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The Relationship Between the Perceived Level of Contribution of Virtual Team Members and Their Energization Source as Described by Jung's Typology

by

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Submitted to the College of Technology

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In partial fulfillment of the requirements

For the degree of

DOCTOR OF PHILOSOPHY

Proposal Examination Committee:

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Ypsilanti, Michigan

Dedication

I am honored to dedicate this work, and all the effort surrounding it, to my wife and best friend, Caryn Bartone. Caryn has been a relentless and constant supporter of my academic efforts, through endless courses that stole from our family time, to weekends filled with research and writing, spent locked in libraries and coffee shops. She has always been there for me: supporting me when I needed it and pushing me when it was necessary. Thank you, Caryn.

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I would like to acknowledge Dr. Fields for believing in me as a course developer and instructor, and helping provide opportunities in both areas. Dr. Fields has always been there to encourage me, and without his support through the years, this research would have not been possible.

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Outside of my committee, I would like to acknowledge Dave Wood, president of TypeFocus, as well as Ken Meyer of the Eastern Michigan Advising Career Development Center. Without Dave's and Ken's support providing TypeFocus data, this research would not have been possible.

I am truly fortunate to have had a committee and extended team of such high caliber and excellence, and also to be able to complete this work knowing that I have developed and nourished these relationships, not only on an academic and professional level but on a personal level as well.

Abstract

The increasing use of virtual teams as a result of advances in technology has altered the manner in which team members communicate and interact (Holton, 2001). The media-rich face-to-face team environment has frequently given way to asynchronous communication, using tools such as emails and discussion threads (Ohler, 2004). This study focused on the role of personality type in the emerging academic asynchronous environment; specifically, it explored the relationship between the Jungian dimension of energization (introversion vs. extroversion) of a team member and the perceived level of contribution of that team member to a team in an academic asynchronous virtual environment.

The sample for this study included 144 university students who were participating in several courses that required virtual team activities. Respondents completed both an online personality survey similar to that of a Myer Briggs Type Inventory (MBTI), as well as an online teammate contribution questionnaire based on McGrath's (1964) measures of team efficiency.

The null hypothesis that no relationship exists between energization source and perceived virtual team contribution was tested. Nine of the 14 questions that addressed individual contribution to the team were correlated with energization at the ≥ 95% confidence (≤ 0.05 significance) level. When the individual rating items were grouped consistent with the McGrath (1964) team contribution model, a ≤ 0.05 significance level correlation was found with two of the three groupings.

The null hypothesis was thus rejected, and it was concluded that at the university level, there was a significant relationship between Jung's energization dimension of personality scale and perceived contribution to a virtual team. It was also concluded that at the university level, a relationship between an individual's levels of introversion vs. extroversion likely impacts the

manner in which a team member communicates and contributes in a virtual team environment. This conclusion suggested that future virtual team leaders and team members should be aware of, and give consideration to, the levels of introversion vs. extroversion of their teammates because this is an aspect of personality that may influence how team members communicate most effectively.

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Chapter I: Introduction and Background

Introduction

Communication is an integral component of a functioning organization; by its nature, communication occurs constantly, and in many forms and formats (Santra & Giri, 2009). Indeed, effective communication is at the foundation of most modern organizations; today, communication is inseparable from everything that occurs in organizational life (Santra & Giri, 2009).

At the heart of effective organizations lies a solid understanding and respect for the value of communications, particularly as it is applied to one of the most powerful organizational tools: the team. A team has been defined as a working group with a common goal and well-defined responsibilities; core values for an effective team often include trust, independence, and excellent communication (Ohler, 2004). A team has also been defined as a complex, dynamic system that develops and changes as members interact over time, and evolves and adapts as situations change (Kozlowski & Ilgen, 2006). This research considers team effectiveness as described by McGrath (1964) consisting of Input, Process, and Output (I-P-O). In this team effectiveness model, *inputs* are defined by the people and the individual capabilities they bring to the team, *processes* are defined as activities utilizing the input resources, and *outputs* are defined as (a) team performance as perceived by outside sources, (b) the ability to meet team member's needs, and (c) the team's long term viability, that is, whether members are willing to continue to serve on the team (Kozlowski & Ilgen, 2006; McGrath, 1964).

The effectiveness of a team, however, is influenced by a number of factors; one factor is the ability of team members to communicate effectively. Indeed, the increased requirement for geographically-remote team members has increased the complexity related to their operational

functionality – with a particular emphasis on "intra" team communication methodologies. New methodologies have the potential to improve communication, but these new methods may also hinder the team's ability to communicate (Holton, 2001). Team members are no longer regularly located in common office areas or even in the same geographic locations – in fact team members are often located remotely from one another, through multiple time zones, as well as varying cultures. Situations such as these have given rise to the virtual team (Ohler, 2004). This represents a team where the members may never interact face-to-face but rather communicate predominantly via computer-based communications methods that were not available in the past. A virtual team often consists of individual participants who are geographically distributed, functionally or geographically diverse, and frequently electronically linked (DeSanctis & Monge, 1999). It should be considered, however, that while technology has created a potential change in the organizational design of the workplace, team structures, and communication, the team structure and the concept of teamwork have not changed (Ohler, 2004). It should also be considered that the virtual team environment may impede the team's ability to function optimally. Collaboration is often viewed as the backbone of an effective team, and the ability of team members to communicate effectively is at the heart of collaboration; in some cases, the nature of virtual teams may limit a team member's ability to communicate effectively (Holton, 2001).

Prior to the emergence of virtual teams, organizational teams used various modes of communication available to them, including telephones, memos, noticeboards, and face-to-face (FTF) communications. Today's technology has rendered many of these modes of communication seemingly obsolete; we currently operate in a world where computer networks

are at the heart of our day-to-day communication tools, enhancing the flow of information and increasing the level of organizational efficiency (Santra & Giri, 2009).

Computer-mediated communications (CMC) is a method or group of methods that allow individuals and teams to communicate with the assistance of tools such as computers and the high speed internet (Thompson-Hayes, Gibson, Scott, & Webb, 2009). These tools include a number of potential applications, including web meetings, instant messaging, email, and chat, and have altered the dynamics in which teams operate. The nature of these tools and their applications give reasons to consider their impacts on organizational effectiveness (Santra & Giri, 2009). The traditional meeting room where team members would converse in a synchronous face-to-face environment has given way to communications such as email and discussion threads, where immediate responses have, in many cases, been replaced by crafted and researched written responses. The "media-rich" face-to-face environment, where members observe "cues" such as voice inflection and body language (Epstein, 2000), have given way to such actions as using capital letters to indicate "loud" writing.

Arguably, the loss of the media richness inherent in face-to-face communication may prove a shortcoming of richness-poor email communications; however the asynchronous response of an email may allow a communicator the opportunity to consider, research, and reflect on their response before the message is sent (Orchard & Fullwood, 2010). While it has also been suggested that information low in complexity is best transmitted in an environment low in richness such as asynchronous CMC to avoid the "noise" of unnecessary verbal and tonal cues, it has conversely been suggested that more complex information is best transmitted in a media-rich environment such as face-to-face conversation (Epstein, 2000). Interestingly, though, one research effort reported that while CMC users generate more original and higher-quality

ideas than FTF, they reach consensus with more difficulty than FTF groups (Tanis & Postmes, 2007). It is clear that media-rich, synchronous FTF communications are fundamentally different in method and, most probably, in effect, from asynchronous computer-mediated communications such as email and discussion threads. While the tools of computer-mediated communications allow us to overcome the inherent barriers of virtual teams such as distance, CMC is sometimes viewed as cold and impersonal, in comparison to media-rich face-to-face communication (Tanis & Postmes, 2007).

While the aforementioned communication tools, ranging from media-rich FTF conversation to technologically-advanced computer-aided communications, are certainly relevant to the overall effectiveness of communication within a business, it is possible that certain characteristics of team members may have an impact on the effectiveness of such tools and, ultimately, on the team performance itself. One group of characteristics may be the personality traits of the individual or team member using the communication tools.

Katherine Briggs and Isabel Myers Briggs developed a psychometric instrument, the Myers-Briggs Type Indicator (MBTI), using Jung's theory of psychological types. This instrument has been tested extensively for validity and reliability and has become one of the most widely used instruments in business in evaluating personality types (Bradley & Hebert, 1997). While a number of personality traits are considered in this model, of particular interest to this research is that of energization; more specifically, how an individual is energized. The diametrically generalized MBTI model differentiates two basic sources of motivation: introversion and extroversion. In general terms, the introvert is energized from within, while the extrovert is energized by interaction with others (Bradley & Hebert, 1997). While in practice the MBTI is used to represent an individual's energization source as either introverted or

extroverted, the Jung type specification, at its core, reflects a continuous scale. Although one may have both introverted as well as extroverted traits, the overall or net tendency is generally toward one or the other.

This research used a Jungian personality measurement instrument available through Eastern Michigan University entitled "TypeFocus." This tool is similar to the Myers-Briggs's instrument, differentiating personality types into identical categories, including energization source; specific validation information is offered later in this document.

With an understanding that individuals may be energized in two very different ways, a natural consideration is how these different personality types affect the individual's interaction with other team members and how their personality traits affect the usefulness of the selected communication method and, ultimately, the contribution level to a team. It may be presumed that the media-rich, synchronous environment of face-to-face communication would be more natural for the extrovert than the introvert (Bradley & Hebert, 1997). Extroverts are often viewed as fluent communicators. In fact, it has been discovered that an abundance of extroverts participating on a single team may result in reduced communication effectiveness, as they interrupt each other to express their views (Bradley & Hebert, 1997). When the ground rules are altered to non-media-rich, asynchronous computer-mediated communication mode such as email and threaded discussions, does the extrovert still thrive? Or will the advantage possibly turn to the introvert to better contribute to team objectives, due to the slower paced mode of conversation, allowing opportunity for reflection? Indeed, it has been shown that introverted personalities use internet tools considerably more readily than extroverts (Orchard & Fullwood, 2010). Supporting this premise, it has been found that email can encourage more equal team participation and, in turn, result in decisions based more on knowledge than on the influence of

high status members (Kiesler & Sproull, 1992). Specifically, it would seem that the extroverted team member who thrives in the face-to-face environment may find himself or herself frustrated by the less dynamic, cue-lacking nature of distant, asynchronous communication (Orchard & Fullwood, 2010). Conversely, it is conceivable that introverts who find the synchronous face-to-face situation challenging may find that an asynchronous communication mode such as email and discussion threads will allow them to better express themselves and their ideas (Orchard & Fullwood, 2010). Questions such as these are central to understanding the influence of CMC on team behavior and effectiveness (Bonner, 2000).

This research explored the effect that the introvert's and extrovert's energization personality trait has on their perceived contribution level to their team in an asynchronous computer-mediated communication environment. A better understanding of this relationship will help a team leader to best enable team member communications, based on their personality type. Additionally, within virtual teams where asynchronous CMC is unavoidable, the result of this research will help the team leader better understand introverts' and extroverts' perspectives on their environment, resulting in an increased level of empathy and, ultimately, team performance. Further, with the increasing prevalence of international "virtual" teams, an understanding of the impact of personality type on communication method is desirable to help a team leader create an environment that draws the highest level of contribution from each team member.

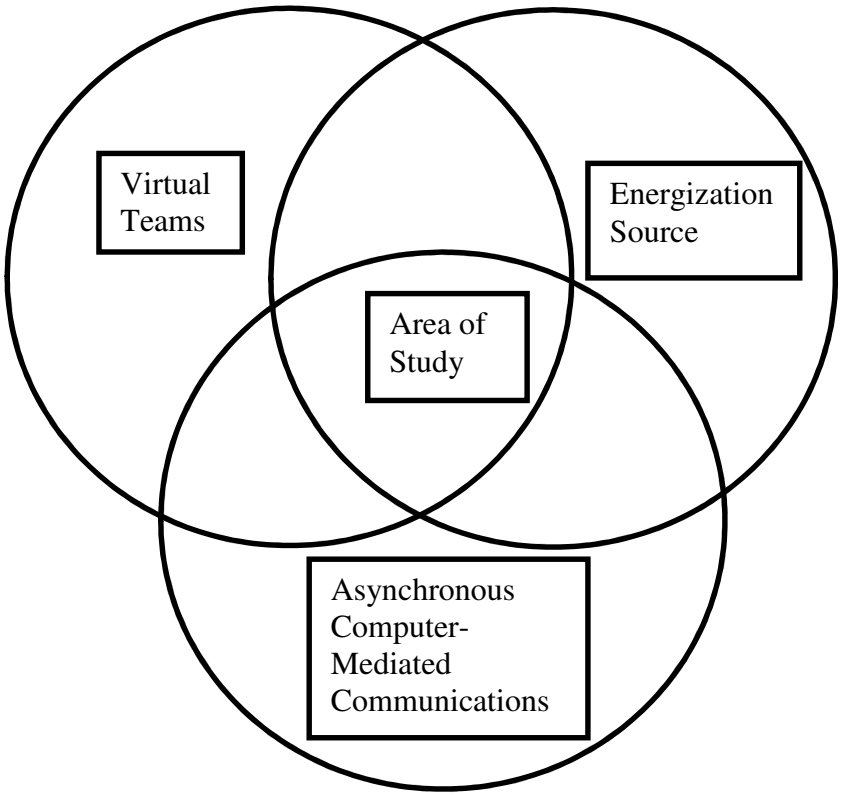

Figure 1. Area of Study

Figure 1 offers an image of the key concepts used in this research. The area of research interest is contained in the intersection region of virtual teams, energization source, and the asynchronous computer-mediated communication environment.

Statement of the Problem

The relationship between a team member's energization source, as described by Jung's model, and the resulting perceived level of virtual team contribution by that team member, while constrained by an asynchronous computer-mediated communication environment, has not been adequately investigated.

Justification and Significance

Several key components that must be addressed in order to understand the fundamental premise of this research are indicated below; ultimately, all of these topics will combine to allow the study of a specific personality type's effect on perceived contribution to virtual teams, while working within an asynchronous computer-mediated environment.

1. Organizational communication
2. Media richness including verbal and nonverbal cues; consideration of face-to-face communications
3. Organizational team structure, purpose, and goals
4. Virtual teams
5. Computer-Mediated Communications
6. Teams and Communication
7. Personality types as defined by Jung's model; specifically, introverted and extroverted energization sources
8. The impact of personality types on computer-mediated communication effectiveness
9. Contribution of team members in a virtual team environment.

The current literature reveals research on all of the above topics; these will assist in building a solid structure for the current research and support the problem statement. More information about existing literature on these topics will be given in Chapter II. Team management and, more importantly, team leadership remain important aspects of organizational effectiveness. The evolution of high-speed communication tools has created an environment where virtual teams have become more prevalent, and the nature of these teams is far different from face-to-face teams. That said, management methods must evolve to allow effective

leadership (Mohammed & Angell, 2003). At the heart of effective leadership is an understanding of team members' personalities, and how those personalities may best be organized, nurtured, and utilized to help realize the highest level of team effectiveness (Mohammed & Angell, 2003). A solid understanding of how virtual team members' personality traits influence their ability to contribute in the asynchronous computer-mediated communication environment will allow a team leader the opportunity to adjust team operational strategy and empathize with team members. Making this information available represents the fundamental value of this research.

Research Question

The primary research question is: Is there a relationship between a virtual team member's energization source and his or her perceived level of contribution within a virtual team, when constrained by an asynchronous computer-mediated communication environment?

Hypothesis

The following null hypothesis was tested at the 0.05 significance level.

It was hypothesized that there is no significant relationship between the source of energization (introversion/extroversion) of a team member and the perceived level of contribution of that team member in an asynchronous computer-mediated communication team environment.

Limitations/Delimitations

1. This research was delimited to an academic environment. The research did not directly study non-academic environments; however, the results may be expanded into those arenas. This may provide an opportunity for future research.

2. While this research recognized various forms of computer-mediated communications including webcasts, chat, and others, it focused specifically on the asynchronous computer-mediated communications: email and threaded discussions.
3. This research was delimited to fully online and hybrid courses.
4. While additional attributes of Jung's personality model exist, this research only considered energization sources, that is, the prevalence of introversion and extroversion personality traits.
5. Research subjects were delimited to graduate and undergraduate Eastern Michigan University students engaged in online and hybrid course(s) which require a team project.

Assumptions

1. It was assumed that participants would respond honestly to both the Jungian personality evaluation and the teammate evaluation questionnaire.
2. It was assumed that while individuals might misrepresent themselves in the self-administered Jungian personality evaluation, it was assumed that this did not take place.
3. It was assumed that confounding variables exist that are not specifically addressed in this research, such as team members' prior exposure to virtual team environments, team members' past experience with computer-medicated communication, and aspects of team members personality traits that are not considered in the energization portion of the Jungian personality evaluation test.

Definition of Terms

Computer-Mediated Communications (CMC) – A method or group of methods whereby individuals and teams may communicate with the assistance of technological tools such as

computers and the Internet, to overcome hurdles such as geography and time (Thompson-Hayes, et al., 2009).

Team – A complex, dynamic system that exists in a context, develops as members interact over time, and evolves and adapts as situational demands unfold (Kozlowski & Ilgen, 2006).

