Working in Harmony: The Impact of Personality on the Short- and Long-Run

Dynamics of Team Cohesion

Bryan P. Acton

Roseanne J. Foti, Chair
Michael T. Braun
Daniel J. Beal

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ABSTRACT

Team cohesion represents arguably the most studied team construct as it has been consistently shown to be associated with improved performance. However, although cohesion is now understood to be an emergent state—as it develops over a team's life cycle—research has yet to uncover the dynamic nature of cohesion. The current study was designed to particularly test the impact of team personality composition both on the initial status of cohesion, and on changes in cohesion over time. 80 Newly formed teams performed a highly interdependent team task, and team cohesion was measured over six time points. Personality was measured prior to the task and calculated at the team level, as both an average and a variability score. After performing longitudinal hierarchical linear modeling, results indicated that team personality impacts cohesion differently at initial status and over time.  In particular, higher team agreeableness predicted greater slopes of cohesion, but not initial cohesion levels.  Also, higher extraversion predicted greater initial status of cohesion, but not greater slopes.  These results present important boundary conditions for understanding the role of team personality composition on team cohesion.

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**Introduction**

Although the study of teams has existed for well over a century (Mathieu, Maynard, Rapp, & Gilson, 2008), the importance of this research area recently has grown as a result of teams becoming the focal point in the modern day organization (Kozlowski & Ilgen, 2006). Furthermore, teams have an impact in a wide variety of situations, including those involving high stakes. Flight crews, emergency medical teams, and surgical teams are examples of teams that are expected to perform in these intense environments immediately after inception. Uncovering the components of an effective team has become imperative in the organizational sciences and beyond.

There has been substantial progress in the search to uncover the components of effective teams over the past fifty years. Marks, Mathieu, and Zaccaro (2001) sparked this growth by introducing the distinction of team processes versus "emergent states." This work described teams as encompassing collective cognitive, emotional, and affective states. According to Kozlowski and Klein (2000), these states begin as individual characteristics and *emerge* as a higher phenomenon through the individual interactions on the team.  Team cohesion represents the most widely studied emergent state, as it has continuously been shown to have a positive relationship with team performance (Beal, Cohen, Burke, & McLendon, 2003; Evans & Dion, 1991; Gully, Devine, & Whitney, 2012).

Although cohesion has been identified as a critical factor to a team's effectiveness, little is known about the antecedents that impact teams' levels of emergence over time. As a team often includes members with a diverse set of knowledge, skills, abilities, and other characteristics (Kozlowski & Ilgen, 2006; Salas, Rosen, Burke, & Goodwin, 2009), research is frequently conducted to understand how these characteristics of individual team members influence emergent states like cohesion (Barrick, Stewart, Neubert, & Mount, 1998; Bell, 2007). Findings have illustrated that both surface-level (e.g. sex, race) and deep-level (e.g. personality, self-efficacy) compositional variables have a significant impact on levels of team cohesion (Grossman, 2014; Williams & O'Reilly, 1998).

Although compositional variables have been shown to impact team cohesion, much of this research relies on static designs, often studying cohesion in existing teams at a single time point (Carron & Brawley, 2000; Drescher, Burlingame, & Fuhriman, 2012; Kozlowski, 2015). Emergent states are the result of self-reinforcing, micro-level interactions that occur between individual team members over time (Kozlowski & Klein, 2000). To understand how team composition affects the levels of emergent states like cohesion, studies must aim to capture this process dynamically, starting from the team's original formation. Studies have recently begun to study cohesion longitudinally (e.g., Mathieu, Kukenberger, & D'Innocenzo, 2015), but few examine this process of emergence from the beginning of a team's life cycle. As emergent states such as cohesion are shaped through the individual interactions among team members, it is expected that the pattern of members' individual differences (e.g. team with many extraverts) are critical in determining levels of emergent states both after initial impressions and over the life cycle of the team. It is thus imperative to study the effect of team composition on team dynamics both after initial formation and over the course of a team's life cycle.

While studying teams over multiple time points is essential to capturing the process of emergence, having only a few time points may not be sufficient. Following theory on emergent phenomena (Kozlowski et al., 1999) and impression formation (Denrell, 2005), the early interactions among team members are crucial in determining longer-term team outcomes. Accordingly, in discussing how to study these types of dynamic phenomena, many have advocated for the use of research designs consisting of frequent measurement occasions, over short periods of time, immediately after a team forms (Dormann & Griffin, 2015; Kozlowski, 2015). Thus, in addition to studying emergent phenomena dynamically over a team's life cycle, it remains essential to study this process at its most critical moments, through frequent measurements.

This study will begin to address these gaps by studying the impact of personality team compositional patterns on levels of cohesion after initial impressions as well as over the course of a team's short-term development. More specifically, I will evaluate how team personality—

expressed as both mean and variance—impacts levels of cohesion on newly formed teams, both immediately after a team forms, as well as over the course of their early development. Not only will I study the impact of time on levels of team cohesion, but I will also focus on the effect of team personality composition in this dynamic process. I will finish by discussing both the applied and theoretical impact of the reported findings.

## Literature Review

### Team Cohesion

Before further explaining the underlying social processes that occur within teams, it is important to define a team using the lens of organizational science. Teams are generally defined as two or more individuals who socially interact, have common goals, perform related task functions in which they exhibit task interdependencies, and are embedded within a larger organizational context (Kozlowski, Gully, Nason, & Smith 1999; Kozlowski & Illgen, 2006; Salas et al., 2009). Teams can exist in numerous forms and in a variety of different contexts. Some of the categorizations include newly formed (ad hoc) teams as opposed to previously existing teams, high-skilled as opposed to low-skilled teams, and structured as opposed to unstructured teams (i.e. Self-Managed Teams; Kozlowski, et al., 1999). Within the study of teams, researchers have been particularly interested in ad hoc teams, as they can be used to study the dynamic social phenomena that occur as a team develops, although the majority of team dynamics research has used previously existing teams (Dion, 2000).

Since organizational scientists have been interested in the components of an effective organization, they have looked for the components of an effective team (Dion, 2000; Hackman, 1987). Early theorists such as Kurt Lewin began to develop a possible answer to this important question by identifying what he called a "field of forces," which has significant impact on group behavior (Marrow, 1969). Lewin and his colleagues labeled this construct cohesion and it soon became the central focus in the new field of group dynamics (Dion, 2000). Lewin's student, Leon Festinger, developed three primary components of group cohesion: interpersonal attraction, task

commitment, and group pride (Festinger, 1950). Both the definition and measurement of cohesion

has continued to shift over time, but these three components tend to remain in all

conceptualizations of cohesion. A current agreed upon definition of cohesion is: a team member's

attraction and commitment to their team task and team members (Greer, 2012; LePine, Piccolo,

Jackson, Mathieu, & Saul, 2008). Since Festinger's original conceptualization of cohesion,

researchers have identified two unique types of cohesion that exist within the overall concept:

social and task cohesion. The former represents attractiveness to the group and the latter represents

shared vision in relation to the teams goals, held across team members (Dion, 2000).

Teams are currently viewed using McGrath's I-P-O model (Hackman, 1987; McGrath,

1964), which describes team dynamics as a set of inputs, processes, and outputs. Inputs are

environmental characteristics or characteristics of the team (e.g. mental ability of team members).

These inputs come together at the team level through team processes (e.g. coordination) and result

in team-level outcomes (e.g. team performance). When originally introduced, team cohesion was

viewed as an outcome of team process—simply a consequence of teams working together.

However, the study of cohesion took a leap forward as a result of Marks, Matthews, and Zaccaro's

(2001) identification of team emergent states. Instead of being grouped with team processes such

as coordination and communication, team cohesion now is viewed as dynamic in nature and as a

function of context (Marks et al., 2001). Under this view, cohesion is able to serve both as an input

and an output. For example, recent research has shown that team performance at time 1 positively

relates to cohesion at time 2. Subsequently, levels of cohesion at time 2 positively relate to

performance as time 3, supporting Marks et al.'s dynamic framework (Mathieu et al., 2015). The I-

P-O model has since been expanded to the I-M-O-I model (Ilgen, Hollenbeck, Johnson, & Jundt,

2005), recognizing our modern understanding of teams as inherently "dynamic, emergent, and

adaptive entities" (Kozlowski & Ilgen, 2006, p.78).

Following these important developments within the area of team dynamics, researchers

have focused on team cohesion as the primary emergent state of interest. Multiple meta-analyses

(Beal et al., 2003; Evans & Dion, 1991; Gully, Devine & Whitney, 1995) provide strong support for the claim that team cohesion is an important predictor of team performance. Teams that are more cohesive have been shown to perform better, though this relationship does change as a result of certain moderating variables. Cohesion plays a much larger role in a team's performance when the team's task is interdependent and cohesion has a stronger relationship to performance when performance is measured as a behavior than a self-reported outcome (Beal et al., 2003). Nevertheless, it is now clear that increasing levels of cohesion should be a primary objective in teams if the end goal is to improve team performance. However, while the importance of this emergent state is understood, research has yet to look at the factors that impact levels of cohesion as it begins to emerge on the team.

