large multinational organizations in the high-tech industry.

The responses from the 47 teams were used as input for the higher-order factor analysis to uncover the pattern of relations among the scales. The responses on items concerning one category were averaged to yield a scale to measure the category in question. Because the study was conducted at the group level, we aggregated the data before we calculated Cronbach's alpha. The scales concerning **active participation**, **handling diversity**, **extra-role behavior**, **reliable interaction**, **interaction frequency**, **information sharing**, and **interaction volume** had Cronbach's alphas of .80, .82, .83, .80, .92, .89, and .91, respectively. Because the first item measuring **Including team members** lowered the alpha to .14, we decided to delete this item. We averaged the remaining two items to yield one scale (r = .64).
Table 4.2

*Factor loadings for categories (n=310)*

<table>
<thead>
<tr>
<th>Category and items</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Information sharing</td>
<td></td>
</tr>
<tr>
<td>The team leader involves team members by sending information</td>
<td>.85</td>
</tr>
<tr>
<td>The team leader communicates to the team why decisions were made</td>
<td>.82</td>
</tr>
<tr>
<td>The team leader communicates to the team how decisions were made</td>
<td>.79</td>
</tr>
<tr>
<td>The leaders shares important information with all team members</td>
<td>.75</td>
</tr>
<tr>
<td>The team leaders sends an email with standards to everyone in the team</td>
<td>.72</td>
</tr>
<tr>
<td>Interaction volume</td>
<td></td>
</tr>
<tr>
<td>We send unnecessary &quot;reply to all&quot; emails</td>
<td>.89</td>
</tr>
<tr>
<td>Category and items</td>
<td>Factor</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>We copy team members into an email conversation when this is not necessary</td>
<td>.88</td>
</tr>
<tr>
<td>We send unnecessary impersonalized group emails</td>
<td>.85</td>
</tr>
<tr>
<td>We forward messages without specifying why</td>
<td>.82</td>
</tr>
<tr>
<td>We communicate a message compactly, completely, and clearly</td>
<td>.61</td>
</tr>
<tr>
<td>Interaction frequency</td>
<td></td>
</tr>
<tr>
<td>We have regular meetings</td>
<td>.89</td>
</tr>
<tr>
<td>We have regularly scheduled meetings</td>
<td>.84</td>
</tr>
<tr>
<td>We initiate regular meetings</td>
<td>.83</td>
</tr>
<tr>
<td>We have frequent contact with our team members</td>
<td>.57</td>
</tr>
<tr>
<td>Active involvement</td>
<td></td>
</tr>
<tr>
<td>We add something to a meeting by giving our opinions</td>
<td>.80</td>
</tr>
<tr>
<td>Category and items</td>
<td>Factor</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>We are objective in a meeting and do not automatically agree</td>
<td>.74</td>
</tr>
<tr>
<td>We ask for clarification when a problem is unclear</td>
<td>.66</td>
</tr>
<tr>
<td>We work in a pro-active way</td>
<td>.55</td>
</tr>
<tr>
<td>We ask feedback from team members</td>
<td>.54</td>
</tr>
<tr>
<td>Handling diversity</td>
<td></td>
</tr>
<tr>
<td>We take into account the lower level of English of team members if things were understood correctly</td>
<td>.77</td>
</tr>
<tr>
<td>We take into account norms and values of team members from other cultures</td>
<td>.74</td>
</tr>
<tr>
<td>We take into account that words can have different meanings in other countries/cultures</td>
<td>.72</td>
</tr>
<tr>
<td>We use plain, simple English when communicating with a virtual team member with a lower level of English</td>
<td>.69</td>
</tr>
<tr>
<td>Category and items</td>
<td>Factor/table</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td><strong>We take into account time-zone differences when having meetings</strong></td>
<td>1 2 3 4 5 6 7 8</td>
</tr>
<tr>
<td>and contact with the virtual team</td>
<td>.57</td>
</tr>
<tr>
<td><strong>Extra-role behavior</strong></td>
<td></td>
</tr>
<tr>
<td>We do things that are beyond the formal task</td>
<td>.79</td>
</tr>
<tr>
<td>We do extra things on our own initiative</td>
<td>.69</td>
</tr>
<tr>
<td>We help team members who need help</td>
<td>.63</td>
</tr>
<tr>
<td><strong>Reliable interaction</strong></td>
<td></td>
</tr>
<tr>
<td>We share our agendas and day plannings, so our team members know our whereabouts</td>
<td>.85</td>
</tr>
<tr>
<td>Our team knows the hours that the team members are available</td>
<td>.81</td>
</tr>
<tr>
<td>We respond quickly to an email</td>
<td>.49</td>
</tr>
<tr>
<td>Category and items</td>
<td>Factor</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Including team members</td>
<td></td>
</tr>
<tr>
<td>We tell team members who have dialed in that they should say something when they</td>
<td></td>
</tr>
<tr>
<td>are feeling left out</td>
<td></td>
</tr>
<tr>
<td>We say somebody's name when feeling that this person is not participating in the</td>
<td></td>
</tr>
<tr>
<td>meeting</td>
<td></td>
</tr>
<tr>
<td>We ask if a team member, who is located elsewhere and has dialed in, has something</td>
<td></td>
</tr>
<tr>
<td>to add</td>
<td></td>
</tr>
</tbody>
</table>

**Eigen value**  
7.46  3.39  2.36  2.19  1.83  1.55  1.30  1.16

**Variance explained**  
22.59  10.26  7.15  6.64  5.53  4.69  3.93  3.50

**Cumulative variance explained**  
22.59  32.85  40.00  46.64  52.18  56.87  60.79  64.29

**Cronbach's α**  
.88  .88  .86  .76  .77  .77  .67  .60

*Note.* Principal Component Analysis, Varimax Rotation with Kaiser Normalization; Factor loadings below .40 are not shown in the table.
Chapter 4

The scree plot of the higher-order exploratory factor analysis (Principal Component Analysis, Varimax Rotation with Kaiser Normalization) showed a single higher-order factor that explained 40 percent of the variance. Next, we conducted a one-factor analysis. The scales that belonged to this higher-order factor were: information sharing, including team members, active participation, extra-role behavior, reliable interaction, and interaction frequency. These scales loaded .65 or higher on the higher factor, as can be seen in Table 4.3. All categories that belonged this factor were social behaviors concerning smooth collaboration. When the scales were averaged, Cronbach's alpha reliability coefficient for EVT was .75. The scales that did not belong to EVT were interaction volume and handling diversity. These scales measured something different than EVT because they loaded .26 and .16 on EVT. EVT, interaction volume, and handling diversity will be analyzed separately.

Table 4.3

<table>
<thead>
<tr>
<th>Scale</th>
<th>Loadings on higher-order factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interaction volume</td>
<td>.26</td>
</tr>
<tr>
<td>Information sharing</td>
<td>.73</td>
</tr>
<tr>
<td>Including team members</td>
<td>.66</td>
</tr>
<tr>
<td>Active participation</td>
<td>.85</td>
</tr>
<tr>
<td>Handling diversity</td>
<td>.16</td>
</tr>
<tr>
<td>Extra-role behavior</td>
<td>.73</td>
</tr>
<tr>
<td>Reliable interaction</td>
<td>.65</td>
</tr>
<tr>
<td>Interaction frequency</td>
<td>.67</td>
</tr>
</tbody>
</table>

Note. Principal Component Analysis

Measurement team satisfaction, team performance, and team trust

In addition to the items concerning critical interaction behaviors, the questionnaire contained items measuring team satisfaction, performance, and team trust. Participants were asked to respond to the items on a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree. Team satisfaction was measured with five items (e.g. we are satisfied with
each other's contribution in my virtual team) that had been derived from Smith and Barclay (1997) and have been used in many studies to measure satisfaction (e.g. Costa, Toe, & Taillieu, 2001). The value of Cronbach's alpha was .86. Performance was measured with six items measuring perceived task performance (e.g. Compared to the standards, my virtual team has good results) as in Roe, Zinovieva, Dienes, and Ten Horn (2000). In previous research, perceived task performance had been found to correlate with more objective measures of performance (Smith, & Barclay, 1997). Responses to the six items were averaged to yield one scale (Cronbach's alpha = .92). Team trust was measured with the four-item scale of Schoorman (1996). This scale has often been used as an operationalization of team trust (e.g. Jarvenpaa, & Leidner, 1999). After the second item was deleted because it lowered the reliability, three items were averaged together to measure trust (Cronbach's alpha = .78). All items were aggregated to the group level. ICC1 and ICC2 values for each scale were calculated to determine whether aggregation was appropriate (cf. Snijders, & Bosker, 1999). As can be seen in Table 4.4, ICC1 values for satisfaction, performance, trust, EVTB, interaction volume, and handling diversity indicate substantial and significant group-level variance and ICC2 values suggest acceptable reliability of team means (Snijders, & Bosker, 1999).

Table 4.4

<table>
<thead>
<tr>
<th>Variable</th>
<th>ICC1</th>
<th>ICC2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>.29**</td>
<td>.58</td>
</tr>
<tr>
<td>Performance</td>
<td>.39**</td>
<td>.69</td>
</tr>
<tr>
<td>Trust</td>
<td>.33**</td>
<td>.63</td>
</tr>
<tr>
<td>EVTB</td>
<td>.24**</td>
<td>.35</td>
</tr>
<tr>
<td>Interaction volume</td>
<td>.31**</td>
<td>.62</td>
</tr>
<tr>
<td>Handling diversity</td>
<td>.20**</td>
<td>.47</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01

4.4 Results

The exploratory factor analysis yielded an instrument with eight scales to measure virtual team behaviors. The higher-order factor analysis showed that six of the eight scales were related to one another. These six scales dealt with social behaviors that are important for
smooth collaboration in a virtual team (EVTB), e.g. what should be shared and who should be involved. The scales *interaction volume* and *handling diversity* were not part of the EVT construct.

**Descriptive statistics and correlations**

Descriptive statistics, correlations, and reliability coefficients for all measures are presented in Table 4.5. As can be seen in the table, there was a significant positive correlation between EVT and satisfaction \((r = .63, p < .01)\) and performance \((r = .62, p < .01)\). The measure of *handling diversity* did not fall into EVT and did not correlate with satisfaction \((r = .07, \text{n.s.})\) or performance \((r = .09, \text{n.s.})\). *Interaction volume*, that did not fall into EVT as well, correlated positively with satisfaction \((r = .37, p < .05)\) and performance \((r = .30, p < .05)\). The table also shows a significant positive relation between team trust and performance \((r = .85, p < .01)\). A significant positive correlation was also found between team trust and satisfaction \((r = .63, p < .01)\). This means that in virtual teams, high team trust is associated with high performance and satisfaction. Moreover, we also found a positive correlation between EVT and trust \((r = .6, p < .01)\). *Interaction volume* and *handling diversity* were unrelated to trust.

**Performance and satisfaction**

To access the mediating effect of trust, we used the regression procedure described by Baron and Kenny (1986). These authors stated that three conditions need to be fulfilled to conclude that a mediator effect is present: (1) a significant relation between the independent variable and the mediator, (2) a significant relation between the independent variable and the dependent variable, and (3) a significant relation between the mediator and the dependent variable while the independent variable is kept constant. In the third condition the effect of the independent variable on the dependent variable would be less than in the second condition. *Handling diversity* and *interaction volume* turned out to be unrelated to trust. Moreover, *handling diversity* was also not related to team performance and team satisfaction. For this reason, these scales were not included in further analyses regarding the mediating effects of trust.
Table 4.5

**Descriptives, Correlations, and Reliability Coefficients (N = 47).**

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Satisfaction</td>
<td>4.80</td>
<td>.61</td>
<td>(.86)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Performance</td>
<td>4.78</td>
<td>.73</td>
<td>.85**</td>
<td>(.92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Trust</td>
<td>5.39</td>
<td>.76</td>
<td>.63**</td>
<td>.57**</td>
<td>(.78)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Effective VT Behaviors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. EVTB</td>
<td>3.74</td>
<td>.29</td>
<td>.63**</td>
<td>.62**</td>
<td>.60**</td>
<td>(.75)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Interaction volume</td>
<td>5.24</td>
<td>.56</td>
<td>.37*</td>
<td>.30*</td>
<td>.24</td>
<td>.18</td>
<td>(.91)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Information sharing</td>
<td>3.76</td>
<td>.36</td>
<td>.45**</td>
<td>.39**</td>
<td>.59**</td>
<td>.65**</td>
<td>.17</td>
<td>(.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Including team members</td>
<td>3.88</td>
<td>.54</td>
<td>.37*</td>
<td>.29*</td>
<td>.38*</td>
<td>.58**</td>
<td>.16</td>
<td>.47**</td>
<td>(.64)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Active participation</td>
<td>3.90</td>
<td>.30</td>
<td>.52**</td>
<td>.50**</td>
<td>.60**</td>
<td>.76**</td>
<td>.27†</td>
<td>.60**</td>
<td>.52**</td>
<td>(.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Handling diversity</td>
<td>3.68</td>
<td>.39</td>
<td>.07</td>
<td>.09</td>
<td>-.02</td>
<td>.11</td>
<td>.08</td>
<td>.08</td>
<td>.16</td>
<td>.04</td>
<td>(.82)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Extra-role behavior</td>
<td>3.91</td>
<td>.36</td>
<td>.47**</td>
<td>.52**</td>
<td>.51**</td>
<td>.73**</td>
<td>.02</td>
<td>.46**</td>
<td>.26†</td>
<td>.55**</td>
<td>.05</td>
<td>(.83)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Reliable interaction</td>
<td>3.50</td>
<td>.64</td>
<td>.46**</td>
<td>.39**</td>
<td>.37**</td>
<td>.76**</td>
<td>.12</td>
<td>.27†</td>
<td>.30*</td>
<td>.35**</td>
<td>.12</td>
<td>.49**</td>
<td>(.80)</td>
<td></td>
</tr>
<tr>
<td>12. Interaction frequency</td>
<td>3.88</td>
<td>.49</td>
<td>.47**</td>
<td>.55**</td>
<td>.26†</td>
<td>.73**</td>
<td>.08</td>
<td>.27†</td>
<td>.32*</td>
<td>.51**</td>
<td>.01</td>
<td>.42**</td>
<td>.43**</td>
<td>(.92)</td>
</tr>
</tbody>
</table>

Note: Table X displays team-level descriptives and correlations; Cronbach's alphas are on the diagonal between parentheses.

