The Influence of Transformational Leadership Training on Team Resilience

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Abstract

This study evaluated the effectiveness of team transformational leadership training for enhancing the resilience in teams. The training was developed from various existing literature on the correlations between transformational leadership and team resilience. Results from 36 three-person action teams working on an intellective interdependent decision-making task revealed a significant and positive impact of the transformational leadership training on resilience, compared to teams that received no or a transactional leadership training. Transformational trained teams made a quicker recovery and showed greater resilience. Furthermore, results show that the teams' perception of resilience, obtained via questionnaires, is positively correlated with our measurement of resilience. Also, team potency correlated positively with our measurement of recovery and resilience, as well as perceived resilience. However, no correlations were found with any measurement of resilience and psychological safety or cohesion. Post-hoc video analysis in search for team behaviors show a significant difference between training conditions on team orientation. Implications of these findings for future research and practice are discussed.

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Introduction

Teams have become a major focus in both organizational (Robbins, 2003) and scientific areas (Kozlowski & Bell, 2003).Teams are more effective than individuals because team members can share the workload, monitor the behavior of teammates, and combine areas of expertise (Mathieu et al., 2002). To achieve maximum performance, organizations are increasingly relying on what Sundstrom (1999) calls "action teams" (e.g. military teams), which can "conduct complex, time-limited engagements with audiences, adversaries, or challenging environments in 'performance events' for which teams maintain specialized, collective skill". However, action teams are often unsuccessful due to lack of knowledge on their own teamwork skills (Marks, Sabella, Burke, & Zaccaro, 2002). As Ellis et al. (2005) have demonstrated, knowledge of generic team competencies can improve significantly with even a brief (30-minute) training intervention, with significant effects on the expression of teamwork competencies as well as some behavioral aspects. The aim of the current study is to examine whether such short training interventions can also improve the *resilience* (Sutcliffe & Vogus, 2003) of a team, which reflects how efficient people respond to workplace setbacks.

The issue with resilience is that much research is done towards the factors that contribute to it, but none focus on promoting these factors in order to increase performance after a disturbing event. A review of Kozlowski and Ilgen (2006) on teamwork describes previous work related to resilience (e.g. LePine, 2005) but also stresses that team-training interventions (e.g. Ellis et al., 2005) and team leadership

interventions are key leverage points for shaping the development of team regulatory-process competencies.

Failure in leadership has previously been identified as one of the leading causes of failure in a team-based work system (Katzenback, 1997; Stewart & Manz, 1994), yet, to our knowledge, no study (Murphy & Rogarty, 2009) has explicitly intended to enhance effective leadership behaviors, for instance transformational leadership, in an experimental design in order to investigate their direct effects on resilience and group effectiveness. In the present study we intend to examine the effects, of a training of a recently formed team on outcomes such as psychological safety, team potency beliefs, and team members' cohesion. This study makes an important new theoretical and practical contribution by providing information on the possible utility of a leadership training to enhance resilience in teams. Also, the current study is able to assess the causal nature of certain relationships that before only have been demonstrated with analyses of a correlational nature. Finally, the study of resilience and adaptation has an urgent need for quantitative measures of these concepts instead of using questionnaires.

This study focuses on Shared Leadership (Harland, Harrison, Jones, & Reiter-Palmon, 2005), the idea that leadership is shared amongst all team members, as opposed to vertical leadership, which is the idea that leadership should be placed on one position in the team. As we will discuss later, we thereby extend previous studies which claim that sharing leadership functions can be more effective in displaying transformational behaviors, compared to the vertical leadership model (Avolio, Sivasubramaniam, Murry, Jung, & Garger, 2003).

It is important to note that, similar to Sivasubramaniam et al. (2002) we are not negating the importance of a single leader. The function of shared leadership is to reduce the amount of influence of the team leader because it is believed that individual members are perfectly capable of performing some functions themselves. Therefore, sharing leadership functions should be viewed as an additive to the existent leadership models which can be trained to every member of the group instead of the single leader. We also believe that by providing training to all team members, we can increase the effectiveness of our training by means of three persons remembering instructions better than a single leader.

In the following sections, I will first discuss the previous research on resilience and factors contributing to our training program and hypothesize on the effects of our training. In the following sections, I will discuss our experimental design and analytical approaches, the following results and the possible limitations.

Resilience

Cook and Nemeth (2006) define resilience as a systems feature that allows it to respond to sudden, unanticipated demands for performance and then to return to normal operating condition quickly and with a minimum performance decrement. Additionally, Woods (2006) defines some essential characteristics of a resilient system. First, it must have a *buffering capacity* to let the system absorb or adapt to its environment. It also needs *flexibility* to be able to restructure itself in response to these changes. The *margin* (how closely or precarious the system is currently operating relative to one or another kind of performance boundary) and *tolerance* (how the system behaves near this boundary) are

also important features of resilience. On a more individual level, Harland, Harrison, Jones, and Reiter-Palmon (2005) define resilience as developed from confronting stressful experiences and coping with them effectively.

Resilience is the overarching concept of several factors (Woods, 2006; Karoly, 1993), for instance team learning. Team learning encompasses the acquisition of knowledge, skills, and performance capabilities of an independent set of individuals through interaction and experience (Kozlowski & Ilgen, 2006). Although they are sometimes seen as much alike, the two concepts are not equal. Where resilience requires team learning in some situations (e.g. the acquisition of new skills in order to overcome disturbances), it is not always a necessity per se. As Kozlowski and Bell (2007) noted, team learning processes can facilitate team performance and team adaptability, along with motivational states and behavioral capabilities. Team learning can promote the anticipation of a certain disturbance, and provide guidelines for the quickest recovery of performance, which is essential in Woods' definition of resilience (Woods, 2006).

As Cook and Nemeth (2006) note, a resilient system also needs to restore to its normal operating conditions with a minimum decrement of performance. This implies that along with anticipation of a disturbance, a team must be able to *recover* from it. Woods (2006) describes this process of recovery as the *robustness* of a team. A robust team's performance will not drop to a zero-level performance, a robust team tries to maintain the highest level of performance that their environmental conditions make possible.