**Team Emergent States**

Scholars have long attempted to discover the processes that occur within complex social phenomena such as teams (Hackman, 1987; Kozlowski & Illgen, 2006). Katz and Kahn's (1966; 1978) role theory represents a seminal work within this area of research. This theory describes organizations as social systems that are constantly developing through individual interactions of employees. During this process, each individual goes through a period of "organizational sense making" (Maitlis, 2005) in which they seek to understand their respective role within the social system. This social phenomenon occurs over time and across levels, starting from the individual level and transferring up to the team level (Kozlowski et al., 1999).

Prior to the introduction of emergent states and the I-P-O model (Marks et al., 2001), attempts to model the dynamic social processes that occur within teams have often resulted in models that neglect the multilevel, dynamic, and longitudinal nature of team development (Kozlowski et al., 1999). Instead of following Katz and Kahn's model, most research on team development has followed a top-down, single-level approach, focusing only on the team-level analysis. This neglects the bottom-up process, by which team states like cohesion develop through the dynamic interactions within the team (Kozlowski, Chao, Grand, Braun, & Kuljanin, 2013).

Portraying a more accurate model of team development, Kozlowski and colleagues (1999) explicated a developmental process model that is truly multilevel, dynamic, and longitudinal in nature. Beginning at team formation, teams are viewed as undergoing a series of phases that ultimately result in the emergence of team states such as cohesion. According to this model, teams begin as not much more than a collection of individuals. However, team members rapidly begin to increase their understanding of the team and their role within it. This results in each member investigating their individual relationships, followed by the overall network of team relationships (Kozlowski et al., 1999). During this phase of team development, individuals must first identify who they need to interact with in order to accomplish desired outcomes, as well as negotiate the role they will have within that relationship (Kozlowski et al., 1999). These individual-level processes set the stage for later interactions within the team, which ultimately shapes the course of a team's development (Kozlowski et al., 1999). Thus, team emergent states cannot be understood without focusing on the interactions between individuals on the team (Kozlowski et al., 2013).

While these individual-level transactions represent the building blocks in the development of team cohesion, finding the determinants of these relationships has represented a major challenge within the social sciences. Modeling relationships is a complex endeavor even under the simplest example, as it will include each individual's inputs, context, and each individual's perceptions of the social situation (Snyder & Ickes, 1985). Most researchers in this area adopt an interactional strategy, which seeks to understand social behavior through the interaction of both dispositional and situational features. Under this lens, researchers will look for certain categories of traits that tend to impact social environments in a consistent and predictable pattern.

**Deep-Level and Surface-Level Characteristics**

When categorizing these dispositional features, researchers generally separate them into two categories, deep-level and surface-level characteristics. Surface-level characteristics are overt, generally physical characteristics that are typically biological in nature (e.g. sex), while deep-level characteristics represent difference in individuals' attitudes, beliefs, and values (Harrison, Price, &

Bell, 1998). Research has indicated that while surface-level characteristics are immediately evident in newly formed teams, deep-level characteristics take time to become salient, and their importance grows over a team's development (Harrison et al., 1998; Harrison, Price, Gavin, & Florey, 2002). Consequently, deep-level characteristics are likely to have more of an impact over an ad hoc team's growth (Harrison et al., 1998; Harrison et al., 2002). As team members spend time together, deep-level characteristics will play a critical role in determining the course of cohesion development (Grossman, 2014).

Of the deep-level characteristics that have been found to influence relationships, much of the research has focused on the role of personality (Bell, 2007; Byrne, 1971; Snyder & Ickes, 1985; Terborg, Catore, & DeNinno, 1976). Over the past thirty years, the Five Factor Model (FFM; McCrae & Costa, 1987; 1992) has become the prominent taxonomy of personality and has been used to investigate the influence of personality on a wide variety of social phenomena (Byrne, 1971; Judge & Bono, 2000; Judge, Heller, & Mount, 2002; Snyder & Ickes, 1985). Within the realm of teams, each of the five facets of the FFM—extraversion, emotional stability (opposite of neuroticism), openness, agreeableness, and conscientiousness have been illustrated to have relationships with various team outcomes (Bell, 2007; Kozlowski 7 Ilgen, 2006; LePine, Buckman, Crawford, & Methot, 2011). Personality has been shown to play an important role on an individual's cognitive and affective states, which will ultimately shape how that individual interacts with other team members (Stewart, 2003). Personality composition of the team has thus become a growing area of research in the search to understand the components of an effective team (Jackson et al., 1995).

**Personality and Team Cohesion**

In a recent meta-analysis performed on the antecedents of cohesion, Grossman (2014) found consistent relationships between various personality characteristics and team cohesion. However, most of these studies have looked at simple correlations between facets of the FFM and team performance, as well as other team outcomes (LePine et al., 2011). As research on team

dynamics indicates, in order to understand an emergent state such as cohesion and its relationship

with individual-level inputs, it must be examined in a dynamic fashion (Kozlowski, 2015).

Consequently, the relationship between personality and cohesion must be conceptualized and

ultimately tested in a longitudinal manner. Simple bivariate relationships only indicate a snapshot

at one point of a team's development. In order to understand the entire picture, an ad hoc team

(composed of members with varying degrees of each personality characteristic) must be studied

from the team's original formation, as well as over the team's developmental course (Drescher et

al., 2012). Although teams researchers are starting to study how individual differences relate to

levels of emergent states (e.g., Bell, 2007; LePine et al., 2011), it remains evident that the impact

of individual differences on the development of emergent states like cohesion cannot be fully

understood unless teams are studied in this dynamic fashion (Kozlowski, 2015).

Recent work by Humphrey, Hollenbeck, Meyer, and Illgen (2007; 2011) began to fill this

gap by designing teams with different levels of personality traits and studying their team

performance. They performed a semester long natural experiment using MBA students and found

that different facets of personality can serve both as a complementary role (the team benefits when

members have different levels of a trait), or supplementary role (the team benefits when members

have similar levels on a trait). The authors found that these effects were prevalent both on short-

term and long-term team performance. This study aims to continue this important line of research

by studying the effect of team composition on newly formed teams over time. However, in

addition to focusing on cohesion, the current study will analyze the impact of personality on

changing perceptions of cohesion over time, instead of looking only at short and long-term

outcomes. Studying the influence of personality on the developmental courses of teams will allow

examination of the role of team composition has on team cohesion over the course of a team's

development.

In order to hypothesize about these short-run and long-run dynamics, I will use previous

research and theory from a variety of disciplines, which all have either theorized about or tested

how individuals with various levels of personality will come together to create a team's level of cohesion (or related construct) over time. Starting with agreeableness, four of the five factors of the FFM will be discussed separately. Openness to experience will not be discussed as research has indicated its measurement has been largely inconsistent, and its impact on team dynamics is minimal (LePine et al., 2011; Prewett et al., 2009).

As Humphrey and colleagues illustrated, personality traits are often viewed as having either a supplementary or a complimentary fit at the team level (Bell, 2007; Dyce & O'Connor, 1992; Humphrey et al., 2007). Consequently, team composition research has focused on studying levels of personality at both mean and variance. For example, if a certain trait were to serve a complimentary benefit, higher levels of variance would be associated with higher team cohesion. Each trait will therefore be discussed in regards to levels of mean and variance on the team. Mean level refers to the overall team level for a specific trait (e.g. extraversion), and variance refers to the amount of variability on the team for a specific trait. When measuring either mean or variance levels in the current study, the other is held constant. Furthermore, mean-variance interaction is hypothesized for some personality traits. For example, if mean level extraversion is expected to impact cohesion levels only when variance level is high. Finally, in order to assess the impact of each personality trait on cohesion both after initial formation and over time, cohesion will be measured both *after initial impressions* and *over a team's development*.

**Agreeableness**

Agreeableness is a factor of personality that is most closely associated with the quality of interpersonal relationships (Costa, McCrae, & Dye, 1991). Agreeableness refers to the extent to which a person is caring, helpful, trusting, and cooperative (Wiggins, Trapnell, Hogan, Johnson, & Briggs, 1997). Agreeableness plays a prominent role in information sharing, which is a central process through which team members collectively utilize their available informational resources. (Mesmer-Magnus & DeChurch, 2009). This will directly impact many important team processes including the tendency for team members to share their own ideas, the team's ability to effectively

solve problems, and their ability to solve conflict (Mesmer-Magnus & DeChurch, 2009).

Furthermore, all of these team processes tend to positively impact levels of team cohesion

(Grossman, 2014)

Multiple studies have found positive relationships between agreeableness and cohesion.

Both Barrick and colleagues (1998) as well as Vianen and Dreu (2001) found higher levels of

cohesion in work teams with higher mean levels of agreeableness. An important corollary of these

results is that these studies used teams that were already formed prior to the research. Although

there is research in support of the link between agreeableness and cohesion, it is not clear whether

the benefits of agreeableness exist from the start of the team, or whether the effect takes time to

unfold.