† p < .10; *p < .05; **p < .01
To test whether EVTB (independent variable) predicted a significant portion of the variance in team trust (mediator), we performed a regression analysis. As can be seen in Table 4.6, EVTB ($\beta = .59; p < .001$) explained a significant portion of the variance in team trust after we controlled for team size ($R^2 = .37; p < .001$). These findings support hypothesis 3. This implies that the first condition of Baron and Kenny (1986) was fulfilled. Next, a hierarchical regression analysis was performed to test the second and third conditions of Baron and Kenny regarding performance. As can be seen in Table 4.7, the results show that EVTB ($\beta = .61; p < .001$) predicted a significant portion of the variance in performance ($R^2 = .38; p < .001$). This is in accordance with hypothesis 1a. Next, we added team trust, which increased the explained variance in performance by six percent ($R^2 = .44; p < .001$). EVTB ($\beta = .43; p < .01$) and team trust ($\beta = .31; p < .05$) were significant predictors of performance after we controlled for group size. In hypothesis 2a, we proposed that trust is related to performance in global virtual teams. The data support this hypothesis. These results showed that the second and third condition of Baron and Kenny (1986) have been met, indicating that the relation between EVTB and performance was partially mediated by trust. This also indicated that, in addition to the direct effect of EVTB on performance, there is an indirect effect through trust, and according to the Sobel test (Sobel, 1982) this indirect effect was significant ($z = 1.91, p < .05$). This means that hypothesis 4a has also been supported.

With regard to satisfaction, we conducted a hierarchical regression analysis that can be found in Table 4.7. The results show that EVTB ($\beta = .63; p < .001$) predicted a significant portion of the variance in satisfaction ($R^2 = .40; p < .001$), after we controlled for team size. This finding was in accordance with hypothesis 1b. Next, we added team trust to the regression, which increased the explained variance in satisfaction by ten percent ($R^2 = .50; p < .001$). EVTB ($\beta = .40; p < .01$) and team trust ($\beta = .40; p < .01$) were significant predictors of satisfaction. Trust was indeed a significant predictor of satisfaction, as was suggested in hypothesis 2b. Having fulfilled the second and third conditions of Baron and Kenny (1986), these findings indicated that the relation between EVTB and satisfaction was partially mediated by trust. In other words, there were direct effects between EVTB and interaction volume and satisfaction, and an indirect effect though trust. The indirect effect of the EVTB on satisfaction through trust was significant according to the Sobel test ($z = 2.69, p < .01$). This means that hypothesis 4b has also been supported.
Table 4.6
Regression predicting trust

<table>
<thead>
<tr>
<th>Variable</th>
<th>Trust</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
</tr>
<tr>
<td>Step 1</td>
<td>.02</td>
</tr>
<tr>
<td>Team size</td>
<td>.15</td>
</tr>
<tr>
<td>Step 2</td>
<td>.37***</td>
</tr>
<tr>
<td>Team size</td>
<td>.11</td>
</tr>
<tr>
<td>EVT B</td>
<td>.59***</td>
</tr>
</tbody>
</table>

***p < .001

Table 4.7
Regression analysis predicting satisfaction and performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Performance</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$R^2$</td>
</tr>
<tr>
<td>Step 1</td>
<td>.01</td>
<td>.01</td>
</tr>
<tr>
<td>Team size</td>
<td>.07</td>
<td>.02</td>
</tr>
<tr>
<td>Step 2</td>
<td>.38***</td>
<td>.38*</td>
</tr>
<tr>
<td>Team size</td>
<td>.04</td>
<td>-.01</td>
</tr>
<tr>
<td>EVT B</td>
<td>.62***</td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td>.44***</td>
<td>.06†</td>
</tr>
<tr>
<td>Team size</td>
<td>.00</td>
<td>-.05</td>
</tr>
<tr>
<td>EVT B</td>
<td>.43**</td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>.31*</td>
<td></td>
</tr>
</tbody>
</table>

†p < .10; *p < .05; **p < .01; ***p < .001

Survey studies in which the same rater responds to all items in a single questionnaire at the same point in time are susceptible to common method variance (Kemery, & Dunlap 1986, Lindell, & Whitney 2001). To make sure our findings were not biased, we conducted the regression analysis again with split samples (Lance, Noble, & Scullen, 2002), in which one member per virtual team responded to the independent variable (EVT B), one responded to the mediating variable (trust), and one team member responded to the dependent variables (satisfaction and performance). The results of this regression analysis are presented in Tables
4.8 and 4.9. The indirect effect of the EVTB on performance through trust was significant according to the Sobel test ($z = 1.93, p < .05$). The indirect effect of the EVTB on satisfaction through trust was also significant ($z = 2.10; p < .05$). The findings of the regression in which we used the split samples support the original findings in which we used the aggregated means of the variables per virtual team, indicating that our findings were not biased.

Table 4.8

<table>
<thead>
<tr>
<th>Variable</th>
<th>Trust</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td>.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team size</td>
<td></td>
<td>.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td>.18*</td>
<td>.18*</td>
<td></td>
</tr>
<tr>
<td>Team size</td>
<td></td>
<td>.11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVTB</td>
<td></td>
<td>.40**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001

Table 4.9

<table>
<thead>
<tr>
<th>Variable</th>
<th>Performance</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
<th>Satisfaction</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td>-.02</td>
<td></td>
<td></td>
<td>-.02</td>
<td></td>
<td></td>
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<tr>
<td>Team size</td>
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<td>.07</td>
<td>.02</td>
<td></td>
<td>.02</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
<td>.11†</td>
<td>.11†</td>
<td></td>
<td>.31***</td>
<td>.31***</td>
<td></td>
<td></td>
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<tr>
<td>Team size</td>
<td></td>
<td>.05</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVTB</td>
<td></td>
<td>.32*</td>
<td></td>
<td>.56***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td>.18*</td>
<td>.07†</td>
<td></td>
<td>.43***</td>
<td>.12†</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team size</td>
<td></td>
<td>.03</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVTB</td>
<td></td>
<td>.17</td>
<td></td>
<td>.43**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td></td>
<td>.38*</td>
<td></td>
<td>.37**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

† p < .10; *p < .05; **p < .01; ***p < .001
4.5 Discussion

The contribution of this study to the current knowledge on global virtual teams is twofold. First of all, we have provided an instrument to measure behaviors that are important in global virtual teams. Secondly, using this instrument, we have shown the relation between these behaviors and virtual team effectiveness and the mediating role of team trust.

To our knowledge, we have provided the first instrument to measure behaviors that are critical for the effectiveness in virtual teams. This instrument can be used to develop a richer and more profound understanding of critical behaviors in virtual teams and their relation to processes and outcomes. We do not compare face-to-face teams with virtual teams, but rather provide a deeper understanding of what behaviors are critical in global virtual teams. The results of the current study offer a better understanding of dynamics in virtual teams. Previously, Dekker et al. (Dekker, & Rutte, 2008; Dekker, Rutte, & Van den Berg, 2008) suggested that EVTB were critical for enhancing satisfaction and productivity in virtual teams. We have now offered empirical evidence that EVTB are important for enhancing satisfaction and increasing the productivity of virtual teams. Moreover, we have shown that team trust partially mediates this relation. This finding adds to the understanding of interaction behaviors and trust in virtual teams.

Interaction volume has a direct relation with team performance and satisfaction. This relation is not mediated through team trust, because interaction volume is unrelated to team trust. The category deals with effective behaviors that are related to effective communication via emails, e.g. avoiding unnecessary emails. Byron (2008) also stated that email can have negative effects on the working relationship. Sarbaugh-Thompson and Feldman (1998) found that an increase in emails between team members resulted in a decrease in other forms of interaction. Team members felt less connected to their virtual team as the number of emails increased. We have also found that, for example, forwarding unnecessary emails or unnecessarily adding team members to an email conversation is negatively related to the effectiveness of the virtual team. We have found that trust does not mediate this relation. It may be that when virtual team members send each other too many emails, which results in a full email inbox, team members start to delete unimportant messages and may accidentally delete important emails. When these messages are missed, outcomes may be negatively affected.

It turned out that handling diversity is neither related to satisfaction, performance, nor trust. This is interesting because in a previous study global virtual team workers listed these behaviors as being critical for effective virtual team functioning (Dekker, & Rutte, 2008;
Dekker et al., 2008). An explanation may be that, contrary to the other scales, handling diversity deals more with ethically correct behaviors. These are behaviors of how virtual team members should behave in order to be ethically correct, but they are not directly related to the outcomes. In their previous study, Dekker et al. (2008) also argued that behaviors regarding handling diversity were probably found because people felt that they had to mention these behaviors in order to be politically correct. Also, in the previous study it turned out that these behaviors were most often mentioned by American virtual team workers. In this sample, we have less Americans than in the sample of the Dekker et al. (2008) study.

Theoretical contribution
The effective virtual team behaviors are directly related to performance in the virtual teams and to the satisfaction of its team members. In accordance with the TIP theory of McGrath (1991), the behaviors are instrumental in facilitating team performance. The theory suggests that production, member support, and group well-being are especially important in teams that face technical uncertainty, such as virtual teams.

Previous researchers have demonstrated the importance of high trust in virtual teams (e.g. Saunders, 2000). The high correlations between trust and the outcome variables in this study support the fact that trust plays a substantial role in virtual teams. We adopted Martins et al.’s (2004) suggestion that researchers should focus on mediating effects in virtual teams. Such extensions give a deeper understanding of the underlying dynamics in virtual teams. We have found that team trust is an important mediator between critical behaviors and effectiveness in global virtual teams. The current study shows that trust and critical behaviors are important for the effectiveness of global virtual teams.

Swift trust theory reasons that trust is adopted and that members do not influence it. This means that behaviors regarding member support and group well-being are unnecessary because trust cannot be changed (Meyerson et al., 1996). The TIP Theory, on the other hand, states that it is important that teams take care of these functions in order to perform well. We found that behaviors dealing with well being and member support (e.g. including team members, extra role behavior, reliable interaction) are important in global virtual teams and are related to effectiveness and trust. This means that behaviors in global virtual teams are not only important for the effectiveness of the team, but also for trust. Trust, in turn, is positively related to effectiveness.

This study contributes to the current virtual team literature in that it answers the question of Jarvenpaa and Leidner (1999) concerning the behaviors that are related to trust.
EVTB explain a great deal of variance in team trust in global virtual teams. Team trust is important when members are vulnerable and depend on the actions of others. Certainty stimulates team members to take risks regarding vulnerability by, for example, sharing information and being involved, which is positive for the effectiveness of a virtual team. Social Exchange theory (Gouldner, 1960) can help to explain how certainty can grow in global virtual teams. This is particularly because of the central notion of reciprocity. Showing critical behaviors may result in more trust.

In their previous study, Dekker and Rutte (2008) described critical behaviors in virtual teams that are different from, and not necessarily relevant to, face-to-face teams. For example, *interaction volume* deals with writing too many emails. This behavior is not found in traditional frameworks regarding behaviors in face-to-face teams. Other behaviors, responding to an email, actively involving members in virtual meetings, are also unique for virtual teams. In this study we show that these unique behaviors are critical not only for effectiveness, but also for trust, in global virtual teams.

**Practical implication**

Because organizations increasingly rely on global teams, it is important that the members of these teams are satisfied and productive. This study provides insight into what behaviors enhance team trust, the satisfaction of virtual team members, and the productivity of virtual teams. Satisfaction is important because it influences whether people want to stay in a team or organization and because it affects absenteeism (Martins et al. 2004). Following previous research (e.g. Saunders, 2000), this study provides further evidence for the important role of trust in the effectiveness of virtual teams. Organizations should increase trust in their virtual teams, but *how* to do so is usually not clear.

A practical implication of this study is that training can improve behaviors of team members. In line with the developmental view of trust, this study provides explicit behaviors that are linked to trust, satisfaction, and effectiveness in virtual teams. The instrument, developed in this study, may be used to rate individuals or teams on whether they show critical virtual team behaviors – especially when the team is not functioning appropriately. It would be interesting to study organizational interventions that change the behavior of team members.
Strengths, weaknesses, and suggestion for future research

A major strength of the current study is the use of real long-term global virtual teams. Most research regarding virtual teams has been conducted using student teams doing a short term task (e.g. Polzer, Crisp, Jarvenpaa, & Kim, 2006; Wilson, Straus, & McEvily, 2006). However, it is unlikely that student teams performing a task reflect the international world in which real global virtual teams operate. It is questionable whether conclusions regarding behaviors, processes, and outcomes from such studies can be generalized to real virtual teams. For example, team trust in short-term student teams most likely does not reflect team trust in real global virtual teams that has been developed over time.

Another strength of this study is that we used quantitative data to study the effect of behaviors and trust in global virtual teams. Many studies that do research concerning virtual teams in real organizations are qualitative (e.g. Jarvenpaa, & Leidner, 1999). Of course, qualitative studies offer insight into processes and behaviors, especially where theory and insight is lacking. However, quantitative studies permit stronger conclusions with regard to relations between variables. Moreover, we had multiple respondents in our global virtual teams – the advantage being that we could aggregate data to the group level instead of basing a group score on the responses of a single individual. Finally, we controlled for common method variance, which means that our findings are not biased.

