

**MASTER**

**Development of the critical teamwork competence questionnaire**

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*Award date:*  
2009

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Eindhoven, August 2009

**Development of the  
Critical Teamwork Competence  
Questionnaire**

by  
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in partial fulfilment of the requirements for the degree of

**Master of Science  
in Innovation Management**

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TUE. Department Technology Management.  
Series Master Theses Innovation Management

Subject headings: (ENG) Competence, Team, Measurement, Questionnaire  
(NL) Competentie, Team, Meten, Vragenlijst

## Abstract

Military staff is increasingly required to serve in teams that are composed of people who do not know each other beforehand. The team members have often diverse expertise which is brought together to meet a specific, mostly short-term, objective. This type of team is referred to as an ad-hoc team.

Working in an ad-hoc team brings along specific challenges. Preliminary research indicated that it is more difficult to engage in core teamwork components, such as back-up behavior and mutual performance monitoring. Therefore, it has been assumed that ad-hoc teams are more likely to be effective when they consist of people who are competent in engaging in core teamwork components. It is expected that more competent members, will engage in these critical components more easily. In this thesis, a competence is defined as “a set of behaviours, which is instrumental in the delivery of desired results or outcomes” (Landy & Conte, 2004, p. 116). The competences are regarded as mixtures of knowledge, skills, abilities, and personality characteristics (KSAO's), in which each of the ingredients is equally important. Due to the increasing usage of ad-hoc teams within the Dutch military, there is an increasing demand for training concepts to support this particular type of team. Currently, TNO is engaged in the development of such a training concept. One of the steps of the development of this training concept is the creation of an assessment tool. This assessment tool is supposed to assess the ad-hoc team members on a range of factors which are related to ad-hoc team effectiveness. For most factors, validated and reliable questionnaires already exist. However, for the measurement of critical teamwork competences a validated and reliable questionnaire was unavailable. Therefore, this thesis focused on the development of an instrument to measure critical teamwork competences. Based on literature, six competences were selected to comprise the Critical Teamwork Competences Questionnaire (CTCQ). These were: Team Orientation, Mutual Trust, Mutual Performance Monitoring, Back-up Behaviour, Adaptability and Communication. To be able to measure the competences properly, each competence was split up into two or more distinct facets. For each of the 13 facets a set of questions was devised. This resulted in an initial 88-item questionnaire. Before the CTCQ could be used, three aspects were to be assessed (Cooper& Schindler, 2003): reliability, validity and practicality. Therefore, the following three research questions were answered in this thesis:

- R1: Does the (CTCQ) assess the competences in a reliable way?
- R2: Does CTCQ assess the competences in a valid way?
- R3: Does the CTCQ assess the competence in a practical way?

Each research question was answered by a separate study. The first study assessed the reliability of the CTCQ. During this study, the internal consistency, factor structure and stability of the CTCQ were assessed. The results can be found in Table 1. The internal consistency assessment revealed that the scale on the communication facet ‘information sharing’ was unreliable. Since the psychometric quality of the scale could not be improved, the facet was excluded from the rest of the studies. Some items from the other scales were deleted and this resulted in a 38-item questionnaire. The factor structure showed that the majority of items related to different scales also loaded on distinct factors. Only the items that belonged to the adaptability facet ‘change’ and the mutual performance monitoring facet ‘monitoring’, appeared not to load on the intended factor. However a set of new items for these scales should be created in future, the scales have been taken into account in the rest of the studies to provide additional insights for future item generation. The test-retest reliability evaluated whether the scales were reliable over time. Therefore, the consistency was assessed between the responses of an individual within a one-month interval. The majority of the scales were proven to be reliable over time, but both mutual trust facets reported an unsatisfactory result. It was decided not to drop the scales, but to take them into account in the other studies as well to obtain additional insights for future improvements. To answer the first research question: 8 scales were found to be reliable, 4 required extra attention in future to improve their reliability and 1 scale was dropped and should be completely

revised. The result of study one was that the CTCQ which was used in study two and three consisted of 38 items that measured 12 facets of 6 teamwork competences.

The second study focussed on the second research question and concerned the validity of the CTCQ. The study consisted of two parts: the construct validity and the criterion-related validity. The results are shown in Table 1. The construct validity was assessed by comparing the results of the CTCQ to the results of several existing instruments that were expected to be related. Additionally, the construct validity was assessed by the discriminant validity by comparing it to an instrument which was not expected to be related. The study gathered evidence to assume construct validity of the most of the CTCQ scales.

To assess the criterion-related validity, an experiment was conducted. Forty-one teams of three people engaged in a team task. After the task was completed, participants rated themselves and their peers on teamwork behaviours. Additionally, several team performance measures were obtained. The predictive power of the competences questionnaire was to be determined based on these measures. The results from this study are shown in Table 1. The data provided evidence for the criterion validity of the adaptability facet ‘change’ and the back-up behaviour facet ‘shifting’. Weak evidence was found for team orientation preference, team orientation acceptance, mutual trust open communication, mutual performance monitoring facet ‘monitoring’, back-up behavior recognition and adaptability awareness. To answer the second research question, for 8 scales evidence was found for the construct validity and for two scales the data supported the criterion validity. Hence, it cannot be concluded that this study provides support for the validity of all the CTCQ scales.

Table 1 Overview of the reliability, validity and practicality of the CTCQ Scales

#	Critical Teamwork Competence Facets	Study 1		Study 2	Study3	
		Internal Consistency	Factor structure	Construct validity	Criterion validity	Practicality (IM/SDE)
1	Team orientation <i>Preference</i>	+	+	+	+/-	+
2	Team orientation <i>Acceptance</i>	+	+	..	+/-	+/-
3	Team orientation <i>Team goal</i>	+	+	+	-	+/-
4	Mutual trust <i>Open Communication</i>	+	+	+/-	+/-	+
5	Mutual trust <i>Task, Roles, Protection</i>	+	+	-	-	+/-
6	Mutual performance monitoring <i>Monitoring</i>	+	+/-	+	+/-	+/-
7	Mutual performance monitoring <i>Feedback</i>	+	+	+	-	+/-
8	Back-up behaviour <i>Recognition</i>	+	+	+	+/-	+/-
9	Back-up behaviour <i>Shifting</i>	+	+	+/-	+	+/-
10	Adaptability <i>Awareness</i>	+	+	+/-	+/-	+
11	Adaptability <i>Change</i>	+	-	+	+	+
12	Communication <i>Closed-loop</i>	+	+	+/-	..	+
13	Communication <i>Information Sharing</i>	-	..	..	..	..

NOTE: + = Good +/- = Acceptable - = Bad ...= Not assessed

IM=Impression Management SDE= Self Deception Enhancement

The third study was related to practicality of the instrument. The practicality of the CTCQ was evaluated based on the economy, convenience and interpretability. Since the CTCQ consisted of 38 items, it is expected that it will take the respondent only 7 minutes to fill out the entire questionnaire. The questionnaire is available online and can be easily administered. Results obtained by the online questionnaire can be converted into an SPSS data file in seconds. Since a tailor-made SPSS syntax is

available, the results can be processed and converted into a personal profile quickly. Hence, it was concluded that the CTCQ is both an economic as a convenient instrument. Since this thesis provides definitions and evidence for reliability, construct validity and criterion validity, users are expected to be able to interpret the obtained results correctly. Additionally, as shown in Table 1, the study showed that the measurements were not substantially affected by impression management (IM) or self deception enhancement (SDE). This supported the interpretability of the instrument. To answer the third research question, the CTCQ can be regarded as a practical instrument but its design is be improved.

Now several scales of the CTCQ are proven to be reliable, valid and practical, the instrument will be added to TNO's ad-hoc team assessment tool. In the near future, the CTCQ profiles will serve, among other factors, as a foundation for on tailor made ad-hoc team training.

## Preface

This thesis is part the final project for the master Innovation Management of the Eindhoven University of Technology (TU/e). The project has been conducted at TNO Defence and Security in Soesterberg at the department of Training and Innovation (T&I) and Human in Command (HIC).

I would like to thank my first TU/e supervisor Tanja Bipp for her inspiring and stimulating support throughout the whole project. I really appreciated the large amount of time she made available to help me. Her enthusiasm and valuable comments have contributed vastly to the quality of the project. I also would like to thank my second supervisor Josette Gevers for her efforts and useful remarks. Her expertise on teams really contributed to my understanding of the project and substantially improved the quality of this report.

This project would not have been possible without the support of my company supervisor Josephine van Meer. I would like to thank her for her support during the project and everything she organized for me at TNO. Furthermore, I would like to express my special gratitude towards Peter Essens and Tineke Hof. The interesting discussions and their input were highly appreciated. Finally, I would like to thank David Molenaar, Wim Kamphuis, Diana Draaijer and Rick van der Kleij for their useful advice and help during the experiment.

Ward Venrooij,  
Soesterberg, August 2009

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# 1 Introduction

This chapter presents the background, purpose, research question and the structure of this thesis.

## 1.1 Background

“In a situation I faced in Kuwait, I was in charge of more than 300 people from many nations who were literally thrown together. I had to form teams. I didn’t know any of them, none of us really knew what we were going to do. I didn’t know what level of training or particular talents any of them had, I didn’t know what made them tick, so when I came to distribute them, I had no idea who would make a good partner with whom, who would survive in more rugged areas, and who would not”. This account was given by a brigadier from the British army while being interviewed about the beginning of the second Gulf War (Mills, Pascual, Blendell, Molloy & Verrall, 1999, p. 22). Military personnel are increasingly required to serve in teams that are composed of people who do not know each other beforehand. This type of team is referred to as an ad-hoc team. While regular teams can be defined as ‘two or more individuals who have specific roles, perform interdependent tasks, are adaptable, and share a common goal’ (Krokos, Baker, Alonso, & Day, 2009, p. 384), ad-hoc teams have the following additional specific characteristics (Mills et al., 1999):

- Team members have diverse expertise which is brought together to meet a specific objective.
- The teams consist of people who have rarely or never worked with each other before.
- Often the team is put together to reach a short-term goal and the team is due to disassemble after the team objective is met.

The second Gulf War is just one example of the increasing amount of military operations in which multi-national ad-hoc teams are formed. Multi-national cooperation, which is often referred to as a combined operation, is also becoming regular practice for the Dutch military. The Dutch participation in the NATO Response Force, peace keeping operations and various Operations Other Than War, requires the ability to cooperate closely with personnel from different military departments and other non military agencies (Koninklijke Landmacht [KL], 2008). Because members of ad-hoc teams initially are not used to working with each other, there is a certain degree of unfamiliarity within the team. The expertise of its members is often diverse and the members are likely to be unfamiliar with or unaware of the skills and expertise of the other team members. Despite this personal and functional unfamiliarity, the team members are expected to act as an effective team on the short-term. Operating in ad-hoc teams has shown to bring along several challenges to team effectiveness. Research has shown that it is mainly the lack professional familiarity that causes challenges to teamwork (Mills et al., 1999). This professional familiarity is about ‘knowing what people are like to work with and how to work with them’ (Mills et al., 1999, p 10). Mills et al. (1999) conducted interviews with 20 UK military officers who had been involved in military ad-hoc teams. This resulted in four fundamental problem areas for ad-hoc teams mentioned in Table 2.

Table 2 *Identified fundamental problem areas in ad-hoc teams (Mills et al., 1999, p 9)*

Fundamental problem area	Identified/ discussed by:	Key issues addressed:
Communications	66%	<ul style="list-style-type: none"> <li>• A lack of familiarity means team members are unsure of the best ways to convey information to each other.</li> <li>• More misunderstandings and communication breakdowns.</li> <li>• In multinational teams there are significant language and cultural barriers to contend with.</li> </ul>
Establishing & maintaining situational awareness	73%	<ul style="list-style-type: none"> <li>• More difficult to know other team members' information requirements and when/ where to update them.</li> <li>• More difficult to be sure team members have understood situation updates.</li> </ul>
Engaging in 'core' teamwork behaviours	80%	<ul style="list-style-type: none"> <li>• More difficult to know how and when to monitor each other's situation, tasks and progress.</li> <li>• More difficult to know how and when to offer performance feedback.</li> <li>• More difficult to know how and when to intervene and support/help each other.</li> </ul>
Additional leadership challenges	86%	<ul style="list-style-type: none"> <li>• More difficult to allocate tasks (due to lack of knowledge about strengths and weaknesses of individuals).</li> <li>• More difficult to anticipate what other team members will do in situations.</li> <li>• More difficult to anticipate and prevent team problems.</li> <li>• More difficult to manage and co-ordinate a unified effort.</li> <li>• More difficult to know how to motivate team members.</li> <li>• More effort required building and maintaining a good team atmosphere.</li> <li>• Cultural and political issues may be present in multinational teams.</li> </ul>

Four fundamental problem areas are distinguished in the table above. The first problem is related with communication. Due to a lack of familiarity among the team members, communication is reported to be more difficult. As a result, misunderstandings are more likely to occur in ad-hoc teams than in conventional teams. The second problem area is related with building and maintaining shared awareness in teams. In ad-hoc teams it is reported to be more difficult to keep each other up to date than in conventional teams. Engaging in core teamwork behaviours is also more difficult than in conventional teams. Finally, leading ad-hoc teams is also reported to be more complex.

Since ad-hoc team structures are rapidly becoming common practice in the Dutch military, there is an increasing demand for training concepts that support ad-hoc teams in becoming effective quickly. However, to the knowledge of the author no such training concepts are available at the moment.

## 1.2 Purpose

This thesis is part of a larger TNO project on ad-hoc team training. The main aim of the TNO project is to develop a tailor made training concept for ad-hoc teams in order to enable them to become effective as quickly as possible. The project focuses mainly on ad-hoc teams which are formed in the higher strategic echelons of the military. Hence, the target group of training consists mainly of military staff officers and commanders. It is assumed that the ad-hoc teams are already formed before the training commences and that the instruments developed in this project will not be used for selection purposes.

The development of this training concept comprises of three steps. The first step consists of describing the antecedents and mediators of effectiveness of ad-hoc teams (Venrooij, van Meer, Hof & Essens 2009). The second step involves, based on findings from a literature study, developing an assessment tool that is able to evaluate ad-hoc team members on a range of relevant factors (described in this thesis). In future, this tool should be able to identify possible impediments to ad-hoc team effectiveness based on these relevant factors. Finally, the third step encompasses the development of the training concept to enable ad-hoc teams to overcome these impediments and become effective as fast as possible.

The most relevant antecedents of ad-hoc team effectiveness identified from the literature (Venrooij et al., 2009) are:

1. Critical Teamwork Competencies; individual competencies, such as mutual performance monitoring and adaptability, are expected to enhance the effectiveness of ad-hoc teams.
2. Big-Five Personality traits; traits, such as conscientiousness and extraversion, are likely to foster ad-hoc team effectiveness.
3. Goal orientation; a learning goal orientation is expected to be positive for ad-hoc team effectiveness, while a performance goal orientation is considered to affect performance negatively.

Further discussion with the project team led to three possible additional antecedents of effectiveness in ad-hoc teams:

4. Demographics; such as age and background. Demographic difference is expected to decrease effectiveness (Sartori, Waldherr & Adams, 2006).
5. DISC behaviour styles; i.e. Dominance, Influence, Stability and Conformity. Specific combinations between these four behavioural styles are expected to increase effectiveness (Furlow, 2000).
6. Belbin team roles; roles such as the teamworker, plant and coordinator. Some combinations are expected to increase effectiveness while others may lead to friction (Mumford, Iddekinge, Morgeson & Campion, 2008).

The assessment tool is supposed to assess team members on the factors mentioned above, and will lead to an individual and team profile on these factors. To serve as a foundation for the training, all these factors should be measurable in a reliable and valid way. For most factors, a validated and reliable questionnaire already exists. However, a valid and reliable questionnaire measuring critical teamwork competencies was missing. Hence, the research problem that this thesis addressed concerned the construction of a validated and reliable questionnaire to assess critical teamwork competences.

### 1.3 Defining the research questions

The process of developing a questionnaire to assess the critical teamwork competences consists of two steps. First, developing the Critical Teamwork Competences Questionnaire (CTCQ) based on the current body of literature. Second, testing the instrument.

According to Cooper & Schindler (2003) an instrument has to be tested on three major criteria:

1. Reliability; relates to the accuracy and precision of the tool
2. Validity; relates to whether the tool actually measures what was planned to be measured
3. Practicality; includes economy, convenience and interpretability of the instrument.

Therefore, the following three research questions were posed:

- R1: Does the critical team competence questionnaire assess the competences in a reliable way? An instrument can be called reliable when it generates consistent results (Cooper & Schindler, 2003).

- R2: Does the critical team competence questionnaire assess the competences in a valid way?  
An instrument can be regarded as valid when the scales accurately represent the concepts it intends to measure.
- R3: Does the critical team competence questionnaire assess the competences in a practical way?  
The practicality of a tool can be evaluated considering the following aspects: economy, convenience and interpretability (Cooper & Schindler, 2003). Economy refers to the financial aspects of the use of the instrument. Convenience of an instrument is related to the ease-of-use. Interpretability is related to the extent to which outsiders can understand the results easily.

Each of the three research questions will be answered by conducting a separate study. Hence, study one, two and three are related to research question numbers one, two and three respectively.

#### **1.4 Structure of the report**

Chapter two describes the construction of the Critical Teamwork Competences Questionnaire (CTCQ). Chapter three deals with the research question 1 and describes the methods and results of the reliability study. In Chapter four, research question 2 is addressed by describing the methods and results from the validity study. Research question 3 is answered in chapter five, in which the practicality study is assessed. Chapter six contains a conclusion and general discussion. Furthermore, limitations and directions for further research are presented in that chapter.

## 2 Development of the competences questionnaire

This chapter deals with development of the Critical Teamwork Competences Questionnaire (CTCQ). First, the selection process of the competences that constitute the CTCQ is described. Second, the chapter elaborates on the creation of questionnaire items for each of the selected competences. The chapter concludes with a brief overview.

### 2.1 Selection of the competences

The selection of the competences for the CTCQ was mainly based on the theoretical model presented by Salas, Sims and Burke (2005). A literature review conducted by these authors resulted in a list of eight core teamwork components, which were expected to be critical across various types of teams. Exclusion of some of these components in teamwork was believed to result in decreased team effectiveness. Salas et al. (2005) presented the following core components for teamwork:

1. Team leadership (e.g. coordination, motivation)
2. Team orientation (e.g. the motivation to be part of the team)
3. Mutual performance monitoring (e.g. keep an eye on each other's performance)
4. Back-up behaviour (e.g. help each other when necessary)
5. Adaptability (e.g. change strategies when environment changes)
6. Shared Mental Models (e.g. knowledge on relationships and interaction)
7. Closed-loop communication (e.g. effective communication between members)
8. Mutual Trust (e.g. trust among team members)

Salas et al. (2005) assumed that these eight components interacted with each other, as shown in the theoretical model displayed in Figure 1. As presented in the figure, team leadership and team orientation are among the first required teamwork components. In combination with proper communication and the emergence of shared mental models and mutual trust, they were expected to enable the team to engage in the other teamwork components, such as mutual performance monitoring, back-up behaviour and adaptability. According to the model, the components back-up behaviour and adaptability were expected to eventually lead to team effectiveness.

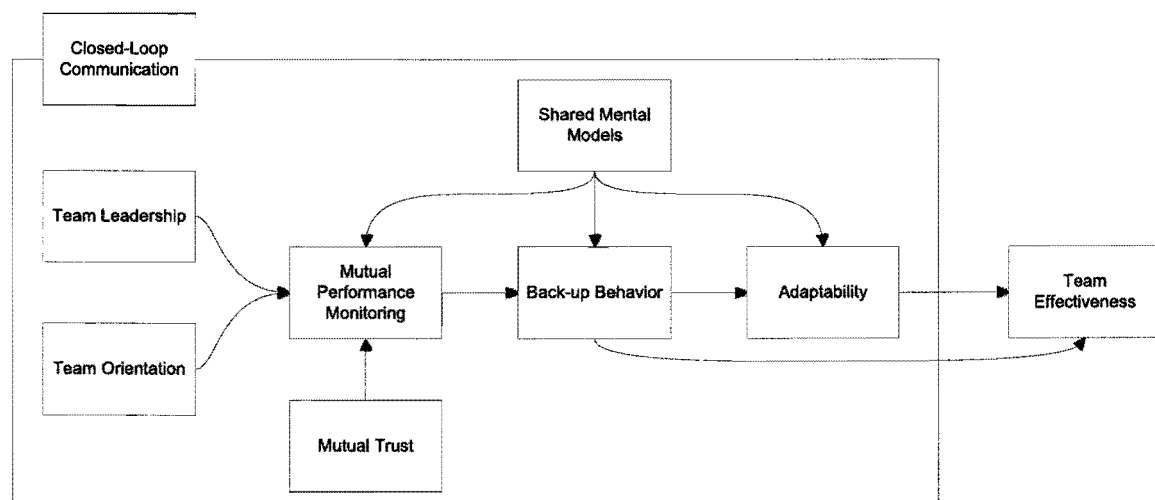


Figure 1 Model of teamwork (Salas et al., 2005, p. 571)

Since ad-hoc teams are expected to operate in the same way as conventional teams, these critical teamwork components were assumed to be required in ad-hoc teamwork as well (Venrooij, et al., 2009). However, research shows that engaging in these components is more difficult in ad-hoc teams

(Mills et al., 1999). For example, mutual performance monitoring was argued to be challenging due to typical ad-hoc team related characteristics like personal unfamiliarity and diversity in expertise (Venrooij et al., 2009). Due to these ad-hoc related challenges, it is more difficult to engage in core teamwork components, and perform well. Therefore, it has been assumed that ad-hoc teams are more likely to be effective when they consist of people who are competent in engaging in core teamwork components. It is expected that more competent members, will engage in these critical components more easily. In order to select the most relevant competences required for successful ad-hoc teamwork, the author attempted to match every core teamwork component to an appropriate competence. In this thesis, a competence is defined as “a set of behaviours, which is instrumental in the delivery of desired results or outcomes” (Landy & Conte, 2004, p. 116). The competences are regarded as mixtures of knowledge, skills, abilities, and personality characteristics (KSAO's), in which each of the ingredients is equally important. Furthermore, only competences on the individual team member level of analysis were taken into account and each competence was regarded as changeable over time.

The competencies were selected from a recently published overview of KSAO's, which contained competencies that were argued to be important for effective teamwork. This overview was created by Salas, Rosen, Burke & Goodwin (2009) and comprised thirty competences. Examples are mission analyses, adaptability and closed-loop communication. Unfortunately, not all critical teamwork components could be matched to an appropriate competence. For example, the component 'shared mental models' reflects an emergent state that could not be expressed as an individual competence. Also the vital teamwork component 'leadership' was not matched, since it appeared to constitute an array of competences. Mutual trust was matched with an individual competence although it was presented as an emergent state by Salas et al. (2005). Hence, the author linked six out of eight critical teamwork components listed in Salas et al. (2005) to a competence. These six competences that comprise the Critical Teamwork Competences Questionnaire (CTCQ) are: team orientation (TO), mutual trust (MT), mutual performance monitoring (MPM), back-up behaviour (BU), adaptability (AD) and closed-loop communication (CO).

## **2.2 The construction process**

A deductive approach has been used to generate items (Hinkin, 1998). Based on definitions and behavioural markers presented by Salas et al. (2005; 2009), the items of the initial questionnaire were developed. The author created the items in cooperation with a specialist at TNO. For each competence, the specialist and the author studied and discussed the definitions and behavioural markers. After the discussion a set of items was developed. It must be noted that no items have been derived from existing scales. Occasionally, the Dutch military competence handbook was used to get a better understanding of the defined different competence levels of an individual. In order to construct a reliable set of items, it appeared to be necessary to split up each competence into multiple facets that represented parts of the competence. Therefore, the six competences have been divided into thirteen facets. The competencies and their subordinate facets are presented in Section 2.3. After the initial questionnaire was constructed, it was reviewed by a questionnaire specialist at TNO. After improving various items, the CTCQ was administered to two students. Results from the CTCQ were individually discussed with each student on both competence- and item level. Based on these two discussions, several items have been rephrased. As a result, the initial CTCQ consisted of 88 items.

For convenience, the CTCQ was published as an online questionnaire in which the respondent had to answer ten questions per page. Respondents were asked whether the items were applicable to them and to rate each item on a 7-point Likert scale from 'strongly disagree' (1) to 'strongly agree' (7). A 7-point Likert scale was used to generate an adequate variation among respondents.

## **2.3 Construction of the CTCQ scales**

This section elaborates on the development of the scales that constitute the CTCQ.

### 2.3.1 Team orientation

Team orientation, as a component of teamwork, does not only relate to behaviours, but also to a certain attitude (Salas et al., 2005). It has been defined as the ‘propensity to take other’s behaviour into account during group interaction and the belief in the importance of team goals over individual members’ goals’ (Salas et al., 2005, p.560). Hence, team orientation contains also the individual’s preference to work in a team (Driskell & Salas, 1992). In a recent paper on various teamwork competencies, Salas et al. (2009) referred to a competence for team/collective orientation. In Table 3, the description and three behavioural examples of this competence are shown.

Table 3 Team orientation competence (Salas et al., 2009, p.52)

Teamwork competence	Description	Examples
Team/collective orientation	A preference for working with others and the tendency to enhance individual performance through the coordination, evaluation, and utilization of task inputs from other group members while performing group tasks.	-Team members are accepting input from other teammates; input is evaluated based on quality, not source. -Team members have high levels of task involvement, information sharing, participatory goal setting, and strategizing. -Team members value team goals over individual goals.

Based on the description of the competence mentioned in Salas et al. (2009) and the descriptions in Salas et al. (2005), three distinct facets which constitute this competence have been identified:

- Preference (preference to work with others)
- Acceptance (accepting input from team mates)
- Team goal importance (assigning a higher priority to team goals over individual goals)

Team orientation preference (TO-P) reflects the attitudinal part of the competence. It is related with someone’s preference to work with others instead of alone. Acceptance (TO-A) refers to the acceptance of task input from other group members. The facet ‘team goal’ (TO-T) relates to whether someone values the team goal over his or her individual goal. To be able to measure these three facets of team orientation, seventeen items have been created. Five items have been created for TO-P, eight for TO-A and four for TO-T. These items can be found in Appendix 1.

### 2.3.2 Mutual Trust

Mutual trust is defined as “the shared perception that individuals in a team will perform particular actions important to its members and will recognize and protect the rights and interests of all the team members engaged in their joint endeavor” (Salas et al., 2005, p. 568). In this thesis, mutual trust was not regarded emergent state, but was expected to reflect the competence to engage in trusting others. Therefore, not the trust which emerges in a team. This propensity to trust was assumed to be measurable on the individual level. Mutual trust was regarded as a competence as proposed by Salas et al. (2009) in Table 4.



Table 4 *Mutual trust competence* (Salas et al., 2009, p. 54)

Teamwork competence	Description	Examples
Mutual trust	The shared belief that team members will perform their roles and protect the interests of their teammates.	-Team members share a belief that team members will perform their tasks and roles. -Team members share a belief that fellow team members will work to protect the interests of the team. -Team members are willing to admit mistakes; they are not fearful of reprisal. -Team members share information openly.

Based on the descriptions in Salas et al. (2005; 2009), the author identified two distinct facets:

- Task, Roles & Protection (e.g. belief that team members perform tasks and roles, and protect interests of the team)
- Open communication (e.g. willingness to admit mistakes & information sharing)

The ‘task, roles and protection’ facet (MT-TRP) relates to the initial trust somebody has in potential team members. Higher scores on this facet, indicate a stronger initial believe that fellow team members will work to protect team interests and will perform their task and roles. The ‘open communication’ facet (MT-OC) is expressing someone’s initial belief that mistakes can be admitted and information can be shared freely without reprisal. To be able to measure these two facets, thirteen items have been created. Six items for MT-TRP and seven item for MT-OC. These items can be found in Appendix 1.

### 2.3.3 *Mutual performance monitoring*

Mutual performance monitoring is defined as the ‘ability to develop common understandings of the team environment and apply appropriate task strategies to accurately monitor teammate performance’ (Salas et al., 2005, p.560). Or to put it more simply, ‘keeping track of fellow team members’ work while carrying out their own <...>, to ensure that everything is running as expected and observing fellow team members to be sure that they are following procedures correctly’ (McIntyre & Salas, 1995 p.23). Salas et al. (2005) presents two behaviours which are related to this component:

- Identifying mistakes and lapses in other team members’ actions
- Providing feedback regarding team member actions to facilitate self-correction.

