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Measuring preference for virtual teams scale development and validation

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Measuring preference for virtual teams
Scale development and validation

by

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DEDICATION

A César por enseñarme que lo importante es navegar y que a veces la realidad no debe ser un obstaculo para los sueños. A Cecilia por enseñarme que otras veces el valor esta en hacer los sueños realidad, despacito, día a día, con esfuerzo. A Marianita, por abrir este camino y estar siempre a una puerta de casa. A Tati por este proyecto, que no era mio y hoy lo es. A mis hermanos - los de sangre - por estar ahi, por exigirme, por apoyarme, por marcar el sur y por seguir siempre la ley primera. A mis hermanos – los de la vida - por hacer del viaje una aventura, y cuando faltan inventarlas. A Claudia que me mostro que a veces reinventarse es cuestión de que alguien inesperado crea en ti. A Rut, Fer, Nati, Facu, y Zoe, por todo… y por agregarme cinco motivos a los 100 que ya listó Sabina.

TABLE OF CONTENTS

List of Tables

Abstract

Virtual teams have become increasingly popular in many different environments due to their ability to break the boundaries of time and space. Their importance is reflected by the growing number of research that is done to understand virtual communication and virtual team structure and processes. In order to better understand what drives attitude for virtual teamwork, we propose an instrument that measures preference for virtual teams. This paper reviews the proposed scale and its internal validity.

Introduction

Increasing global competition challenges companies to react and adapt faster than ever before. To effectively compete in a global market, businesses face the pressure of doing more with less people and resources. To be cost-efficient, companies are organizing themselves in new ways, with newer types of organizational-units, like self-managed work teams, replacing middle management. Information technology breaks the barriers of space and time by enabling people to interact in teams that are not located proximate to one another. These "virtual teams" allow companies to tap into their human resources without incurring the costs involved in putting team members in the same location at the same time.

The growing number of virtual team studies reflects their importance for businesses. Most virtual team research has focused on team structure (Bell and Kozlowski 2002; Dubé and Paré 2002; Townsend, DeMarie and Hendrickson 1998; Townsend, Hendrickson and DeMarie 2002) and what influences its performance (Armstrong and Priola 2001; Balthazard, Potter and Warren 2004; Bell 2004; Furst, Blackburn and Rosen 1999; Ocker and Fjermestad 2000; Wong and Burton 2000). However, there has been little research regarding the individual preference for virtual teams (Workman, Kahnweiler and Bommer 2003).

Research Objective

Morsel and Caldwell's research shows that a correct fit between an employee's personality and his environment leads to increased satisfaction and performance. This fit exists when the environment provides the employee with the opportunity to express behaviors that are associated with his or her individual personality predispositions (Morse and Caldwell 1979). There is plenty of research that looks into how personality affects teamwork and what types of personality work well with others (Armstrong and Priola 2001; Gorla and Lam 2004; Morgeson, Reider and Campion 2005; Thomas 2005). It is important to understand how personality affects attitude towards virtual teamwork, so managers can take this into account when selecting team members. Careful selection of team members helps managers to put together well balanced virtual teams and increase their chances of success. This research is a preliminary design and validation of an instrument to measure preference for virtual teamwork.

Virtual Team Definition

Townsend *et al.* defined virtual teams as dispersed groups of people interacting through computer mediated communication (CMC) tools aiming to accomplish an organizational task (Townsend *et al.* 1998). This work unit performs and is evaluated as a team, even though the team members may never be physically co-located.

Today there is no actual consensus on the exact definition of the term "virtual team". Both of the words "virtual" and "team" encompass a wide degree of configurations. For some, the word team includes "task groups", "coordinated independents", actual teams, etc. (Dubé and Paré 2002; Furst *et al.* 1999; Katzenbach and Smith 1993; Misiolek and Heckman 2005). Teams can also have different degrees of "virtuality". It is rare today to find a pure "face to face team" that does not use any CMC tools in their communication, almost every team has at least a small degree of virtuality (Bell and Kozlowski 2002; Dubé and Paré 2002; Martins, Gilson and Maynard 2004). Teams with the highest degree of "virtuality" rely completely on CMC since members reside in different locations and never see each other face to face. These team members may even be situated in different time zones, work asynchronously and belong to different organizations and cultures (Bell and Kozlowski 2002; Dubé and Paré 2002).

Many believe the key characteristic differentiating virtual teams from other teams is the use of technology to communicate, regardless of the location of the team members (Dubé and Paré 2001; Townsend *et al.* 1998). For others, the main characteristic is geographic dispersion (Bell and Kozlowski 2002). The majority of scholars agree that virtual teams have complex tasks to address, requiring close interaction, and that team members communicate mostly by some type of computer mediated system (Bell and Kozlowski 2002; Dubé and Paré 2002; Lipnack and Stamps 1997; Townsend *et al.* 1998; Townsend *et al.* 2002).

Lipnack and Stamps modeled teams using three ingredients: people, purpose and links (Lipnack and Stamps 1997). The main difference between conventional co-located teams and virtual teams resides in their links - the way the team members interact with each other. It is the use of technology to communicate that allows a virtual team to break the boundaries of time and space.

We adopt Lipnack and Stamps' model of virtual teams. A virtual team is any small group of people communicating mostly through CMC and rewarded together. That is to say, not only do they have a common goal, but their work cannot be evaluated independently.

Thesis Organization

The rest of the thesis is organized as follows: First a brief discussion about what is a virtual team is provided, follow by a review of electronic communication and virtual team dimensions. Based on the reviewed literature, the next section analyzes the development of a preference for virtual teamwork scale. This is followed by an analysis of the construct validation of the scale, including how personality theories and other constructs like computer anxiety and self-efficacy are related to attitude towards virtual teams. Finally results, limitations and contributions of the study are highlighted.

Understanding CMC and Virtual Teamwork

MEDIA RICHNESS AND MEDIA NATURALNESS THEORIES

Media Richness (Daft and Lengel 1986; Daft, Lengel and Trevino 1987) is one of the most used theories to study electronic communications. Daft and Lengel classified communication media in different levels of "*richness*" depending on their number of channels, cues, feedback capacity and the extent that they allow participants to experience others as being psychologically close (social presence). Face to face (FTF) communication is the "richest", followed by videoconference, telephone and eventually text-only communication (Daft and Lengel 1986; Daft *et al.* 1987). The richness of a particular medium channel is an objective factor that depends on the medium capabilities (Daft and Lengel 1986; Daft *et al.* 1987).

According to Jarvenpaa, Media Richness theory questions the ability of lean media to allow the development of interpersonal relationships, given its inability to transmit social cues (Jarvenpaa and Leidner 1999). This limitation represents a strong impediment for developing virtual teams that communicate solely through technology because it does not develop trusting relationships and, therefore, team cohesion. Walther's research (Walther 1996) provides evidence that teams communicating through CMC experience the same interpersonal interaction as FTF teams, given enough time and all other things being equal.

The only difference between CMC and FTF communication in terms of its capacity to exchange social information resides in the amount of time it takes (Parks and Floyd 1996; Walther 1996, 1997).

Newer theories such as Media Naturalness (Knok 2002) have been developed to explain why perceptions of various media are not constant but become more positive as people get familiar with leaner media (DeRosa, Hantula, Kock and D'Arcy 2004). Media Naturalness theory was developed from an evolutionary point of view and it states that since FTF communication has historically been the main form of human interaction, humans are adapted and optimized for it. That is why FTF is the most "natural" way to communicate (Knok 2002).

According to this theory, the lower the *degree of naturalness* of the media, the higher the level of cognitive effort required. A less natural media increases the ambiguity and decreases the physiological arousal (Knok 2002). The theory also claims that all humans share the same innate schema that rules communication preferences regardless of cultural or social background. Differences in preferences are explained by the fact that new schema can be learned and acquired through experience (DeRosa *et al.* 2004). The degree of naturalness of a particular medium depends on individual perceptions of the required effort and can change over time (Knok 2002). The importance of this theory is that it explains why once individuals adapt to leaner media, the medium becomes natural to them and, thus, they perceived it in a more positive way and are able to use it more effectively.

DIMENSIONS OF VIRTUAL TEAMWORK

What we know about conventional teamwork does not necessarily transfer to a virtual team setting. Many authors have compared conventional teams to virtual teams (Andres 2002; Bordia 1997; Ocker 2001a; Warkentin, Sayeed and Hightower 1997) and studied how the virtual environment affects teamwork participation differences (Bordia 1997; Hightower and Sayeed 1996; Siegel, Dubrovsky, Kiesler and McGuire 1986; Weisband, Schneider and Connolly 1995), trust (Jarvenpaa, Knoll and Leidner 1998; Jarvenpaa and Leidner 1999), leadership (Jarvenpaa *et al.* 1998; Misiolek and Heckman 2005), communication behaviors and processes (Hightower and Sayeed 1996; Lurey and Raisinghani 2001; Ocker 2001b).

Virtual teams can be quickly assembled since members are ready to participate wherever they are, at whatever time. This advantage over conventional teams influences the fact that most virtual teams structure are temporary, they generally have a short lifespan, membership is often fluid and changes as the task requirements change, their roles may shift over time, leadership is rarely appointed and might depend on the particular task, and team members might have to manage conflicting membership requirements for several virtual teams (DeRosa *et al.* 2004; Townsend *et al.* 1998). The different nature of the virtual teams' environment requires an additional skill-set in addition to the skill set required for teamwork in traditional team settings. Some of the skills needed by virtual teams include proficiency with the communication technologies, an increased ability to multi-task, capacity to interact with people from different cultures, and the ability to integrate tasks and behaviors with different groups of people (Townsend *et al.* 1998). These differences between virtual and conventional teams will have implications for how individual characteristics influence whether a person is a good virtual team member and they will also affect an individual's preference for working in a virtual team.

Participation

In a conventional team setting there are many factors that can limit a member's ability to participate during a discussion: research shows that participation from lower status members might be inhibited in the presence of higher status members (Weisband *et al.* 1995). Moreover, most people tend to be reluctant to go against the prevailing sentiment of their group (Hightower and Sayeed 1996) and might not contribute polemic information when they feel they may be poorly evaluated (Hightower and Sayeed 1996).

In virtual teams, participants are buffered from the social context as a result of the lower ability of communication media to transmit social context information (Siegel *et al.* 1986). This has a depersonalizing effect that leads to less inhibited behavior since participants are less worried about "what others might think" (Bordia 1997). In general, participation is more balanced in virtual teams and inequalities are attenuated (Bordia 1997; Hightower and Sayeed 1996).

Communication Process

In a FTF team session, members' opportunities to contribute information can be limited if there are time constraints or if the information load is high, since only one person can talk at a time. In order to produce a coherent flow, groups practice a set of implicit social norms (Hightower and Sayeed 1996). In general, FTF communication is an orderly process, with few long silences or interruptions. The flow is regulated by paraverbal and nonverbal cues (like voice volume, tone of voice, facial expression and body language) that provide feedback and help to communicate subtle meanings (Warkentin *et al.* 1997).

Similarly, CMC also has its own rules and norms, depending on the type and richness of the media (Balthazard and Potter 2000; Beranek 2000). In simultaneous text-based communication (chat) the ability of each member to process and follow the conversation is affected by their reading and writing speed and the fact that everybody can "talk" simultaneously. Since each individual processes the conversation in their own time, this can generate problems, like submitting a contribution that is no longer relevant or is out of context. At the same time, individuals have more time to think and edit their contributions before submitting them. In asynchronous text based communication (e.g. email or forums) there might be a considerable delay between messages, making it difficult for members to maintain a discussion or a line of thought, but this same fact also provides participants with more time to analyze and reflect before contributing (Warkentin *et al.* 1997).

In order to compensate for the leanness of CMC, teams need to come up with explicit conventions and procedures so that the communication can still have the same smooth flow as FTF communication (Balthazard and Potter 2000; Beranek 2000). The lack of social cues also affects communication limiting the social exchange, so team members still need to come up with ways to convey their meaning. One example of such tools is an "emoticon", which consists of character-combinations that denote emotional content (Beranek 2000).

Virtual teams tend to be more task-oriented than conventional teams because exchanging social information tends to be more difficult or require more time (Warkentin *et al.* 1997).

Trust

In virtual teams, trust is not only required to develop group cohesion, but it is also needed to prevent physical distance translating to psychological distance (Jarvenpaa *et al.* 1998). Research has shown that virtual teams, even when members never meet each other face to face, can develop trusting relationships (Kirkman, Rosen, Gibson, Tesluk and McPherson 2002). Moreover, it is possible to increase chances to develop this trust through training (Beranek 2000). Jarvenpaa *et al.* found that trust in virtual teams takes the form of "swift trust." Swift trust is developed by temporary teams where members have very little history of working together. They have low expectations about working together again in the future, the timeframe for accomplishing the team's goals is tight, and there is limited time for relationship building (Meyerson, Weick and Kramer 1996).