A weakness of the current study is that the data were collected at one point in time. Therefore, it is difficult to draw causal conclusions. In this study, we have used theoretical assumptions that suggest a relation between trust and behaviors, and how they lead to satisfaction and performance. However, we do not know which comes first: the behaviors or trust. Future research should study this matter longitudinally so that conclusions about cause and effect can be drawn - and it would even be better if the start up phase is included. Because we studied virtual teams that already existed, we have no insight into how trust came to exist in these teams. It could be that trust was adopted, as suggested by the "swift" trust theory (Meyerson et al., 1996), and was changed through critical behaviors. However, "swift" trust theory does not specify what do to when trust is absent because it only focuses on task-related behaviors.

A final suggestion for future research is related to cultural differences in global virtual teams. Because global virtual teams have members located in various countries, these teams deal with cultural differences. In a previous study, Dekker et al. (2008) found that a team member's culture influences what behaviors are considered to be effective in global virtual teams. These findings may also have implications for the link between behaviors and trust.
Conclusion
This study provides an instrument to measure effective virtual team behaviors. Moreover, we provide promising insights into the effect of behaviors and processes on outcomes in global virtual teams. We have shown empirically that effective virtual team behaviors, reported by Dekker and Rutte (2008; Dekker et al., 2008), are positively related to satisfaction and performance. This relation is partially mediated by team trust. In conclusion, the instrument and the empirical findings of this study are promising foundations for future research regarding global virtual teams.
This chapter focuses on the positive consequences of isolation in global virtual teams. The Isolation index is the percentage of team members with no other team members at their site (O'Leary, & Cummings, 2007). Using SIDE theory (Turner, Sachdev, & Hogg, 1983), we theorized that isolation is positively related to performance and satisfaction, due to higher social presence among and towards isolated team members. Forty-seven professional global virtual teams (n=168) completed an online questionnaire. Results show that the positive relation between isolation and outcomes was indeed mediated by social presence. Moreover, we found that teams that were 100 percent isolated had the most positive outcomes and that this was mediated by social presence.

Media technologies, such as chat, email, and videoconferencing, have enabled organizations to "go virtual." This means that organizations can combine skills, knowledge, and expertise in global virtual teams. Members of global virtual teams work in different countries on common goals through the various media technologies (Hardin, Fuller, & Davison, 2008). This study focuses on the positive consequences of isolated team members in global virtual teams. Isolated team members are members with no other team members at their site and the isolation index is the percentage of members that are isolated (O'Leary, & Cummings, 2007). Previous experimental studies (e.g. O'Leary, & Mortensen, in press; Polzer, Crisp, Jarvenpaa, & Kim, 2006) have shown that isolation is positively related to team outcomes. The exact results and underlying processes, however, are not clearly understood. The present study, using social categorization literature, considers the mediating role of social presence to...
understand this process. Social presence, or "the feeling that the other team members are really present" (Short, Williams, & Christie, 1976) and feeling psychologically involved, is required for interactions in virtual teams, and we will argue that social presence – counter intuitively - is positively related to isolation. Our research question can be formulated as follows: Is the relation between isolation and team outcomes mediated by social presence?

5.1 Social Presence in Global Virtual Teams

In traditional face-to-face meetings, team members experience the physical presence of the other team members. During these face-to-face interactions team members can see each other, look each other in the eyes, see whether others are involved, and see whether others are listening when one is talking. Instead of physical presence, virtual team members may experience social presence of distant team members. Social presence is the feeling that geographically distributed team members are perceived as physically present during virtual interactions (Short, Williams, & Christie, 1976). In other words, one experiences a high social presence if the other team members are perceived as real individuals with whom one feels psychologically connected.

In traditional theories, social presence was seen as an aspect of interaction media, defined as how a medium could increase the salience of other people in the interaction (Short et al., 1967; Biocca, Harms, & Burgoon, 2001). These studies were usually based on Media Richness Theory (Daft, & Lengel, 1986) which defines media on their richness. An example of a rich medium is videoconference, whereas chat is an example of a lean medium. Recently, social presence has been interpreted as a psychological variable defined as the subjective experience of closeness and connectness with mediated others (Bente, Rüggenberg, Krämer, & Eschenburg, 2008). When social presence is high, members of a virtual team are psychologically involved with the entire team, including those who are geographically distant. Previous research has consistently demonstrated that the level of social presence positively affects outcomes and satisfaction (e.g. Moore, Masterson, Christophel, & Shea, 1996; Johnson, Hornik, & Salas, 2008; Klauwer, Herfordt, & Voss, 2008). Lowry, Roberts, Romano, and Cheney (2006) found that social presence improves the communication among group members in virtual teams. This can be explained by the fact that members are involved and behave in a pro-social way when social presence is high. Because social presence is required for interactions among virtual team members (Tu, 2000), we propose that social presence is positively related to team satisfaction and team performance.
Hypothesis 1: Social presence in global virtual teams is positively related to (a) team performance and (b) team satisfaction.

5.2 Dispersion in global virtual teams

Global virtual teams can be dispersed in various ways. For example, a team can be very small with two small subgroups located in two countries, whereas a team can also be very large with many locations. O’Leary and Cummings (2007) distinguished three dimensions of dispersion: (1) the spatio-temporal dimension, (2) the socio-demographic dimension, and (3) the geographic configuration dimension. Researchers have started to gain insight into the effects of these dimensions of dispersion. Previously it has been found that if the spatial distance (e.g. kilometers, miles) between team members increased, they communicated less frequently and effectively (e.g. Allen, 1977; Van den Bulte, & Moenaert, 1998). The role of socio-demographic differences such as organizational, cultural, and national differences have been related to greater creativity and decision quality, but also to tension and conflict (e.g. Gibson, & Gibbs, 2006; Hardin et al., 2007; Jehn, 1994). In this study we focus on isolation, which is part of the geographic configuration dimension.

Although several researchers have advocated the importance of geographic configuration, few have actually studied it. Geographic configuration is defined as "the number of geographically dispersed sites and the relative number of team members at those sites, independent of the spatial, temporal, and socio-demographic distances between them" (O’Leary, & Mortensen, in press). Sites can be buildings, offices, or cities where one or more team members are located. For example, a team with 8 members can be dispersed in 21 different configurations (O’Leary, & Cummings, 2007). The dispersions can take many forms. For example, it is possible that more than one virtual team member is located in each geographical location. This means, in fact, that we are dealing with geographically collocated subgroups that are working together within a virtual team. On the other hand, it is also possible that team members are collocated with other team members at some sites, whereas there are also isolated team members at other sites. Finally, it is possible that no one is collocated with other team members, and everybody is isolated at his or her site. This means that in global virtual teams, members can either be collocated at one site in subgroups with some other team members, or isolated with no other team members at their site. Geographically defined subgroups have been related to negative outcomes, whereas isolated team members have been related to positive outcomes (O’Leary, & Mortensen, in press; Polzer et al., 2006). Using social categorization theories (e.g. Turner, Sachdev, & Hogg,
1983), we would like to provide an explanation of why the existence of subgroups versus isolated team members can lead to different dynamics in global virtual teams.

**Subgroups in global virtual teams**

Previous findings have shown that geographic subgroups in virtual teams are related to negative outcomes: impeded communication (Cramton, 2001; DeSanctis, & Mong, 1999), reduced trust (Jarvenpaa, & Leidner, 1999), increased conflict (Mortensen, & Hinds, 2001), and coordination problems (Rutkowski, Saunders, Vogel, & Van Genuchten, 2007). Moreover, an imbalance among subgroup sizes negatively affects team dynamics and has been related to conflict (Armstrong, & Cole, 2002; O'leary, & Mortenson, in press). The negative effects of geographically defined subgroups may occur because of an in-group versus out-group effect.

The social identity theory (Tajfel, & Turner, 1979) concerns how people use social categorization as cognitive tools to understand self and others in social situations. According to the Social Identification/Deindividuation Theory (SIDE), people categorize themselves as either part of the in-group or out-group based on the characteristics of others in the group. Similarity positively reinforces members' own identity and adds to their willingness to cooperate (Turner, Sachdev, & Hogg, 1983). A consequence of in-group salience is in-group favoritism. This means that one views one's own group as the center of everything and looks with contempt at outsiders (Summer, 1906 in Cramton, & Hinds, 2005). In-group favoritism and absence of individuating cues about members of the out-group (as is the case in virtual teams) stimulates members to build stereotypical impressions of others based on limited information (Turner et al., 1983; Lea, & Spears, 1992; Lea, O'Shea, Fung, & Spears, 1992). Moreover, favoritism with regard to the in-group results in withholding information, less cooperation, conflict, and hostile responses towards the out-group (LeVine, & Campbell, 1972; Cohen, & Bailey, 1997). Subgroup dynamics are characterized by an us-versus-them attitude (e.g. Armstrong, & Cole, 1995; Hinds, & Bailey, 2003). On the other hand, one is strongly emotionally attached and one is tempted to show pro-social team behaviors towards in-group members (LeVine, & Campbell, 1997; Hogg, & Terry, 2000). Social categorization theories provide insight as to why subgroups in a team may impair team functioning.

Cramton and Hinds (2005) proposed that members of global virtual teams may use differences in geographic location as a basis for categorization. Poltzer, Crisp, Jarvenpaa, and Kim (2006) found empirical support that collocated subgroups that were homogeneous in nationality, as is usually the case for geographically based subgroups in virtual teams,
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Impaired team functioning. This means that individuals are likely to attribute in-group status to those members at the same locations and out-group status to those at distant locations. In this paper we link social categorization theories to insight on social presence. Besides the influence of interaction media on social presence, we propose that the dispersion of a global virtual team may also influence how much social presence is experienced among global virtual team members. When subgroups from geographically different locations are seen as out-group members, as was supported by Polzer et al. (2006), we argue that the social presence may be lower because in-group members are less psychologically involved with out-group members. Involvement is an important aspect of social presence (Bente et al., 2008). In-group favoritism also makes clear that geographically distant subgroups are not fully included into the in-group discussions, that information is withheld, and that there is less cooperation (Cohen, & Bailey, 1997) as compared to members of the alleged superior in-group. On the other hand, if these distant team members are not viewed as members of the out-group, then social presence should be higher because members feel more connected with the team.

Isolation in global virtual teams

Isolation is an important aspect of geographical configuration. To our knowledge, this is the first study to link the effects of geographical configuration, in particular isolation, to social presence. Isolated team members are members with no other team members at their site. The isolation index is the percentage of team members with no other team members at their site (O'Leary, & Cummings, 2007). A team that has four members, of which one is isolated, has an isolation index of 25 percent. A team with no isolated team members has an isolation index of zero percent, whereas a team that consists entirely of isolates scores 100 percent on the isolation index. Isolation is an interesting topic because in practice isolated team members in virtual teams are common. Moreover, more and more employees are working from home, which also makes them geographically isolated. To our knowledge, only two studies have addressed the role of isolation. Both studies were experimental and were conducted with students. First, Polzer and colleagues (2006) conducted an experiment in which a 6-person group was split into six, three, or two locations. They created balanced subgroups with an equal number of virtual team members in each location. In the virtual teams that were split up into six locations, all members were isolated. The results showed that the fully dispersed virtual teams were associated with the most positive consequences, as compared to the other configurations, because the team members experienced the least conflict and the most trust.
Second, O'Leary and Mortensen (in press) conducted an experiment in which four different configurations with six individuals across two sites were compared. In the first configuration, all individuals were collocated (6-0). In the second and third configurations, the individuals were distributed into two subgroups (3-3 and 4-2, respectively). The final configuration had one isolated team member (5-1). Interestingly, O'Leary and Mortensen's (in press) concluded that teams which contained one geographically isolated member (5-1) were associated with the most positive outcomes, even more positive than outcomes of the collocated team.

Thus, the negative effects that are associated with subgroups in global virtual teams were not found in the configurations that included isolated team members, as was the case in O'Leary and Mortensen's (in press) and Polzer et al.'s (2006) experiment. We propose two reasons why we believe that an isolated team member is qualitatively different from a subgroup and how this may affect effectiveness and social presence. Firstly, geographically isolated team members are not a geographical subgroup because at least two individuals at one site are required to form a group. Because isolates are not a group, they are not perceived as a threat by subgroups. Isolates may not trigger critical categorization processes and may avoid the negative dynamics experienced by subgroup conditions, which is positively related to team performance and team satisfaction. Following O'Leary and Mortensen (in press) we believe that isolate status reduces the likelihood that they will be categorized (both by themselves and their team members) with respect to their location. Following this reasoning, isolates may not be viewed as an out-group-member, and may even be seen as a distant member of the in-group. This suggests that virtual team members are psychologically involved with geographically isolated team members, and that social presence should increase.

Secondly, because isolated team members are not a member of a geographical subgroup, they have no geographically based in-group at their site. For interaction with the team, the focus of isolated team members must be directed towards team members that are geographically distant. Thus, unlike geographical subgroups, in which the focus is directed towards the geographical in-group, isolates are focused towards and experience connectness and closeness with distant others because they have no geographically based in-group. Consequently, because isolated team members are fully psychologically involved and directed towards geographically dispersed others, social presence should be higher. These two reasons help to explain why we think that isolation in global virtual teams is positively related to team performance and team satisfaction. Moreover, we expect that the relation
between isolation and effectiveness is mediated by social presence. We think that social presence is higher in teams with more isolates. This stimulates them to perform better and members are more satisfied with the team. Therefore we formulate the following hypotheses:

Hypothesis 2: Isolation is positively related to (a) social presence, (b) team performance, and (c) team satisfaction in global virtual teams.

