



## Predictors of the emergence of transformational leadership in virtual decision teams

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### ABSTRACT

This study examined the etiology of transformational leadership in virtual team contexts. First, we compared 127 members of virtual decision-making teams with 135 members of traditional face-to-face teams in terms of the relationship between aspects of personality and the emergence of transformational leadership. The type of communication media (face-to-face versus “pure” virtual) was found to interact with extraversion and emotional stability in the prediction of emerging transformational leadership. In line with prior findings, we showed how these personality characteristics were relevant to transformational leadership emergence in our face-to-face teams. However, they were largely unrelated to such leadership in the virtual team context. We also focused specifically on the virtual context by analyzing the content of team interactions. After accounting for the effect of degree of activity level, the linguistic quality in one’s written communication was found to predict the emergence of transformational leadership in virtual teams.

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Transformational leaders articulate strongly-held beliefs and values, stimulate thinking that fosters innovative solutions to problems, and generate high degrees of follower confidence, trust, and admiration (Bass, 1997; Bass & Avolio, 1994). Given the relevance of such leadership to the success or failure of groups in organizations (Judge & Piccolo, 2004), researchers have turned their attention to its etiology and whether variables can be identified that predict its formation (e.g., Judge & Bono, 2000). The current study expands this line of investigation by focusing primarily on virtual teams (VTs) and the extent to which various traits or qualities exhibited by team members predict their emergence as perceived, transformational leaders.

Our study is important for two key reasons. First, much more is known about the individual and group level outcomes of transformational leadership (e.g., Cascio & Shurygailo, 2003; Lowe, Kroeck, & Sivasubramaniam, 1996; Judge & Piccolo, 2004), as compared to the traits or qualities that could give rise to perceptions of its formation in emerging leaders. Yet, an understanding of the etiology of transformational leadership could have important implications for the selection and development of effective leaders in organizations. Second, our current understanding is somewhat limited to face-to-face settings (Judge & Bono, 2000). Little is known about why or how transformational leadership may emerge in a virtual context, despite the fact that it may be of equal relevance in such a setting (Avolio, Kahai, & Dodge, 2000; Kahai, Sosik, & Avolio, 1997). As noted by Avolio and Kahai (2003), the few studies that have tried to systematically examine leadership in virtual teams (VTs) have done so by assigning or designating a leader. However, VTs oftentimes have no designated leader, instead relying on a shared leadership model (Conger & Pearce, 2003; Pearce, 2004), also known as distributed or rotating leadership (Pulley, Sessa, & Malloy, 2002). This type of leadership is used in self-managed teams, and it allows for leadership to shift depending on the task, expertise, and influence of certain members (Duarte & Snyder, 1999; Lipnack & Stamps, 2000). As such, even in the shared leadership environment exemplified by VTs, individual leadership qualities do matter, and individual leaders may emerge (cf., Conger & Pearce, 2003; Pearce, Yoo, & Alavi, 2004; Shamir, 1997).

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Thus, our focus is on the individual emergence of transformational leadership. In sum, our purpose is twofold: (1) to examine the degree to which the five-factor model of personality is predictive of perceived transformational leadership behavior in both virtual and face-to-face settings, and (2) to examine predictors that may be specific to VTs. Our specific focus is on the nascent or formative stages of decision-making teams, and our research context involved student teams engaged in an ethical decision-making task. Next, we overview the theoretical basis for our research, followed by the development of hypotheses.

## 1. Predictors of perceptions of transformational leadership in a virtual context

A model of personal qualities that may serve as predictors of emergent transformational leadership in a virtual context is shown in Fig. 1. Two key aspects of the model should be noted. First, the model suggests the potential relevance of trait-based predictors, as well as more behaviorally-oriented variables. Second, although to some degree we consider comparisons with face-to-face groups, our primary focus is on understanding the emergence of transformational leadership perceptions in a virtual context.

Schneider and Goktepe (1983) defined emergent leaders as group members who exert significant influence over other members of the group although no formal authority has been vested in them. Leaders emerge through a complex process of role taking and peer perceptual processes (cf. Seers, 1989; Taggar, Hackett, & Saha, 1999). Arnoff and Wilson (1985) explained sources of leadership status as either ascribed or achieved. Ascribed sources of status stem from a process whereby readily observable individual differences, such as gender or personality, result in attributions of competency and leadership ability that affect status within a group. Thus, status is ascribed based on implicit theories (ILTs), schemas, or societal stereotypes, with or without accompanying behavioral support. In contrast, achieved sources of status stem from a process whereby valued behaviors and tangible contributions to others or the group result in a person earning status within the group. Thus, as described in Neubert and Taggar (2004), leadership emergence can follow two possible pathways in teams: (a) team members are ascribed emergent leader status by means of identifiable individual differences; or (b) team members achieve emergent leader status by fulfilling valued roles within the team and/or providing valued contributions. As described in further detail below, we see both pathways as relevant to the perception of emergent transformational leadership through the information processing of followers.

### 1.1. Information processing and implicit leadership theories

A number of authors have discussed how cognitive information processing is relevant to how individuals make sense of their surroundings, including perceptions of leadership. For example, ILTs and cognitive categorization would suggest that individuals create leadership prototypes in their mental schema and then access those schemas to evaluate information regarding a particular leader. That is, potential leaders are evaluated by others on the basis of beliefs and assumptions that those others have about the characteristics of effective leaders, and specific behavior or actions of the leader are compared against these leadership prototypes (Lord & Brown, 2001; Lord & Maher, 1991; Offerman, Kennedy, & Wirtz, 1994). Thus, ILTs represent “cognitive frameworks and categorization systems that influence the perception and interpretation of information about leaders” (Shamir, 1992, p. 389). If followers believe that the actions and behaviors exemplify such things as providing vision that is different from the status quo, exuding confidence, and being innovative or showing special capabilities, then they are likely to interpret the leader as being transformational (Conger & Kanungo, 1987). In short, this matching process provides a means of simplifying the vast array of information or stimuli that a follower may encounter with regard to his/her leader (Markus & Zajonc, 1985).

We propose that media type (i.e., virtual versus face-to-face) can affect the behaviors that leaders are able to demonstrate, and in turn, the interpretation of their leadership on the part of followers in a team setting. By definition, a virtual team context involves spatial or geographic dispersion, coupled with technology-mediated communication (Kozlowski & Bell, 2003; Jarvenpaa & Leidner, 1999). As such, less personal information or cues are likely to be communicated in a virtual team context, as compared to a face-to-face setting (e.g., Daft, 2008; Zaccaro & Bader, 2003). Nevertheless, the findings of Carlson and Zmud (1999) would suggest that a virtual context can convey reasonably rich communication if appropriate technology is used.