Adaptability has been defined as the ability to recognize deviations from expected action and readjust action accordingly (Priest, Burke, Munim, & Salas, 2002).

Adaptability is the ability of a team to identify cues that the conditions have changed, to assign meaning to that change, and finally develop and successfully carry out a new plan of treatment (Salas et al., 2005). Woods (2006) notes a difference with resilience, that "all systems adapt, (…) resilience refers to how well a system can handle disruptions and variations that fall outside of the base mechanism/model for being adaptive as defined in that system". Although we concur with this idea, we believe that some authors (e.g. LePine, 2005) define adaptability as indistinguishable from resilience. According to Woods (2006), resilience demands a shift of processes, strategies and coordination. Usually resilience is more than applying textbook plans and activities in the face of changing circumstances that demand a qualitative shift in assessment, priorities, or response strategy. Also, due to its tolerance, a resilient system can absorb certain disturbance which causes stress to rise. This stress can be managed until a certain point, in which adaptive capacity is needed. For these reasons, we believe that much work of adaptability can be applied to the study of resilience, but research should focus on the construct of *resilience* for measurement of effect.

The factors that are associated with adaptability or resilience have been examined thoroughly in recent years. Research has shown that certain (shared) leadership styles, along with effective team coordination, team cohesion, and the creation of a psychological safe climate are strongly associated with resilience (Kozlowski & Ilgen, 2006; Bell, 2002).

Team Leadership

Sivasubramaniam, Murry, Avolio, and Jung (2002) define *team leadership* as the collective influence of members in a team on each other. In their view, team-level leadership is similar to individual-level leadership in that the functional relationships hypothesized at the individual level are expected to be isomorphic within the next level. Another important contributor to the notion of shared leadership is the study from Bowers and Seashore (1966), in which they define *peer leadership* or *mutual leadership* as leadership that could come from peers. Their study revealed this behavior to be positively related to unit performance, compared to the leadership exercised by an individual manager. A possible explanation for this is the "team think" model (Martin, 1993) which states that as a team progresses in collaboration, the team identity would inspire and challenge individual team members to superior performance in very much the same way a single leader can influence his or her followers to perform when they are inspired.

Another form of shared leadership amongst team members is for instance what Greenleaf (1977) describes as 'servant leadership', which involves understanding followers' needs and aspirations and helping them to fulfill their desires in ways that are ethical and socially responsible. This idea still has the leader in the most prominent position, delegating few tasks to its 'servants' to *let them feel* as important. Our notion of shared leadership however, does not only distribute the leadership functions amongst all team members evenly, we also want to ensure that every member is responsible for their own actions, with feedback given to them by their fellow members of the team instead of the single leader.

Our intention for focusing on the group members themselves comes for three reasons. The first (more practical) reason is that there are already many forms of leadership training in the field. We believe that our resilience training would then be a supplement to the existent leadership training. The second reason is that we believe that focusing just on the leader as decision maker for the group could result in an overload of demands, while the subordinate members of the group can be trained to take on some of his/her job demands. The third reason is that Pearce and Conger (2003a) have already provided evidence showing that sharing leadership is a more powerful predictor of team performance than vertical or individual leadership. They also reported that shared leadership accounted for greater occurrence of unique variance in potency, social integration, and problem-solving quality than leadership exhibited by a single appointed leader.

The relationship between shared leadership and resilience

A study by Harland, Harrison, Jones, and Reiter-Palmon (2005) has identified certain types of individual (or vertical) leadership to be an important predictor of resilience. They utilized Bass and Avolio's Full Range Leadership Theory (FRLT; Avolio, 1999) to investigate its impact on subordinate resilience, because the FRLT itself focuses on adaptation and growth in the follower (Harland et al., 2005). Also, Seltzer, Numerof, and Bass (1989, in Harland et al., 2005) found that charisma, individualized consideration, intellectual stimulation, and contingent reward were negatively related with stress and burnout, which Harland et al. (2005) saw as a suggestion towards the relationship of these variables on resilience.

The FRLT as described by Harland et al. (2005) contains nine factors which reflect three broad classes of leader behavior: Transformational, Transactional and Laissez-Faire. The Transformational behaviors include Attributed Charisma, Idealized Influence, Inspirational Motivation, Intellectual Stimulation, and Individualized Consideration. Transactional Leadership includes Contingent Reward, Management-By-Exception Passive, and Management-By-Exception Active. The Laissez-Faire leadership style reflects a sort of avoidant leadership. We will first describe all these behaviors briefly.

Transformational leadership behavior

- *Attributed Charisma* is described as the degree to which the leader behaves with confidence, engenders respect and pride amongst subordinates, and seems to look beyond his or her own self-interest. These behaviors may reduce panic and feelings of helplessness during stressful situations. It inspires team members to positively and confidently approach the situation.
- *Idealized Influence* emphasizes a leader transmitting a higher sense of purpose that goes beyond the goals of the individual and focuses attention on the common good. Since positive reappraisal of the situation is essential for coping with a situation, focusing on positive outcomes might promote these outcomes.
- *Inspirational Motivation* is described as disclosing opportunities, arousing courage, and stimulating enthusiasm (Bass, 1990). It emphasizes leader behaviors that transmit enthusiasm, optimism, and ability to articulate a compelling vision of the future.
- *Intellectual Stimulation*, the fourth of the Transformational Leadership dimensions, emphasizes leader behaviors that focus on effective problem solving

behaviors such as re-examining critical assumptions and seeking different perspectives and approaches.

- *Individualized Consideration*, the final dimension, emphasizes developing employees and treating them as individuals. Employees who feel more valued may be more likely to engage in positive appraisals of the situation because they feel more capable of meeting the challenges.

Transactional leadership behavior

- The *Contingent Reward* dimension focuses on whether the leader is clear about who is responsible for achieving particular outcomes and the benefits resulting from achieving those outcomes.
- The second of the three Transactional Leadership dimensions, *Management-by-Exception Passive*, focuses on leader behavior such as failing to interfere until problems become serious or waiting until something has gone seriously wrong before action is taken.
- The third of these dimensions, *Management-by-Exception Active*, focuses on leader behaviors such as focusing on mistakes, failures and complaints.