Kenny's Social Relation Model (SRM; 1994) illustrates a multilevel framework for

understanding social interactions and helps to further illuminate the impact that agreeableness will

have on levels of team cohesion. According to Kenny, when attempting to understand the impact

of individual differences on social relationships, assumed similarity is an important consideration.

Assumed similarity represents the tendency for an individual to see others in the same way as they

are (Curry & Kenny, 1974). Within the realm of personality, agreeableness has been found to have

the strongest impact on assumed similarity (Kenny, 1994; Malloy & Albright, 1990). Stated

simply, individuals high in agreeableness will tend to view others as high in agreeableness,

regardless of their actual standing on the trait. As seeing agreeableness in others is associated with

feeling a sense of unity (Wiggins, 1996), this has important consequences in regards to the team. If

members of a team are high on agreeableness, this could potentially create a sense of relatedness

and mutual understanding on the team. As these two team properties have been shown to have an

important link with team cohesion (Forsyth, 1990), agreeableness is likely to have an important

impact on levels of cohesion. Finally, research has shown that perceived similarity has a large

positive relationship on levels of liking (Tidwell, Eastwick, & Finkle, 2012). They have also found

that this impact is immediate (i.e. within minutes), and that it does not differ with the amount of

interaction (Montoya, Horton, & Kirchner, 2008; Tidwell et al., 2012). Therefore, I made the following hypothesis.

*Hypothesis 1a:* Teams with higher levels of agreeableness will have greater levels of cohesion after initial impressions than teams with lower levels of agreeableness.

Agreeableness has rarely been investigated over time within the context of the team, but research on the trait's impact on relationships over time illustrates that its positive influence often becomes stronger over time. Specifically, research has shown that agreeableness most prominently influences relationships over time through conflict management. In studying relationships over an 18-month period, Asendorph and Wilpers (1998) found agreeableness to be a strong predictor of later conflict within a relationship (negative relationship). As relationship conflict has a strong link with levels of cohesion (Behfar, Peterson, Mannix, & Trochim, 2008; Sari, Suwarno, Nuryanti, & Diananta, 2014), this research illustrates that agreeableness likely continues to be important to cohesion as new relationships develop. Furthermore, as previously discussed, SRM shows that agreeableness is likely to increase the levels of cohesion over time through perceived similarity. This leads to the following hypothesis.

*Hypothesis 1b:* Teams with higher levels of agreeableness will have greater slopes in cohesion than teams with lower levels of agreeableness.

**Extraversion**

Extraversion represents the most widely studied personality factor across the history of personality taxonomies (Hogan & Ones, 1997). Extraversion refers the extent to which a person is sociable, talkative, lively, active, and excitable (Wiggins et al., 1997). Extraversion is associated with many positive individual characteristics that impact the team such as goal-seeking behavior, leadership skills, positive affect, and adaptability (Judge, Higgins, Thoresen, & Barrick, 1999). Previous studies have found positive relationships between mean levels of extraversion and team cohesion, in that teams with higher levels of extraversion had higher levels of team cohesion (LePine et al., 2011; Van Vianen & De Dreu, 2001).

Research on personality judgment accuracy has continually shown extraversion to be the most salient of all personality characteristics (Kenny, 1994). Others can accurately predict an individual's standing on extraversion within minutes of observing their behavior (Ambady & Rosenthal, 1992; Kenny, 1994). Thus, research has shown that levels of extraversion are noticeable almost immediately within the context of a team. It is likely to have an impact on individual relationships within a team immediately after team formation.

Within personality literature, research on attraction is particularly relevant when assessing the impact of extraversion on initial levels of team cohesion. Byrne's (1969) "law of similarity" indicates that initial attraction in a relationship is largely determined by similarity in individual characteristics. This theory has been illustrated to be especially influential for the trait of extraversion; research has shown that extraverts rate other extraverts higher than introverts on levels of liking minutes after their first interaction (Byrne, 1969; 1971). Unexpectedly, research has also found that introverts tend to like extraverts more than other introverts only a few minutes after meeting (Hendrick, & Brown, 1971). As interpersonal liking represents the central tenet of social cohesion (Beal et al., 2003), this leads to the following hypothesis.

*Hypothesis 2a:* Teams with higher levels of extraversion will have greater levels of cohesion after initial impressions than teams with lower levels of extraversion.

Early research on personality has theorized about the potential complementary aspect of extraversion (Snyder & Ickes, 1985). Individuals high on dominance, a micro-factor of extraversion, have long been theorized to work better with individuals on the submissive end of the dominance spectrum (Leary, 1957). Addressing this issue and its impact within teams, Kristof-Brown, Barrick, and Stevens (2005) tested individual's preference for levels of extraversion on teams. They found that at the team level, extraversion was complementary in that individuals preferred to work on teams with mean levels of extraversion that were most different from their own. This study helps illustrate the potential importance of diversity in regards to extraversion on a team.

The idea of a potential complementary benefit of extraversion is further supported by research theorizing about role identification on the team. As extraverts have been shown to prefer leadership and decision-making roles on the team, research has indicated that too many extraverts can result in greater team conflict as team members will compete for identical leadership roles (Bendersky & Shah, 2013; Dyce & O'Connor, 1992; Humphrey et al., 2007). This is especially important in self-managed teams (SMT's; i.e. ad hoc teams) where no leader exists at original team formation. Furthermore, as this role identification process takes time to unfold (Kozlowski et al., 2006), the importance of complementary fit on extraversion will take time. This is supported by the fact that most studies on cohesion have either used previously formed teams or analyzed team performance over an entire semester (Grossman, 2014). Therefore, while the benefits of having a diverse team in regards to extraversion will improve team cohesion, this effect is expected to take time to develop. As a result I made the following hypothesis.

*Hypothesis 2b: Teams with higher variability of extraversion will have a greater slope of cohesion than teams with lower variability of extraversion.*

**Neuroticism**

Emotional stability (the opposite of neuroticism) refers to the extent that an individual is emotionally stable, calm, and secure (Wiggins et. al, 1997). Neuroticism has a vast history of research illustrating its influence on social relationships (Bolger & Zuckerman, 1995). As neuroticism has shown to be an important predictor of relationship satisfaction, it has long been thought to have an impact on team dynamics. Earlier research found that teams with higher mean levels of emotional stability (opposite of neuroticism) tend to have higher levels of cohesion (Barrick et al., 1998; Van Vianen & De Dreu, 2001). However, as is the case with the other FFM factors, this relationship has rarely been investigated over time.

Research on personality has indicated that neuroticism impacts relationships early on. Individuals high on neuroticism tend to rate newly formed relationships lower on quality, regardless of contextual influences (Karney & Bradbury, 1995). Research has also illustrated that

individuals high on neuroticism will be more likely to see other group members as potential

sources of conflict (Bolger & Zuckerman, 1995).

Kenny (1994) referred to the above tendency as assimilation: the extent to which one

perceiver tends to view all other targets as being alike. Kenny's work has shown that assimilation

is especially associated with the personality trait of neuroticism. Under this view, these individuals

are more likely to associate all other team members with negative social outcomes, and therefore

they will express behavior detrimental to cohesion such as criticism and contempt (Levenson,

Carstensen, & Gottman, 1994). Research on assimilation has shown that this impact becomes

evident early on in relationships (Kenny, 1994). Accordingly, this leads to the following

hypothesis.

*Hypothesis 3a: Teams with lower levels of* neuroticism *will have greater levels of cohesion after*

*initial impressions than teams with higher levels of* neuroticism

The negative impact of higher levels of neuroticism on team cohesion is expected to continue

over time, as the trait is associated with many negative attributes including susceptibility to stress

and perceptions of low relationship quality (Tamir, 2005). As stated previously, individuals high

on neuroticism will tend to express behaviors associated with greater conflict—which can remain

detrimental to the team over time (Levenson et al., 1994). This may account for the finding that of

the FFM, neuroticism has been shown to have the most important impact on the success of long-

term dyadic relationships (Malouff, Thorsteinsson, Schutte, Bhullar, & Rooke, 2010).  As such, I

made the following hypothesis.

