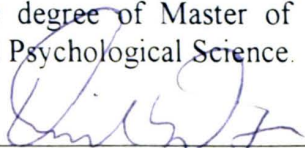# THE BIG FIVE:
CONSCIENTIOUSNESS AND ITS RELATION
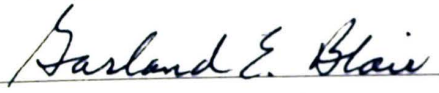## TO TRACKING TASK PERFORMANCE

PAUL NELSON LAMB

To the Graduate Council:

I am submitting herewith a thesis written by Paul Nelson Lamb entitled "The Big Five: Conscientiousness and its relation to tracking task performance". I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Arts, with a major in Industrial/Organizational Psychology and Psychological Science.

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Dr. David Denton, Major Professor

We have read this thesis
and recommend its acceptance:

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The Big Five:

Conscientiousness and Its Relation to Tracking Task Performance

A Thesis

Presented in Partial Fulfillment for the

Master of Arts

Degree

Austin Peay State University

Paul Nelson Lamb

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ABSTRACT

Tracking tasks are a common occurrence that we all perform. From driving a car to performing job duties, we perform tracking tasks on a daily basis. In order to assess performance or practice on a given task, computer generated tracking tasks have been developed which employers can use as tools to simulate real world tasks. Recently, personality traits, specifically conscientiousness, have shown to be statistically significant in predicting job performance. The purpose of this study was to see if performance over time on a tedious and mundane simulated compensatory tracking task was related to individuals that scored high on conscientiousness using a Big Five personality instrument made up of 100 common trait adjectives. A group of Child and Youth Services employees at a military installation in Ft. Campbell, KY completed a self-assessment on the personality instrument and a five minute compensatory tracking task. Due to the lack of number of participants, a K-means analysis was implemented to see there were any groupings that were meaningful. Results indicated that the conscientiousness was not related to performance on the tracking task as expected. Further review of the results showed that extroversion was negatively related to performance on the tracking task. These results are consistent with the notion that extroverts have a low cortical arousal and thus were not stimulated enough to perform well at this fairly simple task. Limitations of this present study are addressed and suggestions for future research are noted.

DEDICATION

This thesis is dedicated to my family for all the encouragement and support they have given me throughout my academic endeavors. First, to my mother, Trula, her unconditional love and unwavering belief that I could better myself has been instrumental in motivating me to pursue greater knowledge. Your own endeavors in education and work have been a model for me throughout life that has taught me about the importance of compassion, work ethics, and the value of family. Thank you for all your love, support, patience and tolerance of my emotional undulations throughout the years. To the memory of my father, James Edom, whose strength and dedication through all the adversity won my undying admiration and love. His untimely passing changed my life in ways I thought it never could.

"Oh dear Dad, can you see me now? I am myself, like you somehow. I'll ride the wave where it takes me, I'll hold the pain... I'll open up, release me."

When we spent time together, I was not joking when I said that it is times like these that mean the most to me. Finally, to all my siblings, Kaila, Donna, Jeff and Bill, whose love and camaraderie throughout the years has helped make the difference and see why family is so important.

ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION

There are numerous studies as well as everyday experiences that demonstrate how tracking tasks relate to our everyday lives. For example, using a mouse for a computer is a tracking task. Driving a vehicle is another tracking task. You must track the road and the lines on the road to remain on the road. Reading a book is another such task. Many work-related tasks are tracking tasks, and with the onslaught of technology in the workplace, this list will probably grow. The list seems boundless, especially when one considers all the simple and complex types of tasks we must track throughout a day. This is important because if you are not tracking properly, you may move the mouse off the screen, you may leave the road, and you might not understand what the book is about, or equally as tragic, you may fail at your job. Studying tracking tasks helps people understand the focuses and limitations of human perception. It also allows insight into more complex behaviors from only a simple tracking task sample. Moreover, studies that find correlates to job performance allow models to be developed and researched that could help organizations make better connections between increasingly complex jobs and the people performing these jobs (Jerneic and Sverko, 1993). Given the importance of tracking tasks for many different job tasks, it is important to understand the factors that are related to performing such tasks. The use of personality measures to predict the performance of tracking tasks is an area ripe for investigation.

There has been growing empirical evidence that some personality traits are related to performance. Recent meta-analyses have shown that certain personality constructs are

valid predictors of job performance criteria for numerous occupations (Dunn, Mount, Barrick, and Ones, 1995). Much of this research centers on the five-factor model of personality (Digman, 1990). For example, Barrick and Mount's (1991) meta-analysis of one hundred seventeen studies showed that the Big Five factor Conscientiousness was a valid predictor for at least five different jobs using three criterion types. Other studies have shown that introverts (neurotic introverts in particular) are more susceptible to the adverse effects of increased process demands, distractions, and environmental stress (Jerneic and Sverko, 1993; Morganstern, Hodgson, and Law, 1974). Furthermore, there has been evidence that anxiety by itself (i.e. Neuroticism) (Mathews, May, Mogg and Eysenck, 1990) effect performance, although this result has not been consistently found (Barrick and Mount, 1991). Lastly, Openness to Experience has been found to correlate positively with performance and cognitive ability, another positive correlate of performance criteria across jobs (Barrick and Mount, 1991).

The quest to find measures of personality traits that help predict specific performance and/or behavior is still being pursued. This is probably due to the common use of personality tests as predictors and their acceptance as simple, valid, and useful measures, as well as their face validity to participants. Noting the importance of tracking tasks to our lives and the growing use of personality measures, this study will address how well an abbreviated version of a Big Five personality trait Conscientiousness correlates with a tracking task.