Laissez-Faire Leadership focuses on leader behaviors such as avoiding getting involved, avoiding making decisions, being absent when needed, and delaying responding to urgent questions.

The results from the study of Harland et al. (2005) indicate that the FRLT dimensions of Attributed Charisma, Idealized Influence, Inspirational Motivation, Intellectual Stimulation, Individualized Consideration, and Contingent Reward are positively related to subordinate resilience. Also, Management-by-Exception Passive,

Management-by-Exception Active, and Laissez-Faire leadership were not related to subordinate resilience.

Burns (1996) extended the notion of individual transformational leadership to include a focus on the collective or shared leadership. Substituting “initiator” for “leadership”, he mentioned that “The initiator may continue as a single dominating leader a la Castro, but more typically he or she will merge with others in a series of participant interactions that will constitute collective leadership” (pp.2-3). Avolio et al. (2003) extended this view that teams can collectively display a transformational style, whereby members of the team share in influencing each other to perform for “the good of the team”. They also develop shared expectations of each other as typically defined by transactional leadership. Avolio et al. (1999) developed and validated a questionnaire which was able to measure team leadership behaviors.

When combining the existing knowledge from correlations of Transformational and Transactional leadership behaviors on subordinate resilience and the idea of sharing these leadership behaviors amongst team members, there is reason to expect that the same (shared) leadership behaviors can be used to promote team resilience. Also, a study by LePine (2005) concluded that by refocusing more on transition processes (i.e., analysis and planning) rather than focusing on action processes (i.e., performance monitoring) teams are more likely to adapt after a disruption. Teams can be instructed to focus on the former processes more (e.g. in a transformational leadership training) in order to achieve greater resilience than in teams that are instructed to focus on the action processes (e.g. via transactional leadership training which focuses on performance monitoring; Bass & Avolio, 1986). Also, as Ellis et al. (2005) have demonstrated, generic teamwork skills

knowledge can be enhanced in a short (30 minute) training intervention. Where their study focused on skills like monitoring team members (mutual performance monitoring, Salas, 2005) and helping one another (back up behavior, Salas, 2005), the current study focuses more on transformational leadership interventions even though both have similarities amongst them (Priest, Burke, Munim, & Salas, 2002).

We expect that by enforcing the shared Transformational leadership behaviors, along with Contingent Reward behaviors team resilience will increase. Also, promoting Management-By-Exception Passive, Management-by-Exception Active, and Laissez-Faire will have no effect on team resilience.

> Hypothesis(H) 1: Providing each individual team member in a group with Transformational leadership instructions along with Contingent Reward instructions, will increase the adaptability of a team, following that team performance more quickly normalizes after a sudden unanticipated event, as compared to teams that receive Transactional leadership instructions along with Laissez-Faire leadership instructions.

Psychological safety

Edmondson (1999) states that team psychological safety should facilitate learning behaviors along with feedback seeking and experimentation because it ‘alleviates excessive concern about others’ reactions to action’. Burke, Stagl, Salas, Pierce, and Kendall (2006) integrated team psychological safety into their adaptation model, in which psychological safety relates to plan formulation and plan execution. During plan development, a team member may speak up to the team and offer contributions. Because

teams are often more effective when different viewpoints are taken into account (and in essence take the role of devil's advocate) team psychological safety may have a facilitating role in team effectiveness. Team psychological safety also facilitates plan execution via the degree to which monitoring of other team members is accepted. When psychological safety is low, monitoring is less accepted and therefore team effectiveness can decrease (Burke et al., 2006). A study by Sanne (2007) has shown that there is a positive relationship between transformational leadership and psychological safety. With the association between the factors demonstrated, we propose that:

> H2: Providing each individual team member in a group with Transformational leadership instructions along with Contingent Reward, will increase the psychological safety of a team, as compared to teams that receive Transactional leadership instructions along with Laissez-Faire leadership instructions.

Cohesion

Previous research (e.g. Smith et al., 1994; Hambrick, 1995; Katzenback & Smith, 1993) has generally supported a positive relationship between team cohesion and performance. Cohesion refers to both the group's commitment to a shared goal or task (Hackman, 1976), and to a group member's attraction to or liking of the group (Evans & Jarvis, 1980). However, as Kozlowski and Ilgen (2006) point out, techniques for enhancing group cohesion are not yet sufficiently developed. A study by Pillai et al. (2004) has shown however that transformational leadership is positively related to team cohesiveness (amongst others). What is not known is how the relationship between

cohesion and transformational leadership is. Does cohesion increase as a result of transformational leadership, or the other way around?

Similarly, a study by Jung and Sosik (2002) has shown that empowering transformational leadership in organizations is positively related to cohesion in work teams. The study of Jung and Sosik (2002) did not study the effects of different forms of training on cohesiveness in teams however. Where not much is known about the relationship of transformational leadership and team cohesion, we do propose that with the training of transformational leadership to teams, team cohesion will increase as transformational leadership increases. We then expect transformational trained teams to be more cohesive than the transactional trained teams.

H3a: Transformational leadership along with Contingent Reward within teams will be correlated with team cohesion.

H3b: Providing each individual team member in a group with Transformational leadership instructions along with Contingent Reward, will increase the cohesion of team members, as compared to teams that receive Transactional leadership instructions along with Laissez-Faire leadership instructions.

Team potency

Team potency is described as the perception of team members of their team's effectiveness. It was used in the study of Sivasubramaniam (2002), who proved that it was positively correlated with transformational team leadership. They measured teams of students performing a case assignment, using the TMLQ (Bass & Avolio, 1994) described above. They proved that team transformational leadership influences group potency

beliefs, and that these beliefs can predict group performance. They also found strong support that team leadership and performance was mediated by the team's potency beliefs. A question that rises from this study however is that if teams are trained for a form of leadership, will this affect their potency beliefs as well? Given that higher team potency beliefs will result in a better team performance (Bass & Avolio, 1994), we are specifically interested whether our training will result in higher team potency beliefs and in the relationship of this hypothesis with our first hypothesis (that transformational training will result in higher team performance).