Virtual Team – A collection of a small number of interdependent, geographically-dispersed individuals who depend on electronic linking in order to collaborate and achieve a common goal. Virtual teams are often temporary and self-managed (Alexander, 2006).

Media Richness – A conversational environment which supports complicated interaction by allowing verbal and visual cues in addition to written material, as well as the use of other facets of language such as non-word sounds and sending or receiving prompt feedback. (Ferry, Kydd, & Sawyer, 2001).

Conclusion

Organizational leadership has faced many challenges throughout the years due to continually evolving environments. Certainly the fundamentals of communication have evolved at an astounding pace, continually "changing the game" for team leaders. International business, aided by these evolving forms of communication, has increased the usefulness of computer-mediated communications, and, as a result, the traditional local team has become increasingly a virtual environment. The traditional conference room meeting is being replaced by the computer-mediated web meeting, and the traditional "water cooler" conversation is being replaced by email and electronic discussion chains. This evolving environment demands that the modern team leader understand the available means of communication, the influence these communication tools have on their team members, and the effect that their team members'

personality traits have on the effectiveness of those tools. This research fills a gap in the existing literature in these regards.

Chapter II: Review of the Literature

Purpose of Chapter

The purpose of this chapter is to summarize the existing literature related to this research. The proposed research topic, at its foundation, consists of a number of components, ranging from the fundamentals of teams to communication methodology and personality types. The chapter is structured using an organizational approach as shown below, where each item reflects a fundamental research premise.

1. Organizational communication
2. Media richness including verbal and nonverbal cues; consideration of face-to-face communications
3. Organizational team structure, purpose, and goals
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8. The impact of personality types on computer-mediated communication effectiveness
9. Contribution of team members in a virtual team environment.

The intent of this structure is to build an understanding of the foundations of this research and reflect the available knowledge related to each section; cumulatively this information formed the basis of the study.

Organizational Communication

Many types of communication are available for people in organizations, such as face-to-face, telephone, email, and web-based conferencing. All of these serve a common purpose: the transmission of knowledge within an organization. This communication is pivotal to the effectiveness of the employees of a business and, ultimately, to the business itself (Epstein, 2000).

People are central to any effective organization, and the effectiveness of communication among those people has a direct impact on their contribution to the effectiveness of the organization. The creation of knowledge within an organization begins with the ability of individuals to communicate (Epstein, 2000).

Computer-Mediated Communication is frequently found to be an important source of organizational communication; for example, Andrew and Robert (1997) explain how product designers often search for knowledge by sending out email-based "calls for help" (Epstein, 2000). In cases such as these, communication is fundamental as the key to sharing knowledge.

Organizations use communications in many forms. The written word is typical. However, when written communication proves ineffective, narratives are often used (Epstein, 2000). For example, Orr, during a study of photocopier technicians, found the technicians often searching for information beyond that offered in the manuals provided (1996). Orr explained that "the expertise vital to such contingent and extemporaneous practice cannot be easily codified" (p. 2). At one point in his study, Orr finds "technicians joking about the uselessness of their manuals (p. 60) and narrative discussion was found [to be] used during shared meals to communicate knowledge" (Epstein, 2000; Orr, 1996).

At the operational level, knowledge may be defined in a number of categories. Some research suggests that knowledge may be differentiated into two categories: tactic and general; and further tactic knowledge may be divided into complex and personal knowledge (Epstein, 2000). Regardless of the type of information that is communicated, it is important to note that what is communicated is not necessarily dependent on the tools that are used to communicate it (Epstein, 2000). Explicit knowledge may be communicated electronically, and research suggests that tactic knowledge may also be effectively transmitted electronically (Epstein, 2000; Nonaka, 1985). The important point is that the form of communication used does not necessarily affect the knowledge that must be communicated; virtual teams still must be able to communicate knowledge, even while burdened with distant locations and sometimes limited information channels.

Media Richness

Media richness theory (MRT) was one of the first theories to describe how and why people choose a particular medium to communicate with others in the workplace (Ferry et al., 2001). Richness is defined in terms of a medium's ability to accomplish four goals: (a) send multiple cues through multiple channels of communication, (b) support the use of language variety, (c) provide immediate feedback, and (d) support a high degree of personal interaction (Ferry et al., 2001). Indeed, according to the "richness imperative," the most effective medium for communication of information depends on the medium's richness (Ferry et al., 2001). Further, a media-rich environment supports more complicated interaction by allowing (a) verbal and visual cues in addition to written material, (b) the use of other facets of language such as non-word sounds, (c) sending or receiving prompt feedback, and (d) a personal communication to take place (Ferry et al., 2001). Studies have shown that face-to-face communication offers the

purest form of media-rich communications, allowing all of the above richness descriptions to take place (Ferry et al., 2001; Snowball & Willis, 2011). It has been found that face-to-face interviews offer more consistent and thorough results than formats such as self-completion and online surveys (Snowball & Willis, 2011). This suggests a definite difference in the information provided in a synchronous face-to-face conversation and an asynchronous format.

Another definition of media richness is the ability of information to change understanding within a time interval (Daft & Lengel, 1986). Communication methods that can clarify ambiguous issues in a timely manner are considered rich. Communications that require excessive time to enable understanding are lower in richness (Daft & Lengel, 1986).

In order of decreasing richness, the media classifications as defined by Daft (1986) are (a) face-to-face, (b) telephone, (c) personal documents such as letters or memos, (d) impersonal written documents, and (e) numeric documents (Daft & Lengel, 1986). Face-to-face is the richest medium because it provides immediate feedback so that interpretation can be checked. Face-to-face communication also provides multiple cues including body language and tone of voice (Daft, Lengel, & Trevino, 1987).

Conversely, uncertainty and ambiguity influence the ways in which information is processed, or not processed, by organizations. Carlson and Zmud (1999) built on this to propose "channel expansion theory," which suggests that individuals who acquire experience with a certain medium are more likely to perceive it as rich and may thus develop the ability to communicate effectively through it (Carlson & Zmud, 1999). Expanding on this idea, perceptions of media richness may be defined as the medium's capacity to convey messages that communicate rich information (Carlson & Zmud, 1999; Ferry et al., 2001; Shintaro & Jaime, 2010).

Organizational Teams

Leadership and communication are essential to maximize the performance of successful teams. A leader who encourages group communications and provides positive feedback will recognize increased team productivity (Ohler, 2004). Indeed, teams of people working together for a common purpose have been at the core of human social organization since our ancestors first came together to hunt game, raise families, and defend their communities (Kozlowski & Ilgen, 2006). Human history is, without doubt, an evolution of people working together in groups to explore and achieve (Kozlowski & Ilgen, 2006).

Yet the relatively modern-day concept of teamwork in large organizations that developed in the late 19th and early 20th centuries is, for the most part, a collection of individuals working with their individual skills and abilities on individual tasks (Kozlowski & Ilgen, 2006). More recently, however, global competition has pushed organizations worldwide to restructure work and tasks to include teams that enable more rapid, flexible, and adaptive responses. This shift in the structure of work and teams has made team effectiveness a significant organizational concern (Kozlowski & Ilgen, 2006). Speaking to the evolutionary aspects of human communication, organizations around the world are nearly 150 years into the evolution of the design of work, shifting from individual jobs to teams using more complex workflow systems. A number of forces are driving this change, including competition, consolidation, and innovation pressures for skill diversity; high levels of expertise; rapid response; and adaptability. Effective teams facilitate these characteristics (Kozlowski & Ilgen, 2006).

Virtual Teams

While the traditional organization has long existed within local geographic regions, virtual organizations have become increasingly more prevalent (DeSanctis & Monge, 1999). A

virtual organization may be considered a collection of geographically-distributed, culturally-diverse entities that are linked by computer-mediated communications and that rely on relationships for coordination; note that teams inside firms are becoming more geographically-distributed (DeSanctis & Monge, 1999).

Virtual teams, however, by the nature of their communication challenges, are fragile; relationships within the virtual team are delicate. In fact, a key component of virtual organizing is that these teams are more reconfigurable, their boundaries are often more blurred, and their relationships are more likely to be by assignment, potentially straining communication and effectiveness (DeSanctis & Monge, 1999).

It is noted that due to the evolution of computer technology and the Internet, as well as the increased need for worldwide consolidated and focused efforts between and within companies, the use of virtual teams is increasing; it is becoming clear that computer-mediated communications has had, and will continue to have, a significant impact on the processes necessary for effective team management (Branson, Clausen, & Sung, 2008).

It is clear that the virtual team is an important component of many successful businesses, and as such, understanding their effective operation is likewise important (Holton, 2001). Due to the vast amount of information and skills needed to address the challenges of global organizations, global teams are necessarily making and implementing more decisions in multinational companies; this again suggests the importance of effective virtual organization and communication (Martha & Joseph, 2000). It should be noted that virtual teams also require proper management to insure success. While virtual teams have become increasingly used, virtual team communication methods are very different from face-to-face communications. As an example, it has been shown that while face-to-face teams thrive in a less formal and structured

environment, those same studies indicate that virtual teams perform much more effectively by using structure, organization, and discipline (Rice, Davidson, Dannenhoffer, & Gay, 2007).

Additional aspects of the virtual team's success include the ability to build trust among team members remotely. In a virtual team, many of the traditional ways humans interact and communicate are absent; thus, building trust becomes even more important (Holton, 2001). A virtual team leader is hindered because he or she cannot manage his or her team in a face-to-face environment and must therefore trust that team members are honoring their commitments. This, again, emphasizes the role of trust in a virtual team (Charlene, 2001). Jarvenpaa and Leidner examined the challenges of creating and maintaining trust in a global virtual team (1999). The authors reported on a series of descriptive case studies on global virtual teams that worked on a common collaborative project with CMC and whose members were separated by location and culture. The authors concluded that trust can, in fact, exist in teams built solely on an electronic network (Branson et al., 2008; Jarvenpaa & Leidner, 1999).

The building of trust and relationships within a virtual team is, however, not without challenges. Virtual team members do face challenges in building a trusting relationship with other team members (Branson et al., 2008). Not only are communication methods lacking in cues, but the building of trust, while possible, is more infrequent (Branson et al., 2008). Virtual teams must always be conscious of the limited communication channels of a virtual team environment; virtual teams can form trusting relationships, but it takes extra effort and skills to do so (Branson et al., 2008).

There are fundamental aspects that contribute to successful virtual teams, including positive team climate, opportunity for regular team communications, action learning, and personal growth of team members through structured team building (Holton, 2001). While

proper attention and efforts related to virtual team building will help the team build trust and mutual respect, the everyday challenges of competing priorities as well as time and resource limitations are significant threats to the team development. These challenges may be a source of personal frustration and hinder progress toward team goals (Holton, 2001). While virtual teams can, and do, bring value to organizational effectiveness, they clearly present their own sets of requirements and challenges.

Considering the virtual team environment from a communication perspective, both positive and negative attributes might be envisioned. Greater apparent geographical presence of the organization might be enabled via computer-mediated communications, but the organization may also struggle with maintaining a coherent identity (DeSanctis & Monge, 1999). While more participation in CMC communication by virtual teams may be possible, information overload may be a burden to participants; in effect, with more efficient communication may come greater alienation (DeSanctis & Monge, 1999). Figure 2 shows the attributes of computer-mediated communications, as well as practical implications and limitations.

Table 1 **Major Results of Research on Electronic Communication and Some Implications for Virtual Organizations**

Research on Electronic Communication	Implications for Virtual Organizations
1. **Communication Volume and Efficiency**—In electronic communication settings, volume tends to increase and efficiency tends to decrease. 2. **Message Understanding**—Message bias decreases but comprehension is more difficult (relative to face-to-face). Impression formation takes longer. Social context is critical.	**Highly Dynamic Processes**—Managing communication load and meaning will be difficult as business processes change repeatedly. Message understanding may go down (at least initially) when processes change. We can expect simultaneous pressures to routinize and personalize communication.
3. **Virtual Tasks**—Some tasks are performed less effectively when done electronically; for example, consensus formation.	**Contractual Relationships**—Some tasks may not lend themselves to execution across boundaries; design of contracts may have to vary by task, with some more formal (legal) and others more informal (psychological).
4. **Lateral Communication**—Broader, more diverse participation is likely; less domination and hierarchy in electronic communication (though these are not entirely eliminated). 5. **Norms of Technology Use**—Styles of technology use emerge in individuals, groups, and organizations.	**Edgeless, Permeable Boundaries**—More boundary spanning is likely; broader, more functionally and culturally diverse parties will communicate. Conflicts are likely if communication norms that are formed in different locations are not compatible.
6. **Evolutionary Effects**—Impressions of others, impression management, and the degree and type of relational communication all change over time. Interpersonal relationships deepen. Norms develop.	**Reconfigurable Structures**—Reliable communication norms may be difficult to develop if redesign occurs too rapidly; use of communication histories may help to shorten evolutionary time periods following redesign.

Figure 2. Electronic Communications Implications (DeSanctis & Monge, 1999)

Schmidt, Montoya-Weiss, and Masey compared individuals, FTF teams, and virtual teams in the area of product development effectiveness (2001). Two experiments examined the effectiveness of new product development project continuation decisions. The first study compared individuals versus FTF decision-making effectiveness, and the second study compared the decision-making effectiveness of individuals, FTF teams, and virtual teams. They concluded that teams make more effective decisions than individuals, and that virtual teams made the most effective decisions (Branson et al., 2008; Schmidt et al., 2001).

Computer-Mediated Communication

Conflicting information is prevalent related to CMC. Barefoot (1982) stated that the only consistent finding in the literature related to task and media is that groups are more effective in divergent thinking tasks when communicating electronically rather than face-to-face, especially (but not only) if the communication is done anonymously. Thinking in a convergent manner, resolving conflict, or reaching consensus, however, are better done face-to-face than

electronically (Barefoot, 1982). In other words, electronic communication facilitates information-sharing but can make consensus formation more difficult in time-limited contexts (DeSanctis & Monge, 1999).

It is often stated that the lack of face-to-face contact in electronic communication may negatively affect message understanding; however, the literature is confusing on this point. DeSanctis (1999) writes that CMC virtual teams have been found to have more difficulty establishing information meaning and managing feedback in discussions due to the lack of localized team control; but it has also been shown that removing visual cues from conversation does not necessarily disrupt control and understanding (DeSanctis & Monge, 1999). In fact, it has been suggested that there may be some value in reducing the visual channel in interaction. For example, Straus and Miles (1998) demonstrated that evaluations by others (e.g., interviewers evaluating job applicants) may be less stereotyped and more valid when visual observation is removed from communication (Straus, 1998). The implication is that removal of visual cues may, in some instances, actually improve the quality of message understanding by removing the distraction of irrelevant information (DeSanctis & Monge, 1999). These points again emphasize the existence of conflicting information.

Some studies indicate that individuals take longer to form impressions of one another when conversing via CMC, because cue-lacking CMC requires more time to establish social relationships (Sproull, 1986). Nevertheless, mutual understanding via electronic media is possible in replacing visual cues; in some cases participants in CMC may rely on "community membership" to help make inferences about fellow team members (DeSanctis & Monge, 1999).

Galegher (1990) suggested that given sufficient contextual information, mutual understanding can be very high in computer-mediated communications. Team members can

become highly cohesive, and electronic conversation can take on the attributes of a social community (Galegher, Kraut, & Egido, 1990; Wilkins, 1991). DeSanctis (1999) adds the implication that, although shortcomings exist, electronic communication can, in many cases, allow effective relationships among team members (DeSanctis & Monge, 1999). As such, mutual understanding can be achieved via electronic communication, and the implications for virtual organizations are positive.

Key to virtual teams is the provision of "contextual" information for all members concerned; contextual information can improve message understanding, reduce the time required to establish CMC-based relationships, and ultimately enhance team effectiveness (DeSanctis & Monge, 1999). Additionally, during an interview by Alison (2006), Alan Huberty, a consultant to Ford Motor company's Virtual Team Projects 1988-2000, stated that one of the more significant challenges to the advancement of CMC remains a simple bureaucratic resistance to change (Alison & Peter, 2006).

Teams and Communication

Mastery of communications methods within virtual teams is a key requirement for team leaders. Even with advances in technology and communication methods, change in the way we work together is a process, not an event (Holton, 2001). As such, virtual team leaders will be required to new adapt to new environments, new technologies, and new ways of working. A wise virtual team leader will recognize this and learn the effective application of CMC to virtual team creation and management (Holton, 2001).

Of special interest in this study is the specific asynchronous CMC of email and discussion threads; the nature of these media have both advantages and disadvantages. Email is often preferred over phone calls because it is viewed as a medium that is useful in overcoming

time and distance challenges, even though it may not be the most effective mean of conveying certain types of information (Shintaro & Jaime, 2010).

Differences between face-to-face and virtual teams are prevalent; it appears that the most successful and efficient CMC-based teams will exhibit more formal procedures and structured processes than face-to-face teams (Rice et al., 2007). Extending this concept, it was found that those tasks that are best supported by a structured approach are more effectively accomplished during CMCs than those tasks that do not require a structured approach within a face-to-face environment (Rice et al., 2007). The data in Figure 3 are the results of a study comparing face-to-face and computer-mediated communications effectiveness in completing various tasks.