Literature on trust differentiates between dispositional and situational bases of trust. Dispositional trust is based on personality traits like an individual's inherent propensity to trust others while situational trust depends on contextual characteristics and an individual's perceptions of the other team members' trustworthiness. Even though situational-based trust has been found to be a stronger predictor of attitudes and behavior, dispositional trust is a better predictor in novel, ambiguous or unstructured situations (Kiffin-Petersen and Cordery 2003) like the ones generally presented by virtual teams. Jarvenpaa *et al.* found that in virtual teams' early stages of development, trust is based mostly on the members' own propensity to trust and stereotypical perceptions of other members' integrity and ability (Jarvenpaa *et al.* 1998).

The initial stereotypes will be influenced by previous experiences in constructing virtual relationships, so individuals that had good experiences in the past will have a higher propensity to trust and develop trusting virtual relationships (DeRosa *et al.* 2004). After the initial stages, trust is also based on the perception of other members' benevolence (e.g. willingness to do good beyond an egocentric profit motive) so the members' ability to show behaviors that help maintain trust is also important (Jarvenpaa *et al.* 1998). Jarvenpaa *et al.* found a set of behaviors and strategies that were common in virtual teams that exhibited high trust (Jarvenpaa *et al.* 1998). Based on their research we proffer a set of characteristics and

behaviors that should be present in the "ideal" virtual team member in terms of their ability to create and maintain trust:

- Proactive style of action, showing initiative and dependability.
- Focus on results while not ignoring social interaction completely and not spending too much time worrying about the group's procedures.
- A clear shared vision of the team's goals and what members need to do to achieve the goals.
- A communication style that shows a positive tone connoting excitement and encouragement.
- Predictability in the communication patterns. To avoid the inherent uncertainty of the virtual environment, the team should communicate frequently, providing substantial feedback on other member's contributions and keeping each other posted about expected changes in their communication patterns (i.e. members should notify the team when they expect they will not be able to participate as frequently as before).

Virtual team members need to feel comfortable and be open to learning how to use the CMC tools in order to communicate in such a way that fosters trusting relationships. Thus acceptance of technology is a requisite for developing trust in a virtual environment (Brown, Poole and Rodgers 2004).

Leadership

Due to the nature of the virtual teams, leadership is not always appointed *a priori* and might emerge during the team's life; it can also be distributed or shared among team members (Jarvenpaa *et al.* 1998; Jarvenpaa and Leidner 1999; Misiolek and Heckman 2005). DeRosa suggested that because virtual teams are more task-oriented and have higher levels of autonomy, they can be studied as self-managed work teams (SMWT) (DeRosa *et al.* 2004) which is consistent with virtual teams' rotational leadership.

Even if the requirements for the leaders might be different, Misiolek and Heckman suggest that existing functional theories about leadership in a conventional setting can be

applied to virtual teams. Their study suggests that even if leadership is not appointed, "no team is truly leaderless" and that leadership is achieved by a set of behaviors; such as initiating more social, task or process-oriented communication (Misiolek and Heckman 2005). Research shows that leaders are recognized by high participation rates both in FTF teams and virtual teams (Sudweeks and Simoff 2005).

Typical leader's tasks like monitoring members' activities and manage conflict might be conducted in a virtual team in a totally different way and require a different skill set. The exercise of leadership is also different since there are fewer means of social control (Warkentin *et al.* 1997). Emergent leaders in virtual teams usually present the following characteristics: (i) early and frequent task-related participation (Sudweeks and Simoff 2005) and (ii) competence both in terms of technical and communication ability. Technical ability depends on the task while communication ability refers to the individual's ability to relate to others and develop mutual understanding and the ability to convey a shared meaning to which other members can relate (Sarker, Grewal and Sarker 2002).

Preference for Virtual Teamwork

Preference for teamwork has been shown to be related to team members' satisfaction (Shaw, Duffy and Stark 2000) and performance (Bell 2004). There are several factors that influence people's attitudes towards teamwork. Among them are pre-dispositional and situational factors. Dispositional explanations include tolerance for change, propensity to trust and cultural values like collectivism orientation. Situational factors include trust in co-workers, managerial support, justice perceptions and workload distribution (Kiffin-Petersen and Cordery 2003).

Collectivistic orientation (vs. individualistic orientation) refers to the individual's general orientation towards group goals and propensity to cooperate (Wagner 1995; Wagner and Moch 1986), and it does not depend on the particular situation or team configuration. People with an individualistic orientation have a poor attitude about teamwork, they exhibit low team loyalty, and they lack pro-social behaviors (Ramamoorthy and Flood 2004). Collectivistic orientation is related to self-efficacy for teamwork, need for social approval and teamwork experience are related to collectivistic orientation (Eby and Dobbins 1997) . Shaw proposed preference for teamwork as a dimension of Wagner's individualism-

collectivism construct (Shaw *et al.* 2000). Shaw's scale reflects the degree to which an individual prefers to work on a team (i.e., a collectivist perspective) rather than autonomously (i.e., an individualistic perspective).

The *propensity to trust* is another personality trait that has been related to teamwork preference. Individuals with a high degree of trust in strangers have a better attitude towards teamwork (Kiffin-Petersen and Cordery 2003). Situational-trust factors, like trust in management and co-workers, have also been related to preference for teamwork (Kiffin-Petersen and Cordery 2003).

It is expected that the variables that affect preference for teamwork also affect preference for virtual teamwork, since virtual teams are merely one type of a team. Shaw *et al.* show that preference for teamwork is positively related to members' satisfaction and performance (Shaw *et al.* 2000). It is to be expected that preference for virtual teamwork has a similar effect.

Improving understanding about what personality traits affect preference for virtual teamwork, and being able to measure this preference, is relevant for individuals who have to assemble virtual teams. However there is little research that studies what influences attitude towards virtual teamwork (Brown *et al.* 2004; Workman *et al.* 2003). The present study is designed to shed light on this area by developing an instrument that measures preference for virtual teamwork. The construct *preference for virtual teamwork* is defined as the degree by which individuals prefer working in virtual teams over other work-organizations. The construct is expected to be multidimensional, encompassing concepts such as the preference for virtual teamwork over working alone and preference for virtual teamwork over conventional teamwork.

Scale Development

Validation is required to ensure that the instrument reflects the difference among individuals when measuring the characteristic it intends to measure (Churchill and Iacobucci 2002). Validity is established by ensuring internal, external and predictive validity. Internal validity refers to the accuracy of the measurement (reliability) (Cronbach 1951), as well as content and construct validity (Straub 1989). Content validity ensures that the instrument captures the domain of the characteristic that is being measured. Face validity, a common

sense indication that the scale appears to measure what it is intended to measure, is required but not sufficient. The key to content validity lies in the process used to develop the instrument and a careful selection of the scale items (Churchill and Iacobucci 2002).

Construct validity focuses on the effects of the instrument on the measurement. It is expected that the use of different methods to measure the same construct should produce the same results, in other words, measures of the same construct using different scales, or methods, should be highly correlated (Straub 1989). In this study, construct validity cannot be fully assessed, since there are no other methods for measuring preference for virtual teamwork. However, for pilot instruments construct validity can be assessed by establishing factorial validity, which establishes that the factors identified by exploratory factor analysis reflect the expected dimensions of the measure (Straub 1989).

External validity of a scale is ensured by testing its convergent and discriminant validity. If the construct preference for virtual teamwork exists and can be measured, it is expected that it can be measured with different tools across different samples of individuals. Measures of the same construct should be highly correlated, while measures of different constructs should not correlate too highly (Churchill and Iacobucci 2002). Since this is a pilot study and no comparable measures are available external validity cannot be assessed without further data collection.

The construct *preference for virtual teamwork* was understood to be related to preference for working with others and also influenced by attitude towards computers and particularly CMC. The basic hypothesis is that while some individuals will prefer to work by themselves and other people will prefer working within FTF teams, many individuals will fall somewhere "in the middle" and prefer working in virtual teams. This middle ground will be preferred by some people since virtual teams have characteristics from each end of the team spectrum.

The first five items in our scale were adapted from Shaw and Duffy's *Preference for Group Work* scale, which was based on Wagner's work about individualism-collectivism (Shaw *et al.* 2000; Wagner and Moch 1986). These items were expected to capture preference for virtual teams over working alone. Items six through 12 were designed to capture preference for virtual teams over conventional teams, taking into account differences

in attitude towards CMC. For a complete list of the items included in the scale refer to Appendix 1

Before asking experimental subjects to respond to the scale, the items were reviewed by researchers familiar with virtual team research in order to ensure the scale face validity and preliminary content validity.

Materials and Methods

Participants

The sample for this research consists of 153 subjects, 92 graduate students from the MBA program (60.0%) and 61 senior undergraduate business students (40.0%). The survey used to collect data was quite long, so students received extra credits for their participation. After eliminating fourteen cases due to missing responses the final sample included in 139 subjects.

Data were collected in two waves from graduate and undergraduate students, so an independent-sample t test was calculated comparing the MBA students to the undergraduate students. Since no significant differences were found between these groups, the results reported in this study are based on the pooled sample of 139 cases. The mean scores for each of the study variables as well as descriptive statistics for the final sample are included in Appendix 2

Materials

PERSONALITY: FIVE FACTOR MODEL

Maddi defines personality as a set of stable characteristics that determine the differences and similarities in the way people think, feel and act (Maddi 1989). The Five Factor Model (FFM) of personality is a widely accepted personality inventory that describes personality in terms of five factors generally labeled: extraversion, openness, neuroticism, agreeableness and conscientiousness (Digman 1990).

Extraverted individuals are sociable, assertive, active, and talkative. Introverts are not defined as the opposite of extraverts; rather, they are defined as being reserved and independent (Costa and McCrae 1985) .

Openness refers to having an openness to new experiences. Individuals exhibiting openness are curious, creative and open to new ideas and unconventional values. On the other hand, individuals with low scores in openness tend to be associated with people who tend to judge in more conventional terms or favor conservative values (Costa and McCrae 1985).

Neuroticism refers to emotional stability. Individuals who have low scores in this dimension are emotionally stable, they tend to be calm, relaxed and they are able to manage stressful situations without becoming upset. High scores in neuroticism are related with anxiety, tension, lack of confidence, impatience, pessimism and shyness (Costa and McCrae 1985).

Agreeableness is also a characteristic that reflects interpersonal tendencies. Agreeable people are altruistic, trustful and willing to help others. Disagreeable people are egocentric, tend to view other's intention with skepticism and are competitive rather than cooperative (Costa and McCrae 1985).

Conscientiousness is related to self-control and determination; it is also related to the ability of planning, organizing and willingness to achieve. People who score low in this dimension tend to be hedonistic and be more relaxed when trying to achieve their goals (Costa and McCrae 1985).

Personality was assessed using the Revised NEO PI-R Five-Factor Inventory (Costa and McCrae 1985). The instrument consists of 240 items, 48 for each factor, using a five point Likert scaled instrument (the scale ranges from strongly disagree to strongly agree). Higher scores in each dimension are associated with higher levels of that personality factor. Internal consistency of each scale was calculated using coefficient alpha. Coefficients for extraversion (E), openness (O), neuroticism (N), agreeableness (A) and conscientiousness (C) were .91, .90, .93, .89 and .90 respectively. Construct validity for this test is reported in the Revised NEO PI-R manual (Costa and McCrae 1985). Descriptive statistics for the NEO PI-R factors are presented in Table 1.

Table 1   FFM factors mean, sd, range and alpha

	Mean	Std. Deviation	Range	Cronbach's Alpha
Extraversion	119.49	21.53	54-163	.91
Openness	114.52	20.63	64-165	.90
Neuroticism	85.67	23.57	24-150	.93
Agreeableness	116.56	18.30	52-159	.89
Conscientiousness	126.79	18.55	60-177	.90

Valid N: 135

Each of the five NEO PI-R domains consists of six subcategory scales that measure different facets that allow for a better interpretation of the dimensions. A complete description of each of these factors' facets is found in Appendix 3.

COGNITIVE STYLE

The construct "style," originally defined by Allport, is a very important individual-level variable in human performance (Allport 1937). A style does not refer to an individual's abilities but instead to the way the individual prefers to use them. Many theories and models of styles were developed, including cognitive style (Messick 1984; Witkin, Moore, Goodenough and Cox 1977) and thinking style (Sternberg 1994).