> H4: Providing each individual team member in a group with Transformational leadership instructions along with Contingent Reward, will increase the teams potency beliefs, as compared to teams that receive Transactional leadership instructions along with Laissez-Faire leadership instructions.

To summarize, to our knowledge few attempts have been made to investigate the relationship of shared leadership functions on team resilience, psychological safety, cohesion, and potency beliefs. It is our intention to investigate these effects in order to find a possible proof-of-concept of Transformational Leadership Resilience training on a newly formed team.

Method

Participants and experimental design

The participants were 120 people, who volunteered for the experiment. The participants were randomly assigned to teams of three members, which were assigned to one of three

possible conditions in the experiment. The participants were recruited via various participant databases and flyer's, promoting the intention and need for participants in this study. Participants were mainly students from various colleges and universities. The participants' age ranged from 18 to 35 (M= 24.4, SD = 4.0). Fifty-seven (44, 2%) participants were male, 72 (55, 8%) were female. One hundred nineteen people were Dutch, one (0,8%) participant was German. All participants responded they had previous experience working in teams (M = 5.43, SD = 1.12) when asked to rate their experience on a Likert 7-point scale. Also, all participants had experience in team discussions (M = 4.86, SD = 1.46). The participants did not know their other teammates from before (M = 1.29, SD = 1.03). The participants were randomly distributed over the conditions, as analysis from the pre-experiment questionnaire showed. This pre-questionnaire contained questions concerning whether the participant had gaming experience, experience with the program, and whether they had ever heard of transformational or transactional leadership. Analysis of the questionnaire showed there were no significant differences across all groups.

Each participant was paid 45 Euro for their participation. Also, motivation for the task was ensued by awarding a bonus to the team that performed the best in the condition it was placed.

The experimental design was a one-way between-subjects design, with two training conditions (transformational, transactional) and a no-training condition as levels. The teams were randomly assigned to experimental conditions; men and women were randomly assigned to a team, thereby creating mostly heterogeneous teams.

Experimental setting

Figure 1 gives an overview of the room the participants were placed. Each was seated at a table behind one of three computers (In figure 1, PC1 to PC3). The computers were linked via a network (see figure 1). Each individual performed his or her work individually on PC1, PC2, and PC3. PC4 was intended to register the final team input. This meant that during each trial, all participants had to move their chair from their own PC to PC4 on which they could see their own answers and come to a consensus on the final input.

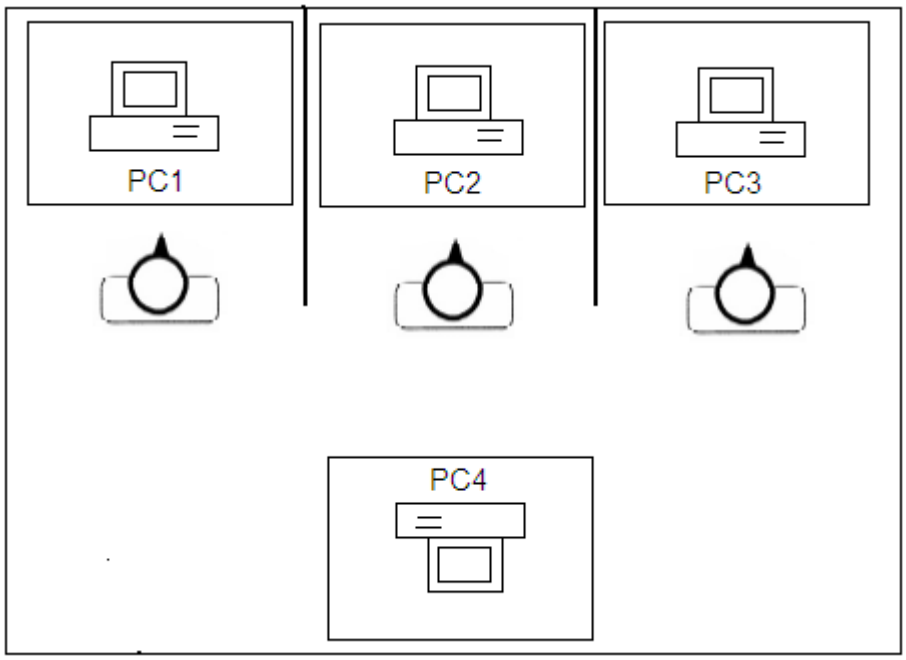

Figure 1. Schematic representation of the experimental set-up. PC4 was used as a server. PC1, PC2, and PC3 checked PC4 for new entries in a log file every second to update their own terminal. The experiment leader was able to start the simulation by starting up PC4. From that point, the simulation continued automatically.

Task

The present study focuses on teams working together on an intellective task, in which an unanticipated event could easily be programmed. Also, teams should be able to monitor their own performance as well as the team's performance in order to recognize that their task environment has changed. Finally, as stated before the study of resilience and adaptation has an urgent need for quantitative measures of these concepts instead of using just questionnaires. Therefore, one additional demand for the task was that it should contain many short items presented successively, which can be measured individually. The specific task used for this study was therefore a multiple-cue probability learning task called the Team Interactive Decision Exercise for Teams Incorporating Distributed Expertise (TIDE²). An extensive description of this task, which simulates a military command-and-control context, is given in Hollenbeck et al. (1995). Three participants served as a team and were stationed at networked computer terminals.

Participants were randomly assigned to roles termed Coastal Air Defense (CAD), Cruiser, and AWACS and were required to classify aircraft as friendly or threatening on the basis of certain pieces of information. The team as a whole was responsible for gathering a total of nine specific pieces of information about an aircraft (e.g. speed, range, altitude, angle, and radar type). Each member was assigned three specific pieces of information to gather and combine in a specific combination rule and was given training on how to transform information values into probable threat levels using tables. Members obtained information by clicking on a pull-down "Measure" menu and selecting the piece of information that they were interested in. However, each team member had personal access to only one of the three pieces of information that he or she was in charge of gathering along with two pieces of information that was of their team member's interest;

thus, each member also needed to communicate with teammates to receive the other pieces of information. Communication occurred via mouth-to-mouth sharing of information, and virtually no restriction were made with regards to what kind of information could be shared between members.