Task or attribute	More effective format	Reason	Comment or improved CMC "best practice"
Meeting preparation			
Schedule meeting	CMC	Anytime, anyplace meeting format	–
Prepare documents	FFC	CMCs require more up-front preparation, as agenda and "discussion-guiding" documents seen as essential to successful outcomes	These documents also aide in FFCs, however, easier to "get-by" without them
Meeting dynamics			
Flow of conversation and work-process	FFC	"More natural"	1-PC-to-1-participant and system normalization protocols significantly improved CMC dynamics
Develop conceptual understanding	FFC	Discussion-intensive	System performance hinders CMC effectiveness
Brainstorming	CMC	Eliminates "filtering" and influence of dominant personalities	Result requires CMC-optimized simultaneous input method
Evaluating ideas	FFC	Discussion-intensive	System performance hinders CMC effectiveness
Negotiating a desired outcome	FFC	Discussion-intensive, requires non-verbal social cues	High potential for unresolved conflict in CMCs
Choosing among options	Neutral	Appropriate CMC-process allows equal input from members	Result requires CMC-optimized method
Document creation	CMC	Allows document to be viewed and input to be received from all members	Requires adoption of associated meeting protocol
Confirmations	CMC	Natural tendency observed for confirmations to occur more readily in CMCs	System features allow confirmations during CMCs that are easy and non-disruptive to adopt
Task assignments	CMC	Can be done as real-time document creation	Real-time buy-in by team members
Dissemination of meeting outcomes			
Distribute outcomes	CMC	Minutes and resolutions kept in real-time may be distributed immediately; results "unfiltered"	Requires adoption of associated meeting protocol

Figure 3. Comparison of FTF and CMC Task Effectiveness (Rice et al., 2007)

Personality Types

This research considered personal characteristics as being either physical or psychological. The emphasis of this study was on psychological characteristics, as these are most significant to the nature of the research.

MBTI and Jungian Personality Type Assessment. Katherine Briggs and Isabel Myers Briggs developed a psychometric instrument, the Myers-Briggs Type Indicator (MBTI), using Jung's theory of psychological types. The instrument has been tested extensively for validity and reliability and has become widely used in business environments as a tool to evaluate personality types (Bradley & Hebert, 1997).

An understanding of personality types is significant when considering proper virtual team communications and applications. There is strong evidence that a personality assessment contributes knowledge about an individual team member that can help accurately predict his or her job performance under specific team circumstances; in addition to knowledge, skills, and abilities, personality is a strong indicator of team performance and individual contribution (Chauhan & Chauhan, 2001).

Clearly an understanding of team member personality type is significant and may play a role in the optimal effectiveness of team operations.

Energization Source. Of specific interest to this research is the MBTI classification of energization source, that is, introversion vs. extroversion. The critical difference between introversion and extroversion is the energy source an individual utilizes—extroverts are energized by interacting with other people, while introverts are renewed by being by themselves. Extroverts prefer the "outside world of people and things," while introverts enjoy the inner world

of concepts and ideas (Bradley & Hebert, 1997). Figure 4 gives a comparison of traits frequently distinguishing introverts from extroverts.

Extrovert	Introvert
external	internal
outside thrust	inside pull
blurt out a comment	keep in comments
breadth	depth
involved with people, things	interested in ideas/thoughts
interaction	concentration
action	reflection
do-think-do	think-do-think

Figure 4. Description of Introverts vs. Extroverts (Bradley & Hebert, 1997)

Impact of Personality Type on Computer-Mediated Communication

Exploring the motivating factors behind media-related behavior is not new. Goby (2006) used the Myers-Briggs Type Indicator to investigate the preference for offline or online communication between extrovert and introvert university students (Goby, 2006). It was discovered that both extroverts and introverts show a preference for offline social communication; however, introverts were more likely to be drawn toward online communication than extroverts (Orchard & Fullwood, 2010). A similar finding was also disclosed by Ebeling-Witte, Frank, and Lester (2007), whereby extroversion in university students, as measured by the Eysenck Personality Questionnaire, was negatively correlated with a preference for online communication (Ebeling-Witte, 2007; Orchard & Fullwood, 2010).

McKenna and Bargh's (2002) concept of a "real me" may aid in explaining these findings. The "real me" concept suggests that people are not always able to express themselves during social interaction, and the "real me" status is only achieved when a person feels comfortable and able to communicate effectively (Bargh, McKenna, & Fitzsimons, 2002;

Orchard & Fullwood, 2010). So, for example, those who are shy may feel less comfortable interacting in a face-to-face setting because they may not be able to effectively communicate their ideas to others. In a study concerned with social interactions online and offline, Amichai-Hamburger, Wainapel, and Fox (2002) found that introverts were able to locate their "real me" through online social interaction (in this study, specifically through chat); extroverts, however, were better able to find their "real me" through offline face-to- face communication (Amichai-Hamburger, 2002; Orchard & Fullwood, 2010).

Expanding on the ideas of specific online consumption preferences, introverts may locate their "real me" online rather than offline because of the unique properties associated with CMC (Orchard & Fullwood, 2010).

In other words, introverts may prefer to socialize online, whereas extroverts may prefer face-to-face interaction. It is likely that introverts will gravitate toward the properties of CMC, and this may in fact account for introverted preferences (Orchard & Fullwood, 2010). Does CMC allow the introvert to "hide" across space and time? Some research suggests that the CMC environment can reduce the anxiety experienced by some individuals generated by face-to-face communications, making the online experience seem more isolated (Orchard & Fullwood, 2010).

It has been shown, however, that while theories exist regarding the more effective mode of communication for introverts vs. extroverts, extroverts are able to communicate complex and general knowledge more effectively than introverts, regardless of the method of communication used (Epstein, 2000).

For instance, remaining invisible to others may be considerably advantageous to an introvert (e.g., because he or she may be worried that appearing "embarrassed" would reflect

poorly on them). Extroverts, however, may consider access to such cues important, particularly when it comes to gaining an understanding of other individuals (Orchard & Fullwood, 2010).

In an academic environment, introverted learners tend to be more quiet, passive, thoughtful, and able to focus on a single topic longer than their extroverted counterparts (Anderson, 2004). Thus, they may actively participate in asynchronous environments such as web-based threaded discussion, simply because they have enough time to think. Introverted learners may benefit from CMC threaded discussions because they may be able to express their ideas in an anonymous and depersonalized manner, not constrained by a synchronous and sometimes uncomfortable (to the introvert) face-to-face environment (Lee & Lee, 2006; Taylor, 1998). In asynchronous web-based, threaded discussions, extroverted learners learn by actively posting their opinions when they want to; introverted learners, however, have the opportunity to consider and reflect more when given time vs. when they engage in real-time discussions (Lee & Lee, 2006).

One study comparing academic introverted virtual team members to extroverted virtual team members have shown that the extroverted members in a chat environment tended to post more strings than their introverted counterparts, while introverted members tended to post less and reflected on others' postings in more depth than extroverts (Lee & Lee, 2006). Indeed, on a given topic, the extroverted learners typically generated messages before the introverted members, and the introverted learners then provided feedback as in-depth responses to previously posted messages (Lee & Lee, 2006). Generally speaking, extroverted team members initiated new topics and issues, and introverted team members commented on those posts (Lee & Lee, 2006).

Indeed, extroverted learners tend to enjoy learning with the cooperation of other team members in an ongoing iterative process. Vigorous, fast-paced, web-based threaded discussion may, in some instances, not be as appealing to introverted learners, since they may be more passive and standoffish during the discussions (Lee & Lee, 2006). In addition, it has been shown that more introverted students generally engage in higher levels of internet usage (Landers & Lounsbury, 2006).

Indications of this also exist in the social aspects of the CMC environment. It is possible that the anonymous internet CMC provides the environment in which introverted women feel secure enough to engage in discussions with others, in order to reduce their emotional loneliness (Hamburger & Ben-Artzi, 2000).

From a social media perspective, it has been found that individuals' personality traits, including extroversion, play a role in their use of interactive social media (Correa, Hinsley, & de Zúñiga, 2010). These findings are consistent with previous studies conducted by Amichai (2002), who tested how personality played a role in internet use, and with studies that examined online applications that involved some degree of social interaction (Amichai-Hamburger, 2002; Correa et al., 2010).

Measuring Team Effectiveness

The conceptualization of team effectiveness that has shaped the last 40 years of theory and research is based on the logic of an input-process-output (I-P-O) heuristic formulated by McGrath (1964). In this framework, inputs refer to the composition of the team in terms of the combination of individual characteristics and resources at multiple levels (individual, team, organization; Kozlowski & Ilgen, 2006). Processes refer to activities that team members engage

in, combining their resources to resolve (or fail to resolve); processes thus convert inputs to outcomes (Kozlowski & Ilgen, 2006). Output has three facets:

- Performance judged by relevant others external to the team
- Meeting of team member needs
- Viability or the willingness of members to remain in the team (Hackman, 1989).

This research used the fundamental outline of McGrath's I-P-O as a basis for team effectiveness measurement. Figure 5 illustrates the I-P-O model and the effect that team members and environment have on effectiveness.

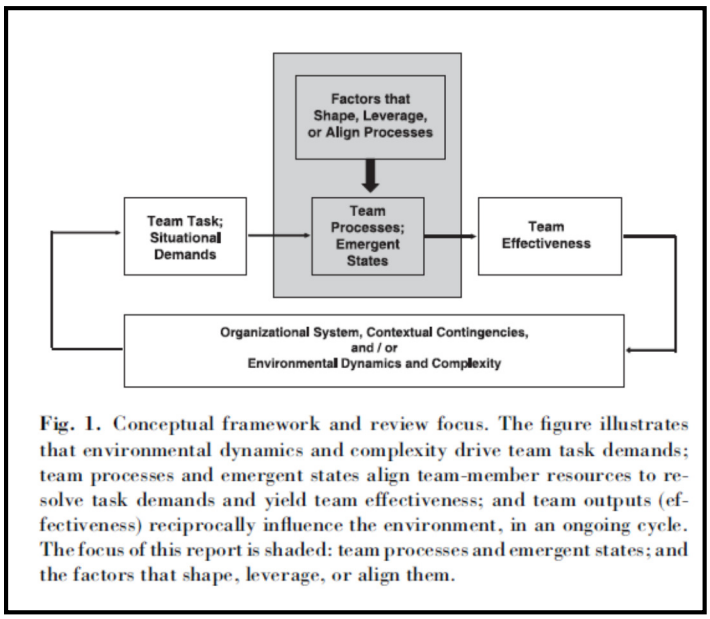

Fig. 1. Conceptual framework and review focus. The figure illustrates that environmental dynamics and complexity drive team task demands; team processes and emergent states align team-member resources to resolve task demands and yield team effectiveness; and team outputs (effectiveness) reciprocally influence the environment, in an ongoing cycle. The focus of this report is shaded: team processes and emergent states; and the factors that shape, leverage, or align them.

Figure 5. Team Model and Effectiveness (Kozlowski & Ilgen, 2006)

Conclusion

This chapter has offered insight into a number of topics directly related to, and of fundamental importance to, this research. The potential of this study, however, is to fill a clear gap in the available literature that relates these topics, that is, the impact that they have on each

other. This research offers a connection between asynchronous computer-mediated communication, virtual teams, personality type, and associated team performance.

Chapter III: Methodology

Purpose of Chapter

The purpose of this chapter is to describe the research methodology. The topics addressed include:

1. Research Method
2. Research Population and Sample
3. Research Instrumentation/Instrument Development
4. Research Data Collection
5. Research Data Analysis.

Method

This research is descriptive in nature; it used a survey designed by the researcher to measure virtual team contributions for an individual and a generally accepted personality inventory. These instruments were used to gather information from virtual team members enrolled in classes at a Midwestern regional university; the results were analyzed, resulting in insights regarding the relationship between personality type and perceived contribution in a virtual team environment.

Population and Sample

The population for this research was students enrolled in US postsecondary online and hybrid classes that required virtual team activity. The sample consisted of students enrolled in online and hybrid courses within a Midwestern regional university that used virtual team assignments as required parts of the curriculum.

Instrumentation/Instrument Development

Data were collected for this research using two instruments: a personality inventory, including a specific focus on energization source, and a questionnaire used to gather data that could be used to measure the perceived level of contribution of fellow virtual team members.

Personality Inventory. Katherine Briggs and Isabel Myers Briggs developed a psychometric instrument, the Myers-Briggs Type Indicator (MBTI), using Jung's theory of psychological types as the primary theoretical framework. The MBTI has been tested extensively for validity and reliability (Bradley & Hebert, 1997).

Four dimensions of personality traits are evaluated by the MBTI, including:

1. Energizing - How a person is energized
    a. Extroversion (E) - Preference for drawing energy from the outside world of people, activities or things.
    b. Introversion (I) - Preference for drawing energy from one's internal world of ideas, emotions, or impressions.
2. Information intake - What a person pays attention to:
    a. Sensing (S) - Preference for using the senses to notice what is real.
    b. Intuition (N) - Preference for using the imagination to envision what is possible; to look beyond the five senses. Jung calls this "unconscious perceiving."
3. Deciding - How a person decides:
    a. Thinking (T) - Preference for organizing and structuring information to decide in a logical, objective way.
    b. Feeling (F) - Preference for organizing and structuring information to decide in a personal, value-oriented way.

4. Relationship with outside world - Life style a person prefers:
    a. Judgment (J) - Preference for living a planned and organized life.
    b. Perception (P) - Preference for living a spontaneous and flexible life (Bradley & Hebert, 1997).

This research used a Jungian personality measurement instrument, available through many universities, entitled "TypeFocus." This tool is quite similar to the Meyer Briggs's instrument, differentiating personality types into identical categories, including energization source. TypeFocus was chosen as the Jungian test instrument due to accessibility through the site license at the Midwestern University and the strong evidence of Jungian construct validity.

TypeFocus has undergone extensive testing for validity and reliability. The following text is available on the TypeFocus website:

> In 2009, Dave Wood asked the TypeFocus clients (career centers in high schools, colleges, universities and community offices like OneStops) to help update the TypeFocus Type Indicator instrument. With their help he was able to distribute over 1000 Form M MBTI® instruments along with an equal number of the new TypeFocus® questionnaires. This excellent sample size allowed him to state with high confidence that the TypeFocus® and Myers-Briggs® instruments measure the same concepts.
>
> **Reliability Results.** The reliability of the TypeFocus Type Indicator ranges from 0.88 to 0.89 for split-half correlations. These are very high reliability scores and indicate that the TypeFocus results will be consistent. To put those figures into context, the reliability of the MBTI® Form G (Table 8.1 in the MBTI® Manual) ranges from 0.82 to 0.86 for split-half correlations; this is considered excellent. The reliability of the MBTI® Form M (Table 8.1 in the MBTI® Manual) ranges from 0.89 to 0.92.

Validity Results. Validity means measuring what you think you are measuring; assessment tools need to demonstrate through empirical (i.e. scientific) studies that what they say they are measuring is in fact true. This is usually accomplished by correlating one result with another. For example, if a test purports to measure intelligence, then high scores on that test should correlate with higher marks in school. In our case, if the TypeFocus test is actually measuring personality type as determined by the MBTI®, then the two tests should be highly correlated. And they are. The TypeFocus Type Indicator results correlate strongly with the Myers-Briggs Type Indicator®. The coefficient of correlation results are:

E-I continuous scores = 0.83

S-N continuous scores = 0.80

T-F continuous scores = 0.83

J-P continuous scores = 0.83

These high correlations indicate that there is strong evidence that both instruments measure the same thing and that the research results based on the Myers-Briggs Type Indicator® can also be applied to the TypeFocus results. Myers-Briggs Type Indicator is a registered trademark of Consulting Psychologists Press Inc. (Type Focus - Success Through Self Awareness, 2012).

While all four primary MBTI type characteristics were gathered, of single interest in this research was the energization source; these data were coded and placed on a continuous scale. Personality test results were available to the researcher through cooperation with the University's TypeFocus administration team as well as the president of TypeFocus.

Contribution Evaluation Questionnaire. The second survey gathered the perceptions of respondents regarding the perceived contributions of the other members to their virtual team; all team members were asked to share their perceptions regarding the perceived contribution of each of their teammates. The instrument used for this purpose was a contribution evaluation questionnaire.

An evaluation questionnaire was developed that allowed the evaluator the opportunity to share their perceptions of their fellow team members' level of contribution to the virtual team. The evaluation questionnaire included questions based on McGrath's Team Effectiveness Model (McGrath, 1964) including team performance as perceived by outside sources, the ability to meet team members' needs, and the team's long-term viability.

The questionnaire was worded in a manner that gathered perceptions regarding the level of contributions of teammates and that supported McGrath's (1964) Team Effectiveness Model as described above, including specific performance focus areas such as:

1. Team performance as perceived by outside sources
2. Project success as determined by course instructor
3. Contribution to overall project grade
4. The ability to meet team members' needs
5. Timely email chain responses and contributions
6. Initiation of email chains
7. Ability to contribute to team cohesion
8. Influence on team progress and direction
9. Response thoroughness
10. Indication of leadership qualities

11. Team members' consistency of contribution throughout the life of the project

12. The team's long-term viability; members' willingness to continue to serve on the team

13. Team members' level of enthusiasm

14. Evaluators' willingness to work with the team member on future projects

15. Additional information-gathering questions.

The evaluators were asked approximately what percentage of their communication with the team member they were evaluating was through asynchronous means, such as email or discussion threads, and what percentage was attributed to synchronous means, such as telephone or video conferencing.