Hypothesis 3a: The relation between isolation and team performance is mediated through social presence in global virtual teams.

Hypothesis 3b: The relation between isolation and team satisfaction is mediated through social presence in global virtual teams.

Taken together, the hypotheses lead to the following research model (figure 5.1):

Figure 5.1
Research model

Number of isolated team members
In the previously described experimental study, Polzer et al. (2006) equally distributed six students across two, three or six sites. The virtual teams that were fully dispersed into only isolates experienced the least conflict and the most trust. O'Leary and Mortensen (in press), however, found that teams with only one isolated team member performed better than teams with multiple isolates. They reason that multiple isolates may bond together into cross-site subgroups, thus diluting the advantage of isolated virtual team members. Polzer et al. (2006), however, argued that teams that consist entirely of isolates have the weakest basis for
Chapter 5

subgroup formation because they are maximally geographically diverse. An empirical study that compares virtual teams with no isolates, one isolate, several isolates, and exclusively isolates is lacking in the literature. Therefore there is no empirical evidence that supports the findings of Polzer et al. (2006) in which a team that consisted entirely of isolates was superior, or of O'Leary and Mortensen (in press) in which a team with one isolate was superior.

We propose that the negative effects of subgroup categorizations are overcome in teams with only geographically based isolates. Geographically isolated team members, most likely, focus on geographically distant others because they have no geographically defined in-group. In these teams there are no negative effects of in-group versus out-group dynamics. If all members of the team are isolated, all members identify themselves as a member of the total global virtual team. This means that all members are psychologically involved with all other geographically distant members, which is defined by a higher social presence. This psychological involvement and connectedness may then influence these teams to be superior to other configurations with regard to team performance and team satisfaction. If there are two or more collocated subgroups within the virtual team, these subgroups negatively impair team functioning due to in-group versus out-group dynamics. This reasoning leads to the following hypotheses:

Hypothesis 4: Compared to other configurations, teams that consist entirely of geographically isolated team members (a) experience the highest social presence, and are superior with regard to (b) team performance, and (c) team satisfaction.

Hypothesis 5a: With regard to performance, the superiority of teams that consist entirely of geographically isolated team members is mediated through social presence in global virtual teams.

Hypothesis 5b: With regard to satisfaction, the superiority of teams that consist entirely of geographically isolated team members is mediated through social presence in global virtual teams.
5.3 Method

Participants

A total of 168 professional virtual team workers from 47 global virtual teams participated in this study. The global virtual teams and team members were selected using snowball sampling, in which existing respondents were used to recruit more respondents. At least three members per team completed an online questionnaire. Participants were invited to participate in the study via email. The email provided a URL link to the online questionnaire. It took about 20 minutes to complete the survey. Thirty participants were female and 138 were male. The average age was 33.3 years old (s.d. = 6.8). The average experience with working in a global virtual team was 6.0 years (s.d. = 5.2). The average number of years spent in the current virtual teams was 2.1 years (s.d. = 1.2).

The virtual teams had an average of 12.5 members (s.d. = 8.2) and all had members in various countries. A total of 32 countries were represented in the sample. Seventy-one members worked in the Netherlands, 38 in the U.S., 18 in Great Britain, 11 in Belgium, and 11 in India. Additional countries included Rwanda, Brazil, and China. Most teams were from large multinational organizations in the high-tech industry. On average the teams used videoconferencing once per year, however, 60 percent never used videoconferencing. Email was used daily and teleconference was used weekly on average.

The data of this study are part of a broader database. In the current study we focused on isolation and social presence and their relations with performance and satisfaction. This has not been reported elsewhere.

Measurements

Participants were asked to respond to the items on a 7-point Likert scale ranging from (1) strongly disagree to (7) strongly agree to measure social presence, team performance, and team satisfaction. To measure social presence we selected four items (e.g. When I have a virtual meeting with my virtual team, it feels as if we are in the same room; and During virtual conversations, I picture my team member sitting in front of me) of Kreijns, Kirschke, Joshes, and van Buuren (2004). These items were applicable to the situation in which professional virtual team workers work. We averaged the responses to yield a scale that measures social presence. Cronbach’s alpha for social presence was .79 after aggregation of the item scores.
Six items measured perceived task performance (e.g. Compared to the standards, my virtual team has good results) as in Roe, Zinovieva, and Ten Horn (2000). Responses were averaged to yield one scale (Cronbach's alpha = .92).

Team satisfaction was measured by means of a five item scale (e.g. we are satisfied with each other's contribution in my virtual team) as in Smith and Barclay (1997), which has been used in many studies to measure satisfaction (e.g. Costa, Toe, & Taillieu, 2001). The value of Cronbach's alpha was .86 after aggregation of the data.

To determine whether we could aggregate social presence, performance, and satisfaction to the team level, we calculated intraclass correlations. We found ICC1 values of .26 (p < .001), .39 (p < .001), and .29 (p < .001) respectively, which suggest substantial and significant group-level variance. The ICC2 values of .58, .69, and .58, respectively, indicated acceptable reliability of means (Snijders, & Bosker, 1999).

Following O'Leary and Cummings (2007) we operationalized isolation as the percentage of team members with no other team members at their site. Nine teams had no isolated team members. Eleven teams consisted entirely of geographically isolated team members.

Analysis
Hypotheses one to three were tested by means of a regression analysis. To conclude whether a mediating effect of social presence is present, three conditions need to be fulfilled (see Baron, & Kenny, 1986): (1) the independent variable has to significantly affect the mediating variable, (2) the effect of the independent variable on the dependent variable needs to be significant, and (3) the mediating variable has to significantly affect the dependent variable while holding the independent variable constant. When controlling for the mediating variable, the effect of the independent variable on the dependent variable should be reduced. Because we predicted directions in our hypotheses, all regression analyses used one-tailed tests.

To test hypotheses four and five, different configurations with regard to the number of isolates (no isolates, one isolate, several isolates, and exclusively isolates) were compared with regard to the amount of social presence, team performance, and team satisfaction by means of a one way analysis of variance. Hypothesis 4 will be supported when main effects are found that are caused by the highest value for the virtual teams that consist entirely of isolated team members. To investigate whether the superior performance and satisfaction of teams that consist entirely of geographically isolated team members is mediated by social
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presence, we added social presence as a covariate. Hypothesis 5 will be supported when the main effects of isolation on team performance and team satisfaction are reduced.

5.4 Results

Descriptive statistics and correlations

The descriptives, statistics and correlations between the variables are presented in Table 5.1. Consistent with our expectations, we found that isolation was positively related to social presence ($r = .52, p < .001$). The higher the percentage of isolates in the team, the higher the perceived social presence of the team members. With regard to the outcome variables, isolation correlated positively with performance ($r = .30, p < .05$) and satisfaction ($r = .31, p < .05$). Social presence was also positively related to performance ($r = .52, p < .001$) and satisfaction ($r = .55, p < .001$). Performance and satisfaction were positively related to each other ($r = .85, p < .001$).

Table 5.1

Descriptives, Correlations, and Reliability Coefficients ($N = 47$).

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
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<td>1. Isolation</td>
<td>43.27</td>
<td>39.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Social presence</td>
<td>4.11</td>
<td>.77</td>
<td>.52***</td>
<td>(.79)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Performance</td>
<td>4.84</td>
<td>.67</td>
<td>.30*</td>
<td>.52***</td>
<td>(.92)</td>
<td></td>
</tr>
<tr>
<td>4. Satisfaction</td>
<td>4.86</td>
<td>.66</td>
<td>.31*</td>
<td>.55***</td>
<td>.85***</td>
<td>(.86)</td>
</tr>
</tbody>
</table>

Note: Table 5.1 displays team-level descriptives and correlations; Cronbach’s alphas are on the diagonal between parentheses.

*p < .05; ***p < .001 (one-tailed)

Testing of hypotheses

To test our research model with regard to social presence and the relation between isolation and the outcome variables, we conducted a regression analysis. Social presence correlated significantly with team performance ($r = .52, p < .001$) and team satisfaction ($r = .55, p < .001$). This means that hypotheses 1a and 1b have been fully supported. The positive correlation between isolation and social presence means that isolation explained a significant portion of the variance in social presence ($r = .52; r^2 = .27, p < .001$). This provides support
Table 5.2

*Regression analysis predicting satisfaction and performance*

<table>
<thead>
<tr>
<th>Variable</th>
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<th>Satisfaction</th>
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<tr>
<td></td>
<td>β</td>
<td>R²</td>
<td>∆R²</td>
<td>β</td>
<td>R²</td>
<td>∆R²</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>.09*</td>
<td>.09*</td>
<td>.10*</td>
<td></td>
<td>.10*</td>
<td>.10*</td>
</tr>
<tr>
<td>Step 3</td>
<td>.30*</td>
<td>.30*</td>
<td>.31*</td>
<td>.28***</td>
<td>.28***</td>
<td>.30***</td>
</tr>
<tr>
<td>Isolation</td>
<td>.04</td>
<td>.04</td>
<td>.05</td>
<td>.04</td>
<td>.04</td>
<td>.05</td>
</tr>
<tr>
<td>Social presence</td>
<td>.51***</td>
<td>.51***</td>
<td>.55***</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05; ***p < .001 (one-tailed)*

for hypothesis 2a. Moreover, this finding indicates that the first condition of Baron and Kenny (1986) has been fulfilled. Tables 5.1 and 5.2 show that the second condition of Baron and Kenny has also been fulfilled because isolation did explain a significant portion of variance in team performance ($r = .30; r^2 = .09, p < .05$) and team satisfaction ($r = .31; r^2 = .10, p < .05$). This means that hypotheses 2b and 2c also have been fully supported. To test the third condition of Baron and Kenny (1986) we added social presence to the regression in the next step. Results showed that social presence was a significant predictor of performance ($\beta = .51, p < .001$) and satisfaction ($\beta = .58, p < .001$). Together isolation and social presence explained 28 percent of the variance in performance and 30 percent of the variance in satisfaction. After social presence was entered in the regression analysis, the effect of isolation on performance ($\beta = .04, p = .81$) and satisfaction ($\beta = .05, p = .78$) became non-significant. A calculation of the Sobel test (Sobel, 1982) showed that these reductions in beta weights were significant ($z = 2.81, p < .01; z = 2.89, p < .01$, respectively). Because all the conditions of Baron and Kenny (1986) have been fulfilled, we can conclude that social presence mediates the relation between the isolation and the outcome variables. This means that hypotheses 3a and 3b have been supported.

By means of a one-way analysis of variance that is presented in Table 5.3, we compared the amount of social presence, team satisfaction, and team performance between 4 types of configuration with regard to isolates. Our database consisted of 9 virtual teams in which none of the team members were isolates (e.g. 3-6-2 or 3-3), 9 teams that contained one isolate (e.g. 3-3-1 or 12-1), 18 teams that contained several isolates (e.g. 3-1-1 or 3-6-2-1-1), and 11 teams that consisted entirely of isolates (e.g. 1-1-1-1). The one-way ANOVA showed
Isolated Team Members and Effectiveness

a significant main effect of isolation on social presence ($F (3, 47) = 17.04, \ p < .001$),
performance ($F (3, 47) = 4.17, \ p < .01$), and satisfaction ($F (3, 47) = 5.91, \ p < .001$).

As can be seen in Table 5.3, teams that consisted entirely of isolates were superior with
regard to social presence, performance, and satisfaction. A Bonferroni post hoc test showed
that the main effect of isolation on social presence was indeed caused by the differences
between the teams that consisted entirely of isolates and the other configurations. All mean
differences were significant at the .001 level. There were no significant differences among
the other configurations. These findings supported hypothesis 4a and implied that teams that
consisted entirely of geographically based isolates experienced more social presence as
compared to teams with no isolated team members, one isolated team member, or several
isolated team members. The significant difference in performance was also caused by the
higher value of the teams that consisted entirely of isolates. In teams that consisted entirely of
isolates, the value was significantly higher than in teams with one isolate, several isolates, or
no isolates (all significant at $p < .05$). These other three types of configurations had similar
values on performance. This finding fully supports hypothesis 4b. Hypothesis 4c is also fully
supported because the teams that consisted entirely of isolates also had the highest
satisfaction value. According to the Bonferroni post-hoc test, the teams that consisted entirely
of isolates had a higher satisfaction than teams that only had one isolate ($p < .05$), several
isolates ($p < .001$), and no isolates ($p < .05$). These other types of configurations did not differ
significantly from one another with regard to satisfaction.

Table 5.3

<table>
<thead>
<tr>
<th>Team with...</th>
<th>Social Presence</th>
<th>Performance</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n m s.d. m s.d. m s.d.</td>
<td>m s.d.</td>
<td></td>
</tr>
<tr>
<td>No isolates</td>
<td>9 3.87$^a$.46 4.50$^a$.27 4.72$^a$.36</td>
<td></td>
<td></td>
</tr>
<tr>
<td>One isolate</td>
<td>9 3.80$^a$.64 4.53$^a$.48 4.74$^a$.59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Several isolates</td>
<td>18 3.77$^a$.61 4.61$^a$.73 4.59$^a$.55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only isolates</td>
<td>11 5.13$^b$.35 5.40$^b$.97 5.45$^b$.67</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47 4.11 .77 4.76 .76 4.85 .64</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: means within social presence, performance, and satisfaction with different superscripts
differ significantly according to the Bonferroni Post Hoc test ($p < .05$)
To investigate the mediating role of social presence, we conducted an ANCOVA. As expected, after social presence was added as a covariate, we found no main effect of isolation on performance ($F(3, 47) = .41, p = .75$) nor on satisfaction ($F(3, 47) = 1.07, p = .37$). These findings support our prediction with regard to team performance and team satisfaction that the superiority of teams with exclusively isolated team members was mediated by social presence. This means that hypotheses 5a and 5b have been fully supported.