CHAPTER II

LITERATURE REVIEW

This review will establish the prevalence and importance of tracking tasks and the need to be able to predict performance on such tasks. This will be followed by a brief review of the literature on the development and usefulness of personality. The chapter will conclude with a discussion of previous research that has considered both personality and its relation to its performance on tracking tasks and the jobs they simulate. From this review, hypotheses will be proposed concerning the relationship between the Big Five personality marker Conscientiousness and tracking task performance.

Tracking Tasks

Tracking tasks require continuous control of something and are present in practically all aspects of vehicle control, including driving an automobile, piloting a plane, or steering and maintaining balance on a bicycle. The basic requirement of a tracking task is to execute correct movements at correct times. There are both inputs and outputs in tracking tasks. Inputs can be constant, as with driving down a straight line, or variable, as with driving down a winding road. Such input is directly received from the environment, either through mechanical sensors or by people. When the input signal is sensed mechanically, different displays may be used as a form of the signal. The input signal is sometimes referred to as a target and its movement is called the course. The

output is usually brought about by a physical response with control mechanism (if by an individual or by the transmission of some form of energy (if by a mechanical element). In some systems the output is reflected by some indication on a display, often called a cursor. The output is frequently called the controlled element.

With pursuit tracking both the cursor controlled by the participant and the target move, each showing its own location in space in relationship to the other. In a compensatory display, using either one or two dimensions, only one of the two indicators moves and the other is fixed. The task for the operator is to get the moving indicator (cursor) to align with the fixed indicator (target). When the two indicators are superimposed, by using either a compensatory or pursuit display, the controlled element is said to be on target and any difference represents error. The role of the operator is to manipulate the controls to minimize the error. With a pursuit display, the operator can determine whether the error is due to target movement or the movement of the controlled element, and further, they can see the target's course independent of any movements of the controlled element. With a compensatory display, only the absolute error, or difference between the target and controlled element is shown (Sanders and McCormick, 1993, pp. 314-317)

Human Limitations in Tracking Tasks

There appear to be numerous reasons why humans are not very good at tracking tasks, especially those that involve higher order control. People do not instantaneously process information, so there is typically a time delay between change in a target and the initiation of the responses required to track the target. Typically, there are larger time delays for higher order tasks than lower order tasks (Wickens, 1984, as cited in Sanders

and McCormick, 1993, p. 319). For example, controlling a ship, which could be considered a higher order task since the linkages between the person steering the ship and the actual movement and position of the ship is not direct. That is, steering the ship one way may not be readily noticed by most peoples since the changes are so subtle or minute and often there are no landmarks that indicate that steering the boat in any way has actually changed the direction of the ship.

Bandwidth, which defines the maximum frequency of a random input that can be successfully tracked, also effects performance on tracking tasks (Wickens, 1984, as cited in Sanders and McCormick, 1993, pp. 319-320). Limits in this area are thought to be a central processing limit rather than a motor response limit because people have no difficulty in tracking predictable courses (Pew, 1974, as cited in Sanders and McCormick, 1993, p. 320).

Anticipation also negatively effects tracking performance. Tracking tasks of this nature requires that the operator anticipate future errors based on present conditions and then make control responses that are expected to reduce that anticipated future error. When the system is slow, as with sailing a ship, humans tend to do poorly at anticipating future error. This is thought to be due to limitations inherent in working memory (Wickens, 1984, as cited in Sanders and McCormick, 1993, p. 320).

Factors That Influence Tracking Task Performance

There are a wide variety of factors that influence tracking performance besides those that are innate in humans. Preview of the track ahead, whether the display is compensatory or pursuit, time lags in tracking, specificity of displayed error in tracking, and whether the tracking is paced or self paced all effect tracking performance.

When one has the opportunity to preview a track, tracking typically improves because previews allow operators to compensate for time lags. As one might surmise, conventional pursuit (true motion) display is preferable to a compensatory (relative motion) display since, for one reason, pursuit tasks make it easier to predict the target's course and to learn the consequences of various control actions on the movement of the controlled element. Another advantage is that they involve greater movement compatibility between the target, the pursuit display, and the corrective action of the operator. That is, if the target goes left and the display shows that it went left, the correct action is to move the control to the left.

There are three types of time lags in tracking and they all increase error in tracking (Poulton, 1974, as cited in Sanders and McCormick, 1993, p. 323). Response lag is the time taken by the operator to make a response to an input. Control system lag, which has three types of basic lag itself, is the time between a control action of an operator and the response of the system under control. Display system lag is the delay between the responses of the system being controlled or a change in the target and the display of that response or change.

Error (the difference between input and output) can be displayed in varying degrees of specificity. Research has shown that performance is typically improved by the presentation of more specific, rather than less specific, displayed information. Lastly, research has show that tracking tasks that are self-paced are easier than those that are guided by a prescribed pace. For example, driving to the store is much easier than landing a plane. One can choose the speed to which to drive to the store. One does not have such liberties when landing a plane (Sanders and McCormick, 1993, p. 324).

The research cited above focuses on aspects of the performance situation in explaining tracking task performance. However, individual differences as a class of factors affecting tracking task performance has received limited attention in the research literature. One of the most widely studied individual difference variables is personality. The recent resurgence of interest in personality research coupled with the prevalence of tracking tasks raises questions about their relationship.

Personality Markers Defined

In his 1990 review, Digman notes that William McDougal (1932) wrote in the first issue of Character and Personality (today's Journal of Personality) on how personality may be categorized into five distinct factors that he called intellect, character, temperament, disposition and temper. Digman notes that this was an "...uncanny anticipation of the results of half a century of work to organize the language of personality into a coherent structure.