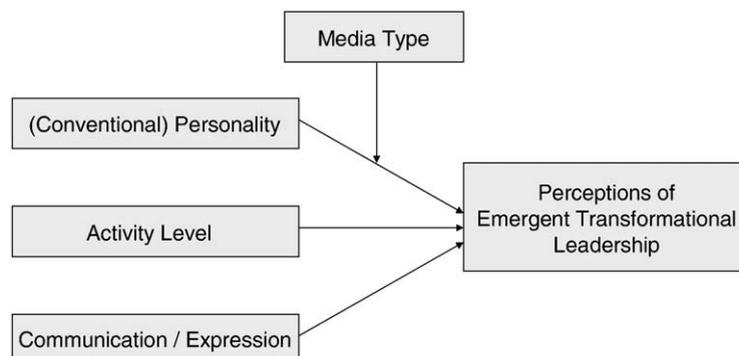


Fig. 1. Personal qualities in relation to perceptions of emergent transformational leadership in decision teams.

So what is the upshot for the display and interpretation of forms of leadership, including transformational leadership? As suggested by Avolio and Kahai (2003, p. 53), in the case of virtual leadership, “the context not only matters but is part of the construct being studied.” Thus, the types of behaviors that are shown and interpreted in transformational terms are likely to be somewhat context-dependent. In sum, the types of behaviors that result in a leader being viewed as transformational are likely to be mediated by characteristics of the communication media and technology. Below, we describe more specifically the implication of this basic proposition as we develop rationales for specific hypotheses.

### 1.2. *The role of personality in the etiology of transformational leadership*

There are reasons for considering personality when attempting to understand transformational leadership in the type of self-managed teams that we studied—teams in their nascent or early stage of development. Barry and Stewart (1997) noted that personality might be particularly important in self-managed teams because of how leadership roles evolve through interpersonal interactions and can be affected by personality. Furthermore, there is evidence that personality is predictive of emergent leadership in terms of the early identification of leadership potential (Hogan, Curphy, & Hogan, 1994).

To date, a large focus of research dealing with the etiology of transformational leadership in groups and organizations has dealt with the role of personality. Judge and Bono (2000) linked traits from the five-factor model of personality to the prediction of transformational leadership behavior, specifically in face-to-face contexts. Their analyses revealed that extraversion and agreeableness positively predicted transformational leadership. Openness to experience also predicted transformational leadership, but its effect disappeared when the other personality factors were controlled. They further found that emotional stability and conscientiousness were unrelated to transformational leadership, although both factors were predictive of more general leadership emergence in other work (Judge, Bono, Ilies, & Gerhardt, 2002).

In the present study, we generally expected to attain findings similar to Judge and Bono (2000) and Judge et al. (2002) in a face-to-face context. As suggested above and further argued by Shamir (1991), follower perceptions of transformational leadership are likely to be based on both behaviors and resulting attributions. Neubert and Taggar (2004) suggested that attributions or ascribed sources of status are derived in part from readily observable individual behavioral differences that stem largely from personality. In a face-to-face context, the emotional expressiveness, as well as positive verbal and non-verbal behaviors, of the extraverted individual will be seen as confident and forceful. As such, the extraverted individual will likely command attributions of respect and confidence among team members, and thus s/he will be viewed as transformational (Gardner & Avolio, 1998). The agreeable individual will achieve a high degree of liking on the part of others because of the apparent concern for others and receptivity to their ideas and interests, which is another necessary ingredient to be perceived as a transformational leader (Bass & Avolio, 1994; Judge & Bono, 2000; Ross & Offerman, 1991). In a face-to-face context, such concern and receptivity can be shown through both verbal and non-verbal (e.g., body language) behavior. Openness to experience should cause others to view the individual as imaginative or even visionary, which in turn, could foster inspiration and perceptions of intellectual stimulation (Bass, 1985, 1997). In addition, such individuals would be seen as flexible and able to adapt to the perspectives of others, which could engender respect and confidence. Further, emotionally stable individuals are likely to show verbal and non-verbal behavior that will be seen as positive and confident, despite challenges posed by other team members to their ideas, or the greater challenges faced by the team. Thus, emotionally stable individuals are likely to generate perceptions of trust and transformational leadership (Ross & Offerman, 1991). Finally, in line with the work of Judge and Bono (2000), we expect no relationship between conscientiousness and transformational leadership.

At the same time, we recognize that the five-factor model has been conceived and measured primarily with a face-to-face orientation (Goldberg, 1999; Judge & Bono, 2000). As an example, extraversion items in Goldberg's (1999) measure deal with the extent to which a respondent feels comfortable around other people and is skilled at handling social situations. Example items include being “the life of the party” and “don't talk a lot” (reverse-coded). Further, items dealing with openness to experience and agreeableness are less directly face-to-face in nature, but imply such a context. For example, respondents are asked whether they enjoy going to art museums, accept people as they are, and make people feel at ease. In short, the conventional assessment of the five-factor model may be somewhat context-specific to face-to-face situations.

As noted in previous research (Murtha, Kanfer, & Ackerman, 1996; Sosik & Dinger, 2007), certain personality traits may best be described in terms of a blend or mixture of situational and dispositional factors. Specifically, Murtha et al. (1996) were somewhat critical of content approaches to personality assessment and criteria prediction (i.e., effects associated with personality) that are general or universal to situations. As an example, an extraversion item such as “don't talk a lot” requires a respondent to average the descriptiveness of the item across situations. Although the item might be true in some situations but not others, the respondent would be required to eliminate situation variance by producing one overall response. Unfortunately, the net effect is to not be able to identify factors that might reflect valid variance in responses due to differences in situations or context. Moreover, criteria prediction may be lessened by essentially attempting to reduce situational variance to noise.

To deal with such issues, Murtha et al. (1996) recommended an interactionist situational–dispositional perspective whereby personality traits, and their effects, are considered in context. We take such an approach here. Specifically, in a pure virtual situation, the personality of individuals (assessed largely in face-to-face terms) may not be readily evident in their behavior or communication, which is largely a text-focused context. The upshot could be a lack of association between personality and perceptions of transformational leadership.

We suggest three reasons for such effects. First, the virtual setting may serve as a filter on those behaviors. As an example, the extraverted behaviors that are associated with social skills may not be readily demonstrable in a virtual setting. Second, the

measurement itself may not be transferable, and thus, a conventional assessment of a trait such as extraversion may not apply to a virtual context. Even an item like “don't talk a lot” might be construed by a respondent as only applying to face-to-face situations, resulting in an evaluation that only considers those settings. Third, and relatedly, it is entirely possible that specific personality characteristics that are demonstrated in a face-to-face context are not demonstrated virtually. For example, a person might be relatively extraverted in a face-to-face context, but not in a virtual context, and vice versa.