**Control for common method variance**

In this study we used the mean of the respondents per virtual team to have aggregated scores on the variables. Because the same respondents assessed the measurements at the same point in time, this study is susceptible to common method variance (Kemery, & Dunlap, 1986; Lindell, & Whitney, 2001). By using split samples, we made sure our findings were not biased (Lance, Noble, & Scullen, 2002). For isolation, we could use the objective score that was the same across individuals within the team. For the mediating variable (social presence) we used the score of one randomly selected individual to represent the virtual team, and for the dependent variables (performance and satisfaction) we used the scores of another randomly selected individual to represent the virtual team. As in the original test, isolation was a significant predictor of social presence ($\beta = .40, p < .01$). Table 5.4 shows that with the split sample use, isolation significantly predicted performance ($\beta = .29, p < .05$) and satisfaction ($\beta = .44, p < .01$), as was the case in the original analysis. Next, social presence was entered into the regression equation and the effect of isolation on performance ($\beta = .12, \text{n.s.}$) and satisfaction ($\beta = .24, \text{n.s.}$) became non significant, as was the case for the original analysis. Social presence was a significant predictor of team performance ($\beta = .42, p < .01$) and team satisfaction ($\beta = .42, p < .01$). A calculation with the Sobel test (Sobel, 1982) showed that the reductions in beta weights for team performance and team satisfaction were significant ($z = 1.93, p < .05; z = 2.03, p < .05$, respectively). The findings of the regression analysis, in which we used the split samples, support the original findings in which we used the means. This means that our findings with regard to hypotheses 1 to 3 were not biased.

Next, we conducted an ANOVA using the split samples. The four configurations had significantly different scores with regard to social presence ($F(3, 47) = 12.86, p < .001$), performance ($F(3, 47) = 3.91, p < .05$), and satisfaction ($F(3, 47) = 4.97, p < .01$). As was the case in the original analysis, teams that consisted entirely of isolated team members had highest values for the three variables. To investigate whether social presence mediated the superiority of teams that consisted entirely of isolates, we conducted an ANCOVA. After
Isolated Team Members and Effectiveness

Social presence was added as a covariate, we found no main effect of isolation on team performance ($F (3, 47) = 2.07, p = .12$) or team satisfaction ($F (3, 47) = .73, p = .54$). Therefore the support for hypotheses 4 and 5 is not biased.

### Table 5.4

**Split samples regression analysis predicting satisfaction and performance**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Performance</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\beta$</td>
<td>$R^2$</td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>.09*</td>
<td>.18**</td>
</tr>
<tr>
<td>Step 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation</td>
<td>.23**</td>
<td>.14**</td>
</tr>
<tr>
<td>Social presence</td>
<td>.12</td>
<td>.24</td>
</tr>
</tbody>
</table>

*p < .05; **p < .01; ***p < .001 (one-tailed)

### 5.5 Discussion

This study advances the knowledge of geographically isolated team members in global virtual teams. Our results show that isolation is positively related to team effectiveness and that this positive relation is mediated by social presence. When teams with various configurations are compared, we find that social presence mediates the superiority of teams that consist entirely of isolated members.

**Theoretical contribution**

Our results suggest that isolation of global virtual team members results in better team outcomes because of the higher social presence experienced by these global virtual teams. The comparison of the different configurations in the current study shows that the positive effects of isolation originate from the superiority of teams that consist entirely of isolates. These teams score 100 percent on the isolation index. The fact that fully isolated teams turn out to be superior provides support for our hypotheses, which are based on the SIDE theory (e.g. Turner, Sachdev, & Hogg, 1983). Geographically isolated team members do not have an in-group at their geographical location, which may protect these teams from negative in-group versus out-group dynamics. This psychological involvement with team members outside their geographical location is reflected in the fact that these teams experience more
social presence. This involvement is important for collaboration in teams, which is reflected in higher team performance and satisfaction.

The global virtual teams with geographically collocated subgroups had worse outcomes compared to teams that consisted entirely of isolates. It may be that, as soon as there are collocated members in global virtual teams, social identity problems start to arise. However, this does not seem to agree with the findings of O'Leary and Mortensen (in press), who suggested that teams with one subgroup and only one isolated team member outperformed all other configurations that were included in their experiment. When we add our results to the findings of O'Leary and Mortensen (in press) and Polzer et al. (2006), it seems that problems arise when virtual teams consist of more than one geographically collocated subgroup. Contrary to the isolate condition in O'Leary and Mortensen's study, our one isolate condition could have had more than one additional subgroup. For example, there could have been two subgroups and one isolated team member. This fundamental difference may have consequences for the link with social categorization theories. When there is only one subgroup, all distant team members are isolated and therefore may not be viewed as a threat to the in-group. When geographically distant team members are not a threat, these members become involved. Isolates are focused on others. O'Leary and Mortensen (in press) also found that virtual teams with one subgroup and one isolated team member outperformed fully collocated teams (or face-to-face teams). A fully collocated team most likely does not deal with negative subgroup dynamics because all members belong to the same geographical in-group. We propose that virtual teams with isolated members and not more than one subgroup outperform face-to-face teams because they deal with the challenges of distance and not seeing each other. These challenges have previously been related to being more task oriented (Martins, Gilson, & Maynard, 2004). This is an interesting topic for future research.

In the current study we interpret social presence in a new way. Previous literature pointed out the importance of media with regard to social presence (e.g. Short et al., 1967). We move forward and look at the effects of isolation and social categorization within global virtual teams. In addition to different types of interaction media, aspects of geographical configuration may influence social presence by making distant team members more salient. In light of the current results we theorize that when geographically dispersed members are perceived as belonging to the out-group, as may be the case with geographically defined subgroups, social presence will be lower. However, when dispersed members are perceived as belonging to the in-group, as is the case with isolated team members or with teams a
maximum of one subgroup, team members are psychologically involved and social presence will be higher.

Practical implications
More and more global organizations have employees who work together in global virtual teams. As the number of global virtual teams is growing, it is important that this form of collaboration is as effective as possible. Some researchers have noted that contact is a challenge for global virtual teams because members are located around the world. This challenge originates from the fact that collocated team members interact more frequently with one another than with distant team members (Mortensen, & Hinds; Walther, 2002). But this is not a challenge in virtual teams in which all members are isolated, because there simply are no collocated team members with whom one can interact. This study suggests that contact among members in geographical subgroups should not be stimulated because it creates in-group dynamics that lower team outcomes.

In addition to making people aware of effective virtual team behaviors through training sessions or interventions as was suggested in the work of Dekker and colleagues (in press), organizations also could pay attention to the geographical configuration of their virtual teams. This study shows the positive effects of having teams that consist entirely of isolates. Members are psychologically involved with each other in such teams, which is positively related to performance and satisfaction. An alternative design is a team with only one geographically based subgroup and one or more isolates (as in O'Leary, & Mortensen, in press). When existing teams are not performing well or when members are not satisfied, organizations might consider redesigning their teams to include only isolated team members.

Strengths, Limitations, and suggestion for future research
A major advantage of the current study is that we used real global virtual teams, in which we used several observations per virtual team. This ensures that our measurements are not based on the perceptions of one individual. Studies with regard to isolation have never been studied outside of the laboratory using students (e.g. O'Leary, & Mortensen, in press; Polzer et al., 2006). We think student teams do not fully reflect the cultural differences and time zones in which real virtual teams operate. Because we use data from a field study, the findings are easily generalizable to real virtual teams. Exploratory studies with students, on the other hand, have the advantage that the effects of isolated team members on social presence can be studied in a controlled setting. Future research should conduct experiments to study the
effects of social categorization on social presence in a more detailed way. For example, it would also be interesting to compare teams that consist entirely of isolates, teams that have one subgroup and one isolate, and teams that have multiple isolates and subgroups. We would predict that the first two teams should perform equally, but better than the latter.

A limitation of the current study is that we collected the data at one point in time through an online questionnaire. Because of this, it is difficult to draw conclusions with regard to cause and effect. For future research, it would be interesting to study this topic with longitudinal data. Moreover, we measured the performance of virtual teams based on the subjective opinion of the team members. It is important that the current findings are validated with objective performance measures.

Finally, we propose that social presence theories should move away from only looking at the effect of media and media theories. In this study we have shown the important role of geographical configuration, specifically of isolated team members. We would like to encourage others to think about how social presence can be influenced other than through media choice.

Conclusion
This research has provided more advanced insights regarding isolation and isolated team members in global virtual teams. SIDE theory helped to explain why isolation positively influenced the amount of experienced social presence in global virtual teams. Social presence turned out to be an important mediator with regard to the effectiveness of teams. We hope that these promising and novel findings encourage other researchers to continue researching global virtual teams.
In this final chapter, the main findings from the four studies presented in the preceding chapters are summarized and discussed. We provide answers to the research questions that were raised in the introduction and discuss the theoretical contributions. In addition, we address important and relevant lessons that have been learned for practice. Moreover, we discuss strengths and limitations of our research and we propose some suggestions for future research. Finally, we give a conclusion.

In the introduction of this dissertation we have given an overview of the state of the current literature regarding the effects of input variables, process variables, and outcome variables in virtual teams (Martins, Gilson, & Maynard, 2004; Hackman, & Morris, 1975). According to various researchers (e.g. Martins et al., 2004; Kozlowski, & Ilgen, 2006; Schiller, & Mandviwalla, 2007) there is limited research and theory on the effectiveness of virtual teams, creating many research challenges. To obtain a better understanding of virtual teams, we have presented four chapters in which we have addressed the five main research questions formulated in the introduction of this dissertation (Chapter 1). Figure 6.1 presents an overview of the variables that we focused on. In the study presented in Chapter 2, we focused on what effective virtual team behaviors (EVTB) are perceived as important for effectiveness (satisfaction and performance). In Chapter 3, we investigated the effect of national culture on the perceived importance of these EVTBB. In Chapter 4, we looked at the process variable team trust and its relation with EVTBB and effectiveness. In the fifth chapter, we investigated the relation between isolation, social presence and effectiveness in global virtual teams.
6.1 Main Findings and Theoretical Contribution

Research question 1

The first research question addressed critical behaviors (process variable) for the effectiveness (outcome variable) of global virtual teams, and was: What behaviors are critical for the effectiveness of global virtual teams? It is important to know these behaviors among team members because they transform inputs into outcomes in global virtual teams (Powell, Piccoli, & Ives, 2004; Rousseau, Aubé, & Savoie, 2006). An overview of these behaviors, however, was lacking in the virtual team literature (Martins, Gilson, & Maynard, 2004). In the study presented in Chapter 2, interviews by means of the critical incident technique (Flanagan, 1952) were held among 30 professional global virtual team workers in the Netherlands. The interviews focused on experiences with critical interaction behaviors of virtual team workers in their teams. We clustered the 413 critical behaviors that had been derived from the interviews into 13 categories of effective virtual team behaviors (EVTB). The categories of critical interaction behaviors were: media use, handling diversity, interaction volume, in-role behavior, structuring of meeting, reliable interaction, active participation, including team members, task progress communication, extra-role behavior, sharing by leader, attendance, and social-emotional communication. Thus, the results of the study presented in Chapter 2 have answered the first research question and provided a framework of critical interaction behaviors in global virtual teams.

Previous researchers have tried to test and expand frameworks from face-to-face literature to virtual teams (e.g. Potter, & Balthazard, 2002a; 2002b). We, however, thought that this was not the right way to investigate interaction behaviors in global virtual teams, because the inputs of virtual teams are different from traditional face-to-face teams and they influence the behaviors that are necessary. Differences with regard of inputs are, for example,
the use of interaction media, having members in various countries, and not seeing each other. By taking virtual teams as a starting point, we made sure that we did not overlook important interaction behaviors in global virtual teams. When we compared our framework with previous frameworks from the face-to-face literature (e.g., Cooke, & Szumal, 1994; for an overview on frameworks in the face-to-face literature see Rousseau, Aubé, & Savoie, 2006) our assumption turned out to be correct. Several categories from our framework turned out to be unique for global virtual teams and had not yet been covered in previous frameworks. Other categories overlapped with previous categories, but the essence in virtual teams differed. For example, the category including team members had also been described in the face-to-face literature (e.g., Rousseau et al., 2006). Teams exist because a group of individuals can usually achieve more than a single individual; therefore behaviors from the category including team members are important in all team types. To get the best solution or discussion, it is important to involve all team members. In virtual teams this category is even more important because it happens that people are "forgotten" when they do not speak up for themselves because the team members do not see each other.