The following procedure guided the creation of the questionnaire.

A questionnaire draft was created based on the research requirements, using McGrath's I-P-O model (1964) as a guideline.

A team of experts was identified, including four individuals with notable experience in the fields of questionnaire creation, computer-mediated communications, team performance, online course administration, and personality type analysis. The panel of participants was:

- Dr. John Dugger, Ph.D; knowledgeable in survey creation.
- Dr. Daniel Fields, Ph.D; knowledgeable in online and virtual course administration and computer mediated communication.
- Dr. Anne Balazs, Ph.D; knowledgeable in internet based advertising and sales, marketing and internet data gathering techniques.
- Ken Meyer; Eastern Michigan University TypeFocus Personality Type Administrator.

The questionnaire draft was submitted to the team of experts for evaluation and enhancement suggestions. The questionnaire was updated based on the team's feedback; this improved instrument content validity.

The questionnaire draft was submitted along with a human subjects request to Eastern Michigan University for approval. Human subjects approval was acquired, and a copy of this approval can be found in Appendix C of this document.

A pilot study was conducted to evaluate the revised questionnaire, using one graduate and one undergraduate face-to-face course. The feedback sessions took place on Monday, August 14, 2012; the evaluated courses were

- IA643 – Disaster Recovery; (6) Students – Graduate Level Course
- IA212 – Open Source Platform; (9) Students – Undergrad Level Course

Each student in each course was given a copy of the proposed questionnaire and asked for feedback including, but not limited to, grammar, readability, and understandability. Some students offered spoken suggestions which were duly noted, while others provided written feedback directly on the feedback request letter. Feedback was collected and modifications were made to the questionnaire when appropriate. A copy of the document requesting student feedback assistance is located in the Appendix A of this document.

An account was established with Survey Monkey. The questionnaire was uploaded and made available to research participants.

The final questionnaire can be found in Appendix A of this document.

Data Collection

The virtual team members were identified with the assistance of the University's online and hybrid instructors. A list of instructors who administered undergraduate and graduate level

online courses, as well as an online course schedule for the subject semester, was requested from the departmental administrative office or department head; all instructors were initially asked via email to participate in the study, and those who were interested in assisting were then contacted via telephone. The request included a detailed summary of the research requirements and a copy of the research proposal. A copy of the EMU Human Subjects approval is included in Appendix C of this document. Only instructors whose online or hybrid courses included team projects were used in the research; it was presumed that team projects within the online or hybrid course environment, by their nature, constitute a virtual team and therefore provide an excellent potential source of data.

Study participants were asked near the beginning of the online or hybrid course via email to participate in the study. They were asked to complete a cost-free online Jungian personality type analysis; the results were available only to the researcher and were used to determine a team member's energization source (other parameters were available for correlation, providing additional insight and potential suggestions for future research). The results were also used to determine perceived team contribution level. The online personality test supported gathering continuous data, that is, values representing introversion vs. extroversion included whole numbers, ranging from 0-15. The respondents completed the online survey in an unsupervised manner.

Near the end of the semester in which data were collected, each team member was asked to complete one team contribution level questionnaire per teammate regarding their perceptions of each of their teammate's contributions. Team members had to be identified by name within the questionnaire to allow for a correlation analysis with the team members' personality

assessment results. The data were gathered from the survey and the personality inventory for analysis by the researcher.

Participation was completely voluntary, and the students were informed that the results of their efforts would not influence their final course grade in any way. Students were informed that the course instructor would not have access to either the personality type results or the team member evaluation questionnaires. To encourage participation, some instructors offered students extra credit to participate in the study.

All potential participants were informed that those who completed both an individual personality type measure as well as team member contribution evaluation questionnaires for all of their team members would be included in a lottery, and one winner would be awarded a $100 appreciation incentive. This incentive was awarded upon final data collection by the researcher, and the winner was randomly selected from the list of participants who provided all the requisite information.

Data Analysis

Indicators of data distribution including central tendency, variability, and skewness were calculated for all Jungian categories and for each contribution evaluation rating and for the summary rating.

The inferential and correlation components relating personality type to team contribution included the calculation of coefficients of determination between dependent and independent variables to identify the significance of the relationship; the percentage of variance in the model can be explained by the independent variables. The correlation between energization level and each variable representing team member contribution was analyzed; the results are given later in this document. The ultimate result of the data analysis was intended to be the support—or

nonsupport—of the hypothesized relationship between the energization source (introversion/extroversion) of a team member and the perceived level of contribution of that team member in an asynchronous computer-mediated communication team environment and, ultimately, resolution of the problem statement.

Chapter IV: Results

Chapter Intent

The intention of this chapter is to describe the data gathered during this research and give an analysis of that data that addresses the research questions and hypothesis. Information is provided describing the participants who took part in the data-gathering efforts and the courses in which they were contacted; statistics such as sample size and measures of central tendency are also provided. The chapter gives the results of the correlation analysis between the energization dimension of their personality type and the respondent's views of their teammates' contributions to their virtual teams. The results of the correlation analysis related to energization is reported in two ways: a model is presented relating the dependent variable, energization, to each individual contribution response; and a model is presented after grouping the contribution responses into the three categories as identified by McGrath (1964). These are (a) team performance as perceived by outside sources, (b) the ability to meet team member's needs, and (c) the team's long-term viability. The raw data that were used in this research (with coding for brevity, where appropriate) is located in Appendix E of this document.

Description of Respondents

Instructors from three schools at a Midwestern University—School of Engineering Technology (SET), School of Technology Studies (STS), and School of Business—who taught courses with titles described in subsequent sub-sections allowed their students to participate in this research. Each course instructor forwarded the request for data collection (located in Appendix D of this document) via email to each student enrolled in the course. All data collection took place during the Fall semester of 2012. Each course required students to

participate in virtual team project activities that required more than 75 percent of team communications to be done asynchronously.

Lean Teams. This was a graduate level hybrid course that met face-to-face once weekly and required assigned teamwork that was completed outside of the face-to-face meeting times. This course generated one team consisting of four students. Ultimately, six data pairs (a teammate evaluation, paired with that teammate's completed personality survey) were completed by students in this course.

Manufacturing Process Planning. This graduate level hybrid course met face-to-face once weekly and required assigned teamwork that was completed primarily outside of the face-to-face meetings. This course had one team made up of the entire roster of six students. All six students participated in this research; each student supplied five teammate evaluations. All students also completed the personality study. Ultimately, 30 data pairs (a teammate evaluation paired with that teammate's completed personality survey) were completed by the students.

Business Policy. This undergraduate 400-level course was completely online; two sections of this course participated. Twenty-four students completed the personality inventory and provided teammate evaluations. Ultimately, 28 data pairs (a teammate evaluation paired with that teammate's completed personality survey) were completed by students enrolled in this course.

Introduction to Product Design and Development. This was an undergraduate 100-level hybrid course that met face-to-face once weekly and required assigned teamwork that was completed primarily outside of the face-to-face meeting. The course was divided at the beginning of the term into five teams randomly assigned by the instructor; one team consisted of five students, and the remaining four teams consisted of three students. Seventeen students were

enrolled in the course, 14 of whom completed teammate evaluations. Ultimately, 27 data pairs (a teammate evaluation paired with that teammate's completed personality survey) were completed by students enrolled in this course.

Introduction to Science and Technology. This was a graduate level course, delivered completely online. The course team structure altered on a weekly basis; each week one student was asked to act as the "team leader" for that week's assignment. The team consisted of the entire class of 18 students. The team leader was then asked to provide teammate evaluations at the end of their assigned week. Ultimately, 53 data pairs (a teammate evaluation paired with that teammate's completed personality survey) were completed by students in this course.

Descriptive Statistics of Variables

This section describes the dependent variable, energization (introversion vs. extroversion), and all descriptive responses and teammate evaluation questions; these are the independent variables in this research. These teammate evaluation variables were used in the final correlation analysis and hypothesis testing, to address the key questions posed in this research.

Descriptive Statistics - Energization of Individual Participant. Energization (introvert vs. extrovert) represents the dependent variable in both models in this research; it was generated by administering the TypeFocus personality instrument. The energization values ranged from 0-15, where *0* represents an extreme introvert, and *15* represents an extreme extrovert. Energization scores were acquired for all 144 data points. Figures 6 and 7 represent the acquired data in histogram and Pareto form, respectively. Figure 6 also suggests a potentially bimodal distribution, which is not of significant concern to the final analysis because the independent

variables were ultimately transformed to make them more normally-distributed. Note that the mode was 0, indicating that this was the most frequent value.

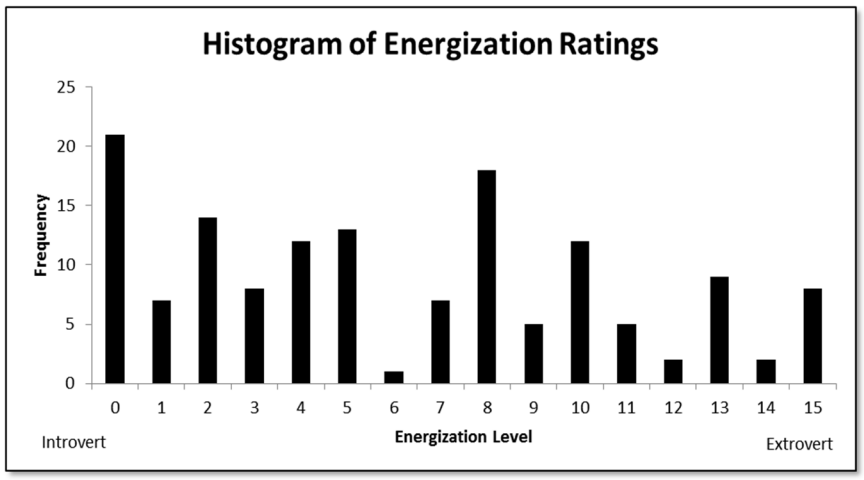

Figure 6. Histogram of Energization Ratings

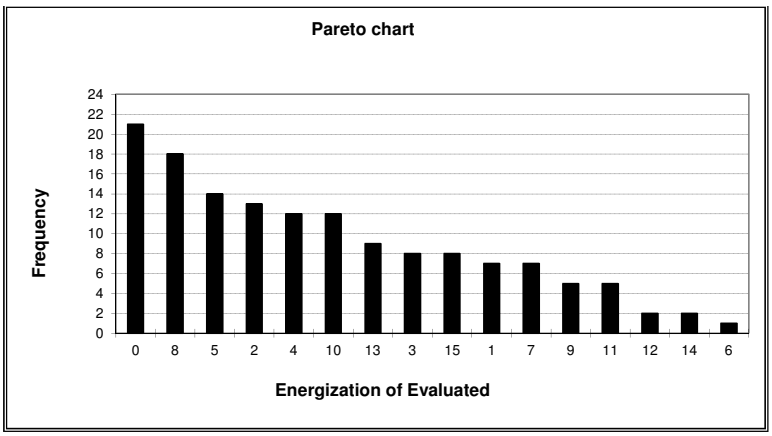

Figure 7. Pareto Chart of Energization Ratings

Descriptive Statistics – Academic Level of Course. Evaluators were asked "At what level was this course taught?" Response options were undergraduate, master's, and doctoral level. Fifty-five (38.2 percent) of the evaluations were at the undergraduate level; 89 (61.8 percent) were at the master's level. No doctoral level evaluations were acquired. This distribution was considered reasonable for the data analysis required to answer the research

questions. It should be noted that the responses to this question were not included as an independent variable in the correlation model but rather were used to describe the responses received.

Descriptive Statistics – Team Member Persistence. Respondents were asked if the team member being evaluated was on the team for the entire project. Of the 144 respondents, 143 (99.31 percent) reported that the teammate they evaluated was on the team for the entire project, while one respondent reported that a teammate was not. A thorough response was provided by this respondent, and as such, the respondent's data remained in the analysis. The purpose of this question was to ensure that the evaluator had ample exposure to the teammate, allowing an appropriate opportunity for evaluation. It should be noted that the responses to this question were not included as an independent variable in the correlation model creation but rather were used to describe the responses received.

Descriptive Statistics – Team Member Assignment Method. When asked how the teammate being evaluated was assigned to the team, 23 (16.0 percent) of respondents reported *by team decision*, 106 (73.6 percent) reported *by instructor decision*, and 15 (10.4 percent) reported "*other.*" Of these 15 "other" responses, five responded that the class consisted of only one team, two responded "first day seating," and the remainder responded "volunteer and assignment." These results suggest that the majority of teams were formed in a somewhat random manner, which helped reduce the risk of confounding variables such as pre-existing relationships that might have influenced responses. It should be noted that the responses to this question were not used as an independent variable in the correlation model creation but rather were used to describe the responses received.

Descriptive Statistics – Communication Methodology. Respondents were asked what percentage of their communication with the team member being evaluated was asynchronous (e.g., email and conversation threads). Figure 8 and Table 1 indicate that, on average, approximately 88.0 percent of team communication was through asynchronous means, while approximately 12.0 percent was through synchronous means. This calculation was based on weighting the categorical data and frequency as shown in Table 1. The intention of this question was to validate that the majority of respondents had communicated with the teammate being evaluated in an asynchronous manner, which is the focus of this research; the resulting 88.0 percent frequency of asynchronous communications was deemed by the researcher to be sufficient to conclude that the communications were primarily asynchronous.

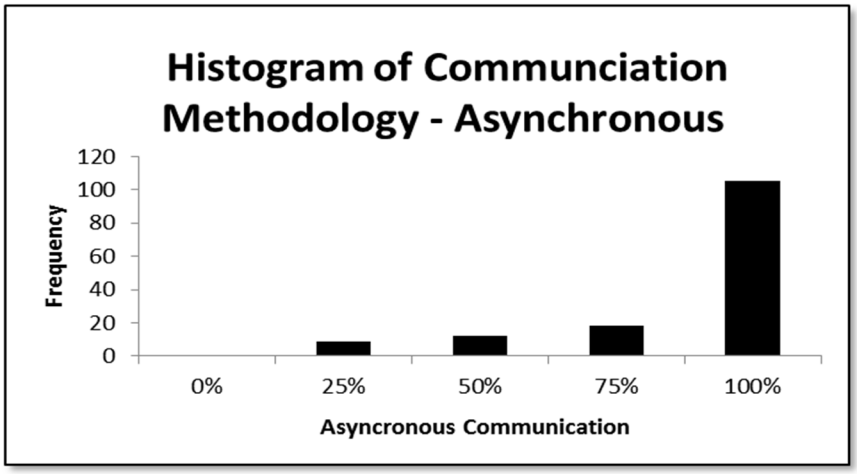

Figure 8. Histogram of Asynchronous Communication Methodology

Table 1

Asynchronous Communication Category Data

Response Category	***Response Frequency***	***Sum***
0%	0	0
25%	9	2.25
50%	12	6.00
75%	18	13.50
100%	105	105.00
Total	**144**	**126.75**
	Average	**88.02%**

Descriptive Statistics – Ability to Evaluate. The respondents were asked if they felt they were able to evaluate this team member. The initial response was that 122 (81.9 percent) of the respondents felt that they were able to evaluate their teammates, 22 (14.8 percent) were "somewhat" able to evaluate their teammate, and five respondents (3.3 percent) answered that they were "not able to evaluate their teammate," totaling 149 initial responses. The five responses indicating "not able to evaluate their teammate" are only described in this section and were removed from the data. These responses are not included in the 144 final responses used in any descriptive statistics throughout this analysis. This question was asked to insure that the respondent did not complete the evaluation without proper exposure to the teammate being evaluated or felt that for any reason their response would be biased; it offered the evaluator a means to inform the researcher that they felt that their response might not be qualified. It should be noted that the responses to this question were not used as an independent variable in the correlation model but rather were used to describe the responses received.

Descriptive Statistics - Final Team Grade. Evaluators were asked what grade was received, or anticipated to be received, representing the product of the team's efforts. The results are shown in Figure 9 and Table 2. It should be noted that the reporting of project grade or the projected grade was acquired when the course and course project were approximately 75 percent completed. This suggested that the respondents had acquired adequate knowledge of the project progress, allowing an accurate response to the question. The responses to this question were also included in the McGrath (1964) grouping of "Average team performance as viewed by outside observers." The responses to this question were used in the model as an independent variable.