In sum, we propose that the personality-based behavior suggested in conventional measures of personality that might be predictive of transformational leadership in a face-to-face context, will not be as predictive in a virtual context. Followers will have less personality-based behavior or responses from which to attribute or ascribe transformational leadership, and conventional personality assessment in and of itself may not be applicable to the virtual setting. The upshot will be a lack of relationship between personality, as conventionally measured, and perceived transformational leadership in virtual settings. In total, our arguments suggest that:

**Hypothesis 1.** Media type will moderate the relationship between Big Five personality factors and the perceived emergence of transformational leadership. That is, (conventional) personality will predict the perceived emergence of transformational leadership in a face-to-face context, while being less related to transformational leadership in a pure virtual context.

### 1.3. Predicting transformational leadership in a virtual context

Given that we expect little if any relationship between conventionally measured personality and perceptions of transformational leadership in a pure virtual context, the question becomes what variable(s) might actually be predictive in such a setting. We identify two variables here, both of which can be linked to follower information processing and implicit leadership theories: (1) leader activity level, and (2) written linguistic quality as a surrogate for communication/expression in a pure virtual setting. Activity level may be a necessary condition for a leader to be perceived as transformational in a problem-solving task such as the one described below, since active participation, in and of itself, signals influence in group settings (Bonito, 2000; Bottger, 1984; Robey, Farrow, & Franz, 1989). Thus, activity level should be in line with follower perceptions of transformational leadership since it provides information indicating confidence, conviction, and influence on the part of the leader. Further, through extensive personal participation, the leader is able to demonstrate intellectual stimulation by showing how problems can be viewed from different angles. S/he is also able to demonstrate activity by seeking differing or additional perspectives. In short, our depiction of the connection between activity level and perceptions of transformational leadership is in line with earlier considerations of such leadership as being highly active in nature (Bass & Avolio, 1994; Waldman, Bass, & Einstein, 1987).

An interesting aspect of activity level relates to its timing. Morris and Hackman (1969) found that emergent leaders were not only those who expressed more ideas, but also those individuals who initiated the process and asked more questions than others within the group. In text-based VTs, frequency of participation can be measured by the quantity of written interactions, that is, the absolute or relative number of comments per individual in the team (e.g., Bonito, 2000; Straus, 1996). It is important to consider, however, that in text-based virtual settings, including those that support synchronous communication, there is no contention for the available bandwidth. That is, unlike in face-to-face settings, all members can be equally high contributors without affecting the opportunities of other members. Thus, within the short time period represented in the task described below, there is more opportunity for activity across all team members. As such, each team member has an equal opportunity to earn the leadership status that is achieved through activity level. In short, we expect that:

**Hypothesis 2a.** Initiation of ideas will predict the perceived emergence of transformational leadership in virtual teams.

**Hypothesis 2b.** Frequency of participation will predict the perceived emergence of transformational leadership in virtual teams.

It also stands to reason that *how* a person communicates should be predictive of other group members' judgments of that person's transformational leadership qualities, beyond *how much* or *when* that person communicates. Trenholm and Jensen (1988) noted how communication competence reflects the ability to communicate in a personally effective and socially appropriate manner, and their research would suggest a strong relationship between how communication is expressed and the subsequent perception of transformational leadership on the part of others. For example, the ability to articulate is a common theme in the transformational leadership literature. Transformational leaders clearly and eloquently articulate ideas, values, and visions (Bass, 1985; Yukl, 2006). In a face-to-face context, Berson, Shamir, Avolio, and Popper (2001) showed how the strength of a leader's stated vision, as reflected in level of optimism, was related to how followers and/or peers perceived his/her transformational leadership. In addition, Sosik and Dinger (2007) recently demonstrated a connection between the communication of inspirational vision themes and the perception of charismatic leadership.

In a typical face-to-face setting, communication expression can manifest itself stylistically in a multifaceted manner, ultimately serving to build the image of a transformational leader in what Gardner and Avolio (1998) referred to as dramaturgical approach toward understanding leadership and its perception. For example, actual spoken words and rhetorical crafting (e.g., a vision statement, stories containing imagery and metaphors, and so forth) are important in relation to building the image of transformational leader. In addition, appearance, body language, and gestures can become quite relevant. Thus, a leader can express ideas and portray emotional appeal in spoken words, or adopt non-verbal behaviors, to influence perceptions and behavior in face-to-face settings.

However, in a pure virtual context, such as the one used in the current research, the written medium through which the leader communicates is more limited. All communication in the VTs of the current study was generated in a textual format. Nevertheless,

even in such a setting, if an individual is able to express written ideas in a thoughtful, clear, articulate, and appealing manner, the other group members are likely to view such behavior positively and in line with the perceived behavioral qualities of a prototypical transformational leader. Such qualities are likely to include confidence, credibility, believability, and being visionary or insightful (Dickson, Resick, & Hanges, 2006; Hanges & Dickson, 2004; Lord, Foti, & DeVader, 1984). In a pure VT context, written linguistic quality may be largely paramount to providing the type of information necessary to make attributions regarding these qualities, and thus, to predicting perceptions of transformational leadership.

We define written linguistic quality in terms of two aspects commonly used in the literature. First, idea density refers to the number of distinct ideas contained in a passage of words (Kintsch, 1972; Kintsch & Keenan, 1973). High scores reflect an economy of expression, whereas low scores reflect vague, repetitious, and redundant expression. Second, grammatical complexity reflects the intricacy and sophistication of embedded grammar in the sentences that an individual writes (Cheung & Kemper, 1992; Rosenberg & Abbeduto, 1987). Both concepts assess mastery of vocabulary, grammar, and an ability to express oneself clearly through writing. We suggest that in a virtual context, an emergent, transformational leader must rely on written linguistic quality to generate admiration, respect, confidence, and believability, and thereby get others to reexamine critical assumptions and get them to look at problems from different angles. In sum, we propose that those who are able to communicate well by expressing their views with a high degree of linguistic quality will be the ones who tend to be perceived as transformational, specifically:

**Hypothesis 3.** Communication/expression quality, in terms of idea density and grammatical complexity, will predict the emergence of perceived transformational leadership in virtual teams.

## 2. Method

### 2.1. Participants, technology, and task

Participants were 262 undergraduate business students enrolled at a public university in a large metropolitan area within the USA. These students were drawn from multiple sections of a required core business course and participated voluntarily for extra course credit. The average age of the participants was 23.5 years, 45% were Caucasian, and 51% were males. Several weeks prior to the task, participants completed self-assessments of their personality based on the five-factor model, as described below. For the purpose of our problem-solving task, participants were randomly split into two treatment groups. An initial group of 127 participants completed the task as members of VTs, whereas a second group of 135 participants acted as a control group by completing the identical task in traditional face-to-face teams. There was no statistically significant difference for age, GPA, a self-report of current grade in course, personality factors, and knowledge of ethics in the two groupings. A total of 29 VTs (average team size = 4.58 participants) and 32 face-to-face teams (average team size = 4.09 participants) completed the task. VT members were dispersed throughout a large computer facility and randomly assigned to a computer-mediated team. Each team was provided with the task online with its own password-protected “chat room.” Conversely, face-to-face team participants received paper-based task materials and huddled around a table with their respective team members, away from other teams. In neither case were leaders assigned to the groups, thus allowing for the possibility of shared leadership emergence. As discussed earlier, it is becoming increasingly clear that in a virtual context, leadership may be shared among group members, rather than being relevant to just a single individual. Thus, it is relevant to examine the leadership shown by the various members (Avolio & Kahai, 2003; Pearce, 2004; Shamir, 1997).