Salas et al. (2009) presents a competence which is strongly related with the teamwork component presented by Salas et al. (2005). The description of this competence can be found in Table 5.

Table 5 *Mutual performance monitoring competence* (Salas et al., 2009, p. 55)

Teamwork competence	Definition	Examples
Mutual performance monitoring	The ability of team members to keep track of fellow team members’ work while carrying out their own to ensure that everything is running as expected.	-Team members recognize errors in their teammates’ performance. -Team members recognize superior performance in their team mates. -Team members offer relevant information/resources before requested. - Team members have an accurate understanding of their teammates’ workload. -Team members offer feedback to their fellow teammates to facilitate self-correction.

Based on the description of the competence and teamwork component mentioned above, two distinct facets have been identified:

- Monitoring (e.g. keeping track of fellow team members)
- Feedback (e.g. giving feedback to fellow team members about their performance)

Although the name contains the word ‘mutual’, it must be noted that the teamwork component was not regarded as an emergent state in this thesis. The ‘monitoring’ facet (MPM-M) is related to keeping track of the work done by others in the team. This includes monitoring workload and recognition of both errors and superior performance of colleagues. The ‘feedback’ facet (MPM-F) reflects the extent to which someone will engage in giving feedback to his or her teammates. However both facets contain the word ‘mutual’, it must be noted that both facets were assumed to be measurable at the individual level. Fifteen items have been created to measure these two facets, six for MPM-M and nine for MPM-F. The items can be found in Appendix 1.

### 2.3.4 Back-up behaviour

Back-up behaviour is described as helping fellow team members when they require it (McIntyre & Salas, 1995). A more elaborate definition is given by Salas et al. (2005, p. 560) “ability to anticipate other team members’ needs through accurate knowledge about their responsibilities. This includes the ability to shift workload among members to achieve balance during periods of high workload or pressure”. Back-up behaviour is expected to influence team effectiveness directly by ensuring that all the parts of the team task are completed (Salas et al., 2005). According to Salas et al., (2009) the competence related to back-up behaviour is defined as presented in Table 6.

Table 6 Back-up behaviour competence (Salas et al., 2009, p.55)

Teamwork competence	Definition	Examples
Back-up behaviour	Ability to anticipate other team members’ needs through accurate knowledge about their responsibilities. This includes the ability to shift workload among members to achieve balance during high periods of workload or pressure.	-Team members proactively step in to assist fellow team members when needed. -Team members communicate the need for assistance. -Team members can identify unbalanced workload distributions. -Team members redistribute workload to underutilized team members

Two facets have been identified that reflect different elements of back-up behaviour.

- Recognition (by potential back-up providers or recipients that there is a workload distribution problem in their team)
- Shifting (shifting work to underutilized team members or helping other team members when needed)

‘Recognition’ (BU-R) is related to the ability to recognize unbalanced workload distributions in a team. Also communicating need for assistance is assumed to be part of this facet. ‘Shifting’ (BU-S) reflects a more attitudinal part of this competence. It is related to assisting each other by finishing work. Explaining other team members how to do a job more effectively is also part of this facet.

To measure someone’s recognition ability, eight items were created and for shifting five. These items can be found in Appendix 1.

### 2.3.5 Adaptability

This competence refers to the ability to adapt team performance processes to the environment in order to obtain team performance outcomes (Salas et al., 2009). It is defined as the “ability to adjust

strategies based on information gathered from the environment through the use of back-up behaviour and reallocation of intrateam resources. Altering a course of action or team repertoire in response to changing conditions” (Salas et al., 2005, p. 560). This teamwork component is critical for teams that operate in dynamic environments (Salas et al., 2009). Three adaptability behaviours were presented by Salas et al., (2005):

- Remain vigilant to changes in the internal and external environment of the team.
- Identify cues that a change has occurred, assign a meaning to that change, and develop a new plan to deal with these changes
- Identify opportunities for improvement and innovation for habitual or routine practices

The competence for adaptability is mentioned in Table 7.

Table 7 Competence for adaptability (Salas et al., 2009, p. 55)

Teamwork competence	Definition	Examples
Adaptability	ability to adjust strategies based on information gathered from the environment through the use of back-up behaviour and reallocation of intrateam resources. Altering a course of action or team repertoire in response to changing conditions	-Team members modify or replace routine performance strategies when characteristics of the environment and task change. -Team members detect changes in the internal team and external environments. -Team members make accurate assessments about underlying causes of environmental changes.

The adaptability competence has been divided into the following facets:

- Awareness (remain vigilant to changes in the internal and external environment of the team).
- Change (assign meaning to that change, and develop a new plan to deal with the changes)

Adaptability facet ‘awareness’ (AD-A) is the ability to detect changes in the environment and within the team. Making accurate assessments about causes is assumed to be part of this facet. ‘Change’ (AD-C) reflects the ability to alter a course of action. People who score high on change are expected to adapt themselves quicker to changing conditions. The awareness scale consisted of six items while the change scale had nine. In Appendix 1, the items are shown.

### 2.3.6 Closed-loop communication

Closed-loop communication is a coordinating mechanism that refers to a specific way of communicating that facilitates effective teamwork (Salas et al., 2009). This way of communicating consists of the following three steps (Salas et al., 2009):

- A message is communicated by the sender.
- The message is received, interpreted and acknowledged by the receiver
- The sender verifies whether the message was both received and correctly interpreted.

In Table 8, a definition of closed-loop competence and examples are presented.

Table 8 *Closed-loop communication competence (Salas et al., 2009, p. 61)*

Teamwork competence	Definition	Examples
Closed-loop you communication	A pattern of communication characterized by (1) a message being initiated by the sender, (2) the message being received, interpreted and acknowledged by the intended receiver, and (3) a follow-up by the sender ensuring that the message was received and appropriately interpreted	<ul style="list-style-type: none"> <li>-Team members follow up to ensure that messages are received and understood.</li> <li>-Team member acknowledge messages when they are sent.</li> <li>-Team members cross check information with the sender to ensure that the message's meaning is understood.</li> <li>-Team members seek information from all available resources.</li> <li>-Team members provide "big-picture" updates to one another as appropriate.</li> <li>-Team members proactively pass information without being asked.</li> </ul>

This competence consists of two facets:

- Closed-Loop
- Information sharing

Communication facet 'Closed-Loop' (CO-CL) is related to the three step communication protocol presented above. People who are competent in closed-loop communication, follow this communication pattern.

'Information sharing' (CO-IS) is more related to the examples mentioned in Table 8. It reflects the ability to search for information from all available resources and share information proactively.

The closed-loop scale consisted of seven items while the information sharing scale had five. The items can be found in Appendix 1.

## 2.4 Conclusion

The competences that comprise the CTCQ were selected based on the model presented by Salas et al. (2005). The following six competences were selected: team orientation, mutual trust, mutual performance monitoring, mutual feedback, adaptability and communication. Every competence has been split up in two or more distinct facets that represent aspects of the competence. The facets are shown in Table 9. For each facet, a scale has been constructed. The initial CTCQ consisted of 13 facets which were measured by 88 items on a 7-point Likert scale. The 88 items can be found in Appendix 1.

Table 9 *Overview CTCQ competencies and facets*

	Competence	Facet	# initial items
1	Team orientation	Preference	5
2	Team orientation	Acceptance	8
3	Team orientation	Team goal	4
4	Mutual trust	Open Communication	7
5	Mutual trust	Task, Roles, Protection	6
6	Mutual performance monitoring	Monitoring	6
7	Mutual performance monitoring	Feedback	9
8	Back-up behaviour	Recognition	8
9	Back-up behaviour	Shifting	5
10	Adaptability	Awareness	6
11	Adaptability	Change	9
12	Communication	Closed-loop	7
13	Communication	Information exchange	5

## 3 Study 1: Reliability

In order to evaluate the Critical Teamwork Competences Questionnaire (CTCQ), three research questions have been presented in Chapter one. Each of these questions has been answered using a separate study. However, it must be mentioned that all studies used respondents originating from one main sample. The main sample consisted of 161 respondents of which 123 participated in all three studies. The majority of the sample ( $N=129$ ) was drawn from a TNO respondent-database and received a financial compensation of €45 for their participation. The rest of the sample consisted of students from the Technical University in Eindhoven, who received no financial compensation.

This chapter deals with the first research question and describes the reliability study. This study consisted of three parts: internal consistency, factor structure and stability. This chapter will start with presenting the methods used to assess the reliability of the CTCQ. After discussing the methods, the obtained results are presented. This chapter concludes with a brief discussion of the results.

### 3.1 Method

This section will present the hypotheses, participants, procedure, measures and data analysis that were used in the reliability study.

#### 3.1.1 Hypotheses

The reliability of a scale reflects the consistency between multiple measurements of a specific construct (Hair, Black, Babin, Anderson & Tatham, 2006), and can be measured by determining the internal consistency, factor structure and the stability of the scale. Internal consistency refers to the consistency among a set of items that are used to measure the same construct (Hair et al., 2006). The initial CTCQ consisted of thirteen facets that have been measured by thirteen sets of items. For each facet the items were expected to measure the same facet and should, therefore, be highly correlated.

In addition to the internal consistency, the underlying factor structure of the questionnaire was assessed. Since the competences were based on a set critical teamwork components which was argued to be interrelated by Salas et al. (2005), factors were assumed to be correlated. However, each item was expected to measure a distinct competence facet, therefore, no substantial cross-loadings were expected in the factor plot.

Stability refers to reliability of measurements over time (Hair et al., 2006). To evaluate the stability of the CTCQ, the consistency was assessed between the responses of an individual between two points in time. A one-month interval was applied, since this period was expected to be long enough for the respondents to forget their initial answers and short enough to avoid the individual competences to change. The CTCQ was expected to be stable and, therefore, the two measurements of the respondents were expected to correlate positively. Rules-of-thumb in personality research suggested a minimal correlation of  $r = .70$ . In contrast to personality, competences were assumed to be changeable states. Therefore, a less strict criterion of  $r \geq .50$  was applied.

- *(H1): The two CTCQ measurements of the same respondents will be positively correlated ( $r \geq .50$ )*

#### 3.1.2 Participants

In order to assess internal consistency and factor structure, a sample of 161 people was used. This sample was partly drawn from the TNO participant database (81%,  $N=129$ ) and partly from the TU/e (19%,  $N=32$ ). The respondents from the TNO database had an average age of 24.3 years ( $SD = 4.0$ ), 56% was male, 66% was student and 34% was employed. The response rate for the TNO sample was

100%. The participants from the TU/e sample were not asked to report their age and gender, but it is expected that the sample had a similar average age and gender distribution. The response rate at the TU/e was 80% (40 people were invited to join). A statistical test was used to verify whether these two samples could be merged.

To assess the stability, 45 people were drawn from the TNO participant database. They were asked to fill out the CTCQ twice with an interval of at least one month. The response rate was 87% ( $N=39$ ). The respondents were on average 24.2 years old ( $SD=3.66$ ), 47% was male, 73% was student and 27% employed.

### 3.1.3 Procedure

Data for the internal consistency study and factor structure were obtained by administering the CTCQ on a computer. The respondents from the TNO database were asked to fill out the online questionnaire when they arrived at TNO. One of TNO's laboratories, equipped with three computers, was used during the whole experiment. The respondents recruited at the TU/e were sent an e-mail containing a hyperlink that brought them to the CTCQ. They completed the questionnaire at home or on university grounds.

For the stability study, the first data sample was gathered at TNO in the same way as the internal consistency study. After exactly one month the first 45 respondents who engaged in the experiment received an e-mail with a hyperlink that brought them to the CTCQ website for the second time.

### 3.1.4 Measures

The answers on the 88-item CTCQ were used for the reliability analyses. As already was reported in chapter two, each item was rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

### 3.1.5 Data analysis

To check whether the answers from TU/e and TNO samples differed significantly, a non-parametric Mann-Whitney test was performed. This test was conducted for each of the 88 items from the CTCQ. For evaluating the internal consistency, Cronbach's alpha has been calculated for all the thirteen facet scales. This reliability coefficient ranges between 0 and 1, in which higher values reflect a better internal consistency. A generally agreed lower limit of Cronbach's alpha is .70 (Hair et al., 2006). Therefore, all alphas above .70 were considered as an indication of a sufficient internal consistency (Field, 2005). In case the internal consistency was not satisfactory, items were removed to enhance the psychometric quality of the instrument (Cooper & Schindler, 2003). In the event that a Cronbach's alpha was found to be above .70, items have been deleted to shorten the length of the questionnaire. Since a minimum of three items is required per scale, no scale was shortened to less than three items.

To analyze the factor structure, exploratory factor analysis was conducted. Since the minimum recommended item-to-response ratio equals 1:4 (Hinkin, 1998), the factor structure could only be calculated after the CTCQ was shortened to at least 40 items. Therefore, the internal consistency analysis necessarily preceded this analysis. It must be noted that the exploratory factor analysis was used for the evaluative purposes only. Therefore, no changes in the questionnaire were made as a result of this analysis. Since the competences were based on a set of interrelated critical teamwork components, the competences were expected to correlate. Correlations were also expected between facets that originated from same competence. Therefore, an oblique rotation was used to obtain theoretically meaningful factors. Instead of the principal component method, principal axes method was used for two reasons. First, not to mix common, specific and random error variances as was advised by Hinkin (1998). Second, principle axis factoring was used since the primary objective of this research was to identify the underlying constructs in the original variables (Hair et al., 2006). Based on a .05 significance level ( $\alpha$ ), a power level of 80%, and, the assumption that the standard errors were twice those of conventional correlation coefficients, factor loadings above .45 were regarded as significant with the current sample size (Hair et al., 2006). The latent root criterion was applied for the first interpretation, so all factors with an Eigen value above 1 were retained. Since 12 factors were initially expected, an a priori stopping rule of 12 was applied in an additional analysis.

The results were compared. Since the obtained factor structures were comparable, only the factor solution obtained by the latent root criterion will be discussed.

To determine the test-retest reliability, the two measurements over time (1 month) were compared by conducting correlational analysis. Due to a sample size below  $N=50$ , the Sharpiro-Wilk test was conducted to assess the normality of the distributions.

### 3.2 Results

#### 3.2.1 Data exploration

The non-parametric Mann-Whitney test was used to compare the means of each item between the two samples. The test identified five significant differences which were all related to the Team Orientation Preference items. The TU/e sample scored significantly higher on the five Team Orientation Preference items  $1315.5 \leq U \leq 1434.5$ ,  $p < .01$ ,  $-0.25 \leq r \leq -0.21$ . Since the effect sizes  $r$  were all below  $|r = .30|$ , the effects were only small. Therefore, they were not further considered and it was concluded that the samples could be merged. Both univariate and multivariate outlier analyses have been conducted prior to the reliability study. Though some odd answering patterns were indicated, no respondents were excluded from the dataset. Lack of convincing evidence was the main reason not to exclude respondents. Since the digital questionnaire was programmed to force the respondent to answer all questions, no values were reported missing.

For the test-retest analysis, one respondent was excluded from the analysis. This decision was made based on visual inspection of several scatter plots and a univariate outlier analysis. For each facet scale a scatter plot was constructed to compare scores of the respondents between the two points in time. Six of the twelve scatter plots indicated a substantial deviation in the responses of respondent number 107. An outlier analysis of the average differences between the two ratings in time confirmed this finding. Respondent 107 had an absolute  $z$ -score of 4.02 ( $p < .0001$ ), which was well above the absolute maximum of 3.29 (Field, 2005). The rest of the respondents scored below  $|1.96|$  and therefore only respondent 107 was removed from the dataset. The descriptive statistics for the test-retest reliability assessment can be found in Table 10 and Table 11. As can be seen in Table 10 and 11, the distributions of AD-C (t1 & t2), MPM -M (t1), MT-OC (t1), MT-TRP (t1), TO-A (t2) and CO-C (t2) were significantly different from normal. Therefore, the test-retest reliability of AD-C, MPM-M, MT-OC, MT-TRP, TO-A and CO-C was assessed with Spearman correlations.

Table 10 Descriptive statistics for the test-retest reliability (t1)

	Minimum	Maximum	M	SD	Skewness	Kurtosis	Shapiro-Wilk	
							Statistic	Sig.
AD-A (t1)	3.00	6.00	4.92	0.76	-0.56	-0.05	.95	.07
AD-C (t1)	3.33	6.33	5.11	0.75	-0.57	0.39	.94	.03
BU-R (t1)	2.75	6.5	4.84	0.89	-0.29	-0.39	.97	.34
BU-S (t1)	3.67	6.67	5.46	0.77	-0.46	-0.31	.95	.08
MPM-M (t1)	3.25	6.75	4.97	0.88	0.07	-0.72	.97	.44
MPM-F (t1)	1.33	6.67	4.59	1.03	0.90	2.06	.94	.04
TO-T (t1)	1.33	7.00	4.42	1.51	-0.25	-0.82	.96	.22
TO-A (t1)	3.67	7.00	5.52	0.79	0.01	-0.26	.97	.31
TO-P (t1)	1.67	7.00	4.51	1.40	-0.08	-0.92	.97	.33
MT-OC (t1)	3.33	6.67	5.25	0.79	-0.43	0.63	.94	.04
MT-TRP (t1)	3.00	7.00	5.62	0.90	-0.98	2.25	.90	.00
CO-C (t1)	2.33	6.67	4.87	0.94	-0.67	0.51	.95	.07

Note:  $N=38$  (t1)= measurement at time 1

TO-P	Team Orientation Preference	MPM-F	Mutual Performance Monitoring Feedback
TO-A	Team Orientation Acceptance	BU-S	Back-up behaviour Shifting
TO-T	Team Orientation Team Goal	BU-R	Back-up behaviour Recognition
MT-OC	Mutual Trust Open Communication	AD-A	Adaptability Awareness
MT-MTRP	Mutual Trust Team Roles and Protection	AD-C	Adaptability Change
MPM-M	Mutual Performance Monitoring Monitoring	CO-CL	Communication Closed-Loop

Table 11 *Descriptive statistics for the test-retest reliability (t2)*

	Minimum	Maximum	M	SD	Skewness	Kurtosis	Shapiro-Wilk Statistic	Sig.
AD-A (t2)	3.33	6.33	5.25	0.72	-0.74	0.72	.92	.01
AD-C (t2)	3.67	6.33	5.21	0.64	-0.13	-0.48	.96	.19
BU-R (t2)	3.25	6.5	4.99	0.86	-0.28	-0.76	.96	.14
BU-S (t2)	3.67	7.00	5.57	0.71	-0.51	0.44	.96	.19
MPM-M (t2)	3.25	6.75	5.18	0.73	-0.14	0.72	.96	.29
MPM-F (t2)	2.67	6.67	4.9	0.90	-0.57	0.11	.96	.16
TO-T (t2)	1.00	7.00	4.16	1.39	-0.18	-0.55	.98	.77
TO-A (t2)	3.33	7.00	5.52	0.76	-0.27	1.10	.93	.02
TO-P (t2)	1.00	6.67	4.39	1.36	-0.40	-0.47	.97	.28
MT-OC (t2)	3.00	7.00	5.18	0.82	-0.46	0.51	.96	.21
MTT-RP (t2)	3.67	7.00	5.39	0.75	-0.27	-0.44	.96	.14
CO-C (t2)	2.33	7.00	5.02	0.97	-0.82	0.72	.93	.02

Note: N=38 (t2)= measurement at time 2

### 3.2.2 Results Internal consistency

This analysis was used to verify the reliability of the scales that measure the 13 competences facets. The results of the internal consistency assessment can be found in Table 12. The table mentions the initial Cronbach's alpha of each scale while including all the items. Furthermore, the items which were kept and removed from the scale are presented in combination with the final amount of items of the scale and final Cronbach's alphas.

Table 12 *Reliability expressed in Cronbach's alpha*

	<i>CTCQ Scale</i>	<i>Initial <math>\alpha</math></i>	<i>Items kept</i>	<i>Items deleted</i>	<i>#Items final</i>	<i>Final <math>\alpha</math></i>
1	Team orientation <i>Preference</i>	.94	1,2,4	3, 5	3	.93
2	Team orientation <i>Acceptance</i>	.84	1,2,5	3, 4, 6, 7,8	3	.83
3	Team orientation <i>Team goal</i>	.89	1,2,3	4	3	.92
4	Mutual trust <i>Open Communication</i>	.79	4,5,7	1,2,3,6,8	3	.74
5	Mutual trust <i>Task, Roles, Protection</i>	.91	1,3,4	2,5,6	3	.89
6	Mutual performance monitoring <i>Monitoring</i>	.74	1,4,5,6	2,3	4	.71
7	Mutual performance monitoring <i>Feedback</i>	.75	1,2,4	3, 5,6,7,8,9	3	.81
8	Back-up behaviour <i>Recognition</i>	.77	2,3,4,5	1,6,7,8	4	.85
9	Back-up behaviour <i>Shifting</i>	.72	1,3,4	2,5	3	.76
10	Adaptability <i>Awareness</i>	.79	1,5,6	2,3,4	3	.80
11	Adaptability <i>Change</i>	.76	1,6,9	2,3,4,5,6,7,8	3	.76
12	Communication <i>Closed-loop</i>	.73	2,4,5	1,3,6,7	3	.77
13	Communication <i>Information exchange</i>	.53	3,4,5	1,2	3	.59

Note: N=161

As shown in Table 12, all initial scales, except communication information exchange, reported initial Cronbach's alpha's above .70. To shorten the questionnaire, several items were deleted. This process resulted in twelve internally consistent scales with three or four items each. The psychometric quality of the communication information exchange scale could not be improved and its Cronbach's alpha remained well below  $\alpha=.70$ . This internal consistency analysis resulted in a 38-item questionnaire that was used in the rest of this study and in the following two studies.



### 3.2.3 Results Factor structure

The factor structure was obtained to evaluate whether the remaining 38 CTCQ items loaded on the expected factors. As stated before, factors were extracted based on Principal Axis Factoring in combination with the latent root criterion. Hence, all factors with an Eigen value above 1 were retained. Due to expected correlations, oblique rotation was used. The obtained factor structure can be found, among the other factor analysis results, in Appendix 2. As the rotated factor matrix shows, an eleven-factor solution was obtained ( $\lambda_1=9.68$  to  $\lambda_{11}=1.02$ ), which accounted for 64% of the total variance.

Three items correlated with factor 1 (BUS1, BUS3, BUS4) and their factor correlations ranged from  $r = .49$  to  $r = .76$ . Since these three items were developed for the back-up shifting scale, factor 1 was referred to as the 'BU-S factor'. The three items of the mutual trust task roles and protection scale correlated with factor 2 (MTTRP1, MTTRP3, MTTRP4). The factor correlations ranged from  $-.73$  to  $-.86$ . Factor two was named "MT-TRP". Factor 3 was found to correlate to the three team orientation preference items (TOP1, TOP2, TOP4). These items were developed for the team orientation preference scale and had factor correlations ranging from  $.81$  to  $.85$ . Hence, factor 3 was called 'TOP'. The mutual trust open communication items correlated with factor 4 (MTOC4, MTOC5, MTOC7) while their factor correlations ranged from  $.56$  to  $.83$ . Since no substantial cross loadings ( $\geq .40$ ), were found, the factor was called MT-OC. The three mutual performance monitoring feedback items correlated with factor 5. The factor correlations ranged from  $.56$  to  $.83$ , and the factor was named MPM-F. The three items measuring closed-loop communication, correlated with factor 6 (COC2, COC4, COC5). Their factor correlations ranged between  $.59$  and  $.83$ , and the factor was called CO-C. The three adaptability awareness items correlated with factor 7 (ADA1, ADA5, ADA6). Their factor correlations ranged from  $-.65$  to  $-.76$  and the factor was referred to as AD-A. The three team orientation team goal items correlated with factor 8 (TOT1, TOT2, TOT3) with factor correlations ranging from  $.70$  to  $.92$ . Since the items were developed for the same scale, the factor was called TO-T. Four factors were found to correlate with factor 9 (TOA1, TOA2, TOA5, ADC6). The TOA items were developed for the team orientation acceptance scale, while ADC6 was initially developed for the adaptability change scale. The TOA item factor correlations ranged from  $-.53$  to  $-.65$ , while the ADC6 correlation was  $-.50$ . Although this cross loading, the factor was called TOA. This was done because the wording of ADC6 was found to be related with TOA. Four factors were correlated to factor 10 (BUR2, BUR3, BUR4, BUR5). These items were developed for back-up recognition scale and their factor correlations ranged from  $-.50$  to  $-.84$ . Two items correlated with factor 11 (MPMM4, MPMM5). The factor correlations ranged were  $.65$  and  $.53$  respectively. Since both items belong to the mutual performance monitoring facet 'monitoring' scale, this factor was referred to as MPMM.

To sum up, 11 factors could be assigned to individual competence facets. One factor, comprised items from two competence facets and not all 38 items correlated with factor. As stated before, no changes were made to the 38-item questionnaire that was derived from the internal consistency study.

#### Results Test-retest

The 38-item CTCQ was subjected to a test-retest analysis. The analysis was conducted using an interval of more than one month. The average time between the measurements was 35.5 days ( $SD=5.67$ ). Whether the scales met the hypothesized  $r > .50$  criterion, is shown in Table 13.

Table 13 Test-retest reliability of the CTCQ Scale

#	CTCQ Scale	Mean $t_1$	SD $t_1$	Mean $t_2$	SD $t_2$	Correlation
1	Team orientation <i>Preference</i>	4.51	1.40	4.39	1.36	$r$ .75
2	Team orientation <i>Acceptance</i>	5.52	0.79	5.52	0.76	$r_s$ .62
3	Team orientation <i>Team goal</i>	4.42	1.51	4.16	1.39	$r$ .72
4	Mutual trust <i>Open Communication</i>	5.25	0.79	5.18	0.82	$r_s$ .47
5	Mutual trust <i>Task, Roles, Protection</i>	5.62	0.90	5.39	0.75	$r_s$ .43
6	Mutual performance monitoring <i>Monitoring</i>	4.97	0.88	5.18	0.73	$r_s$ .67
7	Mutual performance monitoring <i>Feedback</i>	4.59	1.03	4.90	0.90	$r$ .70
8	Back-up behaviour <i>Recognition</i>	4.84	0.89	4.99	0.86	$r$ .65
9	Back-up behaviour <i>Shifting</i>	5.46	0.77	5.57	0.71	$r$ .52
10	Adaptability <i>Awareness</i>	4.92	0.76	5.25	0.72	$r$ .53
11	Adaptability <i>Change</i>	5.11	0.75	5.21	0.64	$r_s$ .64
12	Communication <i>Closed-loop</i>	4.87	0.94	5.02	0.97	$r_s$ .51

Note:  $N=38$   $r$  = Pearson correlation,  $r_s$ =Spearman correlation

As can be seen in Table 13, two scales were correlated above  $r = .70$ . Seven scales above  $r = .60$ , ten scales above  $r = .50$  and two scales below  $r = .50$ . Therefore hypothesis 1 was not supported for both mutual trust facets.

### 3.3 Discussion

Study one consisted of three parts: internal consistency, factor structure and stability.

To assess the internal consistency, the Cronbach's alpha of each scale was calculated and items were deleted if necessary. From the initial thirteen, twelve scales eventually reported a Cronbach's alpha above the required  $\alpha = .70$ . Only one scale failed to meet the  $\alpha = .70$  criterion for internal consistency. The communication information sharing (C-IS) scale was, therefore, excluded in the rest of the studies. The low Cronbach's alpha could be caused by diversity in the items comprising this scale. Additional assessment of the items led to believe that the scale measured more than one construct. Items CO-IS4 and CO-IS5 appeared to relate more to searching information from multiple sources, while the other items more reflected the information sharing aspect. Exploratory factor analysis confirmed this finding by reporting a two factor solution (oblique rotation, latent root criterion). Item 1, 2 and 3 loaded on factor 1 ( $\lambda_1=1.85$ ) with factor correlations ranging from .60 to .76, and item 4 and 5 on factor 2 ( $\lambda_2=1.35$ ) with correlations ranging from .89 to .90. Therefore, it is advised to split up this facet into two sub-facets, and develop several additional items for them in future. The internal reliability analysis resulted in a 38 item questionnaire.

