TEAM EXTRAVERSION, TEAM EFFECTIVENESS AND SILENCE

Does silence mediate the effect of team extraversion on team effectiveness?

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Abstract

This study examines the relation of team extraversion on team effectiveness and the mediating role of silence in this relation. Team extraversion was operationalized by the mean, variance and an interaction term (mean times variance). It was expected that the mean, variance and the interaction term of team extraversion were positively related to team effectiveness. However, none of the expected results were observed in this study. In contrast to what was expected, this research finds the average degree of team extraversion to be negatively associated with team extraversion, such that a higher mean of team extraversion predicted greater team effectiveness.

Furthermore, it was expected that more extraversion in a team and greater diversity of team extraversion would result in fewer silence and, in turn, greater team effectiveness. This study finds no mediating role of silence between team extraversion and team effectiveness. As was expected, the results show that more silent segments predict less team effectiveness.

Team extraversion is measured by means of a questionnaire. Team effectiveness was analysed by means of calculating the number of solved puzzles per minute, per team, during an escape game. In an escape game, a team solves several puzzles in a specified time to escape a locked room. Silences during the escape game were measured with sociometric badges worn by each participant during the game. The study included 363 participants spread over 72 teams.

Although this research offers insight into certain predictors of the effectiveness of a team, more research is needed to further explore the effect of team extraversion or other personality traits on team effectiveness and the possible mediating role of communication.

Does silence mediate the effect of team extraversion on team effectiveness?

The efficiency of teamwork has gained importance in organizational contexts due to economic and technical changes (Bell, 2007; Cohen & Bailey, 1997; Devine, Clayton, Philips, Dunford, & Melner, 1999; Rothstein & Goffin, 2006). Organizations facing complicated tasks often adopt team strategies to solve problems when the outcome is of importance or when a task is too difficult for an individual (Fay, Borrill, Amir, Haward, & West, 2006; Salas, Cooke, & Rosen, 2008). One example is teams who develop a new product need to apply different expertise or knowledge, such as from economics, engineering or merchandising (Cohen & Bailey, 1997). A team is characterized as a social entity of two or more individuals who depend on each other, share a common goal, execute tasks and are linked to organizational boundaries or systems (Cohen & Bailey, 1997; Kozlowski & Ilgen, 2006; Salas et al., 2008). An effective team is able to coordinate, plan and implement different tasks and practices (Zaccaro, Gualtieri, & Minionis, 1995). Therefore, teams performing a task need to communicate for information exchange, decision making and monitoring activities. According to Bell (2007), team effectiveness is defined as 'the extent to which a team accomplishes its goals or mission'. Knowing how teams cooperate and effectively reach their goals might improve their effectiveness in achieving their goals. For instance, effective teamwork is very important for patient safety in healthcare (Makary et al., 2006) or in other critical safety workplaces such as in maritime and aviation (Sexton, Thomas, & Helmreich, 2000). Furthermore, knowing how teams effectively function might result in more job satisfaction, turn resulting in less absenteeism in the workplace (Makary et al., 2006).

One of the influencing factors for team effectiveness is personality (Barrick, Stewart, Neubert, & Mount, 1998; Bell, 2007; Morgeson, Reider, & Campion, 2005), whereby extraversion is described as one of the most influential personality traits for team effectiveness (Rothstein & Goffin, 2006). Little information appears in the literature about how the association between extraversion and team effectiveness arises (Halfhill, Sundstrom, Lahner, Calderone, & Nielsen, 2005). Studies have operationalized team extraversion in different ways, the most common of which has been to calculate the mean and variance degree of extraversion in a team (Bell, 2007; Neuman, Wagner, & Christiansen, 1999). The present research both examines operationalization methods for extraversion and adds to the existing literature the testing of the interaction effect of these two operationalizations (mean multiplied by variance) on the possible extraversion–effectiveness relation in a team.

Furthermore, previous research has proposed that the relation between team effectiveness and extraversion is mediated by communication during a team performance (Mathieu, Maynard, Rapp, & Gilson, 2008). However, little evidence is offered in the literature concerning how communication influences this relation (Macht & Nembhard, 2005). Therefore, this research assumes that communication might mediate the relation between extraversion and team effectiveness. In other words, extraversion in a

team might be expressed in communication behaviour that influences the way a team reciprocally interacts and, in turn, might affect the effectiveness of a team. Not all characteristics of communication are analysed in this study. This research focusses on silence in communication, because silences might result in tension among team members, in turn influencing the effectiveness of a team (Poyatos, 1983).

All in all, this study analyses the role of possible predictors for team effectiveness which leads to the following research question: *Is there an effect of team extraversion on team effectiveness, and is this effect mediated by silence?*

Theoretical framework

The direct effect of team extraversion on team effectiveness

An extraverted individual can be described as adventurous, assertive, sociable and talkative (Colbert, Barrick, & Bradley, 2014). Extraversion refers to the extent to which people feel vital and appreciate themselves. Highly extraverted individuals are likely to lead a group of people, enjoy social gatherings and interactions, and be positive and enthusiastic about social gatherings and interactions. On the other hand, lowly extraverted individuals (i.e., introverts) are inclined to be reserved in social situations, generally feel less lively and enthusiastic, and take less pleasure in social activities compared to extraverts. Moreover, introverts usually feel uncomfortable when they are at the centre of attention (De Vries, Ashton, & Lee, 2009).

The studies of Morgeson, Reider, and Campion (2005) and Barrick et al. (1998) proposed three characteristics of extraversion that might contribute to an effective team. First of all, extraverted individuals prefer working in a team instead of working alone and feel secure in their ability to effectively function in a team. Secondly, extraverted individuals are likely to be socially intelligent, and through their communication, strategies can be debated and groups norms can be generated. Finally, extraverted individuals are inclined to experience positive feelings and are energetic. Through a process of 'contagion', others possibly adapt this positive emotion and energy that might contribute to positive and collaborative communication. These factors are related to team success (Morgeson et al., 2005; Barrick et al.,1998). Therefore, it is expected that extraversion on an individual level might positively influence team effectiveness. Moreover, the literature mentions that extraversion on team level is also related to team effectiveness. Extraversion on a team level implies that an extraverted team is likely to be more adventurous, assertive, sociable and talkative than is an introverted team. Team-level of extraversion does not imply that each individual on the team is extraverted, but rather that at least a few individuals on the team are extraverted (Morgeson, Reider, & Campion, 2005; Barrick et al., 1998).

Several studies have found that an average degree of team extraversion is associated with a higher team effectiveness (Barrick et al.,1998; Bell, 2007; Mathieu et al., 2008). Barrick and Mount (1991)

reported similar findings but mentioned that this team extraversion–effectiveness relation depends on the type of task a team has to perform. Extraversion in a team will be more effective when a task needs leading figures and when team members are highly interdependent. Another reason for why an extraverted team could be more effective is given by Porter et al. (2003), who analysed the relation of backing up behaviour (the ability and willingness to help others) and personality. These researchers concluded that teams who scored high on backing up behaviour also had a high mean score for team extraversion. This conclusion implies that extraverted teams are on average more intended to help each other that could further improve team effectiveness (Porter et al., 2003). In summary, it could be assumed that the mean level of extraversion positively influences team effectiveness.