Once the CAD, Cruiser, and AWACS had obtained the three pieces of information they needed, they used that information to ascertain the aircraft's probable threat level. Each individual team member then made a recommendation about the aircraft (reflecting what they would do if they were in charge of the group). This recommendation took the form of a course of action to take regarding the aircraft, on a 7-point continuum of aggressiveness (1 _ *ignore,* 2 _ *review,* 3 _ *monitor,* 4 _*warn,* 5 _ *ready,* 6 _ *lock-on,* and 7 _ *defend*). Once every member had made their decision, a fourth computer was used by all three team members to make the team's final decision. This terminal did not measure anything; it only reflected the individual decisions made by the team members. The team had to decide what the final team decision would be, given their individual answers. The fourth computer was added to ensure that no leader could be appointed by the experiment leader or the software itself, since the original version of TIDE² appoints the CAD as the leader of the team, who makes the final team decision.

Once they registered the final decision into the computer, it was compared to the correct decision. Teams were then given feedback via the computer on the absolute difference between their decision and the correct decision. The teams' decision, the correct decision, and every team members' recommendation were listed on this feedback screen, along with aggregate information on how the team had performed over the time. Each individual trial lasted no more than 120 seconds.

Procedure

Participants were first given some demographical questions to answer, after which they received either a transformational or (mostly) transactional training. To assess whether our training would also have significance in a more applied (natural) situation, we also included a third group which did not receive leadership training on a subject related to leadership, instead they were given a break from the task for an equal amount of time. This group was expected to perform about as well as the transactional group, for there are no stimulations for improving the team's work present in this condition. Also, Kozlowski and Ilgen (1996) noted that people in a newly formed team will automatically behave more transactionally because it is easier and allows for getting to know the rules of the team and its members. The group that received no training was used to assess in hindsight whether there were effects from simply putting a team in a discussion concerning their tasks.

The transformational training consisted of explaining what factors contribute to resilience and guiding them through each individual bullet on a list which displays certain behaviors we expected them to perform. To assure that participants read every point on the list the behaviors were put in a questionnaire, which participants were asked to fill in first. After that, participants were given ten minutes to discuss how they were to perform these behaviors as a team. The experiment leader was not included in this discussion to prevent experimenter effects (Rosenthal, 1998). The transactional training contained training and discussion on another bullet list, which the participants were led to believe would also promote resilience. The same instructions and amount of time were given as

the resilience training, with the exception of the behaviors expected from them. Using the third group, we assessed whether our training condition differed significantly from a non-resilient team, factoring out any possible training effects. Each participant was randomly assigned to a group and each group was randomly assigned to one of the three conditions.

After a short introduction to the task, participants were first given ten practice trials. After a successful completion of the task training, they were given their resilience instructions list (depending on their training). Before the experimental trials started participants were told that their own individual decisions could not have the same impact on the teams' decision in every trial. After that, they started with the first 10 trials, in which randomly calculated targets needed to be identified. After a short break, the next 20 trials were played by the participants the same way they did before. Unknown to the participants the weights of each combination rule was changed, so that instead of the team decision being an average of the three individual decisions, one team member now had all the information needed to make the team's decision. The decision rules of the other team members were then irrelevant, which meant the team's decision was then based on just one team member instead of a combination of the decision rules of all three members. The participants were to find out themselves what had changed in their environment and adapt accordingly. This technique is similar to the method successfully used by LePine, Colquitt and Erez (2006) in which decision rules in the same task also changed in weight in order to assess adaptability with personal characteristics.

The session ended with a questionnaire and a debriefing to assess whether the participants knew their environment had changed. The experiment was recorded via four cameras attached to a video recorder for post-hoc analysis of various team behaviors.

ANOVA comparisons were made between groups to ascertain the workings of the training. For post-hoc analysis, by using the 'Big Five' model of teamwork behaviors (Salas, 2005) we were able to classify various team work behaviors and compare the conditions using ANOVA. Two independent experts (between-observer concordance = . 72) rated the quantities of certain team behaviors, which are believed to be essential for good teamwork (Salas, 2005). Due to practical limitations, we only focused on the components of team leadership, mutual performance monitoring, back-up behavior, and team orientation. Each component contained a set of observable behaviors, based on various definitions provided by Salas (2005). In the post-hoc analysis the independent judges observed eight identical trials over all teams and kept a record of various behaviors displayed by team members. The results of this analysis could be used to clarify how the training had its effect, along with the answers given on the questionnaires.

Dependent variables

Resilience. Resilience was measured via quantitative data from the task, as well as questionnaires to assess the participant's perception of its team resilience. Resilience can be quantitatively obtained via various methods. We attempted to use multiple methods for obtaining data, in an attempt to explain the behavior from more than one standpoint. The first way to quantitatively assess *resilience* from decreased performance is by calculating the slope of the regression line in each team's performance. After the disturbance was brought upon the team, a drop in performance (and team score) will be seen immediately when performance data is displayed graphically, which will reflect in less steepness of the total team's cumulative performance score when graphically displayed. A performance

regression line from this initial trial to the last, in which recovery has taken place, shows how fast a following recovery has taken place. If a team adjusts very early after the disturbance, the slope of regression line will be much steeper than when the onset of the recovery comes very late, because the resilient team will score at baseline level much earlier than the non-resilient team. Hence, a between subjects ANOVA was carried out with Group (Transformational, Transactional, No training) as between subjects variable and the slope of the regression line as dependent variable.

A way of quantitatively measuring *recovery* is by assessing the number of trials it took for the team to overcome the disturbance. Using video-analysis and performance data, a number was assigned to every team, reflecting the number of trials it took for them to correctly notice the disturbance and adjust in a correct way, so that they performed at baseline level again.

A way of measuring *perceived* resilience was measured post-session perception of the team's resilience, using a self-made questionnaire based on the definition of Woods (2006), combined with the questionnaire used in the study of Harland et al. (2005). Ratings could be given on a seven-point Likert scale, in which a score of 1 represents a negative response to a statement, and a score of 7 the most positive response. The questionnaire contained 7 items (Crombach's $\alpha = .85$) and contained questions on how the team recognized, adapted to, and handled an uncertain situation. An example question is 'As a team we were very much capable of anticipating surprising disturbances in the task'.