Second, the factor structure of the 38-item CTCQ was assessed. The interpretation of the rotated factor matrix showed the eleven extracted factors (eigen value's  $>1$ ) could be assigned to a distinct competence facet. One of them, factor 11, comprised only two of the four available items for the scale on mutual performance monitoring facet 'monitoring' (MPM-M). Two items of this scale were found to be uncorrelated with any of the factors. Though the internal consistency analysis reported a satisfactory Cronbach's alpha of  $\alpha = .71$ , the two uncorrelated items were apparently not reflecting the monitoring facet properly. Evaluation of the wording of these two items indeed showed that the tone of MPMM1 and MPMM6 was different. Item 1 and 6 were found to be more negatively phrased than item 4 and 5. Therefore, it is advised to derive several new items for this scale in future which are more in line with MPMM4 and MPMM5. Furthermore, one of the factors was found to comprise all the items from team orientation 'acceptance' and one item from adaptability 'change' (ADC6). ADC6 was the only item of the adaptability facet 'change' that showed a correlation with a factor. Therefore, it was assumed that the factor belonged to team orientation acceptance rather than adaptability change. This implies that a set of new items should be devised for the adaptability change scale in future.

Third, the test-retest reliability of the CTCQ scales was assessed. A group of respondents filled out the questionnaire twice with a one-month interval and their answers were compared. For a stable scale, the criterion for the correlations between the answers was set on  $r \geq .50$ . As shown in this study, two scales were below  $r = .50$ , ten scales exceeded  $r = .50$ , seven scales exceeded  $r = .60$  and two scales exceeded  $r = .70$ . In personality research a criterion of  $.70$  is usually applied. Since the competences were regarded as changeable states, lower values until  $.50$  were accepted. It must be noted that values between  $.50$  and  $.60$  are generally not accepted as strong evidence for test retest reliability. The fact that three scales reported correlations in this range may also have been caused by the way the experiment was organized. Since all the test-retest respondents also participated in the ad-hoc team experiment (study 2), their perception of their competences may have been changed. After the task the respondents had to rate themselves and their teammates on competence related behavior and this may have changed their self-perception. Therefore, it is advised to use a sample that does not engage in additional team experiments in future. As shown in this study, the two mutual trust scales reported correlation coefficients below the criterion of  $r = .50$ . With hindsight, it was not that surprising that the mutual trust scales reported a lower test-retest correlation than the other scales. When the CTCQ was administered for the first time, the respondents were located in the same room as their teammates. Since the respondents also knew that they would work together in one team, it is likely that the answers to the mutual trust questions were related to the members present. While at the second occasion the members were at home without these team members around them. Since this possible explanation cannot be verified, future research should again evaluate the test-retest reliability of the mutual trust scales. Though both mutual trust scales did not meet the stability criterion, the scales will be taken into account into the other studies.

To conclude study one, from the initial thirteen scales the communication information exchange scale was dropped after the internal consistency analysis. The rest of this study showed that 4 of the remaining 12 scales require additional attention in future: for the adaptability facet 'change' and mutual performance monitoring facet 'monitoring' new items should be devised and both mutual trust facets should be tested again on test-retest reliability. The four scales were taken into account in the other studies to provide additional insights. Thus, the result of study one was that the CTCQ which was used in study two and three consisted of 38 items that measured 12 facets of 6 teamwork competences.

## 4 Study 2: Validity

Validity refers to the “extent to which a scale or set of measures accurately represents the concept of interest” (Hair et al., 2006, p. 137). For the CTCQ three widely accepted forms of validity were assessed; the convergent, divergent and criterion related validity. The convergent and divergent validity are often referred to as construct validity. This chapter will deal with the validity of the twelve CTCQ scales that have been derived in the previous study.

### 4.1 Method

This section will present the hypotheses, participants, procedure, measures and data analysis that were used in the validity study.

#### 4.1.1 Hypotheses

First, this section presents the hypotheses related with the convergent validity. Second, the hypotheses on the discriminant validity are presented. Third, the criterion validity hypotheses are discussed.

Convergent validity reflects the “degree to which two measures of the same concept are correlated” (Hair et al., 2006, p.137). In this study, four of the six competences were tested on convergent validity. This was due to a lack of proper instruments to determine the convergent validity of the competences ‘communication’ and ‘mutual performance monitoring’.

##### 4.1.1.1 Team orientation

The team orientation facets ‘preference’ and ‘team goal importance’ can be subjected to a convergent validity assessment by comparing it to the Individualism-collectivism scale developed by Wagner and Moch (1986) and extended by Wagner (1995). Eby en Dobbins (1997) used this scale to measure five constructs which were argued to evaluate team orientation. The constructs ‘independence’, ‘preference to work alone’ and ‘group goal’ have been selected by the author since they were expected to be closely related with the CTCQ facets on team orientation. The construct ‘independence’, measures the degree to which someone prefers to be independent of others. The concept ‘preference to work alone’ reflects the ‘affective orientation towards individualistic behaviour’ (Wagner & Moch, 1986, p.288). The construct ‘group goal’ expresses whether someone values team objectives above the individual objectives. This resulted into the following hypotheses:

- (H2): *The team orientation competence facet ‘preference’ correlates negatively with the Individualism-collectivism facet ‘independence’.*
- (H3): *The team orientation competence facet ‘preference’ correlates negatively with the Individualism-collectivism facet ‘preference to work alone’.*
- (H4): *The team orientation competence facet ‘team goal importance’ correlates positively with the Individualism-collectivism facet ‘group goal’.*

Additionally, also some correlations with the Big-Five personality inventory were expected. Extraversion refers to a combination of assertiveness/dominance and sociability/affiliation (Driskell, Goodwin, Salas & O’Shea, 2006). A high score on the extraversion dimension indicates that the candidate is socially oriented and will easily make contact with others (Bloemens, 2004). The trait extraversion includes a set of facets from which gregariousness and warmth are expected to be specifically related to the desire to work together with others instead of being alone (Driskell et al., 2006). Gregariousness reflects the preference to be with others instead of alone. Warmth expresses being affectionate and friendly. These facets are expected to correlate to the ‘preference’ facet.

- (H5): *The team orientation competence facet 'preference' correlates positively with the Big Five facet 'gregariousness'.*
- (H6): *The team orientation competence facet 'preference' correlates positively with the Big Five facet 'warmth'.*

#### 4.1.1.2 Mutual trust

The formation of trust between people is proven to depend on both perceptions and personality (Aubert & Kelsey, 2003). Earlier research showed that the personality characteristic 'propensity to trust' has a stable effect on trust between people. People with a higher propensity to trust, were more likely to trust others than people with low scores. The propensity to trust scale used by Aubert (2003), created by Jarvenpaa, Knoll and Leidner (1997), was used to test construct validity of trust competence. It was expected that the ability to trust and both mutual trust competence facets were correlated positively.

- (H7): *Both 'mutual trust' competence facets correlate positively with the 'propensity to trust' scale.*

The Big Five facet trust was also expected to relate to this competence. People who score high on the trust facet believe that team members are honest and have good intentions. People scoring low on this facet are suspicious and do not believe others to be well-intentioned or sincere (Driskell et al., 2006). This Big Five trust scale was especially expected to correlate to the Team, Roles and People facet of the mutual trust competence, since it clearly reflects the trust in people.

- (H8): *The mutual trust competence facet 'team, roles and people' correlates positively with the Big Five facet 'trust'.*

#### 4.1.1.3 Back-up behaviour

Conscientiousness and Extraversion have been found to predict back-up behaviour in teams (Porter, Hollenbeck, Ilgen, Ellis, West & Moon, 2003). Those who are more conscientious were found to be better in recognizing whether someone required back-up and provided back-up more often. Those who are more extravert were found to ask for back-up behaviour more often. These findings from previous research led to the following three hypotheses:

- (H9): *The back-up behaviour competence facet 'recognition' correlates positively with Big Five 'conscientiousness'.*
- (H10): *The back-up behaviour competence facet 'shifting' correlate positively with Big Five 'conscientiousness'.*
- (H11): *The back-up behaviour competence facet 'recognition' correlates positively with Big Five 'extraversion'.*

Back-up seeking can be regarded as an aspect of back-up behaviour. It refers to asking team members for back-up in case of work overload. Before someone engages in back-up seeking, it is believed that people compare the potential benefits and costs of seeking feedback to judge whether it is beneficial for their individual performance. Goal orientation is found to be related with this decision. People with a Prove Performance Goal Orientation (PPGO) are less inclined to engage in seeking backup than people with a Learning Goal Orientation (LGO). Due to a lack of research on the relationship between back-up behaviour and goal orientation, this relationship was tested in an exploratory manner.

#### 4.1.1.4 Adaptability

Part of the facet 'mobility' of the Pavlov Temperament Scale (PTS) was used to assess the construct validity of the adaptability competence. A part of the 'mobility' facet refers to 'the ability to adequately respond to unexpected changes in the environment and the ability to adapt to new environments' (Heck, Raad, Vingerhoets, 1993, p.5). Since this ability to adapt was expected to have a positive relation with the adaptability facet 'change', a positive correlation was hypothesized.

- (H12): *The adaptability change scale correlates positively with 'mobility' facet of the Pavlov Temperament Scale.*

People who are capable to perform properly in a changing task context score highly on adaptability (Le Pine, Colquitt & Erez, 2000). Personality has been found to predict people's adaptability in these contexts. A higher level of 'openness' has been found to predict adaptability (Le Pine et al., 2000). This led to the following hypothesis:

- (H13): *Scores on Big Five 'openness to experience' correlate positively with 'adaptability'.*

#### 4.1.1.5 Discriminant validity

Discriminant validity is the "degree to which two conceptually similar concepts are distinct" (Hair et al., 2006, p. 137). The assessment of this type of validity shows whether the CTCQ is sufficiently different from other related instruments. Goal orientation was expected to be such a different but related concept. Goal orientation refers to 'one's dispositional or situational goal preference in an achievement situation' (Payne, Youngcourt & Beaubien, 2007, p. 128). Thus, someone's goal orientation is regarded to be rather stable over time, but can be altered temporarily by situational characteristics. The last decade, goal orientation has received a considerable amount of attention in organization research (Payne et al., 2007). A recent meta-analytic review revealed that goal orientation appeared to predict job performance above and beyond personality and general mental ability (Payne et al., 2007). Two types of goal orientations have been identified: performance and learning goal orientation (Button, Mathieu & Zajac, 1996). When an individual adopts a goal through a performance orientation, the person will either try to get favorable judgments on their competence or try to avoid unfavorable remarks (Button et al., 1996). In case a person has a learning orientation and adopts a goal, the person will mainly focus on increasing his or her level of competence (Button et al., 1996). With this kind of orientation, judgments made by others are not perceived as an objective or treat, but more as valuable feedback which supports learning. It was expected that goal orientations would be conceptually different from the CTCQ competences. Therefore, correlations were expected to be below  $r=.30$ . Only the back-up competence was expected to have higher correlations with goal orientation as discussed before.

#### 4.1.1.6 Criterion validity

Criterion validity is defined as "the degree to which a summated scale makes accurate predictions of other concepts in a theoretically based model" (Hair et al., 2006, p.138). As stated before, it was expected that members with higher levels of competence would engage in critical teamwork components more easily.

Therefore, it was expected that the scores of the CTCQ facets correlate positively with the frequency that somebody engages in the facet related behaviours.

- (H15): *Scores on the CTCQ facets correlate positively with the frequency that somebody engages in facet related behaviour.*

Several studies have revealed that team performance is related to the knowledge, skills and attitudes (KSA) of the people who are on the team (Cooke et al., 2003; Stevens & Campion, 1994). It has been suggested that these abilities do not guarantee team effectiveness, but simply enable the team to be

effective. It was therefore expected that the average level of team member competences is correlated positively with team performance. Additionally, competence level differences between the team members were taken into account. Since the competences were related to teamwork, it was expected that difference in these competences would affect the performance negatively. This expectation was based on the similarity-attraction theory, which states that there will be more mutual interpersonal attraction in homogenous groups (Sartori et al., 2006). This attraction was expected to help a team in overcoming the ad-hoc related challenges to effectiveness.

Since it was unknown which of the CTCQ competences would be required for better task performance in this specific team task, no hypotheses were formulated. The relations were tested in an explorative manner.

#### 4.1.2 Participants

The participants for the construct and related validation were 123 people drawn from the TNO participant database. The participants in the sample had an average age of 24.3 years ( $SD = 4.0$ ), 56% was male and 66% was student and 34% was employed. During the criterion validity study, the participants had to work in teams of three people.

#### 4.1.3 Procedure

All the participants of this study came to TNO. After they arrived they were asked to complete the questionnaires on one of the computers in the TNO laboratory. The respondents received a unique participant ID and were told that their answers would be treated as confidential. Instead of their names, each participant was asked to use their participant ID. The respondents first completed the CTCQ after which they also filled out several additional questionnaires. Completing all the questionnaires took approximately 50 minutes in which the participants were allowed to take small breaks. To assess the criterion related validity, the respondents engaged in a team task after they completed the questionnaires. In total, 41<sup>1</sup> teams were formed that met the three ad-hoc team conditions set by Mills et al. (1999). First, the respondents had not worked with each other before. Second, they had a short-term goal and knew the team would be disassembled after the task was completed. Third, they had to complete a task in which their diverse expertise had to be brought together in order to meet a specific objective. The ad-hoc team is engaged in a task in which the members had to share information and were required to make a team decision based on all the information gathered. The research environment that was used is TIDE<sup>2</sup> (Team Interactive Decision Exercise for Teams Incorporating Distributed Expertise). This environment provided participants with a decision-task simulation in which they monitor the airspace and needed to reach consensus about an appropriate team response towards incoming airplanes. They had seven response possibilities which varied in aggressiveness: ignore (1), review (2), monitor (3), warn (4), ready (5), lock-on (6) and defend (7). Each participant had a specific role and was able to measure only a part of the attributes of the incoming plane. Since each role had its own specific knowledge about what would make a plane dangerous (the so-called 'decision rule') and the ability to measure only a part of the attributes, team members had to work closely together. Based on the information gathered from the others, each team member should individually devise an appropriate response and send it to the main computer. After the three team members had decided individually, the team had to determine the most suitable team response. A screenshot can be found in Appendix 4. Discussion was required because the outcome of each individual decision rule did not necessarily predict the appropriate team response. The three team members were required to share the outcomes on the decision rules and combine these findings to find the right team response. The team members could communicate by chat, but were also allowed to talk with each other directly. Each computer showed a clock on the screen that counted down from 300 seconds. A beep sounded when 30 seconds were remaining. The team needed to discuss about how to respond to the incoming aircraft and take appropriate action. After the team order was sent, the team received feedback containing the correct answers. Each team was engaged in 30 trials of approximately two minutes. During the first 10 trials, the teams could derive a correct team decision

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<sup>1</sup> Originally the teams worked under three slightly different experimental conditions, but these conditions did not result in any significant differences in the obtained dataset.

by simply taking the average of the individual judgments. This implied that the outcomes of the individual decision rules had the same weight in the team decision. After round 10, the environment changed without prior notice and the correct team decision could only be derived by taking only one of the individual decisions into account. This implied that input from the two other players was not necessary anymore to make the right team decision. Since this change was unexpected, the team initially judged each individual decision as equally important which caused a drop in performance. Before the team could improve its performance, they had first to become aware of the change in the environment. Second, they had to assign meaning to this change and devise a new strategy to cope with the environmental change. This required a decision making and problem solving activities. Considering the nature of the task, not all competences were expected to be fully required. During the first 10 trials, especially mutual performance monitoring & feedback, back-up recognition & shifting were assumed to be the most important competences. It was expected that teams which consisted of members with these competences would perform better. Team members who would monitor each other's performance to identify mistakes, give feedback or assistance, were expected to perform better, because the quality of the individual decision making would increase. During the last twenty trials after the unexpected change, also the adaptability was expected to be important. Becoming aware of the change and altering procedures was required to perform well. The team orientation facet 'team goal' was expected to be unimportant in this task, since the teams worked on a task which included no individual goals. The task related documents and a screenshot can be found in appendix 4. After the experiment the members were asked to rate specific teamwork behaviours of their own and their two team members. These ratings were administered on a computer together with some additional questionnaires.

#### 4.1.4 Measures

To evaluate the construct validity of the competences, several scales have been used. All the original and adopted scales can be found in Appendix 3.

##### 4.1.4.1 Related measures for Team orientation

In order to test the hypothesis on the validity of the construct team orientation, three scales have been used. These scales were the individualism-collectivism scale by Wagner and Moch (1986) and Wagner (1995), the gregariousness scale (Goldberg, 2009) and the warmth scale (Goldberg, 2009). The collectivism scale was constructed by Wagner and Moch (1986) and Wagner (1995) and used by Eby and Dobbins (1997). It consisted of five facets, from which three were used in this study: (1) Independence, (2) Preference to work alone and (3) Group goal. The facet 'independence' consisted of five items such as 'Only those who depend on themselves get ahead in life'. The facet 'preference to work alone' was measured by three items like 'Working in a group is better than working alone (reverse keyed)'. The facet 'team goal' consisted of three items such as 'A group is more productive when its members follow their own interests and concerns (reverse keyed)'. A 7-point Likert scale (1=strongly disagree to 7=strongly agree) was used. Eby and Dobbins (1997) reported an internal consistency of  $\alpha=.68$  for the whole scale. Cronbach's alpha's for the individual facets were not reported.

The gregariousness scale was part of the International Personality Item Pool (Goldberg, 2009). The scale contained ten items such as "I am the life of the party". A 5-point Likert scale was used ranging from "very inaccurate" (1) to "very accurate" (5). Goldberg (2009) reported a Cronbach's alpha of .83. The warmth scale originated from the IPIP as well and consisted of ten items that were measured on a 5-point Likert scale that ranged from "Very Inaccurate" (1) to "Very Accurate" (5). It included items such as 'I make others feel welcome'. A Cronbach's alpha of .84 was reported by Goldberg (2009). All three scales were translated from English into Dutch. The translations were checked by an expert in English at TNO.

##### 4.1.4.2 Related measures for Mutual trust

The hypotheses on the construct validity of mutual trust has been tested with the propensity to trust scale used by Aubert (2003) and the trust scale (Goldberg, 2009). The propensity to trust scale that



was used by Aubert (2003) consisted of three items that had to be rated on a 7-point Likert scale ranging from Disagree (1) to Agree (7). An example item follows: 'Most students are honest in describing their experiences and abilities'. Aubert & Kelsey (2003) reported a Cronbach's alpha of .81 for the propensity to trust scale. The trust scale originated from the International Personality Item Pool brought together by Goldberg (2009). It contained ten items such as "I believe in the human goodness" and originated from the NEO Big Five personality inventory. A 5-point Likert scale was used ranging from "Very Inaccurate" (1) to "Very Accurate" (5). Goldberg (2009) reported a Cronbach's alpha of .82. All scales were translated from English into Dutch. The translations were checked by an expert in English at TNO.

#### 4.1.4.3 *Related measures for Back-up behaviour*

The bi-polar Big Five personality inventory has been used to measure conscientiousness and extraversion. The scale consisted of three items for each Big Five dimension. Respondents had to rate themselves on a 9-point scale. An example item for extraversion is 'Silent'(1), to 'Loves to talk'(9). A Cronbach's alpha of .79 was reported for the complete scale. No internal reliabilities were reported for each individual dimension.

Goal orientations have been measured with the goal orientation scale developed by Van Yperen (2004). This scale consisted of items such as 'I want to learn as much as possible in my work'. Since it was expected that the sample would contain a majority of students, the items were adapted and 'work' was replaced with 'study'. The complete questionnaire measures four types of goal orientations, but for this study three were selected. Each type of goal orientation was measured with three items on a 7-point Likert scale ranging from 'Completely not applicable' to 'Completely applicable'. Cronbach's alpha was .87 for Learning Goal Orientation (LGO), .80 for Prove Performance Goal Orientation (PPGO), and .62 for Avoidance Performance Goal Orientation (APGO) (Yperen, 2004). Since both scales were available in Dutch, no translations were necessary.

#### 4.1.4.4 *Related measures for Adaptability*

Two facets of the subscale 'mobility' of the Pavlov Temperament Scale (PTS) adapted for the Dutch population by Heck et al., (1993) were used. This Mobility subscale consisted originally of five facets (20 items) of which two facets (10 items) were used. Examples of items that comprised these two facets were 'It is difficult for me to adapt myself to a new environment (reverse keyed)'. A 4-point Likert scale was used (1= completely disagree, 4=completely agree). Heck et al. (1993) reported a Cronbach's alpha of .91 for the 20-item scale.

The bi-polar Big-Five personality inventory was used to measure openness. Three items were used to measure 'openness'. Scale and reliability are the same as discussed previously. Since the scales were available in Dutch, no translations were necessary.

#### 4.1.4.5 *Teamwork behaviour*

To measure teamwork behaviour, self and peer ratings were used. Respondents were asked after the team task to rate their peers on teamwork behaviours related to the six competences. Unfortunately, not all the facets of the six competences would be clearly visible to others. Two of the three facets of team orientation ('*preference*' & '*team goal*'), the two facets of mutual trust ('*task roles protection*' & '*open communication*') and one of the two facets of mutual performance monitoring ('*monitoring*') were excluded from the peer review and were only measured through self-reviews. As a result of possible questionnaire fatigue, it was decided to pose only one question per competence facet. For example, the facet 'change' of the competence adaptability was presented as follows:

- |   |                         |
|---|-------------------------|
| 1. I have tried to adapt myself to changes                | [Never (1)– Always (7)] |
| 2. The CAD* has tried to adapt his/herself to changes     | [Never (1)– Always (7)] |
| 3. The Cruiser* has tried to adapt his/herself to changes | [Never (1)– Always (7)] |
- \* the CAD and Cruiser refer to the teammates

In the question presented above, the respondent first had to rate his/her own behaviour related with the adaptability facet 'change', after which he/she had to rate their peers on the same behaviour. Since each respondent was rated by two peers, the average of these two ratings was taken for the analysis.

#### *4.1.4.6 Objective output measures*

In addition to the self and peer ratings, each team has produced two objective task output measures on team level: Stable Environment Performance (SEP) and the Dynamical Environment Performance (DEP). The SEP was based on the team decisions made in the first 10 trials in which the environment remained stable. The DEP related to decisions in the final 20 trials in which the team had to cope with a unexpected change. Both the SEP as the DEP measure were operationalized as decision-making performance of the team as a whole. Therefore, the role related individual decisions of team members were not taken into account in this score.

#### *4.1.5 Data analyses*

To determine the construct validity, two components of this type of validity were evaluated: convergent validity and discriminant validity. To judge the hypotheses on these validities, one-tailed correlations between the competences and established instruments were calculated. This was done on the individual level.

To determine the criterion validity, one-tailed correlation coefficients were used to test the hypothesized relations between the CTCQ and the self & peer ratings. The analysis was also conducted on individual level. The relations between the average and difference levels of competence and team performance have been tested though correlational analysis. This analysis was done on team level, since the team performance measure could not be expressed in performance on the individual level. Therefore, the individual CTCQ measurements had to be aggregated to team level. This was done by taking the mean and average deviation from the mean respectively.

Variables with significant correlations were entered into a regression.

## **4.2 Results**

### *4.2.1 Data exploration*

#### *4.2.1.1 Data exploration for convergent and discriminant validity*

In Table 14, the range, mean and standard deviations of each of the twelve competence facet scales are shown. As shown in Table 14, all means are above 4.00 and half of the scales have their mean above 5.00. Table 14 also shows the skewness, kurtosis and results of the Kolmogorov-Smirnov (K-S) test for each scale. The K-S test was used to verify whether distributions of the variables were significantly different from normal (Field, 2005). When a significant deviation from normality was detected, the K-S test reported a significant result ( $p < .05$ ). As shown in Table 14, all the scale distributions were reported to be significantly different from normal. These findings implied that non-parametric analysis should be used. Therefore, Spearman was used for the correlational analysis.

Table 14 Range, mean, standard deviation and Kolmogorov-Smirnov test results for the competence sub scales

	Minimum	Maximum	M	SD	Skewness	Kurtosis	K-S Normality Test	
							Statistic	Sig.
TO-P	1.00	7.00	4.28	1.43	-0.21	-0.62	.09	.03
TO-A	3.33	7.00	5.57	0.82	-0.37	0.00	.13	.00
TO-T	1.33	7.00	4.45	1.36	-0.36	-0.88	.16	.00
MT-OC	2.00	7.00	5.29	0.99	-0.62	0.37	.13	.00
MT-TRP	2.00	7.00	5.50	1.02	-1.02	1.44	.14	.00
MPM-M	2.75	7.00	5.20	0.84	-0.23	-0.01	.11	.00
MPM-F	1.33	7.00	4.73	1.18	-0.69	0.29	.14	.00
BU-R	1.75	6.75	4.85	0.94	-0.71	0.73	.09	.02
BU-S	3.00	7.00	5.59	0.91	-0.68	0.22	.13	.00
AD-A	1.33	6.67	4.90	0.85	-0.74	1.63	.12	.00
AD-C	2.67	7.00	5.13	0.84	-0.39	0.05	.15	.00
CO-CL	2.00	7.00	4.95	0.99	-0.38	0.25	.11	.00

Note N=122 K-S= Kolmogorov-Smirnov Test

TO-P	Team Orientation Preference	MPM-F	Mutual Performance Monitoring Feedback
TO-A	Team Orientation Acceptance	BU-S	Back-up behaviour Shifting
TO-T	Team Orientation Team Goal	BU-R	Back-up behaviour Recognition
MT-OC	Mutual Trust Open Communication	AD-A	Adaptability Awareness
MT-MTRP	Mutual Trust Team Roles and Protection	AD-C	Adaptability Change
MPM-M	Mutual Performance Monitoring Monitoring	CO-CL	Communication Closed-Loop

Table 15 presents the spearman correlations between the twelve competence scales. As shown in Table 15, the majority of the facet scales correlated significantly with each other. All correlations were positive. Two correlations were strong ( $r_s \geq .50$ ). The correlation between Adaptability Change (AD-C) and Team Orientation Acceptance (TO-A) was the highest ( $r_s = .58, p < .001$ ).

Table 15 Intercorrelations between the competence facet scales

	1	2	3	4	5	6	7	8	9	10	11
1 TO-P	---										
2 TO-A	.24	---									
3 TO-T	.49	.42	---								
4 MT-OC	.21	.41	.21	---							
5 MT-TRP	.23	.49	.48	.23	---						
6 MPM-M	-.03	.23	-.03	.22	.02	---					
7 MPM-F	.20	.10	.03	.26	.00	.42	---				
8 BU-R	.21	.44	.29	.35	.16	.47	.33	---			
9 BU-S	.18	.35	.23	.37	.17	.37	.19	.51	---		
10 AD-A	.13	.25	.04	.25	.03	.40	.34	.42	.32	---	
11 AD-C	.32	.58	.37	.45	.31	.19	.24	.39	.49	.38	---
12 CO-C	.14	.34	.21	.27	.14	.29	.31	.36	.28	.34	.31

Note. N= 122.  $|r_s| \geq .15$   $p < .05$ ,  $|r_s| \geq .20$   $p < .01$

TO-P	Team Orientation Preference	MPM-F	Mutual Performance Monitoring Feedback
TO-A	Team Orientation Acceptance	BU-S	Back-up behaviour Shifting
TO-T	Team Orientation Team Goal	BU-R	Back-up behaviour Recognition
MT-OC	Mutual Trust Open Communication	AD-A	Adaptability Awareness
MT-MTRP	Mutual Trust Team Roles and Protection	AD-C	Adaptability Change
MPM-M	Mutual Performance Monitoring Monitoring	CO-CL	Communication Closed-Loop

For this study, various other scales have been used to evaluate convergent validity. In Table 17, Cronbach's alpha, mean and standard deviation for each scale are shown. As shown in Table 17, Cronbach's alpha of the scale on the collectivism facet 'independence' was  $\alpha=.64$ . This is substantially below the minimum level for established scales  $\alpha=.70$ , but slightly above the absolute minimum  $\alpha=.60$  (Field, 2005). Therefore, the scale was maintained but was interpreted with caution. Cronbach's alpha of Goal Orientation Avoidance Performance equaled  $\alpha=.54^2$ , which is below the minimum of  $\alpha=.70$  and below the absolute minimum of .60. Therefore, this scale was considered as unusable.

#### 4.2.1.2 Data exploration for the criterion validity study

Table 18 shows the mean, standard deviations of the measures used in the criterion validity assessment. As Table 18 shows, the self ratings have slightly higher averages than the peer ratings. The self and peer ratings correlated significantly. All correlations were small ( $.10 \leq r_s \leq .30$ ) and positive. Additional analysis revealed that a great deal of peer ratings differed substantially. In Table 16, the range, mean and standard deviation of these differences in ratings are shown. An interrater reliability analysis was conducted to determine the consistency among ratings. This resulted in Kappa = 0.076 ( $p < .0001$ ). This value is well below the minimum .40 criterion for moderate agreement (Texassoft, 2008). This low Kappa value implied that the peer ratings were an unreliable measure and could not be aggregated.