Cognitive style refers to the way people process information. It is a relatively stable personality dimension that influences attitudes, values, and social interaction and it denotes a tendency to behave in a certain manner (Armstrong and Priola 2001; Workman *et al.* 2003). Research has studied the relationship between cognitive style and attitude towards computers, particularly in terms of extraversion/introversion (Benbasat and Taylor 1978; Zmud 1979).

One of the most common cognitive-style theories is based in Carl Jung's personality types theory (Jung 1923) and measured by the Myers-Briggs Type Indicator (MBTI). Briggs, Myers and Myers describe personality types in terms of four bipolar dimensions (Briggs Myers and Myers 1995).

Sensory vs. Intuition (SN): This dimension describes whether the individual prefers to observe his surroundings and gather information focusing on the facts or on the relationship among them. Sensing individuals perceive facts based on the five senses. In contrast, intuitive people perceive information through meaning and relationships or possibilities that go beyond what they perceive with their senses (Leonard 1996).

Thinking vs. Feeling (TF): This dimension describes how an individual judges or comes to conclusions about what they observe. Thinkers tend to make decisions using a logical step by step analytical process compared to the subjective values used by feelers (Leonard 1996).

Extraversion vs. Introversion (EI): This dimension measures whether the individual source of energy is focused on the outside world or the inner self. Extroverts are oriented

towards the outside world, they prefer oral communication and often process information verbally (Leonard 1996). Introverts, on the other hand, are more oriented towards the inner world; they draw energy from the world of ideas and impressions. They tend to prefer written dialog since it allows them pauses for thought and analysis (Leonard 1996).

Judging vs. Perceiving (JP): This dimension describes life style orientation, whether the individual prefers to interact with the world by perceiving or judging methods. Judging individuals regard life as something to be decided and willed, they like to plan things ahead and then consistently pursue that plan. Perceptive individuals believe that life is something to be experienced and understood, they are more spontaneous and like to keep their options open (Briggs Myers and Myers 1995).

These first two dimensions (SN and TF) describe how individuals gather and evaluate information. Individuals will have one of these aspects as the dominant dimension and the other will be subordinated. Thus some people are more focused on what they think about what they perceive, and other people will be more focused on the perceptions without imposing judgment on them. The other two dimensions (EI and JP) affect how individuals make decisions in terms of the preferred orientation and way of dealing with the outer world (Myers and Myers 1998). In each dimension, individuals have the ability to use both modes. However, they are inclined towards one over the other, and will learn to develop that mode throughout life. For example, there are two ways to gather information: individuals can be aware of things directly by use of their senses, or indirectly by intuition, which is the unconscious association of ideas about the things that are perceived through the senses – often called "a hunch." Each individual will be more adept to use one over the other, trust one mode over the other, and over time will become an S or an N type. The four MBTI dimensions can be combined giving rise to sixteen possible combinations. A detailed description of each of them is found in Appendix 3

There are different categories or factors to describe cognitive style depending on the theory and measuring instrument used. Another popular instrument is the Cognitive Style Index (CSI) developed by Allinson and Hayes (Allinson and Hayes 1996). Both MBTI and CSI are validated instruments and have been shown to be correlated (Allinson and Hayes 1996).

In this study, cognitive styles were assessed using the MBTI Form M (Myers and Myers 1998).The instrument consists of 93 dichotomous items measuring 8 bipolar dimensions. A difference score was calculated for each respondent: TF (Thinking-Feeling), EI (Extraversion-Introversion), SN (Sensing-Intuition) and JP (Judging-Perceiving) so that a positive score indicates Thinking, Extravert, Sensing and Judging. Descriptive statistics for the MBTI scores can be found in Table 2. Construct validity for this test was reported by Gardner and Martinko (Gardner and Martinko 1996)

Table 2   MBTI dimensions mean, sd, range and reliability

	Mean	Std. Deviation		Range	K20
EI	1.86		12.41	-21 – 21	.73
SN	-0.25		14.06	-26 – 26	.91
TF	1.53		13.89	-24 – 24	.85
JP	5.25		13.04	-22 - 22	.92

Valid N: 135

THINKING STYLES

Thinking styles, defined in the theory of mental self-government (Sternberg 1994), refer to the preferences in the way individuals manage their every day activities. The theory describes 13 styles, along five dimensions: function (includes the legislative, executive and judicial styles), form (includes monarchical, hierarchical, oligarchic and anarchic styles) level (includes global and local styles), scope (includes the external and internal styles) and learning (including liberal and conservative styles). Workman *et al.* found that the dimensions of scope, level and learning are relevant to understand preferences for telework vs. teamwork (Workman *et al.* 2003).

The **scope** dimension differentiates internal vs. external cognitive styles. Internal people tend to prefer working alone, analyzing a situation and coming up with their answer before sharing their thought process with other people, thus team discussion might be perceived as a distraction to their concentration. External people tend to prefer brainstorming and their thought process benefits from the interaction with others (Workman *et al.* 2003).

The **level** dimension differentiates between global and local cognitive styles. Global people tend to prefer mental representations that have fuzzy boundaries, and they can work at

different levels of abstraction depending on the context. Local people tend to need a higher level of detail to develop their mental representations, and they can handle less ambiguity (Workman *et al.* 2003).

The **learning** dimension differentiates between liberal and conservative cognitive styles. Conservative people tend to prefer structures and rules and have a low tolerance for change. Conversely, liberal people prefer to do things in their own way; they favor change, innovation and lack of structure (Workman *et al.* 2003).

Thinking styles have been related to the FFM factors. Fjell *et al.* show that there is a correlation between the scope dimension of thinking style and the extraversion dimension (Fjell and Walhovd 2004). The global and liberal thinking styles are significantly related to the extraversion and openness dimensions of the FFM, while local and conservative styles are significantly related to the neuroticism dimension (Zhang and He 2003). Due to the scope of this project, thinking styles were not assessed. There is research that studies how thinking styles affect commitment for telework vs. virtual teams (Workman *et al.* 2003).

SELF-EFFICACY

Virtual teamwork requires effective communication through CMC tools, consequently people in virtual teams require a certain degree of proficiency with the tools. According to Media Naturalness theory, this will lower the level of cognitive effort required and make the medium more natural. There is also evidence that previous experience influences expectation, acceptance and satisfaction with CMC tools (Bordia 1997). Individual attitude towards IT is not only affected by ability, but also by the perception of an individual's abilities regarding IT - or self-efficacy. IS research has established that self-efficacy is strongly related to individual adoption and use of computers (Compeau and Higgings 1995a) and is also related to learning computers and software (Compeau and Higgings 1995b).

General Self-efficacy was measured using Sherer *et al.*'s self-efficacy scale (Sherer, Maddux, Mercandenk, Prentice-Dunn, Jacobs and Rogers 1982). The instrument consists of 12 five point likert scale items. Coefficient alpha for the sample is .80. Sample items used in the scale include: "If I can't do the job the first time, I keep trying until I can", "Failure just makes me try harder", and "I feel insecure about my ability to do things".

COMPUTER ANXIETY

Computer anxiety has also been related to attitude towards computers (Leonard 1996). Computer anxiety is an anxiety state that affects individual reactions when interacting, or planning to interact, with computers. It involves a set of emotions that includes fear, hope, apprehension and personal threat, even if the situation does not present any real danger (Cambre and Cook 1985). Because computer anxiety is a state and not a personality trait, it can change over time and generally decreases with experience and training (Cambre and Cook 1985). Staples *et al.* state that lower levels of computer anxiety lead to higher levels of remote work self-efficacy (Staples, Hulland and Higgins 1999).

Computer Anxiety was measured using Dambrot *et al.*'s instrument (Dambrot, Watkins-Malek, Siling, Marshal and Garver 1985). The scale consists of 20 items that participants respond to using a five point Likert scale. Coefficient alpha for the sample is .72.

VIRTUAL TEAM EXPERIENCE

Virtual Team Experience was measured using a 5 point Likert scale to answer the question "I have worked on virtual teams" (from 'never' to 'frequently'). Table 3 presents descriptive statistics for each category.

Table 3   VT Experience

Has worked in VT	Count	%
1 – Never	70	50.4
2	22	15.8
3	21	15.1
4	19	13.7
5 – Frequently	7	5.0
Total	139	100.0

Results

Scale Refinement

ITEM ANALYSIS

Distributions for each of the scale's items were examined before conducting the analysis. Highly skewed and unbalanced distributions are not desirable, because they may adversely affect the results. Skewed items should be discarded unless a skewed distribution is expected based on previous studies (Clark and Watson 1995).

Distribution's skewness results for each of the items are found in Appendix 1. The fact that items six, nine, ten and eleven distribution skewness level was significant at the .95 confidence level indicates that they do not have normal distributions. Since no information is available about the items' distributions across different samples, items were not removed. Some caution should be exercised when interpreting results that involve items that are skewed.

FACTOR ANALYSIS

We examined the factor structure of the virtual teams scale through the use of Exploratory Factor Analysis, using a principal component estimation method with varimax rotation and the criterion of eigenvalue greater than 1.0. Varimax rotation yielded two strongly identifiable factors (accounting for 59.05% of variance from the data from the 12 items). These factors accounted for 30.9% and 28.1% of the total variance respectively (after rotation). All of the items exceeded the minimum required loading of 0.4 (Clark and Watson 1995). Based on this criterion we would have kept all the items, however, item six's loadings were very similar for both factors (0.40 for the first factor and 0.31 for the second one). We opted for removing item six from the final scale given its low loadings, its skewed distribution and the fact that factor one's reliability improved (from alpha = 0.86 to alpha = 0.89) after removing the item. Although item seven's loadings were above the cut criteria, it received careful consideration due to its relatively low loadings. In this case, the distribution of the responses for item seven was acceptable and the alpha coefficients remain the same if

we removed the item. Consequently, we kept the item even though its loadings were relatively small and even though it was the only item that presented cross-loadings.

Using these results, we calculated coarse factor scores and established two sub-scales for the preference for virtual teamwork scale. Pearson correlation among the sub-scales was relatively strong and significant $(r(137)=.43, p<.01)$, which indicates that both factors are measures of the same latent construct (preference for teamwork) but they capture sufficiently different dimensions of the construct to be consider independent sub-factors. The first sub-scale labeled "*Preference for VT over working alone*" includes items one through five. The second one, labeled "*Preference for VT over FTF*" includes items seven through 12. The means, standard deviations and loadings (with varimax rotation) for the 11 items composing the two factors are presented in Table 4.

Except for item seven, the factor loadings are consistent with the expected factors, showing relatively good support for the factorial validity of the scale. We expected both items six and seven to be in the second of the factors. Item six was eliminated from the scale since that improved the reliability results. Even though item seven presents cross-loadings, it loads higher in factor two, as expected.

Table 4 Items means, sd and loadings of exploratory FA

	Mean	SD	Fac.1	Fac.2
Factor 1: Preference for VT over working alone	0	1.00		
1. Rather work in VT than by myself	3.09	1.06	0.82	0.30
2. Prefer VT rather than individual tasks…	2.93	1.00	0.86	0.23
3. Working on VT is better than alone…	3.12	0.97	0.82	0.24
4. Rather work alone than VT (R)	3.04	0.99	0.82	0.17
5. Prefer to do own work and let others do theirs. (R)	2.88	0.92	0.72	-0.12
Factor 2: Preference for VT over FTF	0	1.00		
7. Likes working with others at diff locations …	3.23	0.88	0.43	0.54
8. As comfortable in VT as F2F	3.13	1.10	0.15	0.84
9. Easier working in VT than F2F	2.68	0.97	0.10	0.62
10. As effective in VT as F2F	3.55	0.95	0.11	0.79
11. Could not feel part of a VT team (R)	3.42	0.92	0.13	0.72
12. Would participate as much in VT as F2F…	3.29	1.08	0.17	0.73
Items that did not load in the factor structure				
6. Like to interact with others through technology	3.69	0.92	0.40	0.31

RELIABILITY

We computed coefficient alphas to determine the internal consistency of the entire 11-item scale and for each of the sub-scales. The results indicated a coefficient alpha of 0.87 for the 11-item scale, 0.89 for the 5-item *preference for VT over working alone* factor and 0.83 for the 6-item *preference for VT over FTF* factor. A high Cronbach alpha (i.e., above 0.80) indicates that a measure is reliable (Straub 1989), so these results support the reliability of the scales.

Validation

According to Cronbach and Meehl, the required steps to ensure construct validity are: (i) define the concepts and their interrelationships, (ii) based on the theory, generate a measurement instrument and (iii) empirically test the hypothesized interrelationships among the constructs (Cronbach and Meehl 1955). The following section continues the study of the construct validity by analyzing personality concepts and their expected relationship to the preference scales and finally testing those hypotheses based on the sample data.