*Hypothesis 3b: Teams with lower levels of neuroticism will have greater slopes in cohesion than*

*teams with higher levels of neuroticism.*

The work of Kenny and colleagues on assimilation has shown that its effects tend to degrade

quickly as the number of interactions increases (Kenny, Horner, Kashy, & Chu, 1992). The

negative perceptions that individuals high on neuroticism have will be most salient immediately

after interactions begin, but as the individual interacts with the other person more, they will rely on

other, more newly gathered information (Kenny, 1994). Furthermore, although evidence showing a strong negative relationship between neuroticism and team cohesion would imply a simple linear relationship, recent research on the impact of neuroticism at the team level paints a more complex picture. In particular, Bendersky and Shah (2013) showed that as a result of predisposition to greater social anxiety, individuals high on neuroticism often improve team effectiveness over time because they want to gain social approval from team members. Through this process, these individuals high on neuroticism gain particular status within the group, as they surpass the low expectations team members have set for them. Furthermore, as neurotics exceed the low expectations of other team members, team morale is likely to benefit (Bendersky & Shah, 2013). This has important implications in regards to cohesion, as improved team morale is associated with higher team cohesion (Forsyth, 2013). Accordingly, although greater neuroticism is expected to result in lower cohesion early on, neuroticism is expected to serve a potential benefit over the course of a team's development. Nevertheless, there remains substantial evidence showing that low levels of emotional stability remain highly problematic for team cohesion (Barrick et al., 1998; Van Vianen & De Dreu, 2001). Therefore, the potential benefit of neuroticism is only expected to be complementary, as having an *individual* but not the entire team high in neuroticism has been shown to be beneficial. In other words, the potential complementary benefit of neuroticism is only expected to occur with teams that have low mean levels of the trait. Research on team personality has provides support for this claim, showing that heterogeneity on neuroticism is associated with improved team functioning (Le et al., 2011; Neuman, Wagner, and Christansen, 1999). This leads to the following hypothesis.

*Hypothesis 3c: Mean and variance level of neuroticism will interact, such that the positive impact of neuroticism variance on cohesion slopes will be stronger in teams with lower mean levels of neuroticism.*

**Conscientiousness**

The trait of conscientiousness has a long history within the organizational sciences, as it has

been the most widely studied in regards to work performance (McAdams, 1990; Wiggins et al., 1997). It had led to a revival of sorts in the field of personality assessment. Conscientiousness refers to the extent to which a person is organized, careful, self-disciplined, and responsible (Wiggins et al., 1997).

Of the five factors, conscientiousness is the strongest predictor of team performance, with teams higher on trait tending to be more effective (Barrick et al., 1998; Bell, 2007; LePine et al., 2011). However, its relationship with team cohesion is less clear. Unlike the other four factors of the FFM, conscientiousness is the only one to make the distinction between task and social cohesion particularly relevant. Many have theorized that it is associated more strongly with task cohesion than social cohesion (LePine et al., 2011; Van Vianen & De Dreu, 2001). Barrick and colleagues (1998) did not find a significant relationship between conscientiousness and social cohesion. Later research has supported this conclusion, but has found that lower variability of conscientiousness is associated with higher levels of task cohesion (Van Vianen & De Dreu, 2001).

The distinction between task and social cohesion in regards to the influence of conscientiousness is understandable based on research on previous research. Individuals high on conscientiousness more easily develop their role on a team task (Stewart et al., 2005) and thus teams with less variability on conscientiousness will feel more unified in regards to the team's goals. Ergo, a unified vision on a task represents the central tenet of task cohesion (Dion, 2000); teams with less variability on conscientiousness will likely have higher levels of task cohesion.

However, although the distinction between task and social cohesion appears relevant in terms of conscientiousness, research has shown the correlation between task and social cohesion is particularly high (Van Vianen & De Dreu, 2001). In addition, research has indicated that individuals low on conscientiousness are often perceived as "social loafers" by those higher on the trait (Barry & Stewart, 1997; Taggar & Neubert, 2008). Therefore, having a mix of members on this trait can prove to have an incendiary effect on a team's social relationships because individuals disagree about how a task should be approached, resulting in interpersonal conflict (LePine & Van

Dyne, 2007).

Research indicates that the trait of conscientiousness is particularly associated with the team process of goal setting (Stewart et al., 2005). Accordingly, as this team process occurs over some period of time (Marks et al., 2001) the relationship between this trait and cohesion is expected to take time to unfold. Teams with lower variability of conscientiousness are therefore expected to have higher levels of cohesion, but this relationship is expected to develop over time. In addition, although lower variability is expected to benefit a team's cohesion, mean levels of this trait remain important. Teams with low mean levels of conscientiousness tend to perform poorly, often resulting in discord between team members over subpar performance (Stewart et al., 2005) Consequently, although mean level conscientiousness has not been found to impact levels of team cohesion directly (Barrick et al., 1998), the positive impact of low variability is only likely to occur when mean levels of conscientiousness are at higher levels. In order to reap the benefits of variability on conscientiousness, a team should thus have higher mean levels. This leads to the following hypothesis.

*Hypothesis 4: Mean and variance level of conscientiousness will interact, such that the positive impact of less conscientiousness variance on cohesion slopes will be stronger in teams with higher mean levels of conscientiousness.*

**Method**

**Participants**

Participants in this study were undergraduates recruited using the SONA experiment management system from a large southeastern university. Undergraduates in psychology were given the option to sign up to obtain class extra credit. Following estimates found commonly in the literature, and suggestions made regarding statistical power in multilevel modeling (Scherbaum & Ferreter, 2009), the total number of teams required was determined to be 80, resulting in the final sample size for this study being 80, four-person teams. Participants' ages ranged from 18-24. The sample included 51% females and 49% males. As participants were randomly assigned to teams in

the session, the groups were not gender balanced.

**Procedure**

When signing up for participation, each participant chose a block of time for which they wished to participate. To account for possible cancellations, each session had two extra signup slots. Thus, each three-hour study block included ten signups ultimately used to create two teams of four. Once participants arrived for the study, the research assistant randomly assigned each participant to either one of two teams; they then randomly chose two individuals to receive partial credit and allowed them to sign up for a later session. One of two trained research assistants (two males) supervised each study session. However, one research assistant conducted 89% of the sessions. The study occurred in a computer lab with a PlayStation 4 gaming system connected to a monitor on opposing sides of the room. The room included 5X4 foot room dividers to separate the two teams while the session was in progress.

Each team member was randomly assigned a number and a computer that they used to complete questionnaires periodically during the game. After every member of the two teams was assigned a computer, the research assistant read the informed consent with all of the participants. Participants were then given the opportunity to ask any questions and sign the form if they wished to participate. Once informed consent was complete, participants were asked to watch a 10-minute PowerPoint presentation that was designed to explain the purpose of the study, as well provide them with basic training for the game. Both research assistants had been previously trained to provide consistent instruction to all teams.

Once the PowerPoint presentation was complete, each participant completed a computerized NEO-FFI short form (Psychological Assessment Resources, 1991) measuring personality. Once every participant completed the personality measure, each team was designated to their associated positions in front of the television, and was given a nametag with their team member number written on it so that other member could identify them on later questionnaires.

Each team completed six, fifteen-minute intervals of gameplay, following a specified order

of levels. During the training participants were told that they would be measured on their level

completion time, and that they should work together with their team members to achieve the best

time. At the end of each of the six intervals, participants completed the team cohesion

questionnaires. Following the six game sessions, participants were debriefed and dismissed.

**Measures**

**Personality (see Appendix A for Survey).**

*NEO-FFI (short-form)* From Psychological Assessment Resources (1991).   This is a

questionnaire used to assess an individual standing on each of the five traits associated with the

Five Factor Model of personality (McCrae & Costa, 1992). The questionnaire included 60

questions—12 questions for each of the five factors. Responses are made on a five-point Likert

scale with strongly agree (5) to strongly disagree (1) anchors.  Sample items include, "I often feel

inferior to others" (Neuroticism), and "I'm hard-headed and tough-minded in my attitudes."

(Agreeableness).  This variable was aggregated to the team level, as both mean and variance.

**Team Cohesion (see Appendix B for Survey).** Team cohesion was measured using a six-

item measure adapted from Kozlowski, Ployhart & Lim (2010). Participants were asked to rate

each item on a 5-point scale (1 = strongly disagree to 5 = strongly agree) based on their

experiences with the team. Sample items include, "Our team has a unified vision for what we

should do." (task cohesion; 3 items) and "Our team members got along well with each other"

(social cohesion; 3 items). Following Bliese's (2000) discussion of "fuzzy composition processes,"

team cohesion was aggregated to the group level only after finding acceptable ICC (1) values. ICC

(1) values for each time point were as follows: time 1= .32, time 2=.26, time 3= .35, time 4= .41,

time 5=.38, and time 6= .30. Following similar results found in the literature (Beal et al., 2003), the

sub dimensions of task and social cohesion were strongly correlated (.70).

**Team Task**

**Team Videogame Task (see Appendix C for image).** Team members played a

PlayStation 4 game titled Octodad (Hamilton, 2014). This game is a highly interdependent

adventure game, which involves an octopus (Octodad) completing everyday tasks. Each team member controls one of Octodad's four limbs, and must work together to complete the timed levels. The game involves simple controls that a novice can operate, but it has been described as one of the most interdependent and team-oriented team video games that currently exists (Hamilton, 2014).

