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# Applying a Psychobiological Model of Personality to the Study of Leadership

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**Abstract.** Cloninger's psychobiological model of temperament and character is a general model of personality that has been widely used in clinical psychology, but has seldom been applied in other domains. In this research we apply Cloninger's model to the study of leadership. Our study comprised 81 participants who took part in a diverse range of small group tasks. Participants rotated through tasks and groups and rated each other on "emergent leadership." As hypothesized, leader emergence tended to be consistent *regardless* of the specific tasks and groups. It was found that personality factors from Cloninger, Svrakic, and Przybeck's (1993) model could explain trait-based variance in emergent leadership. Results also highlight the role of "cooperativeness" in the prediction of leadership emergence. Implications are discussed in terms of our theoretical understanding of trait-based leadership, and more generally in terms of the utility of Cloninger's model in leadership research.

**Keywords:** Cloninger, TCI, temperament, character, learning, personality, leadership, harm avoidance, cooperativeness

According to the trait theory of leadership, individuals with certain personality characteristics – *traits* – are more likely to excel in leadership roles than others. Most laboratory research on leadership has focused on *emergent leadership* (e.g., Campbell, Simpson, Stewart, & Manning, 2003; De Souza & Klein, 1995; Kenny & Zaccaro, 1983; Zaccaro, Foti, & Kenny, 1991). Emergent leaders are individuals who come forward as "leader-like" in leaderless group activities (Hogan, Curphy, & Hogan, 1994). Such individuals are not merely dominant and/or controlling, but rather are rated as effective and trustworthy leaders by other members of the group. Recent research demonstrated that "emergent leaders" are more likely to also become good long-term leaders (Foti & Hauenstein, 2007). The study of personality and emergent leadership therefore remains an important area in leadership research.

Early reviews of personality and emergent leadership largely dismiss the role of individual differences in leader emergence (e.g., Mann, 1959; Stogdill, 1948). Later research, however, demonstrated that individual differences strongly discriminate among leaders and nonleaders (e.g., Brandstatter & Farthofer, 1997; Kenny & Zaccaro, 1983; Zaccaro, Foti, & Kenny, 1991). For example, Zaccaro et al. (1991) found that 59% of the variance in leader emergence could be explained on the basis of stable individual characteristics. Subsequent research linked emergent leadership with emotional stability and dominance (Brandstatter & Farthofer, 1997), extraversion (Kickul & Neuman, 2000), persistence (Northouse, 1997), and flexibility (Zaccaro et al., 1991). Nonexperimental studies of leader effec-

tiveness also provide support for the relationship between personality and leadership ability (see Kirkpatrick & Locke, 1991).

However, despite some success at predicting leader emergence, much leadership research conducted in the 1980s and 1990s failed to reveal *consistent* findings across studies – and no single trait emerged as being predictive of leadership in the majority of studies (Judge, Bono, Ilies, & Gerhardt, 2002). Judge and colleagues argued that this lack of consistency is because of the absence of a guiding theoretical framework of personality. For this reason, contemporary research on trait theory of leadership has focused on the relationship between *models* of personality and leader emergence/effectiveness.

Big Five models of personality provide possibly the most widely used and empirically supported structure for *describing* individual differences in total behavior (Costa & Widiger, 1994; McCrae & John, 1992) and therefore provide an appropriate structural framework for the trait-based assessment of leadership emergence (Judge et al., 2002). According to the Big Five model, variation in personality can be summarized along five independent dimensions including Extraversion, Agreeableness, Neuroticism, Openness, and Conscientiousness. The Big Five model has been widely studied in the context of leadership (e.g., De Hoogh, Den Hartog, & Koopman, 2005; Judge et al., 2002) as well as numerous other organizational variables (such as Job Performance; Hurtz & Donovan, 2000). A recent meta-analysis of research on Big Five personality dimensions and leadership revealed that emergent leadership is moder-

ately correlated with Neuroticism (−.24), Extraversion (.31), Openness to Experience (.24), and Conscientiousness (.28) (Judge et al., 2002). Overall, this study indicated that the Big Five model could account for 28.1% of the variance in leader emergence, and demonstrated the utility of using Big Five personality models in the study of leadership.

Thus, the Big Five model provides an effective framework for the study of leadership from a predictive point of view. However, we argue that it is also important to consider alternative models of personality in the study of emergent leadership. In the following section we outline related limitations of studying leadership *solely* from a Big Five perspective and discuss how the consideration of an alternative model of personality can be both informative and useful in research on trait theory of leadership.

## Descriptive Versus Explanatory Approaches to Trait Theory of Leadership

As noted by Revelle (1995), the Big Five model represents a descriptive *taxonomy* of personality, and Big Five researchers traditionally focused on discovering the appropriate number and nature of personality dimensions. “Appropriate,” from a taxonomic point of view, means a parsimonious, replicable, and *useful* set of dimensions (Revelle, 1995). From this highly statistical framework, therefore, it is no surprise that the Big Five model provides an excellent prediction of emergent leadership. However, as many personality theorists have pointed out (e.g., Block, 1995; Cloninger, 1987; Zuckerman, 1991), while factor analytic models can help determine the *number* of personality dimensions, they cannot determine their underlying *structure* (i.e., relationship between dimensions) or *rotation* in space<sup>1</sup>. Consistent with Cloninger (1987) we argue that extrastatistical information is needed to help determine the specific rotation most consistent with the underlying biological and social structure of personality.<sup>2</sup> McCrae and Costa (1999) attempted to account for the genetic basis of the Big Five personality dimensions (Five-Factor Theory), however this theory is posthoc and focuses on empirically derived traits (as opposed to theoretically derived traits).