Further, we should note that although short in duration and working within a simulated environment, our teams are consistent with accepted classifications of “virtualness.” Specifically, the literature identifies three key dimensions that are commonly characteristic of virtual teams: (1) relatively limited lifespan, dependent on transient organizational or task needs, (2) team dispersion in terms of geographical, social, or temporal space, and (3) technological enablement (Jarvenpaa & Leidner, 1999; Townsend, DeMarie, & Hendrickson, 1998). Virtualness can be treated as a continuous variable reflecting the degree to which a team uses technology-mediated communication as opposed to face-to-face communication in its collaboration and in reaching its goals. The current study attempted to provide a clear delineation by comparing face-to-face teams to “pure” VTs (see Arnison & Miller, 2002), or teams that interact virtually via text-based collaboration 100% of the time. To assess the success of the delineation, a number of manipulation check measures were collected. For instance, VT participants found that they could not work as effectively as FTF groups ( $F=9.62, p<.01$ ), they did not think that their group improved upon their knowledge as much as FTF groups ( $F=7.168, p<.01$ ), and they thought that their group wasted more time and energy than FTF groups ( $F=29.64, p<.001$ ).

The participants engaged in the Ethical Decision Challenge™ from Human Synergistics International of Chicago, Illinois. The exercise requires participants to rank 10 biomedical and behavioral research practices—all of which involve human subjects—in terms of their relative permissibility and acceptability (Balthazard, 2000; Cooke, 1994). It provides participants with an opportunity to engage in ethical analysis and group decision-making. This protocol recreates an *intensive* workflow (most complex) where team members must diagnose, problem solve, and/or collaborate simultaneously as a team to accomplish their task (Van de Ven, Delbecq, and Koenig, 1976). Such tasks are typically quite challenging, with the need for high levels of synchronous collaboration and information sharing among team members (Kozlowski et al., 1996). They are likely to represent a fair test for members of both traditional and virtual teams (Sundstrom, de Meuse, & Futrell, 1990). Turner, Barling, Epitropaki, Butcher, and Milner (2002) recently demonstrated an empirical relationship between transformational leadership and higher stages of moral development. Indeed, others (e.g., Bass & Steidlmeier, 1999) have suggested linkages between transformational leadership and the ethical behavior of followers. Thus, an ethical decision task seemed like a reasonable choice to examine the emergence of transformational leadership in a work unit that involves decisions pertaining to ethical dilemmas.

Participants were given 10 minutes to read the problem statement and get acquainted with the web system or paper materials. This period of time was followed by an additional 10 minutes to provide their initial individual solution. Those individual solutions were then submitted via an interactive Web form (for VTs) or registered on a scoring sheet (for face-to-face teams). Teams were then introduced either via threaded discussion, or alternatively through face-to-face contact, and given 35 minutes to discuss the problem and provide the best possible consensus solution—a solution that all team members could “live with.” This amount of time allowed all teams to complete the task without excessive time pressure and without generating participant fatigue or disinterest. Following the completion of the task as a team, and prior to revealing the expert solution, participants were then provided with additional time to respond to a post-task transformational leadership questionnaire (web- or paper-based), allowing each member to assess confidentially the leadership exhibited by each of the other members in his or her team.

## 2.2. Measures

### 2.2.1. Personality

Several weeks prior to the above task, we measured the five-factor model of personality using 50 items (i.e., 10 items per factor) developed by Goldberg (1999). These items are also contained in the International Personality Item Pool (2001). Goldberg (1999) reported strong convergent validity evidence in relation to NEO measures developed by Costa and McCrae (1992). Specifically, the average correlation between corresponding scales in the two sets of measures was .73. Goldberg (1999) calculated that this figure would translate into an average correlation of .94 when corrected for attenuation due to the unreliabilities of the various scales. Furthermore, Goldberg's measures have been used in a number of studies, e.g., Barry and Stewart (1997). Each item asks the respondent to describe himself/herself on a number of characteristics using a 5-point scale with anchors ranging from “very accurate” to “very inaccurate.” Items were coded such that higher scores represented more of a respective personality variable. The resulting alpha reliabilities for Extraversion, Agreeableness, Conscientiousness, Openness to Experience, and Emotional Stability were .86, .74, .77, .76, and .83, respectively.

### 2.2.2. Activity level

We then developed a set of behaviorally-oriented measures appropriate to the virtual context. For activity level, we followed Morris and Hackman (1969) and Bonito (2000) and flagged initiation of ideas in the VTs by registering a score of “1” in each team for the participant that authored the first meaningful, written utterance, and “0” for the others. We also calculated a percentile for each participant that shows their frequency of participation—the proportion of the total group utterances that was represented by their contribution (see, Mullen, Salas, & Driskell, 1989). We measured the proportion of utterances because in a virtual context there is no production blocking, that is, participants can submit their contributions simultaneously (George, Easton, Nunamaker, & Northcraft, 1990).

### 2.2.3. Communication/expression quality

Language sample analysis was used to assess communication/expression quality (Kemper & Sumner, 2001). Hard copy output representing all the utterances in the text-based team discussion was used in the evaluation. We employed two widely-adopted measures of written linguistic performance: (1) idea density (Kintsch, 1972; Kintsch & Keenan, 1973), and (2) grammatical complexity (Cheung & Kemper, 1992; Rosenberg & Abbeduto, 1987). Idea density measures the ratio of ideas to words and was calculated according to the procedures originally described by Turner and Greene (1977). We specifically counted the number of ideas per 10 words used. Ideas refer to elementary propositions, typically verbs, adjectives, adverbs, and prepositional phrases, and statements representing relationships between ideas or propositions (Snowdon et al., 1996). An example of a sentence and its scoring, where each idea is indicated by brackets is: [The merits [of [beneficence] principles] can be judged [effectively] [after reading the [ethical decision] study]]. This sentence has six ideas and 15 words, or 4 ideas per ten words. The mean idea density score for all participants in our study was 4.26, which compares to scores obtained in similar studies (e.g., mean = 4.17 in the Davidson, Slotnick, and Waldman (2000) examination of problem-solving essays by accounting students; mean = 4.30 in Kemper and Sumner's (2001) analysis of writing samples in younger and older adults).