While Digman (1990) points out that the number of personality factors has been reasonably well established, the meaning of each is less clear than others. Specifically, dimension I seems to correspond to what Eysenck (1947, as cited in Digman, 1990) labeled Extraversion/Introversion or Surgency (Tupes and Christal, 1961, as cited in Digman, 1990). Common traits associated with this dimension include talkative, assertive, impetuous, active on one end of the scale and untalkative, inhibited, and unadventurous at the other end (Goldberg, 1992, Barrick and Mount, 1991). Dimension IV is often referred to Eysenck's other big finding, Neuroticism/Emotional Stability (Tupes and Christal, 1961, as cited in Digman, 1990), which has been called the first "Big Two." This factor reflects unemotional, relaxed, and imperturbable at one end and

anxious, emotional, and fretful at the other end (Goldberg, 1992; Barrick and Mount, 1991).

Dimension II has generally been interpreted as Agreeableness (Tupes and Christal, 1961; Norman, 1963, as cited in Digman, 1990; Goldberg, 1990; 1992; McCrae and Costa, 1985). Although it accounts for a list of diverse adjectives like kind, cooperative, and trustful at one end and unkind, demanding, and selfish at the other end (Goldberg, 1992; Barrick and Mount, 1991). Relatedly, it has also been labeled Friendliness (Guilford and Zimmerman, 1949, as cited in Digman 1990), Conformity, and Friendly Compliance versus Hostile Noncompliance (Digman and Takemoto-Chock, 1981).

Although dimension III has been typically been labeled Conscientiousness or Dependability (Barrick and Mount, 1991; Tupes and Christal, 1961, as cited in Digman, 1990), other labels have included Will or Will to Achieve and Volition (Digman and Takemoto-Chock 1981; Digman, 1990). Traits that describe this dimension include organized, thorough, conscientiousness at one end of the factor spectrum and disorganized, undependable, and negligent at the other end (Goldberg, 1990; 1992; Barrick and Mount, 1991).

Dimension V has been labeled as Intellect (Goldberg, 1990; 1992; Digman and Takemoto-Chock, 1981; Peabody and Goldberg, 1989; Digman, 1990), Intelligence (Borgatta, 1964, as cited in Digman, 1990), Openness (McCrae and Costa, 1985), Openness to Experience (Barrick and Mount, 1991) and Culture (Tupes and Christal, 1961, as cited in Digman, 1990). Digman (1990) notes that this dimension is quite like all of these. For example, intellectual, creative, imaginative, and artistic for positive

adjectives and unintellectual, unimaginative, uncreative, and shallow for negative adjectives have been used to describe this dimension (Goldberg, 1992; Barrick and Mount, 1991). Encouragingly, McCrae and Costa (1987) note these studies have increased in methodological sophistication and restored confidence in the intelligent use of individual difference models of personality.

Block (1995) has argued that lay adjectives are not necessarily a useful basis for identifying dimensions of personality and lay raters are not necessarily trustworthy. Thus, he feels that any lexical version of the five-factor model is suspect. Block also expressed concern over how the NEO-PI, based on the five-factor model or Big Five, has a lack of orthoganality. The scales by McCrae, Costa and Goldberg are construed to be orthogonal since they are fairly parsimonious (unlike oblique systems). McCrae and Costa argue that the choice of orthogonal constructs is theoretical, not empirical, but that it has empirical consequences (Costa and McCrae, 1995). These authors do admit that the NEO-PI does not show a clear and simple structure, several of the traits or facets have meaningful secondary loadings on factors other than intended (i e activity/extraversion on secondary conscientiousness). But Costa and McCrae reiterate that the dimensions of the NEO-PI in particular are not scale scores, but hypothetical constructs and construed as orthogonal.

The obvious question that arises when reviewing the long history of personality research is why has it taken so long for personality measures to have any scientific worth and utility. This was mainly due to advancements and interests in the fields of social psychology and behaviorism, which focused on the influence of situations on behavior. Unfortunately, much of the professionals/proponents of the situational view simply

ignored much of the evidence on personality variables, including the fact that situational variables often accounted for no more than fifteen percent of the criterion variance. For example, it appears that the effect of parental rearing practices, although significant, is smaller than many of us have believed, (Digman, 1990).

In fact, none of the situationists' hypotheses, including attribution, stereotypes, semantic illusions, held up under scrutiny, (Kendrick and Funder, 1988, as cited in Digman, 1990). Although it should be noted that summated rating correlations can be improved by raters being well acquainted with ratees, the use of multiple behavioral observations and multiple observers, and the use of characteristics that are publicly observable.

Connections Between Personality Traits and Performance

Historically, the general agreement among researchers has been that personality is an inadequate predictor of job performance (Ghiselli, 1973; Guion & Gottier, 1965; Lock & Hulin, 1962; Reilly & Chao, 1982; Schmitt, Gooding, Noe, & Kirsch, 1984, as cited in Barrick and Mount, 1991). However, Barrick and Mount (1991) note that at the time earlier studies were conducted, no well accepted taxonomy existed for classifying personality traits. Thus, this would not allow researchers to find consistent, meaningful relationships between traits and performance criteria in the workplace or otherwise. In other words, some previous studies used personality constructs that were not measures of conscientiousness, whereas others used personality constructs that were intended to be components of conscientiousness but for which no validity data was provided. Furthermore, this may explain, to a certain extent, the different findings in more recent studies compared to earlier studies (Mount, Barrick and

Strauss, 1999). Since the most recent resurgence in personality research, reliance on the five-factor model of personality as an organizing framework has allowed more consistent relationships to be uncovered.