An example of a unique category of the current framework is media use. Because traditional teams do not have interaction media as an input variable, they do not show behaviors dealing with types of media. Another unique category is handling diversity. Unlike traditional face-to-face teams, all global virtual teams deal with people that are located in various countries. Because of this, team members in global virtual teams need to show behaviors dealing with cultural, language, and time-zone differences. The last example of a category that turned out to be unique for virtual teams after a comparison of the framework to frameworks from the face-to-face literature (Rousseau et al., 2006) is reliable interaction. Behaviors from this category seem to be important in global virtual teams, because team members cannot see each other. Cramton (2001) mentioned some aspects of this category in her research on virtual teams. Her research concerned "silence" after sending an email. This means that one does not get a reply to an email. People in global virtual teams have difficulty interpreting silence because they cannot see each other. Unlike in traditional face-to-face teams, where one can see the team member is not responding because he or she is working on another task, members in virtual teams have to take this into account and always share calendars or let the team know their whereabouts. The unique contribution of the study presented in Chapter 2 to the virtual team literature is a framework of interaction behaviors that are critical in global virtual teams.
Chapter 6

Research question 2

The second research question concerned national cultures (input variable) and EVTB (process variable), and was: Are effective virtual team behaviors culture specific? The framework that was developed in the study presented in Chapter 2 was based on interviews with professional global virtual team workers in the Netherlands. In the study presented in Chapter 3, we investigated whether members of professional global virtual teams who were located in the U.S., India, and Belgium perceived the same interaction behaviors to be critical as the Dutch members from the study presented in Chapter 2. We thus investigated whether we could generalize the findings that were presented in Chapter 2 to other national cultures. Thirteen virtual team workers in the U.S., 11 in India, and 11 in Belgium were interviewed by means of the critical incident technique (Flanagan, 1954). The results showed that EVTB are culture specific. Most of the behaviors mentioned by the American, Indian, and Belgian respondents could be grouped into the same 13 categories, but, the distribution differed from those of the Dutch respondents. This means that other national cultures emphasize or put greater value on other behaviors. Indian and Belgian interviewees also mentioned behaviors that could not be grouped into the existing framework. This seemed to imply that, after investigating these national cultures, we needed to add a fourteenth category to the original framework: Respectfulness.

Because global virtual teams per definition have members in various national cultures, the findings of this study are relevant. The study presented in Chapter 3 showed that behaviors that are critical for team performance and team satisfaction are culture specific. This means that the various cultures have not adopted values from one dominating culture. Our finding can be used in line with the fusion theory of Janssens and Brett (2006) which assumes that cultures differ with respect to what behaviors are perceived as critical. Specifically, this means that behaviors viewed by virtual team members from one national culture as being critical for the effectiveness of a virtual team, are not necessary valued the same by team members from another culture. The fusion theory states that, instead of having one dominant culture, culturally diverse teams have to accept and respect coexistence of differences and utilize the unique qualities of those differences to produce best team outcomes (Janssens, & Brett, 2006). It is thus important that team members respect and understand the cultures of other team members in global virtual teams. But first of all, it needs to be clear whether there are cultural differences with regard to EVTB. The study in Chapter 3 has provided insight into the differences within global virtual teams. The cultural dimensions (power distance, uncertainty avoidance, individualism, masculinity, and long-
term orientation) of Hofstede (2001) could explain some of these differences, indicating that these dimensions are useful for research on cultural differences in global virtual teams. For example, we found that behaviors from the category extra-role behavior were relatively most often mentioned by virtual team workers in the Netherlands. The Netherlands has a low masculine, thus feminine, culture, as compared to the other national cultures that were included in the study. Behaviors from the category extra-role behavior are very feminine in that they are about caring and doing other things for team members. These behaviors are unlikely to be valued in the more competitive, hard, and assertive (masculine) cultures of the U.S., India, and Belgium. Another example is that we found that global virtual team workers in India mentioned relatively most behaviors regarding active participation. Compared to the other individualistic national cultures that were included in the study, the Indian national culture has a low score on individualism (collectivism). It is not surprising that active behaviors in meetings are seen as important by virtual team members in collective cultures, such as India, because everybody needs to ask and talk so that a collective decision can be made. In conclusion, this chapter has added value to the current literature in that it gives more insight into how interaction behaviors are influenced by national culture.

**Research question 3**

The third research question concerned whether EVTB can be measured. More specifically the research question was: How can EVTB be measured in a reliable and valid way? In the study presented in Chapter 4 we addressed this research question. On the basis of the critical incidents that were derived from the critical incident technique interviews (Flanagan, 1954) in Chapter 2, we developed an instrument to measure EVTB by means of an online survey study among 310 professional global virtual team workers. We entered items that were originally grouped into 13 categories into an exploratory factor analysis. After we conducted the exploratory factor analysis, we found 8 theoretically sound scales.

The results presented in Chapter 4 have provided an instrument to measure EVTB. The instrument has 8 scales of at least three items: information sharing, interaction volume, interaction frequency, active involvement, handling diversity, extra-role behavior, reliable interaction, and including team members. Each scale had a high Cronbach's alpha meaning that the scales are reliable. The studies presented in Chapters 2 and 3 based the relation between EVTB and effectiveness on interviews with professional global virtual team workers. In Chapter 4, we provided empirical evidence that EVTB are indeed positively related to team performance and team satisfaction in global virtual teams. This means that the
instrument has concurrent validity with regard to effectiveness (Hough, 1998). The correlations were significant but no too strong, indicating divergent validity. Prior to this study, an instrument to measure EVTB was missing in the virtual team literature. The findings of the study presented in Chapter 3, however, focus exclusively on behaviors in global virtual teams. The instrument that has been developed in the study presented in Chapter 4 provides a unique contribution to the current literature because it can be used to investigate and understand EVTB behaviors in virtual teams and to develop more profound theories regarding virtual teams.

Research question 4
The fourth research question concerned what process variables can explain the relation between EVTB and effectiveness (outcome variable) and was: Does team trust mediate the relations between EVTB and team satisfaction and team performance, respectively? This research question regarding team trust has been addressed in Chapter 4. In this chapter, we selected 47 global virtual teams of which at least three members completed the online questionnaire that was described when we discussed research question three. These 168 individuals from 47 global virtual teams completed the EVTB instrument, as well as questionnaires measuring team trust, team performance, and team satisfaction. The results showed a positive relation between EVTB and outcomes. Moreover, the results presented in Chapter 4 showed that team trust mediates the relation between EVTB and effectiveness.

Previously, researchers have demonstrated the importance of team trust in global virtual teams (e.g. Saunders, 2000; Jarvenpaa, & Leidner, 1999). The study described in Chapter 4 has provided more evidence of the role of trust in global virtual teams. Following Martins et al.’s (2004) suggestion that researchers should focus on mediating effects in global virtual teams, the data provided evidence that team trust is an important mediator between EVTB and effectiveness in global virtual teams. Several researchers have adopted Swift trust theory to understand the existence of trust in global virtual teams. This theory suggests that trust is adopted from other situations and that members cannot influence it (Meyerson, Weick, & Kramer, 1996). It was originally based on short term teams that had limited face-to-face interaction and lacked time to develop expectations of others. According to the theory, these teams imported expectations of trust from other settings. The theory also implies that trust is stable and not likely to change after it has been adopted. Recently, more and more researchers have started to adopt the developmental view of trust (Lewicki, & Bunker, 1995). This means that trust is created, through behaviors, rather than imported.
(Jarvenpaa, & Leidner, 1999). Jarvenpaa and Leidner (1999) concluded that trust in virtual
teams should be reexamined from the developmental point of view. Moreover, they
questioned what behaviors are related to trust. The investigation described in Chapter 4
contributes to the virtual team literature in that it has provided behaviors that explain a great
deal of variance in team trust. Team trust is important when team members depend on each
other for the successful completion of a task. When team members notice EVTB of others,
they may be stimulated to take risks and show these behaviors as well. Building on Social
Exchange Theory (Gouldner, 1960) this study showed that EVTB in virtual teams lead to
more trust. These behaviors were directly related to better performance and greater
satisfaction among the team members, but also indirectly through trust. The investigation
presented in Chapter 4 contributes to the current literature in that it has provided insights into
the positive relation between EVTB and effectiveness. We now know that team trust is an
important mediator in this relation.

Research question 5

The final research question concerned how isolation (input variable) and social presence
(process variable) influenced outcomes in global virtual teams. More precisely, the fifth
research question was: Does social presence mediate the positive relation between isolation
and effectiveness in global virtual teams? Isolated team members are members with no other
team members at their site (O'Leary, & Cummings, 2007). Social presence is the subjective
feeling that other team members are perceived as physically present and with whom one feels
psychologically involved (Bente, Rüggenberg, Krämer, & Eschenburg, 2008). The survey
among 47 professional global virtual teams that is described in Chapter 4, has also been used
to investigate the fifth research question. The investigation that is presented in Chapter 5
confirmed the positive relation between isolation and effectiveness and the mediating role of
social presence in this relation.

Previous studies found that the input variable, isolation, was related to positive
outcomes in global virtual teams. The study described in Chapter 5 contributes to the current
virtual team literature in that it explains why isolation – counter intuitively – is positively
related to team effectiveness. The results suggest that isolation of global virtual team
members results in better team outcomes because it is mediated by social presence.
Moreover, we found that this result most likely originated from the fact that teams that
consisted entirely of isolates had superior performance and the highest satisfaction. This was
also mediated by social presence. This supports our hypotheses, which were based on Social
identification theory (e.g. Turner, Sachdev, & Hogg, 1983). Unlike members that are located face-to-face with some other team members, geographically isolated team members do not have a geographically defined in-group, which may stimulate them to focus and feel psychologically involved with members in other locations. Also, because there are no geographically in-groups present in virtual teams that consist entirely of isolates, problems with social categorization are overcome. This psychological involvement is reflected in the fact that these team members experience more social presence. Social presence is important for collaboration in global virtual teams, which is also reflected in the superior performance and greater satisfaction. When we add our findings to the findings of O'Leary and Mortensen (in press), who found that teams with only one isolate and one subgroup outperformed the other configurations in their experiment, our reasoning still holds. It seems that problems arise as soon as there is more than one geographically defined subgroup, because then in-group versus out-group dynamics negatively influence social presence of distant team members. The fact that teams with one isolated team member also outperformed face-to-face teams is probably due to the fact that virtual teams are more task oriented than face-to-face teams (Martins et al., 2004).

The study presented in Chapter 5 was the first to look at other inputs, besides media technologies, that influence social presence. Not only different types of interaction media, but also aspects of geographical configuration may stimulate that distant team members are perceived as more socially present. Depending on the geographical configurations, members can be perceived as in-group or out-group members, which influences social presence.

In conclusion, the four chapters have provided insights into input and process variables that influence the team performance and team satisfaction in global virtual teams. EVTB are directly related to effectiveness of virtual teams. We have, moreover, shown that this relation is mediated through the process variable trust. Moreover, the results show that national culture is an input variable affecting EVTB. Social presence is another variable important for the effectiveness of global virtual teams. We have shown that this process variable is at least partly determined by isolation in global virtual teams.

**6.2 Lessons Learned for Practice**

Overall, this dissertation has important practical implications for global virtual teams. The number of virtual teams is growing and therefore it is important that this form of collaboration is as effective as possible. Together, the chapters have provided new insights
regarding input variables and process variables to improve the effectiveness of global virtual teams. Both team performance and team satisfaction are important determinants of effectiveness. Team performance is the productivity of a team. Team satisfaction is an affective outcome variable that is also very important because it influences, for example, whether people want to stay with the organization, and absenteeism (Martins et al., 2004).

We will now provide the top 4 lessons that have been learned regarding effectiveness from the studies presented in this dissertation.

**Lesson 1**
The first lesson that has been learned is the importance of EVTB to improve the effectiveness of global virtual teams. The studies presented in Chapters 2 and 3 have provided insights into EVTB. Experiences of professional team members from global virtual teams have been investigated to present a framework. Table 6.1 gives recommendations for practice regarding the categories.

In Chapter 4 the experiences from the interviewees in Chapter 2 have been used to provide an 8-scale instrument to measure EVTB. Chapter 4 has provided empirical evidence that EVTB are related to team performance and team satisfaction. For practice, it is thus important that members of global virtual teams know and show these behaviors. This can be accomplished through training sessions and interventions. In these training sessions, team members can be made aware of EVTB. Through interventions members can receive instructions to change behaviors. Moreover, by means of the instrument that was developed in the study presented in Chapter 4, it is possible to know exactly how teams or individuals score on the behaviors that are critical for the effectiveness of global virtual teams. This can be done through 360 degree feedback, where peers and supervisors are asked about the performance of the team. For example, if a global virtual team is not performing well, and the team members score low on the category *interaction volume*, the team can set rules regarding this category. An example rule can be "only forward messages when you specify why you do this, and if you do not have a good reason – do not forward the message." Newly developed virtual teams can also use this knowledge. Instead of discovering everything themselves, these teams can learn from other teams and start with rules of conduct.