For example, someone who is Conscientious (as defined by the Big Five), might be described as reliable, careful, thorough, and hard working, but this overt, *phenotypic* pattern does not necessarily reflect straightforward underlying biological or social variation. Conscientiousness, though a clearly recognizable pattern of overt behaviors, may in-

stead reflect complex interactions among underlying biological mechanisms, which become masked by the criteria for simple structure in factor analysis. Thus, while behaviors characterizing each dimension of the Big Five model tend to “go together” statistically, this association is not necessarily indicative of underlying (whether biological or learned) personality structure.

As previously mentioned, the factor analytic approach is not problematic for a taxonomic description of personality, particularly when used to predict leadership emergence. However, if the goal is also to *explain* trait-based variance in leadership emergence (i.e., *why* do some people make better leaders than others?, or similarly: *why* are some people more conscientious than others?), then relying on taxonomic descriptive models alone will not provide an adequate answer. Alternatively, we argue that such models should be considered in addition to models that also seek to explain variation in personality, based on biological and sociocognitive mechanisms. It seems likely therefore, that this explanatory approach has the potential to aid not only in our understanding of leadership, but also in the application of trait theory to functions other than just the prediction of leaders (examples of this are discussed later).

Biological models of personality tend to focus on the motivational bases of behavior (e.g., Cloninger, 1987; Eysenck, 1967; Gray & McNaughton, 2000; Zuckerman, 1991), but only two theory-driven models of personality have a broader perspective in bringing together the biological and sociocognitive theoretical structures of personality, motivation, and learning. These are Cloninger’s *psychobiological model* (Cloninger, Svrakic, & Przybeck, 1993) and Jackson’s *model of functional and dysfunctional learning* (Jackson, 2005, 2008; O’Connor & Jackson, 2008), which has also been used to predict leadership (Jackson, Hobman, Jimmieson, & Martin, 2009). In this paper, we focus on Cloninger et al.’s model in the context of leadership.

Cloninger (1987) originally proposed a 3-dimensional model of personality, consistent with comparable 3-factor temperament models of that era (e.g., Eysenck, 1967, 1985). The model was based on a synthesis of information from a variety of sources, including family studies, studies of longitudinal development, drug studies, and neuroanatomical studies (see Cloninger, 1987, for an extensive overview of the biological basis for this model). Later, Cloninger’s model was extended to incorporate individual differences in “character,” influenced partially by social learning. Cloninger et al.’s (1993) final model includes four dimensions of temperament and 3 dimensions of character. Dimensions of temperament were termed Harm Avoid-

<sup>1</sup> “Rotation” as used here, refers to statistical rotation in terms of factor analysis. From a mathematical point of view, there is no one “optimal” rotation; indeed, there are an infinite number of potential levels of rotation, each of which explains the same amount of variance in different ways. For example, depending on the specific level of rotation chosen, either “Extraversion” or “Sensation Seeking” might emerge as a primary dimension of personality.

<sup>2</sup> We note that we do not see this as a specific limitation of the Big Five model, but one simply beyond the scope of the taxonomic approach. Indeed, from a purely descriptive or “usefulness” standpoint, the level of rotation does not affect the amount of variance explained or the predictive ability of the model.

ance, Novelty Seeking, Reward Dependence, and Persistence. Dimensions of character were termed Self-Directedness, Cooperativeness, and Self-Transcendence.

Cloninger and colleagues (Cloninger, 1987; Cloninger et al., 1993) suggest that dimensions of temperament are heritable, largely determined by genetics, and are caused as a result of biases in information processing related to the implicit memory system. There has been much neuropsychological research on Cloninger et al.'s proposed basis of temperament, which tends to show links between Novelty Seeking and dopamine (e.g., Ebstein, Nemanov, Klotz, Gritsenko, & Belmaker, 1997; Keltikangas-Jarvinen, Raikkonen, Ekelund, & Peltonen, 2004; Strobel, Wehr, Michael, & Brock, 1999) and between Harm Avoidance and serotonin (e.g., Lesch et al., 1996; Osher, Hamer, & Benjamin, 2000). Furthermore, Novelty Seeking and Harm Avoidance are closely related to Gray's (1994) highly influential approach (BAS) and avoidance (BIS) systems, respectively. There is less evidence for the biological basis of Reward Dependence and Persistence, although a number of studies provide some support for the biological basis of these dimensions. For example, some studies found an association between Reward Dependence and norepinephrine (e.g., Ham, Choi, Lee, Kang, & Lee, 2005; Samochowiec et al., 2002), and there is some evidence that Persistence is heritable (Heath, Cloninger, & Martin, 1994).

Cloninger et al.'s major character traits, on the other hand, are said to be related to insight learning and are described as being shaped both by temperament and environmental factors (Cloninger et al., 1993). Some support for Cloninger et al.'s temperament/character dichotomy comes from research indicating that the perceptual and conceptual memory systems are distinct both functionally (Parkin, Reid, & Russo, 1990) and anatomically (Bachevalier, 1990; Phillips, Malamut, Bachevalier, & Mishkin, 1988).

Recent research has questioned Cloninger et al.'s (1993) dichotomy of personality into genetic and environmental traits (Ando et al., 2002, 2004; Gillespie, Cloninger, Heath, & Martin, 2003). This research has tended to find that both temperament and character have a common genetic basis (Ando et al., 2004). However, a careful consideration of Cloninger et al.'s original model reveals that the separation of personality into temperament and character was *not* a strict dichotomy of genetic and environmental influences. Cloninger et al. (1993, p. 978) state that "personality development is seen as an iterative epigenetic process in which heritable temperament [genetic] factors initially motivate insight learning of self-concepts [character]," and that "temperament and character development influence one another and motivate behavior." Clearly, therefore, Cloninger et al. were

not averse to the idea of a genetic component to character. Indeed, consistent with Cloninger et al.'s (1993) original theory, Ando et al. (2004) suggest that temperament and character are expressions of the same genes, but that character is mediated by adult socialization.