Grammatical complexity is a measure of the intricacy of embedded grammatical structures in each sentence. It ranges from simple, one-clause sentences to complex sentences with multiple forms of embedding and subordination. While the scale, originally developed by Rosenberg and Abbeduto (1987), produces an ordinal measure, there is precedence for using such measures in parametric statistical analyses (Johnson & Creech, 1983).<sup>2</sup> Table 1 shows the criteria used for the scoring of this variable. An example of a relatively simple sentence taken from a transcript and scored as a ‘2’ for a compound sentence is: “There is minimum risk and no direct benefit.” The following is an example of a relatively complex sentence scored as a ‘7’ for combining multiple sentence forms

<sup>2</sup> Our Grammatical Complexity measure uses an ordinal scale with seven categories. Ordinal scales with relatively few levels (i.e., 3 or 4) are often classified as categorical and are analyzed using a binomial class of statistical tests. In contrast, ordinal scales with many levels (i.e., 5 or more), along with interval and ratio scales, are usually analyzed with the normal theory class of statistical tests (Agresti, 1984; Cliff, 1996; Johnson & Creech, 1983). As with Likert-type scales, when there are 5 or more levels, there is relatively little harm in treating them as continuous, and thus, normal theory statistics may be used (Johnson & Creech, 1983; Long, 1997). Nevertheless, one possible practice is to do a median split, thereby placing those with scores above and below the median into two categories. MacCallum, Zhang, Preacher, and Rucker (2002) query outline problems associated with this practice, such as the resulting artificial dichotomization and loss of specificity of the data. However, for the sake of comparison, we created a dichotomous variable to represent grammatical complexity. Scores less than 2 represented low complexity, while scores greater than 2 represented high complexity. All analyses were repeated, and results were generally equivalent to those shown in Tables 3 and 5.

**Table 1**  
Scoring of sentences for increasing grammatical complexity.

Score	Requirement
0.	Simple one-clause sentences (e.g., <i>John hit the ball.</i> )
1.	Embedded infinitival complement with subject identical to that of the matrix clause (e.g., <i>The doctor prepared to examine the boy.</i> )
2.	Wh- <sup>1</sup> infinitive clause (e.g., <i>Remember where it is?</i> ); sentence conjoined with a coordinating conjunction (e.g., <i>I brought candy and Peter cleaned up.</i> ); compound sentence (e.g., <i>John and Mary left early.</i> )
3.	Object noun phrase relative clause (e.g., <i>The man scolded the boy who stole the bicycle.</i> ); object noun phrase complement (e.g., <i>John knew that Mary was angry.</i> )
4.	Gerundive complement (e.g., <i>I felt like turning it.</i> ); comparative (e.g., <i>John is older than Mary.</i> )
5.	Subject noun phrase relative clause (e.g., <i>The man who cleans the rooms left early today.</i> ); subject noun phrase complement (e.g., <i>For John to have left Mary was surprising.</i> ); nominalization (e.g., <i>John's refusal of the drink angered Mary.</i> )
6.	Two sentences conjoined with a subordinating conjunction such as <i>if, because, before, so</i> (e.g., <i>They will play today, if it does not rain.</i> )
7.	More than one use of sentence combining in a given sentence (e.g., <i>John decided to leave Mary when he heard that she was seeing Mark.</i> )

within one sentence: “The behavior was troubling, and the idea that names were exchanged was inexcusable, but the fact that a second project followed indicated a redeeming value.” The mean grammatical complexity score for all participants in our study was 2.04, which is similar to a mean of 2.10 reported in Kemper and Sumner’s (2001) analysis of spontaneous writing samples in younger and older adults. However, our mean grammatical complexity score was significantly less than the mean score of 4.14 from essays reported in Davidson et al. (2000), most probably attributable to the more fragmented nature of web-based interactions.

Following Snowdon et al. (1996), a research associate who was blind to the research questions of the study scored written linguistic quality by reviewing the first ten utterances for each participant. If there were fewer than ten utterances, all of the content was scored. This work was accomplished prior to the tabulation of any measures of personality or transformational leadership. To ensure reliability, a second research associate independently assessed the utterances. The inter-rater correlation was 0.84 for idea density and 0.91 for grammatical complexity. These correlations compare to 0.88 and 0.98, respectively, found by Snowdon et al. (1996).

#### 2.2.4. Emergent transformational leadership

The most common way of assessing emergent leadership or more specifically, transformational leadership, in groups has been to simply ask group members to nominate the individual(s) who they perceive to be the leader(s). However, as stated by Neubert and Taggar (2004, p. 190), “despite the regularity of these measures in leadership emergence research, ... an alternative approach in future research might be to have team members rate all team members on several distinct leadership dimensions. In field research, the time required for respondents to provide this information may be untenable from the perspective of the organization, yet if viable, this alternative approach to assessing informal leadership would be a valuable extension...” In the current study, such an approach did prove to be tenable. Participants assessed other respective team members by rating 8 items taken from a short form of the Multifactor Leadership Questionnaire (Bass & Avolio, 1990). Specifically, after examining all items from the short form, these 8 items were judged by the researchers and an additional colleague to be potentially relevant to a 35-minute team problem-solving task. The 8 transformational leadership items appear in Table 2. As can be seen, they generally tapped charismatic, inspirational, and intellectual stimulation aspects of transformational leadership (Bass & Avolio, 1994). As such, our items capture the two basic components of transformational leadership as articulated by Bass (1985): emotional and intellectual. Bass (1985) identified an additional component, individualized consideration. We did not include this factor in our conceptualization or analyses for two reasons. First, research has shown a lack of independence between individualized consideration and other transformational leadership factors, as well as a lack of additional predictive power with regard to outcomes (Bass, 1997; Lowe, Kroeck, & Sivasubramaniam, 1996). Second, it focuses on how a leader deals with individual followers in terms of their mentoring, coaching, and development. We concluded that such leadership actions are more long-term in nature and could not be readily accomplished or perceived in the relatively short period of time allowed for our team task.

Items were answered on a five-point scale ranging from (1) *not at all* (5) to *a very great extent*. The ratings were then summed, and an average score was computed for each participant. We should note that the Multifactor Leadership Questionnaire typically

**Table 2**  
Rotated component matrix of transformational leadership items.<sup>a</sup>

Scale <sup>b</sup>	Items	Component	
		1	2
IM-1	Expressed confidence that goals would be achieved	.93	.06
IM-2	Talked enthusiastically about what needed to be accomplished	.92	.07
AC-1	Acted in ways that build your respect	.92	.15
AC-2	Displayed a sense of power and confidence	.87	-.11
IS-1	Sought out differing perspectives when solving the problem	.07	.92
IS-2	Reexamined critical assumptions to question whether they are appropriate	.09	.89
IS-3	Suggested new ways of looking at how to solve the problem	.18	.82
IS-4	Got you to look at the problem from many different angles	-.15	.61

<sup>a</sup> Extracted via principal components analysis; Varimax rotation with Kaiser normalization KMQ measure of sampling adequacy = .78.