In addition, the literature contains analyses of team extraversion considering the diversity of extraversion in a team. Neuman, Wagner and Christiansen (1999) have proposed that a (homogeneous) team with less variance in extraversion negatively affects team effectiveness because many having extraverted individuals in a team might result in conflict over role division or power, due to the possibility that extraverted individuals are outgoing and are inclined to take the lead. Furthermore, a team with fewer extraverted individuals (i.e., less variance of team extraversion) might be more reserved and lack leadership, also disadvantageous for team performance (Neuman et al., 1999). Curşeu, Ilies, Vîrgă, Maricuţoiu, and Sava (2018) have reported, furthermore, that extreme extraverts in a team might be ostentatious, too talkative, and poor at listening, as well as likely to dominate others in the team, which can disturb team communication. As a result, other team members might not speak up or may not be listened to, and their ideas and knowledge of how to solve problems may be withheld (Curşeu, et al., 2018). In such a case, more diversity of team extraversion may result in less team effectiveness, because some team members speak more often than others, which is disadvantageous for a team performance (Sherf, Sinha, Tangirala, & Awasty, 2018; Woolley, et al., 2010).

However, diversity of extraversion in a team might be positively related to team effectiveness. A heterogeneous team, in which some team members are extraverted and some are not, might perform more efficiently because some will take the lead while others will follow (Neuman et al., 1999). As a consequence, Neuman et al. (1991) reasoned that a role division might become clear which gives structure to a team, an important feature for a team to function. Likewise, two other studies mentioned that a balance of extraverted individuals in a team enables a complementary role division of leading and following, which is advantageous for team performance (Barrick et al., 1998; Halfhill et al., 2005). All in all, the effectiveness of a team may depend on variation among extraverted individuals in a team. It is expected that greater team diversity (i.e., higher variance) of extraversion is positively related to team efficiency because extraverts and introverts might supplement each other during a team performance.

The literature does not discuss whether the interaction of the average degree of team extraversion and the diversity of team extraversion affects team effectiveness. In other words, it could be that the mean level multiplied by the variance level of team extraversion is also related to the effectiveness of a team. The mean and variance level of team extraversion could be interdependent and interactive, which might mean that these operationalisations of team extraversion combined might be a predictor of team effectiveness. For example, a team that scores on-average high on extraversion might simultaneously be a team with both highly and lowly extraverted individuals (i.e., a team with high diversity). Then, this composition of extraversion (i.e., a high mean and a high variance level) might be advantageous for team effectiveness, due to greater information sharing among the team members and an efficient role division. Contrarily, team scores that are on average low on extraversion and not diverse in extraversion (i.e., a low mean and variance scores) might be disadvantageous for team effectiveness, due to the possibility of less information sharing and missing leading figures (Barrick et al., 1998; Halfhill et al., 2005). Thus, it is expected that the interaction of the mean multiplied by the variance degree of team extraversion positively influences team effectiveness. Thus, if either the scores for the mean or variance of team extraversion diminishes, the effectiveness of a team is expected to diminish as well.

The literature mentions that there is an extraversion–effectiveness relation during team performances, but some studies have proposed that this relation is mediated by communication in a team. A model that underlies this assumption and by which team effectiveness can be analysed is the input-mediator-output-input model. The input factors mutually influence each other and include, for example, task complexity, role division, personality, individual qualities and environmental characteristics. Outputs are the result or product of team functioning (i.e., team effectiveness). The effect of the inputs on the output is mediated by interactions in a team. Thus, communication characteristics should be considered when exploring the concept of team effectiveness (Barrick et al., 1998; Mathieu et al., 2008).

The influence of silence on the team-extraversion–team-effectiveness relation

Communication deals with flow in a conversation, especially in small groups. Conversational flow is defined as 'the extent to which a conversation is experienced as smooth, efficient and mutually engaging' and is seen as the result of conjunctive interplay between team members that contributes to team effectiveness (Koudenburg, Postmes, & Gordijn, 2014). Team members adjust to each other's communication to improve this flow, for instance by preventing awkward silences (Koudenburg, Postmes, & Gordijn, 2017) because the longer a silence lasts, the more tension might occur in a conversation (Poyatos, 1983).

A short silence in communication, for example pauses in speech, stuttering, or hesitations, are most often perceived as normal (Kurzon, 2007), but longer silences can have advantages and disadvantages for team communication which might affect team effectiveness (Brinsfield, Edwards, &

Greenberg, 2009). Long silent segments might be perceived as positive when this silence is seen as time to think or to reflect on what has been said. In that case, a person who spoke up before the silence occurred might feel listened to because that person's words are reflected on, and the same silence might be perceived by team members as useful. In addition, within a long silence team members have the choice to hold their silence or to speak up. This gives each team member the opportunity to contribute to the interaction (Pinder & Harlos, 2001). However, someone might be insecure or concerned to speak up and therefore chooses to be silent. Long silences might then have negative consequences for team performance, due to less information sharing and limited variety in perspective (Kirrane, O'Shea, Buckley, Grazi, & Prout, 2017). Moreover, when a team member speaks up, and a long silence occurs, this team member might perceive this silence as a sign of being ignored, excluded or not listened to, because no one reacts to that team member's words. In turn, this sense of being ignored might prompt stress or dissatisfaction (Pinder & Harlos, 2001), whereby the tension that has emerged in the conversation negatively affects the conversational flow (Poyatos, 1983). This hindrance might also decrease a team's effectiveness by diminishing the efforts of the unsatisfied team members (Medina & Srivastava, 2016).

Certain studies have investigated that duration required for a silence to be perceived as long or awkward. According to Koudenburg, Postmes, and Gordijn (2011), four seconds of silence is the minimal duration of silence in which an individual might unconsciously perceive the silence as normal but at the same time feel less comfortable. Hence, silences longer than four seconds could negatively affect the smoothness of a conversation and the dynamics of information sharing (Koudenburg et al., 2017). These silences are most often an intentional gap in interaction and can be seen as longer-held pauses which indicate interruption or turn-taking (Kurzon, 2007; Pinder & Harlos, 2001).

Extraversion and silence. It could be that extraversion determines whether someone is talkative in communication or prefers to remain silent, which in turn might cause more silences and silences longer than four seconds. For instance, Ramsay (1966) concluded that, compared to introverts, extraverts speak longer, are less silent and leave shorter silences between their utterances. Aside from Ramsay's (1966) study, there is little evidence in the literature that extraverted individuals are associated with less silences in communication (Macht & Nembhard, 2005).

Another explanation for the link between extraversion and silence might be derived from literature about dominance in personality. The literature concerning dominance indicates that a dominant individual is perceived to have shorter pauses in speech and interrupts others more (Beňuš, Gravano, & Hirschberg, 2011; Hall, Coats, & LeBeau, 2005; Kim & Pentland, 2009). This association between dominant personality and the previously mentioned speech characteristics might also account for extraverted individuals, because both a dominant and extraverted person are characterized as socially

dominant, forceful and persuasive (Anderson & Kilduff, 2009; Bono & Judge, 2004). It could then be assumed that extraverted individuals speak longer and more often and are therefore less silent during team performance. On a team level, this assumption might further mean that a team scoring high on extraversion is less silent than a team who scores low on extraversion. Therefore, it is expected that extraverted teams experience fewer silences longer than four seconds than do introverted teams and, in turn, this effect might influence the effectiveness of a team during team performance.

Mediation of silence. Two studies have established that verbal communication mediates the positive relation between extraversion and team effectives (Macht & Nembhard, 2005; Macht, Nembhard, Kim, & Rothrock, 2014). These studies operationalized verbal communication into the number of messages, number of words per message and duration of the messages. However, they did not study silences in communication as a possible mediating variable. The two studies concluded that extraverted teams have longer and more speaking turns, and as a result, extraverted teams were more effective because they communicated more. They found this result both when calculating the mean and variance level for team extraversion. It could be that extraverted teams communicate more efficiently by discussing more topics than do introverted teams (Macht et al., 2014). Therefore, it is expected that if a team speaks more and fosters longer speaking turns, this team is less silent. It is further expected that extraverted teams, compared to less extraverted teams, communicate more and are less silent, producing a more effective team.