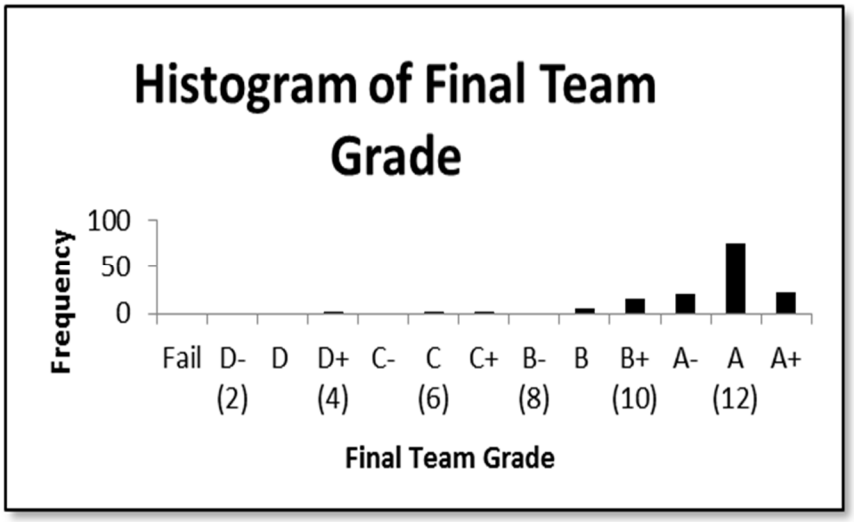

Figure 9. Histogram of Final Team Grade

Table 2

Tabulation of Final Team Grade

		Relative	***Cumulative***	***Cum. Rel.***
Class	***Frequency***	***Frequency***	***Frequency***	***Fraction***
Failing	0	0.0000	0	0.0000
D-	0	0.0000	0	0.0000
D	0	0.0000	0	0.0000
D+	1	0.0069	1	0.0069
C-	0	0.0000	1	0.0069
C	2	0.0139	3	0.0208
C+	1	0.0069	4	0.0278
B-	0	0.0000	4	0.0278
B	6	0.0417	10	0.0694
B+	16	0.1111	26	0.1806
A-	21	0.1458	47	0.3264
A	75	0.5208	122	0.8472
A+	22	0.1528	144	1.0000

Descriptive Statistics – Contribution to Final Grade. Responses to the question of the teammate's contribution towards the final team grade are shown below in Table 3 and Figure 10. In cases where the respondent indicated there was "No Opportunity to Observe," the responses were removed from this report; two such data points were removed based on these criteria. The responses to this question were also used in the McGrath (1964) grouping of "Average team performance as viewed by outside observers." The responses to this question were used in the model creation as an independent variable.

Table 3

Tabulation of Contribution to Final Grade

Class	***Frequency***	***Relative Frequency***	***Cumulative Frequency***	***Cum. Rel. Fraction***
Strongly Disagree	11	0.0775	11	0.0775
Somewhat Disagree	10	0.0704	21	0.1479
Indifferent	23	0.1620	44	0.3099
Somewhat Agree	30	0.2113	74	0.5211
Strongly Agree	68	0.4789	142	1.0000

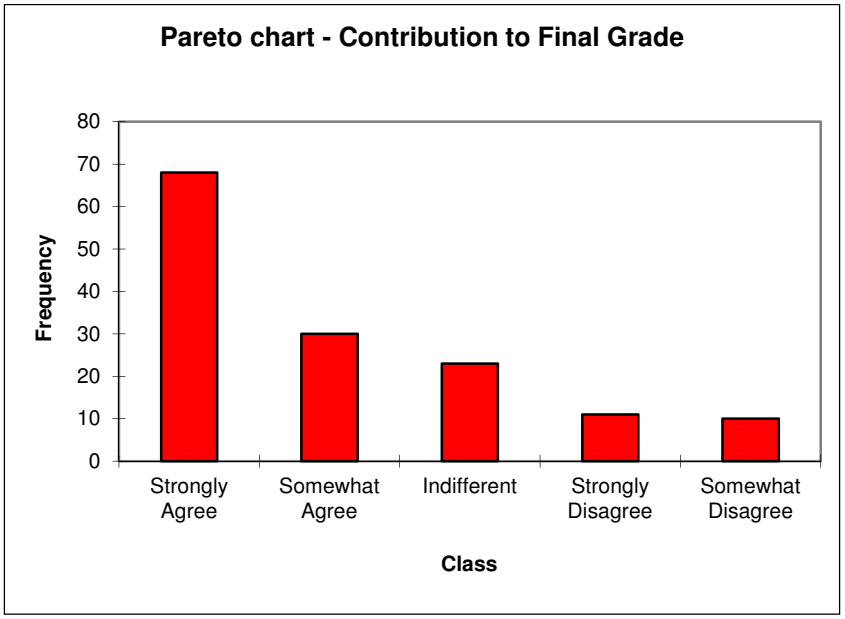

Figure 10. Contribution to Final Grade Pareto Chart

Descriptive Statistics – McGrath (1964) Grouping of "Ability to Satisfy Team Member Needs" Questions. Table 4 reflects the tabulated responses of each of the ten questions from the McGrath (1964) grouping of "Ability to Satisfy Team Member Needs." These questions include:

1. Team Member Engagement – This question asked the respondent if the team member was engaged throughout the entire project.
2. Communication Effectiveness – This question asked if the team member being evaluated communicated effectively, thoroughly, and thoughtfully.
3. First to Respond – This question asked if the team member was frequently the first to respond to conversation threads.
4. Communication Initiation – This question asked if the team member often initiated email or discussion threads.
5. Response Length – This question asked if the team member typically provided more lengthy responses to email and discussion threads than other team members.
6. Team Leader – This question asked if the evaluator would consider the team member being evaluated to be a team leader.
7. Contribution to Team – This question asked if the team member contributed significantly to the overall product of the team.
8. Creation of Team Stress – This question asked if the team member contributed undue stress to the team.
9. Quick Response – This question asked if the team member responded more quickly than most team members.

10. Enthusiastic Contribution – This question asked if the team member contributed to the team in a positive, upbeat manner.

Table 4

Tabulated Responses to "Ability to Satisfy Team Member Needs" Grouping

Tabulated Response Frequencies for "Ability to Meet Team Member Needs" Question Grouping										
Question	Team Member Engagement	Communication Effectiveness	First to Respond	Communication Initiation	Response Length	Team Leader	Contribution to Team	Creation of Team Stress	Quick Response	Enthusiastic Contribution
No Response	0	0	0	1	2	2	0	15	0	0
Strongly Disagree	11	11	15	14	13	18	12	51	13	4
Somewhat Disagree	9	9	17	12	14	12	8	11	18	5
Indifferent	18	20	30	28	36	43	30	27	33	30
Somewhat Agree	34	37	33	35	39	16	36	23	39	40
Strongly Agree	72	67	49	54	40	54	58	17	41	65

Descriptive Statistics – McGrath (1964) Grouping of "Team Long Term Viability"

Questions. Table 5 and Figure 11 reflect the responses to each question from the McGrath (1964) grouping of "Team Long Term Viability." These questions include:

1. Future Teaming – This question asked if the evaluator would choose to work with the team member in the future.
2. Attractiveness to Others – This question asked if the team member presented a level of contribution and enthusiasm that made others want to work with him or her.

Table 5

Tabulated Responses to Team Long Term Viability Grouping

Tabulated Response Frequencies for "Team Long Term Viability" Question Grouping

Question	Future Teaming	Attractiveness to Others
No Response	0	1
Strongly Disagree	19	11
Somewhat Disagree	7	8
Indifferent	27	32
Somewhat Agree	25	33
Strongly Agree	66	59

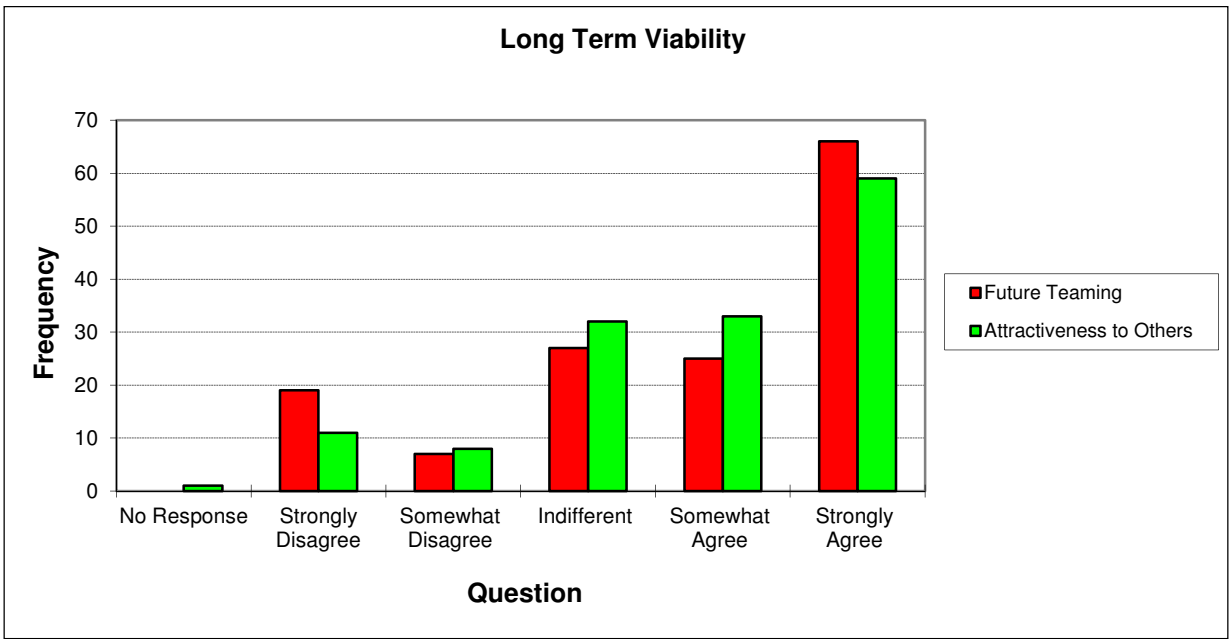

Figure 11. Pareto Responses to Team Long Term Viability Grouping

Analysis of Normality

The 14 independent variables above were tested for normality. Table 6 indicates the best fit distributions for all independent variables. Best fit distributions are indicated by the lowest A-D values, and are highlighted in yellow for identification. Note that none of the independent variables were normally-distributed. Table 7 shows the variable coding scheme used in the analyses.

Table 6

Best Fit Distributions for Independent Variables

	A-D for:															
distribution	**FTG**	**OCE**	**AVO**	**EEP**	**CE**	**FTR**	**IC**	**LR**	**TL**	**CS**	**CUS**	**QR**	**PUM**	**ASTN**	**FT**	**MOWTL**
min. extreme value	**8.870**	12.215	13.585	11.874	7.279	7.456	8.300	6.043	9.495	9.309	**7.127**	6.084	12.095	11.728	9.676	9.895
normal	11.476	11.375	12.952	11.490	6.857	7.013	8.040	5.803	8.121	8.849	7.846	5.817	10.341	11.080	8.877	9.064
logistic	9.671	**10.257**	**11.553**	**10.206**	**6.275**	**6.415**	**7.227**	**5.377**	7.585	**7.965**	7.328	**5.414**	**9.861**	**9.917**	**8.106**	**8.279**
3-parameter Weibull	8.874	12.215	13.587	11.875	7.278	7.455	8.297	5.959	9.325	9.301	16.204	6.004	12.095	11.722	9.670	9.892
3-parameter lognormal	11.476	11.367	12.946	11.490	6.857	7.012	8.033	5.804	8.119	8.852	17.313	5.815	10.331	11.084	8.865	9.057
2-parameter exponential	47.191	24.243	27.035	26.191	18.095	18.330	20.831	19.134	18.217	23.746	46.625	18.168	31.690	23.311	23.643	23.938
3-parameter loglogistic	9.673	10.259	11.556	10.209	6.277	6.417	7.230	5.378	**7.584**	7.967	15.440	5.416	9.861	9.918	8.107	8.280
Weibull	9.447	12.558	14.153	12.436	7.413	7.592	8.718	6.087	8.814	9.558	7.728	6.124	11.515	12.402	9.667	9.881
lognormal	14.416	13.641	15.613	14.269	8.822	8.985	10.531	8.074	9.397	11.472	9.454	7.813	11.162	13.791	11.086	11.272
exponential	53.256	36.986	39.101	38.694	33.137	33.438	34.689	34.475	31.835	37.196	21.801	34.236	43.506	34.132	37.216	37.559
loglogistic	10.379	11.461	12.980	11.668	7.426	7.568	8.639	6.559	8.105	9.211	8.615	6.527	9.970	11.602	9.045	9.213

Table 7

Variable Coding

Independent Variable Full Description	**Coding Utilized in Best Fit Table**		**Independent Variable Full Description**	**Coding Utilized in Best Fit Table**
Final Team Grade	FTG		Team Leader	TL
Contribution to Final Grade	OCE		Contribution to Team	CS
Team Member Engagement	EEP		Creation of Team Stress	CUS
Communication Effectiveness	CE		Quick Response	QR
First to Respond	FTR		Enthusiastic Contribution	PUM
Communication Initiation	IC		Future Teaming	FT
Response Length	LR		Attractiveness to Others	MOWTL
Average Performance as Viewed by Outside Observers	AVO		Average Ability to Meet Team Member Needs	ASTN

Transformation for Improved Normality – Box-Cox

The Box Cox transformation method was applied to each of the 14 independent variables to improve their normality. The Box-Cox procedure is summarized below; the intention of this analysis is to identify the most effective transformation value (λ) for each independent variable that will maximize the resulting distributions normality. The Box-Cox transforms are a family of power transformations on Y of the form:

$$Y_{transform} = \begin{cases} (Y^{\lambda} - 1) / \lambda \cdot \dot{Y}^{\lambda - 1} & for \;\; \lambda \neq 0 \\ \ln Y \;\; for \;\; \lambda = 0 \end{cases}$$

$$where: \dot{Y} = \exp(1/n \sum_{1}^{n} \ln Y) = geometric \; average$$

To determine the best value of λ, we maximize the function:

$$L_{\max}(\lambda) = -\frac{1}{2} \ln(residual \;\; SS / n) + (\lambda - 1) \sum_{i=1}^{n} \ln Y_i$$

$$where \;\; n = no. \; of \;\; runs$$

When λ-values are determined by the Box-Cox procedure, we consider the so-called benchmark power functions because, if applicable, they considerably simplify the analysis: When:

1. $\lambda \sim -2$, try Y^{-2}
2. $\lambda \sim -1$, try Y^{-1}
3. $\lambda \sim -0.5$, try $Y^{-1/2} = 1/\text{sqrt}(Y)$
4. $\lambda \sim 0$, try $\ln(Y)$
5. $\lambda \sim 0.5$, try $Y^{1/2} = \text{sqrt}(Y)$
6. $\lambda \sim 1$, try Y, i.e., original scale
7. $\lambda \sim 1.5$, try $Y^{1.5}$
8. $\lambda \sim 2$, try Y^{2}

The Box-Cox transforms employed in this study were obtained using Minitab. Table 8 summarizes the resulting Box-Cox λ–values that were used to transform the independent variables. See Table 7 for coding cross reference.

Table 8

Box Cox Resulting Lambda and Transformation Values

term	Box-Cox λ value	benchmark power function
FTG	3.65	use full Box-Cox
OCE	3.00	y^3
AVO	3.61	use full Box-Cox
EEP	3.00	y^3
CE	3.00	y^3
FTR	2.00	y^2
IC	2.00	y^2
LR	2.00	y^2
TL	1.00	y
CS	2.00	y^2
CUS	0.00	ln(y)
QR	2.00	y^2
PUM	3.00	y^3
ASTN	2.00	y^2
FT	2.00	y^2
MOWTL	2.00	y^2
ALTV	2.00	y^2

Correlation Values and Significance

To determine if a relationship exists between the participants' energization sources (introversion vs. extroversion) and perceived team member contribution, two multivariate models were created.

1. A model including all 14 teammate evaluation contribution variables.

2. A model including three aggregate values, where each aggregate represented the average response to one of the three McGrath (1964) contribution areas given below:
    a. Performance as viewed by outside observers.
    b. Ability to satisfy team member needs.
    c. Team's long-term viability.

Both models used energization as the dependent variable. Commercially available statistical software packages were used for all analyses. All cases where a participant responded "not able to evaluate" were removed. The initial model exhibited autocorrelation as indicated by the Durbin-Watson statistic (the root cause of the autocorrelation is unknown); data randomization was employed to eliminate this situation. As described above, it was noted that all independent variables were initially non-normally-distributed. These were transformed using a Box-Cox transform as discussed earlier; the resulting values were used to create all models. No interaction terms were significant at the $p < 0.05$ level.

Relevant model creation steps included:

1. Randomization of samples to eliminate autocorrelation.
2. Box-Cox transformations of all independent variables to cause them to become more normally-distributed, and the subsequent use of these transformed variables in model creation.
3. Weighted least squares multivariate model creation, using 1/Residuals^2 as the weighting factor.
4. Insignificant terms ($p > 0.05$) were removed by backward stepwise regression.

Modeling Using all Evaluative Independent Variables

An initial multiple regression model was created using all 14 independent variables and energization as the dependent variable. Table 9 shows the final model containing only significant terms. Table 10 gives the analysis of variance. Figure 12 displays a Pareto chart of % ANOVA contributions based on the sum of squares of each significant variable. See Table 7 for the coding matrix. These values determine the relative influence of each significant variable in the model.