Baseline performance. Another way of obtaining performance data quantitatively is by using the mean-squared error (MSE), as described by LePine, Hollenbeck, Ilgen,

Colquitt, and Ellis (1999). For each decision, there was a decision outcome calculated as the squared difference between the total individual's decision, the following team decision and the correct decision. MSE scores can range from 0 (the best match between trials) to 36 (the worst match between trials). Because MSE is a measure of accuracy, lower scores reflect higher decision-making performance. We did not use the MSE scores for recovery or resilience measures but strictly for our so-called baseline performance, because our disturbance only affected team level performance, not individual performance on which our disturbance was targeted.

Psychological safety. Psychological safety was based on the original questionnaire created by Edmondson (1999), but adapted to the task situation and translated into Dutch. It originally contains seven questions concerning the perception of influence each team member has on the team and whether the team climate was open for suggestion from each individual team member. However, due to an initial low alpha (α = .51) two items were removed from the scale, leaving 5 items in total (Cronbach's α = .61). All items were measured on seven point Likert scales; an example item of the scale is "My efforts are not being undermined by members of my team".

Satisfaction. A satisfaction questionnaire was administered after completion of the task. The questionnaire was adapted from Dennis (1996) and translated into Dutch. It contained five items pertaining to satisfaction about the task, other members, and the communication processes of interacting with other members (5 items, Cronbach's α = .95). All items were measured on seven point Likert scales, in which a score of 1 corresponds to the most negative response to a statement and a score of 7 corresponds to the most positive response to a statement.

Information exchange. Information exchange refers to the perception of participants concerning the completeness, speed, and amount of information given and received during discussions while performing the task. It was measured by a questionnaire which measured the perception of team members of the way information was exchanged in the group. The questionnaire was adapted from the information exchange questionnaire by Van der Kleij, Lijkwan, Rasker, and De Dreu (2009) to match the task requirements. The questionnaire contained 7 items, which could be answered on a 7-point Likert scale (Crombach's $\alpha = .76$). An example item of this questionnaire is 'There was enough opportunity to exchange information'.

Cohesion. Cohesion refers to a group's commitment to a shared goal or task (Hackman, 1976), or to a group member's attraction to or liking of the group (Evans & Jarvis, 1980). Cohesion was measured via a 4-item scale developed by Dennis (1996). Crombach's alpha was 0.80. Answers were given on a 5-point rating scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire was translated in Dutch. An example item of the cohesion questionnaire was 'to what extent do you trust the members of this group?'.

*Group Potency***.** Group potency refers to the overall amount of belief team members have that their team can be effective. Similar to the study of Sivasubramaniam et al. (2002), group potency was assessed using the 8-item scale developed by Guzzo et al. (1993). Crombach's alpha was 0.90. Answers were given at a 5-point rating scale, ranging from 0 (strongly disagree) through 4 (strongly agree). The questionnaire was translated into Dutch. An example item from the Group Potency scale is 'Our group believes it can be very productive'. All questionnaires can be found in the appendix.

Results

A total of 4 teams were excluded from the study, three teams due to prior knowledge of the disturbance in the task, and one team due to a failure in following the instructions given in the training. Results were obtained, if possible, at team level and were based on the remaining 36 teams: 12 teams in the transformational setting, 12 teams in the transactional setting, and 12 teams that did not receive any training.

Table 1 describes the outcomes of the dependent variables. Table 1 gives an overview of the correlations and descriptive statistics for all variables in the study. It is important to note that nearly all the quantitative measures correlate, which was expected. No correlation could be found between the MSE scores and the performance regression line, which is in part due to the fact that MSE tends to take larger mistakes more into account (by squaring the error scores) than the other two measures.

Table 1

Cell Means (M) and Standard Deviations (SD) of the Dependent Variables by Condition

	Condition		
Dependent variable	Transformational	Transactional	No training
Recovery	13.5 (2.76)	16.42 (1.83)	15.33 (2.81)
Resilience	3.80 (.53)	3.60 (.32)	3.44 (.58)

Baseline performance [a]	.58 (.43)	.51 (.34)	.45 (.83)
Perceived resilience [b]	5.13 (.76)	4.86 (.88)	4.85 (1.17)
Psychological Safety [b]	4.56 (.75)	4.71 (.37)	4.59 (.45)
Information Exchange [b]	5.61 (.86)	5.69 (.71)	5.66 (.62)
Process Satisfaction [b]	5.88 (1.01)	5.99 (.79)	5.91 (.90)
Solution Satisfaction [b]	5.06 (.94)	5.39 (.91)	5.23 (.97)
Team Potency [c]	4.00 (.43)	3.85 (.64)	4.05 (.52)

Note. Values enclosed in parentheses represent standard deviations.

[a] The values represent scores obtained by the Mean Squared Error method in which a lower score predicts a better decision-making accuracy across team and individual scores.

[b] The values represent mean scores on seven-point Likert scales.

[c] The values represent mean scores on five-point scales

Instruction checks. Both the transformational and transactional questionnaire were measured again afterwards, to ensure that our training had changed the participant's handling of the task. Bivariate correlation results show that across all participants (regardless of condition) a significant difference (r = -0,303; p < .01) in the expected direction exists between de transformational and transactional behaviors. This implies the transformational and transactional items in the questionnaire can be seen as distinct from each other.

No main effect of condition was found on transformational behaviors across the transformational and transactional condition, F (1,24) = 1.130, p = .16, η_p^2 = .030, *one-tailed.* The transformational questionnaire (M = 4.05; SD =.63) differed not significantly from the transactional questionnaire (M = 2.52; SD = .32). The observed power (.29) was quite low. A main effect of condition was found on the transactional behaviors however, F (1,24) = 3,243, p = .04, η_p^2 = .10, *one-tailed*. The transformational questionnaire (M = 3.83; SD= .40) differed significantly from the transactional questionnaire (M = 2.87; SD= .63).