The current study

The main goal of this study is to explore the direct effect of team extraversion on team effectiveness and to analyse whether this effect is mediated by silence. It is assumed that team extraversion operationalised by mean (hypothesis 1 [H1]) and variance level (hypothesis 2 [H2]) positively influence team effectiveness. Furthermore, it is expected that the interaction of the mean multiplied by the variance degree of team extraversion positively influences team effectiveness (hypothesis 3 [H3]) such that if either the scores for the mean or variance of team extraversion diminishes, the effectiveness of a team is expected to diminish as well. Analysing the mean, variance level, and interaction term of team extraversion might give insight into the possible effect of team extraversion on team effectiveness. In sum, the hypotheses are expressed as follows:

H1: The mean level of team extraversion will be positively related to the effectiveness of a team.
H2: The variance of team extraversion will be positively related to the effectiveness of a team.
H3: The interaction of the mean and variance level for team extraversion is positively related to the effectiveness of a team.

Furthermore, it is discussed that the effect of team extraversion on team effectiveness might be mediated by silence in communication. It is expected that an extraverted team (i.e., with a high mean, variance or interaction term) compared to a less extraverted team (i.e., a low mean, variance or interaction term) is less silent due to more communication, which results increases team effectiveness (see Figure 1). In this assumption, team extraversion is subjected to the same three operationalizations (mean, variance and their interaction) of the former hypotheses. To explore whether silence mediates the team extraversion–effectiveness relation, the last and fourth hypothesis reads thus:

H4: The effect of team extraversion on team effectiveness is mediated by silence; high team extraversion causes fewer silences than does lower team extraversion, and this decrease in silences, in turn, causes high team effectiveness.
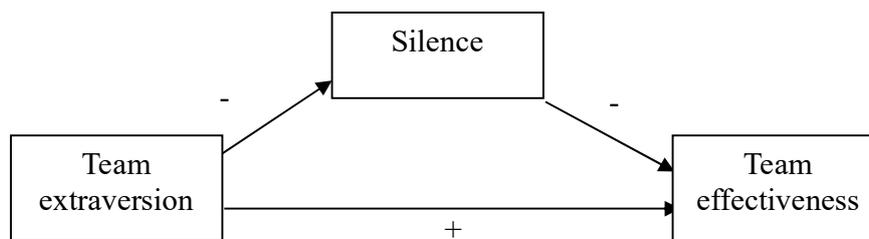

Figure 1. *Conceptual model for the expected mediation of silence between team extraversion and team effectiveness.*

Method

Design

The current study analyses by means of a mediation model whether silence mediates the relation between team extraversion as independent variable and team effectiveness as dependent variable. The data were gathered in two different time periods, with a gap of two years in between (i.e. in 2016 and 2018). In order to answer the research question, data were collected in three different escape rooms on two locations in Enschede and included participants that booked a game in one of the escape rooms.

Escape rooms. An escape room is a group activity in which a group is locked up in a room and has to find a way out of the room by solving puzzles and riddles. During this group activity, the group collaborates and interacts with each other to achieve a successful escape.

This research was conducted in 2016 in three different Dutch Escape Rooms. The first was a temporal room, named Turin, that was specifically set up at the campus of the University of Twente (UT) to gather data for this research. Data gathered in an existing and commercial escape room, Roomescape Enschede, which included two further rooms (Lab and Doka) made by the same designer. In 2018, data

were gathered again in the two rooms at Roomescape Enschede. A team won the escape game at the UT if they could escape within 45 minutes, whereas a team at the Roomescape Enschede won if they could escape within 60 minutes. A team failed to escape if they exceeded the specified time of the escape game. In all the escape rooms, the puzzles were similar in kind and were about finding codes or keys for a lock. The puzzles could be solved by logical thinking, making connections, doing math or some combination of these activities. The rooms differed in the number of puzzles that needed to be solved whereby the rooms were developed in such a way that escaping within the specified time would be possible. In 2016, the room Turin counted 30 puzzles, the room Doka counted 33 puzzles and the room Lab counted 32 puzzles. In 2018, the number of puzzles for Lab changed from 32 into 30 due to the removal of two too-difficult puzzles, whereas the number of puzzles in the Doka remained unchanged.

During the escape games, an employee of the escape room (i.e., leader of the escape game) kept an eye on a participating team to help or assist the team, if necessary. In all the rooms, participants received hints from the employee of the escape room when a team had difficulties in solving a puzzle or in continuing the game. For example, a team received a hint when it took a team too long to solve a puzzle or when a team had no clue how to solve a puzzle that was necessary to proceed in the game. A team could also ask for hints, for instance by using an intercom or tablet. However, the employee of the escape game decided whether a team would receive a hint or not.

Materials

In order to answer the research question, three different measures were used: a questionnaire, a scoring form and sociometric badges. The questionnaire gathered data about team extraversion and was available in Dutch, English and German. The scoring form was used to measure team effectiveness. By means of sociometric badges, data were gathered to measure silences during the escape games.

Questionnaire. In this study, a questionnaire was used that asked participants for descriptive statistics, group composition, earlier experiences with escape rooms and whether or not they had consumed alcohol during or soon before their attempt to escape. Questions for the variables extraversion, group cohesion and conscientiousness were furthermore administered. The 2018 questionnaire also asked about agreeableness. Team extraversion is further discussed in the present study, whereas the other variables were used to test hypotheses for other studies.

The questions about extraversion differed between the questionnaire used 2016 and that used in 2018. In 2016, team extraversion was measured by means of 16 questions derived from the HEXACO Simplified Personality Inventory (HEXACO-SPI). In 2018, team extraversion was measured with 10 questions derived from the HEXACO Personality Inventory-Revised (HEXACO-PI-R). According to De Vries and Born (2013), the HEXACO-SPI and -PI-R are strongly correlated ($r = .78$). The questions about extraversion in both the questionnaires of 2016 and 2018 were answered by the participants on a 5-point

Likert scale, from 1 (*totally disagree*) to 5 (*totally agree*). For example, the participants in 2018 indicated the degree to which they agreed with the following statement about extraversion, derived from the HEXACO-PI-R: 'I feel reasonably satisfied with myself overall' (De Vries et al., 2009).

Reliability was calculated for both questionnaires about extraversion. The extraversion scale in 2016 had high reliability for both the Cronbach's alpha ($\alpha = 0.85$) and Guttman's Lambda-2 ($\alpha = 0.86$). Furthermore, the extraversion scale in 2018 was also reliable, for both Cronbach's alpha ($\alpha = 0.72$) and Guttman's Lambda-2 ($\alpha = 0.74$). The individual scores for extraversion in 2016 and 2018 were computed into an average score per participant for extraversion and were converted into z-scores because z-scores of different questionnaires are comparable. Then, these z-scores were aggregated into team z-scores for the mean and standard deviation. Thus, two variables on team level for extraversion were computed: the z-scores for the mean and for the standard deviation. Next, these two variables were multiplied by each other to compute the interaction term for team extraversion. Finally, team extraversion was operationalized by three variables computed with z-scores: the mean of extraversion in a team, the variance of extraversion in a team and the interaction between these two factors (mean times standard deviation). The Kolmogorov–Smirnov test showed that these three variables had the same non-significant statistic ($p = .20$), which means that these variables were normally distributed.

Scoring form. The degree of team effectiveness was objectively scored on a scoring form that one of the researchers and the employee of the escape room completed. The scoring forms filled in by the researchers were more complete than the scoring forms of the employees of the escape room, because the main focus of the employee was to guide a team in solving the puzzles during the game, which resulted in missing data on the employee scoring forms. Therefore, only the scoring forms filled in by the researchers were used in the present study, and no interrater reliability analysis was performed.