Multiple Regression - Energization of Evaluated
Dependent variable: Energization of Evaluated
R-squared = 97.7663 percent
R-squared (Adjusted for Degrees of Freedom) = 97.5915 percent
Standard Error of Est. = 0.085198
Mean absolute error = 0.00352077

Table 9

Final Model

Parameter	*Estimate*	*Standard Error*	*P-Value*
CONSTANT	7.79845	0.279695	0.0000
Final Team Grade	-0.000282245	0.0000218431	0.0000
Contribution to Final Grade	-0.0225521	0.00197334	0.0000
Communication Initiation	-0.0182837	0.00877667	0.0394
Response Length	-0.167628	0.010859	0.0000
Contribution to Team	0.0536518	0.0149211	0.0005
Quick Response	0.0738332	0.0153056	0.0000
Enthusiastic Contribution	-0.00362917	0.00169287	0.0342
Future Teaming	-0.112022	0.022516	0.0000
Attractiveness to Others	0.33937	0.0238046	0.0000

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	36.5362	9	4.05958	559.27	0.0000
Residual	0.83475	115	0.00725869		
Total (Corr.)	37.3709	124			

Table 10

Final Model Analysis of Variance

Source	***Sum of Squares***	***Df***	***Mean Square***	***F-Ratio***	***P-Value***
Final Team Grade	4.84899	1	4.84899	668.02	0.0000
Contribution to Final Grade	0.087493	1	0.087493	12.05	0.0007
Communication Initiation	6.40566	1	6.40566	882.48	0.0000
Response Length	0.71553	1	0.71553	98.58	0.0000
Contribution to Team	0.106375	1	0.106375	14.65	0.0002
Quick Response	15.5766	1	15.5766	2145.93	0.0000
Enthusiastic Contribution	7.09908	1	7.09908	978.01	0.0000
Future Teaming	0.221109	1	0.221109	30.46	0.0000
Attractiveness to Others	1.47531	1	1.47531	203.25	0.0000
Model	36.5362	9			

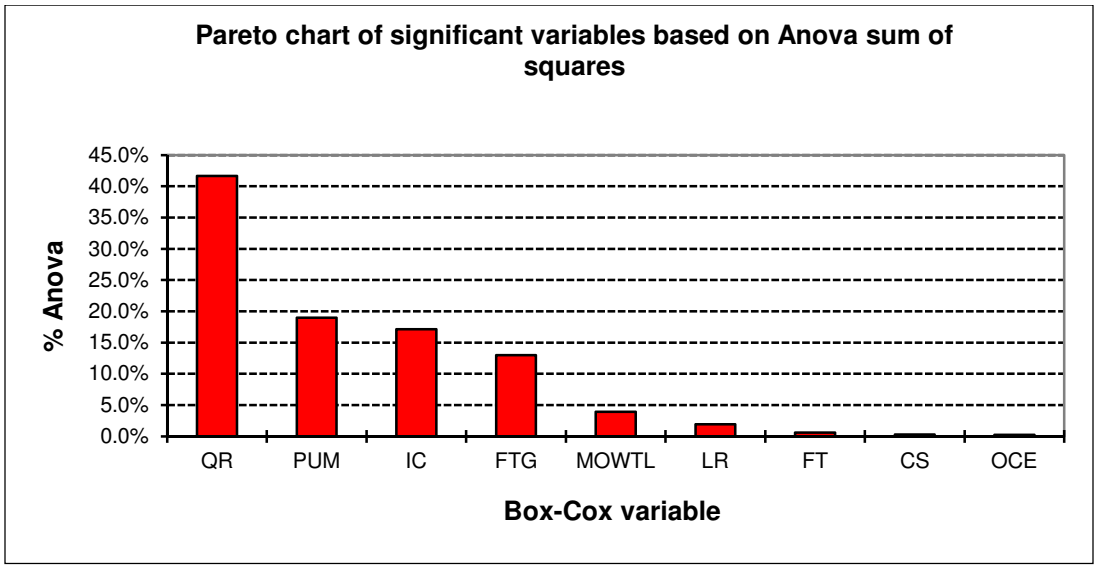

Figure 12. Significant Evaluative Variables Sum of Squares Pareto Chart

Modeling of McGrath (1964) Data Groupings

To create the McGrath (1964) data groupings, the questions were grouped as shown in Table 11.

The Box Cox transformed independent variables that were used to create the groupings, but they required scaling (normalization) so that the independent variables within the grouping could be averaged without bias due to widely different starting values. Scaling was done by creating z scores for each Box Cox transformed independent variable; the resulting z scores were averaged to create the grouping value. Table 11 shows the groupings, as well as the mean and standard deviation for each question. The z score is created for a sample as follows:

Z = (x - Mean) ÷ Standard Deviation $$z = \frac{(x - \bar{x})}{\sigma}$$

Where *x* is the value to be scored, *Mean* is the mean value of the question responses, and *Standard Deviation* the associated response standard deviation.

Table 11

Means and Standard Deviations used to Create z Scores

Independent Variable Name	**Variable Grouping**	**Question Mean**	**Question Standard Deviation**
Final Team Grade	Performance as viewed by Outside Observers	7864	2569
Contribution to Final Grade	Performance as viewed by Outside Observers	142	77
Team Member Engagement	Ability to Satisfy Team Member Needs	148	75
Communication Effectiveness	Ability to Satisfy Team Member Needs	144	75
First to Respond	Ability to Satisfy Team Member Needs	23	11
Communication Initiation	Ability to Satisfy Team Member Needs	24	11
Response Length	Ability to Satisfy Team Member Needs	22	10
Team Leader	Ability to Satisfy Team Member Needs	4.5	1.4
Contribution to Team	Ability to Satisfy Team Member Needs	25	11
Creation of Team Stress	Ability to Satisfy Team Member Needs	1.2	.4
Quick Response	Ability to Satisfy Team Member Needs	22	11
Enthusiastic Contribution	Ability to Satisfy Team Member Needs	147	69
Future Teaming	Team Long Term Viability	25	12
Attractiveness to Others	Team Long Term Viability	25	11

The regression model representing each of McGrath's (1964) grouped measures of team contribution as independent variables and energization as dependent variables is shown in Table 12. This includes all final significant independent variables, coefficient estimates and associated p values, and analysis of variance values. Table 13 shows the analysis of variance for the significant individual variables. It should be noted that while the analysis using the McGrath (1964) grouped variables shows that two groupings contribute significantly to this model, R-squared is low compared to the model with all individual variables. One possible explanation is that the groupings do not allow the removal of single insignificant variables, which may cause a poorer fit.

Multiple Regression - Energization of Evaluated

Dependent variable: Energization of Evaluated
Weight variable: 1/RESIDUALS^2
R-squared = 41.4291 percent
R-squared (Adjusted for Degrees of Freedom) = 40.5983 percent
Standard Error of Est. = 0.0413426
Mean absolute error = 0.000829721

Table 12

Final McGrath (1964) Grouping Model

Parameter	*Estimate*	*Standard Error*	*P-Value*
CONSTANT	6.11507	0.117239	0.0000
Average Performance as Viewed by Outside Observers	-1.61682	0.204759	0.0000
Average Team Long Term Viability	0.722634	0.073096	0.0000

Analysis of Variance

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Model	0.170466	2	0.0852332	49.87	0.0000
Residual	0.240999	141	0.00170921		
Total (Corr.)	0.411465	143			

Table 13

Analysis of Variance - Final McGrath (1964) Grouping

Source	*Sum of Squares*	*Df*	*Mean Square*	*F-Ratio*	*P-Value*
Average Performance as Viewed by Outside Observers	0.00341682	1	0.00341682	2.00	0.1596
Average Team Long Term Viability	0.16705	1	0.16705	97.73	0.0000
Model	0.170466	2			

Hypothesis Testing Results

The hypothesis stated earlier in this document is repeated below for ease of review:

Hypothesis:

The following null hypothesis was tested at the 0.05 significance level.

It was hypothesized that there is no significant relationship between the source of energization (introversion/extroversion) of a team member and the perceived level of contribution of that team member in an asynchronous computer-mediated communication team environment.

As indicated by the significant relationships at or above the 0.05 level of many independent variables as well as the McGrath (1964) grouped variables with the dependent variable, the null hypothesis is rejected, and a relationship at the ≥ 0.05 significance level between energization and team member contribution does in fact exist.

Summary of Results

The data analysis indicates that a relationship between individual energization (introversion vs. extroversion) and the perceived performance on a virtual team as determined by team members does exist at a significance level of 0.05 or above. This relationship holds true at

an individual item level, as well as at the McGrath (1964) grouping level; a brief summary of this relationship is provided in Table 14, related to individual responses, and Table 15, related to McGrath (1964) groupings.

Table 14

Suggested Relationships of Significant Independent Variables

Response	**Response Group**	**Relationship to Energization**	**Level of Significance as Indicated by p Value**	**Suggested Relationship**
Final Team Grade	Team Performance as Viewed by Outside Observers	Negative	0.0000	More Favorable Team Grades were Associated with More Introverted Individuals
Contribution to Final Grade	Team Performance as Viewed by Outside Observers	Negative	0.0000	Increased Overall Contribution to the Teams Final Grade was Associated with More Introverted Individuals
Communication Initiation	Ability to Meet Team Member Needs	Negative	0.0394	Increased Communication Initiation was Associated with More Introverted Individuals
Response Length	Ability to Meet Team Member Needs	Negative	0.0000	More lengthy responses were Associated with More Introverted Individuals
Contribution to Team	Ability to Meet Team Member Needs	Positive	0.0005	Increased Contribution to Team was Associated with More Extroverted Individuals
Quick Response	Ability to Meet Team Member Needs	Positive	0.0000	Quick Response was Associated with More Extroverted Individuals
Enthusiastic Contribution	Ability to Meet Team Member Needs	Negative	0.0342	Enthusiastic Contributions were Associated with More Introverted Individuals
Future Teaming	Long Term Team Viability	Negative	0.0000	Future Teaming was Associated with More Introverted Individuals
Attractiveness to Others	Long Term Team Viability	Positive	0.0000	Attractiveness to Others was Associated with More Extroverted Individuals

Table 15

Suggested Relationships of McGrath (1964) Groupings

Response	**Relationship to Energization**	**Level of Significance as Indicated by p value**	**Suggested Relationship**
Average Performance as Viewed by Outside Observers	Negative	0.0000	Results viewed as Favorable by Outside Observers were Associated with More Introverted Individuals
Average Long Term Team Viability	Positive	0.0000	Results viewed as Favorable related to Long Term Viability was Associated with More Extroverted Individuals

As indicated in Table 14, a number of individual evaluation scores were significantly correlated with energization, the majority of which favor the introvert. *Final team grade, contribution to final grade, communication initiation, response length, enthusiastic contribution*, and *future teaming* questions all drew responses that favored the introvert. *Contribution to team, quick response*, and *attractiveness to others,* however, all favored the extrovert. Consistent with these findings, from a McGrath (1964) grouping perspective, the *performance as viewed by outside observers* group of questions favored the introvert, while the *average long-term team viability* group of questions favored the extrovert.

The results of this data analysis indicate that a significant relationship between an individual's energization (introversion vs. extroversion) score on the TypeFocus instrument and perceived contribution to a virtual team does exist.

Chapter V: Discussion

This chapter is divided into three sections: summary, conclusions, and recommendations. The summary portion provides an overview of the research intent, methods, data collection, and analysis. The conclusions section provides an interpolation of the data collected and analysis results, and the recommendations section offers suggestions based on the research results related to practical applications and suggestions for future research.

Summary

The intent of this study was to determine whether a relationship exists between personality type on Jung's energization scale (introversion vs. extroversion) as measured by the TypeFocus instrument and that person's contribution to a virtual team as perceived by their fellow team members. The following section presents an overview of the study.

The framework of this research revolved around the team unit and the distinction between a face-to-face team using predominantly synchronous, media-rich communications, and a team in a virtual environment where asynchronous communications such as emails and discussion threads are the predominant sources of communication. This research focused on the virtual team environment and how one's level of introversion vs. extroversion may or may not affect how they contribute to that virtual team.

The personality type aspect of this research was measured for each respondent by the administration of an online survey entitled TypeFocus, a Myers-Briggs-based questionnaire that produced an estimate of an individual's personality type, including energization, that is, introversion vs. extroversion. The energization dimension of a respondent's personality was reported on a continuous scale ranging from 0-15, where zero represented the extreme introvert,

and 15 represented the extreme extrovert. Energization was the dependent variable in the data analysis portion of this research.

The independent variables used in this research were the perceived contribution of the respondent to the virtual team; a key task was to quantify this contribution level. To do this, all respondents evaluated each of their teammates' contributions to their virtual team based on questions that supported McGrath's (1964) model of team performance. The McGrath (1964) model separates team performance into three categories: 1) Team performance as viewed by outside observers, 2) Ability to meet team member needs, and 3) Team long term viability. The questionnaire used for this research was designed and organized into these three categories; specific questions were asked of the respondents that related directly to each aspect.

Data were gathered from students enrolled in five university-level courses requiring virtual team participation. The respondents completed both the personality survey and an evaluation of each of their teammates' contribution to the team effort.

The analysis consisted of two regression models; the first model examined the correlation between energization and each of the independent 14 teammate *level of contribution* items (independent variables). The second model examined the correlation between energization and each of the three McGrath (1964) groupings of the 14 *level of contribution* items.

The first model indicated that nine of the 14 teammate contribution items were correlated with the dependent variable, energization; this result suggested that at a university level, an individual's personality dimension—introvert vs. extrovert—influences their contribution to academic virtual teams at a statistically significant level. The *level of contribution* questions that were significantly correlated with energization at the ≥ 0.05 level predominantly favored the introvert; *Final Team Grade* and *Contribution to Team Grade* (both measures of performance as

viewed by outside observers) were more highly related to introverts than extroverts. Additional aspects, such as *Communication Initiation*, *Response Length*, *Enthusiastic Contribution*, and *Future Teaming,* favored the introvert as well.

Conversely, the extrovert was favored over the introvert in areas including *Contribution to Team*, *Quick Response*, and *Attractiveness to Others*.

Related to the second model, two of the three McGrath (1964) groupings indicated significance, and these results were split; introverts were rated more highly than extroverts when the question group related to *Team Performance as Viewed by Outside Observers* was evaluated; conversely, extroverts were rated more highly than introverts relating to the question group *Teams Long-term Viability*. It was noted that the question group, *Ability to Meet Team Member Needs,* was not correlated with energization at the ≥ 0.05 significance level.

Conclusions

The data analysis began by considering both the individual contribution responses found to be significantly correlated with energization, and whether the introvert or the extrovert was perceived by team members as making a more positive contribution to the team. The first variables considered were the *Final Team Grade* and *Contribution to Team Grade*. Both of these are included in the McGrath (1964) grouping of "Team Performance as Viewed by Outside Observers" and both directly favored the introvert; this may indicate that the introvert is preferred over the extrovert by fellow team members when the topic is contribution to the team's ability to create a quality product. This is possibly due to the introverts' opportunity in an asynchronous environment to gather and better express their thoughts, communicate those thoughts, and ultimately contribute via those thoughts directly to the team product, resulting in an improved team grade. This is not to suggest that the introvert is in any way more intelligent

than the extrovert; rather, it suggests that the introvert may be able to contribute more effectively than the extrovert in the asynchronous environment to the team product or "grade." It should be noted that the McGrath (1964) grouping of "Performance as viewed by outside observers" also favored the introvert. This stands to reason because this question grouping consists of both of the above questions: the *Final Team Grade* and *Contribution to Team Grade* item.

The research results also credit the introvert with *Communication Initiation, Response Length,* and *Enthusiastic Contribution*. Collectively, it appears that the introvert is preferred over the extrovert for "initiating lengthy communication, enthusiastically." This conclusion may at first be surprising, as the introvert in a face-to-face environment is often considered to be the quiet, less-engaged individual; however, this research indicates that in the virtual asynchronous environment, just the opposite is true: the introvert is indeed an initiator of communication and responds at length with enthusiasm. Lee (Lee & Lee, 2006), reflecting on asynchronous communication, stated that "on a given topic, the extroverted learners typically generated messages before the introverted members, and the introverted learners then provided feedback as in-depth responses to previously posted messages." The above discussion supports these statements.

Last, the introvert is also favored in the *Future Teaming* question. Specifically, the question asked the respondents if they would choose to work with this team member in the future, a question that is included in the "Team Long Term Viability" McGrath (1964) grouping. While that grouping ultimately favored the extrovert, this particular question favored the introvert, indicating that overall, the introvert is favored over the extrovert when team performance is the key criterion. It can be presumed that this is due to the above results, which

seem to support the notion that the introvert contributes to the team product more significantly than the extrovert and, as such, is favored for future teaming.

Although much of the previous discussion indicates that introverts contribute more than extroverts, certain responses did favor the extrovert. Interestingly enough, overall *Contribution to the Team* was rated higher for extroverts. Specifically, the question asked if the "team member contributed significantly to the overall product of the team." This response would seem to contradict that explained above; if the introvert was favored for *Final Team Grade* as well as *Contribution to Team Grade*, how could the extrovert be favored in this category? A possible explanation is that while *Team Grade* and *Contribution to Team Grade* represented a portion of the "product" of the team, team dynamics including relationships and social interactions may not be included in that consideration. Could it be that the extrovert, while not the primary contributor to the team's product of grade, did in fact contribute to the team in other, non-tangible ways, earning their teammates' favor with this question?