We argue that the study of leadership will benefit from employing Cloninger et al.'s biological, sociocognitive, and motivationally driven model of personality. Specifically, Cloninger et al.'s theory allows us to take an explanatory approach to the study of trait-based leadership. Importantly, it provides some insight into the underlying biological and cognitive mechanisms responsible for the association between personality traits and leadership. This richer understanding of the personality basis of leadership has potential unique implications in areas of leadership other than just prediction. As far as we know, Cloninger et al.'s model of personality is completely unknown in the broader organizational psychology literature as well as more specifically in leadership literature. There is consequently an important gap in the literature this study aims to fill.

In this study, the relationship between personality and emergent leadership is examined in a female sample. The general construct of leadership was studied via leader emergence, as this behavior represents an important construct on its own, it is amenable to an experimental design, and is predictive of long-term effective leadership (Foti & Hauenstein, 2007). This study follows an experimental design similar to that used by Zaccaro et al. (1991), in that emergent leadership is examined over a variety of different groups and tasks<sup>3</sup>. A number of different tasks were chosen so that the emergence of leaders in multiple situations would reflect leadership instead of task mastery. Groups of *only* females were studied in order to eliminate the effect that gender differences might have on the results.

There were three primary hypotheses: First, in accordance with what Zaccaro and colleagues found, it was predicted that a substantive portion of variance in leadership emergence would be trait based, which means that some people would likely emerge as leaders *regardless* of the specific situation or task. Second, it was hypothesized that both Cloninger et al.'s (1993) and the Big Five model would predict emergent leadership. Although the two models were not specifically compared, both models were used to predict leadership, and results from both models are presented. And finally, it was hypothesized that Cloninger et al.'s full model of personality (i.e., both temperament and character combined) would provide a significantly better fit<sup>4</sup> than both temperament and character submodels alone in the prediction of leadership emergence.

There were two further specific hypotheses focusing on

<sup>3</sup> Note that tasks used in this study were also based on those used by Zaccaro et al (1991).

<sup>4</sup> A good fitting model is preferable to a poor fitting model. Models analyzed in multilevel modeling are primarily assessed on the basis of model fit.

the relationship between dimensions from Cloninger et al.'s model and emergent leadership. These hypotheses flow logically from Cloninger's model but are also based on previous literature linking personality dimensions to specific outcomes. First, according to Cloninger's model (Cloninger 1987; Svrakic, Draganic, Hill, Bayon, & Przybeck, 2002), Harm Avoidance plays a role in the "fearful cluster" personality disorders, which by definition involve dysfunctional behaviors inconsistent with effective leadership. Similarly, in many clinical studies high levels of Harm Avoidance have been linked to psychopathology and lack of social effectiveness (e.g., Duijsens, Spinhovena, Goekoop, Spermond, & Eurelings-Bontekoea, 2000; Jylhä & Isometsä, 2006). Harm Avoidance has also been linked to low levels of character in psychometric studies (Duijsens et al., 2000; Hansenne, Delhez, & Cloninger, 2000; Jylhä & Isometsä, 2006; Pelissolo et al., 2005). As emergent leaders are defined as effective and trustworthy individuals, we predict that Harm Avoidance will be *negatively* associated with emergent leadership.

Second, Cooperativeness should also be a significant predictor of emergent leadership. Cooperativeness is defined as the extent to which individuals identify with others, and understand the need to work with other people (Cloninger et al., 1993). Thus, by definition, cooperative individuals share important characteristics with effective leaders. Furthermore, Cloninger et al. (1993) argue that Cooperativeness influences personal and social effectiveness. As emergent leaders possess the ability to exert social influence, it follows that socially effective individuals make good leaders. In addition, research demonstrated a direct link between Cooperativeness and leadership ability (Bass, 1990). It is therefore hypothesized that Cooperativeness will be a significant, positive predictor of emergent leadership.

No further specific hypotheses between emergent leadership and Cloninger et al.'s dimensions have been proposed. Although it is possible that other dimensions from Cloninger et al.'s model are predictive of leadership, we are primarily interested in the relationship between personality *models* and emergent leadership. The hypotheses specified above represent, in our opinion, the two scales from Cloninger et al.'s model *most likely* to be predictive of emergent leadership.

## Method

### Participants

Participants were 81 female part-time workers in tertiary education. They were enrolled in an Introductory Psychology course, though approximately half were not psychology students. Participants lived in Queensland, Australia, and most worked in the service industry (54%). Most participants were aged between 17 and 22 (87%), a few were aged between 23 and 30 (11%), and one person was older

than 30 (< 1%). Nine participants took part in each experimental session.

### Design

This experiment utilized a "rotational" design, whereby the nine participants present at each experimental session randomly rotated through four tasks. Rotation was used to ensure that no participant was in the same group twice. The dependent variable was peer ratings of leadership emergence. Variables used as predictors of leadership emergence included personality dimensions as defined by Cloninger et al.'s (1993) model and the Big Five.

### Tasks

The tasks used in this study measured four leader behaviors identified by the Leader Behavior Description Questionnaire (LBDQ; Stogdill, 1963). These include initiating structure, consideration, persuasion, and production emphasis. Specific tasks were based on those used by Zaccaro et al. (1991) in a similar rotational leadership experiment. Zaccaro et al. (1991) found these tasks to be valid measures of respective leader behaviors.