By means of a live-video stream, one of the researchers observed a participating team whereby different variables were scored on the scoring form. The times at which a team started and finished a game were noted. Additionally, a participating team could receive hints that gave instructions on how to solve a puzzle. At the end of the game, the number of received hints and the number of solved puzzles were counted. Furthermore, the time when a specific puzzle was solved and the time when a hint was given were noted. With these variables, the effectiveness of a team was measured by calculating a quotient for the number of puzzles solved per minute: the number of solved puzzles divided by the total duration of a game in minutes. The higher this quotient was, the more efficient a team was.

The Kolmogorov–Smirnov test for team effectiveness was statistically significant ($p < .001$). Transforming (x^3, x^2, log(x), ln(x), square root, reciprocal and reciprocal root) the variable of team effectiveness did not result in a normal distribution. Therefore, no transformation for this variable was used in the analyses, as transformation decreases interpretability of the variable.

Sociometric badges. A sociometric badge is a wearable device with Bluetooth, infrared and a microphone. Collecting data with sociometric badges is different from using traditional measurements such as questionnaires, observations and interviews because the sociometric badges measure objective behaviour on a large scale and in a real-time setting (Kim, McFee, Olguin, Waber, & Pentland, 2012; Uhl et al., 2018). As a result, this technology has opened up new research possibilities for studying the temporal and spatial characteristics of social interactions. In the current study, each participant wore a sociometric badge during an escape game in order to derive a speech profile of each participant (Sociometric Solutions, 2014). By means of the speech profiles of a participating team, the number of silent segments that lasted at least four seconds were measured. As mentioned above, four seconds of silence is the minimal duration of silence at which an individual might start to feel less comfortable in a conversation (Koudenburg et al., 2011). This research calculated how many silent segments of four seconds or more occurred during a team's performance. The current study analysed the variable of number of silent segments that lasted four seconds or longer (NSS).

The data derived from the sociometric badges were processed in the software programme Sociometric DataLab. In Sociometric DataLab, settings were adapted to the purpose of this research. For instance, the setting 'noisy environment' was applied because in the escape rooms, other noises than speech could emerge, such as from moving objects, sounds from the tablet or a radio that could be turned on. Another customized setting was the resolution for time which was set to 0.1 seconds to calculate the silent segments of 4.0 seconds and further. By means of a script in R, it was calculated how often a team was silent for four seconds or more during an escape game. Finally, the NSS data were exported to Excel and were transferred to Statistical Package for the Social Sciences (SPSS).

The Kolmogorov–Smirnov test for NSS was statistically significant ($p = .02$). Transforming (x^3, x^2, $\log(x)$, $\ln(x)$, square root, reciprocal and reciprocal root) the variable NSS did not result in a normal distribution, as transformation decreases the interpretability of the variable. Therefore, no transformation for this variable was used in the analyses.

Participants

A participating team consisted of at least two participants and at most seven participants. In total, the dataset consisted of 630 participants divided over 124 teams. However, a number of teams had to be excluded for the following reasons. First, 34 teams were excluded from the dataset when a sociometric badge of at least one of the participants did not function, and as a result the number of silent segments in that team were not recorded. Second, eight teams consumed on average more than two glasses alcohol before the escape game and were consequently excluded from the data. Drinking more than two glasses of alcohol is, in general, an indication of diminished cognitive functioning (Meesmann & Boets, 2014), and alcohol consumption might result in other undesirable behaviour, for example in aggressive behaviour

and sensation seeking (Donovan, 2004). This behaviour might affect interactions among team members and their scores for team effectiveness, which could result in different relations between the variables and the expected processes of group dynamics. Third, five teams were excluded due to missing time notations on the scoring form, whereby the team effectiveness scores could not be calculated. Fourth, four teams were excluded because one of the participants did not complete the questionnaire. Finally, one team was excluded because this team had three team members with an autism-spectrum disorder whereby the interactions among the members differed considerably from those of the other teams. In total, 52 teams were excluded from this research.

The final dataset included 363 participants, spread over 72 teams, comprising 174 men (48%) and 189 women (52%). The mean age of the participants was 31 (SD = 12.12 years) but varied from 16 and 73. Most of the groups included both men and women (54%), but some groups consisted of only women (26%) or only men (19%). The teams varied size: 26 teams (36%) included six participants, 23 teams (32%) consisted of four participants and 19 teams (26%) contained five participants. Two teams (3%) represented a group of three, and two teams included seven participants (3%). Most participants (63%) had not previously played an escape game, whereas the other participants (37%) had. Half of the teams successfully escaped the room within the specified time, while the other half did not. Of the teams, 26 (36%) played the room Turin; 25 (35%), Doka; and 21 (29%), Lab.

Procedure

A team that booked one of the escape rooms received a confirmation email with the notification that researchers were present in the escape room. At the location of the escape room, one of the researchers gave the team brief instructions concerning the current research and what was expected from a participating team. By filling out an informed consent form, each participant indicated that they wanted to participate in this study. If one of the team members did not provide informed consent, the whole team was excluded from this research and could immediately start the escape game. A team received further instruction if all the team members provided informed consent. Each participant received a sociometric badge and chose a nickname to preserve anonymity. A nickname was matched to the badge number of the sociometric badge that a participant received and was linked to the questionnaire that a participant would complete after the escape game. A participating team was afterwards sent an email with a visualization of the team's interaction patterns. This visualization showed which nickname (i.e., which participant) spoke how often during the game.

Next, participants were instructed to start the game. During the game, a researcher observed a participating team by means of a live-video stream out of the room where the game took place and filled in the scoring form for team effectiveness. When the maximal specified time for a game was reached (45 or 60 minutes) or when a team had finished the game, the team returned the sociometric badges to the

researcher, who switched the badges off. Next, each participant was asked to fill in the questionnaire on paper that was linked to that participant's badge number and nickname. Finally, the questionnaires were submitted, and the participants were thanked for their participation.

Results

Descriptive statistics

The team effectiveness scores varied between 0.22 and 1.15 ($M = .54$, $SD = .15$). On average, teams escaped in 53.65 min ($SD = 8.91$). The average degree of extraversion in 2016 was 3.76 ($SD = .47$) and was 3.60 ($SD = .54$) in 2018. Silent segments lasted on average 30 s ($SD = 83.36$) and varied between 7 and 497 s (about 8 minutes). Furthermore, the scores of the variable NSS varied between 84 and 260 times per team during an escape game ($M = 192.22$, $SD = 35.33$). Table 1 gives an overview of the mean and standard deviation for the variables used in the current study.

Pearson's correlations (see Table 1) were computed to assess the relationship between the variables used in the analyses. A statistically significant, strong and negative correlation exists between team effectiveness and NSS ($r = -.63$, $p < .001$), meaning that a high score on team effectiveness is associated with a smaller NSS. In addition, the number of hints that the teams received during the escape games correlated significantly with both team effectiveness ($r = -.45$, $p < .001$) and NSS ($r = .62$, $p < .001$). Thus, more hints predicted less team effectiveness and higher NSS. The number of hints was strongly related to the time in which the teams escaped ($r = 0.7$, $p < .001$), meaning that more hints a team received, the longer-lasting the escape game.