Additionally, *Quick Response* favored extroverts over introverts. Potentially, the extrovert's propensity to dominate in the face-to-face environment (Bargh et al., 2002; Orchard & Fullwood, 2010) with swift responses applies to the virtual environment as well; this result is not altogether surprising if considered from this vantage point. Last, *Attractiveness to Others* favored the extrovert. The question asked if "the team member presented a level of contribution and enthusiasm that made others want to work with them." It is suggested that in some manner, even in a virtual, asynchronous environment, the extrovert holds some level of appeal to teammates, as indicated by the response to this question. It should be noted, however, that while this may be so, overall, the introvert appears to be the preferred team member as indicated by the responses described above.

It should be considered that while the above dialog discusses the individual question responses and their perceived preferences (introversion vs. extroversion), not all variables contributed equally to the variance in the model, as noted in Figure 12. For instance, *Quick Response* accounted for approximately 40 percent of the model variance, indicating that this variable is the strongest correlated to energization. *Enthusiastic Contribution* held the next highest contribution value of 18 percent, *Communication Initiation* 17 percent, and *Final Team Grade* 13 percent. These data indicate that while introverts claimed the higher overall quantity of favored responses, the variable with the highest contribution to the model was *Quick Response,* a question whose response favored the extrovert. Conversely, the next three highest contributors, cumulatively contributing approximately 48 percent of the variance of the model, showed preference to the introvert.

The specific item responses above are supported by the McGrath (1964) groupings in general terms; however it should be noted that the McGrath (1964) groupings correlation coefficient level was approximately 41.4 percent. It is suggested that the evaluation of the specific individual questions have more value in this study due to their focused inquiries and responses than the grouped responses.

Taken as a whole, the outcomes of this study suggest that in an academic virtual team environment, where asynchronous communications are the prevalent form of communication, the introvert is favored over the extrovert in two areas: contribution to final grade and enthusiastically initiating lengthy communications. Conversely, the extrovert is favored for overall contribution to the team, and because he/she is quick to respond to conversation threads, "made others want to work with them." Does this suggest that the team or team leader should always work to identify, and then procure, introverted team members? Should extroverts in the

virtual environment be avoided when possible? This study does not make those recommendations, even though some study outcomes suggest that path. One aspect of the virtual team that was not considered in this study is that of teammate interaction: the productivity of the team as a function of the "combination" of introverts and extroverts. As this aspect was not explored, it may be possible that while, on average, an introvert may be a stronger virtual team contributor than an extrovert, an entire team of introverts may interact poorly with each other and not drive the team to its full potential. It is conceivable that a team of both introverts and extroverts in unison may perform at an optimal level; this question is left for further study.

It can be concluded from this study that, on an individual basis, introverts and extroverts in the virtual team environment communicate differently, and that aspect should be considered by future team leaders and team members to help better facilitate asynchronous communication and, ultimately, team performance.

Recommendations Regarding Future Practice

The results of this research offer suggestions for future virtual team leaders and teammates alike. These include considering the personality types of individual team members. While procuring specific attributes of a teammate's personality type may prove challenging, it may prove worthwhile to request that each team member invest in completing a Myers-Briggs evaluation and share the results with the team.

Additionally, it may be of value to execute a synchronous team meeting soon after team creation by synchronous methods such as telephone or video conferencing, if practical. Such a meeting could allow the team leader and other participants to better evaluate and understand the personality types of their teammates; this upfront investment may pay off many times as the team moves forward, by allowing each team member to better understand their teammates'

personality type and how each team member may communicate most effectively. In support of this suggestion, team member training in the interpretation of MBTI testing results may also be of value.

Awareness of team members' introversion vs. extroversion level may enable a team leader to anticipate response patterns—for example, to expect the extroverted members to quickly respond to communication threads but to be patient and wait for a thread initiation by the introvert. While it may require more time, the introvert's response may be more thorough, complete, and delivered with enthusiasm. Additionally, the team leader should consider that the extrovert may contribute response threads that are not necessarily as thoughtful as those provided by the introvert and, as such, may take more time for clarification and elaboration. While these considerations may require considerable forethought and patience on behalf of the team leader and team members, the effort may yield improved team communications and, ultimately, improved team performance.

Recommendations for Future Study

It should be recognized that the sample in this population was limited to university students, which brings into question external validity and the ability to extrapolate the results of the study beyond this boundary to a business environment. Potential differences in these two environments may exist, ranging from participant maturity to team goals. Future research opportunities to be considered include selecting a population and sample from the business environment.

It should also be noted that this research focused on only one specific aspect of an individual's personality, as related to virtual team contribution: that of energization, or introversion vs. extroversion. Jungian theory and the Myers-Briggs instrument include three

additional aspects of an individual's personality type that were not considered: attending, deciding, and living. Similar to energization, each of these aspects reflects a portion of an individual's personality, and it is suggested that future research opportunities include the study of these personality traits in relation to perceived contribution to a virtual team.

Finally, as suggested above, one aspect of team creation that was not investigated was the dynamics of both introverts and extroverts in a common team setting. This research investigated the relationship between energization and the team contribution of the individual. However, it did not investigate team members' contributions to a team when specific combinations of both introverts and extroverts are present. Is a purely introverted team or a purely extroverted team desirable, or should this situation be avoided? Do introverts and extroverts complement each other in a virtual team setting? What is the "optimal" combination of introverts and extroverts in the virtual team environment? The study of this question is left for future research.

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Appendices

Appendix A: Research Participation Request Letter

Dear fellow EMU students,

My name is Ed Bartone, and I am a Ph.D student at EMU. I am currently working to complete my dissertation, and would like to ask you for your help. My research is centered on how an individual's personality type correlates to their contributions to a virtual team, and to complete this research I need to gather supporting data – this is where I would like to ask you for your assistance.

As members of an online course that includes a virtual team project, you are in a unique position to contribute to my research, if you are willing. If you would be willing to participate, I would ask you to take a few moments to complete two surveys as follows:

At the beginning of your course, I would ask you to complete a free, online personality survey. This survey consists of approximately 60 very simple questions requiring approximately 15 minutes to complete, and the result will be a personality assessment very similar to a Myers-Briggs evaluation. The results of this evaluation will of course be available to you as well as myself as the researcher, but to no others. The link to this assessment is as follows (You will have to register as a new user; please see instructions below if needed). **Only the Personality Assessment section is needed** – but feel free to use the rest of the tool if you wish!
https://www.typefocus.com/

Access Code "emu48"

At the completion of your virtual team based assignment, you will be asked to complete a simple on line questionnaire for each team member that you worked with on your team. This questionnaire will require approximately 10 minutes per person evaluated; the results of this questionnaire will be available only to me as the researcher, and no others. The link to this questionnaire is as follows:
https://www.surveymonkey.com/s/Virtual_Team_Member_Contribution_Survey

Please be assured that your participation in this survey is completely voluntary, and your responses would only be available to the researcher; not to your instructor - your responses would in no way influence your course grade, nor would they be available to any of your classmates. The results of this research will be published within a dissertation that will be available through UMI ProQuest, and the EMU Library – the content will also be Google searchable; however no names will be referenced in the research. Should you choose to participate, you can withdraw from either survey or questionnaire at any point in the process until completion; however once the final submit button is clicked, the information cannot be withdrawn. The survey and questionnaires may only be completed by individuals 18 years of age and older.

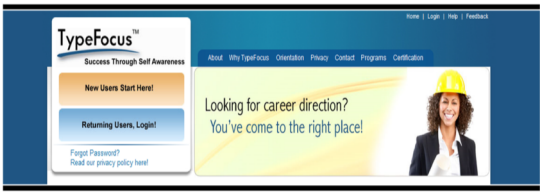
As an incentive to participate in this research, a $100 gift will be awarded to one participant at the completion of the research. The participant will be randomly selected in a blind manner from the list of all participants that completed both the personality survey, as well as the teammate questionnaire.

Please feel free to contact the researcher with any questions, comments, or suggestions.

Edward C. Bartone

248-946-1501
Ebartone@Emich.edu

Thank You!



Instructions for using TypeFocus Assessment

1. Go to the following website: http://www.TypeFocus.com
2. Click on **New Users Start Here!**
3. Enter site password: emu48
4. Create your own username and password to get registered with the system and click 'I accept'.
5. At 'Welcome' side bar on the left side choose 'Self assessment' then choose 'Personality' and begin.

Appendix B: Contribution Evaluation Questionnaire

Virtual Team Member Contribution

Introduction and Information

Thank you for taking a brief moment to provide feedback regarding team members in your virtual team environment! Please be assured that your participation in this survey is completely voluntary, and your responses will be available only to the researcher. They will not be available to your instructor, nor to any of your classmates, and will in no way influence your course grade. This survey will require approximately 10 minutes to complete, and the results will be published within a dissertation that will be available through UMI ProQuest and the EMU Library – the content will also be Google searchable; however no names will be referenced in the research. You can withdraw from this survey at any point in the process until completion; however once the final submit button is clicked, the information cannot be withdrawn. This survey may only be completed by individuals 18 years of age or older.

Purpose

The purpose of this survey is to provide data to the researcher to help establish a level of correlation between an individual's personality type and perceived contribution to a virtual team. The research described is the basis of a PhD dissertation.

Instructions

Please complete one survey for each of your virtual team members. Answer the questions as objectively and honestly as possible, Upon completion of the survey for a team member, please reenter the survey and complete a new version for the next member.

Consent

Continuing with this survey indicates that the respondent understands and complies with the above explanation, purpose, and minimum age requirement.

Please feel free to contact the researcher with any questions, comments, or suggestions.

Edward C. Bartone
248-946-1501
Ebartone@Emich.edu

Thank You!

Page 1

Virtual Team Member Contribution

Virtual Team Member Contribution Survey - General Information

Please keep in mind that this survey will represent your viewpoints on only one virtual team member - the survey will need to be restarted for additional members. Thank you!

1. Please provide your name (Last, First).

2. What is the name of the team member you are evaluating, (Last, First)?

3. At what level was this course taught?

- ◯ Undergraduate
- ◯ Master Level
- ◯ Doctorate Level

4. What was the course name and section number? (Example IA643 Disaster Recovery)

5. Was this team member on your team throughout the entire span of the project?

- ◯ Yes
- ◯ No

6. How was the team member assigned to your team?

- ◯ By Team Decision
- ◯ Assigned by the Instructor
- ◯ Other (please specify)

7. What percentage of your communication (totaling 100%) with this team member has been through:

	0%	25%	50%	75%	100%
Asynchronous Tools (Such as Emails, Conversation Threads).	◯	◯	◯	◯	◯
Synchronous Tools (Such as Video Conferencing, Phone Conversations)	◯	◯	◯	◯	◯

Page 2

Virtual Team Member Contribution

8. Do you feel you are able to evaluate this virtual team member's level of contribution to your team?

- ◯ Yes
- ◯ Somewhat
- ◯ No

9. A $100 incentive will be randomly awarded to one individual participating in this research. If you would like to be eligible for this incentive, please leave your contact information below. Please leave your choice of email, phone number, or address. This information will only be used to contact the recipient of the award, and will be used in no other manner.

Page 3

Virtual Team Member Contribution

Final Team performance

Performance as Perceived by Outside Sources

10. The final team grade on this project was:

- ◯ Failing
- ◯ D-
- ◯ D
- ◯ D+
- ◯ C-
- ◯ C
- ◯ C+
- ◯ B-
- ◯ B
- ◯ B+
- ◯ A-
- ◯ A
- ◯ A+

11. The overall contribution by this teammate to the final project grade was exceptional.

◯ No Opportunity to Observe ◯ Strongly Disagree ◯ Somewhat Disagree ◯ Indifferent ◯ Somewhat Agree ◯ Strongly Agree

Virtual Team Member Contribution

Ability to Satisfy Team Member Needs

12. Ability to Satisfy Team Member Needs

	No Opportunity to Observe	Strongly Disagree	Somewhat Disagree	Indifferent	Somewhat Agree	Strongly Agree
I feel that this team member was engaged with the team throughout the entire project.	◯	◯	◯	◯	◯	◯
I feel that this team member communicated effectively, thoroughly, and thoughtfully vie email and discussion threads throughout the project.	◯	◯	◯	◯	◯	◯
This team member was frequently the first to respond to conversation threads.	◯	◯	◯	◯	◯	◯
This team member often initiated email or discussion conversation threads.	◯	◯	◯	◯	◯	◯
This team member typically responded to mail and discussion threads with a more lengthy response than other team members.	◯	◯	◯	◯	◯	◯
I would consider this team member to be a team leader.	◯	◯	◯	◯	◯	◯
I feel this team member contributed significantly to the overall product of the team.	◯	◯	◯	◯	◯	◯
I feel that this team member contributed undue stress to the team environment.	◯	◯	◯	◯	◯	◯
I feel this team member responded to email and discussion threads more quickly than most team members.	◯	◯	◯	◯	◯	◯
I feel that this team member contributed to the team in a positive, optimistic, and upbeat manner.	◯	◯	◯	◯	◯	◯

Virtual Team Member Contribution

Teams' Long Term Viability

13. Teams' Long Term Viability

	No Opportunity to Observe	Strongly Disagree	Somewhat Disagree	Indifferent	Somewhat Agree	Strongly Agree
I would choose to work with this team member on a future virtual team, if the opportunity presented Itself.	◯	◯	◯	◯	◯	◯
I feel that this team member presented a level of contribution and enthusiasm that made others want to work with them.	◯	◯	◯	◯	◯	◯

Appendix C: Human Subject Approval

EASTERN MICHIGAN UNIVERSITY

Education First

June 13, 2012

UHSRC Initial
Application Determination
EXPEDITED APPROVAL

To: Mr. Edward Bartone
College of Technology

Re: **UHSRC #120510** Category: Approved Expedited Research Project
Approval Date: **June 13, 2012**

Title: **The Relationship between the Perceived Level of Contribution of Virtual Team Members and Their Energization Source as Described by Jung's Typology**

The Eastern Michigan University Human Subjects Review Committee (UHSRC) has completed their review of your project. I am pleased to advise you that **your expedited research has been approved** in accordance with federal regulations.

Renewals: Expedited protocols need to be renewed annually. If the project is continuing, please submit the **Human Subjects Continuation Form** prior to the approval expiration. If the project is completed, please submit the **Human Subjects Study Completion Form** (both forms are found on the UHSRC website).

Revisions: Expedited protocols do require revisions. If changes are made to a protocol, please submit a **Human Subjects Minor Modification Form** or new **Human Subjects Approval Request Form** (if major changes) for review (see UHSRC website for forms).

Problems: If issues should arise during the conduct of the research, such as unanticipated problems, adverse events, or any problem that may increase the risk to human subjects and change the category of review, notify the UHSRC office within 24 hours. Any complaints from participants regarding the risk and benefits of the project must be reported to the UHSRC.

Follow-up: If your expedited research project is not completed and closed after three years, the UHSRC office will require a new **Human Subjects Approval Request Form** prior to approving a continuation beyond three years.

Please use the UHSRC number listed above on any forms submitted that relate to this project, or on any correspondence with the UHSRC office.

Good luck in your research. If we can be of further assistance, please contact us at 734-487-0042 or via e-mail at human.subjects@emich.edu. Thank you for your cooperation.

Sincerely,

Deb de Laski-Smith, Ph.D.
Graduate School
Administrative Co-Chair
University Human Subjects Review Committee

University Human Subjects Review Committee · Eastern Michigan University · 200 Boone Hall
Ypsilanti, Michigan 48197
Phone: 734.487.0042 Fax: 734.487.0050
E-mail: human.subjects@emich.edu
www.ord.emich.edu (see Federal Compliance)

The EMU UHSRC complies with the Title 45 Code of Federal Regulations part 46 (45 CFR 46) under FWA00000050.

Appendix D: Pilot Study Participation Request

Hello!

My name is Ed Bartone, and I would like to ask you to take a brief moment to help me develop a survey that I will be using to gather data for my Ph.D Dissertation.

I would first and foremost like to thank you for taking a few moments to look at my survey and provide feedback! I'll use your feedback to improve my survey before sending it out for actual use. Very briefly, the purpose of this survey is to gather data for my research; this research is intended to gain an understanding of the relationship between an individual's personality traits, and how they perform on a virtual team.

The premise is that an individual who is very extroverted may thrive in a face to face team environment, where an introvert has a harder time contributing; however in a virtual team, does the slower paced environment and communication type favor the introvert? That in general is the study.

So the research really consists of two parts:

A personality test to determine the participants personality aspects (That is not part of this pilot team exercise though, just informational).

A survey that each team member fills out for each of their teammates, reflecting their perception of their teammates contribution level (This is what I'm looking for your opinion on).

The survey itself is attached, and a link is supplied as well in case you would like to actually "take it" to see how it flows – feel free just to enter "bogus" information.

https://www.surveymonkey.com/s/Virtual_Team_Member_Contribution_Survey

Generally speaking, could you please answer the following questions? Feel free to write your response below, or on the attached survey

Is the wording of the questions clear to you? If not, can you please let me know what areas are problematic?