<sup>b</sup> As per MLQ definition (Bass & Avolio, 1990), IM: Inspirational motivation, AC: Attributed charisma, IS: Intellectual stimulation.

involves 0–4 scaling with the high-end anchor of “frequently, if not always”. Our use of a 1–5 scale with a high anchor of “to a very great extent” yielded a mean score comparable to prior research involving the Multifactor Leadership Questionnaire, if prior research was to be recoded to 1–5 scaling (Lowe et al., 1996).

As shown in Table 2, an initial factor analysis revealed separate factors for inspirational leadership and intellectual stimulation. However, since the subsequent correlation was .69, in line with previous research (e.g., Judge & Bono, 2000; Turner et al., 2002), we combined the items to produce a single measure of transformational leadership.

Finally, the literature would suggest that, at the individual unit of analysis, gender might have an effect on the emergence of transformational leadership (Bass & Avolio, 1994; Locke, 2003). Accordingly, we controlled gender in our analyses. Similarly, at the group level of analysis, team size might also influence the emergence of transformational leadership, and hence, that measure was also controlled.

### 2.3. Data analysis

We analyzed the data using a two-level effects model via hierarchical linear modeling as operationalized by the SAS PROC MIXED program (Bryk & Raudenbush, 1992; Hox, 1995; SAS Institute, 1992, 1996). This approach is especially effective in situations where violation of independence is a major disqualifier of using traditional regression models. Although our data are at the individual level of analysis (e.g., the personality of participants), they also are nested within groups. Thus, within the same decision group, the measurements from individuals (e.g., leadership) are not independent. Accordingly, participants from the same group could have more similar (leadership) scores than participants from different groups.

Two-level effects models can be expressed in at least three different ways: (1) by writing a separate equation for each level; (2) by writing a separate equation for each level and then substituting in the previous level to arrive at a single equation; and (3) by writing a single equation that specifies the multiple sources of variation. PROC MIXED requires a single level representation, derived as follows:

First, we express the participant-level outcome as the sum of an intercept for the participant's group ( $\beta_{0j}$ ) and a random error  $r_{ij}$  associated with the  $i$ th participant in the  $j$ th group:

$$Y_{ij} = \beta_{0j} + r_{ij} \quad \text{where } r_{ij} \sim N(0, \sigma^2) \quad (1)$$

At the group level, we express the group level intercepts as the sum of an overall mean ( $\gamma_{00}$ ) and a series of random deviations from that mean ( $u_{0j}$ ):

$$\beta_{0j} = \gamma_{00} + u_{0j} \quad \text{where } u_{0j} \sim N(0, \tau_{00}) \quad (2)$$

Substituting Eq. (2) into Eq. (1) yields the two-level model represented in a single level:

$$Y_{ij} = \gamma_{00} + u_{0j} + r_{ij} \quad \text{where } u_{0j} \sim N(0, \tau_{00}) \text{ and } r_{ij} \sim N(0, \sigma^2) \quad (3)$$

Invoking the procedure and identifying GROUP ID as a categorical variable, we found that the average group average leadership score (not the same as the average of individual leadership scores) was 3.21, the estimated value of  $\tau_{00} = 0.23$ ,  $p < .001$  and the estimated value of  $\sigma^2 = 0.11$ ,  $p < .001$ . These parameter estimates suggest that groups do differ significantly in their average leadership scores, and that there is also significant variation among participants within groups. From these parameters, we estimated the intraclass correlation  $\rho$ , which in this case defines the portion of the total variance that occurs between groups:

$$\rho = \frac{\tau_{00}}{\tau_{00} + \sigma^2} = (0.229 / 0.229 + 0.108) = 0.677 \quad (4)$$

Although the variance component within group is only half the size of the variance component between groups, and between groups effects explain 0.677 of the variance, the procedure nevertheless suggests that there exists some clustering of leadership scores within groups and that our decision to control for within group effects via a hierarchical linear modeling procedure is appropriate.

We thus analyzed the emergence of transformational leadership in virtual teams by regressing leadership on the control variables (at the group and individual levels), personality measures, activity level measures, and measures of written linguistic quality:

$$\begin{aligned} Y(\text{Leadership})_{ij} = & \beta_{0j} + \beta_{1j}(\text{Gender}) + \beta_{2j}(\text{Extraversion}) + \beta_{3j}(\text{Conscientiousness}) \\ & + \beta_{4j}(\text{Emotional Stability}) + \beta_{5j}(\text{Agreeableness}) + \beta_{6j}(\text{Openness}) + \beta_{7j}(\text{Initiation of Ideas}) \\ & + \beta_{8j}(\text{Frequency of Participation}) + \beta_{9j}(\text{Idea Density}) + \beta_{10j}(\text{Grammatical Complexity}) + r_{ij} \end{aligned} \quad (5)$$

$$\text{where } \beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Team Size}) + u_{0j} \quad (5a)$$

**Table 3**Means, standard deviations, and inter-correlations of constructs.<sup>a</sup>

Constructs	Mean	S.D.	C1	C2	M1	P1	P2	P3	P4	P5	N1	N2	Q1	Q2
<b>Control</b>														
C1. Team size	4.16	.78												
C2. Gender	1.56	.50	.05											
<b>Communications media</b>														
M1. Media	1.51	.5	-.19***	.17***										
<b>(Conventional) Personality</b>														
P1. Extraversion	3.56	.62	.06	-.05	-.05									
P2. Conscientiousness	3.59	.51	.03	.02	.10	.20**								
P3. Emotional Stability	2.34	.69	.06	-.12	.04	.31***	.33***							
P4. Agreeableness	3.81	.52	.04	.16**	.02	.12	.37***	.26***						
P5. Openness	3.73	.60	.05	.03	-.07	.49***	.19***	.11	.25**					
<b>Activity level</b>														
N1. Initiation of ideas	0.23	.42	-.02	.09	n/a	.08	-.01	-.07	.03	.04				
N2. Frequency of participation	0.23	.09	-.20**	.21**	n/a	.08	.22**	.04	.28***	.10	.10			
<b>Communication/Expression</b>														
Q1. Idea density	4.29	1.00	-.06	.08	n/a	-.05	.11	-.12	.12	.01	.10	.30***		
Q2. Grammatical complexity	2.05	.96	-.17**	.17**	n/a	-.03	.30***	-.17**	.19**	.12	.15*	.38***	.42***	
<b>Emergent leadership</b>														
L1. Transformational leadership	3.36	.73	.05	.21**	.16***	.07	.14**	.13**	.16**	-.01	.15*	.30***	.33**	.45***

\* $p < .10$ ; \*\* $p < .05$ ; \*\*\* $p < .01$ .<sup>a</sup> Measure based on 127 subjects in cells pertaining to virtual teams and 262 total subjects in other cells.