Table 16 Range, mean and standard deviations of differences in peer ratings

Difference ratings	Minimum	Maximum	<i>M</i>	<i>SD</i>
Δ Peer rating Team Orientation Acceptance	0	4	0.93	0.93
Δ Peer rating Mutual Performance Monitoring	0	6	1.49	1.26
Δ Peer rating Mutual Performance Monitoring Feedback	0	6	1.89	1.46
Δ Peer rating Adaptability Awareness	0	6	1.72	1.49
Δ Peer rating Adaptability Change	0	6	1.60	1.38
Δ Peer rating Communication Closed-Loop	0	4	1.15	0.93
Δ Peer rating Total	3	23	11.24	4.29

Note.  $N=123$  Δ = absolute difference between ratings from peers

Part of the criterion validity was done on team level. Table 19 and 20 shows the minimum, maximum, mean standard deviation and Shapiro-Wilk test of normality, of the variables used on team level. Shapiro-Wilk tests on team level 'average' variables showed only a significant deviation from normality for the average mutual performance monitoring feedback score. Therefore, Spearman correlations were used for this variable and Pearson for the rest. Table 20 shows that the majority of the distributions of the team level competence difference variables was significantly different from normal. Therefore, non-parametric tests were used for the competence difference variables. Regression was used to verify whether the competences were able to explain different parts of the variance of team performance. Before the regression was conducted, all assumptions were checked carefully. One of the assumptions of the regression considering the stable environment performance was violated. The assumption on independent errors did not hold (Durbin-Watson < 1.0). Therefore, logistic regression was conducted for the stable environment performance. In order to conduct logistic regression, SEP had to be converted into a categorical variable. This was done by creating a group ( $N=18$ ) that scored below average ( $SEP < 46$ ) and a group ( $N=20$ ) that scored above average ( $SEP \geq 46$ ). Outlier analysis resulted in excluding three teams from the analysis on the stable environment performance. These teams were excluded due to their poor performance. This poor performance was mainly caused by the fact that some teams still did not fully understand the task after the training. As a

<sup>2</sup> This low alpha level caused by a mistake that was made during the online questionnaire construction. Instead of three items, only two were implemented in the online questionnaire.

result they made numerous mistakes and ended up with a poor performance. Since the poor performance could not only be attributed to the team itself, three teams with the lowest scores (43 points) were removed.

Table 17 *Intercorrelations between scales used for the construct validity*

	$\alpha$	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Collectivism facet 'independence'	.64	4.17	0.97	---												
2 Collectivism facet 'preference to work alone'	.83	3.80	1.31	.19	---											
3 Gregariousness (IPIP)	.86	3.39	0.70	-.05	-.14	---										
4 Warmth (IPIP)	.84	4.02	0.47	-.04	-.19	.27	---									
5 Collectivism facet 'group goal'	.69	5.16	0.71	.01	-.14	-.15	.13	---								
6 Propensity to trust scale	.77	4.07	1.00	-.05	-.35	.06	.04	-.03	---							
7 Trust (IPIP)	.81	3.77	0.51	-.12	-.30	.28	.37	.00	.27	---						
8 PTS facet 'mobility'	.90	2.95	0.53	-.07	-.19	.44	.29	.02	.02	.19	---					
9 Big Five Conscientiousness	.81	5.46	1.75	.20	.05	-.29	.01	.10	.05	-.09	-.22	---				
10 Big Five Extraversion	.80	5.35	1.58	.21	-.04	.65	.25	-.03	.06	.10	.41	-.04	---			
11 Big Five Openness	.77	5.19	1.59	.12	.12	.24	.20	.03	-.10	-.02	.29	-.10	.28	---		
12 Goal Orientation Prove Performance	.91	4.55	1.39	.28	.19	-.16	.07	.04	-.12	-.06	-.37	.25	-.06	.00	---	
13 Goal Orientation Avoidance Performance	.54	4.69	1.36	.21	.08	-.30	.14	.22	-.07	-.11	-.28	.27	-.15	-.01	.45	---
14 Goal Orientation Learning Orientation	.81	5.65	1.06	.16	.09	-.25	.23	.27	-.01	.02	-.09	.36	-.07	.08	.34	.49

Note  $N=122$ .  $|r_s| \geq .15$   $p < .05$ ,  $|r_s| \geq .20$   $p < .01$

Table 18 *Intercorrelations between self and peer ratings used for the criterion validity*

#	Scale	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Self rating Team Orientation Preference	5.19	1.64	---														
2	Self rating Team Orientation Acceptance	6.01	0.87	.25	---													
3	Self rating Mutual Trust Open Communication	6.67	0.57	.17	.19	---												
4	Self rating Mutual Trust Team Roles & Protection	6.63	0.55	.39	.34	.53	---											
5	Self rating Mutual Performance Monitoring Monitoring	5.06	1.42	.09	.14	.13	.05	---										
6	Self rating Mutual Performance Monitoring Feedback	3.09	1.90	.05	.09	-.01	.07	.44	---									
7	Self rating Back-Up behaviour Recognition	4.46	1.83	.02	.11	.05	-.04	.33	.28	---								
8	Self rating Adaptability Awareness	4.63	1.86	.07	.16	.00	.03	.19	.17	.06	---							
9	Self rating Adaptability Change	5.36	1.55	.17	.22	.15	.14	.19	.17	.10	.60	---						
10	Self rating Communication Closed-Loop	5.74	1.06	.23	.29	.17	.18	.36	.21	.14	.36	.40	---					
11	Peer rating Team Orientation Acceptance	5.91	0.81	.14	.22	.01	.12	-.02	-.01	.12	.08	.17	.18	---				
12	Peer rating Mutual Performance Monitoring Monitoring	4.91	1.15	-.01	-.05	-.02	.03	.26	.17	.06	-.06	.06	.08	.19	---			
13	Peer rating Mutual Performance Monitoring Feedback	3.06	1.33	-.08	-.04	-.01	-.09	.11	.22	.09	-.10	.01	.05	-.04	.38	---		
14	Peer rating Adaptability Awareness	4.48	1.52	-.09	.00	-.24	-.24	.04	.04	.02	.23	.16	.07	.23	.15	.09	---	
15	Peer rating Adaptability Change	5.27	1.17	-.08	.15	-.01	-.02	.02	.03	.08	.21	.20	.19	.33	.20	.16	.62	---
16	Peer rating Communication Closed-Loop	5.54	0.89	.01	.11	-.14	-.01	.04	.05	-.02	.11	.17	.15	.32	.32	.15	.31	.50

Note  $N=122$ .  $|r_s| \geq .15$   $p < .05$ ,  $|r_s| \geq .20$   $p < .01$

Table 19 Range, mean, standard deviations and test for normality

Variable	Min	Max	M	SD	Skewness	Kurtosis	Shapiro-Wilk	
							Statistic	Sig.
Average TO-P	2.33	5.78	4.29	0.77	-0.21	0.16	.97	.29
Average TO-A	4.44	6.67	5.57	0.55	0.13	-0.54	.98	.83
Average TO-T	2.89	5.89	4.46	0.79	-0.09	-1.16	.96	.11
Average MT-OC	3.56	6.22	5.29	0.54	-0.69	1.39	.96	.13
Average MT-TRP	4.33	6.78	5.51	0.54	-0.04	-0.12	.99	.98
Average MPM-M	4.00	6.08	5.20	0.52	-0.64	0.18	.95	.05
Average MPM-F	2.89	6.00	4.73	0.78	-0.76	0.06	.93	.02
Average BU-R	3.58	6.00	4.86	0.50	0.00	0.10	.99	.90
Average BU-S	4.78	6.67	5.59	0.50	0.31	-0.98	.95	.08
Average AD-A	3.22	5.89	4.89	0.50	-0.90	2.29	.95	.05
Average AD-C	4.22	5.89	5.13	0.46	-0.21	-0.77	.97	.26
Average CO-C	4.00	6.11	4.95	0.53	0.36	-0.61	.96	.17
Average All	4.48	5.72	5.05	0.32	0.11	-0.84	.98	.52
SEP	43.00	49.00	46.05	1.55	-0.26	-0.42	.95	.05
DEP	58.00	88.00	74.61	8.48	-0.17	-0.95	.96	.17
Adaptability sl.	2.51	4.49	3.60	0.53	-0.22	-0.80	.97	.37

Note: N= 41 Min = Minimum Max = Maximum sl.=slope

TO-P Team Orientation Preference  
 TO-A Team Orientation Acceptance  
 TO-T Team Orientation Team Goal  
 MT-OC Mutual Trust Open Communication  
 MT-MTRP Mutual Trust Team Roles and Protection  
 MPM-M Mutual Performance Monitoring Monitoring  
 SEP Stable Environment Performance

Table 20 Range, mean, standard deviations and test for normality

Variable	Min	Max	M	SD	Skewness	Kurtosis	Shapiro-Wilk	
							Statistic	Sig.
Δ TO-P	0.22	2.07	1.00	0.45	0.34	-0.41	.98	.52
Δ TO-A	0.00	1.04	0.47	0.26	0.63	-0.55	.91	.00
Δ TO-T	0.15	1.93	0.88	0.49	0.51	-0.53	.95	.06
Δ MT-OC	0.15	1.63	0.64	0.36	0.79	0.23	.94	.04
Δ MT-TRP	0.00	1.78	0.63	0.45	1.04	0.39	.90	.00
Δ MPM-M	0.00	1.06	0.52	0.29	0.44	-0.75	.95	.05
Δ MPM-F	0.00	1.70	0.66	0.44	0.94	0.13	.91	.00
Δ BU-R	0.00	1.56	0.62	0.36	0.86	0.24	.93	.01
Δ BU-S	0.15	1.56	0.59	0.35	1.03	1.15	.91	.00
Δ AD-A	0.15	1.48	0.54	0.30	1.17	1.57	.91	.00
Δ AD-C	0.15	1.11	0.54	0.31	0.42	-1.09	.91	.00
Δ CO-C	0.00	1.56	0.66	0.36	0.44	-0.09	.97	.43
Δ All	0.03	0.87	0.39	0.23	0.72	-0.39	.93	.01

Note: N= 41 Min = Minimum Max= Maximum Δ = Average Deviation

MPM-F Mutual Performance Monitoring Feedback  
 BU-S Back-up behaviour Shifting  
 BU-R Back-up behaviour Recognition  
 AD-A Adaptability Awareness  
 AD-C Adaptability Change  
 CO-CL Communication Closed-Loop  
 DEP Dynamical Environment Performance

#### 4.2.2 Results Construct validity

The correlations for the construct validity assessment can be found in Table 21.

##### 4.2.2.1 Construct validity Team Orientation

Table 21 shows that no correlation was found between the team orientation competence facet 'preference' and the individualism-collectivism facet 'independence', thus hypothesis 2 could not be supported. Hypothesis 3 was supported. Preference did correlate negatively with the individualism-collectivism facet 'preference to work alone' ( $r_s = -.86$ ,  $p(\text{one-tailed}) < .001$ ). This large correlation implied that the more someone preferred to work on the team, the less someone preferred to work alone. Hypothesis 4 was supported by the data, since the team orientation competence facet 'team goal importance' correlated positively with the individualism-collectivism facet 'group goal' ( $r_s = .32$ ,  $p(\text{one-tailed}) < .05$ ). The size of the correlation was moderate. No support was found for hypothesis 5. The team orientation competence facet 'preference' does not significantly correlate with the Big Five scale on gregariousness. Hypothesis 6 was supported because a positive correlation was found between the Big Five scale on warmth and team orientation 'preference' ( $r_s = .21$ ,  $p(\text{one-tailed}) < .01$ ). Therefore, the more someone prefers to work on the team, the higher someone's warmth towards others is. The size of the correlation was small.

##### 4.2.2.2 Construct validity Mutual trust

In line with hypothesis 7, both the mutual trust competence facet 'open communication' and 'team roles and protection' correlated positively with the propensity to trust scale ( $r_s = .18$ ,  $p(\text{one-tailed}) < .01$ ) and ( $r_s = .18$ ,  $p(\text{one-tailed}) < .05$ ) respectively. It implies that people with a higher ability to trust had also higher scores on both mutual trust competence facets. Both correlations were small. Hypothesis 8 is supported, the facet 'team roles and protection' correlated positively ( $r_s = .27$ ,  $p(\text{one-tailed}) < .01$ ) with the IPIP trust scale. People with higher scores on the mutual trust facet 'team roles and protection', had higher scores on the IPIP trust scale.

##### 4.2.2.3 Construct validity Back-up behaviour

Hypotheses 9 and 10 are supported because there were positive correlations between 'conscientiousness' and 'recognition' ( $r_s = .35$ ,  $p(\text{one-tailed}) < .01$ ) and with 'shifting' ( $r_s = .35$ ,  $p(\text{one-tailed}) < .01$ ). The higher someone scored on big five conscientiousness, the higher the scores were on both back-up behaviour facets. Both correlation were moderate. Hypothesis 11 was not supported, since 'recognition' did not correlate significantly positively with 'extraversion'.

As expected, no significant correlations were found between back-up behaviour 'shifting' and the prove performance goal orientation. But due to a Cronbach's alpha below  $\alpha = .60$ , this result could not be used. But 'shifting' did correlate with an avoidance performance goal orientation ( $r_s = .29$ ,  $p(\text{one-tailed}) < .01$ ) and with learning goal orientation ( $r_s = .48$ ,  $p(\text{one-tailed}) < .001$ ). This implied that people who head higher scores on the avoidance performance and learning goal orientations, also scored higher on back-up behaviour. Back-up 'recognition' only correlated with learning goal orientation ( $r_s = .36$ ,  $p(\text{one-tailed}) < .001$ ). This moderate positive correlation implied that people with a higher score on a learning goal orientation, also had higher scores on back-up recognition.

##### 4.2.2.4 Construct validity Adaptability

Hypothesis 12 was supported, because adaptability 'change' correlated positively with mobility ( $r_s = .25$ ,  $p(\text{one-tailed}) < .05$ ). The higher scores on the adaptability 'change', the higher the scores were on ability. The size of this correlation was small. Additionally, hypothesis 13 was supported. Big Five 'openness to experience' correlated with 'awareness' ( $r_s = .22$ ,  $p(\text{one-tailed}) < .05$ ) and with change ( $r_s = .15$ ,  $p(\text{one-tailed}) < .01$ ). These small positive correlations implied that people with higher scores on openness to experience also scored higher on both adaptability facets.



#### 4.2.2.5 *Additional correlations*

In addition to the hypothesized correlations, Table 21 shows also several other relationships that provide additional insights in the nomological net. The four largest correlations are discussed.

First, the warmth scale appeared to correlate significantly with most of the competences. These positive correlations can be explained by the fact that the warmth scale is a sub facet of big five agreeableness. Agreeableness was shown by various researchers to be an important personality characteristic for working in team (Sartori et al., 2006). Since people with a higher level of agreeableness were found to perform better in teams, it appeared to be logical that scores on the subfacet warmth correlated positively with most CTCQ facets.

Second, the ability to trust scale was reported to have a positive correlation with team orientation preference and team orientation team goal. Trust was regarded as an important ingredient for team effectiveness, and therefore team oriented members may trust others more quickly. However, the fact that these correlations are substantially higher than the hypothesized correlations with the CTCQ trust facets, caused doubts the construct validity of both trust facets.

Third, the big five dimension conscientiousness correlated positively with the mutual performance monitoring facet 'monitoring'. Being precise might increase someone's motivation to monitor other team members.

Lastly, big five extraversion correlated positively with mutual trust facet 'open communication', mutual performance monitoring facet 'feedback', and facet 'closed-loop communication'. Although not hypothesized, these relations could have been expected. The three competences are all related with some kind of verbal expression. Extroverted people are known to engage more easily in these activities than introverts.

#### 4.2.2.6 *Discriminant validity*

As can be seen in Table 21, goal orientations did correlate with some of the CTCQ facets. Besides the expected correlations with back-up behaviour, the highest correlation was reported between learning goal orientation and the mutual performance monitoring facet 'monitoring' ( $r_s = .39$ ,  $p(\text{one-tailed}) < .01$ ). The rest of the correlations were below  $r_s = .30$ . Although the mutual performance monitoring facet 'monitoring' (MPM-M) was moderately correlated with the learning goal orientation, it was concluded that hypothesis 14 was still supported by the data. This was done because the factor structure in study 1 showed that the MPM-M scale required new items. It was decided to take the scale into account in the other studies to obtain additional insights for future item generation. Therefore, this scale was not regarded as a fully usable scale and was not considered to be part of hypothesis 14.

Table 21 *The Spearman correlations between the competence facet scales and various instruments*

Scales	TO-P	TO-A	TO-T	MT-OC	MT-TRP	MPM-M	MPM-F	AD-A	AD-C	BU-R	BU-S	CO-C
Collectivism facet 'independence'	<u>-.14</u>	-.10	-.06	.04	.03	.16	.13	.15	.00	.00	.09	.28
Collectivism facet 'preference to work alone'	<u>-.86</u>	-.20	-.44	-.18	-.18	.05	-.14	-.05	-.23	-.11	-.14	-.07
Gregariousness (IPIP)	<u>.13</u>	-.05	-.03	.06	-.12	-.18	.3	.08	-.07	-.06	-.25	-.04
Warmth (IPIP)	<u>.21</u>	.38	.05	.37	.19	.16	.33	.23	.32	.43	.26	.28
Collectivism facet 'group goal'	.14	.30	<u>.32</u>	.14	.24	.21	.08	.26	.24	.24	.26	.18
Ability to trust scale	.29	.14	.30	<u>.18</u>	<u>.18</u>	-.15	-.01	-.06	.19	-.05	.10	.01
Trust (IPIP)	.24	.22	.22	.13	<u>.27</u>	-.08	-.05	-.02	.16	.11	.11	.03
PTS facet 'mobility'	.31	.22	.16	.14	.15	-.16	.20	.17	<u>.25</u>	.19	.05	.15
Big Five Conscientiousness	.00	.21	-.04	.18	.00	.54	.05	.21	.19	<u>.35</u>	<u>.35</u>	.14
Big Five Extraversion	.11	.03	.00	.28	.04	.02	.38	.19	.09	<u>.11</u>	-.06	.24
Big Five Openness	-.03	-.01	-.15	.07	.00	-.05	.20	<u>.22</u>	<u>.15</u>	-.02	-.06	.14
Goal Orientation Prove Performance	-.20	-.08	-.24	-.05	-.21	.24	.03	.16	-.06	.09	.10	.19
Goal Orientation Avoidance Performance	-.07	.11	.07	.03	.04	.30	-.01	.20	.24	.12	<u>.29</u>	.22
Goal Orientation Learning Orientation	-.08	.23	.04	.25	.15	.39	.00	.27	.28	<u>.36</u>	<u>.48</u>	.27

Note N= 122  $|r_s| \geq .15$   $p < .05$ ,  $|r_s| \geq .20$   $p < .01$  Underlined = hypothesized

Table 22 *The Spearman correlations between the competence facet scales and the self and peer ratings*

	TO-P	TO-A	MT-OC	MT-TRP	MPM-M	MPM-F	BU-R	AD-A	AD-C	CO-C
Self rating Team Orientation Preference	<u>.35</u>	.06	.07	.08	-.11	.11	-.05	.01	.20	.01
Self rating Team Orientation Acceptance	-.03	<u>.12</u>	.14	.13	.10	.14	.13	-.07	.18	-.03
Self rating Mutual Trust Open Communication	-.07	.11	<u>.14</u>	.08	.00	.00	-.02	-.02	.20	.15
Self rating Mutual Trust Team Roles & Protection	.13	.12	.16	<u>.06</u>	.00	.16	-.08	-.09	.18	.07
Self rating Mutual Performance Monitoring Monitoring	.11	.18	.15	.23	<u>.13</u>	.07	.22	.18	.07	.10
Self rating Mutual Performance Monitoring Feedback	.05	.09	.09	.07	.11	<u>.15</u>	.07	-.07	.01	-.05
Self rating Back-Up behaviour Recognition	.08	.16	.12	.15	.17	.18	<u>.23</u>	.24	.11	.28
Self rating Adaptability Awareness	.07	-.04	.20	-.02	.16	.04	.12	<u>.08</u>	.14	-.03
Self rating Adaptability Change	-.13	.13	.19	-.04	.21	.01	.16	-.01	<u>.22</u>	-.05
Self rating Communication Closed-Loop	.07	.22	.26	.08	.16	.20	.21	.18	.18	<u>.10</u>
Peer rating Team Orientation Acceptance	.15	<u>.14</u>	.00	.06	.08	.12	.03	.00	.07	-.12
Peer rating Mutual Performance Monitoring Monitoring	-.08	-.03	-.04	.01	<u>.08</u>	.05	.03	-.01	-.08	-.20
Peer rating Mutual Performance Monitoring Feedback	-.10	.02	-.07	.00	.09	<u>.07</u>	.05	.01	.00	-.13
Peer rating Adaptability Awareness	.01	.04	.04	.07	.04	-.17	-.03	<u>.03</u>	.02	-.23
Peer rating Adaptability Change	.03	.12	.10	.16	-.02	-.01	-.03	.05	<u>.13</u>	-.17
Peer rating Communication Closed-Loop	.03	.16	-.02	.05	-.05	.01	-.02	.03	.15	<u>-.16</u>

Note. N= 122.  $|r_s| \geq .15$   $p < .05$ ,  $|r_s| \geq .20$   $p < .01$  Underlined = hypothesized

Table 23 The Pearson correlations between the team level average competence facet scales and the stable environment performance

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 SEP	---												
2 Average TO-P	.01	---											
3 Average TO-A	.25	.04	---										
4 Average TO-T	.24	.30	.39	---									
5 Average MT-OC	.03	.06	.49	-.05	---								
6 Average MT-TRP	-.03	.43	.52	.43	.34	---							
7 Average MPM-M	.28	-.04	.26	.14	.11	.11	---						
8 Average MPM-F	-.20 <sup>s</sup>	.05 <sup>s</sup>	-.08 <sup>s</sup>	-.09 <sup>s</sup>	.07 <sup>s</sup>	-.06 <sup>s</sup>	.37 <sup>s</sup>	---					
9 Average BU-R	.26	.02	.39	.23	.35	.25	.67	.37 <sup>s</sup>	---				
10 Average BU-S	.36	.24	.44	.24	.23	.35	.55	.74 <sup>s</sup>	.56	---			
11 Average AD-A	.23	.03	.12	-.19	.34	-.15	.45	.57 <sup>2</sup>	.41	.36	---		
12 Average AD-C	.27	.34	.56	.21	.56	.37	.40	.36 <sup>s</sup>	.46	.6	.46	---	
13 Average CO-C	.04	.17	.30	.00	.28	.08	.49	.33 <sup>s</sup>	.41	.36	.26	.31	---
14 Average All	.25	.48	.60	.46	.51	.59	.60	.47 <sup>s</sup>	.70	.72	.45	.80	.46

Note N= 38. |r| ≥ .27 p < .05 (one-tailed) |r| ≥ .32 p < .05 (two-tailed) <sup>s</sup> = Spearman correlation

Table 24 The Spearman correlations between the team level difference competence facet scales and the stable environment performance

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 SEP	---												
2 Difference TO-P	-.27	---											
3 Difference TO-A	-.38	.13	---										
4 Difference TO-T	-.19	.51	.13	---									
5 Difference MT-OC	-.39	.36	.47	.40	---								
6 Difference MT-TRP	.09	.17	.30	.27	.29	---							
7 Difference MPM-M	-.08	.24	.37	.37	.35	.08	---						
8 Difference MPM-F	.06	.15	.13	.19	.24	.09	.59	---					
9 Difference BU-R	-.20	.25	.08	.21	.34	.02	.39	.32	---				
10 Difference BU-S	-.42	.44	.20	.30	.34	.05	.31	.13	.31	---			
11 Difference AD-A	-.20	-.10	.11	-.17	.10	-.26	.13	.20	.38	.26	---		
12 Difference AD-C	-.41	.26	.39	.33	.27	-.03	.35	.34	.51	.20	.35	---	
13 Difference CO-C	.01	.06	.32	-.07	.11	.12	.00	.03	.13	-.01	.08	-.02	---
14 Difference All	-.38	.38	.50	.40	.48	.34	.43	.46	.49	.33	.37	.58	.21

Note N= 38. |r<sub>s</sub>| ≥ .27 p < .05 (one-tailed) |r<sub>s</sub>| ≥ .32 p < .05 (two-tailed)

#### 4.2.3 Results Criterion related validity

Three measures were used as criteria in this study: teamwork behaviours, stable environment performance (SEP), Dynamical environment performance (DEP). First results on the teamwork behaviours are presented. Second, the team performance measures are discussed.

##### 4.2.3.1 Teamwork behaviours

Table 22 shows the correlations that were found between various CTCQ facets and the peer and self ratings. Concerning the peer ratings, a significant negative correlation was found between communication facet 'closed-loop' and the peer ratings ( $r_s = -.16, p(\text{one-tailed}) < .05$ ). Due to an unsatisfactory Kappa as reported in the previous section, these peer ratings are not further taken into account.

The self ratings correlated positively with the team orientation competence facet 'preference' ( $r_s = .35, p(\text{one-tailed}) < .01$ ), the mutual performance monitoring facet 'monitoring' ( $r_s = .19, p(\text{one-tailed}) < .05$ ) and 'feedback' ( $r_s = .15, p(\text{one-tailed}) < .05$ ), back-up behaviour facet 'recognition' ( $r_s = .25, p(\text{one-tailed}) < .01$ ) and adaptability facet 'change' ( $r_s = .20, p(\text{one-tailed}) < .05$ ).

##### 4.2.3.2 Stable environment performance

In Table 23 the correlations between SEP and the average team level competences can be found. On team level, three average competences did correlate significantly with SEP; Mutual performance monitoring facet 'monitoring' ( $r = .28, p(\text{one-tailed}) < .05$ ), back-up behaviour facet 'shifting' ( $r = .36, p(\text{one-tailed}) < .01$ ), and adaptability facet 'change' ( $r = .27, p(\text{one-tailed}) < .05$ ).

Entering these three variables as predictors into a logistic regression, resulted in a model displayed in Table 25. None of the predictors appeared to significantly improve the prediction. This implied that the three facets were not able to predict whether a team would perform above or below average. The overall model was not significant and accounted for 11% of the variance in the stable environment performance.

Table 25 Logistic regression model for SEP

	B (SE)	95% CI for exp b		
		Lower	Exp b	Upper
Included				
Constant	-8.47 (4.87)		0.00	
Mutual performance monitoring 'monitoring'	0.38(0.83)	0.29	1.46	7.45
Back-up behaviour 'shifting'	2.00(1.07)	0.90	7.39	60.55
Adaptability 'change'	-0.92(1.01)	0.06	0.40	2.90

Note  $R^2 = .11$  (Hosmer & Lemeshow),  $.15$  (Cox & Snell),  $.20$  (Nagelkerke). Model  $\chi^2(1) = 6.30$  \* $p < .05$

The correlations between the average competence difference in teams and a stable environment performance (SEP) can be found in Table 24. Five significant correlations were found with SEP: team orientation facet 'preference' ( $r_s = -.27, p(\text{one-tailed}) < .05$ ), team orientation facet 'acceptance' ( $r_s = -.38, p(\text{one-tailed}) < .01$ ), mutual trust facet 'open communication' ( $r_s = -.39, p(\text{one-tailed}) < .01$ ), back-up behaviour facet 'shifting' ( $r_s = -.42, p(\text{one-tailed}) < .01$ ), and adaptability facet 'change' ( $r_s = -.41, p(\text{one-tailed}) < .01$ ). Entering these three variables as predictors into a logistic regression, resulted in a model displayed in Table 26. As shown in the table, the difference in back-up behaviour shifting appeared to significantly improve the prediction. This implied that the difference in competence in the team was able to predict whether a team performed above or below average. Since the Exp(b) was below 1, a larger difference predicted that the team would be more likely to perform below average. The overall model accounted for 41% of the variance in the stable environment performance.