In a groundbreaking meta analysis that included one hundred seventeen studies, tests and dissertations that related to personality in occupational selection, Barrick and Mount (1991) found that when they used personnel data, job proficiency and training proficiency as criteria as they relate to five occupational groups (i.e. professionals, police, managers, sales, and semi-skilled/skilled workers), personality does emerge to relate to job performance. The most profound finding was that the Big Five trait Conscientiousness was by far the strongest valid predictor for all five occupational groups using three criterion types. Moreover, it was stated that measures associated with Conscientiousness are most likely to be valid predictors for all jobs (Barrick and Mount, 1991; Mount and Barrick, 1995; Mount, Barrick, and Strauss, 1999). As found sporadically in earlier tracking task studies, Extroversion was a valid predictor across the three criteria for the occupations manager and sales. The historically significant factor Emotional Stability was found to have relatively low correlations with performance criteria. Ironically, it is noted that the cornerstone of personality inventories, the Minnesota Multiphasic Personality Inventory (MMPI), measures mostly Emotional Stability and nothing specifically of Conscientiousness, based on factor analyses of the MMPI by Johnson, Null, Butcher, and Johnson (1984, as cited in Barrick and Mount, 1991).

Barrick and Mount's 1991 meta- analysis has proven to be no fluke, although this conclusion was found to be at odds with a similar meta analysis performed around the

same time by Tett, Jackson, and Rothstein (1991). Fortunately, this research was later found to have some problematic statistical and methodological issues, as well as four technical errors (Ones, Mount, Barrick and Hunter, 1994).

Mirroring Barrick and Mount's methodology but conducted in the European community, Salgado (1997) found that Conscientiousness was a valid predictor for performance. In fact, his results were consistent with results found by Barrick and Mount (1991, as cited in Salgado, 1997) and Hough, Eaton, Dunnette, Kamp, and McCloy (1990, as cited in Salgado, 1997) throughout.

In another meta analysis review that considered attitudinal and dispositional predictors of organizational citizenship behavior (OCB), Organ and Ryan (1995) found that although most other dispositional measures do not correlate well with OCB, conscientiousness was the exception. Supporting this trend, Vinchur, Schippmann, Switzer III, and Roth (1998) meta analytic review of predictors of objective and subjective job performance criteria for salespeople found that achievement (a component of the Conscientiousness trait), predicted (subjective) supervisor ratings ($r=.25$) and objective sales ($r=.41$).

Other studies have also found utility for measuring the trait conscientiousness. Kichuk (1997) argued that personality plays a crucial role in determining the success of product development processes, particularly in the evaluation of team performance efficiency. Her results obtained from the analysis of an engineering product design task suggest that team members who possess high levels of conscientiousness manifested increased task performance. Wanberg, Watt, and Rumsey's (1996) research that found that conscientiousness was a significant predictor of job seeking behavior. Results from

Colquitt and Simmering's (1998) research indicated that conscientiousness and learning orientation were positively related to motivation to learn both initially and after feedback was given. Stewart (1999) examined relationships with job performance at different stages of employee tenure for conscientiousness (and order and achievement, not discussed here). He found that conscientiousness exhibited a consistent relationship with performance for employees in both newly hired employees and veteran employees.

In a related vein, Barrick, Mount, and Strauss (1999) noted that within the field of personnel psychology, conscientiousness and general mental ability (GMA) predict performance in virtually all jobs with numerous criteria types. Indeed, Dunn, Mount, Barrick, and Ones (1995) demonstrated, among other findings, that for managers in one of each of J. L. Holland's (1973) six job typologies, GMA and conscientiousness were the most important qualifications related to applicant's hirability and that negative Conscientiousness traits was one of the most important traits related to counter-productivity. Although this appears to be common knowledge to most personnel managers, the most profound finding in Barrick et. al. (1999) study was that conscientiousness accounts for separate variance than does GMA. Their result's showed that the correlation between GMA and conscientiousness was essentially zero. This clearly shows that after accounting for GMA, conscientiousness adds incremental validity to the prediction of job performance. This potentially could add increasing validity to human resource actions, such as selection and training.

Historically, many studies used tracking task performance to find relations with personality. Research has shown that these tracking tasks have proven to be useful and convenient tools for which job samples and simulations could be offered. Unfortunately,

they have often used tracking task simulations unavailable or unknown to most managers, or they used tasks that are indirectly related to job performance criteria to find relations with personality. Most recently, the more broadly, sometimes subjective, and probably more conveniently found performance criteria that can be found in most organizations is being studied in relation to job performance criteria. This point is made because few tracking task studies specifically found what Barrick and Mount found with the trait Conscientiousness and certainly none to the same degree of confidence in the trait's validity to predict performance. In fact, one recent search found only one tracking task study that hypothesized personality to be related to task performance. This article attempted to find relation between monitoring performance on various tasks (i.e. including tracking task performance) and introversion/extraversion, and did not even consider conscientiousness as a predictor (Singh, Molloy, and Parasuraman, 1993). Consequently, they found no relationship between monitoring performance and introversion/extraversion.

It should be noted that this could be due to the aforementioned fact that earlier studies, which often spur new research, did not look specifically for the trait Conscientiousness. Regardless, there has been little connection between sensory and perception research (i.e. psychomotor tracking tasks) and industrial/organizational research and utility. The findings from these two areas are instrumental in allowing different disciplines of study to logically converge and expand knowledge, validity and utility of personality's role on job performance. It is the intent of this study to bring together these two various areas and find if there is indeed a connection between conscientiousness and a specific simulated tracking tasks.