HYPOTHESES

Based on virtual team requirements and personality theories reviewed in the literature, we analyzed whether or not the constructs should relate to one another. Based on this analysis, hypotheses were formulated.

Expected Relationships

When analyzing commitment towards virtual teams or telework – defined as one employee working alone from a remote location - Workman *et al.* found that people with an internal thinking style have greater commitment to telework over virtual teams. Internal individuals prefer to work by themselves. They approach problem solving in an introspective and deliberative way, thus they see social interaction as a disruption to their needed concentration (Workman *et al.* 2003). On the other hand, externals benefit from cooperation and prefer teamwork. For the same reasons, it is expected that internal individuals prefer working in virtual teams over FTF teams, since virtual teams provide a higher degree of

independence. Externals are expected to prefer FTF teams over virtual teams, and virtual teams over working alone, because they benefit from interaction with others in their work.

The internal thinking type is related to the FFM extraversion dimension, external individuals are associated with high extraversion, while internal individuals are associated with low extraversion (Fjell and Walhovd 2004). Consequently, we expect extraversion to be related to preference for virtual teamwork, with high extraverts preferring in order: FTF teams, virtual teams and lastly working by themselves, while low extraverts would reverse the order.

Hypothesis 1   *Extraversion is positively correlated with preference for VT over working alone.*

Hypothesis 2   *Extraversion is negatively correlated with preference for VT over FTF.*

Workman *et al.* also found that people with a liberal thinking style had a greater commitment to telework than to virtual teams. Liberal people prefer change, uncertainty and lack of structure. Working by themselves gives them a less traditional environment where they can set their own rules (Workman *et al.* 2003). For the same reason, we could expect that liberal individuals prefer virtual teams over FTF teams because the rules and structure would be defined by the FTF team and not the individual.

The liberal thinking style has been related to the FFM openness dimension, with liberal individuals scoring high in openness and conservative individuals scoring low in openness (Zhang and He 2003). Therefore, we expect open individuals to have a good predisposition towards virtual teams, compared to other work organization methods. We expect individuals who score low in openness to resist virtual teams since a certain level of openness is required for individuals to try a new concept like a virtual team.

Hypothesis 3   *Openness is positively correlated with overall preference for VT over working alone*

Hypothesis 4   *Openness is positively correlated with preference for VT over FTF*

Hypothesis 5   *Openness is positively correlated with overall preference for VT.*

Long and Averill reported that neurotic individuals tend to prefer being alone (Long and Averill 2003), thus it is expected that they do not have a good predisposition towards teamwork. Swickert *et al.* reported that individuals that are high in neuroticism show lower levels of Internet usage, this tendency has been explained as a result of the neurotics' higher level of anxiety and lowered self-efficacy (Swickert, Hittner, Harris and Herring 2002). Moreover, Burche and Andreson show that neurotic individuals do not prefer a high task-oriented team environment (Burch and Anderson 2004). Since neurotic individuals do not have a good predisposition towards some of the characteristics of working in virtual teams, we expect them to have a poor disposition towards virtual teamwork and prefer either working in FTF teams or alone.

Hypothesis 6   *Neuroticism is negatively correlated with preference for VT over working alone.*

Hypothesis 7   *Neuroticism is negatively correlated with preference for VT over FTF.*

Hypothesis 8   *Neuroticism is negatively correlated with overall preference for VT.*

Armstrong and Priola analyzed the effect of cognitive style in the task or social orientation of individuals. They used the CSI Inventory to determine cognitive styles. Their results showed that people with a predominantly analytic cognitive style (related to the introvert and thinking types of the MBTI) tend to be less socially oriented; they are more aloof and impersonal; they prefer a structured environment with low ambiguity; and they tend to be task-oriented (Armstrong and Priola 2001). Virtual teams are generally more task-focused, the communication tends to require more structure, and thus we expect introverts and thinking people to have a good predisposition to virtual teams. Ellis stated that asynchronous communication is better suited for introverts who prefer to get the "right idea" before communicating it (Ellis 2003) and Ellsworth showed that introvert students' interactions with others were facilitated by CMC (Ellsworth 1995). We expect introverts to

prefer working in virtual teams over FTF teams but alone over virtual teams. On the other hand, we expect extraverts to prefer virtual teams over working alone, and FTF over virtual teams.

Hypothesis 9 *Extroversion-Introversion is positively correlated with preference for VT over working alone*

Hypothesis 10 *Extroversion-Introversion is negatively correlated with preference for VT over FTF.*

McNulty *et al.* found that cognitive style, particularly the thinking dimension, affected the degree to which medical students use computers. Thinking individuals tend to use computers more frequently than feeling individuals (McNulty, Balthazar and Halsey 2002) and show a better overall disposition towards computers (Igbaria and Parasuraman 1989). According to Ellis, when participating in online forum discussions, thinking types prefer to focus in the task at hand and, they also benefit from the need to express ideas in writing (Ellis 2003). Given the good predisposition towards computers and the lower social orientation of thinking people, we expect thinking people to prefer virtual teams over conventional teams.

Hypothesis 11 *Thinking-Feeling is negatively correlated with preference for VT over FTF.*

Armstrong and Priola showed that individuals with an intuitive cognitive style in the CSI index – which corresponds to the intuitive and perceptive styles in the MBTI (Allinson and Hayes 1996) – have been shown to be more socially oriented, emotionally expressive, friendly, nurturing and warm towards others. They prefer less structure and more ambiguity in their work environment (Armstrong and Priola 2001). We expect intuitive and perceptive people to have a better disposition for conventional over virtual teams given the fact that FTF teams provide a better media to express emotions and allow more social interaction.

Hypothesis 12 *Sensing-Intuition is positively correlated with preference for VT over FTF.*

Hypothesis 13 *Perceiving-Judging is negatively correlated with preference for VT over FTF.*

No Relationship Expected

General self-efficacy, or the degree by which individuals trust in their abilities to accomplish tasks, is not expected to influence preference for virtual teamwork. Individuals with low general self-efficacy could be expected to have the same attitude towards virtual teamwork as individuals with high general self-efficacy. There is no reason to expect high or low self-efficacy individuals to have a better or worse predisposition towards working alone, virtually, or in conventional teams. If someone has high self-efficacy, they would believe they could be equally successful in any of these work environments.

Hypothesis 14 *Self-efficacy is not significantly, or very weakly, correlated with the overall preference for virtual teamwork scale or either of its factors*

No Particular Relationship Expected: Necessary But Not Sufficient Conditions

Conscientiousness seems to be an important ingredient for any kind of teamwork. De Jong states that conscientiousness is related to self-efficacy for participating in SMWT and is also related to the team effectiveness (de Jong, Bouhuys and Barnhoorn 1999). Moreover, there is indication that some degree of preference for procedural order might be required for virtual teamwork (Burke and Aytes 2001). Procedural order refers to the way people structure their activities (Putnam 1979). Some individuals prefer 'high procedural order,' which means more structured group sessions, sequenced activities, explicit procedures and time management. Others prefer less structure and more flexibility (Putnam 1979). Lurey suggested that virtual teams might require more structure than conventional teams in order to be effective (Lurey and Raisinghani 2001), Warkentin observed that cohesion and information exchange in CMC teams is positively related to perceptions of shared norms and expectations of task processes (Warkentin *et al.* 1997). These relate with some of the

conscientiousness facets, particularly competence, order, self-discipline and achievement striving. Additionally, it has been shown that conscientiousness is related to task-orientation (Burch and Anderson 2004), which is also a characteristic of virtual teams. Given the limitations of CMC, virtual teams are more task-oriented and require more structure in their planning and communication than conventional teams. Thus, even if conscientiousness is a important for any kind of teamwork, the requirement level is presumably a little bit higher for virtual teams. Beyond the required level of conscientiousness, there is no reason to expect highly conscientious individuals to prefer virtual teams over conventional teams or working by themselves. Therefore, we expect low conscientious individuals to show low or no preference for virtual teams, but no hypothesis can be established for highly conscientious individuals.

Jarvenpaa *et al.* show that a positive tone of the team communication influences the team's ability to generate swift trust and thus be effective (Jarvenpaa and Leidner 1999). The altruism and tender-mindedness facets of the agreeableness dimension are related with tolerance and understanding, which according to Warkentin *et al.* (Warkentin *et al.* 1997) are required traits for an effective virtual team member. Additionally, virtual team members will be more exposed to cultural differences (across different countries or different companies) (Townsend *et al.* 1998), so individuals with more propensity to trust others, that are more tolerant, sympathetic, and friendly will be better equipped to do so. Both agreeableness and openness appear to have a central role in mediating positive feelings about computer use (Bucy and Newhagen 2003), which is critical for individuals who communicate using CMC. Again, a certain level of agreeableness seems to be a requirement for virtual teamwork, but there is no reason to think that highly agreeable individuals would prefer virtual teams over any other work arrangement.

Virtual teams require the use of computers. The presence of relatively high computer anxiety represents an impediment for virtual teamwork. On the other hand, low computer anxiety cannot be linked to preference for virtual teams over other working alone or in conventional teams.

For the three characteristics, conscientiousness, agreeableness and computer anxiety, a low or no preference can be assumed for low conscientious, low agreeable and highly computer anxious individuals. However, when individuals are able to perform in virtual teams, meaning they have low computer anxiety, and a certain minimum level of agreeableness and conscientiousness, there is not enough information to establish a relationship between the characteristics and preference for virtual teams. The fact that individuals are able to perform in virtual teams does not necessarily mean that they prefer them over conventional teams or working by themselves. We do not anticipate a particular relationship, positive or negative, between these three characteristics and preference for virtual teams or any of its factors. The variables might still correlate because individuals who are not fit for virtual teamwork will probably show a low preference, but it is not possible to establish a particular relationship for the entire construct. If there is a relationship, it should be negative in the case of computer anxiety, indicating that the higher anxiety the lower the preference, and positive in the case of agreeableness and conscientiousness indicating that low agreeable and low conscientious individuals would have low preference for virtual teamwork.

CONSTRUCT VALIDITY ASSESSMENT

Pearson correlations were calculated between each of the selected variables and the preference score and its factors in order to confirm the expected interrelationships between the variables. Support for the hypothesized relationships points to the construct validity of the scale. Pearson correlation results for each of the variables are listed in Table 5.

Table 5   Correlations

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
FFM			
E	0.207*	-0.110	0.113
O	0.169*	0.243**	0.244**
N	-0.220*	-0.075	-0.173*
A	0.128	0.045	0.101
C	0.100	0.032	0.077
MBTI			
SN	-0.028	-0.027	-0.033
TF	0.126	0.085	0.124
EI	0.138	-0.153	-0.014
JP	0.117	-0.029	0.049
Comp. Anxiety	-0.197*	-0.333**	-0.315**
Self-Efficacy	0.182*	0.211*	0.232**

Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

N: 135

For *extraversion*, we found a weak positive correlation (r(133)=.207, p<.05) with *preference for VT over working alone*. The linear relationship between the variables indicates that high levels of extraversion correspond to high scores in factor one which supports **Hypothesis 1**. We found no support for **Hypothesis 2** since no correlation was found with *preference for VT over FTF*. This indicates that extraverts tend to prefer working in virtual teams more than working by themselves, but they show no preference when it comes to choosing between virtual teams or conventional teams; thus, they appear to have no preference for working by themselves.

The correlation between *openness* and *preference for VT alone* was weak but significant (r(133)=.169, p<.05). We also found a weak positive correlation between

openness and *preference for VT over FTF* (r(133)=.243, p<.01). These findings support **Hypothesis 3** and Hypothesis 4 respectively**.** This indicates that individuals who are open to new experiences tend to prefer working in virtual teams over working in conventional teams or by themselves. The correlation between *openness* was also significantly correlated to the overall preference score (r(133)=.244, p<.01), which supports Hypothesis 5. This indicates that open individuals have a good predisposition for virtual teamwork.

For the *neuroticism factor*, a weak but significant negative correlation was found (r(133) = -.220, p <.05) between it and *preference for VT over working alone. This indicates that high scores in neuroticism relate to low scores in the factor score, which supports Hypothesis 6*. However, neuroticism was not found to be related to *preference for working in VT over FTF teams*. Consequently, **Hypothesis 7** was not supported. Finally, a negative weak but still significant correlation (r(133)=-.173, p<.05) was found between *neuroticism* and the overall *preference for virtual teamwork* score which supports **Hypothesis 8.** This indicates that neurotics do not have a good disposition towards virtual teams.

No significant correlations were found for any of the MBTI dimensions and the preference score, or its factors. Thus, hypotheses **Hypothesis 9** to **Hypothesis 13** were not supported.

A weak positive significant correlation was found between *self-efficacy* and *preference for VT over working alone (r(137)=.182, p<0.5), preference for VT over FTF* (r(137)=.211, p<.05) and *with the* overall preference score (r(139)=.232, p<.01). Consequently, **Hypothesis 14** was not supported either.