Moderated mediation model

A moderated mediation analysis was conducted to explore whether the independent variables of team extraversion (i.e., mean, variance and interaction) affect the dependent-variable team's effectiveness and whether this effect is caused by the mediator NSS. In the analysis, covariates were added that were expected to influence the relation to team effectiveness or NSS. In this moderation mediation analysis, the four hypotheses were tested simultaneously. The moderated mediation analysis was performed with Hayes' PROCESS macro (Hayes, 2015) for SPSS using model 8 and a bootstrap confidence interval (i.e., drawing 10,000 samples based on the data). The statistical model (see Figure 2) of the variables were added in model 8 of the PROCESS macro with mean team extraversion as independent variable, team effectiveness as dependent variable, NSS as mediator and the variance for team extraversion as moderator, which resulted in the interaction term. The added covariates (U) were type of escape room (i.e., room dummy1 and room dummy2), team size, the number of hints (i.e., hints), and team gender (gender dummy1 and gender dummy2).

Table 1

Means (M)*, Variances, and Correlation Between the Variables (n = 72)*

Variables	M	SD	N	1	2	3	4	5	6	7	8	9	10	11	12
1. Room dummy1[a]			72												
2. Room dummy2[b]			72	−0.47**											
3. Year[c]			72	0.46**	0.13										
4. Team size[d]	5.04	0.49	72	−0.37**	0.20	−0.06									
5. Hints	4.17	0.50	72	0.38**	0.20	0.39**	−0.32**								
6. Time (min)	53.65	8.91	72	0.047**	0.34**	0.39**	0.36**	0.70**							
7. Number of silent segments	192.22	35.33	72	0.72*	0.44**	0.35**	−0.08	0.62**	0.85**						
8. Silent segment length	29.08	83.36	72	−0.05	0.09	−0.03	0.21	−0.12	−0.04	−0.12					
9. Team effectiveness	0.54	0.15	72	−0.23	−0.22	−0.14	0.29*	−0.45**	−0.74**	−0.63**	−0.02				
10. Mean team extraversion	−0.03	0.55	72	−0.02	−0.06	0.02	0.26*	0.02	0.03	0.07	0.13	−0.19			
11. Variance team extraversion	0.89	0.33	72	0.02	−0.05	−0.06	0.07	−0.12	−0.03	−0.05	−0.10	0.01	−0.07		
12. Interaction term extraversion	−0.04	0.51	72	−0.03	0.08	−0.01	0.25*	−0.01	0.02	0.02	0.14	−0.16	0.91**	−0.16	

*p < .05, ** p < .01
[a] Category labels: 0 = Turin and Lab, 1 = Doka
[b] Category labels: 0 = Turin and Doka, 1 = Lab
[c] Category labels: 0 = 2016, 1 = 2018
[d] Category labels: 3 to 7 team members

In the moderated mediation analysis, the direct effects of team extraversion on team effectiveness were examined (*c*-paths). Furthermore, the effect of team extraversion on NSS (*a*-paths) and the effect of the mediator on team effectiveness in the presence of team extraversion were analysed (*b*-path). Moreover, the analysis included whether the mediating effect (*ab*-path) was significant by exploring whether the value zero lies within the bootstrap confidence interval. If the value zero is not included in this confidence interval, the mediation analysis is significant, which means that NSS mediates the relationship between team extraversion and team effectiveness.
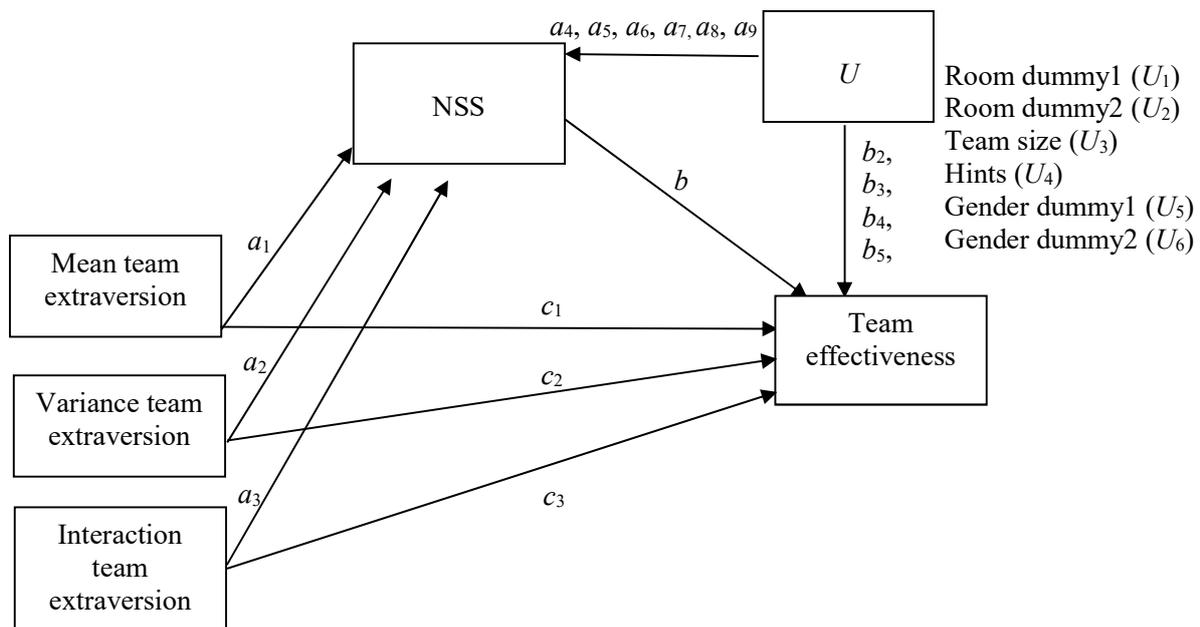

Figure 2. Statistical model of the moderated mediation analysis. NSS = number of silent segments that lasted four seconds or longer.

The direct effect (*c*-paths) for each variable of team extraversion (i.e., mean, variance and its interaction) were analysed controlling for the covariates and the mediator NSS. The effect of the mean for team extraversion on team effectiveness was negative and significant ($b = -0.07$, $t(60) = -2.64$, $p = .011$), which means that higher average scores on team extraversion predicted less team effectiveness. Therefore, the H1 is rejected because it was expected that the average degree of team extraversion would positively affect team effectiveness.

Further, the direct effect of variance ($b = -0.03$, $t(60) = -0.68$, $p = .497$) and the interaction term ($b = -0.04$, $t(60) = -0.52$, $p = .606$) of team extraversion on team effectiveness were not significant. Therefore, H2 and H3 are not confirmed, because a positive effect was expected of both the variance and the interaction term of team extraversion on team effectiveness. The analysis showed that controlling for

the effect of the covariates and NSS, team extraversion had a significant total overall direct effect on team effectiveness, $F (10, 60) = 6.5$, $p < .001$ with $R^2 = .52$. An explanation for this significant proportion of the variance might be derived from the covariates that were added in the analysis. Specifically, there was a significant effect of covariate team size on team effectiveness ($b = 0.05$, $t (60) = 3.04$, $p = .004$), meaning that larger team size predicts higher team effectiveness scores. An overview of the results of the moderated mediation analysis (i.e., the a-, b-, and c-paths) are presented in Figure 3 below.
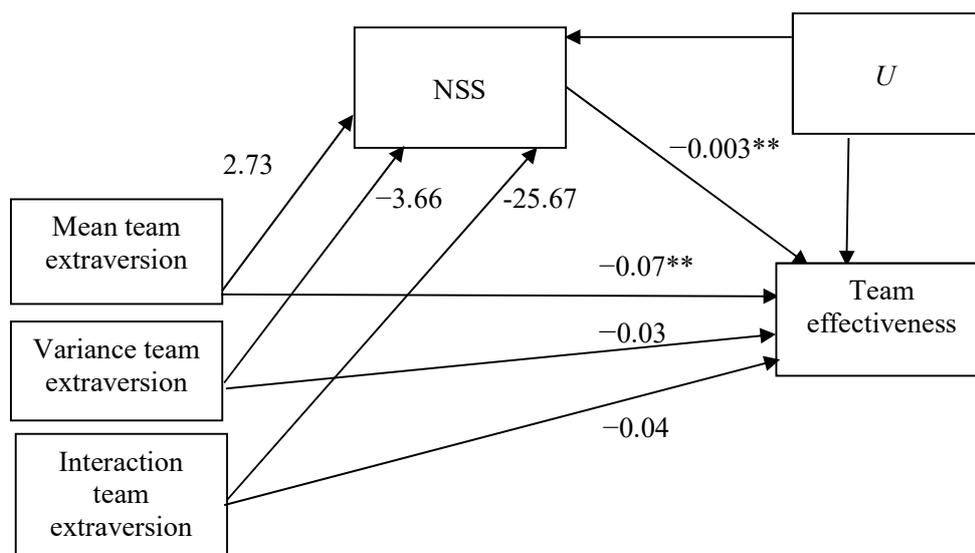
Note. * $p < .05$ ** $p < .01$, *** $p < .001$

Figure 3. Standardized regression coefficients for the relation between team extraversion and team effectiveness as mediated by number of silent segments that lasted four seconds or longer (NSS).