The first task was titled "the manufacturing game" (Zaccaro et al., 1991) and was designed to measure initiating structure. In this game, participants were given the task of running a simulated toy factory. To be successful in this task, participants needed to allocate tasks, purchase enough "raw materials" to make a sufficient amount of toys, and then sell the toys to a hypothetical buyer at a profit.

The second task was designed to reveal leaders high in consideration. Participants were requested to suggest possible solutions to the following question: "How best could a small school accommodate disabled children?" To perform well in this task, participants needed to behave pleasantly to all group members, listen openly to all suggestions, and put forward suggestions of their own.

In the third task, group members were given three sets of newspaper articles. This task was designed to reveal persuasive leaders. Participants were instructed to think of possible headlines for the articles and then discuss these with the group. The groups' ultimate task was to decide on a single headline for each article. To perform well in this task, participants needed to be persuasive in a nonthreatening and nonaggressive manner.

The final task was designed to measure "production emphasis." Groups were required to complete as many small puzzles as possible in a limited time. The groups were given a difficult, yet achievable, performance goal. To be rated as effective leaders in this task, participants needed to primarily focus on the task at hand and work well with other group members. Thus, each task required that participants behave differently if they were to receive positive leadership ratings. Each task was 10 minutes in duration.

## Measures

### Leadership Emergence

Participants rated each other on "leadership emergence" using the GLI (General Leadership Impression scale, five items, Lord, Foti, & de Vader, 1984). This scale has been used in other studies of emergent leadership (e.g., Cronshaw & Lord, 1987; Kellett, Humphrey, & Sleeth, 2002; Zaccaro et al., 1991). An example item from this scale is as follows: "How much did this individual exhibit leadership?" Participants responded to this questionnaire on a 5-point rating scale ranging from *very much* to *not at all*.

### The Big Five

The Big Five factors of personality were measured using the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991). This questionnaire measures the Big Five personality scales on a 44-item Likert-type scale. Scales have been shown to have good internal reliabilities (ranging from 0.75 to 0.88) and good concurrent validity (John et al., 1991).

### Temperament and Character

Cloninger et al.'s (1993) scales of personality were measured using the Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic, & Wetzel, 1994). There are four scales of temperament (Harm Avoidance, Novelty Seeking, Persistence, Reward Dependence) and three scales of character (Self-Directedness, Cooperativeness, Self-Transcendence). Harm Avoidance reflects the extent to which people respond intensely to aversive stimuli; individuals high in Harm Avoidance can be described as anxious and fearful. Novelty Seeking is thought to underlie reward driven and impulsive behavior; those high in Novelty Seeking are often extraverted and highly active. Cloninger's third temperament dimension, Persistence, reflects the tendency to continue regardless of frustration, dissatisfaction or fatigue, and his fourth temperament dimension, Reward Dependence, is best described as the inclination to aggressively seek out rewards and positive reinforcement. Self-Directedness is a dimension of character, defined largely by goal orientation and resourcefulness. Cooperativeness, the second dimension of character, reflects the extent to which individuals relate to others, and recognize the need to work with other people. Finally, Self-Transcendence represents the spiritual component of personality and can be described as the extent to which individuals are transpersonal, spiritual, and idealistic.

The TCI uses a true/false type rating scale and consists of 226 items. Internal consistency for the seven scales is

adequate (ranges from 0.65 to 0.89, Cloninger et al., 1994). Concurrent and construct validity of the TCI have been widely established (e.g., Cloninger et al., 1994; Griego, Stewart, & Coolidge, 1999; Whiteside & Lynam, 2001). This questionnaire, or earlier versions, have been used in studies that investigate the biological basis of personality (e.g., Ebstein et al., 1997; Keltikangas-Jarvinen et al., 2004). These studies have linked specific traits (particularly Novelty Seeking and Harm Avoidance) measured by the TCI to neurobiological mechanisms. This supports the operationalization of these constructs. Furthermore, the TCI is the standard and recommended method for measuring Cloninger et al.'s conceptualization of temperament and character (Cloninger et al., 1994).

### Procedure

Upon arrival at each testing session, participants were given one sticky label containing a number between 1 and 9. Participants were asked to stick this label onto their clothing so that it could be viewed by other participants (this allowed participants to be rated without the use of names). Participants were then broken up into three groups of three, and depending on their number, instructed to partake in one of the four tasks. The order of tasks was counterbalanced over the different sessions.

After each task, participants were given a short questionnaire, which required them to rate their group members on emergent leadership (using the GLI). Participants were given approximately 5 minutes to complete this questionnaire. Once all participants had completed all tasks and associated questionnaires, they were seated individually and administered the TCI and BFI.

### Data Structure and Analysis

Data for this experiment consist of 648 ratings of emergent leadership (i.e., 81 participants by four situations by two external ratings). This study incorporated a repeated measures design and used multiple raters; therefore variance in the dependent variable (Leadership Emergence) theoretically constitutes variance from different sources. These sources include individual differences in those being rated (i.e., consistent, non task-specific differences between participants); differences in the situation/task (i.e., between-participant variability in task specific competence); differences in the *rater* (i.e., rater-specific response tendencies), and remaining error. Thus, data comprise a *nested* structure, as individual ratings of emergent leadership are nested in raters, situations and ratees (participants)<sup>5</sup>. For this reason, hypotheses were tested using a multilevel modeling frame-

<sup>5</sup> Theoretically our data could be conceptualized as having a crossover structure, with "rater" introduced as a level 3 variable. However, since "rater" is completely independent from the IV (personality traits of participants being rated), there is no reason to do so.