**Analytic Strategy**

Hierarchical Linear Modeling (i.e. Random Coefficient Modeling; Bryk & Raudenbush, 1992) can incorporate both level 1 and level 2 predictors. Level 1 predictors vary both within and between teams over time, and level 2 predictors vary between teams, but remain constant within teams over time. Level 1 predictors (can be entered in as a fixed effect, which simply models the average relationship between the predictor and the dependent variable, or a random effect, which models both the average effect of the predictor as well as the variability in that effect across teams. As this study was interested in changes within teams over time, Longitudinal HLM analysis was performed (Longitudinal RCM; Bryk & Raudenbush, 1987). Within this type of analysis, time is treated as the level-1 predictor. Accordingly, time was the level-1 predictor, and team-level personality was the level-2 predictor.

Following previous RCM guidelines (Singer & Willet, 2003), a series of nested model tests was performed to determine the proportion of between-team variance and growth trajectories in the data (Singer & Willett, 2003). Specifically, an Unconditional Means Model was performed to determine how much within and between group variance exists in levels of cohesion. Next, an Unconditional Growth Model was performed to determine the variance in intercepts and slopes in cohesion across teams *over time*. As cohesion was expected to vary significantly both across teams over time, conditional growth models were then performed with level-1 random effects (i.e. cohesion varying over time), and level 2 predictors (i.e. team-level personality variables). As each hypothesis is focused on a specific factor of personality, four separate models were tested. The analysis was used to compare both intercept values—values after the first fifteen-minute interval—

and slope differences in cohesion across teams. The level 2 predictors were thus both the team-level mean and variance values of each of the four factors of personality hypothesized about previously (while controlling for the other value simultaneously). RCM analyses were performed using HLM 7 software (Raudenbush, Bryk, Cheong, Congdon, & Du Toit, 2011).

## Results

Table 1 displays the means, standard deviations, and correlations for study variables; all of the correlations are between team level variables. As expected, the relationship between mean and variance was significant for three of the four personality factors—agreeableness ($r=-.49$, $p<.01$), neuroticism ($r=.29$, $p<.01$), conscientiousness ($r=-.33$, $p<.01$)—supporting the choice to control for mean and variance when the other served as the focal predictor. The cohesion value at every time point has a significant positive correlation with every other value of cohesion (see Table 1), although the relationship is weaker for more temporally distant cohesion values. This result provided early evidence for the need to use multi-level modeling. Overall, most of the personality factors did not have a significant relationship with cohesion (See Table 1). The correlations between personality factors were overall consistent with estimates found in the team personality composition literature (e.g. Barrick et al., 1998; Van Vianen & De Dreu, 2001). For example, mean and variance levels of conscientiousness are frequently negatively correlated at the team level, and this relationship was found in the current study ($r=-.33$, $p<.01$). However, there were some relationships between personality factors that are not common in the literature. For example, mean level agreeableness and extraversion were highly correlated ($r=.42$, $p<.01$), and these two team variables are rarely found to have a relationship (Barrick et al., 1998; Neuman et al., 1999; Van Vianen & De Dreu, 2001). Based on these results, it may be helpful to consider the differences in personality measurement when interpreting how the results of this study fit with the rest of the team personality composition literature.

As outlined previously, I followed a stage approach to HLM (Bryk & Raudenbush, 1992), which tested a series of complex nested models. The first stage examined an unconditional means

model to test whether data supported an HLM framework for analyzing levels of cohesion. Results indicated a significant intercept coefficient in cohesion ($\gamma_{00}$= 4.28, *p*<.01) and an intraclass correlation of .68, indicating that mean group differences accounted for 68% of the total variance in levels of cohesion. This result suggests the appropriateness of using multilevel modeling, and thus to move forward to the unconditional growth model. The second stage was an unconditional linear growth model (ULGM) to test whether levels of cohesion increased significantly within teams over time. The slope parameter of the ULGM was significant ($\gamma_{01}$= .03, *p*<.01), indicating that cohesion does significantly increase within teams over time. Results also indicated that there was significant between-teams differences in both initial status of cohesion ($\tau 00$=.087, *df*=79, $\chi^2$= 757.783, *p*<.01), and the growth parameter ($\tau 01$=.003, *df*=79, $\chi^2$= 198.614, *p*<.01). Next, a Chi-Squared test was used to measure the degree to which the unconditional growth model fit better than the unconditional means model. The unconditional growth model fits the data better than the unconditional means model ($\chi^2$=57.49, *p*<.01), further supporting the claim that cohesion varies significantly within teams over time.

The final stage of the analyses tested separate conditional change models for each of the four personality factors hypothesized. Each of the four models tested whether each of the personality factors—expressed as both mean and variance level—significantly predicted both the initial status of cohesion (i.e. after initial impressions), as well as change in cohesion over time. For each model, both mean and variance values for the hypothesized personality trait were entered as predictors for both intercept and slope values of cohesion. Therefore, when estimating the coefficient for mean, variance was controlled for; also, when estimating the coefficient for variance, mean was controlled for. The results of each of the models are shown in Tables 2a-2d.

Both Hypotheses 1a and 1b were tested using one conditional growth model, with agreeableness expressed as both mean and variance entered as separate predictors at both intercept and slope. This model includes four coefficients $\gamma_{01,}$ $\gamma_{02,}$ $\gamma_{11,}$ and $\gamma_{12:}$ $\gamma_{01}$ refers to the relationship between mean levels of agreeableness and cohesion after initial impressions. $\gamma_{02}$ refers to the

relationship between variance levels of agreeableness and cohesion after initial impressions. $\gamma_{11}$ refers to the relationship between mean levels of agreeableness and cohesion over time. $\gamma_{12}$ refers to the relationship between variance levels of agreeableness and cohesion over time.

Hypothesis 1a predicted that teams with higher levels of agreeableness would have higher levels of cohesion after initial impressions ($\gamma_{01}$). This hypothesis was not supported; in fact, the relationship between mean level agreeableness and cohesion after initial impressions was found to be negative and not significant ($\gamma_{01}$=-.003, $p$=.74). Hypothesis 1b predicted that average level of agreeableness would positively predict the slope of cohesion ($\gamma_{11}$). This hypothesis was supported, as teams with higher levels of agreeableness were shown to have greater slopes of cohesion compared to teams with lower levels of agreeableness ($\gamma_{11}$=.005, $p$<.05). See Table 2a.

Hypotheses 2a and 2b were tested using one conditional growth model, with extraversion expressed as both mean and variance entered in as separate predictors at both intercept and slope. This model includes four coefficients: $\gamma_{01}$, $\gamma_{02}$, $\gamma_{11}$, and $\gamma_{12}$. $\gamma_{01}$ refers to the relationship between mean levels of extraversion and cohesion after initial impressions. $\gamma_{02}$ refers to the relationship between variance levels of extraversion and cohesion after initial impressions. $\gamma_{11}$ refers to the relationship between mean levels of extraversion and cohesion over time. $\gamma_{12}$ refers to the relationship between variance levels of extraversion and cohesion over time.

Hypothesis 2a predicted that teams with higher levels of extraversion would have higher levels of cohesion at initial impressions ($\gamma_{01}$). This hypothesis was supported as teams with higher levels of extraversion showed higher team cohesion after initial impressions ($\gamma_{01}$=.027, p<.01). Hypothesis 2b predicted that teams higher variance on extraversion would have higher slopes of team cohesion compared with teams with lower variance on the personality factor. Results failed to support this hypothesis as the impact of extraversion variance on team cohesion over time was not significantly different from zero ($\gamma_{12}$= -.000, $p$=.45). See Table 2b.

Hypotheses 3a, 3b and 3c were tested using one conditional growth model, with neuroticism expressed as both mean and variance entered in as separate predictors at both intercept

and slope. In addition, this model also included an interaction term for intercept and slope. This model includes six primary coefficients: $\gamma_{01}, \gamma_{02}, \gamma_{03}, \gamma_{11}, \gamma_{12}$, and $\gamma_{13}$. $\gamma_{01}$ refers to the relationship between mean levels of neuroticism and cohesion after initial impressions. $\gamma_{02}$ refers to the relationship between variance levels of neuroticism and cohesion after initial impressions. $\gamma_{03}$ refers to the relationship between levels of the interaction of mean and variance of neuroticism and cohesion after initial impressions. $\gamma_{11}$ refers to the relationship between mean levels of neuroticism and cohesion over time. $\gamma_{12}$ refers to the relationship between variance levels of neuroticism and cohesion over time. Finally, $\gamma_{13}$ refers to the relationship between levels of the interaction of mean and variance of neuroticism and cohesion over time.