Table 26 Logistic regression model for SEP

	B (SE)	95% CI for exp b		
		Lower	Exp b	Upper
<b>Included</b>				
Constant	5.36 (1.85)		213.7	
Team orientation 'preference'	0.39(1.09)	0.18	1.48	12.44
team orientation 'acceptance'	-0.46 (2.05)	0.01	0.63	35.13
Mutual trust 'open communication'	-3.33 (1.97)	0.00	0.04	1.69
Back-up behaviour 'shifting'	-3.89 (1.79)*	0.00	0.02	0.68
Adaptability 'change'	-3.01 (1.95)	0.00	0.05	2.23

Note  $R^2 = .41$  (Hosmer & Lemeshow), .43(Cox & Snell), .58(Nagelkerke). Model  $\chi^2(1) = 21.49$  \* $p < .05$

#### 4.2.3.3 Dynamical environment performance

The correlations concerning the dynamical environment performance can be found in Table 27. Two significant correlations were found between average competence scores and DEP. Back-up behaviour facet 'recognition' ( $r = .30$ ,  $p(\text{one-tailed}) < .05$ ), and adaptability facet 'awareness' ( $r = .30$ ,  $p(\text{one-tailed}) < .05$ ). Concerning the differences in competence, one significant correlation was found: Back-up behaviour shifting ( $r = -.35$ ,  $p(\text{one-tailed}) < .05$ ).

Table 27 Correlations between the team level average/difference competence and the dynamical environment performance

		DEP (Pearson)			DEP (Spearman)
1	Average TO-P	.00	1	Difference TO-P	-.15
2	Average TO-A	.01	2	Difference TO-A	.05
3	Average TO-T	-.20	3	Difference TO-T	-.12
4	Average MT-OC	.11	4	Difference MT-OC	-.15
5	Average MT-TRP	.03	5	Difference MT-TRP	.08
6	Average MPM-M	.20	6	Difference MPM-M	.07
7	Average MPM-F	-.05	7	Difference MPM-F	.06
8	Average BU-R	.30	8	Difference BU-R	-.11
9	Average BU-S	.16	9	Difference BU-S	-.35
10	Average AD-A	.30	10	Difference AD-A	-.20
11	Average AD-C	.17	11	Difference AD-C	-.07
12	Average CO-C	-.16	12	Difference CO-C	.21
13	Average All	.13	13	Difference All	.07

Note  $N = 41$ .  $|r| \geq .26$   $p < .05$  (one-tailed)  $|r| \geq .31$   $p < .05$  (one-tailed)

TO-P	Team Orientation Preference	MPM-F	Mutual Performance Monitoring Feedback
TO-A	Team Orientation Acceptance	BU-S	Back-up behaviour Shifting
TO-T	Team Orientation Team Goal	BU-R	Back-up behaviour Recognition
MT-OC	Mutual Trust Open Communication	AD-A	Adaptability Awareness
MT-MTRP	Mutual Trust Team Roles and Protection	AD-C	Adaptability Change
MPM-M	Mutual Performance Monitoring Monitoring	CO-CL	Communication Closed-Loop

Entering average BU-R en AD-A into a linear regression, resulted in the model shown in Table 28. None of the average competences appeared to be a significant predictor for the Dynamic Environment Performance.

Table 28 Multiple regression model for DEP

	<i>B</i>	<i>SE B</i>	$\beta$
Constant	37.94	15.31	
Back-up behaviour recognition	3.78	2.71	.22
Adaptability Awareness	3.74	2.75	.22

Note  $R^2 = .13\%$  \* $p < .05$

### 4.3 Discussion

In this study both the construct validity as the criterion validity of the CTCQ scales have been assessed.

#### 4.3.1 Construct validity

To assess the construct validity, the CTCQ scales were compared to instruments which were expected to be related. In Table 29 an overview of the construct validity results can be found.

Table 29 Overview of the construct validity

<i>Scale</i>	<i>External Instruments</i>	Prediction	Findings
Team Orientation Preference	Collectivism facet 'independence'	+	NS
	Collectivism facet 'preference to work alone'	-	-.86**
	IPIP-gregariousness	+	NS
	IPIP-warmth	+	.21**
Team Orientation Team Goal	Collectivism scale facet 'group goal'	+	.32**
Mutual trust Open communication	Propensity to trust	+	.18*
Mutual Trust Team Roles and Protection	Propensity to trust	+	.18*
Back-up behaviour Recognition	IPIP-trust	+	.27**
	Big Five conscientiousness	+	.35**
Back-up behaviour Shifting	Big Five extraversion	+	NS
	Big Five conscientiousness	+	.35**
Adaptability Awareness	Big Five openness	+	.22**
Adaptability Change	Big Five openness	+	.15*
	Pavlov temperament scale facet 'mobility'	+	.25**

Note: + = positive relation - = negative relation NS= not significant \*  $p < .05$ , \*\* $p < .01$

The construct validity of the team orientation preference (TO-P) scale was assessed by comparing it to four other scales. Significant correlations were found between TO-P and 'preference to work alone' and also between TO-P and the IPIP warmth. The negative correlation between team orientation preference and 'preference to work alone' was expected, because people who prefer it to work on a team usually prefer it less to work alone. The size of this correlation was unexpected, and it appeared that both measures were strongly related. Although hypothesized differently, no significant correlations were found between TO-P and 'independence' and 'gregariousness'. The fact that no correlation was found with the scale on independence might have been caused by its low Cronbach's alpha ( $\alpha = .64$ ). Due to a Cronbach's alpha below  $\alpha = .70$ , the 'independence' scale might not be reliable enough to draw conclusions on.

From the lack of correlation between TO-P and 'gregariousness', it can be concluded that both constructs were more distinct than was expected. Hypothesis 5 was based on an article that presumed the existence of this relationship based on literature (Driskell et al., 2006). According to Driskell et al. (2006), gregariousness would be positively related to preference to work with others. It must be noted that this assumption was based on theory and was not supported with empirical evidence. However, the results in this study contradict this

assumption. Table 17 shows that gregariousness did not correlate significantly with the facet 'preference to work alone' as could be expected from Driskell et al. (2006). Therefore, it was assumed that the hypothesis was based on an incorrect proposition made by Driskell et al. (2006). This could be the reason that no significant correlation was found between gregariousness and team orientation preference. Although, half of the hypothesis were not supported, it was still concluded that this study found support for the construct validity of the scale.

The construct validity of team orientation facet 'team goal' (TO-T) was assessed by comparing the scale to the individualism-collectivism 'group goal' scale. Since a moderate positive correlation was found, it was concluded that this study provided evidence for the construct validity of the TO-T scale.

The construct validity of the mutual trust facets was assessed by comparing the scales to the 'propensity to trust' scale and the IPIP trust scale. Although significant positive correlations were found between the propensity to trust scale and both mutual trust facets, the size of the correlations was lower than expected. As discussed before, doubts on the construct validity were caused due to the presence of substantial correlations between the propensity to trust scale and team orientation. The absence of test-retest reliability in study 1 and weak support for construct validity, led to believe that the scales were not reflecting mutual trust as was expected. The assumption that mutual trust was measurable on the individual level (and not an emergent state) may not have been valid. It is advised that future research verifies whether this assumption is valid. The fact that the IPIP trust scale correlated only with the mutual trust facet 'team roles and protection', was expected. It is, therefore, concluded that findings from this study, only weakly support the construct validity of both mutual trust facets.

Both back-up behaviour scales (recognition and shifting), reported a moderate positive correlation with Big Five conscientiousness. The hypothesis on the relation between back-up recognition and extraversion was not supported. Although asking for help was considered to be a part of the back-up behaviour facet 'recognition', it was not represented as such in the items that comprised this scale. Initially, the items were included but were removed after the reliability analysis. The lack of correlations between the goal orientation prove performance and the back-up scales, supported the construct validity of the back-up behaviour facets. This evidence could not be used due to an unsatisfactory Cronbach's alpha. Although, it was concluded that this study provided support for the construct validity of back-up shifting and for back-up recognition without the asking for help element.

Since all four hypotheses concerning the adaptability facets were supported, it was concluded that this study provided strong support for the construct validity of these facets. Although study one showed that the adaptability facet 'change' required improvement, its items were shown to be related to the intended construct.

The discriminant validity study showed that the CTCQ scales measured related, but different concepts than goal orientation. The measures were related because correlations were found, but the concepts were different because all correlations were small. As was reported, one correlation exceeded  $r=.30$ . But this correlation was not taken into account since it concerned the mutual performance monitoring facet 'monitoring'. Results obtained in study one, implied that the scale should be repaired and was therefore not regarded as an operational scale.

To conclude, for the eight CTCQ scales mentioned in the table above, supporting evidence for the construct validity has been found. Additionally, it can be concluded that these CTCQ scales measured something new and conceptually different from personality and goal orientations. Therefore, no scale was excluded for study three. However, some correlations were significant but lower than expected ( $r<.20$ ). It must be noted that the possibility exists that these low significant correlations were caused by common-method variance.

#### 4.3.2 Criterion Validity

In addition to the construct validity, also the criterion validity has been assessed. This has been done by comparing self and peer ratings to individual scores on the CTCQ and by comparing team performance to both average and difference in team competence levels. The results can be found in Table 30.

Peer ratings were used in this study since they were expected to yield higher reliability and validity than self-ratings (Stevens & Campion, 1999). Unfortunately, the peer-ratings on the respondent's behaviour have been

shown to differ substantially. On average each of the six peer ratings differed 1.46 points ( $SD=1.24$ ). This is a rather large difference considering the 7-point Likert scale that was used. An interrater reliability analysis was conducted to determine the consistency among ratings. This resulted in Kappa = 0.076 ( $p < 0.001$ ). Since this value was substantially below the minimum .40 criterion for moderate agreement, the peer ratings could not be used in this study. Simply ignoring cases with high inter-rater differences was not found to be successful due to a substantial drop in power. In addition to the low Kappa, results from additional analysis caused doubts about the validity of the peer ratings. After assessing the videos of six teams, the author believes that the peer ratings did not reflect the frequency of the behaviours correctly. The assumption that all respondents were able to rate each other properly after the task did not hold. This is probably caused by the fact that the respondents were too busy with their own tasks to be able to precisely monitor each other's behaviour. Therefore, it was concluded that the method used in this study to capture peer ratings was simply not valid. The self ratings showed some significant positive correlations. Self-ratings of teamwork behaviour reflecting team orientation preference, the mutual performance monitoring facet 'monitoring', back-up behaviour shifting and adaptability change were correlated positively with the reported CTCQ competence levels. Whether these findings support the criterion validity of these competence scales is uncertain. Respondents may have had the desire to be consistent and, therefore, reported frequencies in line with answers given to the CTCQ.

On team level, several relations have been found which are presented in Table 30. Three average competences were found to correlate significantly with the stable environment performance: mutual performance monitoring facet 'monitoring', back-up behaviour facet 'shifting' and adaptability facet 'change'. Logistic regression with these three predictor variables resulted in a non-significant model. Adding these three predictors at once, none of the predictors appeared to significantly improve the prediction. Additionally, the competence differences in teams were taken into account (SEP-DIF). Five competence differences were found to correlate with the stable environment performance negatively; team orientation preference, team orientation acceptance, mutual trust open communication, back-up behaviour shifting, and adaptability change. This result implied that the more team members differed in these competences, the less they performed.

Table 30 Overview of the criterion validity

Facet	SR		SEP AVR		SEP DIF		DEP AVR		DEP DIF	
	P	F	P	F	P	F	P	F	P	F
Team orientation Preference	+	.35**	+	NS	-	-.27*	+	NS	-	NS
Team orientation Acceptance	+	NS	+	NS	-	-.38**	+	NS	-	NS
Team orientation Team goal	..	..	0	NS	0	NS	0	NS	0	NS
Mutual trust Open Communication	+	NS	+	NS	-	-.39**	+	NS	-	NS
Mutual trust Task, Roles, Protection	+	NS	+	NS	-	NS	+	NS	-	NS
Mutual performance monitoring Monitoring	+	NS	+	.28*	-	NS	+	NS	-	NS
Mutual performance monitoring Feedback	+	.15*	+	NS	-	NS	+	NS	-	NS
Back-up behaviour Recognition	+	.23**	+	NS	-	NS	+	.30*	-	NS
Back-up behaviour Shifting	..	..	+	.36**	-	-.42**	+	NS	-	-.35**
Adaptability Awareness	+	NS	+	NS	-	NS	+	.30*	-	NS
Adaptability Change	+	.22**	+	.27*	-	-.41**	+	NS	-	NS
Communication Closed-loop	+	NS	+	NS	-	NS	+	NS	-	NS

Note: P=Predicted relation F=Findings + = positive relation - = negative relation 0=no relation

SR= self rating, SEP-AVR= relation between stable environment performance and average competences in the team

SEP-DIF= relation between stable environment performance and differences in competences in the team

DEP-AVR= relation between dynamic environment performance, and average competences in the team

DEP-DIF= relation between dynamic environment performance and differences in competences in the team



Logistic regression showed that the difference in back-up behaviour shifting was a significant predictor for team performance categorized as below and above average. The obtained result was logical in terms of the environment in which the team had to perform. Each team member had to get used to work with the new computer program and had to learn how to interpret the data. Especially in this setting, helping each other was essential for the team to perform well. The logistic regression showed that teams which differed internally in back-up recognition shifting, were less likely to perform above average.

In the dynamic environment, two team average competences correlated positively with performance: back-up behaviour facet 'recognition' and adaptability facet 'awareness'. The more competent the team was in back-up behaviour 'recognition' and adaptability 'awareness', the better they performed in the dynamic environment. This result appeared to be logical in terms of the dynamical task environment in which discovering of the unexpected change was required to perform well. Conducting a linear regression showed that none of these two average competences was a significant predictor of the dynamical environment performance (DEP). One competence difference correlated positively with the dynamic environment performance. Similar to the stable environment performance, the more a team differed in back-up behaviour shifting, the less they performed.

It was concluded that this study has gathered evidence for the criterion validity of adaptability change and back-up shifting. As was concluded from study 1, the adaptability change scale required a set of new items because the current items did not load on one factor. The scale was taken into account in this study to provide additional insights for future item generation. From this study was concluded that the current scale scored rather well on criterion validity. Therefore, it is advised to pay attention to this result while new items are created. Attempts should be made to create new items that will correlate to one factor, but still yield the criterion validity of the current set. The strongest evidence for criterion validity was found for the back-up behaviour shifting scale. Helping each other during this task appeared to be related with performance in both the stable and dynamic environment. Especially the difference scores appeared to be able to predict the team performance. From this it was concluded that homogeneity in back-up shifting is important in ad-hoc teams that engage in similar tasks.

For team orientation preference, team orientation acceptance, mutual trust open communication, mutual performance monitoring facet 'monitoring', back-up facet 'recognition' and adaptability facet 'awareness', only weak evidence for criterion validity was found. The author believes that this may be caused by the experimental task that was used. As stated before, not all competences were expected to be important. Furthermore, the task appeared to have some weaknesses that will be further discussed in the limitation section in chapter 6. It is strongly advised to test the CTCQ again in teams which engage in more complex tasks. Additional research is required to confirm that the CTCQ scales really measure useful competences.

To conclude, this study assessed both the construct validity and the criterion validity. Supporting evidence for the construct validity of eight scales has been found. Though, it must be noted that for some scales the evidence was weak. But it was concluded that these CTCQ scales measured something new and conceptually different from personality and goal orientations. The criterion validity was assessed as well and supportive evidence for only two competence facet scales was found. Therefore, it is advised to conduct an additional criterion validity study in future to ensure that the CTCQ scales really measures useful competences.

## 5 Study 3: Practicality

The practicality of the teamwork competences questionnaire was evaluated considering the following three aspects: economy, convenience and interpretability.

### 5.1 Method

#### 5.1.1 Hypotheses

Economy refers to the financial aspects of the instrument. Lengthy questionnaires are often more reliable, but the time required to answer all the questions is directly related to salary costs. In addition, the way the instrument requires to collect data can also be related directly to costs. For example, assessing competences through an assessment centre is more expensive than using a questionnaire. Therefore, an economic instrument should contain only necessary items and should gather data in a cost efficient manner.

Although no hypotheses were posed, the time required to fill out the total questionnaire was assessed to judge the economy of the CTCQ. Convenience of an instrument is related to the ease-of-use. Clear instructions and a good design, make an instrument more convenient. No hypotheses were drawn up, but these aspects were taken into account. Interpretability is related to the extent to which outsiders can understand the results easily. The availability of scoring keys, guidelines for test use, evidence of reliability and validity will increase the interpretability of the instrument. Assessing teamwork competences via self-report may be problematic under certain circumstances. An example could be the application of the competence questionnaire in a military setting. The military has a powerful team culture and teamwork is often publicly valued (Diskell et al., 2006). Hence, the response on questionnaire items concerning teamwork competences may be affected by this. To evaluate whether the response on the items is prone to be faked, a social desirability assessment was conducted as well. It was expected that social desirability has no effect on the CTCQ scores.

- *(H17): scores on social desirability have no significant influence on the competences measured by the questionnaire.*

#### 5.1.2 Participants

To obtain information on economy and convenience the TU/e sample ( $N=32$ , mentioned in Study 1) was used. To test the influence of Impression Management (IM) and Self Deception Enhancement (SDE) on the CTCQ, the same sample as the criterion related validity study (Study 2) was used. This sample consisted of 122 participants drawn from the TNO participant database. The participants in the sample had an average age of 24.3 years ( $SD = 4.0$ ), 56% was male, 66% student and 34% was employed.

#### 5.1.3 Measures

Economy of the instrument was judged on the time that respondents needed to fill out the entire questionnaire. Since the respondents completed the initial 88 item questionnaire instead of the final 38-item version, the amount of time was corrected. This was done according to the following formula:  $(\text{Total-required-for-88-items} \times 38) / 88 = \text{Time expected for the 38 item version}$ .

The convenience of the instrument was discussed based on user experiences. Data was gathered by adding three questions to the questionnaire to enable respondents to comment on the instrument. The questions related to whether the items and questionnaire instructions were understandable and whether the design of the CTCQ was clear. These three questions can be found in Appendix 3.

To judge on the interpretability an assessment of the social desirability of each respondent was required. Therefore, Paulhus Deception Scales (PDS) have been used. Using a 40-item questionnaire, respondents were tested on Impression Management (IM) and Self Deception Enhancement (SDE). IM is defined as 'the tendency to give inflated self-descriptions to an audience' (Paulhus, 2006, p. 1). The Impression Management scale was used to test whether a respondent was trying to respond in a social desirable manner. Items, such as 'I have never dropped litter on the street', comprised this scale. Cronbach's alpha for the IM scale was reported to be .84 (Paulhus, 2006). SDE is referred to as 'the tendency to give honest but inflated self-descriptions' (Paulhus, 2006, p. 1). In case respondents scores high on SDE, it implies that they truly believe that they are better than the rest which results in high self-esteem and overconfidence. SDE was measured

with items, such as ‘I don’t care to know what other people really think of me’. Cronbach’s alpha of the SDE scale equals .75 (Paulhus, 2006, p. 1). The scales have been translated from English into Dutch with help from an official interpreter (Venrooij, 2007).

### 5.1.4 Data analyses

To verify the economy and convenience of the instrument, means and standard deviations of the three questions were calculated. To test the hypothesis on social desirability, both the zero-order correlations and partial correlations were calculated. The partial correlation coefficients were calculated between the CTCQ facet scores controlling for both IM and SDE. This was done in order to evaluate the effect of the IM and SDE on the correlations between the CTCQ facets. An effect of social desirability would be proven in case the correlations between the facets would change substantially when controlled for IM or SDE. It must be noted that the normality assumption which is required for partial correlations was violated. Therefore, results should be interpreted with caution.

## 5.2 Results

### 5.2.1 Data exploration

Univariate outlier analysis of the questionnaire completion times resulted in identification of one outlier.

Respondent 12 took 65 minutes this resulted in a z-score of 3.88 ( $p < .001$ ), which was well above the absolute maximum of 3.29 (Field, 2005). It was assumed that this respondent did not close the browser screen of the questionnaire after he or she finished it. Therefore, this respondent was removed from the dataset.

As can be seen in Table 14 in Chapter 4, the non parametric analysis was necessary since the Kolmogorov Smirnov test resulted in significant deviations from normality for the competence items.

In Table 31, the bivariate Spearman correlation coefficients for the variables used in this study are presented.

Table 31 Bivariate correlation coefficients

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 IM	---												
2 SDE	.15	---											
3 TO-P	.04	.10	---										
4 TO-A	-.16	.05	.24	---									
5 TO-T	-.20	-.01	.49	.42	---								
6 MT-OC	-.05	.14	.21	.41	.21	---							
7 MT-TRP	-.23	.13	.23	.49	.48	.23	---						
8 MPM-M	-.16	-.02	-.03	.23	-.03	.22	.02	---					
9 MPM-F	.22	.25	.20	.10	.03	.26	.00	.42	---				
10 BU-R	-.21	.04	.21	.44	.29	.35	.16	.47	.33	---			
11 BU-S	-.24	-.13	.18	.35	.23	.37	.17	.37	.19	.51	---		
12 AD-A	.10	.09	.13	.25	.04	.25	.03	.40	.34	.42	.32	---	
13 AD-C	-.06	.01	.32	.58	.37	.45	.31	.19	.24	.39	.49	.38	---
14 CO-CL	.00	.00	.14	.34	.21	.27	.14	.29	.31	.36	.28	.34	.31

Note  $N=122$  |  $r_s| \geq .15$   $p < .05$  (one-tailed) |  $r_s| \geq .20$   $p < .05$  (two-tailed)

TO-P	Team Orientation Preference	MPM-F	Mutual Performance Monitoring Feedback
TO-A	Team Orientation Acceptance	BU-S	Back-up behaviour Shifting
TO-T	Team Orientation Team Goal	BU-R	Back-up behaviour Recognition
MT-OC	Mutual Trust Open Communication	AD-A	Adaptability Awareness
MT-MTRP	Mutual Trust Team Roles and Protection	AD-C	Adaptability Change
MPM-M	Mutual Performance Monitoring Monitoring	CO-CL	Communication Closed-Loop

The variable IM ( $M=11.26$ ,  $SD=4.24$ ,  $\alpha=.82$ ) ranged from 0 to 20 and SDE ( $M=8.49$ ,  $SD=3.12$ ,  $\alpha=.65$ ) ranged from 0 to 16. As shown in Table 31, seven scales were significantly correlated with IM; the team orientation facet ‘acceptance’ ( $r_s = -.16$ ,  $p < .05$ ), the team orientation facet ‘team goals’ ( $r_s = -.20$ ,  $p < .05$ ), mutual trust facet ‘team roles and protection’ ( $r_s = -.23$ ,  $p < .01$ ), mutual performance monitoring facet ‘feedback’ ( $r_s = .22$ ,  $p < .01$ ), back-up behaviour facet ‘recognition’ ( $r_s = -.21$ ,  $p < .05$  and back-up behaviour facet ‘shifting’ ( $r_s = -.24$ ,  $p < .05$ ). Mutual performance monitoring ‘feedback’ also correlated positively with SDE ( $r_s = .26$ ,  $p < .01$ ).

Table 32 *Pearson correlations in combination with partial correlations controlled for IM and SDE*

	1	2	3	4	5	6	7	8	9	10	11
TO-P	---										
TO-A	.28/.29/.27	---									
TO-T	.51/.53/.51	.41/.40/.42	---								
MT-OC	.22/.22/.21	.40/.40/.40	.18/.18/.18	---							
MT-TRP	.30/.32/.29	.48/.46/.47	.49/.47/.50	.20/.20/.19	---						
MPM-M	-.07/-.06/-.07	.22/.21/.23	-.02/-.04/-.02	.19/.18/.19	-.02/-.06/-.02	---					
MPM-F	.26/.26/.25	.10/.14/.08	.04/.09/.04	.20/.21/.17	.06/.13/.03	.39/.44/.42	---				
BU-R	.22/.23/.22	.42/.41/.42	.30/.27/.30	.32/.32/.32	.14/.11/.15	.47/.46/.47	.36/.42/.38	---			
BU-S	.24/.25/.26	.36/.34/.37	.26/.23/.26	.35/.35/.37	.22/.18/.24	.36/.34/.36	.18/.25/.24	.55/.53/.55	---		
AD-A	.19/.18/.18	.17/.20/.17	.04/.07/.04	.19/.20/.19	.00/.04/-.01	.37/.40/.38	.36/.33/.36	.41/.44/.41	.36/.41/.37	---	
AD-C	.38/.38/.38	.56/.56/.56	.40/.40/.40	.45/.45/.46	.33/.33/.33	.22/.22/.22	.26/.28/.27	.42/.43/.42	.55/.56/.56	.40/.41/.40	---
CO-CL	.16/.16/.17	.28/.29/.28	.15/.16/.15	.23/.23/.23	.14/.15/.14	.29/.29/.29	.35/.35/.37	.36/.37/.36	.24/.25/.24	.37/.37/.37	.28/.28/.28

Note: N=122

a/b/c

a = Pearson correlation

b = Partial IM

c = Partial SDE

### 5.2.2 Results

To assess the economy of the instrument, the average completion time was assessed. After removing the outlier, the average time to complete the 88 item questionnaire equaled 15.9 minutes ( $SD=8.2$ ). The time ranged from 7.5 to 49.7 minutes. Correcting the average completion time for the shorter final CTCQ version resulted in an average completion time for the 38-item version of 6.9 minutes.

Three questions were added to the CTCQ to measure the convenience of the CTCQ. The question to rate the understandability of the items in the CTCQ, was answered with an average 4.47 ( $SD=0.67$ ) on a 7-point scale. An average of 4.59 points ( $SD=0.71$ ) was given to the understandability of the instructions and 3.41 points ( $SD=1.34$ ) to the design of the questionnaire.

As shown in Table 31, seven scales correlated with IM; the team orientation facet 'acceptance' ( $r_s = -.16$ ,  $p<.05$ ), the team orientation facet 'team goals' ( $r_s = -.20$ ,  $p<.05$ ), mutual trust facet 'team roles and protection' ( $r_s = -.23$ ,  $p<.01$ ), mutual performance monitoring facet 'feedback' ( $r_s = .22$ ,  $p<.01$ ), back-up behaviour facet 'recognition' ( $r_s = -.21$ ,  $p<.05$  and back-up behaviour facet 'shifting' ( $r_s = -.24$ ,  $p<.05$ ). Six correlations were small ( $r < .30$ ) and negative. This implied that respondents with higher competence scores scored lower on IM, and vice versa. The correlation between mutual performance monitoring feedback and IM was small and positive, which implied that social desirable responders also obtained higher scores on their feedback competence. The mutual performance monitoring facet 'feedback' correlated positively with SDE ( $r_s = .26$ ,  $p<.01$ ). This implied that people who truly believed that they were better than the average person, also reported to be more competent in mutual performance monitoring feedback. It must be noted that Cronbach's alpha of SDE was below the  $\alpha=.70$  criterion for established scales, but above the absolute minimum of  $\alpha=.60$ . Therefore, results should be interpreted with caution.

Table 32 shows the Pearson correlations between the competence facets and the partial correlations controlled for impression Management (IM) and self deception enhancement (SDE). As shown in Table 32, the majority of differences were around .03. The largest two differences equaled .07 and occurred when controlling for Impression Management. The correlation between the two facets of mutual performance monitoring, increased with .07 if the correlation was controlled for impression Management. The correlation between back-up shifting and mutual performance monitoring feedback also increased with .07.

## 5.3 Discussion

This study assessed the economy, convenience and interpretability of the CTCQ.

The length of the instrument is one of the criteria on which the economy aspect of the CTCQ was assessed. It is expected that it will take the respondent 6.9 minutes on average to fill out the entire questionnaire. Additionally, the cost of test materials is low since the full CTCQ is available online. Therefore, it has been concluded that the CTCQ can be considered as an economical instrument.

This study has shown that the instrument is perceived as rather convenient by the user. The items and the instructions were reported as being understandable. However, the design requires improvement since it scored poorly. This may be caused by the combination of a yellow and white background. The questionnaire is available online and can be easily administered. Results obtained by the online questionnaire can be converted into an SPSS data file in seconds. Since a tailor-made SPSS syntax is available, the results can be processed and converted into a personal profile quickly. Hence, it was concluded that the CTCQ is a convenient instrument, but requires a better design.