Table 1. Means, standard deviations,  $\alpha$ s and correlations among the personality scales

	Mean	SD	$\alpha$	E	A	C	N	O	HA	RD	SD	C	ST	P
Extraversion (E)	3.57	0.78	0.89											
Agreeableness (A)	3.97	0.55	0.77	0.08										
Conscientiousness (C)	3.59	0.71	0.84	-0.05	0.44**									
Neuroticism (N)	2.89	0.78	0.81	-0.14	-0.45**	-0.34**								
Openness (O)	3.62	0.64	0.73	0.33**	0.16	0.02	-0.12							
Harm Avoidance (HA)	0.31	0.20	0.80	-0.43**	-0.26*	-0.18	0.58**	-0.11						
Reward Dependence (RD)	0.66	0.27	0.65	0.42**	0.17	-0.07	0.12	0.24*	-0.19					
Self Directedness (SD)	0.70	0.19	0.84	0.12	0.42**	0.51**	-0.50**	0.04	-0.48**	-0.05				
Cooperativeness (C)	0.82	0.16	0.79	0.11	0.56**	0.26*	-0.45**	0.01	-0.34**	0.23*	0.54**			
Self Transcendence (ST)	0.46	0.26	0.88	0.30*	0.17	-0.04	-0.01	0.37**	-0.18	0.22	-0.02	-0.09		
Persistence (P)	0.59	0.39	0.72	0.15	0.17	0.57**	-0.19	0.22*	0.17	0.00	0.38**	0.16	0.23*	
Novelty Seeking (NS)	0.57	0.23	0.80	0.46**	-0.11	-0.36	-0.14	0.23*	-0.25*	0.22	-0.13	0.09	0.06	-0.23*

\* indicates significance at  $p < .05$ , \*\* indicates significance at  $p < .01$ .

work (MLWin, Version 1.2). Multilevel modeling is a statistical technique that allows researchers to accurately analyse data with a nested structure (see Gelman & Hill, 2007, for a detailed overview of multilevel analysis). Importantly, this technique allows for more accurate partitioning of variance and parameter estimation than multiple regression and factor analysis when analyzing data with a nested structure.

Stable individual differences in the ratee was a level 3 (highest level of prediction) predictor as it remained constant over situation and rater. Differences in situation was a level 2 predictor as it varied over ratees but remained constant over raters. Differences in the rater was a level one predictor as ratings could potentially vary over both ratee and situation (i.e., there were two peer ratings for each subject in each situation).

When evaluating multilevel models, one places the focus on what is referred to as the "deviance statistic," which represents lack of fit between the model and the data (Snijders & Bosker, 1999) and is used to compare different models fitted to the same data set. It is minus twice the natural logarithm of the likelihood statistic. In multilevel modeling there is no straightforward equivalent of  $R^2$ . Models were assessed according to Hox's (1995) five-step procedure for testing and comparing multilevel models. The first step involves computing the deviance statistic for the null model (i.e., the model including only the intercept); the second step involves computing the deviance statistic for the nested model (i.e., the model including the predictors, in this case personality scales), and the third step involves using a  $\chi^2$  difference test to compare the fit of the models, based on the deviance statistic and number of parameters in each model (Hox, 1995). The 4th and 5th steps involve modifying the nested models by adding and subtracting predictors in order to reduce model complexity without significantly affecting fit. As the primary purpose of this study was to

test the association between existing personality models and Emergent Leadership, complex model modification based on fit was not carried out.

## Results

Means, standard deviations, alphas, and correlations among personality measures are summarized in Table 1. Because of the structure of our data, no measure of interrater reliability could be calculated. However, to give some indication of the extent to which rater's evaluations of participants were consistent in each situation, we calculated a correlation of rating 1 with rating 2 over all rating situations. This correlation was found to be significant,  $r(324) = 0.41$ ,  $p < .001$ .

Correlations between personality dimensions and leadership ratings within each level of situation are summarized in Table 2, which indicates that the relationship between personality and leadership was at least somewhat dependent on the different situations. For example, Cooperativeness was significantly correlated with leadership ratings in tasks 1 and 3 but was not significantly correlated with leadership ratings in tasks 2 and 4.

To test hypothesis 1, we conducted a multilevel analysis to assess whether a significant portion of variance in leadership emergence was trait based. The results of this analysis are summarized in Table 3. As can be seen in this table, the null model (i.e., the model with no predictors) revealed a significant level 3 effect of "person" on individual ratings ( $B = 2.35$ ,  $SE = 0.55$ ,  $p < .05$ ), indicating that some people were more likely to emerge as leaders than others, regardless of the situation (i.e., trait-based variance). This provided support for hypothesis 1. Although not as strong, a significant effect of

<sup>6</sup> Methods for calculating analogs to  $R^2$  in multilevel modeling have been developed (e.g., Snijders & Bosker, 1999) however none are widely used.

Table 2. Correlations between personality scales and Emergent Leadership ratings over the four situations

	Initiating structure	Consideration	Persuasion	Production emphasis
Extraversion	0.12	0.25*	0.22	0.23*
Agreeableness	0.12	0.06	0.24*	0.09
Conscientiousness	-0.04	0.11	0.00	0.08
Neuroticism	-0.13	-0.10	-0.14	-0.19
Openness	0.02	0.22	0.30*	0.11
Harm Avoidance	-.26*	-0.27*	-0.21	-0.14
Reward Dependence	-0.10	-0.07	-0.06	0.00
Self Directedness	0.13	0.06	0.00	0.21
Cooperativeness	0.31*	0.12	0.31*	0.16
Self Transcendence	-0.20	0.03	0.09	0.03
Persistence	-0.15	0.08	-0.05	0.10
Novelty Seeking	0.11	0.00	0.15	0.01

\* indicates significance at  $p < .05$ .