Hypothesis 3a predicted that teams higher in neuroticism would initially have lower levels of cohesion ($\gamma_{01}$). The results failed to support the hypothesis as the relationship was positive and not significant ($\gamma_{01} = .003$, $p=.85$). Hypothesis 3b predicted that mean levels of neuroticism would predict levels of cohesion over time and that this relationship would be negative. The results did not support this hypothesis, as the relationship between level of neuroticism and cohesion over time was found to be positive and not significant ($\gamma_{11}=.004$, $p=.24$). Hypothesis 3c predicted that mean and variance levels of neuroticism would interact such that the positive impact of neuroticism variance on cohesion over time would be stronger in teams with lower mean levels of neuroticism ($\gamma_{13}$). As this is an interaction effect the main effects were also included ($\gamma_{11}, \gamma_{12}$) and were not found to be significant ($\gamma_{11}=.004$, $p=.24$; $\gamma_{12}=.001$, $p=.49$). The results failed to support hypothesis 3c, as the interaction between mean and variance levels of neuroticism did not significantly predict levels of cohesion over time ($\gamma_{13}=-.000$, $p=.39$). All results shown in Table 2c.

Finally, hypothesis 4 was tested using one conditional growth model, with conscientiousness expressed as both mean and variance entered in as separate predictors at both intercept and slope. In addition, this model also included an interaction term for intercept and slope. This model thus included six coefficients: $\gamma_{01}, \gamma_{02}, \gamma_{03}, \gamma_{11}, \gamma_{12}$, and $\gamma_{13}$. $\gamma_{01}$ refers to the relationship between mean levels of conscientiousness and cohesion after initial impressions. $\gamma_{02}$

refers to the relationship between variance levels of conscientiousness and cohesion after initial impressions. $\gamma_{03}$ refers to the relationship between levels of the interaction of mean and variance of conscientiousness and cohesion after initial impressions. $\gamma_{11}$ refers to the relationship between mean levels of conscientiousness and cohesion over time. $\gamma_{12}$ refers to the relationship between variance levels of conscientiousness and cohesion over time. Finally, $\gamma_{13}$ refers to the relationship between the interaction of mean and variance of conscientiousness and cohesion over time.

Hypothesis 4 predicted that mean and variance level of conscientiousness would interact, such that the positive impact of less conscientiousness variance on cohesion slopes would be stronger in teams with higher mean levels of conscientiousness. As this is an interaction effect the main effects were also tested ($\gamma_{11}, \gamma_{12}$) and were not found to be significant ($\gamma_{11}=.000$, $p=.78$; $\gamma_{12}=-.000$, $p=.36$). Hypothesis 4 was not supported, as the interaction between mean and variance of conscientiousness did not significantly predict levels of cohesion over time ($\gamma_{13}= -.000$, $p=.70$. All results shown in Table 2d.

## Discussion

The current study examined the complex role of team personality composition on team cohesion using a dynamic framework that incorporates both the short-run and long-run dynamics of an emergent state. While the majority of the hypotheses were not supported, there were some important findings. Most notably, the personality factors of agreeableness and extraversion were found to impact levels of team cohesion differently over time and after initial impressions. Team agreeableness was positively associated with team cohesion, but this was found in regards to growth rates, not the initial status of cohesion. Team extraversion was also found to be positively associated with cohesion, but only for initial status. Notably, level of dispersion was not found to be related to cohesion, across all factors of personality.

Although teams with higher levels of agreeableness were expected to start with higher levels of cohesion, based upon Kenny's (1994) work on zero acquaintance, the results are not surprising. Kenny's (Kenny et al., 1992) research illustrates that it's difficult to accurately judge

someone's level of agreeableness if you do not know that person well. Therefore, the positive impact of agreeableness on social relationships is likely to take time to develop. Not finding support for the hypotheses on neuroticism was surprising as the literature strongly supports a negative relationship between neuroticism and cohesion (Barrick et al., 1998; Van Vianen & De Dreu, 2001). Again however, this result is not entirely unexpected as research shows that neuroticism especially plays a role in terms of adjustment (Driskell, Goodwin, Salas, & O'Shea, 2006); therefore, as these previous studies have used already formed teams, it may take a longer time span for neuroticism to make an impact. Overall, finding no relationship between variability on personality factors and cohesion was not surprising as this is a common finding (Bell, 2007). However, I discuss later a possible explanation for these findings.

**Theoretical Implications**

This research makes several important contributions to the teams literature. First, this addresses the lack of research addressing the dynamic nature of emergent states by studying newly formed teams using intensive longitudinal designs with many, frequent measurement points (Kozlowski, 2015; Kozlowski et al., 2013; Salas, Vessey, & Estrada, 2015). Second, although much remains to be understood about team cohesion, this study begins to answer the specific questions regarding the antecedents to levels of emergent phenomena. Specifically, this study illustrates the importance of studying levels of an emergent state both at initial formation, as well as over a team's life cycle. As the results indicate, the relationships between team composition and levels of emergent states like cohesion are more complex than they are often treated. For example, the cohesion literature generally describes agreeableness as beneficial for cohesion in all situations (Barrick & Stewart, 1998; Stewart, 2003; Van Vianen & De Dreu, 2001). However, the results of this study show that the positive influence of agreeableness takes time to develop. Accordingly, for short-term teams (e.g. emergency response teams), it may not be as beneficial for cohesion to have higher levels of agreeableness. This point is further supported in regards to the role of extraversion in teams. For example, recent work investigating the role of team extraversion on leadership

emergence makes the claim that organizations should recruit individuals high on extraversion in order to reduce group conflict (Lemoine, Aggarwal, & Steed, 2016). As the current study illustrates, making this assumption based upon teams measured statically is problematic. The results of the current study show that team level extraversion may only increase levels of cohesion right after a team forms, and that this benefit likely does not continue over time. For longer-term teams, having a high amount of extraversion may not be associated with higher cohesion. Overall, this study supports early theorizing about the dynamic relationship between team composition and levels of emergent states (Kozlowski et al., 1999; Morgeson & Hoffman, 1999); specifically, as a result of the dynamic nature of teams, the relationships are often more complex than what the results of earlier cohesion studies imply.

Aside from advancing the field's understanding of the relationship between team composition and levels of emergent states, the current study provides support for important previously untested assumptions about level of emergence in teams. Particularly, the results provide support for the claim that early interactions on the team will include meaningful changes that longer-term studies fail to incorporate. As the results show, levels of cohesion grew significantly across teams over time. Since cohesion was measured frequently in this study (every 15 min), it provides empirical support to the argument that studies on emergence should study newly formed teams using intensive longitudinal designs (Kozlowski et al., 2013; Kozlowski, 2015). Recent work by Dormann & Griffin (2015) has also advocated for the use of the current study's research design—what they label as "shortitudinal" research. Following earlier theorizing (Cole & Maxwell, 2009), Dormann & Griffin illustrate that studies often greatly underestimate relationships by using inappropriate time lags. They ultimately argue for the use of more "shortitudinal" studies, especially in regards to psychological phenomena that are not well understood. I argue that research on emergence fits this condition, as the specific nature of the emergence process has been theorized about but rarely tested (Kozlowski, 2015; Salas et al., 2015). Accordingly, not only does this study provide an important test of the "shortitudinal" framework

within the context of teams , but the results also provide further support for the use of these designs.

Nevertheless, It would be beneficial to test whether the dynamics of these short-term teams (i.e. teams only together for hours) stabilize and remain constant over a much longer time (i.e. months or years). The few studies that measure cohesion at multiple waves have used much larger time lags—usually weeks or months apart (e.g. Casey-Campbell, 2005; Fullagar & Egleston, 2008; Mathieu et al., 2015). Coultas, Driskell, Burke and Salas (2014) in particular argue that the distinction between short-term teams like those used in the current study and long term teams is critical when studying emergent states. They claim that emergent states, "measured early on in collective life may be qualitatively different from the same construct measured at a later period in team development" (p. 686). Accordingly, the authors would label the measurement of cohesion in this study as "swift cohesion", and identify it as a unique construct from how team cohesion is commonly measured. While there is some evidence to support the idea of "swift emergent states" (Arthur, Bell, Edwards, 2008), theory on emergence would maintain that using these "short-term" measurements is critical to understanding constructs like cohesion. Therefore, while the use of "shortitduinal" work remains important for understanding emergent states, the idea of "swift cohesion" could provide a potential explanation for the largely null results of this study.

In a seminal article, Ancona, Goodman, Lawrence, and Tushman (2001) argued for a new research lens, which is centered on the concept of time. They argue that although time is often incorporated into theories within the organizational sciences, it serves a peripheral influence to the overall theory. They go on to offer an alternative lens to use for research in the organizational sciences: the lens of time. More important than simply using a new methodology, the current study's largest contribution lies in the fact that it begins to apply this lens to better understand the relationship between team composition and emergent states. As the results show, in applying the lens of time, the relationship between team personality composition and team cohesion is more complex than previous research indicates. The current study could thus provide a blueprint for

future research on the effect of team composition on other emergent states. Incorporating both the short-run (i.e. initial impressions) and the long-run (i.e. change over time) dynamics of emergent states could present the impact of team composition in a dramatically different way than it has been in previous studies that incorporate static frameworks (e.g. Barry & Stewart, 1997; Barrick et al., 1998; Bell, 2007; Van Vianen & De Dreu, 2001, etc). The current study is not the first team's study to incorporate the lens of time; other studies have used a similar framework and found that the relationship between other team compositional factors and team outcomes changes as time serves a different role. For example, Dierdorff, Bell, and Belohlav (2011) found that the specific factors within the overall concept of psychological collectivism influenced team performance differently at the start of a team's life cycle, over time, and at the end of a team's life cycle. Thus, similar to the current study, this research shows the potential boon in applying the "lens of time" to the relationship between team compositional factors and team outcomes. I argue that this lens could prove to have an even larger benefit when studying the relationship between team composition and emergent states like cohesion because of the inherently dynamic nature of emergent states. Therefore, the current study provides great value to the future of research on team composition and emergence by illustrating the benefits of incorporating "the lens of time" to an important area of research.