The CTCQ is also believed to score well on interpretability since this study has shown that the CTCQ is not substantially affected by impression management or self deception enhancement. From the zero order correlations was concluded that 7 of the 12 competence scales correlate significantly with Impression Management (IM). Six correlations were small ( $r < .30$ ) and negative. This implied that respondents with higher competence scores scored lower on IM, and vice versa. Therefore, it can be

concluded that respondents who try to respond in a socially desirable manner do not end up with higher scores on these six competences. The correlation between mutual performance monitoring feedback and IM was small and positive, which implied that social desirable responders also obtained higher scores on their feedback competence. Pearson correlations between the competence facets and the partial correlations controlled for impression Management (IM) were assessed. The majority of differences were around .03. Only the correlation between the two facets of mutual performance monitoring, increased with .07 if the correlation was controlled for Impression Management. The correlation between back-up shifting and mutual performance monitoring feedback also increased with .07. Since all zero-order correlations were small, mostly negative, and only small differences were found in the partial correlation table, no substantial influence of impression management on the responses on the CTCQ questionnaire was found. Also for SDE, no substantial influence was detected. Only one zero-order correlation was found to be significant, positive but small and the partial correlation table showed even smaller differences for SDE than for IM. Additionally, this thesis provides definitions and evidence for reliability, construct validity and criterion validity, and, therefore, users are expected to be able to interpret the obtained results correctly.

In conclusion, CTCQ was proven to be an economical and convenient instrument, but requires a better design. The CTCQ is also believed to score well on interpretability, since impression management and self deception enhancement have been shown not to affect the CTCQ scores substantially. Furthermore, this thesis provides definitions and evidence for reliability, construct validity and criterion validity, and, therefore, users are expected to be able to interpret the obtained results correctly.

## 6 General discussion

This chapter deals with the conclusion and general discussion of the obtained results, limitations and directions for future research.

### 6.1 Conclusion

In the last decades, military staff is increasingly required to serve in teams that are composed of people who do not know each other beforehand. The team members often have diverse expertise which is brought together to meet a specific, mostly short-term, objective. This type of team is referred to as an ad-hoc team. Due to the increasing usage of ad-hoc teams within the Dutch military, there is an increasing demand for training concepts which support this particular type of team. Currently, TNO is engaged in the development of such training concept. One of the steps of the development of this training concept is the creation of an assessment tool. This assessment tool is supposed to assess the ad-hoc team members on a range of factors which are related to ad-hoc team effectiveness. For most factors, validated and reliable questionnaires already exist. However, for the measurement of critical teamwork competences a validated and reliable questionnaire was lacking. Therefore, this thesis focused on the development of an instrument to measure critical team competences.

Based on literature, six competences were selected to comprise the Critical Team Competences Questionnaire (CTCQ). These were: Team Orientation, Mutual Trust, Mutual Performance Monitoring, Back-up Behaviour, Adaptability and Communication. To be able to measure the competences properly, each competence was split up into two or more distinct facets. These facets are shown in Table 33. For each of the 13 facets a set of questions was devised. This resulted in an initial 88-item questionnaire.

Table 33 Overview CTCQ competencies and facets

	<i>Competence</i>	<i>Facet</i>
1	Team orientation	Preference
2	Team orientation	Acceptance
3	Team orientation	Team goal
4	Mutual trust	Open Communication
5	Mutual trust	Task, Roles, Protection
6	Mutual performance monitoring	Monitoring
7	Mutual performance monitoring	Feedback
8	Back-up behaviour	Recognition
9	Back-up behaviour	Shifting
10	Adaptability	Awareness
11	Adaptability	Change
12	Communication	Closed-loop
13	Communication	Information exchange

The further developmental process was guided by three research questions:

1. Does the CTCQ assess the competences in a reliable way?
2. Does the CTCQ assess the competences in a valid way?
3. Does the CTCQ assess the competence in a practical way?

Answers to these research questions were found by completing three separate studies. Results of these studies can be found in Table 34.

The first study assessed the reliability of the CTCQ. During this study, the internal consistency, factor structure and stability of the CTCQ were assessed. The internal consistency assessment revealed that the communication facet 'information sharing' scale was unreliable. Since the psychometric quality of the scale could not be improved, the facet was excluded from the rest of the studies. The factor structure showed that the majority of the items that were related to different scales also loaded on

distinct factors. Only four items that belonged to the adaptability facet ‘change’ and the mutual performance monitoring facet ‘monitoring’, appeared not to correlate with the intended factors. Due to a satisfactory internal consistency, these scales have been taken into account in the rest of the studies to provide additional insights for future improvements. The test-retest reliability evaluated whether the scales were reliable over time. Therefore, the consistency was assessed between the responses of an individual within a one-month interval. The majority of the scales were proven to be reliable over time, but both mutual trust facets reported an unsatisfactory result.

To conclude, from the initial thirteen scales the communication information exchange scale was dropped after the internal consistency analysis. The rest of this study showed that 4 of the remaining 12 scales require additional attention in future: for the adaptability facet ‘change’ and mutual performance monitoring facet ‘monitoring’ new items should be devised and both mutual trust facets should be tested again on test-retest reliability. The four scales were taken into account in the other studies to provide additional insights. Thus, to answer the first research question: 8 scales were found to be reliable, 4 required extra attention in future to improve their reliability and 1 scale was dropped and should be completely revised. The result of study one was that the CTCQ which was used in study two and three consisted of 38 items that measured 12 facets of 6 teamwork competences.

The second study focussed on the validity and consisted of two parts: the construct validity and the criterion-related validity. The construct validity was assessed by comparing the results of the CTCQ to the results of several existing instruments that were expected to correlate, such as big five and, scales on trust and adaptability. Additionally, the CTCQ was tested on discriminant validity by comparing it to an instrument which was not expected to be strongly related. The study gathered evidence for the construct validity of the tested CTCQ scales. The results for each scale can be found in Table 34. In the table is shown that for the eight CTCQ scales supporting evidence for the construct validity has been found. However, for both mutual trust scales only weak support was found. Additionally, it can be concluded that these CTCQ scales measured something new and conceptually different from personality and goal orientations.

Table 34 Overview of the reliability, validity and practicality of the CTCQ Scales

#	Critical Teamwork Competence Facets	Study 1		Study 2		Study3	
		Internal Consistency	Factor structure	Test-retest	Construct validity	Criterion validity	Practicality (IM/SDE)
1	Team orientation <i>Preference</i>	+	+	+	+	+/-	+
2	Team orientation <i>Acceptance</i>	+	+	+	...	+/-	+/-
3	Team orientation <i>Team goal</i>	+	+	+	+	-	+/-
4	Mutual trust <i>Open Communication</i>	+	+	-	+/-	+/-	+
5	Mutual trust <i>Task, Roles, Protection</i>	+	+	-	+/-	-	+/-
6	Mutual performance monitoring <i>Monitoring</i>	+	+/-	+	...	+/-	+/-
7	Mutual performance monitoring <i>Feedback</i>	+	+	+	...	-	+/-
8	Back-up behaviour <i>Recognition</i>	+	+	+	+	+/-	+/-
9	Back-up behaviour <i>Shifting</i>	+	+	+/-	+	+	+/-
10	Adaptability <i>Awareness</i>	+	+	+/-	+	+/-	+
11	Adaptability <i>Change</i>	+	-	+	+	+	+
12	Communication <i>Closed-loop</i>	+	+	+/-	...	-	+
13	Communication <i>Information Sharing</i>	-	...	...	...	...	...

Note: + = Good    +/- = Acceptable    - = Bad    ... = Not assessed  
 IM=impression management    SDE = Self Deception Enhancement



To assess the criterion-related validity, an experiment was conducted. In total, 41 teams of three people engaged in a team task. After the task was completed, participants rated themselves and their peers on teamwork behaviours. The predictive power of the competences questionnaire was to be determined based on these ratings. Unfortunately, the team task did not require the respondents to use all the critical teamwork competences and the peer ratings appeared to be a rather unreliable measure. Therefore, no substantial evidence for criterion validity could be gathered based on peer ratings. Additionally, several team performance measures were used to evaluate the predictive power of the CTCQ on team level. For each of the 41 teams, the average level and differences of each CTCQ facet was calculated and compared to team level performance measures. The results provided evidence for the criterion validity of adaptability change and back-up behaviour shifting.

To answer the second research question, for 8 scales evidence was found for the construct validity and for two scales the data supported the criterion validity. Hence, it cannot be concluded that this study provides support for the validity of all the CTCQ scales.

The third study was related to practicality of the instrument. The practicality of the teamwork competences questionnaire was evaluated considering the economy, convenience and interpretability. Since the CTCQ consists of 38 items, it will take the respondent only 6.9 minutes to fill out the entire questionnaire. The questionnaire is available online and can be easily administered. Results obtained by the online questionnaire can be converted into an SPSS data file in seconds. Since a tailor-made SPSS syntax is available, the results can be processed and converted into a personal profile quickly. The respondents reported that the CTCQ instructions and items were clear, but that the design of the questionnaire was poor. Hence, it was concluded that the CTCQ is both an economic as a convenient instrument, but that the design should be improved. Since this thesis provides definitions and evidence for reliability, construct validity and criterion validity, users are expected to be able to interpret the obtained results correctly. Furthermore, this study has shown that the CTCQ is not substantially affected by impression management (IM) or self deception enhancement (SDE). The results in Table 34 refer to the influences of IM and SDE on each scale. No scale appeared to be substantially influenced by IM or SDE, therefore, it was concluded that scores could be interpreted without having to take social desirability into account. To answer the third research question, the CTCQ can be regarded as a practical instrument but its design should be improved.

To conclude, from the thirteen facets that constituted the initial CTCQ, eleven have been included in the final questionnaire. The communication facet 'information sharing' was excluded since the items lacked internal consistency. An entire new set of items should be developed in future. The adaptability facet 'change' was excluded because the factor matrix showed that its items loaded on various factors. Also for this facet, new items should be devised. Some of the eleven facets still require additional attention. Both mutual trust facets scored unsatisfactory on the test-retest reliability. The author believes that this could be caused by the experiment itself and, therefore, it is advised to repeat the test-retest reliability in another setting. The mutual performance monitoring facet 'monitoring' also requires additional attention. More than half of its items loaded on factors belonging to other facets. It is advised that a set of new items is devised which are more in line with the two items that loaded on a distinct factor.

## **6.2 Theoretical implications**

The studies conducted in this thesis have two theoretical implications. First, this thesis contributed to theory by operationalizing six teamwork competences mentioned by Salas et al. (2009) on the individual level. According to the author's knowledge, the six competences have not been converted into scales on the individual level before. Each competence was split into two or three distinct facets which were shown to be measurable as distinct but related aspects. The creation of these scales may assist future research on these competences. For example, the results obtained in this thesis can be

used to explore the nomological net. Additionally, now scales are developed, future research could include the competences more easily.

The second theoretical implication is related to the critical teamwork model from Salas et al. (2005). To the knowledge of the author, no attempts have been made yet to validate this model. Since the competences have been based on the critical teamwork model from Salas et al. (2005), the results obtained in these studies could be used to commence with the validation. To assess whether the model contains the right critical elements, related competences could be used. In the TIDE task not all competences were shown to matter for team performance, only back-up behavior shifting appeared to be able to predict performance significantly. This may imply that the critical teamwork component model does not hold in low complexity tasks like TIDE. Now the competences can be measured, teamwork in more complex tasks can be assessed in the same way on the presence of the critical components.

### 6.3 Practical implications

This thesis is part of a larger TNO project on ad-hoc team training. The eventual aim of the TNO project is to develop a tailor made training concept for military ad-hoc teams in order to enable them to become effective as quickly as possible. Before such a tailor made training could be developed, a tool had to be made that was able to provide insights in the individual characteristics of the ad-hoc team members. Earlier research has indicated that teamwork competences, personality, goal orientations, demographics, DISC behaviour and team roles should be included in this tool (Venrooij, et al., 2009). Because a validated questionnaire to assess the teamwork competences was still lacking, the questionnaire had to be developed. This questionnaire, referred to as the Critical Team Competences Questionnaire (CTCQ), was developed in this thesis. Now several scales of the CTCQ are proven to be reliable, valid and practical, the instrument can be added to TNO's ad-hoc team assessment tool.

In this assessment tool the CTCQ profiles will serve, among other factors, as a foundation for tailor made ad-hoc team training. Individual profiles on competences, personality, goal orientations, demographics, DISC behaviour and team roles will be combined into an individual profile that provides insights in the individual team member characteristics.

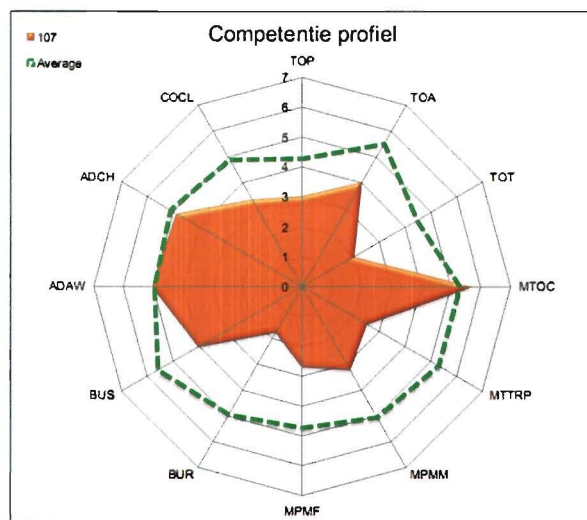


Figure 2 Example of competence profile

In Appendix 5, a full example of such an individual profile is shown. An individual competence profile is shown in Figure 2. Although MPM-M, AD-C, MT-OC and MT-TRP are shown in the profile, these scales still require additional attention before they can be used in the field. These individual profiles can also be combined into a team profile to obtain insights in the ad-hoc team.

As stated before, these insights on team and individual level could serve as a foundation for a tailor made ad-hoc training. This implies, for example, that when a team profile indicates that all the members score low on the mutual trust competence, extra attention should be given to this aspect during the training. These profiles are expected to speed up the training

process by revealing possible impediments to team effectiveness and thus indicating what a team requires most in a training. Additionally, the CTCQ can help ad-hoc team members to obtain insights

in their teamwork competences. The competence profile can, for example, show on which aspects someone needs to work.

In addition to the military setting, the tool can also be used in the commercial sector. Previous research on ad-hoc teams has shown that this type of team is also used in IT and industry (Venrooij et al., 2009). Therefore, the CTCQ could be used in these settings as well to support ad-hoc team development.

## **6.4 Limitations**

First, several general limitations will be discussed, where after the study specific limitations will be mentioned.

The most significant limitation for all three studies is that the results were not obtained from a military sample, but from a civil one instead. In the near future, the CTCQ is expected to function as an integral part of TNO's ad-hoc team assessment tool and will be applied on military commanders serving in ad-hoc teams. Since the CTCQ has not been validated in military setting, results should be interpreted with caution. Additionally, since the target group for the ad-hoc team training consists of military commanders in the higher echelon, the rather low average age might also have its influence on the generalizability of the findings. Another potential limitation of this study could be that the three studies were conducted using the same sample. Hinkin (1998) does not advise to use one sample for both questionnaire construction and validation. He argues that due to common source/common method variance, the factor analytical techniques might result in sample specific measures. As a result the newly formed measure could be less generalizable.

A specific limitation considering the first study was caused by using the same sample for the test-retest assessment and for the criterion related validity study. As a result, the perception of the team members on their own competences may have been changed. After the task, the respondents had to rate themselves and their teammates and this may have changed their self-perception. Therefore, it is advised for future research to use a sample that does not engage in additional team experiments.

Another limitation was located in the construct validity assessment in the second study. Although most hypotheses were supported, some were based on a rather low correlation. These low correlations could have been caused by common method variance. This might imply that some hypotheses have been accepted while they should have been rejected.

A limitation of the criterion validity study was related to the unreliability of the peer ratings. Peer ratings were used in this study since they were expected to yield higher reliability and validity than self-ratings (Stevens & Campion, 1999). Unfortunately, the peer-ratings on the respondent's behaviour have been shown to differ substantially. The assumption that all respondents were able to rate each other properly after the task did not hold. This is probably caused by the fact that the respondents were too busy with their own tasks to be able to precisely monitor each other's behaviour. To be able to assess the criterion validity in future, a more reliable measure on peer ratings is required.

Another limitation of the criterion validity study was caused by the experimental task. The author believes that the lack of significant correlations in is mainly caused by the experimental setting due to three reasons: (1) lack of complexity, (2) weak scenario, (3) only team level performance measures. The author believes that the task was too simple and, therefore, did not require the team members to engage in all competences. This can be proven by evaluating the self ratings on teamwork behaviour. The self ratings used in this study could be used to find out which competences were required during the team task. The respondents were asked to rate themselves on the frequency that they engaged in competence related behaviours. As can be seen in study 2, not all competences were rated as frequently. Behaviours concerning mutual performance monitoring feedback, back-up behaviour recognition and adaptability awareness were reported less frequently than the behaviours related to other competences. This may imply that these competences were less necessary during the team task. Additionally, the author believes that the scenario used for the dynamic environment performance had a major weakness. As stated before, an unexpected change occurred in the dynamic environment and

only the results obtained from one of the team members mattered for the correct team decision. Initially, it was expected that teams which engaged in teamwork would solve this problem faster due to joint problem solving. But, occasionally the problem was solved as result of individual input; one of the team members simply saw what was happening and reported it. This had little to do with teamwork, but more with individual general mental ability. The last reason is related to the performance measures obtained by TIDE. In the current setting, only team performance could be measured and no appropriate measures on individual team performance were available. This required the aggregation of the individual competences to team level. Because the CTCQ aims to measure competences on the individual level, it would have been better to have performance measures also on this level. Due to this lack of proper individual teamwork measures this was not possible. It must be noted that it was not verified whether the team level of analysis was suitable for all CTCQ facets. A limitation of this study is that this has not been checked by statistical procedures (like for example  $r_{wg}$ ) as proposed by Sartori et al. (2006). Due to the reasons mentioned above, it is advised for future research to test the CTCQ in more complex settings. A more complex team task that could be used in future is PLATT (Kamphuis, Essens, Houttuin & Gaillard 2009). This team task requires more decision making and problem solving activities than TIDE does. Additionally, it is less prone to individual influence and provides performance measures on individual level as well. Hierarchical Linear Modeling can then be applied to control for team membership.

## **6.5 Directions for further research**

The present research could be extended in a variety of ways. First, additional validation studies can be conducted. Validating the CTCQ in a military setting and in a more complex task environment is highly advisable. An additional criterion validity study could be conducted in future to ensure that the CTCQ is really assessing useful competences. Some support has been found in this study, but this was marginal and additional research is required. It is advised to include ratings from independent observers and to select a team task which provides individual level performance measures as well. It is also advised to evaluate whether the competences are able to explain different parts of the performance variance than for example personality does. Testing the new scales for mutual performance monitoring facet 'monitoring' and for the adaptability facet 'change' should be included in these additional studies. Both mutual trust facets could then also be subjected to a new test-retest reliability analysis. Second, since this attempt failed to construct a reliable and valid scale for the communication competence, this is a challenge that remains for future research. Adding a proper scale for this competence would increase the applicability for the CTCQ. Third, additional analysis can be done on the dataset generated by the experiment to assess the effect of personality and goal orientations on ad-hoc team performance. It would be interesting to consider both the team averages and difference scores. Also combinations with DISC and Belbin Teamroles can be taken into account. In addition to team performance, also satisfaction was regarded as an important outcome for ad-hoc teamwork (Venrooij et al. 2009). Since the satisfaction was measured as well after the experiment, it would be interesting to take this into account. Due to the large amount of questionnaires administered, the generated dataset still contains a great deal of interesting research opportunities. In addition to satisfaction, also task and process conflict, team potency, psychological safety, information exchange and resilience have been measured after the task was completed. The obtained dataset can easily be used to gain several additional insights in ad-hoc team challenges.

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## Appendix 1 CTCQ Items

These are the initial 88 items of the CTCQ questionnaire. Items that were retained in the final version of the questionnaire are marked with \*\*.

### Team Orientation

#### *Preference*

1. Ik werk graag met anderen samen\*\*
2. Mijn persoonlijke prestatie wordt beter als ik samenwerk in een team\*\*
3. Werken in een team haalt het beste in mij boven
4. In een team kan ik betere prestaties halen dan alleen\*\*
5. Werken in een team is beter dan alleen

#### *Acceptance*

1. Ik neem de inbreng van mijn andere teamgenoten serieus\*\*
2. Ik houd rekening met de ideeën van mijn teamgenoten\*\*
3. Ik heb interesse in wat mijn teamgenoten zeggen over de teamtaak
4. Als teamgenoten een nieuw idee hebben, neem ik dit serieus
5. Ik neem de inbreng van teamgenoten mee in de team beslissing\*\*
6. Ideeën van teamgenoten moeten worden meegenomen in team besluiten
7. Ik beoordeel de inbreng van een teamlid op basis van kwaliteit en niet op de persoon die het zegt
8. De inbreng van alle teamleden moet serieus genomen worden

#### *Team goal importance*

1. Ik vind de teamdoelen belangrijker dan mijn persoonlijke doelen\*\*
2. Ik vind het belangrijker te werken voor mijn team dan voor mijzelf\*\*
3. Het groepsdoel is voor mij belangrijker dan mijn eigen doel\*\*
4. Mijn eigen doel is ondergeschikt aan het doel van het team

### Mutual Trust

#### *Open communication*

1. Ik vertrouw erop dat teamgenoten belangrijke informatie delen
2. Ik kan alle taak gerelateerde informatie met mijn teamgenoten delen
3. Ik deel makkelijk informatie met mijn teamgenoten
4. Ik geef fouten die ik maak toe\*\*
5. Ik vertrouw erop dat ik een fout kan toegeven zonder straf te krijgen\*\*
6. Ik accepteer het als teamgenoten een fout maken
7. Als ik een fout maak, zeg ik dit tegen mijn teamgenoten\*\*
8. Ik verwacht geen negatieve reacties als ik een gemaakte fout meld aan mijn teamgenoten.

#### *Task, roles & protection*

1. Ik vertrouw erop dat mijn teamgenoten de belangen van het team verdedigen\*\*
2. Ik vertrouw erop dat mijn teamgenoten hun taken uitvoeren
3. Ik vertrouw erop dat teamgenoten de belangen van het team behartigen\*\*
4. Ik ga ervan uit dat teamgenoten hun best doen\*\*
5. Ik vertrouw op het werk van anderen
6. Ik vertrouw erop dat teamgenoten het beste met het team voorhebben



## **Mutual Performance Monitoring**

### *Monitoring*

1. Het valt mij op als mijn teamgenoten een fout maken in hun taakuitvoering\*\*
2. Het valt mij op als teamgenoten bovengemiddeld presteren
3. Ik weet precies wat de werkdruk van mijn teamgenoten is
4. Ik houd bij of alles volgens plan verloopt\*\*
5. Ik houd naast mijn eigen taken ook de voortgang van mijn teamgenoten in de gaten\*\*
6. Ik kijk kritisch naar de prestaties van mijn teamgenoten\*\*

### *Feedback*

1. Ik zeg het tegen mijn teamgenoten als hun prestatie niet voldoende is\*\*
2. Ik geef feedback aan teamgenoten zodat zij zichzelf kunnen bijsturen\*\*
3. Ik bespreek met mijn teamgenoten hoe de taakuitvoering gegaan is
4. Ik geef, indien nodig, kritiek op de prestaties van teamgenoten\*\*
5. Ik vertel het aan teamgenoten als ze een goede prestaties leveren
6. Ik accepteer tips en feedback van teamgenoten
7. Bij het geven van feedback hebben teamgenoten het beste met mij voor
8. Opmerkingen van mijn teamgenoten over mijn prestatie zijn welkom
9. Teamgenoten mogen mij aanspreken op mijn prestaties

## **Back-up Behaviour**

### *Recognition*

1. Ik let op of teamgenoten ondersteuning nodig hebben
2. Ik zie het als er te veel werk bij een teamgenoot komt te liggen\*\*
3. Het valt mij op als mijn teamgenoten hulp nodig hebben\*\*
4. Het valt mij op als teamgenoten te veel werkdruk hebben\*\*
5. Ik houd in de gaten of de werklast eerlijk over het team verdeeld blijft\*\*
6. Als teamgenoten het drukker hebben dan ik merk ik dat
7. Ik vraag mijn teamgenoten om hulp als ik dat nodig heb
8. Als ik het te druk heb, zeg ik dat tegen mijn teamgenoten

### *Shifting*

1. Ik help teamgenoten met hun taken als dat nodig is\*\*
2. Ik probeer vooruit te denken of mijn teamgenoten hulp nodig gaan hebben met bepaalde taken
3. Ik neem taken over van mijn teamgenoten als dit nodig is\*\*
4. Ik assisteer mijn teamgenoten als ze daar behoefte aan hebben\*\*
5. Ik geef teamgenoten advies als ik zie dat ze effectiever zouden kunnen werken

## **Adaptability**

### *Awareness*

1. Ik herken het als er veranderingen in de werkomstandigheden van mijn team optreden\*\*
2. Als ik een reactie van een teamgenoot niet herken/verwacht had, probeer ik de oorzaak ervan te achterhalen
3. Ik maak een inschatting van de oorzaken van veranderingen in de werkomstandigheden
4. Als ik een verandering in de omgeving waarneem, ga ik op zoek naar de oorzaak hiervan
5. Ik ben alert op veranderingen binnen mijn team\*\*
6. Ik heb het snel door als de situatie verandert\*\*

### *Change*

1. Ik pas mijn strategie aan als er veranderingen in de werkomgeving zijn\*\*
2. Als ik zie dat een bepaalde aanpak niet werkt, stuur ik aan op een nieuwe benadering
3. Als ik zie dat een taak niet goed uitgevoerd wordt, pas ik de taak of de randvoorwaarden (zoals het materiaal of de omstandigheden) aan
4. Als een teamgenoot zijn taak niet uitvoert zoals ik verwacht, denk ik na over mogelijke alternatieven om de taak alsnog tot uitvoer brengen
5. Ik schakel bij tegenslag over op een andere aanpak en zoek naar alternatieven om mijn doel te bereiken
6. Ik pas mijn gedrag aan aan de situatie en mijn teamgenoten\*\*
7. Ik verander mijn mening, houding, of aanpak op basis van nieuwe informatie of argumenten
8. Ik wijzig mijn aanpak op het moment dat deze door mijn teamgenoten niet wordt geaccepteerd
9. Als de werkomstandigheden wijzigen pas ik mij aan\*\*

### **Communication**

#### *Closed-loop Communication*

1. Ik toets of mijn boodschap goed is overgekomen
2. Ik controleer of mijn teamgenoten mij goed begrepen hebben als ik iets zeg\*\*
3. Ik formuleer mijn boodschap naar teamgenoten tactvol, en let hierbij op mijn woordkeuze
4. Ik bevestig het wanneer ik een boodschap heb ontvangen\*\*
5. Ik controleer of ik een boodschap goed begrepen heb door dit na te vragen\*\*
6. Ik let op mijn woordkeuze bij het formuleren van mijn boodschap
7. Als ik een boodschap niet begrijp vraag ik om verheldering

#### *Information sharing*

1. Ik geef teamgenoten informatie die ze nodig hebben voordat ze er om vragen
2. Ik hou mijn teamgenoten op de hoogte van wat ik doe
3. Ik geef relevante informatie door aan teamleden zonder dat zij hiernaar hoeven vragen
4. Ik gebruik alle beschikbare bronnen om naar informatie te zoeken
5. Ik probeer verschillende bronnen te raad plegen bij mijn informatie verzameling

## Appendix 2 Factor Loadings

Pattern Matrix<sup>a</sup>

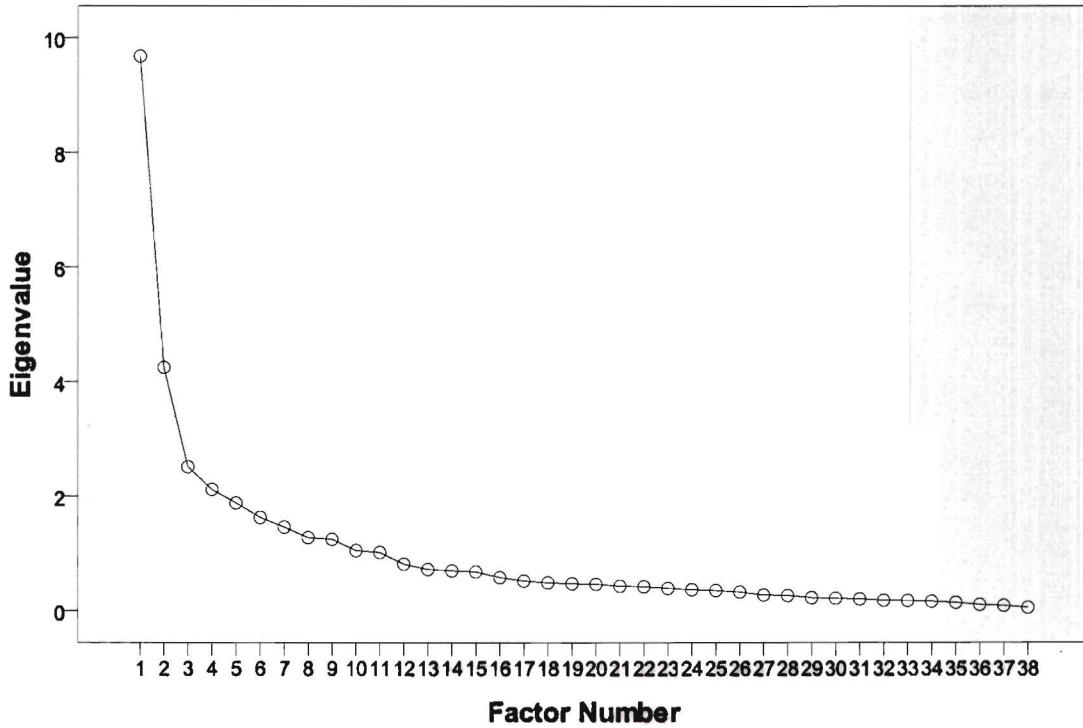
	Factor										
	1	2	3	4	5	6	7	8	9	10	11
ADA1							-,756				
ADA5							-,709				
ADA6							-,653				
ADC1											
ADC6									-,496		
ADC9											
BUR2										-,718	
BUR3										-,499	
BUR4										-,835	
BUR5										-,598	
BUS1	,758										
BUS3	,618										
BUS4	,485										
COC2						,662					
COC4						,587					
COC5						,827					
MPMF1					,827						
MPMF2					,562						
MPMF4					,810						
MPMM1											
MPMM4											,652
MPMM5											,527
MPMM6					,398						
MTOC4				,800							
MTOC5				,601							
MTOC7				,599							
MTTRP1		-,859									
MTTRP3		-,855									
MTTRP4		-,725									
TOA1									-,533		
TOA2									-,581		
TOA5									-,655		
TOP1			,846								
TOP2			,848								
TOP4			,807								
TOT1								,919			
TOT2								,699			
TOT3								,919			

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 13 iterations.