Barrick and Mount has stated that conscientiousness would probably be a good predictor of all jobs. Most evidence has shown that conscientiousness is an important determinant of job performance and should occupy a central role for those that seek to explain job performance (Schmidt and Hunter, 1992, as cited in Barrick, Mount and Strauss, 1999).

Given the preponderance of evidence that traits like will to achieve, dependability, and organization are valid predictors of performance, it seems logical that subjects that score high on a conscientiousness scale would do better at a tracking task than those who score lower. Indeed, it seems rational that people who exhibit a trait like will to achieve would perform better and try to achieve at all levels, no matter what task, job, career, etc. that they were attempting than others. It could also be speculated that these individuals would be more dependable, thus they would try to follow directions as closely as possible (i.e. keep cursor on target) and try harder for longer periods of time. Lastly, it could be argued that individuals high in Conscientiousness would try to find some way to find organization within the tasks, where they would try and find some pattern to more efficient performance. Conversely, those that do not show exhibit these traits would be destined to fail at most tracking tasks.

Given the empirical argument as to the utility of Conscientiousness and tracking tasks, this study proposes the following hypothesis:

H1:   There will be an increasingly powerful negative relationship between individual scores on the Conscientiousness scale of the Goldberg 100 item personality inventory and the 10 interval performance scores on the compensatory tracking task over 5 minutes

The purpose of the present study is to expand the knowledge base on what personality traits relate to tracking tasks' performance criteria By using a tracking task in this study, new directions are being pursued A greater understanding of human limitations and capacity is being sought which may allow greater efficiency in selection in a variety of arenas in human resources

CHAPTER III

METHODS

Participants

The subjects that participated in this study work within the Child and Youth Services Division and included employees from the Watter's Child Development Centers #1 and #2 (CDC #1 and #2), School Age Services and Youth Services on the Fort Campbell, Kentucky Army base. The cultural make up consisted of American Federal employees of the following ancestry or ethnic background: Puerto Rican, Mexican, Spanish, German, Jamaican, African, and varying degrees of European ancestry. The socioeconomic level was low to middle class. There were a total of 51 volunteer participants in the study.

Measures

Personality Markers. Subjects responded to a computer-based measure of Goldberg's (1992) one hundred item unipolar adjective trait markers (appendix A). Goldberg (1992) was able to find a set of 100 variables that uniformly produced the Big Five factor structure. This set included five reasonably homogenous subsets of variables and that were orthogonal to all the others. Goldberg used the 133 and 100 synonym clusters used in his previous studies, as well as the NEO-PI and Hogan-Personality Inventory (HPI), as criteria to compare his new briefer version of the Big Five since the former was based on a representative sampling of English language trait. Although a fairly new instrument, initial tests have shown content validity and reliability to be strong (Goldberg, 1992). The mean convergence correlations across the five corresponding factors were .85 for the 133 clusters and .86 for the 100 clusters

described in Goldberg (1990). For the 100 difference scores in Goldberg's 1992 study, the mean convergence validity was $r=.90$. The NEO-PI and abbreviated 100 trait items averaged .60, the bipolar scales averaged .71 and the Hogan-Personality Inventory (HPI) scales averaging .53. The NEO scale was lower for factor five (i.e. intellect vs. openness, .46) than for the other four factors. It should be noted that Goldberg defines factor markers as being intended solely as a means of locating other measures within a comprehensive structural representation, while personality scales are intended as measures of individual differences to be used for decision making in applied contexts. Thus markers are more global in their purpose while the scales are more specific in their purpose. Also, scales are often products of markers.

Tracking Task. Using the same computer and mouse, subjects were then instructed to perform a relatively boring and frustrating compensatory tracking task following the completion of the personality inventory. The compensatory tracking task required each subject to move the mouse that controls a computer screen cursor to compensate for computer generated deviations in the cursor in order to match the cursor to a target on the screen. The subjects were then asked to perform the task for a five-minute trial.

All trials produced a data output list that includes the program's icon position, subject position, and the difference between the two, indicating how close subjects are matching the criteria. The compensatory tracking tasks computer program to be used was developed by Dr. G. Blair, at Austin Peay State University, Clarksville, Tennessee. The task is called simply Compensatory Tracking Tasks, although not formally.

Procedure

Before beginning each session, subjects were asked to volunteer for the study. The trials were completed away from all interruptions in a closed office. Subjects were assured that their results and responses would be kept confidential and signed a statement of informed consent that briefly explained the purpose of the study and as well as their rights as participants.

Subjects were then asked to use Goldberg's (1992) Big Five personality instrument of common human traits to describe themselves as accurately as possible. Each was asked to describe himself/herself at the present time, not as each wishes to be in the future. They were further instructed to describe themselves typically, or generally, as compared with other persons they know of the same sex and roughly the same age. Subjects were then asked to rate each adjective on a nine point summated rating scale ranging from 1 (Extremely Inaccurate) to 9 (Extremely Accurate) using a mouse to point and click their choice. Sum scores of each trait adjectives determined whether they are conscientious or unconscientious, extraverted or introverted, etc.

Finally, the subjects were asked to perform the tracking task. No practice was permitted. Subjects were informed to keep the icon cursor as close to the target as possible by manipulating the computer mouse.