No significant correlation was found between *conscientiousness* and the *preference for VT over working alone* factor and the *preference for VT over FTF* factor. The correlations between *agreeableness* and the preference scores were also not significant also. However, a negative correlation was found between *computer anxiety* and *preference for VT over working alone* (r(137)=-.197, p<0.5), *preference for VT over FTF* (r(137)=-.0333, p<.01) and the overall *preference for virtual teamwork* score (r(137)=-.315, p<.01). The correlation between computer anxiety and the overall score and the second factor are relatively strong. This could be due to the fact that our sample has a higher proportion of individuals who have

more than the required level of computer anxiety and thus their resistance to virtual teams is taking precedence over the preferences of lower anxiety individuals, but further research is needed to shed light on this relationship.

PREDICTIVE VALIDITY

Predictive validity refers to the ability of the scale to actually predict behavior. It would be expected that people who have a higher preference for virtual teamwork actually do it, at least when they have the choice.

We analyzed whether preference for virtual teamwork, and its factors, had an effect on actual use of the virtual team structure. Significant positive correlations were found between virtual team experience and *preference for VT over FTF* and the overall *preference for virtual teams* ($r(137)=.399$ and $r(137)=.302$, $p<.01$ respectively) indicating that individuals with higher frequency use of virtual teams have a higher preference for virtual teams, particularly when compared to face to face. No significant correlation was found with *preference for VT over working alone*. A one-way ANOVA was computed to compare whether there were differences between the levels of virtual team use (from 'never' to 'frequently'). The results are shown in Table 6. Significant results were found for the overall preference score and factor 2 (preference for VT over FTF teams). Individuals who worked frequently in virtual teams showed a significant slightly higher preference for virtual teams than people who have no experience in virtual teams ($m=38.7$ vs. $m=32.8$ respectively, $n=139$, $p<.01$) and higher preference for virtual teams over FTF teams ($m=24.5$ vs. $m=18.2$ respectively, $p<.01$). Differences for preference for virtual teams over working alone were not significant.

Table 6   VT Experience Means by Category

Has worked in VT	Preference for VT Mean (**)	Preference for VT over Alone Mean	Preference for VT over FTF mean (**)
1 – Never	32.8	14.6	18.2
2	32.7	14.9	17.8
3	35.9	15.6	20.3
4	38.4	16.5	21.8
5 – Frequently	38.7	14.1	24.5

(**) Significant at the .01 level- ANOVA

After the initial survey, a follow up study was done with the 94 MBA students to gather information about their use of virtual teams during their MBA experience. Each respondent was asked to estimate a proportion of the time that their MBA team worked in a virtual mode vs. a face to face mode. Responses for each member of the team were compared. When all members agreed that at least 60% of their work time was performed as a virtual team, we assigned that team to the virtual team category. When no agreement between the members' evaluation of their virtual team work was found or when the estimation indicated a FTF team, we categorized the team as being a conventional team. Unfortunately, only 31 students answered the follow up study.

To analyze if there was any difference between individuals who actually used virtual teams as part of their MBA experience and people who did not, an independent-sample t test was performed. No significant difference was found ($t(29)=.57$, $p>.05$). The mean preference score for students who used virtual teams predominantly ($m=32.1$, $sd=9.08$) was not significantly different from the mean of the students who used FTF teams ($m=32.0$, $sd=7.9$). Results were not significant for each of the two factors either.

Post Hoc Analysis

FFM

Given the significant findings involving the FFM's personality factors and preference for working in virtual teams, additional analysis were conducted using the subscales that comprise each of the FFM's factors.

Extraversion

As noted in 0 the extraversion factor in the NEO PI-R inventory is actually composed of six sub-dimensions: warmth, gregariousness, assertiveness, activity, excitement-seeking and positive-emotions. Correlations between each facet and the preference scores are listed in Table 7. W*armth* and *gregariousness* are the facets of extraversion that affect the preference for virtual teamwork scores. The Pearson correlations between *warmth* and *gregariousness* with *preference for VT over working alone* are weak but significant ($r(133)=.198$, $p<.01$ and $r(133)=.359$, $p<.01$ respectively). Gregariousness also shows a significant correlation with

the overall preference score (r(133)=.20, p<.01). Warm individuals tend to be friendly and develop attachment with others easily. Gregarious individuals are those who prefer other people's company. Both warm and gregarious individuals prefer working with other people rather than alone, even if it is virtually.

Table 7   Correlations for Extraversion and sub-items

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
E	0.207*	-0.110	0.113
E1 – Warmth	0.198**	-0.012	0.108
E2 – Gregariousness	0.359*	-0.130	0.200**
E3 – Assertiveness	0.063	-0.048	0.008
E4 – Activity	0.002	-0.034	-0.020
E5 – Excitement Seeking	0.153	0.057	0.123
E6 – Positive Emotions	0.075	0.008	0.048

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Openness

Open individuals prefer working in virtual teams rather than in conventional teams and overall have a good predisposition towards virtual teams. Table 8 reports the Pearson correlations among the six sub-dimensions of openness facet and the preferences scores. A weak positive significant correlation was found between the *actions* facet and *preference for VT over working alone* (r(133)=.248, p<.05), indicating that individuals who are willing to try new ideas, activities and places, prefer virtual teams rather than working by themselves. Also, a significant weak positive correlation was found between *preference for VT over FTF* and *values* (r(133)=.182, p<.01), *ideas* (r(133)=.259, p<.05) and *aesthetics* (r(133)=.172, p<.05). This indicates that individuals who are intellectually curious and are willing to consider unconventional ideas, who are ready to re-examine their social values prefer the new challenges that a virtual team offers in comparison with a more traditional or conservative setting.

Table 8   Correlations of Openness and sub-items

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
O	0.169*	0.243**	0.244**
O1 – Fantasy	-0.024	0.109	0.052
O2 – Aesthetics	0.140	0.172*	0.185*
O3 – Feelings	-0.010	-0.028	-0.023
O4 – Actions	0.248**	0.217*	0.274**
O5 – Ideas	0.145	0.259**	0.240**
O6 – Values	0.182*	0.208*	0.230**

** Correlation is significant at the .01 level (2-tailed)

* Correlation is significant at the .05 level (2-tailed)

Neuroticism

The six sub-dimensions that compose the neuroticism factor in the NEO PI-R are shown in Appendix 3. Neurotic individuals prefer working alone rather than in virtual teams, and overall have a negative attitude towards virtual teams. When analyzing the neuroticism facets we found a weak negative correlation between *preference for VT over working alone* and the *angry-hostility* (r(133)=-.225, p<.01), *self-consciousness* (r(133)=-.170, p<.05) and *vulnerability* (r(133)=-.186, p<.05) subscales. This indicates that a linear relationship exists among the variables. Individuals who are prone to feel angry or frustrated (angry hostility), who are worried about awkward social situations (self consciousness) and feel unable to cope with stressful situations (vulnerability) tend to prefer working by themselves over virtual teamwork.

The overall *preference for virtual teamwork* score is affected only by the facets of angry-hostility (r(133)=-.198, p<.05) and vulnerability (r(133)=-.178, p<.05). No facet is significantly related to the *preference for VT over FTF* either. This could be due to the fact that neurotics might prefer to work alone and don't like interacting with others, virtually or face to face.

Table 9   Correlations for Neuroticism and sub-items

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
N	-0.220*	-0.075	-0.173*
N1 – Anxiety	-0.114	-0.021	-0.079
N2 – Angry Hostility	-0.225**	-0.113	-0.198*
N3 – Depression	-0.157	-0.014	-0.099
N4 – Self Consciousness	-0.170*	-0.039	-0.122
N5 – Impulsiveness	-0.155	-0.046	-0.117
N6 – Vulnerability	-0.186*	-0.116	-0.178*

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Agreeableness

We found no relationship between the general factor of *agreeableness* and the preference scores. However a weak but positive correlation between the *altruism* facet of *agreeableness* and *preference for virtual teams over working alone* (r(133)=0.195, p<.05) was found. These results suggest that altruists -- which are people who are concerned for the welfare of others and are generous and always ready to help others -- have a better disposition towards working in virtual teams compared to working by themselves. However, the correlation is weak and is the only correlation found with any of the agreeableness facets; thus, it could be a Type II error. Further research is needed to corroborate this finding. Results for each agreeableness' facet are found in Table 10.

Table 10   Correlations for Agreeableness and sub-items

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
A	0.128	0.045	0.101
A1 – Trust	0.084	-0.015	0.040
A2 – Straightforwardness	-0.012	0.015	0.002
A3 – Altruism	0.195*	0.043	0.139
A4 – Compliance	0.121	0.073	0.114
A5 – Modesty	0.060	0.021	0.047
A6 – Tender Mindedness	0.111	0.069	0.106

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Conscientiousness

Even though we found no correlation between the general factor of *conscientiousness* and the preference scores, the *competence* facet and *preference for VT over working alone* showed a weak but significant correlation (r(133)=.200, p<.05). This suggests that individuals who have high self-esteem, believe in their abilities, and feel prepared to face life prefer working in virtual teams rather than alone. Similar to the *altruism* facet in agreeableness, the fact that this is the only correlation for all the conscientiousness facets could mean that this is coincidental. However, the *competence* facet is related to self-efficacy (both are significantly correlated (r(133)=.59, p<.01), and the fact that self-efficacy is correlated with the preference scores (refer to Table 5) suggests that this correlation should be given more credence.

Table 11   Correlations for Conscientiousness and sub-items

	Preference for VT over Alone	Preference for VT over FTF	Preference Score
C	0.100	0.032	0.077
C1 – Competence	0.200*	0.037	0.138
C2 – Order	-0.069	-0.034	-0.060
C3 – Dutifulness	0.117	0.031	0.087
C4 – Achievement Striving	-0.016	0.039	0.014
C5 – Self-Discipline	0.124	0.033	0.092
C6 – Deliberation	0.120	0.042	0.095

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

MBTI

The FFM extraversion dimension was found to be related to preference for virtual teamwork. On the other hand, the MBTI E-I dimension was not. Even though the dimensions do not represent the same thing, they are related. Further analysis was done to understand how cognitive styles related to preference for virtual teams. In order to do this, the four dimensions were combined to create each of the 16 MBTI styles and the four quadrants (Introverts/Extraverts – Sensing/Intuitive) The list of the generated variables is listed in Appendix 6.

T-tests and one-way ANOVA were performed to search for differences in the preference score means between each of the MBTI combinations. No significant results were

found in any of the sub-categories. However, these results are not necessarily discouraging. Due to the relatively small sample size for this analysis, it is possible that the sample does not have enough variation to reflect the differences in preferences.

Conclusions

Discussion

Preference for virtual teamwork is assumed to be one of the factors affecting virtual team members' satisfaction and performance. The purpose of this study was to develop and validate an instrument to measure this variable in order to create an instrument that could be used by managers when making decisions about virtual team's composition.

The effort shows relative support for the proposed scale, though more research is needed to test its predictive validity; i.e. to see if the preference score measured with this instrument can be used to predict team members' satisfaction and performance.

The original scale was developed in a previous study. Item analysis was performed to eliminate items that did not discriminate properly between the underlying factors that compose the preference construct. The study provided support for factorial validity: after eliminating an ambiguous item the pattern of factor loadings confirmed the *a priori* structure of the instrument. Preference for virtual teamwork over working alone items loaded highly on one factor and preference for virtual over face to face teamwork loaded highly in the other with almost no cross-factor loadings. The only exception was one item, item seven. Cronbach alpha reliability for both factors was higher than 0.80 supporting the internal consistency of the proposed measurement scale.

In order to ensure the construct validity of the instrument, personality theories were analyzed to understand how general personality dimensions relate to preference. In addition, hypotheses about expected correlations were formulated and tested. The study shows encouraging results, although not all the hypothesis were confirmed and further research needs to be done to understand these results.

Even though the extraversion factor of the FFM and the extraversion-introversion dimension of MBTI are related, they do not measure exactly the same thing. This can explain why we found a correlation between FFM extraversion and not with MBTI's Extraversion-introversion dimension. In one model, extraversion is more related to sociability, while in the second one it is related to whether the individual motivation comes from thinking about people and the external world, or about ideas and the internal world. Social orientation seems

to be the driving one of the driving forces that influences preference. If there is a continuum that represents social orientation in a work environment, where in one extreme we have individuals who prefer working by themselves, and in the other extreme we have people who benefit from the presence of others and prefer face to face teams, extraverts would be expected to be on the FTF side and introverts would be expected to be on the individualistic side. Virtual teams are located somewhere in the middle. They allow members to work independently on their own schedules but at the same time provide opportunities to interact with others to solve tasks. However, our findings do not fully support this common sense idea. Extraverts (socially-oriented individuals) showed higher preference for virtual teams over working alone, but they did not show higher preference for working in FTF teams over virtual teams. This suggests that social orientation influences preference for working with others, regardless of the way they do it. This is further supported by the fact that gregariousness is the strongest facet that drives the extravert's preferences.