Stable task performance. Results show no main effect of condition in the MSE performance scores across the first ten trials, which reflected a baseline measure of performance, F (2,35) = .41, p = .33, η_p^2 = .018, *one-tailed*. The observed power was .58. This means that transformational leadership (M = .58; SD = .44) has no effect on performance when no environment change is present compared to the transactional teams (M = .51; SD = .35) and no-training condition (M = .46; SD = .18).

Recovery. Results from the recovery study show that there was a main effect of condition on performance, F (2,35) = 3.90, p = .015, *one-tailed*. The observed power

(.94) was high. Post-hoc Bonferroni comparisons made on all conditions show that the transformational trained group made a hundred-percent score (this meant that no mistakes were made after a certain number of trials) after an average of 13.5 trials (SD = 2.84), where the transactional group had an average of 16.4 trials (SD = 1.88) which resulted in a significant difference between the transformational and transactional trained teams. The groups that received no training (M = 15.3 trials, SD = 2.90) did not differ significantly from the transactional condition however (M = 1.08, SD = .59; p = .15, *one-tailed*).

Resilience. Results from the resilience study show that there was a main effect of condition on resilience, F (2,35) = 4.877, p < .02, *one-tailed*. The observed power (.93) was high.

Post-hoc Bonferroni comparison show there was not a significant difference between the transactional condition and the no-training condition (M = .159, SD = .12, p = .27, *one-tailed*), as expected. Based on the latter findings, we can conclude that training effects alone are not solely responsible for our findings, as we would then expect significant differences between the transactional condition and the no-training condition as well.

The results on recovery and resilience confirm our first hypothesis that providing Transformational leadership instructions will increase the adaptability of a team, compared to the group that receives no training or transactional training.

Perceived Resilience. Results from the perceived resilience study indicated that no significant main effect of condition could be found, F (2,35) = .74, η_p^2 = .015, p = .27. The observed power (.22) was low. The indications reveal that with a change in condition, no more perception of resilience could be found within the participants. These results were

not consistent with our expectations. Table X shows that the perceived resilience is however correlated with our quantitative resilience measure (r = .206, p = .022, *one-tailed*).

Psychological Safety. Psychological safety did not significantly correlate with the number of trials or the regression slope as can be seen from table 1. We did find a positive relationship between psychological safety and the resilience questionnaire. There was no main effect of condition on psychological safety, F (2,35) = .727, η_p^2 = .014, p = .24. Observed power was .17. This means there was no significant difference between the transformational (M = 4.56; SD = .76), the transactional (M = 4.71; SD = .37) and the no-training condition (M = 4.59; SD = .46). We therefore cannot confirm our second hypothesis - providing teams with Transformational leadership instructions will increase the psychological safety of a team compared to the - with these findings.

Cohesion. Linear regression models show a significant correlation with team cohesion and team transformational leadership (t = 4.04, p = .00, *two-tailed*). We can therefore confirm hypothesis 3a, that team cohesion correlates with team transformational leadership.

However, no significant main effect of condition was found on group cohesion, F (2,35) = .449, η_p^2 = .008, p = .32, *one-tailed.* Observed power was .12. This indicates that no significant differences exist between the transformational (M = 5.83; SD = .83), transactional (M = 5.87; SD= .86) and no-training condition (M = 6.00; SD = .72) on the group's cohesiveness. We therefore cannot confirm hypothesis 3b, that the team members' cohesion will increase when given a transformational training compared to the teams that were given mostly transactional training.

Group potency. No significant main effect of condition was found on group potency, F (2, 105) = 1.372, η_p^2 = .025, *p* = .13, *one-tailed.* Observed power was .29. Group potency was measured at individual level for each individual was asked for their perception of their team's ability and therefor it was a purely individual measure. It is therefor more suitable not to aggregate their answers to a team level.

The results indicate that no significant differences exist between the transformational (M = 4.00; SD = .43), transactional (M = 3.85; SD= .64) and no-training condition (M = 4.05; SD = .52) on the belief the group can achieve more than the sum of its parts.

We cannot confirm our fifth hypothesis, that transformational training will increase the team's potency beliefs compared to mostly transactional training.

Post-hoc video analysis. When compared across conditions, a main effect of condition is found on team orientation, F (2,21) = 6.157, η_p^2 = .446, *p* = .008. The observed power was high (.91). There is a significant main effect of condition between the groups that received no training (M = 8.78; SD = 1.63), the transformational condition (M = 10.51; SD = 1.01) and the transactional condition (M = 7.63 ; SD = 2.32).

No main effect of condition was found on mutual performance monitoring, F (2,21) = .132, η_p^2 = .019, *p* = .822; no main effect of condition was seen on backup behavior, F (2,21) = .132, η_p^2 = .012, *p* = .877; Also, no main effect was seen on leadership, F (2,21) = .511, η_p^2 = .046, *p* = .607. The observed power mutual performance monitoring, backup behavior, and leadership was overall low (all values ranging lower

than .13). Means and standard deviations of the occurrences of these variables are presented in table 2.

Table 2

Cell Means (M) and Standard Deviations (SD) of the Dependent Variables by Condition

	Condition		
Dependent variable	Transformational	Transactional	No training
Team Orientation	10.51 (1.01)	7.63 (2.32)	8.78 (1.63)
Mutual Performance Monitoring	7.56 (3.25)	7.94 (3.21)	6.92 (2.63)
Backup behavior	1.74 (1.65)	1.52 (1.01)	1.83 (.72)
Leadership	5.67 (2.26)	5.11 (1.65)	4.67 (1.63)

Note. Values enclosed in parentheses represent standard deviations.

Discussion

Where organizations expect their own teams to remain flexible and adaptive, even when the environment around them changes (Cooper, Dewe, & O'Driscoll, 2001), *resilience* has been studied with high interest for scientific and organizational purposes. As previous research has linked transformational leadership to subordinate resilience, this study evaluated the effectiveness of team transformational leadership training for enhancing the resilience in teams. Our measurements of resilience consisted first of recovery, by

determining the number of trials the team took to get to their baseline performance. Second, resilience itself was measured by a cumulative performance regression line slope comparison across training conditions. Results show a significant positive impact of team transformational leadership on the team's resilience in both measurements, compared to no training or transactional leadership training which is thought to have no or a detrimental effect on resilience.