Data Analysis Strategy

Tentatively, the analysis was to be a multiple regression on conscientiousness scores and tracking tasks scores. Conscientiousness scores would have been regressed over ten thirty second intervals (five minutes total time), with the conscientiousness score as the dependent variable and the ten scores as the independent variable. It was hypothesized that the discrepancy would be smaller for people who are high in conscientiousness, thus allowing negative beta weights for the last one or two intervals. The beta score is a semi-partial correlation with each one-minute interval and conscientiousness scores. Since this study tracked errors, beta would have started with zero and moved towards more negative values if highly conscientious subjects made fewer errors.

CHAPTER IV

RESULTS

The hypothesis suggested that there would be a negative relationship between conscientiousness and tracking task performance. More specifically, it was assumed that the magnitude of this relationship between these two variables would become increasingly strong with each successive trial on the tracking task. Originally, the hypothesis was to be tested using a multiple regression analysis by regressing conscientiousness scores on tracking task performance with performance on each trial being treated as a separate predictor. However, this analysis was deemed inappropriate because there were an insufficient number of participants from whom data could be gathered ($\underline{N}=51$). As an alternative analysis, correlations that included all 51 participants were computed for the ten intervals measured for the tracking task. A visual inspection of these correlations in Table 1 show that the pattern did not show an increasingly negative correlation as hypothesized.

Table 1.

Correlation Matrix of Conscientiousness and Tracking Task Performance.

Tracking Task Intervals	Conscientiousness
Conscientiousness	1.000
Interval 1	-0.051
Interval 2	0.094
Interval 3	0.102
Interval 4	0.245
Interval 5	0.348
Interval 6	0.023
Interval 7	-0.028
Interval 8	-0.084
Interval 9	0.203
Interval 10	0.130

In addition, a K-Means cluster analysis was performed on the data to identify the presence of any groupings of participants who performed similarly on the tracking task. Such groupings were then compared to determine if they differed on the basis of personality. The analysis proceeded as follows. First, a K-Means cluster analysis using the Euclidean distance metric was performed and resulted in the creation of two distinct groups. One cluster contained 49 cases while the second cluster contained only 2 cases. Figure 1 shows the cluster profile plots of the two clusters. As can be seen in the plots, the first cluster profiles show little variance in the performance of the 49 participants in

this cluster over the ten measures of tracking task performance. Conversely, the

two participants or cases in the second cluster demonstrated a greater amount of variance

in their performance on the tracking task.

Figure 1.

Cluster Profile Plots Using the Euclidean Distance Metric

Cluster 1
n= 49

Cluster 2
n= 2

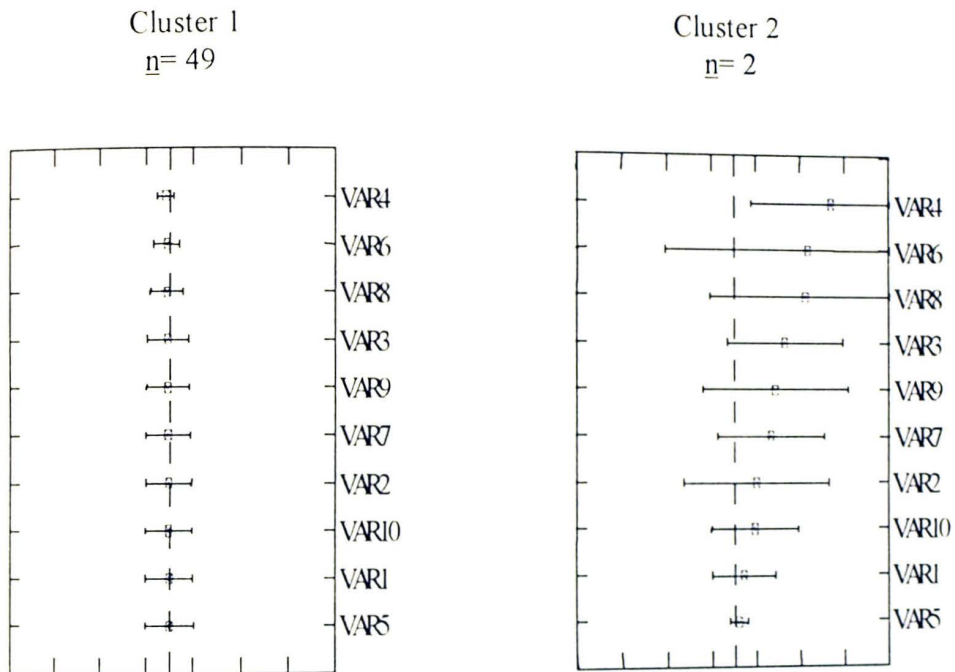Table 2 shows the means and standard deviations. Because the second group

consisted of only two participants, it was not possible to compare the two groups using a

t test. Consequently, the data was simply examined to note any apparent differences

between the groups on personality. Contrary to the hypothesis stated above,

Conscientiousness resulted in little effect on tracking performance. Rather, the mean and

standard deviation of the two participants in cluster 2 (M=130.50, SD=7.778) showed

little difference from that of cluster 1 participants (M=121.694, SD=17.786). The

magnitude of the difference between the standard deviations of the two clusters was

small, given the insufficient number of participants in cluster 2. Compounded with the

8.806 point difference in means between the two clusters indicates that this is not a

meaningful difference given the sample size. It was originally thought that since the task

was relatively boring and tedious, subjects' performance would be progressively better

(i.e. less error) if they scored higher on Conscientiousness. Looking at Figure 1, these

two individuals' performance was more cyclical than progressive. Again, these results

are contrary to the hypothesis that states that highly conscientious individuals would

perform better at this task over time.