In the moderated mediation analysis observed the possible role of the mediator NSS between team extraversion (i.e., mean, variance and its interaction) and team effectiveness, controlling for the covariates. The results showed, first, no significant effect of the variables for team extraversion (i.e., mean, variance and its interaction) on NSS (a-paths). Additionally, NSS was significantly related to team effectiveness, in the expected direction (b-path) ($b = -0.003$, $t (60) = -4.22$, $p < .001$). In other words, for every (extra) single silent segment that occurred, the team effectiveness score was diminished by 0.003. Thus, more silent segments while performing the escape game predicted lower team effectiveness scores. Within the analysis, a bootstrap confidence interval for the indirect effect ($ab = 0.07$) based on 10,000 bootstrap samples was likely to be around zero, 95% CI [−0.03, 0.15]. The mediation analysis thus showed that when controlling for the covariates, team extraversion (i.e., mean, variance and its

interaction) had no significant indirect effect on team effectiveness via the mediator NSS. Thus, there is no mediating effect of NSS, so H4 is rejected because a mediating role of NSS was expected.

The effect of the covariates on team effectiveness and NSS are shown in Table 2. Hints ($b = 5.07$, t (61) = 4.17, $p < .001$), room dummy 1 ($b = 39.23$, t (66) = 4.62, $p <.001$) and room dummy 2 ($b = 44.93$, t (61) = 5.74, $p <.001$) were both related to NSS. Thus, more hints predicted higher scores on NSS. The team effectiveness scores differ per room type. The average score on team effectiveness in the room Doka was 0.50 ($SD = .13$) and in Lab, 0.49 ($SD = .09$). For Turin, the effectiveness score was on average 0.63 ($SD = .16$). These results display that the team effectiveness scores were on average higher in the Turin than were the effectiveness scores in Doka and Lab.

Table 2

Summary of the moderated mediation analysis for covariates predicting team effectiveness and number of silent segments that lasted four seconds or longer (NSS)

Variable	Team effectiveness		NSS	
	b	p	b	p
Room dummy1[a]	0.01	.779	39.23	<.001***
Room dummy2[b]	0.01	.859	44.93	<.001***
Team size[c]	0.05	.004*	4.53	.186
Hints	−0.00	.878	5.07	<.001***
Gender dummy1[d]	0.00	.939	7.25	.366
Gender dummy2[e]	0.03	.461	−17.93	.021*

* $p < .05$ ** $p < .01$, *** $p < .001$
[a] Category labels: 0 = Turin and Lab, 1 = Doka
[b] Category labels: 0 = Turin and Doka, 1 = Lab
[c] Category labels: 3 to 7 team members
[d] Category labels: 0 = only women and mixed gender, 1 = only men
[e] Category labels: 0 = only men and mixed gender, 1 = only women

Additional analyses

Additional analyses were computed to explore whether the moderated mediation model was significant by means of replacing NSS with another possible mediator. It is analysed whether the mediator average silent segment length (ASSL) (i.e., the average length of the silent segment from four seconds or more) mediates the effect between team extraversion (i.e., mean, variance and its interaction) and team effectiveness. The Kolmogorov–Smirnov test for ASSL was statistically significant ($p < .001$). Transforming (X^3, X^2, log(x), ln(x), square root, reciprocal and reciprocal root), the variable ASSL did not result in a normal distribution, so no transformation for this variable was used in the analyses. The same

moderated mediation model as above was performed with Andrew Hayes' PROCESS macro using model 8 and a bootstrap confidence interval (i.e., drawing 10,000 samples based on the data included in SPSS). In this analysis, the same covariates (i.e., room dummy 1 and 2, team size, hints and team gender dummy 1 and 2) were added. None of the covariates were related to ASSL. Covariates that predicted the effectiveness of a team were room dummy2 ($b = -0.10$, t (60) $= -2.46$, $p = .017$), team size ($b = 0.04$, t (60) $= 2.13$, $p = .037$) and hints ($b = -0.01$, t (60) $= -2.17$, $p = .034$).

The results of the moderated mediation analysis with ASSL as mediator on the *a*-, *b*-, and *c*-path are reported in Figure 4. The analysis shows a significant direct effect of the mean for team extraversion on team effectiveness (*c*-path) ($b = -0.07$, t (60) $= -2.50$, $p = .015$). The mediation analysis shows that controlling for the covariates, team extraversion had no significant indirect effect on team effectiveness via the mediator ASSL, because a bootstrap confidence interval for the indirect effect ($ab = 0.00$) based on 10,000 bootstrap samples was likely to be around zero, 95% CI [-0.02, 0.02].
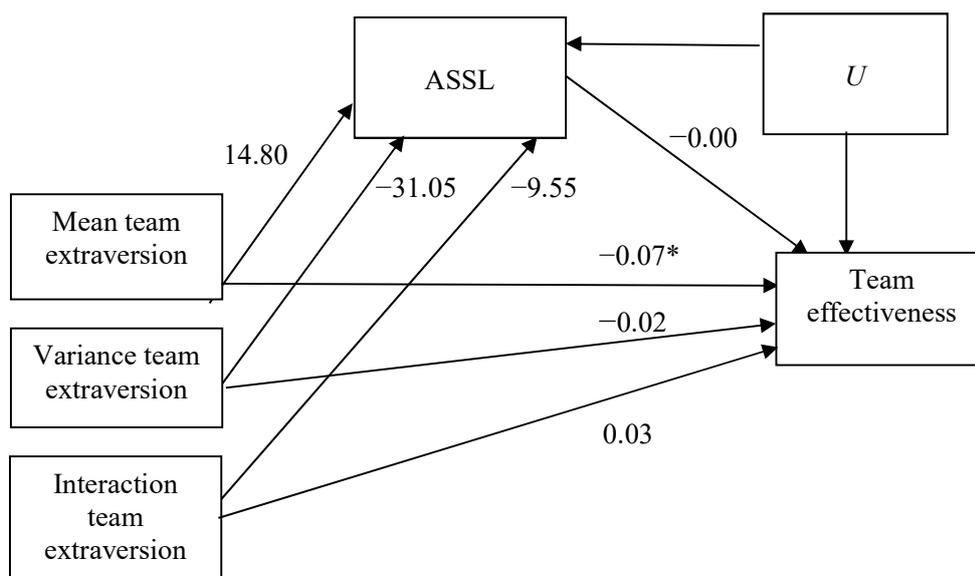
Note. * $p < .05$ ** $p < .01$, *** $p < .001$. ASSL = average silent segment length.