**Lesson 2**
The second lesson that we have learned is that we have to take cultural differences in global virtual teams into account for them to be effective. The results of the study presented in
Chapter 3, showed that virtual team members working in various national cultures differ with respect to what behaviors they view to be important for the effectiveness of global virtual teams. Because global virtual teams are, per definition, dealing with various national cultures, it is important that people in practice take this into account. Cramton, Orvis, and Wilson (2007) highlighted the importance of knowing situational differences in global virtual teams. When team members are not aware of their team members' situation (for example a broken down network), they might wrongly make dispositional attributions which will most likely negatively influence the collaboration in the future. The study presented in Chapter 3 adds to this that team members should also be aware that their team members' national culture could differ from their own, and that this could influence their behavior. For example, Dutch team members, whose national culture scores low on masculinity, value behaviors from the category extra-role behavior. This is not shared by individuals from national cultures scoring high on masculinity, such as India and the United States. It is thus likely that American team members behave differently than the Dutch team members would have behaved or expected other team members to behave in certain situations. If the Dutch team members are unaware of differences in national culture, they might wrongly make a dispositional attribution by blaming the personality of the American team member. If the Dutch team members, on the other hand, are aware of the differences in culture with regard to masculinity, they could have expected this difference and dealt with it adequately. In line with fusion theory (Janssens, & Brett, 2006), we suggest that global virtual teams should engage in activities to explore and understand the cultures of other team members and the consequences of these cultures. These can be activities that focus on the interpretation of English words (if that is the common language in the team), highlight the differences in frame of reference, or concentrate on cultural norms. This may result in mutual respect and understanding among team members of various national cultures. Consequently, teams may even adopt adequate behaviors from other national cultures than their own.
Table 6.1

Critical interaction behavior categories

<table>
<thead>
<tr>
<th>Category label</th>
<th>Advice:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Media use</td>
<td>Have various types of interaction media available.</td>
</tr>
<tr>
<td>Handling diversity</td>
<td>Agree on a common language to use for interactions.</td>
</tr>
<tr>
<td></td>
<td>Take into account time zones when scheduling meetings.</td>
</tr>
<tr>
<td></td>
<td>Know and understand the national cultures of team members.</td>
</tr>
<tr>
<td>Interaction volume</td>
<td>Do not use surplus interaction.</td>
</tr>
<tr>
<td>In-role behavior</td>
<td>Work on the assigned task.</td>
</tr>
<tr>
<td>Structuring of meeting</td>
<td>Structure the virtual meeting by means of an agenda.</td>
</tr>
<tr>
<td>Reliable interaction</td>
<td>Share when and where one is available.</td>
</tr>
<tr>
<td></td>
<td>Be responsive to messages.</td>
</tr>
<tr>
<td>Active participation</td>
<td>Show active participation behaviors during meetings.</td>
</tr>
<tr>
<td>Including team members</td>
<td>Invite distant team members to participate actively.</td>
</tr>
<tr>
<td>Task progress communication</td>
<td>Communicate deadlines, progress, and actions regarding the completion of tasks.</td>
</tr>
<tr>
<td>Extra-role behavior</td>
<td>Show pro-social behaviors.</td>
</tr>
<tr>
<td>Sharing by leader</td>
<td>Share information and decisions with the team.</td>
</tr>
<tr>
<td>Attendance</td>
<td>Be physically (or virtually) and psychologically (no multitasking) present during a team meeting.</td>
</tr>
<tr>
<td>Social-emotional communication</td>
<td>Notify the team about personal issues.</td>
</tr>
<tr>
<td>Respectfulness</td>
<td>Show respect towards team members.</td>
</tr>
</tbody>
</table>

Lesson 3

The third lesson learned for global virtual teams in practice is the important role of trust in the relation between EVTB and effectiveness. Previously, several researchers have already suggested that virtual teams should increase their trust, because this is directly related to more positive outcome variables (e.g. Saunders, 2000; Jarvenpaa, & Leidner, 1999). However, how trust can be improved is usually not clear. The study presented in Chapter 4 provided evidence that trust is related to EVTB. Moreover, the investigation showed that trust mediates
the relation between EVTB and team performance and team satisfaction. Because in Chapter 4 an instrument has been developed to measure EVTB, this instrument can be used to see how trust in virtual teams can be increased. If a virtual team, for example, lacks behaviors in certain categories, the team can be made aware of this and interventions can be designed to improve these behaviors, like in the first lesson.

Lesson 4

The fourth lesson we have learned is that organizations should pay attention to the geographical configuration of global virtual teams. Specifically, the discussion showed that having more than one geographically defined subgroup should be avoided in global virtual teams. When we add our results to the results of O’Leary and Mortensen (in press) we see that teams consisting entirely of isolates, and teams with a maximum of one subgroup outperform other configurations. Thus, when organizations are going to design virtual teams, this is an important suggestion to take into account. Moreover, when teams do not function as desired, it is also suggested to take a critical look at the geographical configuration of teams, especially with regard to isolation and the number of subgroups.

However, in practice it is not always possible to configure the teams as desired. Then we have to look for other ways to overcome the negative effects of in-group out-group dynamics. Following Brewer and Miller (1984), we propose that the best way to reduce in-group favoritism is to make the categories based on geographical location less salient. This can be done by providing a superordinate categorization dimension that cuts across the geographical locations. This can, for example, be a superordinate goal of the virtual team. A second solution is the contact hypothesis (Allport, 1954), which suggests that in-group favoritism can be reduced through contact between individuals from different groups. In cases of teams with various geographically defined subgroups, this would mean that contact between geographically defined subgroups and other individuals should be stimulated. This can, for example, be achieved through regular face-to-face meetings in which all the team members come together.

6.3 Strengths, Limitations and Suggestions for Future Research

The main strength of this dissertation is that in all the studies that were presented in the chapters, we used members from real professional global virtual teams from practice. Most previous empirical studies have been conducted with students in laboratory settings (e.g. Conolly, Yessup, & Valacich, 1990; Mcleao, Baron, Marti, & Yoon, 1997). Martins et al.
(2004) suggested that researchers should move out of the laboratory and find answers to questions that can only be tested in field settings. The fact that this study concerned real global virtual teams makes our findings easier to generalize to other global virtual teams. The subject that was described in Chapter 5, isolation, had never been studied outside the laboratory before. Another suggestion of Martins et al. (2004) was that researchers should take virtual teams as a starting point instead of face-to-face teams. By using real global virtual teams in the studies presented in Chapters 2 through 5, we moved away from comparing virtual teams with traditional face-to-face teams. Since there are almost no pure face-to-face teams, except in the laboratory, it is more interesting to take virtual teams as a starting point for research and look at the specific input and process variables influencing effectiveness.

A strength of the studies presented in Chapters 2 and Chapter 3 is that we used the critical incident technique (Flanagan, 1954) to interview professional global virtual team workers. This technique has proven its worth in previous research by giving a more profound understanding of the subject studied and, because the interviewee decides what is discussed, it provides a true understanding of topics that are important (Latham, & Wexley, 1981; Wiersma, 1994; Arthur, 2001; Driskill, & Downs, 1995). A disadvantage of the technique used in Chapters 2 and 3 is that it was not proven empirically that the critical behaviors in the framework were indeed related to team satisfaction and team performance. This limitation was compensated by the study presented in Chapter 4, where we found empirical evidence for the relation between EVTB and the outcomes. This study also provided a more profound understanding of why the behaviors are important, by demonstrating the mediating role of team trust. For future research it would be interesting to look at other process variables that might explain the importance of EVTB, by means of the instrument developed in Chapter 4 (for an overview of processes, see Kozlowski, & Ilgen, 2006). An example of a process that might be important is cohesiveness. Cohesiveness has previously been found to be an important process variable in virtual teams (Martins et al., 2004). Moreover, it would also be interesting to look at other factors influencing trust besides EVTB. Previously it has been found that trust has been related to shared social norms, repeated interactions, and shared experiences (e.g. Bradach, & Eccles, 1988; Jarvenpaa, & Leidner, 1999).

A strength of the study presented in Chapter 3 is that we selected national cultures with practical and theoretical relevance. Theoretically, these countries were different on some cultural dimensions of Hofstede (2001), but similar on other cultural dimensions (maximum variation sampling) (Miles, & Huberman, 1994). Practically the countries were also
interesting because India, Belgium, and the United States have many virtual team workers. A lot of work that was previously done within Europe or the U.S. is now outsourced to India. For future research it would be interesting to obtain a deeper understanding of EVTB in, for example, China or countries in Eastern Europe, because people in these countries are becoming common in global virtual teams. This can be done by means of a large survey study with EVTB instrument. Besides asking whether certain behaviors are common in the virtual team, for future research it would be interesting to know how important members of various national cultures perceive the behaviors to be. This can then be linked to the effectiveness of virtual teams. Another important future research question could be how a global virtual team should deal with cultural differences. In Chapter 3 we suggested to follow the fusion theory in which differences are respected. However, is this really the best solution? Or should one culture be assigned as being dominant over the others? Or does it help enough to provide insights regarding cultural differences in virtual teams? Research regarding this topic is needed. The results of this research might then even have consequences for our instrument in which handling diversity concerns behaviors dealing with cultural differences in global virtual teams. Now this category is a part of the instrument. When we have more insights on how to deal with the various national cultures in global virtual teams, this category might even become more important.

A limitation of the study in Chapter 4 is that the instrument that has been developed was only based on Chapter 2. In Chapter 3 we found that an important category, namely respectfulness, was missing in the overview of EVTB. In Chapter 4, this category had not been taken into account when the instrument was developed. In order to have an instrument that can be used across cultures, Respectfulness should probably be incorporated into the instrument. This will be something for future research.

A limitation of the investigations presented in Chapters 4 and 5 is the use of one group of respondents to respond to all variables. We tried to deal with this cross-sectionality problem by using split samples. With split samples we found the same results as in the original analyses. This indicates that our results were not biased. A strength of the studies presented in Chapters 4 and 5 is that we used several observations per virtual team. Thus, the findings were not based on the perception of one single individual.

The study presented in Chapter 5 has provided insights into the effects of isolation and social presence in global virtual teams. For future research, we suggest to study the effects of social categorization based on isolation in a laboratory setting. Thus various configurations could be compared and it could be tested whether our reasoning regarding
geographical configuration and in-group out-group dynamics holds stand. In addition to this, we suggest to use objective measures for effectiveness. In Chapter 5 we used perceptions of performance because this was the only way to compare the various global virtual teams with each other. Moreover, we suggest that other researchers interested in social presence should look at the effect of other inputs besides media technologies, such as other geographical aspects and national culture. Our research has shown the important role of isolation; it would be interesting to look at other effects of configuration on social presence.

We based our study on an input-process-outcome model that suggests causality. In all our studies, however, we collected data at one point in time, which makes it impossible to draw conclusions with regard to cause and effect. A suggestion for future research is, therefore, to study this matter longitudinally.

### 6.4 Conclusion

In sum, this dissertation has provided more insight into inputs, processes, and outcomes in global virtual teams. The instrument to measure EVTBB that has been developed in this dissertation has added to the knowledge on interaction behaviors in global virtual teams that underlie processes important for the effectiveness. In addition, we have looked at the effects of the input variable national culture and showed the relation of these EVTBB to team performance and team satisfaction. We have also demonstrated the important role of team trust in this relation. Moreover, this dissertation has given insight into the effect of isolation and outcomes, and the mediating role of social presence. Although our results have answered some important questions and contributed to a better understanding of inputs, processes, and their effects on outcomes in global virtual teams, our results also have raised many new questions. Therefore, we would like to invite fellow researchers to join us in future research to get a better understanding of inputs, processes and outcomes in global virtual teams.


References


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Summary

This dissertation addresses the topic of effectiveness in global virtual teams. Nowadays, many organizations use global virtual teams in which employees from all over the world work together by means of interaction media. Examples of these media are email, chat, and audio conference. Although global virtual teams bring many benefits to the organizations, such as a reduction of travel expenses and the possibility to use talents from all over the world, organizations also complain about problems such as not meeting deadlines and reduced satisfaction of the team members. In the introduction of this dissertation we have provided an overview of the state of the current literature regarding the effects of input variables and process variables on outcome variables in virtual teams (Martins, Gilson, & Maynard, 2004; Hackman, & Morris, 1975). According to various researchers (e.g. Martins et al., 2004; Kozlowski, & Ilgen, 2006; Schiller, & Mandviwalla, 2007) there is limited research and theory on the effectiveness of virtual teams, creating many research challenges. To get a better understanding of virtual teams, we have presented four chapters in which we have addressed and investigated input variables (isolation and national cultures), process variables and interaction behaviors (social presence, trust, and effective virtual team behaviors (EVTB)), and the effects of these variables on outcome variables (satisfaction and performance).

We were interested to know what behaviors are critical for the effectiveness (outcome variable) in global virtual teams. It is important to know these behaviors among team members because they transform inputs into outcomes in global virtual teams (Powell, Piccoli, & Ives, 2004; Rousseau, Aubé, & Savoie, 2006). An overview of these behaviors, however, was lacking in the virtual team literature (Martins, Gilson, & Maynard, 2004). In the study presented in Chapter 2, interviews by means of the critical incident technique (Flanagan, 1952) were held among 30 professional global virtual team workers in the Netherlands. The interviews focused on experiences with critical interaction behaviors of virtual team workers in their team. We clustered the 413 critical behaviors that had been
Summary

derived from the interviews into 13 categories of effective virtual team behaviors (EVTB). The categories of critical interaction behaviors are:

- Media use
- Handling diversity
- Interaction volume
- In-role behavior
- Structuring of meeting
- Reliable interaction
- Active participation
- Including team members
- Task progress communication
- Extra-role behavior
- Sharing by leader
- Attendance
- Social-emotional communication

These categories are perceived as critical for the effectiveness of global virtual teams. Furthermore, to broaden the knowledge of behaviors in global virtual teams, we were interested whether the perceived importance of these EVT B behaviors is culture specific. The study presented in the third chapter concerns national cultures (input variable) and EVT B. The framework in Chapter 2 was based on interviews with professional global virtual team workers in the Netherlands. In Chapter 3, we investigated whether members of professional global virtual teams who were located in the U.S., India, and Belgium perceive the same interaction behaviors to be critical as the Dutch members. We thus investigated whether we could generalize the findings that were presented in Chapter 2 to other national cultures. Thirteen virtual team workers in the U.S., 11 in India, and 11 in Belgium were interviewed by means of the critical incident technique (Flanagan, 1954). The results show that EVT B are culture specific. Most of the behaviors mentioned by the American, Indian, and Belgian respondents could be grouped into the same 13 categories, however, the distributions differed significantly from each other and from those of the Dutch. This means that other national cultures emphasize or put greater value on other behaviors. Indian and Belgian interviewees also mentioned behaviors that could not be grouped into the existing framework. This seemed
to imply that, after investigating these national cultures, we needed to add a fourteenth category to the original framework: Respectfulness.