Through using a dynamic lens to understand the relationship between team personality composition and cohesion, this study essentially provides important boundary conditions for understanding these relationships. For example, as previously mentioned, while research discusses team level agreeableness and extraversion to be universally beneficial for cohesion, this work illustrates that these relationships vary significantly as function of time. Thus, this study shows that different personality factors likely influence cohesion at different times during a team's life cycle. While extraversion matters immediately, agreeableness likely takes some time to influence cohesion, and neuroticism likely takes even longer. By incorporating the "lens of time", the relationship between team personality composition and team cohesion shifts considerably.

Therefore, while this study found largely null results, it does generate an important conclusion regarding the role of team composition and emergent states—that early research on the role of team composition in determining levels of emergent states should be revisited as these relationships likely change meaningfully as a function of time.

**Limitations and Directions for Future Research**

The current study presents multiple opportunities for future research. While this study made many predictions regarding the impact of personality variability on team cohesion, none of these hypotheses were supported. This follows similar work on deep-level compositional variables, which has found that team-level personality variability often fails to predict team level outcomes (Bell, 2007). While this would seem to support the idea that variability is not important to emergent states and team effectiveness, more recent work has shown that this is instead an artifact of using artificial teams formed in a lab setting (Humphrey et al., 2007; 2011). Specifically, Humphrey and colleagues (2011) created teams by using members with identical means, but differing variance values. By using this "seeding" technique, they were able to show significant relationships between team personality variance and team outcomes. I apply this rationale to the currents study's failure to support any of the variance hypotheses. Future studies could combine the current methodology with Humphrey and colleagues (2011) "seeding" technique in order to be able to fully test the influence of team personality variability on levels of team cohesion, both after initial impressions and over time.

Another opportunity for future research could be found in regards to the measurement of cohesion. Although most within the organizational sciences now understand the many problems with using self-report measures, these problems (Donaldson & Grant-Vallone, 2002) are especially relevant in terms of measuring cohesion. Measuring cohesion in lab teams using self-report has been associated with numerous problems including ceiling effects and minimal variance (Salas et al., 2015). The issues with using self-report likely impacted the results of the current study, as levels of cohesion rarely reached below three on a 5-point likert scale. In addition, the amount of

variability on the cohesion measure was low. These problems provide a possible explanation for the lack of significant results in this study. Future work could use a similar design to this study, but use other modes of measurement including sociometric ratings, audio/video recording, or biological measures. There has been a recent push to incorporate these new types of methods for measuring cohesion (Kozlowski, 2015).

Building off of the idea of incorporating new measurement tactics in the study of cohesion, it is important to clarify the levels versus process distinction. Although the methods used in the current study are capturing cohesion dynamically, this study is not measuring the actual process of cohesion. As cohesion is an emergent state, it is often discussed in terms of a developmental process (Marks et al., 2001); however, it is a major challenge to actually capture these process dynamics. For example, the current study measured levels of cohesion over time, but using a self-report measure every 15-minutes will not be able to capture the dynamic process as it occurs in real time. Again, future work could aim to incorporate new methods of measurement, including real time bio-data (Kozlowski, 2015) or discourse analysis (Scribner, Sawyer, Watson, & Myers, 2007) to be able to start capturing the actual emergence process.

One final point in regards to measurement could be made regarding personality. Within the team context, research has shown that specific factors of personality interact to affect the dynamics of the team. For example, Witt (2002) found that extraversion only positively impacted team performance when levels of conscientiousness were high. Likewise, research on emergent leadership has shown that pattern approaches—which incorporate multiple traits into one overall category—better predict the emergence process than treating each trait separately (Foti & Hauenstein, 2007). Measuring team personality as a pattern rather than an average will ultimately allow researchers to get closer to the full scope of team personality composition. Ultimately, future work could apply this pattern or person oriented approach to the realm of team personality composition, by looking at the most effective combinations of personality factors, rather than treating each factor separately.

**Conclusion**

The purpose of this project was to examine the relationship between team personality composition and levels of team cohesion dynamically—both after initial status and over time. Although only average extraversion and agreeableness predicted differences in team cohesion, the manner in which they influenced cohesion provided important findings. While most previous studies have discussed the role of team composition on team cohesion in a static manner (e.g. higher agreeableness is always associated with higher cohesion), this study provides new insights by showing that the relationship between team composition and levels of emergent states is often more complex than how it is currently discussed. Specifically, measuring an emergent state both immediately after a team forms (i.e. minutes), and over time, provides a perspective that is not captured by current methods of measurement. The results of this study provide important boundary conditions for understanding the relationship between team personality composition and cohesion. This work shows that previous conclusions about the role of team composition in team dynamics need to be revisited. When emergence theory (Kozlowski & Klein, 2000), and the lens of time (Ancona et al., 2002) is applied to the measurement of the relationship between team composition and levels of emergent states like cohesion, it becomes evident that team compositional differences relate to team emergent states in a dramatically different way depending on the role of time.

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Table 1. *Correlation Matrix for Team Level Variables*

| Variable | *M* (*SD*) | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CohesionT1 | 4.18 (.34) | --- | | | | | | | | | | | | | |
| CohesionT2 | 4.29 (.36) | .62** | --- | | | | | | | | | | | | |
| CohesionT3 | 4.30 (.40) | .58** | .74** | --- | | | | | | | | | | | |
| CohesionT4 | 4.28 (.39) | .47** | .72** | .83** | --- | | | | | | | | | | |
| CohesionT5 | 4.32 (.40) | .48** | .72** | .82** | .85** | --- | | | | | | | | | |
| CohesionT6 | 4.35 (.38) | .42** | .65** | .76** | .75** | .83** | --- | | | | | | | | |
| Agree M | 30.45 (3.30) | .03 | -.07 | .12 | .10 | .10 | .15 | --- | | | | | | | |
| Agree V | 38.12 (33.42) | -.14 | .02 | -.04 | .20 | -.05 | .02 | -.49** | --- | | | | | | |
| Extra M | 32.16 (2.90) | .26* | .21 | .22* | .11 | .19 | .18 | .42** | -.18 | --- | | | | | |
| ). Extra V | 35.78 (26.46) | -.13 | -.06 | -.18 | -.12 | -.14 | -.17 | -.22 | .23* | -.10 | --- | | | | |
| . Neuro M | 21.54 (3.15) | -.11 | -.05 | -.12 | -.04 | -.07 | -.05 | -.36** | .04 | -.21 | -.06 | --- | | | |
| !. Neuro V | 51.61 (40.40) | -.02 | -.10 | -.12 | -.08 | -.10 | -.20 | -.15 | .04 | .04 | .12 | .29** | --- | | |
| !. Consc M | 32.01 (2.57) | .04 | .18 | .23* | .18 | .15 | .15 | .13 | .21 | .14 | -.02 | -.26* | -.07 | --- | |
| !. Consc V | 39.26 (34.71) | .03 | -.24* | -.14 | -.17 | -.15 | -.17 | -.23* | .11 | -.08 | .06 | .15 | .21 | -.33** | --- |

*Note*. * $p < .05$, ** $p < .01$.; *N* = 80 (teams), n= 320 (individuals); T= time point, M= mean, V= variance, Agree= agreeableness, Extra= extraversion, Neuro= neuroticism, Consc= conscientiousness

Table 2a. *Results of HLM Model Test for Agreeableness*

| Fixed Effect | Coefficient | SE | t-ratio | p-value |
|---|---|---|---|---|
| Intercept (cohesion after initial impressions), $B_0$ | | | | |
| Intercept, $\gamma_{00}$ | 4.222** | .036 | 116.410 | <.01 |
| Agreeableness (m), $\gamma_{01}$ | -.003 | .012 | -.328 | .74 |
| Agreeableness (v), $\gamma_{02}$ | -.001 | .001 | -.772 | .44 |
| Time, $B_1$ | | | | |
| Intercept, $\gamma_{10}$ | .026** | .008 | 3.399 | <.01 |
| Agreeableness (m), $\gamma_{11}$ | .005* | .003 | 2.026 | .05 |
| Agreeableness (v), $\gamma_{12}$ | .000 | .000 | 1.575 | .12 |

*Note.* *p < .05, **p <.01 (two-tailed)