Some of the expected relationships were not found: E-I, T-F, S-N and J-P dimensions were not found to be related to preference for virtual teamwork and neuroticism was not found to be related to preference for VT over FTF teams. This does not necessarily mean that the instrument has no merit, it just indicates that some of the constructs need to be more precisely specified and refined. Lack of significant results could be due to the fact that the sample included many individuals who were situated 'in the middle,' which is evidenced by the relatively small means in EI, TF and SN factors. Variability in the sample might not have been sufficient to capture the relationships.

An unexpected relationship was found with self-efficacy and also with the FFM conscientiousness's competence facet. This suggests that self-efficacy about virtual teamwork could be related to preference, an idea that is supported by Eby's findings (Eby and Dobbins 1997). A relatively strong relationship was found with computer anxiety. Though high computer anxiety was expected to be related to low preference for virtual teams, low computer anxiety was not expected to be related in a particular way. The strength of the correlation could mean that there is, in fact, a relationship for low computer anxiety individuals. Further research is needed to examine this relationship.

Results from this study provided some new insights in terms of the personality factors that affect preference for virtual teamwork, particularly in terms of the first factor (preference for virtual teams over working alone), which can be used to further develop the scale.

Socially oriented individuals, who benefit from the interaction with others when trying to accomplish a task, who are easygoing and show concern for other people, who are calm and not easily discouraged, who are confident in their own abilities and like to try new things, prefer working in virtual teams rather than by themselves. Virtual teams are preferred to face to face teams by individuals who are less socially oriented but open to consider new ideas and values, and at the same time have a good predisposition towards computers and IT (low computer anxiety) and have high self-efficacy.

The correlation between virtual teams experience and the preference score suggests that preference might be affected by previous experience and thus training. A better understanding of how predisposition and training affect preference could be used by companies when making hiring or training decisions.

Limitations and Future Research

The proposed scale was developed as part of a previous study and results here are part of its initial pre-test. As pre-test findings the results for our study are promising, but a follow up study should be done after eliminating item six, and probably rewording item seven (since its loadings were not really strong for factor two over factor one). Construct validity cannot be established by a single set of observations (Clark and Watson 1995), so it remains to be assessed in future studies.

Due to the length of the survey it was not feasible to measure other constructs that would be interesting to compare in order to improve the validity analysis. For example it would be good to compare how the preference for virtual teamwork correlates with the preference for teamwork scale proposed by Wagner and Moch (Wagner and Moch 1986) or to analyze how our scale compares to Workman's findings in terms of commitment to virtual team over telework (Workman *et al.* 2003). Given the fact that Wagner's preference for teamwork scale is not a fully validated instrument, its use to assess convergent validity of this scale would reflect only tentative results.

While our results suggest that personality is related somehow to preference for virtual teamwork, there are probably other state-variables and trait-variables that affect it as well. Since this was an exploratory study, we focused on high level personality factors, but more 'concrete' constructs are thought to be related to preference but were not included given the scope of this project. Among them are: preference for procedural order, tolerance for ambiguity, attitude towards authority, attitude towards individualism, need for affiliation, propensity to trust, etc. These variables were identified in other studies to be related to preference, satisfaction and performance in teams (Burke and Aytes 2001; Jarvenpaa and Leidner 1999; Morse and Caldwell 1979) and would serve as a useful framework for future research.

Our results in terms of predictive validity were only partially supportive in that individuals who prefer virtual teams over working by themselves reported more experience in virtual teams. Although the findings with respect to actual VT use were not significant, the number of students that responded to the follow-up survey was low. Also, the MBA teams are pre-assigned, so individuals who have a high preference for virtual teamwork might end up in a team composed of a majority of individuals who prefer face to face. To test the predictive validity, future research should focus on how the preference scores relate to voluntary use of and satisfaction with actual performance when working in virtual teams.

The proposed scale was tested with students. It is possible that preference for virtual teamwork is different for different environments, i.e. some individuals prefer to collaborate virtually with others in study-teams but not in work-teams. It is also important to note that preference is not the only variable that affects fit with a particular job environment, and it is not a guaranty for satisfaction or performance.

Preference is not the only factor that affects satisfaction or performance. It would be interesting to study "readiness for virtual teamwork" understood as something that is affected by both preference and ability. Given the differences between conventional teams and virtual teams, a different skill set is required for team members. We found that self-efficacy and competence were related to preference for virtual teamwork. This suggests that there may be a relationship between preference and ability, so individuals who feel they are capable of doing something would feel more inclined to try it.

Nevertheless these research findings suggest that the notion that building a preference for virtual teamwork scale is possible and that such a scale may have merit in terms of predicting who actually engages in virtual teamwork. Reliable and fully validated instruments ensure consistent and reliable measures, which are important to further research and can be real-life settings as tools to make decisions. Refinement of such a scale would be useful for organizations when making hiring or team-design decisions.

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Appendix 1   Item Additional Information

		Communalities	
	Fac.	**12 items**	**11 items**
VT1: When I have a choice I would rather work in a virtual team than by myself	1	0.77	0.78
VT2: I prefer to work on a virtual team than on individual tasks	1	0.79	0.81
VT3: Working in a virtual group is better than working alone	1	0.72	0.75
VT4: Given the choice, I would rather do a job where I can work alone rather than do a job where I have to work with others in a virtual team (Reverse)	1	0.70	0.70
VT5: I prefer to do my own work and let others do theirs (Reverse)	1	0.53	0.53
VT6: I like to interact with others via technology (email, chat rooms, etc) when working on projects	1	.25	
VT7: I personally enjoy working with others who are not at the same location that I am	2	0.48	0.46
VT8: I would be as comfortable working on a virtual team as I would in a FTF team	2	0.72	0.72
VT9: Working on a virtual team would be less burdensome to me than working in a FTF team	2	0.39	0.40
VT10: If given the appropriate technology, I can be just as effective working on a virtual team as I can on a FTF team	2	0.64	0.64
VT11: I could not feel part of a team that did not meet FTF (Reverse)	2	0.53	0.53
VT12: I would participate as easily on a team that used chat rooms, e-mail and conference calls to communicate with my fellow team members as I could in a FTF discussion	2	0.56	0.57

Table 12   Item Skewness

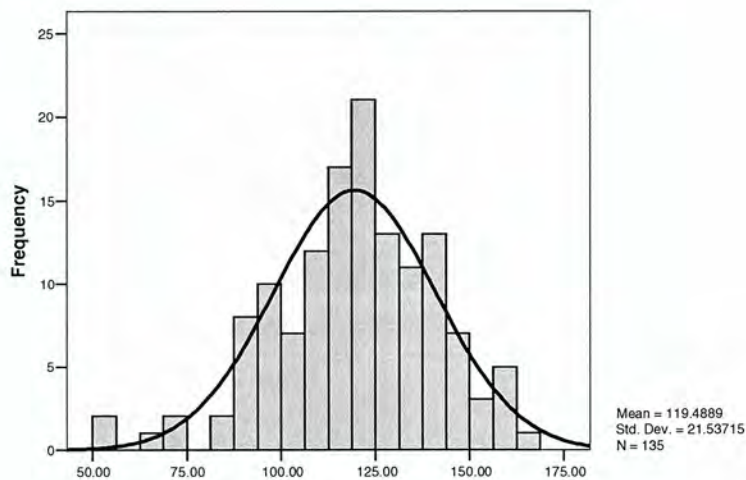|	Statistic	Std. Error	.95% Lower	95% Upper
VT 1	-0.14	0.21	-0.54	0.27
VT 2	0.06	0.21	-0.35	0.46
VT 3	-0.25	0.21	-0.65	0.15
VT 4	-0.18	0.21	-0.58	0.23
VT 5	-0.09	0.21	-0.50	0.31
VT 6	**-0.63**	**0.21**	**-1.03**	**-0.23**
VT 7	-0.21	0.21	-0.61	0.19
VT 8	-0.10	0.21	-0.50	0.31
VT 9	**0.60**	**0.21**	**0.19**	**1.00**
VT 10	**-0.57**	**0.21**	**-0.98**	**-0.17**
VT 11	**-0.53**	**0.21**	**-0.93**	**-0.12**
VT 12	-0.25	0.21	-0.65	0.16

N: 139

Std. Error: 0.21

Appendix 2   Sample t-tests and descriptives

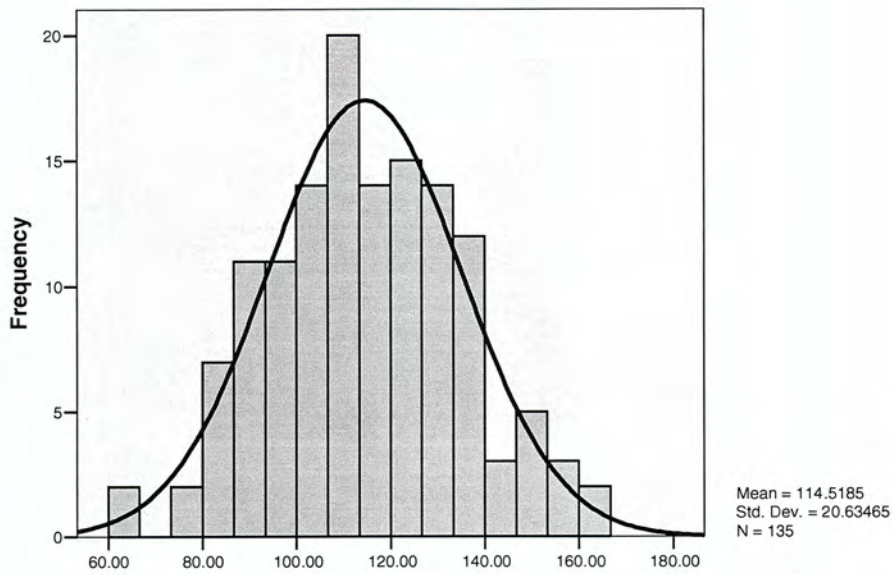## Table 13   T-tests and Sample descriptive stats