No effect however was found on the perception of team members' resilience, even though the three measurements do correlate significantly with each other. We believe that resilience measured in retrospect of the task was probably not effective enough to provide significant differences. At the experimental debriefing participants often told us they could have done better, no matter what their score was. Some other teams declared they were satisfied with the result, because they just noticed the disturbance, regardless whether they adapted to the disturbance properly. Both these effects have probably reflected into answers they provided on the perceived resilience questionnaire.

To possibly counter the aforementioned effect, we analyzed the videos made during the experiment and, by using the Big Five model of teamwork (Salas, 2005), investigated whether some factors of this model are displayed more in the transformational group than in the transactional group. Our reason for choosing this model was that the instructions we gave to the transformational teams were very much alike the definitions of for instance team orientation, an aspect of the Big Five model (Salas, 2005). Because the preexisting literature on the Big Five model used in transformational leadership was, to our knowledge, little to non-existent we did not state any hypotheses and/or expectations. The results indicate that team orientation appears to

be an important aspect of transformational leadership, as it is displayed significantly more in the transformational group. We could not find any significant differences in backup behavior, mutual performance monitoring, or leadership. We believe that our setup and design of the task is probably most responsible for these findings, as our task design did not create much need for helping other team members in their task. Therefore, we would expect that there is no significant difference in monitoring or backup behavior of other team members. As for leadership, we believe that there was a difference in leadership taking between the groups, however it was too difficult to distinguish leadership taking via communication analysis. Often the leadership functions were not spoken aloud to each other (e.g. by saying ”What do you think we should do?”), but implicitly carried out by team members. We believe this behavior could be easily missed and therefore, differences between groups are difficult to be discovered. As recommendation, we reckon that an experiment deliberately set up for video analysis is needed to account for these difficulties and provide researchers with better results.
We must at least urge future researchers in this field to take caution when assessing the perception of resilience and look out for possible biases reflected in their answers.

Aside from the perception of resilience, our results agree with much of the previous research (e.g. Harland et al., 2006; Kozlowski & Ilgen, 2006) on the positive effects of transformational leadership and team leadership on team resilience. We were able to produce significant differences between transformational and transactional leadership styles by providing different types of training to different groups. Our results are in line with the team adaptation model of Burke, Stagl, Salas, Pierce, and Kendall (2006), by showing (post-hoc) that team orientation does lead to better situation

assessment, which is equivalent to a higher team score in our task. We did not answer whether situation assessment also leads to plan formulation, as this would require for a measurement of shared mental models and psychological safety. As we have tried to measure psychological safety, we are not convinced that questioning team members themselves is the best measurement, as the inconclusive results between the transformational and transactional groups prove. A possible next step in the research involving the team adaption model could therefore be to invent new ways of determining team mental models and, perhaps more importantly, psychological safety.

We could not demonstrate the relationship between psychological safety as an outcome of resilience, nor psychological safety as mediator between the training and resilience. A possible explanation is that, as psychological safety was not deliberately intended to diminish by direct but via indirect manipulation, the manipulation was too subtle for changes in psychological safety to occur. As Edmundson (1999) stated, teams can have an innate capacity for high psychological safety without external stimulation, which could mean that positive stimulation via training has no to little effect in some teams. Furthermore, as the transactional training was not strong enough to produce significant effects compared to the condition that received no training, we can assume that the transactional training did not have a detrimental effect on psychological safety as well.

Implications. The results presented in this paper have a practical implication for future training interventions. We proved the possibility of a relatively small training to have its effect on team resilience and therefore, we provided a proof-of-concept which can guide as a basis for innovative team leadership interventions. As a theoretical

implication, we provided evidence for the effectiveness of team leadership and transformational leadership models, as well as parts of the Big Five model of Salas (2005). We must stress again however that this study provided merely a proof-of-concept of team transformational training on team resilience, and future studies should focus more on the exact workings and details of the intervention and the workings of team resilience. When these are well understood, the training can be fine-tuned to have an increased effect on specific teams (e.g. action teams). Consequently, training practices can be adjusted or introduced to have its effect on resilience in practice.

Limitations and future directions. A few limitations around this study should be highlighted. First, as mentioned earlier, this study should be seen as proof-of-concept for transformational training on team resilience. We do not infer that this type of training is in any ways superior to other ways, because we did not compare the various types of training. Also, a study of Arthur, Bennett, Edens, and Bell (2000) revealed that lectures are one of the more effective ways of organizational training methods, particularly for achieving cognitive outcomes. As our task was mainly cognitively based, the lecture-based training provided us with a good basis for achieving outcomes. We cannot imply however that other, more behaviorally based outcomes will be achieved using this exact method. Also, as Salas et al. (2002) state, some additional principles of human learning should also be accounted for in providing teams with training, which we did not fully account for. As we stated earlier, additional (field) research towards the practical use of the training should be conducted before making these types of inferences.

Future research could also answer the question whether certain types of groups benefit more from transformational training than others. Our study focused mainly on

students with age ranging from 18 to 30 years old. As this group is useful in our study for it was intended to promote resilience in groups consisting of *all* types of people, we could argue that as these people typically do not represent action team members, it would be wise to study the effects of the training on more typical members, e.g. soldiers and doctors. Perhaps educational differences should also be considered, as we would expect that not every team member with different levels of education would understand and adapt to the cognitive and behavioral changes the training demands. We would also expect differences in motivation. Again, future studies can focus on these issues to broaden the field of the study of resilience.

Finally, due to time and practical constraints we were unable to produce large differences between groups. We believe that given more time, we would have been able to produce greater differences in performance measures, perhaps also in questionnaires. We believe that with more time we should have been able to produce more understanding of our training and therefore, more motivation to comply with our instructions. One has to be careful with overloading the team member with too much information (Paas, Renkl, & Sweller, 2003). We hope that future research will address these issues by finding the appropriate amount of information one can convey to a team in order to produce the maximum amount of results.

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