### 3. Results

Table 3 presents means and standard deviations for all constructs. It also presents inter-correlations of constructs in two distinct blocks: the first containing personality and leadership values from the 262 subjects in both media conditions; the second (presented in italics within shaded cells) containing measures of participation and linguistic quality that are only applicable to the 127 subjects in the virtual media condition.

Table 4 shows parallel hierarchical linear modeling (HLM) analyses to test direct effects and potential interactions with media for each of the five personalities on perceptions of emergent transformational leadership. Predictors were entered in one step and included gender and team size as control variables, media, the targeted personality variable, and the interaction of the targeted personality variable with media type. Table 5 shows the HLM analysis for predicting perceptions of emergent transformational leadership, specifically testing our hypotheses pertaining to virtual teams. Predictors were entered in four blocks: (1) control variables, at the group and individual levels, (2) personality measures, (3) participation measures, and (4) communication/expression measures. In line with Cohen and Cohen (1983), personality was entered into the regression equation earlier than participation and communication/expression measures for two reasons. First, personality is a more established predictor of transformational leadership in the literature. Second, it represents characteristics developed over time by participants, as well as measured in our design prior to participation in our group task.

The pattern of results provides support for Hypothesis 1 that media type moderates the relationship between personality (operationalized conventionally) and the perceived emergence of transformational leadership. The interaction effect of media depicted graphically in Fig. 2 and quantified in Table 4 demonstrates that even large differences in levels of extraversion and emotional stability predict little or no differentiation in perceived transformational leadership for individuals within VTs, while the same differences predict a high degree of differentiation in transformational leadership in face-to-face teams. Fig. 2 shows transformational leadership in face-to-face and VTs for individuals one standard deviation below the mean level of a personality

**Table 4**

Fixed and interaction effects of media and personality on leadership.

	Extraversion <sup>a</sup> estimate (Std. Err.)	Conscientiousness estimate (Std. Err.)	Emotional stability estimate (Std. Err.)	Agreeableness estimate (Std. Err.)	Openness estimate (Std. Err.)
Intercept	2.42*** (.49)	2.33*** (.52)	4.00*** (.41)	2.45*** (.53)	3.04*** (.50)
Gender	.12 (.08)	.12 (.08)	.13 (.08)	.09 (.08)	.12 (.08)
Team size	.00 (.09)	.00 (.09)	.00 (.09)	.00 (.09)	.00 (.09)
Media	.68 (.45)	.47 (.52)	1.09*** (.29)	.40 (.59)	.14 (.50)
(Conventional) Personality	.24** (.08)	.24** (.09)	.31*** (.07)	.23* (.10)	.06 (.09)
Media* personality	-.24** (.12)	-.15 (.13)	-.40*** (.11)	-.15 (.15)	-.08 (.13)
LR ratio ( $\chi^2$ ) <sup>b</sup>	41.48***	40.39***	41.69***	38.48***	37.62***

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  (two tailed tests).<sup>a</sup> Effect estimate with robust standard errors in parentheses.<sup>b</sup> Null Model Likelihood Ratio Test.

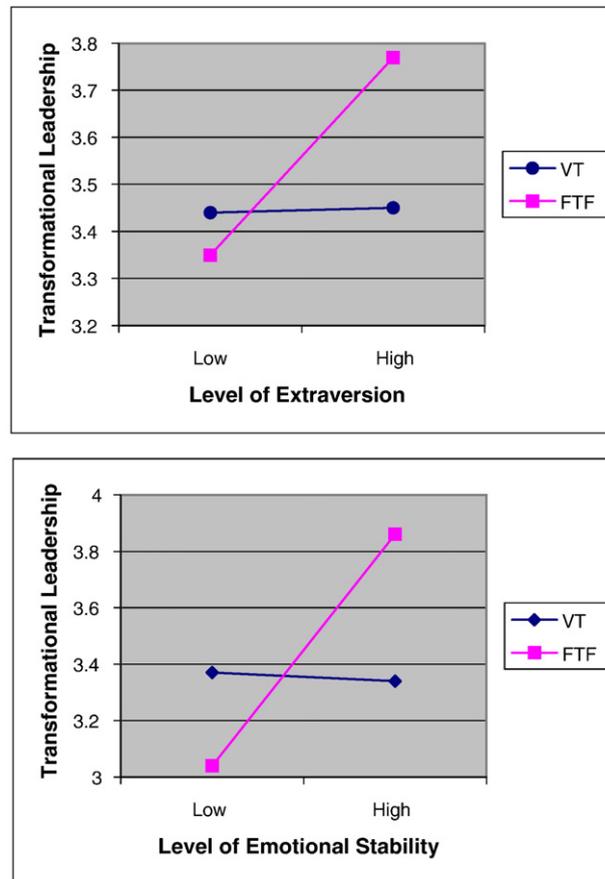
**Table 5**

Fixed effects measures of emergent leadership in virtual teams.

Model	Emergent Transformational Leadership <sup>a</sup>			
	1	2	3	4
Intercept	3.03**(.47)	2.31**(.64)	2.39***(.60)	2.49***(.59)
Control				
Team size	-.02 (.10)	-.02 (.10)	.03 (.10)	.05 (.09)
Gender	.23** (.08)	.18* (.08)	.08 (.08)	.06 (.07)
(Conventional) Personality				
Extraversion		.05 (.07)	.02 (.07)	.04 (.06)
Conscientiousness		.12 (.08)	.08 (.07)	-.01 (.07)
Neuroticism		.13 (.07)	.11 (.06)	.05 (.06)
Agreeableness		.03 (.09)	-.05 (.08)	-.07 (.08)
Openness		-.06 (.08)	-.05 (.07)	-.07 (.07)
Activity level				
Initiation of ideas			.13 (.07)	.10 (.07)
Frequency of participation			1.77** (.42)	1.29** (.43)
Communication/Expression				
Idea density				.03 (.04)
Grammatical complexity				.15** (.05)
LR ratio ( $\chi^2$ ) <sup>b</sup>	59.81***	57.94***	66.02***	62.47***

\* $p < .05$ ; \*\* $p < .01$ ; \*\*\* $p < .001$  (two-tailed tests).<sup>a</sup> Effect estimate with robust standard errors in parentheses.<sup>b</sup> Null model likelihood ratio test.

variable (low) and one standard deviation above the mean level of a personality variable (high). Further, the second HLM model (see Table 5), testing the fixed effects of control variables and personality on leadership, found no significant predictive value of personality on the emergence of transformational leadership within virtual teams.



**Fig. 2.** Interaction effects between media type and extraversion, and between media type and emotional stability, in the prediction of the emergence of transformational leadership in decision teams.