Table 3. A multilevel analysis of the relationship between personality, situation and leadership emergence. Personality dimensions from the BFI are included as fixed predictors

Parameter	Null model	Partial model	Complete model
Five factor model			
Fixed			
Intercept	15.04 (0.21)***	12.98 (0.94)***	13.65 (2.65)***
Extraversion		0.58 (0.26)**	0.49 (0.27)
Openness			0.33 (0.45)
Conscientiousness			-0.27 (0.33)
Agreeableness			0.40 (0.30)
Neuroticism			-0.13 (0.34)
Random			
Person	2.35 (0.55)**	2.13 (0.52)**	1.97 (0.49)**
Task/situation	0.90 (0.41)*	0.91 (0.41)**	0.91 (0.41)**
Log-likelihood	<b>2465.55</b>	<b>2459.36</b>	<b>2456.97</b>

\*\*significance at  $p < .05$ ; \*\*\*significance at  $p < .01$ .

situation was also found ( $B = 0.90$ ,  $SE = 0.41$ ,  $p < .05$ ), which indicated that some participants were more likely to emerge as leaders in some situations than others (i.e., situation-based variance). To obtain estimates of the variance accounted for by the random effects (person, task, and rater), we calculated intraclass correlation coefficients (Bliese, 2000). Person (i.e., individual differences factors) explained approximately 13% of the variance in leadership ratings, task explained approximately 5% of the variance in leadership ratings, and rater explained 82% of the variance in leadership ratings. Such results indicate the importance of the multilevel approach and of the need to explain the variance at different levels of the model.

To test hypothesis two, we used the two models of personality to explain the level 3 (trait based) variance in leadership emergence. Again this analysis was conducted using multilevel modeling; the summary statistics from these two analyses are included in Table 3 and Table 4. A  $\chi^2$  difference test was conducted to determine whether the inclusion

of personality scales significantly improved fit from the null model. For Cloninger's psychobiological model, the inclusion of level 3 predictors significantly improved fit ( $\chi^2 = 17.56$ ,  $p(7) < .05$ ). However, inclusion of the Big Five level 3 predictors did not significantly improve fit ( $\chi^2 = 8.58$ ,  $p(5) > .10$ ).

In order to test hypothesis 3, we once again used multilevel modeling to determine whether the 3 character dimensions of personality collectively provided incremental validity over the four temperament dimensions. Results of this analysis are summarized in Table 5. As can be seen in this table, both temperament ( $\chi^2 = 10.76$ ,  $p(4) < .05$ ) and character ( $\chi^2 = 10.8$ ,  $p(3) < .05$ ) level 3 predictors alone provided a better fit than the null model. And, importantly, in terms of the hypothesis, the complete model, including both temperament and character dimensions, was a better fit than the temperament sub-model alone ( $-2 \log \text{likelihood} = 2454.7$  for the temperament sub model, versus 2447.99 for the complete model). When tested for significance, this effect was significant at  $p < .1$  ( $\chi^2$

**Table 4.** A multilevel analysis of the relationship between personality, situation and leadership emergence. Personality dimensions from the TCI are included as fixed predictors

Parameter	Null model	Partial model	Complete model
Fixed			
Intercept	15.04 (0.21)***	16.02 (0.37)***	13.82 (1.68)***
Harm Avoidance		-3.24 (1.03)**	-2.32 (1.22)*
Novelty Seeking			0.57 (0.93)
Reward Dependence			1.11 (0.80)
Persistence			0.17 (0.57)
Self Directedness			1.15 (1.41)
Cooperation			3.73 (1.52)**
Self Transcendence			0.00 (0.85)
Random			
Person	2.35 (0.55)**	2.04 (0.50)**	1.75 (0.46)**
Task/situation	0.90 (0.41)**	0.89 (0.41)**	0.88 (0.41)**
Log-likelihood	<b>2465.55</b>	<b>2456.03</b>	<b>2447.99</b>

\*significance at  $p < .10$ ; \*\*significance at  $p < .05$ ; \*\*\*significance at  $p < .01$ .

**Table 5.** Comparison of TCI sub models with the complete TCI model

Parameter	Temperament	Character	Complete Model
Psychobiological model			
Fixed			
Intercept	16.17 (0.89)**	11.62 (1.24)***	13.82 (1.68)***
Harm Avoidance	-3.00 (1.06)**		-2.32 (1.22)*
Novelty Seeking	0.62 (0.97)		0.57 (0.93)
Reward Dependence	-0.97 (0.77)		1.11 (0.80)
Persistence	0.15 (0.55)		0.17 (0.57)
Self Directedness		0.20 (1.30)	1.15 (1.41)
Cooperation		4.13 (1.51)**	3.73 (1.52)**
Self Transcendence		-0.26 (0.75)	0.00 (0.85)
Random			
Subject	1.99 (0.49)**	1.95 (0.49)**	1.75 (0.46)**
Task/situation	0.88 (0.41)**	0.89 (0.41)**	0.88 (0.41)**
Log-likelihood	<b>2454.79</b>	<b>2454.75</b>	<b>2447.99</b>

\*significance at  $p < .10$ , \*\*significance at  $p < .05$ , \*\*\*significance at  $p < .01$ .

= 6.8  $p(3) < .1$ ) but not at  $p < .05$ . This finding provides some support for the utility of the full psychobiological model in the area of leadership research.