### Scree Plot



**Total Variance Explained (only First 15 cases of 38)**

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings <sup>a</sup>
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9,680	25,473	25,473	9,330	24,554	24,554	4,188
2	4,253	11,192	36,665	3,946	10,383	34,937	3,880
3	2,516	6,620	43,285	2,251	5,923	40,859	3,400
4	2,117	5,571	48,857	1,806	4,754	45,613	3,090
5	1,882	4,953	53,810	1,533	4,035	49,648	3,422
6	1,630	4,289	58,098	1,232	3,242	52,890	3,791
7	1,462	3,847	61,945	1,099	2,893	55,783	4,084
8	1,277	3,361	65,307	,967	2,544	58,328	4,742
9	1,249	3,287	68,594	,850	2,236	60,564	3,792
10	1,053	2,771	71,365	,660	1,737	62,301	5,107
11	1,020	2,685	74,050	,629	1,655	63,956	2,001
12	,818	2,152	76,203				
13	,725	1,908	78,111				
14	,701	1,845	79,956				
15	,682	1,795	81,751				

Extraction Method: Principal Axis Factoring.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.

**KMO and Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		,811
Bartlett's Test of Sphericity	Approx. Chi-Square	3677,650
	df	703
	Sig.	,000

**Factor Correlation Matrix**

Factor	1	2	3	4	5	6	7	8	9	10	11
1	1,000	-,167	,101	,246	,187	,161	-,319	,241	-,265	-,404	,159
2	-,167	1,000	-,173	-,159	-,039	-,123	,015	-,374	,321	,083	,050
3	,101	-,173	1,000	,114	,064	,092	-,074	,318	-,095	-,061	-,155
4	,246	-,159	,114	1,000	,158	,182	-,168	,159	-,279	-,161	-,026
5	,187	-,039	,064	,158	1,000	,261	-,307	,053	-,074	-,266	,210
6	,161	-,123	,092	,182	,261	1,000	-,343	,199	-,184	-,368	,167
7	-,319	,015	-,074	-,168	-,307	-,343	1,000	-,153	,160	,341	-,125
8	,241	-,374	,318	,159	,053	,199	-,153	1,000	-,256	-,269	,014
9	-,265	,321	-,095	-,279	-,074	-,184	,160	-,256	1,000	,218	-,063
10	-,404	,083	-,061	-,161	-,266	-,368	,341	-,269	,218	1,000	-,317
11	,159	,050	-,155	-,026	,210	,167	-,125	,014	-,063	-,317	1,000

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

## Appendix 3 Questionnaires

Every English questionnaire was translated according to the translation-back translation principle. Unfortunately some items could not meet the translation-back translation requirement due to differences in language patterns. These items have been reviewed carefully, the author expects no problems.

### Individualism-collectivism scale

Obtained from: Wagner and Moch (1986), Wagner (1995) and Eby and Dobbins (1997).

Since the items were English, translations have been made.

Geef aan in hoeverre u het eens bent met de volgende stellingen.

Let op: de antwoordcategorieën variëren van Nadrukkelijk mee oneens (1) tot nadrukkelijk mee eens (7).

Individualism-collectivism scale (Wagner, 1995)	Translated items
1. Only those who depend on themselves get ahead in life	1. Alleen mensen die op zichzelf vertrouwen schoppen het ver in het leven.
2. To be superior a person must stand alone	2. Iemand moet op zichzelf staan om superieur te zijn.
3. If you want something done right, you've got to do it yourself	3. Als je wil dat iets goed gebeurt, moet je het zelf doen.
4. What happens to me is my own doing	4. Wat er met mij gebeurt is door mijn eigen toedoen.
5. In the long run the only person you can count on is yourself	5. Op de lange termijn kun je alleen op jezelf vertrouwen.
6. I prefer to work with others in a group rather than working alone	6. Ik werk liever met anderen in een team dan alleen
7. Given the choice, I would rather do a job where I can work alone rather than doing a job where I have to work with others in a group	7. Als ik de keuze heb, werk ik liever in een baan waarbij ik alleen werk dan in een baan waar ik werk met anderen in een team.
8. Working in a group is better than working alone	8. Werken in een team is beter dan alleen werken.
9. People should be made aware that if they are going to be part of a group then they are sometimes going to have to do things they don't want to do	9. Mensen moeten er op bedacht gemaakt worden dat als ze deel uit maken van een team, ze soms dingen moeten doen die ze niet willen.
10. People who don't belong to a group should realize that they are not always going to get what they personally want	10. Mensen die geen deel uit maken van een team zouden zich moeten realiseren dat ze niet altijd gaan krijgen wat ze willen.
11. People in a group should realize that they sometimes are going to have to make sacrifices for the sake of a group as a whole	11. Mensen in een team moeten zich realiseren dat zij soms iets zullen moeten opofferen voor het belang van het team.
12. People in a group should be willing to make sacrifices for the sake of the group	12. Mensen in een team moeten bereid zijn offers te maken voor het team.

### IPIP scales

Obtained from Goldman (2009).

The three different facet scales are adopted from International Personality Item Pool.

Since the items were English, items have been translated.

#### *Gregariousness (Alpha = .83)*

Gregariousness scale	Translated item
1. Am the life of the party.	1. Ik ben de gangmaker van het feestje
2. Talk to a lot of different people at parties.	2. Ik praat met veel verschillende mensen op een feest
3. Start conversations.	3. Ik start conversaties

4. Love large parties.	4. Ik hou van grote feesten
5. Don't talk a lot. <i>(reversed)</i>	5. Ik praat weinig
6. Keep in the background. <i>(reversed)</i>	6. Ik hou me op de achtergrond.
7. Am quiet around strangers. <i>(reversed)</i>	7. Ik ben stil in het gezelschap van onbekenden
8. Don't like to draw attention to myself. <i>(reversed)</i>	8. Ik trek niet graag de aandacht naar mijzelf.
9. Bottle up my feelings. <i>(reversed)</i>	9. Ik krop mijn gevoelens op.
10.Keep my thoughts to myself. <i>(reversed)</i>	10.Ik hou mijn gedachten voor me.

### Warmth

Warmth Scale	Translated item
1. Am interested in people.	1. Ik ben geïnteresseerd in mensen
2. Make people feel at ease.	2. Ik laat mensen zich op hun gemak voelen
3. Know how to comfort others.	3. Ik weet hoe ik anderen gerust moet stellen
4. Inquire about others' well-being.	4. Ik vraag anderen hoe het met hun gaat.
5. Take time out for others.	5. Ik neem de tijd voor anderen
6. Make people feel welcome.	6. Ik laat mensen voelen dat ze welkom zijn
7. Show my gratitude.	7. Ik toon mijn dankbaarheid
8. Make others feel good.	8. Ik laat anderen zich goed voelen
9. Feel others' emotions.	9. Ik voel andermans emoties
10. Am not really interested in others. <i>(reversed)</i>	10. Ik ben niet erg geïnteresseerd in anderen
11. Rarely smile. <i>(reversed)</i>	11. Ik lach zelden

### Trust

Trust scale	Translated item
1. Trust others.	1. Ik vertrouw anderen
2. Believe that others have good intentions.	2. Ik geloof dat anderen goede bedoelingen hebben
3. Trust what people say.	3. Ik geloof wat mensen zeggen
4. Believe that people are basically moral.	4. Ik geloof dat mensen in principe morelen hebben.
5. Believe in human goodness.	5. Ik geloof in de menselijke goedheid
6. Think that all will be well.	6. Ik denk dat alles goed komt
7. Distrust people. <i>(reversed)</i>	7. Ik wantrouw mensen
8. Suspect hidden motives in others. <i>(reversed)</i>	8. Ik verdenk anderen ervan verborgen motieven te hebben
9. Am wary of others. <i>(reversed)</i>	9. Ik ben op mijn hoede voor anderen
10. Believe that people are essentially evil. <i>(reversed)</i>	10. Ik geloof dat mensen in principe kwaadaardig zijn

### Propensity to Trust Scale

Obtained from Aubert & Kelsey (2003).

Since the items were English, translations have been made. Geef aan in hoeverre u het eens bent met de volgende stellingen. Let op: de antwoordcategorieën variëren van oneens (1) tot eens (7)

Trust Scale	Translated items
1. If I had my way, I would not let the other team members have any influence over issues that are important to the project. <i>(reversed)</i>	1. Als ik het voor het zeggen had, dan zou ik de andere teamleden geen invloed laten uitoefenen op zaken die belangrijk zijn voor het project
2. I would be comfortable giving the other team members complete responsibility for the completion of this project	2. Ik zou me comfortabel voelen bij het geven van de volledige verantwoordelijkheid voor het afmaken van een project aan een ander teamlid
3. I really wish I had a good way to oversee the work of the other team members on the project <i>(reversed)</i>	3. Ik wou dat er een manier was om het werk dat andere teamleden doen in de gaten te kunnen houden
4. I would be comfortable giving the other team members a task or problem that was critical to the project, even if I could not monitor them	4. Ik zou me comfortabel voelen als ik teamgenoten een hele belangrijke taak zou geven, zonder dat ik hen in de gaten kan houden
5. Most students tell the truth about the limits of their knowledge	5. De meeste mensen vertellen de waarheid over beperkingen van hun kennis

6. Most students can be counted on to do what they say they will do	6. Bij de meeste mensen kun je ervan uitgaan dat ze zullen doen wat ze zeggen te gaan doen
7. Most students are honest in describing their experiences and abilities	7. De meeste mensen zijn eerlijk bij het beschrijven van hun ervaringen en vaardigheden

### Big Five (bipolar)

Deze vragenlijst bestaat uit woorden waarmee u een persoon kunt beschrijven. De twee woorden die samen een paar vormen, zijn elkaars tegenovergestelde. Zet een kruisje in een van de negen hokjes die volgens u het beste bij de persoon past. Per woordpaar mag u maar één kruisje zetten.

1	Introvert	extravert
2	Kil	warm
3	Chaotisch	ordelijk
4	Boos	kalm
5	niet intelligent	intelligent
6	Lusteloos	energiek
7	Onaardig	aardig
8	Onverantwoordelijk	verantwoordelijk
9	Gespannen	ontspannen
10	Onopmerkzaam	sensitief
11	Zwijgzaam	praatgraag
12	Onbereidwillig	bereidwillig
13	Onbetrouwbaar	betrouwbaar
14	Zenuwachtig	rustig
15	Global	analytisch

The Bipolar Big Five measures five personality dimensions:

- Extraversion 1, 6, 11
- Agreeableness 2, 7, 12
- Conscientiousness 3, 8, 13
- Emotional stability 4, 9, 14
- Openness 5, 10, 15

### Pavlov Temperament Schaal

Obtained from Heck, Raad and Vingerhoets (1993)

Geef aan in hoeverre u het eens bent met de volgende stellingen.

Let op: de antwoordcategorieën variëren van Helemaal oneens (1) tot Helemaal eens (4)

In hoeverre bent u het met de volgende stellingen eens?

1. Ik kan me snel op onverwacht bezoek instellen
2. Het valt me moeilijk, me aan een nieuwe omgeving aan te passen
3. Ik voel me gauw thuis op een nieuwe werkplek
4. Ik raak snel aan een nieuwe verblijfplaats gewend
5. Ook op vreemde plaatsen voel ik me gauw thuis
6. Ik wen snel aan nieuwe arbeidsomstandigheden
7. Onverwachte veranderingen in mijn dagindeling brengen mij uit mijn evenwicht
8. Ik pas me snel aan veranderingen in mijn werkschema aan
9. Onverwachte gebeurtenissen vormen voor mij een bron van stress
10. Ik pas mij gemakkelijk aan een plotselinge verandering van mijn werkplan aan



## Goal orientation

Obtained from Yperen (2004)

Geef aan in hoeverre de volgende stellingen op u van toepassing zijn.

Let op: de antwoordcategorieën variëren van geheel niet van toepassing (1) tot geheel van toepassing (7)

Since Yperen (2004) presented a questionnaire which only focused on students, the items had to be converted to be applicable to both students as people who work.

Goal orientation item (Yperen, 2004)	Changed items
1. Het is belangrijk voor mij dat ik beter presteer dan de studenten in mijn directe omgeving.	1. Het is belangrijk voor mij dat ik beter presteer dan de collega's in mijn directe omgeving.
2. Het is belangrijk voor mij dat ik in vergelijking met anderen in mijn studie goed presteer.	2. Het is belangrijk voor mij dat ik in vergelijking met anderen in mijn werk goed presteer.
3. In mijn werk ben ik erop gericht om betere beoordeling te krijgen dan mijn studiegenoten.	3. In mijn werk ben ik erop gericht om betere beoordeling te krijgen dan mijn collega's.
4. Ik wil zo veel mogelijk leren in mijn studie.	4. Ik wil zo veel mogelijk leren in mijn werk.
5. Ik heb er behoefte aan om alles wat mijn studie aangaat zo goed mogelijk te beheersen.	5. Ik heb er behoefte aan om alles wat mijn werk aangaat zo goed mogelijk te beheersen.
6. Het is belangrijk voor mij om de inhoud van mijn studie zo grondig mogelijk te begrijpen.	6. Het is belangrijk voor mij om de inhoud van mijn werk zo grondig mogelijk te begrijpen.
7. Ik wil gewoon voorkomen dat ik het slecht doe in mijn studie.	7. Ik wil gewoon voorkomen dat ik het slecht doe in mijn werk.
8. Mijn doel in mijn studie is te voorkomen dat ik slecht presteer.	8. Mijn doel in mijn werk is te voorkomen dat ik slecht presteer.
9. Mijn angst om slecht te presteren in mijn studie is vaak wat mij motiveert.	9. Mijn angst om slecht te presteren in mijn werk is vaak wat mij motiveert.
10. Ik maak mij zorgen dat ik inhoudelijk niet alles uit mijn studie haal wat mogelijk is.	10. Ik maak mij zorgen dat ik inhoudelijk niet alles uit mijn werk haal wat mogelijk is.
11. Soms ben ik bang dat ik de inhoud van mijn studie niet zo grondig begrijp als ik wel zou willen.	11. Soms ben ik bang dat ik de inhoud van mijn werk niet zo grondig begrijp als ik wel zou willen.
12. Ik ben vaak bezorgd dat ik niet alles wat er te leren valt in mijn studie er ook werkelijk uithaal.	12. Ik ben vaak bezorgd dat ik niet alles wat er te leren valt in mijn werk er ook werkelijk uithaal.

## Social desirability

Obtained from (Paulhus, 2006)

In order to check whether the answering patterns on the competence scale are linked to social desirability, self-deception enhancement is measured.

Geef bij de volgende stellingen aan in welke mate ze op u van toepassing zijn.

Succes!

Since the items were English, translations have been made.

SDE items (Paulhus, 2006)	Translated items
1. My first impressions of people usually turn out to be right.	1. Mijn eerste indruk van mensen blijkt meestal te kloppen.
2. It would be hard for me to break any of my bad habits.	2. Het zou moeilijk voor mij zijn om mijn slechte gewoontes, welke dan ook, te doorbreken.
3. I don't care to know what other people really think of me.	3. Ik hoef niet te weten wat anderen echt van mij denken.
4. I have not always been honest with myself.	4. Ik ben niet altijd eerlijk geweest tegenover mijzelf.

5. I always know why I like things.	5. Ik weet altijd waarom ik iets leuk vind.
6. When my emotions are aroused, it biases my thinking.	6. Als ik geëmotioneerd ben, dan beïnvloedt dat mijn denken
7. Once I've made up my mind, other people cannot change my opinion.	7. Als ik eenmaal een besluit heb genomen, kunnen anderen mij zelden van mening doen veranderen.
8. I am not a safe driver when I exceed the speed limit.	8. Als ik de maximum snelheid overtreed ben ik geen veilige bestuurder.
9. I am fully in control of my own fate.	9. Ik heb mijn lot volledig in eigen hand.
10. It's hard for me to shut off a disturbing thought.	10. Het is moeilijk voor mij om mij af te sluiten voor een verontrustende gedachte.
11. I never regret my decisions.	11. Ik heb nooit spijt van mijn beslissingen.
12. I sometimes lose out on things because I can't make up my mind soon enough.	12. Ik loop soms dingen mis omdat ik niet snel genoeg kan beslissen.
13. The reason I vote is because my vote can make a difference.	13. De reden dat ik stem is omdat mijn stem een verschil kan maken.
14. People don't seem to notice me and my abilities.	14. Mensen lijken mij en mijn kwaliteiten niet te zien.
15. I am a completely rational person.	15. Ik ben een volkomen rationeel persoon.
16. I rarely appreciate criticism.	16. Ik stel kritiek zelden op prijs.
17. I am very confident of my judgments.	17. Ik ben erg overtuigd van mijn eigen oordeel.
18. I have sometimes doubted my ability as a lover.	18. Ik heb wel eens getwijfeld aan mijn kwaliteiten als minnaar.
19. It's alright with me if some people happen to dislike me.	19. Ik heb er geen moeite mee als er mensen zijn die mij niet mogen.
20. I'm just an average person.	20. Ik ben een gemiddeld persoon.

<b>IM items (Paulhus, 2006)</b>	<b>Translated items</b>
1. I sometimes tell lies if I have to.	1. Als het moet vertel ik wel eens een leugen.
2. I never cover up my mistakes.	2. Ik probeer nooit de door mij gemaakte fouten te verhullen.
3. There have been occasions when I have taken advantage of someone.	3. Er zijn situaties geweest waarin ik iemand heb gebruikt.
4. I never swear.	4. Ik vloek nooit.
5. I sometimes try to get even rather than forgive and forget.	5. Ik wil soms met gelijke munt terugbetalen in plaats van het te vergeven en vergeten
6. I always obey laws, even if I'm unlikely to get caught.	6. Ik hou me altijd aan de wet, zelfs als de kans klein is dat ik word gepakt.
7. I have said something bad about a friend behind his or her back.	7. Ik heb iets slechts gezegd over een vriend achter zijn/haar rug.
8. When I hear people talking privately, I avoid listening.	8. Als ik hoor dat mensen een vertrouwelijk gesprek voeren, dan vermijd ik dat ik meeluister.
9. I have received too much change from a salesperson without telling him or her.	9. Ik heb wel eens te veel wisselgeld terug gekregen aan de kassa zonder het te melden.
10. I always declare everything at customs.	10. Ik geef altijd alles aan bij de douane.
11. When I was young, I sometimes stole things.	11. Toen ik jong was heb ik wel eens dingen gestolen.
12. I have never dropped litter on the street.	12. Ik heb nog nooit afval op straat gegooid.
13. I sometimes drive faster than the speed limit.	13. Ik rijd soms harder dan de toegestane snelheid.
14. I never read sexy books or magazines.	14. Ik lees of bekijk nooit erotisch getinte bladen of video's.
15. I have done things that I don't tell other people about.	15. Ik heb dingen gedaan waar ik andere mensen niets over vertel.
16. I never take things that don't belong to me.	16. Ik neem nooit dingen mee die niet van mij zijn.
17. I have taken sick-leave from work or school even though I wasn't really sick.	17. Ik heb me wel eens ziek gemeld, terwijl ik niet echt ziek was.
18. I have never damaged a library book or store merchandise without reporting it.	18. Ik heb nooit een bibliotheekboek of een product in een winkel beschadigd zonder het daarna te melden.
19. I have some pretty awful habits.	19. Ik heb een paar behoorlijk nare gewoontes.
20. I don't gossip about other people's business.	20. Ik roddel niet over de handel en wandel van andere mensen.

### **Additional questions for study three**

With these three questions the practicality has been assessed:

Geef aan wat je van deze complete vragenlijst vond.

- Ik vond de vragen goed te begrijpen
- Ik vond de instructies tijdens het invullen duidelijk
- Ik vind het design van de vragenlijst goed

Each question was rated on a 7-point Likert scale (1=Helemaal oneens, 7=Zeer eens)

### **Self and peer rating questions**

Each question was rated on a 7-point Likert scale (1=Helemaal oneens, 7=helemaal eens)

In hoeverre bent u het met de volgende stellingen eens? [Example for Awac]

- Ik werk liever in dit team, dan alleen
- Ik denk dat mijn teamgenoten hun taak zo goed mogelijk probeerden te doen.
- Ik denk dat mijn teamgenoten alle belangrijke informatie met het team hebben gedeeld.
- Ik heb gekeken of de werklast in het team eerlijk verdeeld was.
  
- Ik heb rekening gehouden met de inbreng van mijn teamgenoten
- De CAD heeft rekening gehouden met mijn inbreng
- De CRUISER heeft rekening gehouden met mijn inbreng
  
- Ik heb de prestaties van mijn teamgenoten in de gaten gehouden
- De CAD heeft de prestaties van teamgenoten in de gaten gehouden
- De CRUISER heeft de prestaties van teamgenoten in de gaten gehouden
  
- Ik heb het tegen teamgenoten gezegd als hun prestatie niet goed was.
- De CAD heeft tegen teamgenoten gezegd als hun prestatie niet goed was
- De CRUISER heeft tegen teamgenoten gezegd als hun prestatie niet goed was.
  
- Het viel me op dat er iets was veranderd in de taak.
- Het viel de CAD op dat er iets was veranderd in de taak.
- Het viel de CRUISER op dat er iets was veranderd in de taak.
  
- Ik heb me proberen aan te passen aan veranderingen
- De CAD heeft zich proberen aan te passen aan veranderingen
- De CRUISER heeft zich proberen aan te passen aan veranderingen
  
- Ik heb ervoor gezorgd dat mijn teamgenoten mij goed begrepen.
- De CAD zorgde ervoor dat de teamgenoten hem/haar goed begrepen
- De CRUISER zorgde ervoor dat de teamgenoten hem/haar goed begrepen.

## Appendix 4 Team task instructions

### Welkom

In de volgende simulatie zal u deel uitmaken van een marine battle group. Deze groep houdt een verzameling schepen en ondersteunende eenheden in. Centraal in deze groep staat de zogeheten 'Carrier', het vliegdekschip. Deze Carrier bevat voldoende vliegtuigen om elke mogelijke dreiging te neutraliseren. Deze simulatie bevat zo'n Carrier. Het probleem is echter dat deze niet over informatie beschikt, om een goed oordeel te kunnen maken van de mogelijke dreigingen om haar heen. Hiervoor krijgt het de steun van de andere eenheden: de AWACS verkenningvliegtuigen, de Coastal Air Defense (CAD) en de Aegis Cruisers in haar nabije omgeving. Deze drie eenheden leveren de Carrier en elkaar de nodige informatie van eventuele dreigingen, om tot een gezamenlijk oordeel te komen.

### Missie

U zult straks deel uitmaken van een team en hierin een van de drie rollen (AWACS, CAD en Cruiser) aannemen. De CAD, de AWACS en de Cruiser hebben als gezamenlijke missie om bij een inkomende dreiging te bepalen welke respons zij hierop moeten geven. Dit besluit wordt genomen op basis van data die zij verkrijgen door eigenschappen te meten van het vliegtuig dat zojuist op de radar is verschenen. Deze vliegtuigen die op de radar zijn verschenen noemen we targets.

Het is belangrijk om zeker te weten hoe erg de dreiging is rond de Carrier, om uiteindelijk zo weinig mogelijk levens verloren te laten gaan. Bij een te lage inschatting van de dreiging betekent het dat levens aan boord van de Carrier verloren zullen gaan door een aanval. Bij een te hoge inschatting van de dreiging zullen onschuldige levens verloren gaan. Elk teamlid zal (als ondersteunende eenheid) eerst een beslissing moeten maken wat hij/zij zelf van de binnenkomende target vindt. Hierna dient het team tot een gezamenlijk oordeel te komen over de dreiging van de target (als onderdeel van de Carrier).

### Reacties

Er zijn zeven mogelijke reacties te geven op een target. Deze reacties lopen uiteen van minst tot meest agressief. Elke reactie is hieronder beschreven.

- (1) **IGNORE:** Dit betekent dat de groep geen verdere aandacht moet besteden aan de target. De groep moet uiteraard nooit een target negeren die mogelijk aan kan vallen.
- (2) **REVIEW:** Dit betekent dat het target voorlopig met rust gelaten wordt, zodat het team naar andere targets op zoek kan gaan. Na verloop van tijd wordt er echter toch weer gekeken naar deze target, om te bepalen of de dreiging van deze target groter is geworden.
- (3) **MONITOR:** Met deze reactie geeft het team aan de target continue te blijven volgen.
- (4) **WARN:** In dit geval stuurt de groep een bericht naar de target met de boodschap om weg te sturen. Uiteraard mag pas gewaarschuwd worden als het echt nodig is: een onnodige waarschuwing kan ervoor zorgen dat deze in het vervolg minder serieus worden genomen. Een target waarschuwen dat mogelijk wil aanvallen is ook niet goed, omdat door deze waarschuwing de locatie van het schip duidelijk wordt gemaakt.
- (5) **READY:** Dit betekent dat het schip in een defensieve positie wordt gestuurd. Wapens worden op automatisch (defensief) vuren gesteld, zodat target die dichtbij komen automatisch worden neergeschoten. Hierdoor is de groep nog wel onbestand tegen aanvallen van het schip zelf indien het target toch vijandig is. Indien het target niet vijandig is en het komt te dichtbij, zal er ook geschoten worden op onschuldige slachtoffers.
- (6) **LOCK-ON:** Dit zorgt ervoor dat de radar van de Carrier en haar wapens op het target fixeren. Op deze manier kan binnen seconden de target uit de lucht worden geschoten. Echter, op deze manier worden de mogelijkheden om andere tracks te monitoren ernstig verminderd. Er mag

dus alleen voor Lock-on gekozen worden indien men bijna zeker is van de dreiging van de target.

- (7) **DEFEND:** Dit betekent dat er vrij geschoten mag worden op de target. Dit besluit mag alleen genomen worden indien de groep het erover eens is dat een aanval van de target onvermijdelijk is.

De beslissing van het team wordt genomen door de Carrier. De AWACS, de CAD en de Cruiser moeten wel hun eigen beslissing maken (op basis van hun expertise), maar dit is niet de uiteindelijke beslissing van het team. Deze uiteindelijke beslissing wordt **gezamenlijk** gemaakt, door samen een oordeel door te geven aan de Carrier.

## **Kenmerken**

De volgende kenmerken kunnen door de verschillende eenheden worden gemeten:

De SPEED geeft aan hoe snel de target vliegt.

De ALTITUDE geeft aan hoe hoog de target vliegt.