Figure 4. Standardized regression coefficients for the relation between team extraversion and team effectiveness as mediated by ASSL.

Discussion

This study has explored the relation between team extraversion and team effectiveness and whether this relation is mediated by silence. Team extraversion was operationalized by the average degree of team extraversion, the variance of team extraversion and the interaction term of team extraversion (i.e.,

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mean multiplied by variance). It was expected that these operationalizations for team extraversion would all positively affect team effectiveness. Another hypothesis was that the effect of team extraversion on team effectiveness is mediated by silences.

The direct effect between team extraversion and team effectiveness. First of all, it was expected that a high average degree of extraversion was associated with greater team effectiveness (Barrick et al., 1998; Bell, 2007; Porter et al., 2003). In contrast to what was expected, the results indicated that a higher average degree of extraversion in a team predicted less team effectiveness. Neuman et al. (1999) found that extraversion was positively associated with the effectiveness of a team in social tasks and negatively associated to logical tasks. It could be that the escape game is a logical task in which extraversion is less effective than in a social task. This possibility could explain the negative relation in the current study between the mean team extraversion and team effectiveness. An explanation of the contradiction between the expected and found results might be derived from literature about team composition. Team composition beneficial for team outcomes consists of an average mean degree of extraverted people (Barry & Stewart, 1997). Studies have found a curvilinear relationship between the average degree of extraverts and team effectiveness. A too-high or too-low average of extraverts in a team is disadvantageous for the effectiveness of a team, whereas the inclusion of some extraverts and introverts results in a more effective team (Barrick et al., 1998; Barry & Stewart, 1997).

Some explanations are available for why a certain team composition of extraversion is beneficial or not for the team outcome. A team's composition is effective when some extraverts take the lead and some introverts follow, because this arrangement leads to complementary role division. Thus, a team composition with too many or too few extraverts results in unequal distribution of roles (i.e., leaders and followers) due to a lack of followers or leading figures. A team with too many extraverts might also create conflict over role division because extraverts are outgoing, inclined to take the lead and actively participate in groups (Neuman et al., 1999). Conflict in a team is most often not beneficial for team outcome, because conflict results in tension and requires cognitive load, which diminishes creative thinking and problem solving (De Dreu & Weingart, 2003). Moreover, extraverts are talkative and energetic, and they enjoy social interactions. These characteristics of extraversion might cause extraverts to be less focussed on their tasks and more occupied with each other (Barry & Stewart, 1997). If teams are more socially orientated than task orientated, then this imbalance might decrease the effectiveness of a team, since a focus on problem solving can then become lost. Overall, teams with a high average degree of extraversion might be more occupied with a role division and might be more socially orientated than task focussed, causing these teams to be less occupied with their team performance.

Moreover, the current study expected a positive effect between the variance of team extraversion and team effectiveness. However, this result was not found in the present study, although other previous

studies did find a positive effect between the diversity of team extraversion and team effectiveness (Barrick et al., 1998; 2005; Neuman et al., 1999). The dissimilarity between the result of the current study and those of Barrick et al.'s (1998) study can be interpreted by means of a difference in the research sample. Barrick et al. included only highly interdependent teams in their data, those working together in a team or in an organization, whereas in the current study, the interdependency varied among team members, whereby some teams cooperated together for the first time. It might be that the composition of the teams studied by Barrick et al. do result in an effect, despite that the current study found no effect.

An important alternative explanation for the confounding results in the present study can also be offered, specifically to clarify why this study found an effect between the mean team extraversion and team effectiveness, whereas no effect was found between the variance of team extraversion and team effectiveness. This explanation might as well apply to the expected positive effect between the interaction term (mean times variance) of team extraversion and team effectiveness, also not established in this study. The alternative explanation is derived from literature about Steiner's four types of group tasks (Day et al., 2004; Kramer, Bhave, & Jonhson 2014; Bell et al., 2007). Steiner states that the type of team task influences the procedure a team uses to complete the task. The contribution (e.g., personality, knowledge, or skills) of each team member to the team task can be combined in different ways. For example, it might be that the characteristics of one team member are decisive for the team outcome or that the combined qualities of the team members influence the team outcome. As such, the operationalization of the contribution of each team member influences the team outcome, and these operationalizations differ per type of task.

The first team task according to Steiner is an adaptive task in which each team member performs the same task, whereby each individual contributes to the team outcome (Kramer et al., 2014). Examples of adaptive tasks include pulling on a rope as a group, moving a heavy object, picking strawberries or fabricating trousers. Thus, the contribution of each team member determines team outcome (Day et al., 2004). Second, team members in a compensatory task discuss issues that do not have a direct solution, whereby frequent communication is needed to combine the contributions of all the team members to arrive at a decision. The decisions or judgements of a group are more accurate when the estimates of individuals are averaged (Forsyth, 2010): for example, when predicting stock prices or estimating the number of coins in a can (Day et al., 2004). The third type of task is referred to as a conjunctive task, whereby the least-skilled team member determines the team outcome. Thus, the worst-performing team member is decisive for team outcome. For example, the slowest person in a relay race deteriorates the total duration time at the finish (Kramer et al., 2014). Finally, in a disjunctive task, the most effective team member might solve the team problem, for example when one team members knows all the right

answers in a quiz. The team score then equals the score of the best-performing team members (Bell, 2007).

To resume the alternative explanation, the definition of a compensatory task fits the escape game because the content and procedure of the puzzles were unknown and because the participating teams discussed the possible solution of the puzzles. In a compensatory task, each team member contributes to the team outcome, which means that the team outcome equals the average contribution of the team members. Thus, the average scores of variables related to the team outcome are of interest as an operationalization method for the contribution of each team member to the team outcome (Bell, 2007). This explains why the current study found that only the mean team extraversion affected team effectiveness, while the variance and interaction term for team extraversion were not significant predictors of the effectiveness of a team, because in a compensatory task the decisions of a group are more accurate when the estimates or qualities of individuals are averaged (Forsyth, 2010).

The mediating role of silence. Furthermore, the results indicated that the number and length of silent segments lasting four seconds or more did not mediate the effect between team extraversion and team effectiveness. These findings do not correspond to the results of other studies that found communication characteristics mediated the effect between team extraversion and team effectiveness (Macht & Nembhard, 2015; Macht, et al., 2013). The differences in results between the current study and previous studies might be explained by team classification. Previous studies classified teams based on their personality scores (i.e., highly versus lowly extraverted), providing a clear distinction between two groups. The current study did not manipulate team extraversion by means of dividing the teams into highly and lowly extraverted teams. Therefore, the team extraversion scores of the current study might be more representative of the reality, since more levels of extraversion in a team are analysed.

Furthermore, the current study did not find that silence mediated the effect between team extraversion and team effectiveness because there was no significant effect between team extraversion and the number and length of the silent segments of four seconds or more (*a*-path). However, Ramsay (1966) states that extraverts, as compared to introverts, produce more sounds and are less silent. An explanation for these inconsistent results might arise from a difference in how the tasks were performed. In the current study, a team worked together on the task, whereas in the study by Ramsay, each participant performed several tasks individually. Individual tasks differ from team work, because team performance requires different skills and abilities than does individual work. In other words, team performances require interaction that facilitates the effectiveness of a team (Mathieu et al., 2008).

The mediation analyses showed further that the number of silent segments of four seconds or more did significantly influence team effectiveness (*b*-path) in such a way that fewer silences during the escape game were associated with higher team effectiveness, suggesting that in the escape game,

communication was relevant for the effectiveness of a team. As stated in the literature, in some tasks social skills are more relevant than other tasks requiring other skills, such as technical skills (Neuman et al., 1999). For instance, Barrick and Mount (1991) found that interaction and cooperation were essential for the effectiveness of a team in professions such as sales and management, whereas in other professions (e.g., accountants, architects and production workers) more specified skills such as mathematics or technical abilities were relevant. To resume, it might be that less silence was useful for solving the puzzles, because more communication results in clarifying the task process, along with more sharing of information and ideas, which is beneficial to team outcome (Driskell, Goodwin, Salas, & O'Shea, 2006; Marks, Zaccaro, & Mathieu, 2000).