In accordance with Hox's (1995) recommendations for assessing multilevel models, individual level 3 predictors were then assessed for significance using the Wald statistic. As can be seen in Table 3, the model incorporating the Big Five dimensions of personality did not contain any significant unique predictors of leadership emergence. When a partial model was tested using only Extraversion as a predictor, it was found to be significant ( $B = 0.58$ ,  $S. E. = 0.26$ ,  $p < .05$ ). As can be seen in Table 4, when the model incorporating dimensions of temperament and character was assessed (hypotheses 4 and 5), Cooperativeness emerged as a significant unique predictor of leadership emergence ( $B = 3.73$ ,  $S. E. = 1.52$ ,  $p < .05$ ). When a partial model was

tested using only Harm Avoidance as a predictor, it was found to be significant ( $B = -3.24$ ,  $S. E. = 1.03$ ,  $p < .05$ ). Harm Avoidance however, was not uniquely significant when all dimensions of temperament and character were included as predictors. Please refer to Appendix A for the complete equations for each of the analyses described in this section.

## Discussion

This study provides a test of Cloninger et al.'s (1993) model of personality in the area of leader emergence. There were five hypotheses. First, it was hypothesized that leadership emergence would have some basis in individual differenc-

es. The results of the multilevel analysis provide support for hypothesis one, indicating that a significant portion of variance in leadership emergence is due to some stable characteristics of individuals. Although not as dramatic, this finding replicates the research by Zaccaro et al. (1991) and provides further evidence for the role of individual differences in the prediction of leadership emergence. The situation was also found to significantly affect leader emergence, although the results indicated that the effect of situation was not as strong as the effect of person (5% vs. 13%).

It was expected that the inclusion of personality scales (from both the Big Five and psychobiological models) would significantly improve the fit of the null model. In partial support for hypothesis 2, it was found that inclusion of personality scales from the psychobiological model significantly improved fit of the null model. The third hypothesis stated that Cloninger et al.'s full model of personality (i.e., both temperament and character) would be required to maximally explain the trait-based variance in leadership emergence. In partial support of this hypothesis, it was found that the three dimensions of character collectively provided incremental predictive validity over the four temperament dimensions (at  $p < .10$ ). This finding suggests that the full 7-factor model is required to maximally explain person based variance in leader emergence. Indeed, clinical research also tends to suggest that character dimensions have incremental validity over the four temperament dimensions (e.g., Daneluzzo, Stratta, & Rossi, 2005; Ha, Kim, Abbey, & Kim, 2007). Hypothesis 4 was supported, as Harm Avoidance was a significant (though not unique) predictor of emergent leadership. Finally, in support of hypothesis 5, Cooperativeness could uniquely explain variance in leader emergence (at  $p < .05$ ).

Results were broadly consistent with findings by Judge et al. (2002), as three of the Big Five personality dimensions were significantly correlated with leadership ratings in at least one situation. Results were also consistent with Zaccaro et al. (1991), as trait-based variance was found to be more important than situation-based variance in the prediction of leader emergence.

## Theoretical Implications

The primary implication of this study is that Cloninger et al.'s (1993) psychobiological model of personality can explain some trait-based variance in leadership emergence. It seems that the psychobiological model is comparable with the Big Five model in its ability to predict emergent leadership. In terms of Cloninger et al.'s dimensions of personality, Harm Avoidance (partial model) and Cooperativeness (full model) were found to uniquely predict emergent leadership. In terms of the Big Five model, Extraversion (partial model) could uniquely predict emergent leadership.

As outlined previously, one advantage of explanatory models is their focus on the role of biological and socio-

cognitive mechanisms in the explanation of personality traits. In the area of leadership, this focus can help us to understand *why* some people are more likely to emerge as leaders than others. This builds on a purely descriptive approach which has previously found to have excellent predictive validity.

One consistent finding from research on Cloninger et al.'s model is the link between Harm Avoidance and serotonin. In this study, we found that Harm Avoidance is associated with emergent leadership. Thus, it is plausible that serotonin represents a biological basis for the trait-based variance in emergent leadership. Indeed serotonin has also been linked to the taxonomic Big Five dimension Extraversion (Gillihan, Farah, Sankoorikal, Breland, & Brodtkin, 2007). The association of serotonin with both Harm Avoidance and (low) Extraversion makes sense, as statistically Harm Avoidance and Extraversion are overlapping constructs (Harm Avoidance and Extraversion are significantly correlated at  $-0.43$  in this study, and at  $-0.57$  in DeFruyt, De Wiele, & Van Heeringen, 2000). Thus, our results *imply* some biological trait-based variance in emergent leadership. We note however, that serotonin was not directly measured in this study.

In this study, Cooperativeness was found to be a unique predictor of emergent leadership. Unlike Harm Avoidance, Cloninger did not suggest a biological basis for Cooperativeness. Instead, Cloninger et al. (1993) argued that the development character was influenced by environmental factors *and* temperament dimensions. Importantly, Cloninger argued that character dimensions mature over the lifetime, and that the development of character is largely experiential. Indeed Cooperativeness is correlated with age (Cloninger et al., 1994), and recent research on the genetic basis of temperament and character is consistent with the idea that character development is mediated by adult socialization (Ando et al., 2004). Thus, we suggest that personality affects emergent leadership not just via biological mechanisms, but also via sociocognitive pathways. Specifically, our results are consistent with the idea that mature levels of Cooperativeness, are important for emergent leadership.

## Future Research

One potential extension of this research is the application of Cloninger et al.'s model to leadership development and training programs. In this study, it was revealed that Cooperativeness is an important character scale in the prediction of leader emergence. Because Cooperativeness theoretically matures as a result of learning and experience (Ando et al., 2004; Cloninger et al., 1993), it makes sense to partially focus on the development of Cooperativeness in leadership training programs. We suggest that future research assess leadership training programs that involve experientially based Cooperativeness training. Similarly, we suggest that future research more thoroughly assess the potential sero-

tonin-emergent leadership relationship. Indeed, if serotonin is associated with emergent leadership, it would indicate that some people have a biological predisposition to become leaders. Again this finding would have implications on leader development and training.