As expected, the results also indicate (see [Tables 3 and 5](#)) that gender was positively related to transformational leadership, i.e., female participants tended to be rated as more transformational (cf. [Bass & Avolio, 1994](#)). Unlike personality, gender in our virtual teams could be readily implied from the use of the participants' given names as the identifying label for each utterance in the groups' deliberations. However, the predictive value of gender dissipated in the more comprehensive models, indicating that ascribed sources of status may be relatively less important for attributions of competency and leadership within virtual teams. Beyond taking into account the random effects of the group in our mixed model, we also controlled for group size, which did not relate to transformational leadership.

The pattern of correlations in [Table 3](#) and the results in [Table 5](#) support [Hypotheses 2a and 2b](#) that the activity level of members predicts the perceived emergence of transformational leadership in virtual teams. A team member's frequency of participation, operationalized as the proportion of total team ideas, was found to be the most predictive measure of emergent transformational leadership. In relation to frequency, however, the act of initiating the discussion was only marginally associated with perceptions of transformational leadership.

The pattern of correlations in [Table 3](#) and the results from the final model in [Table 5](#) also support [Hypothesis 3](#) that communication/expression quality predicts the emergence of perceived transformational leadership in virtual teams. Both measures of written linguistic quality were found to be significantly correlated with transformational leadership (see [Table 3](#)), and grammatical complexity emerged as a significant predictor of perceptions of emerging transformational leadership in [Table 5](#).

#### 4. Discussion

Our findings pertaining to the predictive role of personality traits for the emergence of transformational leadership in VTs contradict the findings of [Judge and Bono \(2000\)](#), albeit in what should be considered a significantly different operational context. Whereas, in their study, several personality traits related to transformational leadership, we found no such link in our pure VTs. These findings are supportive of the interactionist situational dispositional perspective put forth by [Murtha et al. \(1996\)](#). A clear implication is that, unlike traditional face-to-face settings, in virtual settings, personality, as it is conventionally measured, may not readily influence the formation of transformational leadership perceptions.

Oral communication and non-verbal cues, fully available through face-to-face interaction (but attenuated through communication technologies) may be necessary to drive the relationship between personality and transformational leadership perceptions on the part of others. Moreover, it is possible that the conventional assessment of personality through measures such as [Goldberg \(1999\)](#) is not transferable to virtual contexts for the purpose of predicting perceptions of leadership. On the other hand, it may simply take more time than was allotted to our short duration task to see the effects of conventionally-assessed personality in a pure virtual context. Obviously, additional research is necessary to better understand personality and its potential relationship to leadership in such settings.

To a large extent, the [Goldberg \(1999\)](#) measures used in the current study were designed with face-to-face settings in mind. For a virtual context, constructs such as extraversion and emotional stability may need to be reconceptualized and perhaps alternative measures devised. That is, the findings of our research suggest that the manifestation, and perhaps even the meaning, of personality may differ in virtual versus face-to-face settings. What exactly does it mean to be extraverted in a virtual context? Is it possible for an individual to show extraversion in virtual settings, but not in face-to-face settings, and vice versa? For example, we can envision individuals who in a face-to-face context may be somewhat introverted or shy. However, in the relative social seclusion (or "safety") of a VT, these individuals may be much more willing to speak up and thus become more outgoing. If such is the case, what is the implication for relationships between personality measures and leadership? Similar questions could also be asked for other personal or behavior constructs, such as aggressiveness and other forms of anti-social behavior. For example, in a virtual context, some individuals may be more prone to show (or be perceived to show) aggressive or rude behavior—as compared to tendencies in a face-to-face context. Such behavior, in turn, could lower perceptions of transformational leadership on the part of others. In sum, our findings suggest a number of questions for future research to answer regarding the assessment of personality and its effect on leadership in virtual settings.

On the other hand, our findings do suggest that *how much* and *how* a person communicates through written media may be important in the determination of transformational leadership in virtual settings. That is, the extent of participation and grammatical complexity, or the intricacy of embedded grammatical structures in written sentences, were the best predictors of transformational leadership in our VTs. Thus, those who took care in crafting more grammatically-involved comments emerged as transformational leaders in their VTs, regardless of their personality traits. So although it may be difficult for team members to be perceived as transformational in a virtual context based on personality, active participation and the compelling use of words can overcome, in part, such a restriction. In line with the work of [Berson et al. \(2001\)](#) and [Sosik and Dinger \(2007\)](#), future research might attempt to examine the independent or interactional effects of inspirational vision themes and grammatical complexity in relation to perceptions of charismatic/transformational leadership in virtual contexts.

##### 4.1. Managerial implications

The findings of this study have some relatively straightforward practical implications. First, virtual media and settings represent growing phenomena in organizational teams. Even if not purely virtual, many teams are largely spatially or geographically distributed and rely on some form of computer-mediated communication. Accordingly, it is important to understand leadership processes in these contexts, including how leadership perceptions and influence are formed. Second, the findings indicate that the

quality or intricacy of one's writing does matter as the potential for leadership influence develops, that is, as perceptions of transformational leadership are formed. Accordingly, the selection or development of leaders of VTs should take into account tendencies toward such qualities as grammatical complexity when communicating in VT context. Individuals lacking such qualities may find it difficult to take on the leadership role and may not be recognized as transformational leaders by potential followers.

#### 4.2. Limitations and conclusions

Finally, we recognize some limitations associated with our task and methodology. Although our participants fully interacted with each other until a problem was solved, they were formed into interdependent teams for only the brief duration of our task. It may be possible that personality characteristics and task knowledge gain in importance, whereas linguistic quality, gender, and participation lose in importance as a VT matures in its processes. Nevertheless, in the face-to-face condition reported above, we did find our expected relationships between personality and emergent transformational leadership. These findings would suggest that our task was indeed sufficient in both length and quality to produce relationships between personality and leadership.

Further, our technology did not include real-time audio (or video) such as conference-calling (or teleconferencing) that VTs sometime use. It is not clear precisely how adding such features to our technology would affect our results, although we can speculate that these types of enriched media may permit greater effects of personality on leadership. In short, we recognize that it would be desirable to extend our work by examining leadership perceptions in VTs with access to enhanced communication channels, or VTs of longer duration to determine if similar findings would be obtained. In addition, we recommend that future research attempt to replicate our findings in VTs in actual organizations.

In conclusion, the information processing approach used here provides some insight as to how transformational leadership perceptions are formed with regard to potential emergent leaders in face-to-face versus virtual contexts. Accordingly, the present research provides findings that may help to move the field forward in terms of understanding the etiology of transformational leadership phenomena, especially in VT contexts. Although we found no effects of conventionally-assessed personality in the VT context of the current study, we do not suggest that personality is irrelevant. However, alternative approaches to its assessment may need to be pursued. On the other hand, in a pure, text-based environment, perhaps it is not surprising that the quality/intricacy of one's writing might come into play as potential followers attempt to make sense of potential leaders—and their degree of possible influence through transformational leadership.

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