Table 2

Means and Standard Deviations of Cluster 1 and 2

CLUSTER 2

	Agreeableness	Conscientiousness	Extroversion	Intellect	Neuroticism
M=	124.500	130.500	149.500	144.500	89.500
SD=	4.950	7.778	6.364	13.435	10.607

CLUSTER 1

	Agreeableness	Conscientiousness	Extroversion	Intellect	Neuroticism
M=	125.510	121.694	99.796	114.122	79.000
SD=	18.427	17.786	17.384	19.967	16.199

Findings on Extroversion

While no hypothesis was offered regarding the relationship between extroversion and tracking task performance, a review of the available data from this study was conducted in light of prior conflicting findings in the literature (e.g. Dornic and Ekehammar, 1990; Jerneic and Sverko, 1993). When the K-Means cluster analysis was performed, a visual inspection showed that there were some interesting findings. Table 2 shows that Extroversion/Introversion had a 49.704 difference in means between the two cluster groups. Specifically, cluster 2 participants' mean average was higher on this scale ($\underline{M}$=149.5) with a lower standard deviation ($\underline{SD}$=6.364) than cluster 1 participants, ($\underline{M}$=99.796, $\underline{SD}$=17.384). The two participants' of cluster 2 had raw scores of 145 and 154, which converted to Z-scores of 2.6 and 3.1, respectively. That is, these two individuals scored 2.6 and 3.1 standard deviations above the mean for cluster 1 participants on the Extroversion/Introversion scale.

A visual inspection of the performance of these two participants on the tracking task measures in Figure 1 shows that the difference was most pronounced for the 4th, 6th, and 8th variables, which indicates that these variables had the greatest amounts of errors on the tracking task. Interestingly, the 1st and 5th variables on the tracking task had fewer errors on these measures of the tracking task. As stated above, these two individuals' performance was more cyclical than progressive. These results support some earlier research concerning Extroversion and performance, which found that less stimulating tasks, such as the task in this study, are less captivating or interesting to people that are highly extroverted (Jerneic and Sverko, 1994).

CHAPTER V

DISCUSSION

The results from the correlation and K-means cluster analysis showed that the hypothesis in this study was not supported. Specifically, the results showed that there was not an increasingly stronger relationship between the personality trait conscientiousness and tracking task performance of participants over time. This is contrary to what recent research on personality traits and job task performance has found. Rather, research has shown that it is commonly accepted that the personality factor Conscientiousness has a statistically significant relationship with job performance (Barrick and Mount, 1991; Salgado, 1997; Barrick, Mount, and Strauss, 1999; Frink and Ferris, 1999).

Incidentally, a review of the K-means cluster analysis demonstrated that individuals that scored high on the personality trait extroversion tended to do worse on the relatively boring and tedious tracking task in this study. This supports earlier arguments by Eysenck (1967, as cited in Jerneic and Sverko, 1994) that asserted extroverts tend to perform better at more complex tasks due to their low cortical arousal or strong nervous system while introverts tend to perform worse at complex tasks due to their high cortical arousal or weak nervous system. That is, it could be assumed that the participants that scored high on extroversion tended to allow their focus to wonder since they were bored with the task.

Limitations

Certain circumstances were present that may have limited the analysis of the data. It was mentioned earlier that only 51 individuals participated in the study, which did not allow for the originally planned multiple regression analysis to be performed. Since a multiple regression analysis would require a larger number of participants, and likely greater variability in scores, a clearer picture of the relationship between conscientiousness and tracking task performance may have been found.

The paucity of individuals that fell within cluster 2 of the K-means analysis makes the results and subsequent interpretation subject to suspicion. Gathering a substantial number of individuals that score extremely high and/or low on the conscientiousness scale and extroversion scales may allow a clearer picture of their relationship to tracking task performance.

Another area of concern was the fact that only one-word adjectives were used in the personality assessment. Some of the words could have been misinterpreted or not understood. Five participants mentioned that they thought the personality assessment was trying to "trick" them by having the same word come up twice. What they thought was a repeat of the word may have been the polar opposite, e.g. intellectual vs. unintellectual. Moreover, a few individuals asked about the meaning of some of the words, such as "imperturbable." Although all participants had at least a high school diploma, all the adjectives may have not been understood by the participants or defined as they relate to the personality traits.

There is also concern that the personality assessment was self-reported. Although the results were kept confidential and no name was associated with individual

scores on either the personality assessment or the tracking task, one could question how honest some individuals would be when asked whether they are negligent, careless or haphazard, etc. Many people are inclined to bias there self presentation so that they may not be able to give a true self rating on adjectives that are seen as derogatory or negative (Ellingson, 1999; Ellingson, Sackett and Hough, 1999). Indeed, there is some evidence that validities of personality measures based on self-assessments may underestimate the true validity of personality traits (Mount, Barrick, and Strauss, 1994). Given that many may not have understood or misinterpreted some of the adjectives, another instrument that includes conscientiousness in its scales and elaborates on the meaning of the adjective, such as the NEO-PI, may serve to measure personality traits better than the instrument used in this study.

Another shortcoming was the fact that there was little incentive for the participants to put forth their best effort on the personality instrument and the tracking task. All participants were volunteers, and most were doing this exercise either during their lunch break or after working for a considerable amount of time with children. Given this information, some may not have been motivated to put much effort into the study. This may have been the case on a few occasions since participants were able to go through all 100 adjectives in less than ten minutes. One could suspect that if they put forth such little effort during this first part of the study, it would follow logically that they would be less diligent with staying on target during the tracking task.