Limitations and further research

There are some limitations in the current study. The first limitation concerns the participating teams' sizes. The results in the current study suggest that the size of a team influences team effectiveness such that more team members predicted a higher team effectiveness. This finding corresponds with other research that has mentioned larger teams possess more qualities and resources to solve problems (Haleblian & Finkelstein, 1993). Although the current study has controlled for team size in the analyses, further research might standardize the size of participating teams by setting a fixed team size to prevent differences in team size.

Another limitation concerns the moment when the questionnaire with questions about extraversion was filled in. Participants might have filled in the questionnaire differently before the escape game than after the escape game, due to trait activation, despite that the questions about extraversion were about general situations and not about the escape game. Trait activation means that in certain situations some traits are more relevant and therefore more exhibited (Tett & Burnett, 2003). For example, someone who is mostly late for an appointment will not express this characteristic when a building is on fire. It could be that during the escape game, extraverted characteristics such as being talkative, positive or enthusiastic were more exhibited and that, as a consequence, participants might have perceived themselves to be more extraverted after than before the escape game. Further research could take this potential bias into account by instructing participants to complete the questionnaire before the escape game and not after.

Another limitation of the current study regards questionnaire completion. Participating teams completed the questionnaires in the same room in which participants sometimes discussed the statements. Some team members publicly attributed a statement to a certain team member. This sort of influence is likely to have affected the answers entered on the questionnaire due to social desirability bias or group

pressure. A possible solution for further research to have a room in which participants sit separately from each other to create more privacy and less distraction.

A further limitation concerns the different escape rooms in which the games took place. The rooms consisted of different puzzles and different puzzle combinations, which might have affected how effective teams were. The results showed that the type of room was both correlated to team effectiveness and to the number of silent segments. The Turin room had higher effectiveness scores than did Doka and Lab, suggesting that the puzzles in the Turin room were easier to solve than those of Doka and Lab. To prevent differences in escape room, further research might standardize the type of escape room by using only one room. Furthermore, further research might analyse the effectiveness of a team by means of other team effectiveness characteristics. Team effectiveness might also be about team satisfaction (i.e., how a team is perceived by their individual team members) and the state of a performing team (i.e., perceived task performance) (Costa, 2003). These other possible variables related to team effectiveness might be further explored with multilevel regression analyses. The different levels represented in this study are nested in a structure, namely team members within teams within escape rooms. With multilevel regression analyses, the impact of individual characteristics and type of escape room on the effectiveness of a team can be explored, as can the relation between these levels.

The last limitation is about the hints that participating teams received from the employee of the escape game. The employee of the escape game decided whether a team received a hint, so the number of hints a team received depended on the subjectivity of the employee. Moreover, teams who differ in number of hints received might simultaneously have the same team effectiveness score, due to the external help. Hence, the hints influenced the effectiveness of a team. The current study did not contemplate the number of hints when calculating team effectiveness scores, because it was unknown whether hints positively or negatively affected team effectiveness scores. Although further research is necessary to explore in more depth the effect of hints and other external interferences on team effectiveness, the results of the current study might offer insight into the effect of hints on the team effectiveness. The results showed that the number of hints was negatively correlated with the effectiveness of a team; thus, more hints predicted less team effectiveness. Furthermore, the more hints a team received, the longer a team lasted in the escape game, thus the number of hints was also related to the time a participating team spent in the escape room. It is advisable for further research to standardize the hints such that both the procedure and content of the hints are equal for all the participating teams. In that case, the hints might be included to calculate the team effectiveness scores. Another way to analyse the hints in further research would be to track which puzzles are solved independently or by means of a hint. Consequently, team effectiveness might be measured by calculating puzzles solved per minute independently of a hint provided during the escape game.

Further research in escape rooms might manipulate the amount of structure that a team receives during the escape game. In the current study, the escape game was a complex task in which teams were not provided with structure about who and how to perform which task. Each team worked together on the team task. In Porter et al.'s (2003) study, by contrast, each team member was assigned a specific task which provided a team with structure, in addition to their team task. With more structure, when each team member fulfils a task role, it is more obvious who will perform which task. Porter et al. (2003) found that extraversion was positively related to team outcome. It would be interesting to analyse the effect of extraversion when there is more structure in a team, because the complexity of the escape game might have affected the relation between team extraversion and team effectiveness. Further research might, for example, assign different tasks to each team member or assign one team member as leader in the game. One might then observe the extent to which extraversion is beneficial for team effectiveness when teams are structured differently. It might be that extraversion is not effective for a team when teams are not structured, whereas extraversion might result in an effective team when teams are structured.

Moreover, the literature raises a difference in how silences are perceived among acquainted individuals compared to strangers. Even a brief silence among strangers in a conversation might be interpreted as threatening, whereas acquainted individuals, especially intimates or loved-ones, might perceive such a silence as a sign of mutual understanding wherein no words are needed (Koudenburg et al., 2017). Further research might use teams with individuals who do not know each other to control that silences might be differently perceived. Future research might also account for the type of task a team has to perform as it affects the silences during a team performance. Ramsay (1966) has indicated that tasks calling for more cognitive capacity include more and longer silences between utterances for both highly and lowly extraverted people. Some tasks require more thinking that causes more and longer silences. This means that the difficulty of a task influences the number and length of silences for both highly and lowly extraverted people. It could be that the escape game is comparable to a cognitively demanding task whereby silences (number and length) occur regardless of the degree of extraversion in a team. Further research might use a different type of task (i.e., easier task) to control the possible influence of a too-difficult task that affects how silences are perceived.

As a consequence, further research could operationalize silence differently. The current study analysed silent segments of four seconds and longer, but it could be that this duration of silence is insufficient to distinguish a difference in the extent to which extraverted teams are silent. Longer silences, for example of 20 seconds or more, may be perceived as awkward in the escape game and, in turn, might affect how highly and lowly extraverted people perform. Another duration of the silent segments might offer more insight into the possible relationships between silence and extraversion. However, more

research is needed to explore the extent to which and at what duration silences are perceived as awkward or normal during a team performance such as an escape game.

Conclusion

The current study has analysed whether silences mediate the effect between team extraversion and team effectiveness. This research suggests that only mean team extraversion is directly related to the effectiveness of a team such that more extraversion in a team predicts less team effectiveness because highly extraverted teams might be more socially than task orientated. The variance and interaction term of team extraversion did not affect the team effectiveness. Furthermore, although silence did not mediate the relation between team extraversion and team effectiveness, silence influenced the effectiveness of a team in the expected direction. The current research suggests that more silences are associated with a less effective team, whereby the length of the silences is not a predictor of team effectiveness.

This research has presented insight into the essence of extraversion during a team performance and a finding that silence in communication negatively influences team performance. Although this research did not find that extraversion was related to silences due to possible disturbing factors, further research may establish an association between personality and silence under different research settings. Overall, the current study observed predictors of the effectiveness of a team. Further research should consider other possible predictors of team effectiveness, such as the type of task (e.g., the importance of interaction, division of workload, task complexity), team size and the amount of external help received. Both organisations and team members should be aware of the essence of communication and personality in order to effectively perform a team task. It would be interesting to further examine the role of silence in communication, and to explore whether certain personality traits and the composition thereof might affect the number and length of silences during a team performance.

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