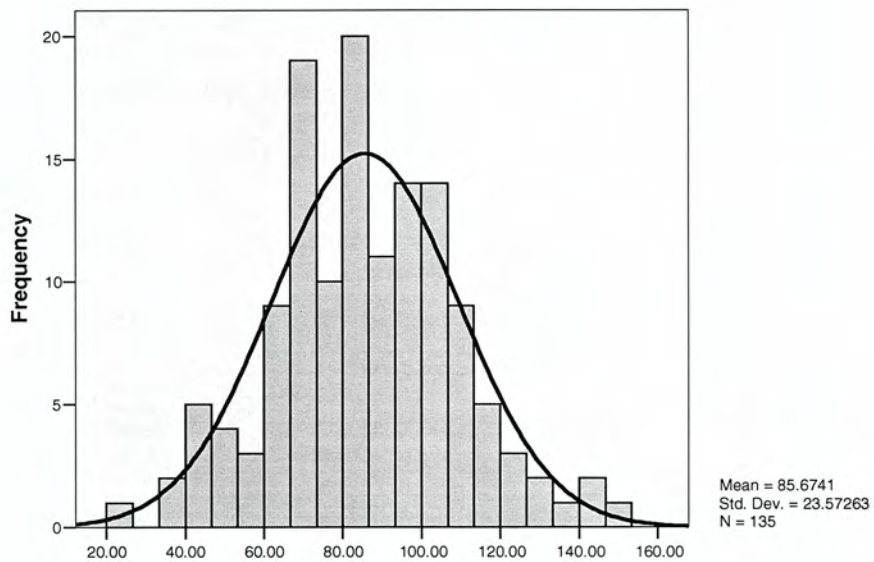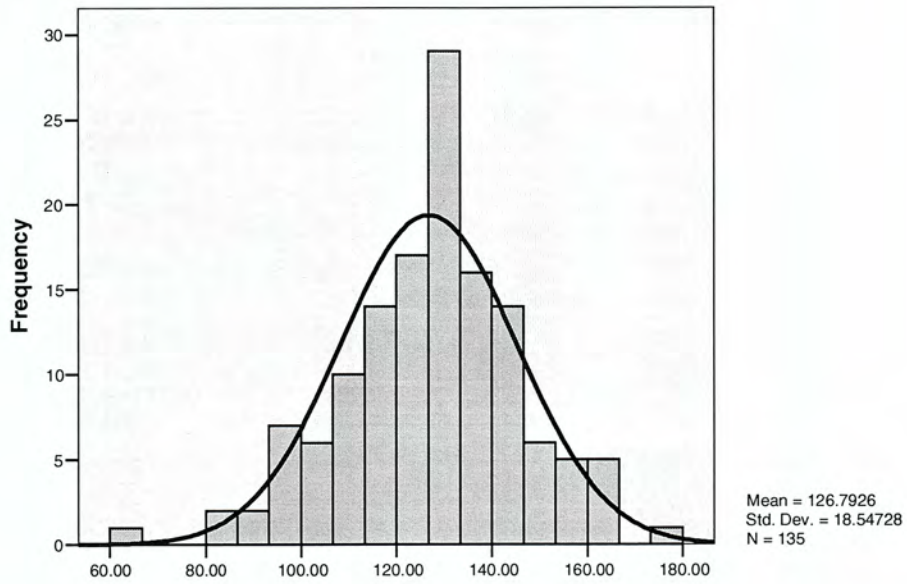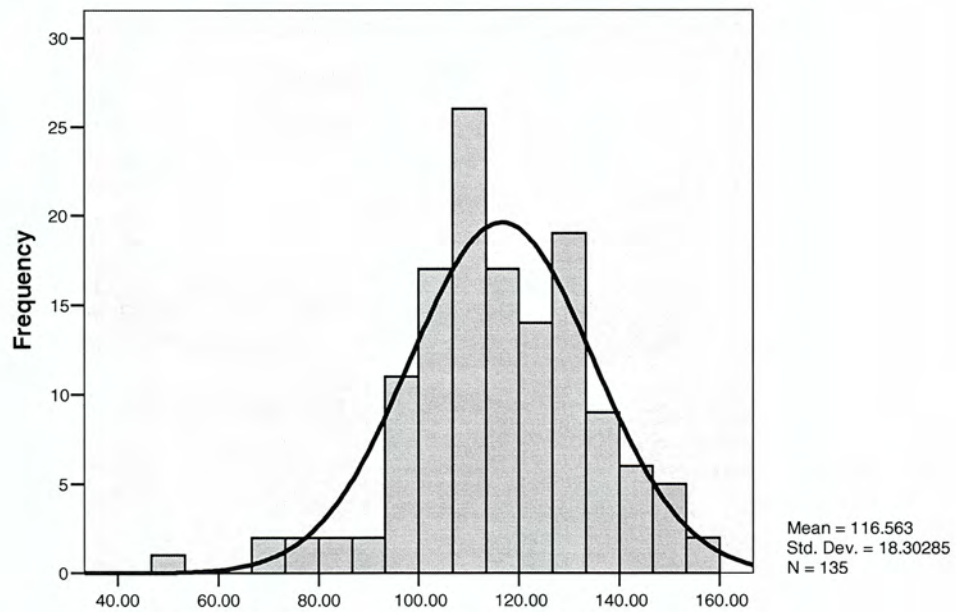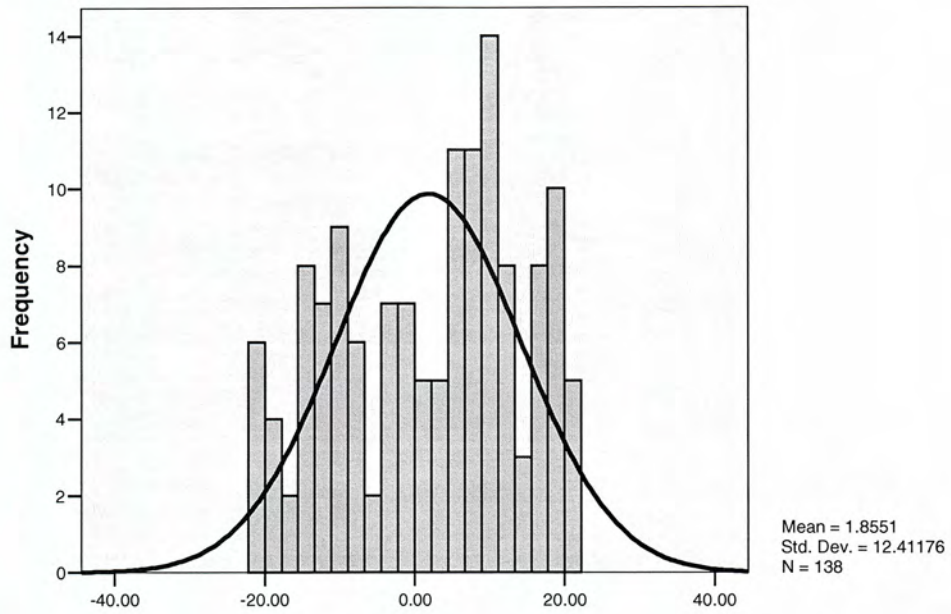| | Wave's Means | | | Pooled Sample Descriptives | | | |
	Grad.	Under-grad.	t-Sig	Min.	Max.	Mean	Std. Deviation
VT Scale	34.83	33.72	0.35	17	49	34.35	7.16
VT vs. Alone	15.32	14.72	0.39	5	24	15.06	4.11
VT vs. FTF	19.51	19.00	0.49	9	29	19.29	4.34
E	119.53	119.43	0.97	54	163	119.49	21.54
N	86.40	84.77	0.68	24	150	85.67	23.57
O	115.99	112.68	0.36	64	165	114.52	20.63
C	126.65	126.97	0.92	60	177	126.79	18.55
A	117.13	115.85	0.68	52	159	116.56	18.30
E-I	2.08	1.57	0.80	-21	21	1.86	12.41
S-N	-2.27	2.30	0.06	-26	26	-0.25	14.06
T-F	2.60	0.18	0.30	-24	24	1.53	13.89
J-P	4.91	5.66	0.70	-22	22	5.24	13.04
Computer							
Anxiety	45.78	47.16	0.20	27	70	46.39	7.31
Self-Efficacy	48.01	48.23	0.80	28	60	48.11	5.15

FREQUENCIES

Extraversion

Mean = 119.4889
Std. Dev. = 21.53715
N = 135

Openness

Mean = 114.5185
Std. Dev. = 20.63465
N = 135

Neuroticism

Mean = 85.6741
Std. Dev. = 23.57263
N = 135

Conscientiousness

Mean = 126.7926
Std. Dev. = 18.54728
N = 135

Agreeableness

Mean = 116.563
Std. Dev. = 18.30285
N = 135

MBTI E-I

Mean = 1.8551
Std. Dev. = 12.41176
N = 138

MBTI T-F

Mean = 1.529
Std. Dev. = 13.89123
N = 138

MBTI S-N

Mean = -0.2536
Std. Dev. = 14.06402
N = 138

MBTI J-P

Mean = 5.2391
Std. Dev. = 13.04431
N = 138

Computer Anxiety

Mean = 46.3885
Std. Dev. = 7.31042
N = 139

Self-Efficacy

Mean = 48.1079
Std. Dev. = 5.152
N = 139
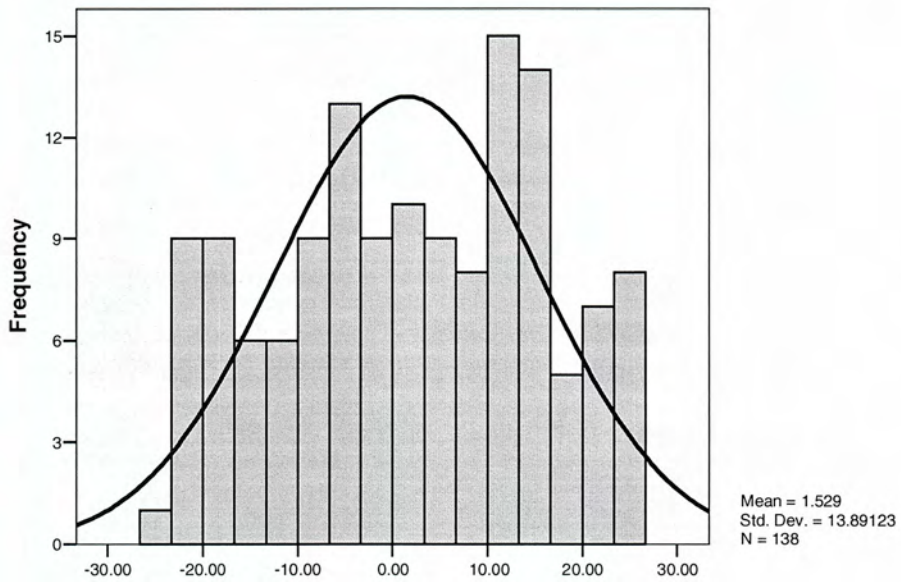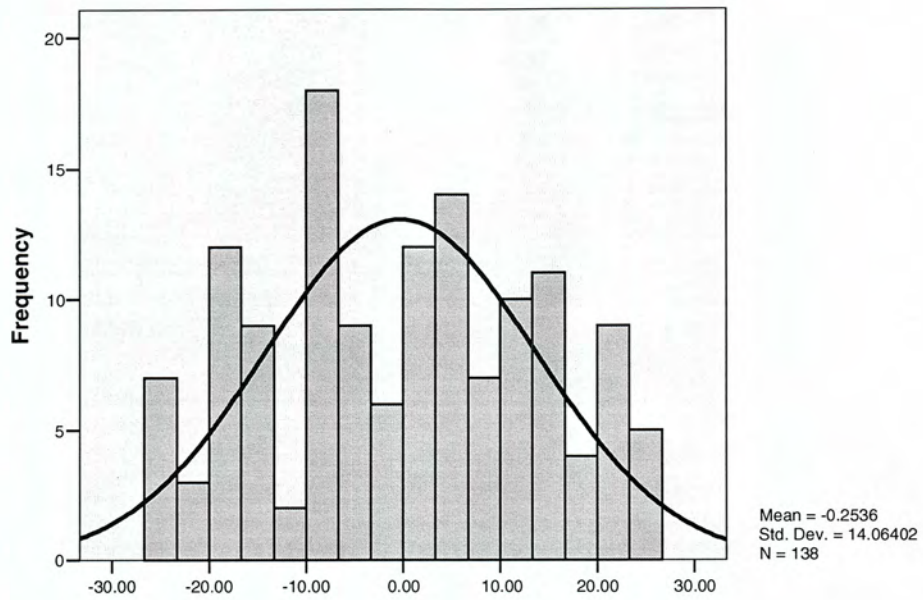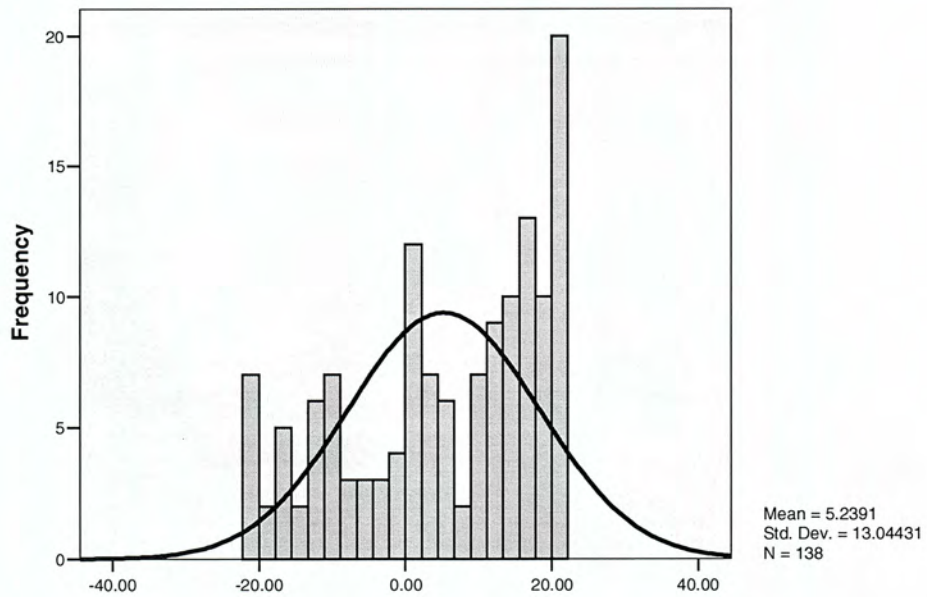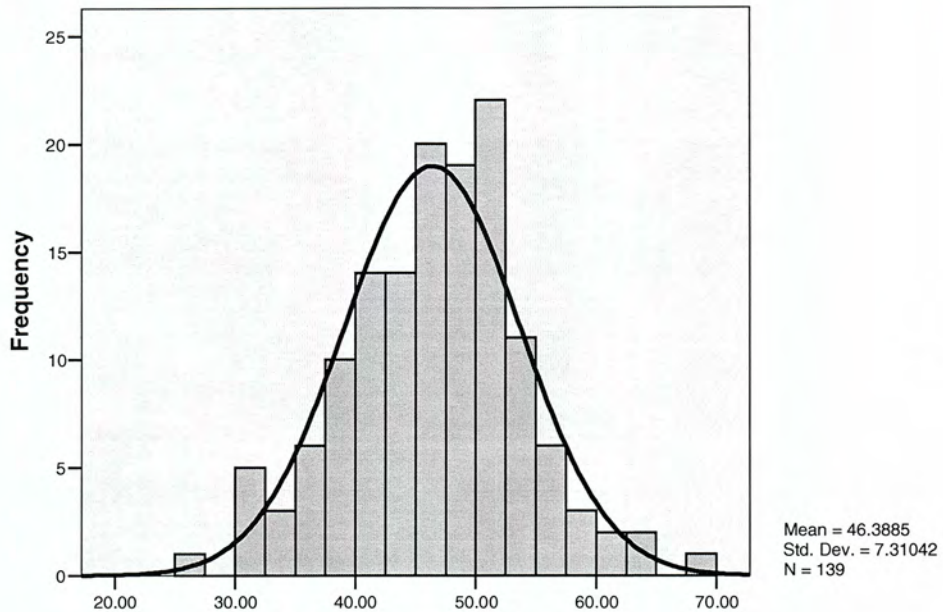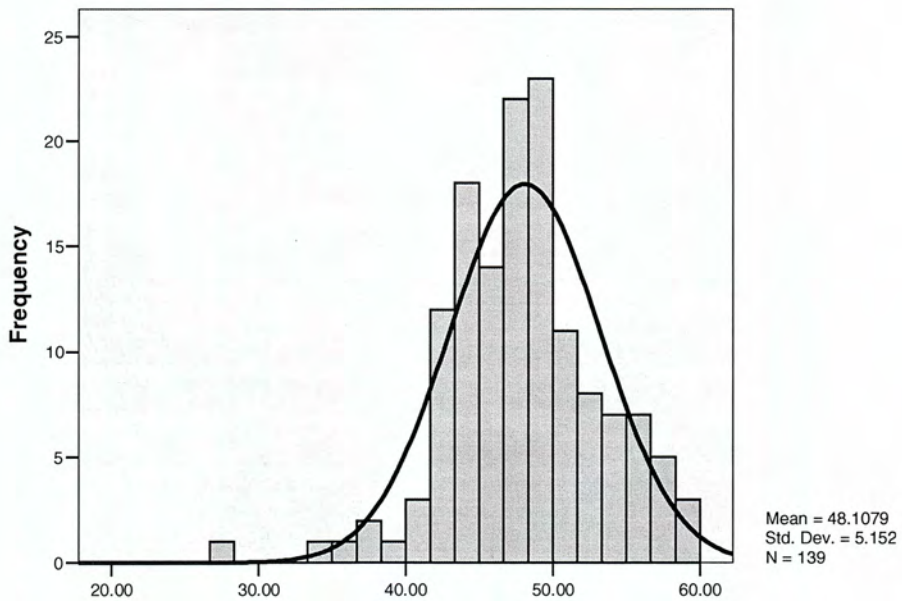
Appendix 3   NEO PR-I Factor Facets