Suggestions for Future Research

First, it would be beneficial to obtain a larger pool of participants. This may increase the variance of scores as well as allow a statistical analysis that would show if

there were any patterns of performance over time for a given group rather than resorting to groupings of overall performance as was necessary in this present study.

As mentioned above, a better known and more commonly used personality measure such as NEO-PI may allow a better assessment of personality traits. Although more lengthy and time consuming for participants than the instrument used in the present study, the NEO-PI has proven to be valid, reliable and easily understood by participants due to the format which elaborates on personality trait adjectives. In addition, this Big Five personality instrument measures the trait Conscientiousness, which other commonly used instruments, such as the Minnesota Multiphasic Personality Inventory (MMPI), do not include (Barrick and Mount, 1991).

If it were possible, allowing some type of incentive or demonstrating a personal benefit to participants could help overcome apathy that was feared to be present in this present study. People will tend to try harder and be more thorough if they feel that there is some incentive or benefit for their efforts. Moreover, if data collection could be conducted during a time when participants have not just finished a work day or when it is not their lunch break may lead to better validity of measures on personality traits as well as performance on the tracking task.

Another suggestion for future studies would be to develop tracking tasks that directly simulate a task that is performed on the job. Since this tracking task was merely a compensatory tracking task that did not relate in any way to the duties or tasks of the participants, they may have seen little value in the task. For example, flight simulators help pilots better their real work performance, it is logical that they would see more value

in being more attentive and diligent when performing the simulated task since it directly relates to the performance they do on the job (Sansone, Wiebe, and Morgan, 1999).

Lastly, increasingly difficult tracking tasks could be incorporated to help find limits of individuals that exhibit a primary personality trait. For instance, Himmelwiet (1946, as cited in Morganstern, Hodgson and Law, 1974) initially found that introverts perform better at tracking tasks, but as process demands, distractions and environmental stress increased, extroverts tend to perform better (Morganstern, Hodgson and Law, 1974). That is, increasing sensory and perception demands on highly conscientious (or other personality traits) individuals may lead to the discovery that the Yerkes-Dodson Law comes into effect, i.e. as arousal increases, performance increases to a point, then drops back off.

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Appendix A

How Accurately Can You Describe Yourself?
100 Unipolar Personality Markers

Please use this list of common human traits to describe yourself as accurately as possible. Describe yourself as you see yourself at the present time, not as you wish to be in the future. Describe yourself as you are generally or is typically, as compared with other persons you know of the same sex and of roughly your same age.

Before each trait, please write a number indicating how accurately that trait describes you, using the following rating scale:

	Inaccurate					Accurate			
Extremely	Very	Quite	Slightly		Neither		Slightly	Quite	Very	Extremely
1	2	3	4		5		6	7	8	9

Active	Extraverted	Negligent	Trustful
Agreeable	Fearful	Nervous	Unadventurous
Anxious	Fretful	Organized	Uncharitable
Artistic	Generous	Philosophical	Uncooperative
Assertive	Haphazard	Pleasant	Uncreative
Bashful	Harsh	Practical	Undemanding
Bold	Helpful	Prompt	Undependable
Bright	High-strung	Quiet	Unemotional
Careful	Imaginative	Relaxed	Unenvious
Careless	Imperceptive	Reserved	Unexcitable
Cold	Imperturbable	Rude	Unimaginative
Complex	Impractical	Self pitying	Uninquisitive
Conscientious	Inconsistent	Selfish	Unintellectual
Considerate	Inefficient	Shallow	Unintelligent
Cooperative	Inhibited	Shy	Unkind
Creating	Innovative	Simple	Unreflective
Daring	Insecure	Sloppy	Unrestrained
Deep	Intellectual	Steady	Unsophisticated
Demanding	Introspective	Sympathetic	Unsympathetic
Disorganized	Introverted	Systematic	Unsystematic
Distrustful	Irritable	Talkative	Untalkative
Efficient	Jealous	Temperamental	Verbal
Emotional	Kind	Thorough	Vigorous
Energetic	Moody	Timid	Warm
Envious	Neat	Touchy	Withdrawn

Factor I: Surgency

I+
Extraverted
Talkative
Assertive
Verbal
Energetic
Bold
Active
Daring
Vigorous
Unrestrained

I-
Introverted
Shy
Quiet
Reserved
Untalkative
Inhibited
Withdrawn
Timid
Bashful
Unadventurous

Factor II: Agreeableness

II+
Kind
Cooperative
Sympathetic
Warm
Trustful
Considerate
Pleasant
Agreeable
Helpful
Generous

II-
Cold
Unkind
Unsympathetic -
Distrustful
Harsh
Demanding
Rude
Selfish
Uncooperative
Uncharitable

Factor III: Conscientious-ness

III+
Organized
Systematic
Thorough
Practical
Neat
Efficient
Careful
Steady
Conscientious
Prompt

III-
Disorganized
Careless
Unsystematic
Inefficient
Undependable
Impractical
Negligent
Inconsistent
Haphazard
Sloppy

Factor IV: Emotional Stability

IV+
Unenvious
Unemotional
Relaxed
Imperturbable
Unexcitable
Undemanding

IV-
Anxious
Moody
Temperamental
Envious
Emotional
Irritable
Fretful
Jealous
Touchy
Nervous
Insecure
Fearful
Self-pitying
High-Strung

Factor V: Intellect

V+
Intellectual
Creative
Complex
Imaginative
Bright
Philosophical
Artistic
Deep
Innovative
Introspective

V-
Unintellectual
Unintelligent
Unimaginative
Uncreative
Simple
Unsophisticated
Unreflective
Imperceptive
Uninquisitive
Shallow

Movebar