In this dissertation we also investigated how EVTBF can be measured in a valid and reliable way. On the basis of the critical incidents that were derived from the critical incident technique interviews (Flanagan, 1954) in Chapter 2, we developed an instrument to measure EVTBF. We did this by means of an online survey among 310 professionals that work in global virtual teams. We entered items that had originally been grouped into 13 categories into an exploratory factor analysis. After we conducted this analysis, we found 8 theoretically sound scales of at least three items:

- Information sharing
- Interaction volume
- Interaction frequency
- Active involvement
- Handling diversity
- Extra-role behavior
- Reliable interaction
- Including team members

Each scale had a high Cronbach's alpha, meaning that the scales are reliable. The studies presented in Chapter 2 and 3 based the relation between EVTBF and effectiveness on interviews with professional global virtual team workers. In Chapter 4, we provide empirical evidence that EVTBF are indeed positively related to team performance and team satisfaction in global virtual teams. This means that the instrument has concurrent validity with regard to effectiveness (Hough, 1998). The correlations were significant but not too strong, indicating divergent validity. Hence, we provide an instrument to measure EVTBF in global virtual teams that can be used to investigate and understand EVTBF behaviors and to develop more profound theories regarding virtual teams.

Furthermore, our research concerned whether trust (process variables) can explain the relation between EVTBF and effectiveness (outcome variable). This research question regarding team trust has been addressed in Chapter 4. From all the professionals that completed the online survey, we selected 168 individuals from 47 global virtual teams of which at least three people completed the EVTBF instrument, as well as questionnaires
Summary

measuring team trust, team performance, and team satisfaction. The results of Chapter 4 show a positive relation between EVTB and outcomes. Moreover, our findings show that team trust mediated the relations between EVTB and team satisfaction and team performance, respectively. The study described in Chapter 4 has provided more evidence of the role of trust in global virtual teams. Following Martins et al.’s (2004) suggestion, we conclude that researchers should focus on mediating effects in global virtual teams, team trust is an important mediator between EVTB and effectiveness in global virtual teams.

Finally, using the data from the online survey among 47 professional virtual teams, our research in Chapter 5 shows that isolation (input variable) and social presence (process variable) influence outcomes in global virtual teams. Isolated team members are members with no other team members at their sites (O'Leary, & Cummings, 2007). Social presence is the subjective feeling that other team members are perceived as physically present and with whom one feels psychologically involved (Bente, Rüggenberg, Krämer, & Eschenburg, 2008). Previous researchers (e.g. O'Leary, & Mortensen, in press) had already found that isolation has a positive influence on outcome variables, but, the mechanisms through which this occurred were not clear. In our investigation, we established similar positive relations between isolation and outcomes. However, we also found that social presence mediates the positive relation between isolation and effectiveness in global virtual teams. Therefore we conclude that isolation is positively related to outcome variables through the process of social presence.

In the final chapter, Chapter 6, we reflect on the results of each of the studies. Based on this theoretical and practical reflection, we present four main lessons that we have learned for global virtual teams in practice and organizations that have "gone virtual." The first lesson concerns the importance of EVTB for the effectiveness of global virtual teams and provides specific recommendations for each of the categories. The second lesson that we have learned is that we have to take into account cultural differences in global virtual teams for them to be effective. The third lesson learned for global virtual teams in practice concerns the important role of trust in the relation between EVTB and effectiveness. This dissertation has provided specific behaviors for trust to be improved in global virtual teams. The fourth lesson we have learned is that organizations should pay attention to the geographical configuration of global virtual teams. More specifically, our results suggest more than one geographically defined subgroup should be avoided.
Samenvatting
(Summary in Dutch)

Dit proefschrift gaat over de effectiviteit van virtuele teams die over de wereld zijn verspreid. Veel organisaties maken gebruik van virtuele teams waarin werknemers in de hele wereld met elkaar samenwerken met behulp van interactieve mediavormen. Voorbeelden van deze interactieve mediavormen zijn e-mail, chat en audio conference. Hoewel virtuele teams veel voordelen hebben, zoals verminderde reiskosten, afgenomen reistijd en de mogelijkheid om talenten uit de hele wereld aan te wenden, zijn er volgens de organisaties ook problemen met bijvoorbeeld het halen van deadlines en de waardering in tevredenheid door teamleden. In de introductie van dit proefschrift zijn we ingegaan op de huidige literatuur betreffende de inputvariabelen, procesvariabelen en uitkomstvariabelen in virtuele teams (Martins, Gilson, & Maynard, 2004; Hackman, & Morris, 1975). Vele onderzoekers (o.a. Martins et al., 2004; Kozlowski, & Ilgen, 2006; Schiller, & Mandviwalla, 2007) laten zien dat er nog weinig theorie is over en onderzoek is gedaan naar de effectiviteit van virtuele teams. Dit betekent dat er nog vele lacunes te dichten zijn. Om een beter inzicht te krijgen in virtuele teams, presenteren wij vier hoofdstukken waarin we dieper zijn ingegaan op inputvariabelen (afzondering en cultuur), procesvariabelen en interactiegedrag (sociale aanwezigheid, vertrouwen en effectieve virtuele gedragingen), en het effect van deze variabelen op de uitkomsten (tevredenheid en prestatie).

In het onderzoek wilden wij graag weten welke gedragingen cruciaal zijn voor de effectiviteit (uitkomstvariabelen) van virtuele teams. Het is van belang om deze te kennen omdat gedragingen van teamleden verantwoordelijk zijn voor het omzetten van inputvariabelen naar uitkomstvariabelen (Powell, Piccoli, Ives, 2004; Rousseau, Aubé, & Savoie, 2006). Een overzicht van zulk gedrag ontbrak echter in de huidige literatuur (Martins, Gilson, & Mayard, 2004). In het onderzoek, in Hoofdstuk 2, staan de 'critical incident' interviews (Flanagan, 1954) beschreven die gehouden zijn onder 30 leden van verschillende professionele virtuele teams. Tijdens deze interviews heeft de nadruk gelegen op de
ervaringen die de geïnterviewden hadden met cruciaal gedrag. We hebben de 413 voorbeelden van cruciaal gedrag gegroepeerd, die verkregen zijn tijdens de interviews, in 13 categorieën van effectieve virtuele team gedragingen (EVTB). Deze categorieën zijn:

- Mediagebruik
- Omgaan met diversiteit
- Interactievolume
- In-rol gedrag
- Structureren van meetings
- Betrouwbare interactie
- Actief meedoen
- Betrekken van teamleden
- Communicatie van taakvoortgang
- Extra-rol gedrag
- Delen van documenten door leider
- Aanwezig zijn
- Sociaal-emotionele communicatie

Samengevat worden deze categorieën als cruciaal ervaren voor de effectiviteit van virtuele teams die over de wereld zijn verspreid. Verder hebben wij onderzocht of het ervaren belang van EVTBC cultuurspecifiek is. Het onderzoek dat wordt gepresenteerd in Hoofdstuk 3 concentreert zich op cultuur (inputvariabele) en EVTBC. Het overzicht dat is ontwikkeld in Hoofdstuk 2 is gebaseerd op interviews met professionals die werkzaam zijn in Nederland. In het onderzoek dat staat beschreven in Hoofdstuk 3 hebben wij onderzocht of professionals uit virtuele teams in de Verenigde Staten, India en België dezelfde gedragingen cruciaal vinden als de Nederlandse leden uit virtuele teams. We hebben gekeken of we de bevindingen van Hoofdstuk 2 kunnen generaliseren naar andere culturen. In Hoofdstuk 3 hebben we 13 virtuele teamleden in de Verenigde Staten, 11 in India, en 11 in België geïnterviewd. De resultaten laten zien dat het ervaren belang van EVTBC cultuurafhankelijk is. De meeste voorbeelden van cruciale gedragingen die door de Amerikanen, Indiërs en Belgen zijn genoemd, zijn gegroepeerd in de 13 categorieën, hoewel de verhoudingen in die verdelingen onderling en met de Nederlanders verschillen. Dit betekent dat de onderzochte verschillende culturen de nadruk leggen op andere gedragingen. De geïnterviewden uit India en België
Samenvatting

vermelden daarnaast nog een type gedrag dat we niet in het bestaande overzicht hebben kunnen plaatsen. Dit betekent dat we, na analyse van verschillende culturen, een veertiende categorie aan ons overzicht hebben moeten toevoegen: respect tonen.

In dit proefschrift hebben we ook onderzocht hoe EVTB op een betrouwbare en valide manier kunnen worden gemeten. Met behulp van de voorbeelden van cruciale gedragingen die zijn verkregen door middel van de critical incident interviews uit Hoofdstuk 2, hebben we een instrument ontwikkeld om EVTB te meten. Dit hebben we gerealiseerd middels een online vragenlijst onder 310 professionals die werkzaam zijn in virtuele teams. Op basis van een exploratieve factoranalyse, uitgevoerd op de items uit de oorspronkelijke 13 categorieën, hebben we 8 schalen gevonden:

- Informatie delen
- Interactievolume
- Interactiefrequentie
- Actief meedoen
- Omgaan met diversiteit
- Extra-rol gedrag
- Betrouwbare interactie
- Betrekken van teamleden

Elke schaal had een hoge Cronbach's alpha, wat betekent dat de schalen betrouwbaar zijn. De studies in Hoofdstuk 2 en 3 zijn gebaseerd op de relatie tussen EVTB en de uitkomstvariabelen op de interviews met de leden van virtuele teams. In Hoofdstuk 4 leveren we empirisch bewijs dat de EVTB inderdaad positief samenhangen met tevredenheid en prestatie (uitkomstvariabelen) in virtuele teams. Dit betekent dat ons instrument concurrent valide is met betrekking tot effectiviteit (Hough, 1998). De correlaties zijn significant, maar niet te sterk, wat een indicatie is voor divergente validiteit. We hebben dus een instrument ontwikkeld om EVTB te meten, dat gebruikt kan worden om EVTB te onderzoeken en te begrijpen en om meer diepgaande theorieën betreffende virtuele teams te ontwikkelen.

Het proefschrift richt zich verder op de vraag of vertrouwen (procesvariabele) de relatie tussen EVTB en effectiviteit (uitkomstvariabele) verklaart. In Hoofdstuk 4 zijn we ingegaan op deze vraag. Van alle professionals die de online vragenlijst ingevuld hebben, zijn 168 leden van 47 virtuele teams, waarvan minimaal 3 leden de vragenlijst hadden ingevuld,
Samenvatting
geselecteerd. De resultaten laten een positieve relatie zien tussen EVTB en de uitkomstvariabelen. Bovendien hebben we laten zien dat vertrouwen de relatie tussen EVTB en tevredenheid respectievelijk prestatie medieert. Het onderzoek dat wordt beschreven in Hoofdstuk 4 geeft meer bewijs van de belangrijke rol van vertrouwen in virtuele teams. In navolging van de suggestie van Martins et al. (2004), dat onderzoekers hun aandacht moeten richten op mediërende effecten in virtuele teams, concluderen we dat vertrouwen een belangrijke mediator is tussen EVTB en effectiviteit van virtuele teams.

Het onderzoek in Hoofdstuk 5, waarbij de data van 47 virtuele teams is gebruikt, laat ten slotte zien dat afzondering (inputvariabele) en sociale aanwezigheid (procesvariabele) invloed hebben op de uitkomsten in virtuele teams die over de wereld zijn verspreid. Afgezonderde teamleden hebben geen andere leden op hun locatie (O'Leary, & Cummings, 2007). Sociale aanwezigheid is het subjectieve gevoel dat de andere teamleden fysiek aanwezig zijn terwijl ze dat niet zijn. Bij een hoge sociale aanwezigheid voelt men zich dus psychologisch betrokken met zijn of haar virtuele teamleden (Bente, Rüggenberg, Krämer, & Eschenburg, 2008). Voorgaande onderzoeken (bijvoorbeeld. O'Leary, & Mortensen, in druk) hebben al aangetoond dat afzondering een positief effect heeft op uitkomstvariabelen. Het onderliggende verklarende mechanisme was echter niet duidelijk. In ons onderzoek, hebben we een vergelijkbare positieve relatie aangetoond tussen afzondering en effectiviteit van virtuele teams. Maar bovendien hebben we aangetoond dat sociale aanwezigheid deze relatie medieert. Daarom concluderen wij dat sociale aanwezigheid het positieve effect van afzondering verklaart.

In het laatste hoofdstuk, Hoofdstuk 6, reflecteren we op de resultaten van alle studies. Gebaseerd op deze theoretische en praktische reflectie presenteren we vier geleerde lessen voor virtuele teams in de praktijk en organisaties die virtueel zijn gaan werken. De eerste les gaat over het belang van EVTB voor de effectiviteit van virtuele teams en geeft specifieke aanbevelingen voor alle EVTB categorieën. De tweede les die we hebben geleerd is dat het belangrijk is om culturele verschillen in acht te nemen voor het effectief laten zijn van een virtueel team. De derde les voor virtuele teams in de praktijk gaat over het belang van vertrouwen. Ons onderzoek geeft specifieke aanbevelingen omtrent welk gedrag het vertrouwen kan verhogen. De vierde les die we geleerd hebben is dat organisaties moeten letten op de verdeling van het aantal teamleden over geografische locaties. Onze resultaten laten zien dat het voorkomen moet worden dat een team meer dan één geografische subgroep heeft.
Daphne Dekker was born on October 27, 1980 in Hilversum, the Netherlands. She obtained her Master's degree at the University of Utrecht in Organizational Psychology in 2004. One semester she studied abroad at Simon Fraser University in Vancouver, Canada. During her study in Utrecht, Daphne was active as a student assistant in statistics and during her last year she instructed courses concerning communication skills and conflict management as a psychology trainer. In September 2004, she started her PhD-research on the effectiveness of virtual teams at the department of Technology Management at the Eindhoven University of Technology. This dissertation is the result of her work. Daphne is currently working as a teacher at the Psychology Department of the Radboud University in Nijmegen. Besides teaching, she is a member of the quality management team concerning the psychology program of the Radboud University in Nijmegen.