De SIZE geeft aan hoe groot de target is.

De ANGLE geeft aan welke hoek de target heeft t.o.v. de horizon (een negatieve hoek betekent dus dat de target daalt)

De IFF (Identify Friend or Foe) bepaalt of een vliegtuig vriend of vijand is, op basis van de transpondercode die het uitzendt. Bij een lage IFF (gemeten in Mhz) is de target vriendelijk / civiel, bij een hoge IFF is de target vijandelijk / militair.

De DIRECTION geeft aan in welke richting de target vliegt t.o.v. de Carrier. Indien deze 0 graden is, vliegt de target direct op de Carrier af.

De CORRIDOR STATUS geeft aan hoever een vliegtuig uit de zgn. 'vluchtcorridor' vliegt, dat zijn bepaalde luchtstromen die een civiel vliegtuig behoort te vliegen. Militaire vliegtuigen kunnen hiervan afwijken, maar worden daarmee wel als dreigender gezien, naarmate het verder buiten deze corridor vliegt.

De RADAR geeft het type radar aan dat de target heeft. Dit kan uiteen lopen van een weerradar (de standaardradar die bij civiele vliegtuigen gebruikelijk is) tot geavanceerde radar.

De RANGE geeft aan hoe ver de target van de Carrier verwijderd is.

Iedere eenheid kan verschillende kenmerken meten van de target en is specialist in het interpreteren van deze metingen.

Het doel is om gezamenlijk te bepalen in hoeverre de target een dreiging vormt voor de groep. Dit gebeurt door metingen te verrichten, deze informatie vervolgens uit te wisselen, de informatie te interpreteren, een eigen oordeel te maken over de target (op basis van de eigen beslisregel), en uiteindelijk een gezamenlijk oordeel te maken over de target.

Het is voor het interpreteren van de regels belangrijk om te weten dat een niet dreigend element (bijvoorbeeld een langzaam vliegend object) de **gehele beslisregel** ongeldig maakt. Bijvoorbeeld: indien teamlid A een niet dreigend element afleest uit zijn/haar tabel, maakt het niet meer uit wat de

andere elementen van de regel zijn: **per definitie** is dit element **volgens deze regel** een IGNORE. Dit betekent overigens niet dat de teambeslissing hiermee IGNORE is! Indien de andere teamgenoten een DEFEND als oordeel geven, is de target waarschijnlijk geen IGNORE, maar een READY.

Als laatste is het belangrijk om te vermelden dat de omgeving waarin jullie zullen opereren veranderlijk is, maar onbekend is nog precies hoe deze verandering zal optreden. Er zijn indicaties dat bepaalde targets in de simulatie op den duur geen optelsom meer zullen zijn van alle individuele beslissingen die door jullie genomen zijn.

Wees hierop voorbereid, dit kan namelijk effect hebben op de uiteindelijke teambeslissing.

## CAD

De CAD zelf een specialist in het meten van de volgende kenmerken: Angle (hoek), Radar (type) en de Direction (richting).

De CAD weet ook wat de andere units kunnen meten. Dat is hieronder aangegeven:

Teamlid	Speed	Altit	Size	Angle	IFF	Direct	Corr. St.	Radar	Range
AWACS	X						X		X
Cruiser		X	X		X				

### Hoe bepaal je het niveau van dreiging?

De CAD heeft een (let op: niet alle) beslissingsregel om te bepalen of de target vriendelijk of vijandelijk is, nl.:

SPEED, SIZE en DIRECTION gaan samen, zodat een **snel en klein target met een directe koers naar de Carrier** het meest dreigend is. Zodra 1 van deze kenmerken niet dreigend is, betekent het niks. Er is niets te vrezen als een snel target met directe koers op de Carrier groot is, of een klein target zonder directe koers op de Carrier te langzaam.

Zodra een target een niet dreigend element in zich heeft, is deze regel in zijn geheel niet meer dreigend.

	Niet dreigend	Licht dreigend	Extreem dreigend
Speed	100 – 275 mph	325 – 500 mph	600 – 800 mph
Size	65 – 43 m	37 – 23 m	17 – 10 m
Direction	30 – 22 graden	18 – 12 graden	08 – 00 graden

## AWACS

De AWACS is specialist in het meten van de volgende kenmerken: Speed (snelheid), Range (bereik) en Corridor Status.

De AWACS weet ook wat de andere units kunnen meten. Dat is hieronder aangegeven:

Teamlid	Speed	Altit	Size	Angle	IFF	Direct	Corr. St.	Radar	Range
CAD				X		X	X		
Cruiser		X	X		X				

### Hoe bepaal je het niveau van dreiging?

De AWACS heeft een (let op: niet alle) beslissingsregel om te bepalen of de target vriendelijk of vijandelijk is, nl.:

ALTITUDE en ANGLE en CORRIDOR STATUS gaan samen, zodat een laagvliegende target, buiten de (reguliere) vluchtcorridor in dalende richting een dreiging vormt. Er is niets te vrezen als alleen ALTITUDE laag is, de target te ver buiten de corridor vliegt of ANGLE te ver negatief gericht. De combinatie maakt de target pas dreigend!

Zodra een target een niet dreigend element in zich heeft, is deze regel in zijn geheel niet meer dreigend.

	Niet dreigend	Licht dreigend	Extreem dreigend
Altitude	35000 – 27000 ft	23000 – 17000 ft	13000 – 5000 ft
Angle	+15 tot +8 graden	+3 tot -3 graden	-8 tot -15 graden
Corridor Status	0 – 8 mi out	12 – 18 mi out	22 – 30 mi out



## Cruiser

De Aegis cruiser eenheid is een specialist in het meten van de volgende kenmerken: Altitude (hoogte), Size (grootte) en IFF (Identify Friendly or Foe).

De Cruiser weet ook wat de andere units kunnen meten. Dat is hieronder aangegeven:

Teamid	Speed	Altit	Size	Angle	IFF	Direct	Corr. St.	Radar	Range
CAD				X		X		X	
AWACS	X						X		X

## Hoe bepaal je het niveau van dreiging?

De Cruiser heeft **een (let op: niet alle)** beslissingsregel om te bepalen of de target vriendelijk of vijandelijk is, nl.:

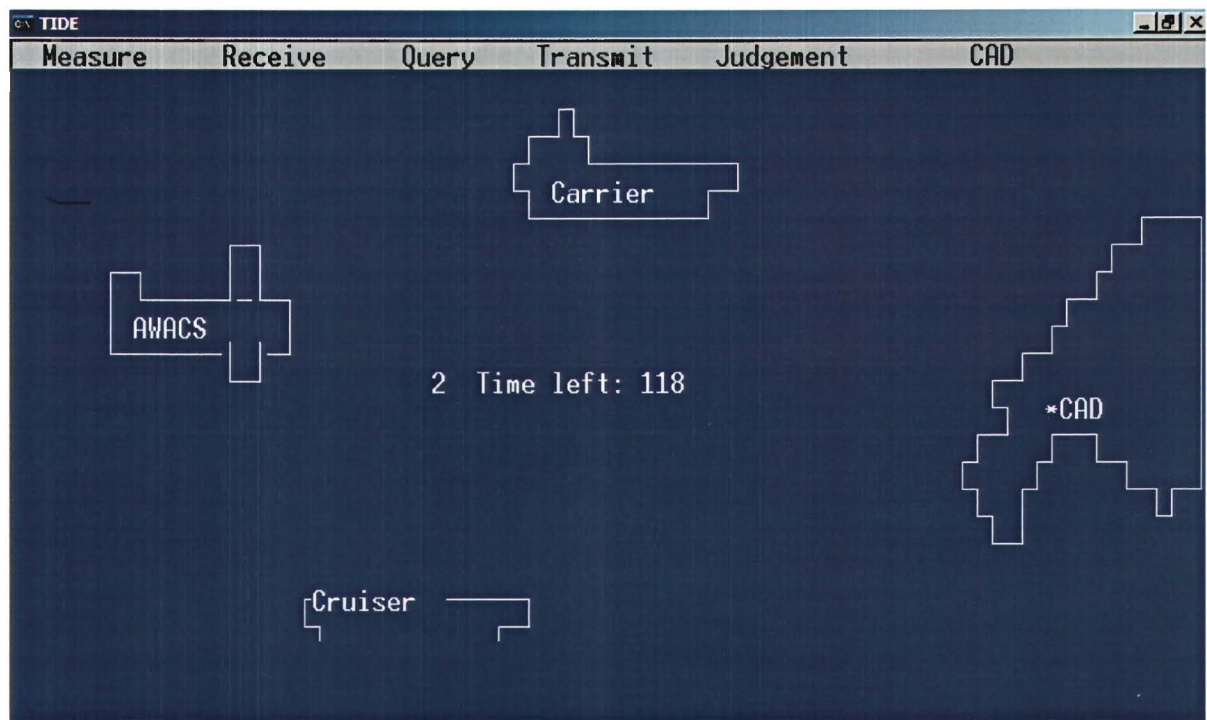
IFF en RADAR en RANGE gaan samen, zodat **een militair toestel met geavanceerde radar binnen bereik** een dreiging vormt. Indien slecht de IFF een militair vliegtuig aanduidt, maar deze met slecht een weerradar is uitgerust, is het bijvoorbeeld geen dreiging. Ook een niet-militair vliegtuig met geavanceerde radar zal geen dreiging vormen.

Zodra een target een niet dreigend element in zich heeft, is deze regel in zijn geheel niet meer dreigend.

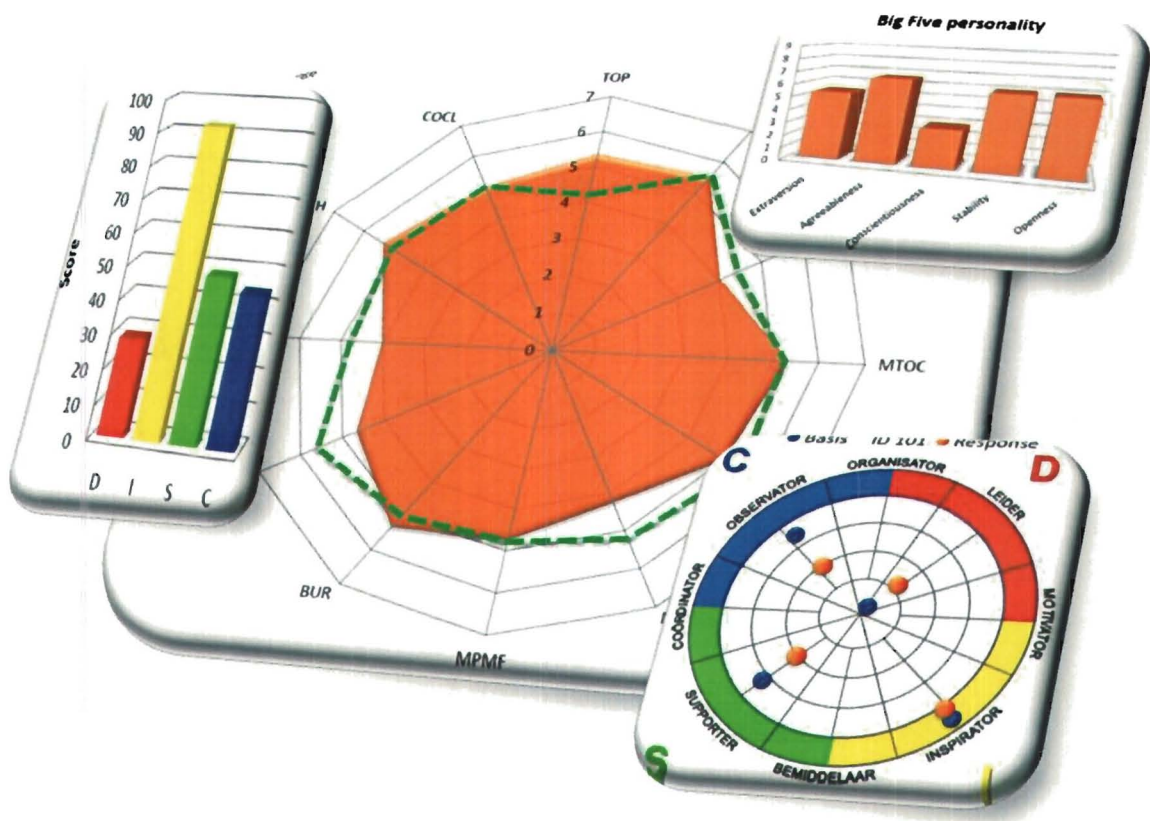
	Niet dreigend	Licht dreigend	Extreem dreigend
IFF	.2 - .6 Mhz	.9 - 1.1 Mhz	1.4 - 1.8 Mhz
Radar	Klasse 1 & 2	Klasse 5	Klasse 8 & 9
Range	200 - 110 mi	90 - 60 mi	40 - 1 mi

Below the expertise and decision rules for each role can be found.

Team member	Expertise
AWAC	Speed Altitude Size Angle IFF <i>Speed-direction combination rule</i>
Cruiser	Angle IFF Direction Corridor status Radar type <i>Altitude-corridor status combination rule</i>
Coastal air defense	Corridor status Radar type Range Speed Altitude <i>Size-radar type combination rule</i>
Carrier	Carries out the team decision

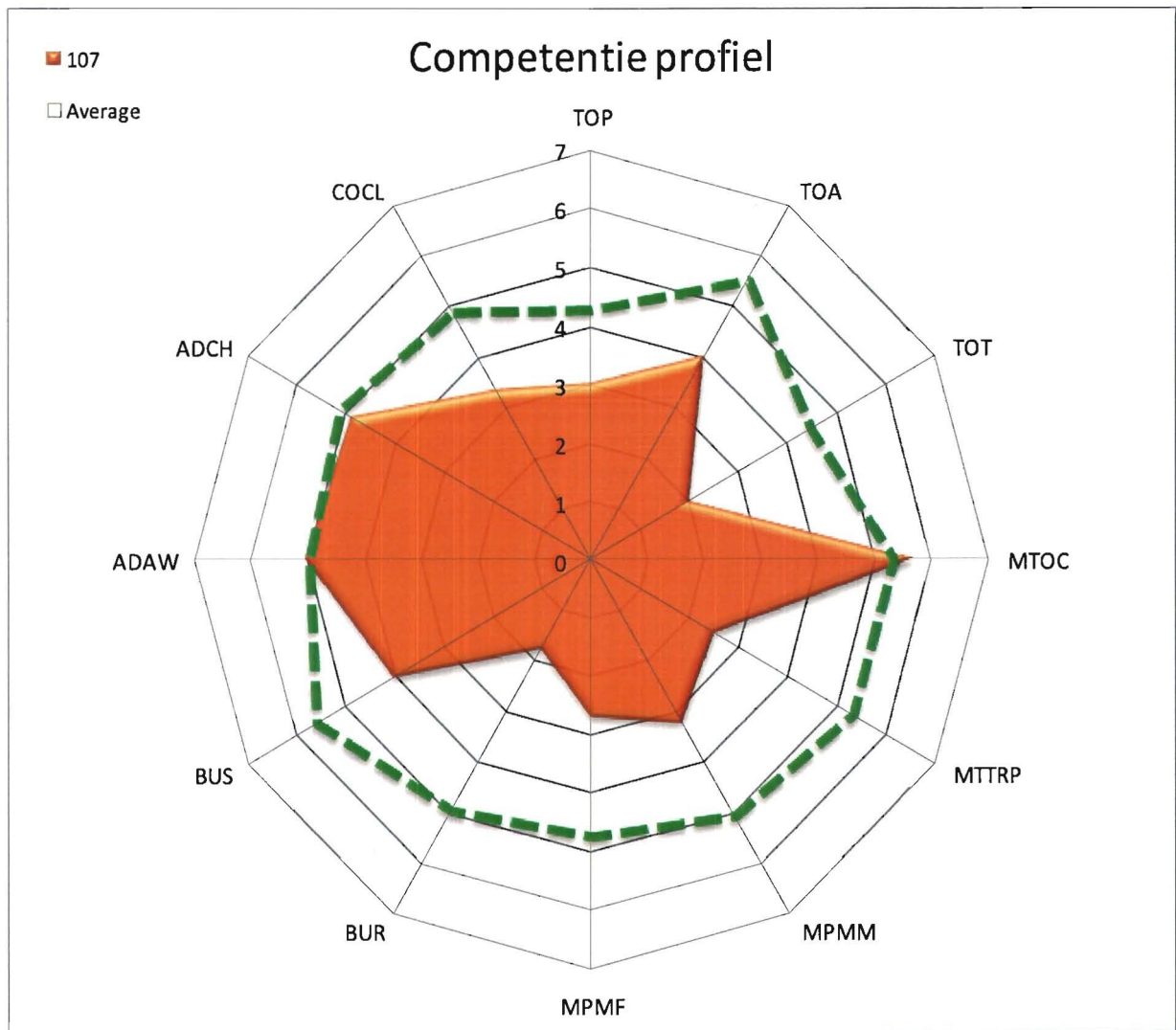


# AD-HOC TEAM PROFILER



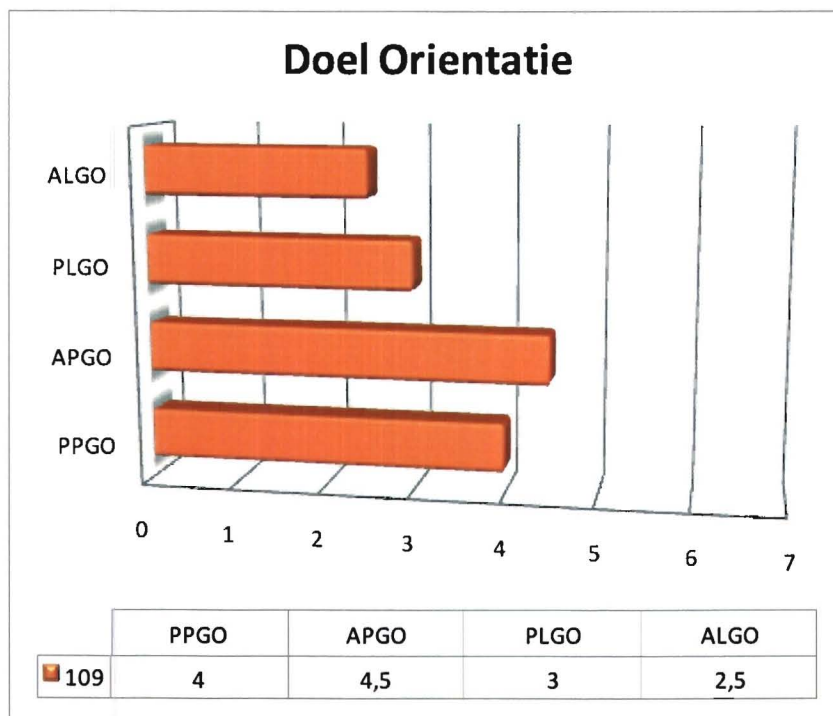
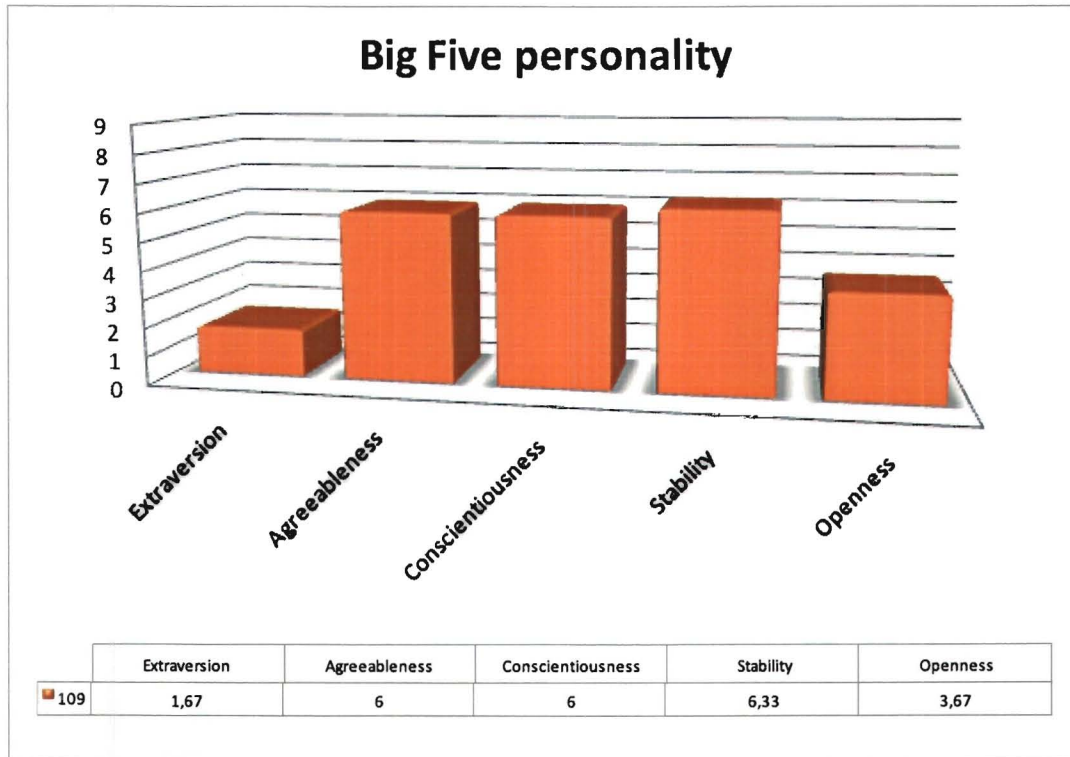
RESPONDENT 107

# 1. CRITICAL TEAMWORK COMPETENTIE SCAN

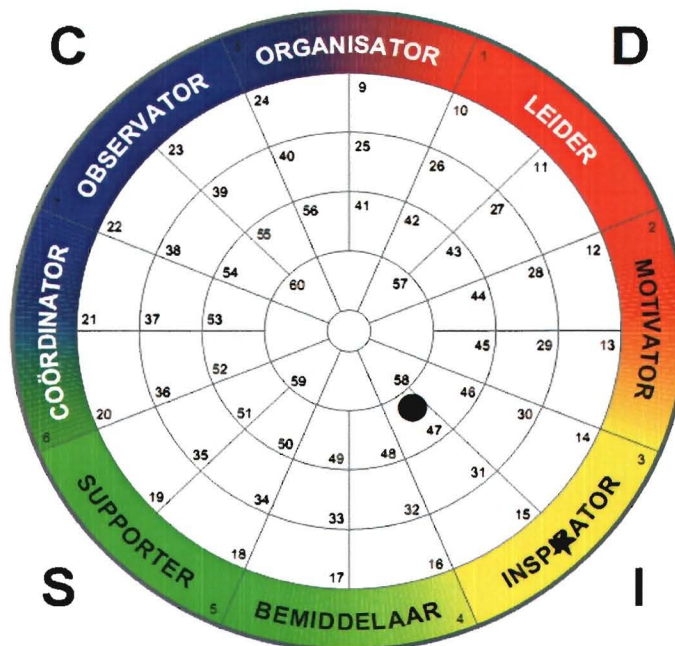
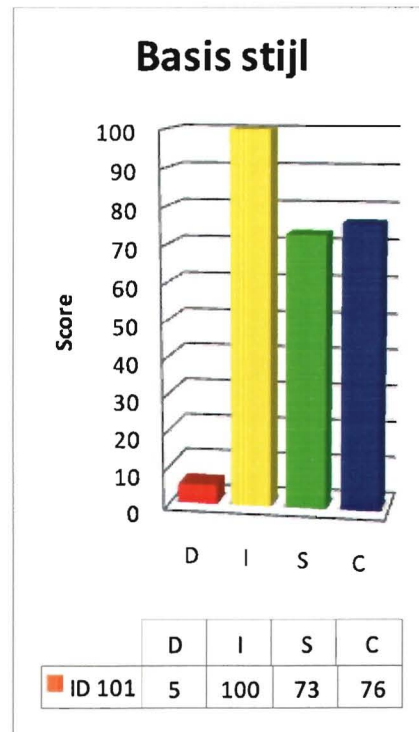
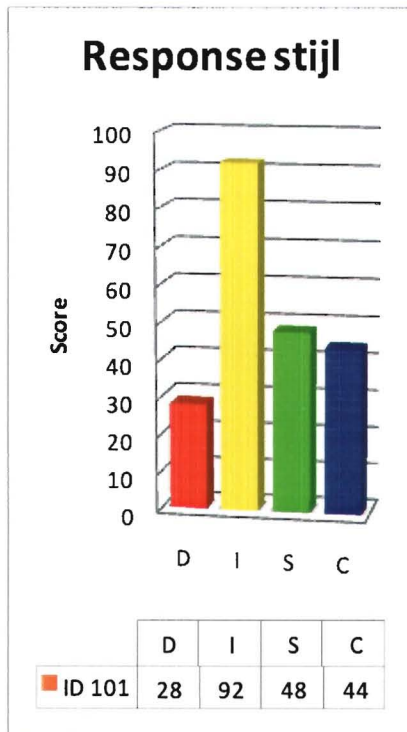


- TOP: Team Orientation preference
- TOA: Team Orientation Acceptance
- TOT: Team Orientation Team Goal
- MTOC: Mutual Trust Open Communication
- MTTRP: Mutual Trust Team Roles & Protection
- MPMM: Mutual Performance Monitoring Monitoring
- MPMF: Mutual Performance Monitoring Feedback
- BUR: Back Up Recognition
- BUS: Back Up Shifting
- ADAW: Adaptability Awareness
- ADCH: Adaptability Change
- COCL: Communication Closed-Loop

## 2. BIG FIVE & GOAL ORIENTATION

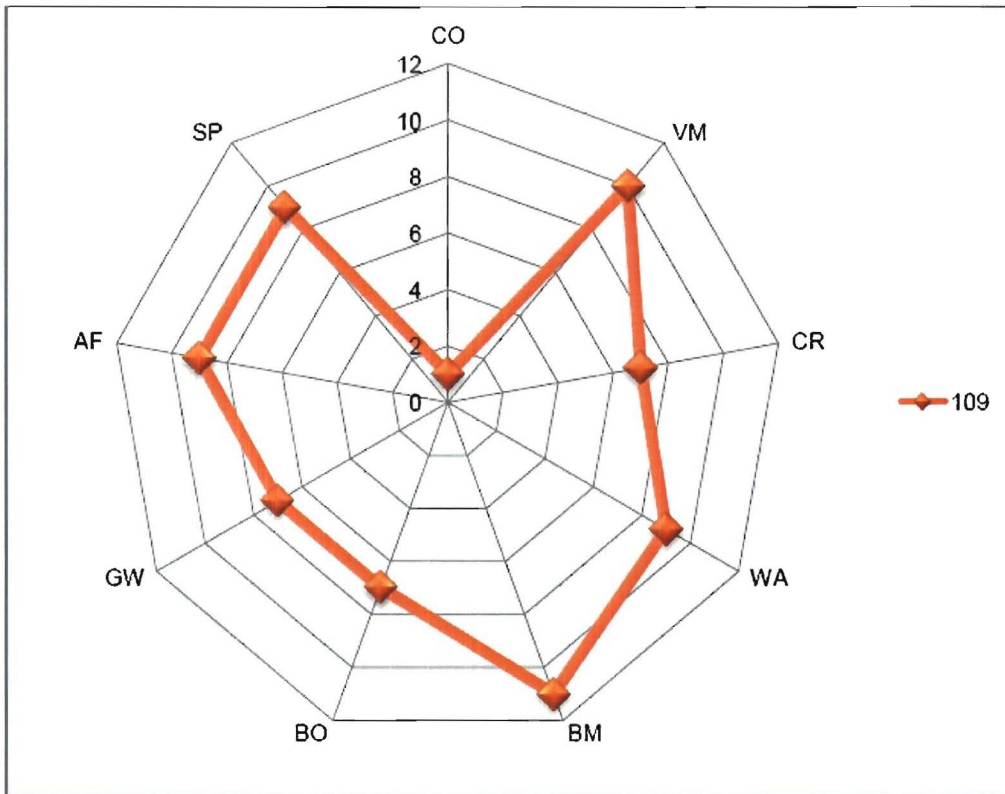


### 3. DISC COMMUNICATION BEHAVIOUR<sup>3</sup>



<sup>3</sup> Dit profiel komt van MDI Benelux.

# 4. BELBIN TEAMROLE INVENTORY



co = coördinator    bm = bedrijfsman    vm = vormer    bo = brononderzoeker    gw = groepswerker  
 cr = creatief    wa = waarschuwer    af = afmaker    sp = specialist