Table 2b. *Results of HLM Model Test for Extraversion*

| Fixed Effect | Coefficient | SE | t-ratio | p-value |
|---|---|---|---|---|
| Intercept (cohesion after initial impressions), $B_0$ | | | | |
| Intercept, $\gamma_{00}$ | 4.222** | .035 | 120.352 | <.01 |
| Extraversion (m), $\gamma_{01}$ | .027** | .010 | 2.692 | .01 |
| Extraversion (v), $\gamma_{02}$ | -.001 | .001 | -.756 | .45 |
| Time, $B_1$ | | | | |
| Intercept, $\gamma_{10}$ | .026** | .008 | 3.319 | <.01 |
| Extraversion (m), $\gamma_{11}$ | -.002 | .003 | -.058 | .56 |
| Extraversion (v), $\gamma_{12}$ | -.000 | .000 | -.076 | .45 |

*Note.* *p < .05, **p <.01 (two-tailed)

Table 2c. *Results of HLM Model Test for Neuroticism*

| Fixed Effect | Coefficient | SE | t-ratio | p-value |
|---|---|---|---|---|
| Intercept (cohesion after initial impressions), $B_0$ | | | | |
| Intercept, $\gamma_{00}$ | 4.562** | .313 | 14.579 | <.01 |
| Neuroticism (m), $\gamma_{01}$ | .003 | .016 | .195 | .85 |
| Neuroticism (v), $\gamma_{02}$ | .007 | .005 | 1.218 | .23 |
| Neuroticism (m*v), $\gamma_{03}$ | -.000 | .000 | -1.250 | .22 |
| Time, $B_1$ | | | | |
| Intercept, $\gamma_{10}$ | .087 | .069 | 1.246 | .22 |
| Neuroticism (m), $\gamma_{11}$ | .004 | .004 | 1.184 | .24 |
| Neuroticism (v), $\gamma_{12}$ | .001 | .001 | .688 | .49 |
| Neuroticism (m*v), $\gamma_{13}$ | -.000 | .000 | -.859 | .39 |

*Note.* *p < .05, **p <.01 (two-tailed)


Table 2d. *Results of HLM Model Test for Conscientiousness*

| Fixed Effect | Coefficient | SE | t-ratio | p-value |
|---|---|---|---|---|
| Intercept (cohesion after initial impressions), $B_0$ | | | | |
| Intercept, $\gamma_{00}$ | 4.234** | .038 | 111.467 | <.01 |
| Conscientiousness (m), $\gamma_{01}$ | .018 | .016 | 1.102 | .27 |
| Conscientiousness (v), $\gamma_{02}$ | .001 | .001 | .398 | .69 |
| Conscientiousness (m*v), $\gamma_{03}$ | .000 | .000 | 1.259 | .21 |
| Time, $B_1$ | | | | |
| Intercept, $\gamma_{10}$ | .025** | .008 | 3.192 | <.01 |
| Conscientiousness (m), $\gamma_{11}$ | .000 | .003 | .276 | .78 |
| Conscientiousness (v), $\gamma_{12}$ | -.000 | .000 | -.923 | .36 |
| Conscientiousness (m*v), $\gamma_{13}$ | -.000 | .000 | -.392 | .70 |

*Note.* *p < .05, **p <.01 (two-tailed)

Appendix A
NEO-FFI short-form (Psychological Assessment Resources, 1991)

Answered on a five-point Likert scale with strongly agree to strongly disagree anchors.

1. I am not a worrier.
2. I like to have a lot of people around me.
3. I don't like to waste my time daydreaming.
4. I try to be courteous to everyone I meet.
5. I keep my belongings clean and neat.
6. I often feel inferior to others.
7. I laugh easily.
8. Once I find the right way to do something, I stick to it.
9. I often get into arguments with my family and co-workers.
10. I'm pretty good about pacing myself so as to get things done on time.
11. When I'm under a great deal of stress, sometimes I feel like I'm going to pieces.
12. I don't consider myself especially "light-hearted."
13. I am intrigued by the patterns I find in art and nature.
14. Some people think I'm selfish and egotistical.
15. I am not a very methodical person.
16. I rarely feel lonely or blue.
17. I really enjoy talking to people.
18. I believe letting students hear controversial speakers can only confuse and mislead them.
19. I would rather cooperate with others than compete with them.
20. I try to perform all the tasks assigned to me conscientiously.
21. I often feel tense and jittery.
22. I like to be where the action is.
23. Poetry has little or no effect on me.
24. I tend to be cynical and skeptical of others' intentions.
25. I have a clear set of goals and work toward them in an orderly fashion.
26. Sometimes I feel completely worthless.
27. I usually prefer to do things alone.
28. I often try new and foreign foods.
29. I believe that most people will take advantage of you if you let them.
30. I waste a lot of time before settling down to work.
31. I often get angry at the way people treat me.
32. I am a cheerful, high-spirited person.
33. I rarely feel fearful or anxious.
34. I often feel as if I'm bursting with energy.
35. I seldom notice the moods or feelings that different environments produce.
36. Most people I know like me.
37. I work hard to accomplish my goals.
38. I believe we should look to our religious authorities for decisions on moral issues.
39. Some people think of me as cold and calculating.
40. When I make a commitment, I can always be counted on to follow through.
41. Too often, when things go wrong, I get discouraged and feel like giving up.
42. I am not a cheerful optimist.
43. Sometimes when I am reading poetry or looking at a work of art, I feel a chill or wave of excitement.
44. I'm hard-headed and tough-minded in my attitudes.

45. Sometimes I'm not as dependable or reliable as I should be.
46. I am seldom sad or depressed.
47. My life is fast-paced.
48. I have little interest in speculating on the nature of the universe or the human condition.
49. I generally try to be thoughtful and considerate.
50. I am a productive person who always gets the job done.
51. I often feel helpless and want someone else to solve my problems.
52. I am a very active person.
53. I have a lot of intellectual curiosity.
54. If I don't like people, I let them know it.
55. I never seem to be able to get organized.
56. At times I have been so ashamed I just wanted to hide.
57. I would rather go my own way than be a leader of others.
58. I often enjoy playing with theories or abstract ideas.
59. If necessary, I am willing to manipulate people to get what I want.
60. I strive for excellence in everything I do.

Appendix B
Team Cohesion Questionnaire (Kozlowski, Ployhart & Lim, 2010)

***Please rate the following statements based on your experience working in your team in your most recent scored game session.***

*(Options: Strongly disagree; Disagree; Neutral; Agree; Strongly agree)*

*Task Cohesion*
1. Our team has a unified vision for what we should do.
2. Our team members contribute to the team's tasks.
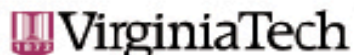3. Our team is committed to our team's task.

*Social Cohesion*
1. Our team members get along well with each other.
2. Our team members enjoy spending time together.
3. Our team members have good relationships with each other.

Appendix C
Image of "Octodad"

Appendix D
IRB Approval Letter

**VirginiaTech**

**MEMORANDUM**

**DATE:**              October 2, 2015

**TO:**                Roseanne J Foti, Bryan Patrick Acton, Sam Robinson, Michael Braun

**FROM:**              Virginia Tech Institutional Review Board (FWA00000572, expires July 29, 2020)

**PROTOCOL TITLE:**    Development of Team Cohesion Over Time

**IRB NUMBER:**        15-392

Effective October 2, 2015, the Virginia Tech Institution Review Board (IRB) Chair, David M Moore, approved the Amendment request for the above-mentioned research protocol.

This approval provides permission to begin the human subject activities outlined in the IRB-approved protocol and supporting documents.

Plans to deviate from the approved protocol and/or supporting documents must be submitted to the IRB as an amendment request and approved by the IRB prior to the implementation of any changes, regardless of how minor, except where necessary to eliminate apparent immediate hazards to the subjects. Report within 5 business days to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

All investigators (listed above) are required to comply with the researcher requirements outlined at:

http://www.irb.vt.edu/pages/responsibilities.htm

(Please review responsibilities before the commencement of your research.)

**PROTOCOL INFORMATION:**

Approved As:                  **Expedited, under 45 CFR 46.110 category(ies) 7**
Protocol Approval Date:       **April 14, 2015**
Protocol Expiration Date:     **April 13, 2016**
Continuing Review Due Date*:  **March 30, 2016**

*Date a Continuing Review application is due to the IRB office if human subject activities covered under this protocol, including data analysis, are to continue beyond the Protocol Expiration Date.

**FEDERALLY FUNDED RESEARCH REQUIREMENTS:**

Per federal regulations, 45 CFR 46.103(f), the IRB is required to compare all federally funded grant proposals/work statements to the IRB protocol(s) which cover the human research activities included in the proposal / work statement before funds are released. Note that this requirement does not apply to Exempt and Interim IRB protocols, or grants for which VT is not the primary awardee.

The table on the following page indicates whether grant proposals are related to this IRB protocol, and which of the listed proposals, if any, have been compared to this IRB protocol, if required.

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