## Strengths and Limitations

One strength of this study was the rigorous experimental design utilized in order to effectively measure emergent leadership. Participants in this study took part in four different tasks, and completed each task with a different group. This ensured that the emergence of leaders in multiple situations was not merely the result of context mastery, but more likely the result of some intrinsic leadership ability. A second strength was the analytical approach employed in this study. Multilevel analysis allows for more accurate parameter estimation and significance testing than techniques that do not partition variance into levels of analysis, such as factor analysis and standard multiple regression.

In this study a highly specific sample was used (female workers in tertiary education). Restricting the sample to females was necessary in this study, as it is likely that prominent gender differences would have overshadowed the more subtle effect of personality in the emergence of leaders. In addition, while not a primary aim of this study, the focus on a female-only sample has the potential of highlighting qualities of female leaders that are gender specific. For example, Harm Avoidance (a trait similar to Anxiety) was revealed as being a negative predictor of leader emergence. Because Anxiety has not consistently emerged as a unique predictor of leadership in other studies (Judge et al., 2002), this finding may be specific to female-only samples. Further research could more fully investigate the relationship between personality and Emergent Leadership in female only samples.

## Conclusion

Support was found for the utility of Cloninger et al.'s model in the prediction of leader emergence. The psychobiological model was found to explain variance in leadership emergence, and Harm Avoidance and Cooperativeness were found to be important predictors of leadership emergence. Finally, in terms of the temperament/character dichotomy proposed by Cloninger et al. (1993), it appears that the entire model is necessary to maximally explain the trait-based variance in leader emergence.

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## Appendix A

### Equations

#### 1. Partial Big Five Model

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + \beta_{\text{extraversion}}_{\text{participant}} + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + 0.58 (0.26) \text{extraversion}_{\text{participant}}$$

$$\beta_0_{\text{rater, task, participant}} = 12.98 (0.94) + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$[v_{0\text{participant}}] = [2.13 (0.52)]$$

$$[u_{0\text{task, participant}}] = [0.91 (0.41)]$$

$$[e_{0\text{rater, task, subjno}}] = [4.83 (0.43)]$$

#### 2. Complete Big Five Model

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + \beta_{\text{extraversion}}_{\text{participant}} + \beta_{\text{agreeableness}}_{\text{participant}} + \beta_{\text{conscientiousness}}_{\text{participant}} + \beta_{\text{neuroticism}}_{\text{participant}} + \beta_{\text{openness}}_{\text{participant}} + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + 0.49 (0.27) \text{extraversion}_{\text{participant}} + 0.40 (0.30) \text{agreeableness}_{\text{participant}} + -0.27 (0.33) \text{conscientiousness}_{\text{participant}} + -0.13 \text{neuroticism}_{\text{participant}} + 0.33 (0.45) \text{openness}_{\text{participant}}$$

$$\beta_0_{\text{rater, task, participant}} = 13.65 (2.65) + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$[v_{0\text{participant}}] = [1.97 (0.49)]$$

$$[u_{0\text{task, participant}}] = [0.91 (0.41)]$$

$$[e_{0\text{rater, task, subjno}}] = [4.83 (0.43)]$$

#### 3. Partial TCI Model

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + \beta_{\text{Harm Avoidance}}_{\text{participant}} + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + -3.24 (1.03) \text{Harm Avoidance}_{\text{participant}}$$

$$\beta_0_{\text{rater, task, participant}} = 16.02 (0.37) + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$[v_{0\text{participant}}] = [2.04 (0.50)]$$

$$[u_{0\text{task, participant}}] = [0.89 (0.41)]$$

$$[e_{0\text{rater, task, subjno}}] = [4.81 (0.43)]$$

#### 4. Full TCI Model

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + \beta_{\text{Harm Avoidance}}_{\text{participant}} + \beta_{\text{Novelty Seeking}}_{\text{participant}} + \beta_{\text{Reward Dependence}}_{\text{participant}} + \beta_{\text{Persistence}}_{\text{participant}} + \beta_{\text{Self Directedness}}_{\text{participant}} + \beta_{\text{Cooperativeness}}_{\text{participant}} + \beta_{\text{Self Transcendence}}_{\text{participant}} + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$\text{Peer Ratings}_{\text{rater, task, participant}} = \beta_0_{\text{rater, task, participant}} \text{const} + -2.32 (1.22) \text{Harm Avoidance}_{\text{participant}} + 0.57 (0.93) \text{Novelty Seeking}_{\text{participant}} + 1.11 (0.80) \text{Reward Dependence}_{\text{participant}} + 0.17 (0.57) \text{Persistence}_{\text{participant}} + 1.15 (1.41) \text{Self Directedness}_{\text{participant}} + 3.73 (1.52) \text{Cooperativeness}_{\text{participant}} + 0.00 (0.85) \text{Self Transcendence}_{\text{participant}}$$

$$\beta_0_{\text{rater, task, participant}} = 13.82 (1.68) + v_{0\text{participant}} + u_{0\text{task, participant}} + e_{0\text{rater, task, subjno}}$$

$$[v_{0\text{participant}}] = [1.75 (0.46)]$$

$$[u_{0\text{task, participant}}] = [0.88 (0.41)]$$

$$[e_{0\text{rater, task, subjno}}] = [4.86 (0.44)]$$