Each of the five NEO PI-R domains is represented by six – more specific – scales that measure different facets of each factor. These allow a better interpretation of the constructs.

Extraversion Facets

E1. Warmth: Warm people are affectionate and friendly; they like interacting with people and develop attachments with others easily. Low scorers are more distant, formal and reserved.

E2. Gregariousness: Represents preference for other people's company. Low scorers tend to be loners while gregarious individuals enjoy the company of others.

E3. Assertiveness: Assertive individuals like to speak out, take charge and dominate the activities of others. They do not hesitate to participate and often become group leaders. Low scorers prefer to keep in the background.

E4. Activity: High scorers live a fast-paced lives and enjoy to take part in many different activities, while low scorers are more relaxed in tempo – but not necessarily lazy.

E5. Excitement Seeking. High scorers represent individuals who are easily bored without high levels of stimulation. Low scorers do not seek thrills and prefer a live that might be boring to high scorers.

E6. Positive Emotions. This facet represents a tendency to experience positive emotions like happiness, joy, excitement and love. High scorers laugh easily and often. They are cheerful and optimistic, while low scorers are less exuberant and high spirited.

Openness Facets

O1. Fantasy. This facet refers to openness to fantasy. High scorers have a vivid imagination and an active fantasy life; they use their fantasy to create a rich and more interesting world. Low scorers are more practical and matter of fact; they like to keep their minds on the task at hand.

O2. Aesthetics. This facet refers to appreciation for art and beauty. High scorers would have a deep appreciation for poetry, music and art – which does not say anything in terms of ability.

O3. **Feelings**. Openness to feelings refers to receptivity to their own feelings. High scorers experience emotions with more intensity than others. Low scorers do not believe that emotions are that important in life.

O4. **Actions**. Refers to openness to try different activities, go to new places, try different foods. High scorers prefer to novelty and variety. Low scorers are more inclined to routine and familiarity.

O5. **Ideas**. This facet refers to the individual's willingness to consider new ideas. High scorers enjoy philosophical arguments and brain teasers. Low scorers have limited curiosity and if they are highly intelligent they focus their abilities in limited topics.

O6. **Values**. This facet refers to the individual's willingness to reexamine social, religious or political values. Closed individuals are generally conservative and tend to honor traditions and authority.

Neuroticism Facets

N1. Anxiety: Low scores in this facet identify calm and relaxed individuals. High scores reflect apprehensive, fearful, and prone to worry individuals.

N2. Angry Hostility: This represents the individual's readiness to experience anger frustration and/or bitterness. Low scores indicate individuals that are easygoing and slow to anger. Whether these feelings are expressed or not, depending on the levels of Agreeableness.

N3. Depression: High scores in this facet indicate people who are easily discourage and have a propensity to feel guilty, sad, hopeless or lonely. Low scorers are not necessarily cheerful, but they rarely experience these emotions.

N4. Self Consciousness: Self conscious individuals worry about what "others might think", they are prone to feel inferior or sensitive to ridicule. Low scorers are less worried about awkward social situations.

N5. Impulsiveness: Refers to the individual ability to resist or control cravings and urges. Low scorers have a higher tolerance for frustration and find it easier to resist temptations.

N6. Vulnerability: Refers to how individuals manage stress. High scorers feel unable to cope or panicked when facing emergency situations. Low scorers perceive themselves as able to handling themselves in stressful situations.

Agreeableness Facets

A1. Trust. This reflects the individual's predisposition to trust others. Trusting individuals would tend to believe in other peoples' honesty and good intentions. Low scorers tend to be more cynical and skeptical and tend to believe that others might be dishonest or dangerous.

A2. Straightforwardness. High scorers tend to be frank, ingenious and sincere. Low scorers tend to use flattery, craftiness or deception in order to manipulate others, but should not be interpreted to mean that low scorers are dishonest or manipulative.

A3. Altruism. This facet reflects the individual's consideration for other people's welfare. High scorers tend to have an active concern and show generosity and are ready to help others. Low scorers are more self-centered and reluctant to get involved in other people's affairs.

A4. Compliance. This facet refers to reactions to interpersonal conflict. High scorers tend to be meek and mild; they inhibit their aggression and tend to avoid conflict. Low scorers tend to be more aggressive and prefer to compete rather than cooperate.

A5. Modesty. High scorers are humble, but not necessarily lacking self-confidence or self-esteem. Low scorers might be perceived as arrogant since they believe they are superior to others.

A6. Tender-Mindedness. This facet refers to attitudes of sympathy and concern for others. High scorers are moved by other people's needs, they focus on the human aspects of social politics. Low scorers are more hardheaded and less moved by appeals to pity. They would consider themselves as realists who make rational decisions based on cold logic.

Conscientiousness Facets

C1. Competence. This facet refers to the sense that one is capable, sensible and effective. High scorers tend to feel well prepared to deal with life. Low corers have a lower opinion of their abilities. Competence is associated with self-esteem.

C2. Order. High scorers on this scale are neat, tidy and well organized. They keep things in their proper places. Low scorers describe themselves as non-methodical and find hard to get organized.

C3. Dutifulness. High scorers in this scale adhere strictly to their ethical principles and scrupulously fulfill their moral obligations. Low scorers are more casual about such matters and may be somewhat unreliable.

C4. Achievement Striving. High scorers have a high aspiration levels and work hard to achieve their goals. They are purposeful and have a sense of direction in their lives. Low scorers are lackadaisical and perhaps even lazy. They lack ambition and might seem aimless, but they are often perfectly content with their low levels of achievement.

C5. Self-discipline. Refers to the ability to being tasks and carry them to completion despite boredom or other distractions. High scorers have the ability to motivate themselves to get the job done. Low scorers tend to procrastinate and are easily discourage.

C6. Deliberation. This facet reflects the tendency to think carefully before acting. High scorers are cautious and deliberate. Low scorers are hasty and often speak or act without considering the consequences. At best, low scorers are spontaneous and able to make snap decisions when necessarily.

Appendix 4   MBTI Personality Types

Personality Type	Function	Description
ESTJ	Extraverted thinking supported by sensing	Individuals that are practical and matter of fact. Well grounded in reality and the present
ENTJ	Extraverted thinking supported by intuition	Intellectually interested in possibilities, curious about new ideas and problem-solving
ISTP	Introvert thinking supported by sensing	Tend to be analytical and impersonal, organizing facts and data to gain meaning. Often quiet and reserved
INTP	Introvert thinking supported by intuition	Tend to be theorists, abstract thinkers and problem solvers with intellectual curiosity and ingenuity
ESFJ	Extravert feeling supported by sensing	Value harmony with others, practical, conscientious and orderly, and like to have things decided and settled
ENFJ	Extravert feeling supported by intuition	Curiosity for new ideas and possibilities, often preferring oral to written communication. Show a combination of warmth and insight towards people
ISFP	Introvert feeling supported by sensing	Value a feeling of inner harmony with deep feeling often not expressed. See the needs of the moment, particularly related to others
INFP	Introvert feeling supported by intuition	Value inner harmony and like to deal with possibilities for people. Imaginative and insightful with an urge to communicate and share ideas, often through the written word
ESTP	Extravert sensing supported by feeling	Realistic and practical with a capacity for facts and details. Prefer action to conversation and judgment is accurate and reliable
ESFP	Extravert sensing supported by feeling	Realistic, friendly, communicate well, like to enjoy life, have lots of experiences. Usually do better in life than in school
ISTJ	Introvert sensing supported by feeling	Systematic, through and hard working, very practical and like dealings with facts. Are logical and decisive. Need to see reason for doing something
ISFJ	Introvert sensing supported by feeling	Systematic, thorough and hard working. Loyal, considerate and values others. Likes things factual and stated clearly
ENTP	Extravert intuition supported by feeling	Open to possibilities, creative, independent and analytical. Hates routine. Can be impersonal in relations with people
ENFP	Extravert intuition supported by feeling	Versatile, enthusiastic, easy with people, and full of ideas about many things, hates routine, strong initiator but may have difficulty with completion of projects
INTJ	Introvert intuition supported by thinking	Intensely individualistic, can be stubborn, likes problem solving, open to possibilities, good with strategy, values competence and excellence
INFJ	Introvert intuition supported by feeling	Individualistic, independent, likes fellowship and harmony with others, open to insights and possibilities related to people, takes a global perspective, seeks understanding.

Appendix 5   MBTI Subgroups

Table 14   MBTI Quadrants and Styles

| | Count | Means | | |
		Factor 1: VT over Alone	Factor 2: VT over FTF	Preference
ES	34	16.02	19.41	35.44
EN	44	15.11	18.84	33.95
IS	34	14.26	19.76	34.03
IN	22	15.31	19.68	35.00
ETSJ	16	17.2	19.6	36.81
ETSP	0			
ETNJ	8	16.9	17.0	33.88
ETNP	8	13.4	21.2	34.63
EFSJ	15	14.5	19.3	33.87
EFSP	1	19.0	19.0	38.00
EFNJ	11	14.8	18.4	33.18
EFNP	13	14.5	17.7	32.15
ITSJ	20	14.55	19.55	34.10
ITSP	2	9.00	17.50	26.50
ITNJ	5	14.40	16.40	30.80
ITNP	9	14.89	20.33	35.22
IFSJ	7	14.71	21.14	35.86
IFSP	3	11.00	16.00	27.00
IFNJ	4	16.00	18.50	34.50
IFNP	4	16.75	23.50	40.25