Does the questionnaire "flow"? In other words, do the questions seem to build on each other?

Is the length prohibitive? In other words, does it seem too time consuming and painful to take?

Do any of the available "answers" to the questions seem inappropriate?

Lastly, do you have any general suggestions, or does anything seem "wrong" to you?

Thank you very much for participating on the pilot team and providing your opinions!

Edward Bartone
Ebartone@Emich.edu
248-946-1501
August 13th 2012

Appendix E: Raw Data and Coding Key

Data Coding Key:

Variable Full Description	Coding Utilized in Table		Variable Full Description	Coding Utilized in Table		Variable Full Description	Coding Utilized in Table
Final Team Grade	FTG		Final Team Grade – Box Cox Transformed	FTG_BC		Final Team Grade – Box Cox Transformed z Score	FTG_BC_z
Contribution to Final Grade	OCE		Contribution to Final Grade – Box Cox Transformed	OCE_BC		Contribution to Final Grade – Box Cox Transformed z Score	OCE_BC_z
Average Performance as Viewed by Outside Observers	AVO		Average Performance as Viewed by Outside Observers – Box Cox Transformed	AVO_BC		Average Performance as Viewed by Outside Observers – Box Cox Transformed z Score	AV_OO_z
Team Member Engagement	EEP		Team Member Engagement– Box Cox Transformed	EEP_BC		Team Member Engagement– Box Cox Transformed z Score	EEP_BC_z
Communication Effectiveness	CE		Communication Effectiveness– Box Cox Transformed	CE_BC		Communication Effectiveness– Box Cox Transformed z Score	CE_BC_z
First to Respond	FTR		First to Respond– Box Cox Transformed	FTR_BC		First to Respond– Box Cox Transformed z Score	FTR_BC_z
Communication Initiation	IC		Communication Initiation– Box Cox Transformed	IC_BC		Communication Initiation– Box Cox Transformed z Score	IC_BC_z
Response Length	LR		Response Length– Box Cox Transformed	LR_BC		Response Length– Box Cox Transformed z Score	LR_BC_z
Team Leader	TL		Team Leader– Box Cox Transformed	TL_BC		Team Leader– Box Cox Transformed z Score	TL_BC_z
Contribution to Team	CS		Contribution to Team– Box Cox Transformed	CS_BC		Contribution to Team– Box Cox Transformed z Score	CS_BC_z
Creation of Team Stress	CUS		Creation of Team Stress– Box Cox Transformed	CUS_BC		Creation of Team Stress– Box Cox Transformed z Score	CUS_BC_z

Quick Response	QR		Quick Response– Box Cox Transformed	QR_BC		Quick Response– Box Cox Transformed z Score	QR_BC_z
Enthusiastic Contribution	PUM		Enthusiastic Contribution– Box Cox Transformed	PUM_BC		Enthusiastic Contribution– Box Cox Transformed z Score	PUM_BC_z
Average Ability to Satisfy Team Member Needs	ASTN		Average Ability to Satisfy Team Member Needs – Box Cox Transformed	ASTN_BC		Average Ability to Satisfy Team Member Needs – Box Cox Transformed z Score	AV_TN_z
Future Teaming	FT		Future Teaming– Box Cox Transformed	FT_BC		Future Teaming– Box Cox Transformed z Score	FT_BC_z
Attractiveness to Others	MOWTL		Attractiveness to Others– Box Cox Transformed	MOWTL_BC		Attractiveness to Others– Box Cox Transformed z Score	MOWTL_BC_z
Average Team Long Term Viability	ALTV		Average Team Long Term Viability – Box Cox Transformed	ALTV_BC		Average Team Long Term Viability – Box Cox Transformed z Score	AV_LTV_z

original run order	random order	Energization of Evaluated	N (Intuition) / Sensing	Feeling / Thinking	Perceive / Judging	Overall Personality of Evaluated	Evaluator Name	Team Member Evaluated Name	Academic Level Taught at
1	91	8	15	7	7	ESFP			2
2	125	1	15	12	13	ISTJ			2
3	106	3	15	15	15	ISTJ			2
4	20	8	0	14	7	ENTP			2
5	40	1	3	8	5	INTP			1
6	35	8	0	0	2	ENFP			1
7	6	5	17	9	15	ISTJ			2
8	141	2	8	6	9	INFJ			2
9	30	0	1	6	7	INFP			2
10	129	2	13	5	11	ISFJ			2
11	38	2	8	10	0	INTP			1
12	80	4	11	7	9	ISFJ			2
13	52	1	8	9	10	INTJ			1
14	90	4	6	14	9	INTJ			1
15	14	10	8	7	7	ENFP			1
16	82	4	11	7	9	ISFJ			2
17	109	3	15	15	15	ISTJ			2
18	63	10	12	7	7	ESFP			2
19	73	4	11	13	13	ISTJ			1
20	50	9	10	7	10	ESFJ			1
21	126	1	15	12	13	ISTJ			2
22	47	5	9	11	13	ISTJ			2
23	28	0	1	6	7	INFP			2
24	72	15	16	9	14	ESTJ			1
25	17	8	0	14	7	ENTP			2
26	22	8	0	14	7	ENTP			2
27	96	13	7	15	6	ENTP			2
28	107	3	15	15	15	ISTJ			2
29	26	0	1	6	7	INFP			2
30	100	15	8	6	10	ENFJ			2
31	132	2	13	5	11	ISFJ			2
32	86	3	6	13	1	INTP			1
33	102	15	8	6	10	ENFJ			2
34	95	13	7	15	6	ENTP			2
35	128	2	13	5	11	ISFJ			2
36	33	9	8	6	9	ENFJ			1
37	29	0	1	6	7	INFP			2
38	79	4	11	7	9	ISFJ			2
39	25	0	1	6	7	INFP			2
40	36	0	17	13	11	ISTJ			1
41	7	5	17	9	15	ISTJ			2
42	69	4	14	4	14	ISFJ			1
43	8	5	17	9	15	ISTJ			2
44	81	4	11	7	9	ISFJ			2
45	85	10	3	13	2	ENTP			1

46	10	5	17	9	15	ISTJ			2
47	123	1	15	12	13	ISTJ			2
48	140	2	8	6	9	INFJ			2
49	92	8	15	7	7	ESFP			2
50	135	11	4	8	1	ENTP			2
51	65	10	12	7	7	ESFP			2
52	71	15	16	9	14	ESTJ			1
53	75	4	4	4	7	INFP			1
54	16	8	0	14	7	ENTP			2
55	23	8	0	14	7	ENTP			2
56	144	2	8	6	9	INFJ			2
57	111	12	9	1	15	ESFJ			1
58	41	13	2	2	2	ENFP			1
59	48	0	10	1	8	ISFJ			1
60	142	2	8	6	9	INFJ			2
61	59	0	10	15	12	ISTJ			2
62	60	0	10	15	12	ISTJ			2
63	1	10	13	8	9	ESTJ			2
64	117	0	16	7	15	ISFJ			1
65	53	0	10	15	12	ISTJ			2
66	31	12	10	15	9	ESTJ			1
67	119	7	9	8	14	ISTJ			2
68	84	10	3	13	2	ENTP			1
69	94	13	7	15	6	ENTP			2
70	2	10	13	8	9	ESTJ			2
71	15	10	8	7	7	ENFP			1
72	137	0	17	6	15	ISFJ			1
73	32	9	8	6	9	ENFJ			1
74	45	5	9	11	13	ISTJ			2
75	104	3	15	15	15	ISTJ			2
76	43	5	9	11	13	ISTJ			2
77	39	2	8	10	0	INTP			1
78	89	4	6	14	9	INTJ			1
79	68	4	14	4	14	ISFJ			1
80	56	0	10	15	12	ISTJ			2
81	74	4	11	13	13	ISTJ			1
82	105	3	15	15	15	ISTJ			2
83	131	2	13	5	11	ISFJ			2
84	93	8	15	7	7	ESFP			2
85	27	0	1	6	7	INFP			2
86	61	10	12	7	7	ESFP			2
87	54	0	10	15	12	ISTJ			2
88	87	3	6	13	1	INTP			1
89	4	7	5	8	7	INTP			1
90	138	2	8	6	9	INFJ			2
91	127	1	15	12	13	ISTJ			2
92	55	0	10	15	12	ISTJ			2
93	99	15	8	6	10	ENFJ			2
94	34	8	0	0	2	ENFP			1

95	108	3	15	15	15	ISTJ			2
96	13	8	8	8	8	ENTJ			1
97	66	5	9	14	9	ISTJ			1
98	77	13	7	10	7	ENTP			1
99	51	5	11	6	11	ISFJ			1
100	83	10	3	13	2	ENTP			1
101	78	13	7	10	7	ENTP			1
102	49	9	10	7	10	ESFJ			1
103	9	5	17	9	15	ISTJ			2
104	11	5	17	9	15	ISTJ			2
105	139	2	8	6	9	INFJ			2
106	115	8	6	10	9	ENTJ			1
107	58	0	10	15	12	ISTJ			2
108	42	13	2	2	2	ENFP			1
109	122	7	9	8	14	ISTJ			2
110	130	2	13	5	11	ISFJ			2
111	124	1	15	12	13	ISTJ			2
112	18	8	0	14	7	ENTP			2
113	67	6	8	9	2	INTP			1
114	57	0	10	15	12	ISTJ			2
115	136	11	6	0	4	ENFP			2
116	101	15	8	6	10	ENFJ			2
117	118	7	9	8	14	ISTJ			2
118	116	14	11	7	6	ESFP			1
119	121	7	9	8	14	ISTJ			2
120	110	11	12	8	10	ESTJ			1
121	37	0	17	13	11	ISTJ			1
122	12	8	8	8	8	ENTJ			1
123	134	11	4	8	1	ENTP			2
124	143	2	8	6	9	INFJ			2
125	24	8	13	14	10	ESTJ			1
126	5	0	15	6	14	ISFJ			1
127	97	13	7	15	6	ENTP			2
128	46	5	9	11	13	ISTJ			2
129	112	9	16	10	13	ESTJ			1
130	133	11	4	8	1	ENTP			2
131	19	8	0	14	7	ENTP			2
132	114	8	6	10	9	ENTJ			1
133	21	8	0	14	7	ENTP			2
134	44	5	9	11	13	ISTJ			2
135	88	0	11	7	11	ISFJ			1
136	62	10	12	7	7	ESFP			2
137	113	14	4	13	3	ENTP			1
138	98	13	7	15	6	ENTP			2
139	70	15	16	9	14	ESTJ			1
140	3	7	5	8	7	INTP			1
141	120	7	9	8	14	ISTJ			2
142	64	10	12	7	7	ESFP			2
143	103	15	8	6	10	ENFJ			2

144	76	4	4	4	7	INFP			1

original run order	Course Name	On Team for Entire Project	How Assigned to Team?	How Assigned to Team; Other.	Percentage Comm Asynchronous	Percent Comm Synchronous	Able to Evaluate	Contact for Incentive (Removed to Protect Privacy)	FTG
1	TS 505 Intro to Technology & Society	1	2		5	1	1		12
2	EM 649 Manufacturing Process Planning	1	0	Only 1 team in this class	5	1	1		12
3	TS 505 Intro to Technology & Society	1	2		5	1	1		13
4	TS 505 Intro to Technology & Society	1	2		5	1	1		12
5	PDD 157 Product Design and Development	1	0	First day seating	5	1	2		13
6	MGMT 490 Business Policy	1	2		4	1	1		11
7	TS 505 Intro to Technology & Society	1	2		5	1	1		12
8	TS 505 Intro to Technology & Society	1	2		5	1	1		13
9	TS 505 Intro to Technology & Society	1	2		5	1	2		12
10	EM 649 Manufacturing Process Planning	1	2		3	3	1		12
11	PDD 157 Product Design and Development	1	2		3	3	1		12
12	TS 505 Intro to Technology & Society	1	2		5	1	1		13
13	MGMT 490 Business Policy	1	2		5	1	1		10
14	PDD 157 Product Design and Development	1	1		5	1	1		12
15	PDD 157 Product Design and Development	1	2		2	4	1		12
16	TS 505 Intro to Technology & Society	1	2		5	1	1		12
17	TS 505 Intro to Technology & Society	1	2		5	1	1		12
18	EM 649 Manufacturing Process Planning	1	0	Only 1 team in this class	5	1	2		12
19	PDD 157 Product Design and Development	1	2		2	1	1		12
20	PDD 157 Product Design and Development	1	2		4	2	1		12
21	EM 649 Manufacturing Process Planning	1	2		3	3	1		11
22	EM 649 Manufacturing Process Planning	1	0	Only 1 team in this class	5	1	1		12
23	TS 505 Intro to Technology & Society	1	2		5	1	1		13
24	MGMT 490 Buisness Policy	1	1		5	5	1		11
25	TS 505 Intro to Technology & Society	1	2		5	1	1		13
26	TS 505 Intro to Technology & Society	1	2		5	1	1		12
27	TS 505 Intro to Technology & Society	1	2		5	1	1		13
28	TS 505 Intro to Technology & Society	1	2		5	1	1		12

29	TS 505 Intro to Technology & Society	1	2		5	1	1		12
30	EM 649 Manufacturing Process Planning	1	2		5	1	1		12
31	EM 649 Manufacturing Process Planning	1	2		5	1	1		13
32	PDD 157 Product Design and Development	1	2		5	1	1		10
33	EM 649 Manufacturing Process Planning	1	1		4	2	1		12
34	TS 505 Intro to Technology & Society	1	2		5	1	1		13
35	EM 649 Manufacturing Process Planning	1	1		5	1	1		12
36	MGMT 490 Business Policy	1	2		5	1	1		10
37	TS 505 Intro to Technology & Society	1	2		5	1	1		11
38	TS 505 Intro to Technology & Society	1	2		5	1	1		12
39	TS 505 Intro to Technology & Society	1	2		5	1	1		13
40	PDD 157 Product Design and Development	1	2		4	1	1		11
41	TS 505 Intro to Technology & Society	1	2		5	1	1		13
42	MGMT 490 Business Policy	1	1		5	5	1		12
43	TS 505 Intro to Technology & Society	1	2		5	1	1		13
44	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	2		6
45	PDD 157 Product Design and Development	1	2		2	1	1		6
46	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	2		7
47	EM 649 Manufacturing Process Planning	1	2		5	1	1		12
48	TS 505 Intro to Technology & Society	1	2		5	1	1		12
49	TS 505 Intro to Technology & Society	1	2		5	1	1		12
50	EM 556 Lean teams	1	2		5	5	1		11
51	EM 649 Manufacturing Process Planning	1	2		5	1	1		13
52	MGMT 490 Business Policy	1	1		5	5	1		12
53	PDD 157 Product Design and Development	1	2		3	3	1		10
54	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	2		10
55	TS 505 Intro to Technology & Society	1	2		5	1	1		13
56	TS 505 Intro to Technology & Society	1	2		5	1	1		12
57	MGMT 490 Business Policy	1	2		5	1	2		11
58	MGMT 490 Business Policy	1	2		5	1	1		10
59	MGMT 490 Business Policy	1	2		5	1	1		12
60	TS 505 Intro to Technology & Society	1	2		5	1	1		13

61	TS 505 Intro to Technology & Society	1	2		5	1	1		12
62	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	1		9
63	EM 556 Lean teams	1	2		4	2	1		13
64	MGMT 490 Business Policy	1	2		5	1	1		10
65	TS 505 Intro to Technology & Society	1	2		5	1	2		11
66	MGMT 490 Business Policy	1	2		5	1	1		10
67	EM 649 Manufacturing Process Planning	1	1		5	1	1		12
68	PDD 157 Product Design and Development	1	2		4	2	1		12
69	TS 505 Intro to Technology & Society	1	2		5	1	1		11
70	EM 556 Lean teams	1	1		2	1	2		9
71	PDD 157 Product Design and Development	1	1		3	3	1		12
72	MGMT 490 Business Policy	1	2		5	1	1		12
73	MGMT 490 Business Policy	1	0	Worked together in past	5	1	1		9
74	EM 649 Manufacturing Process Planning	1	1		5	1	1		12
75	TS 505 Intro to Technology & Society	1	2		5	1	1		12
76	EM 649 Manufacturing Process Planning	1	2		3	3	1		12
77	PDD 157 Product Design and Development	1	1		3	3	1		12
78	PDD 157 Product Design and Development	1	2		5	1	1		10
79	MGMT 490 Business Policy	1	2		5	1	1		12
80	TS 505 Intro to Technology & Society	1	2		5	1	1		12
81	PDD 157 Product Design and Development	1	2		5	1	1		11
82	TS 505 Intro to Technology & Society	1	2		5	1	2		11
83	EM 649 Manufacturing Process Planning	1	1		2	4	1		12
84	TS 505 Intro to Technology & Society	1	2		5	1	2		12
85	TS 505 Intro to Technology & Society	1	2		5	1	1		12
86	EM 649 Manufacturing Process Planning	1	1		5	1	1		12
87	TS 505 Intro to Technology & Society	1	2		5	1	1		13
88	PDD 157 Product Design and Development	1	1		2	1	1		9
89	PDD 157 Product Design and Development	2	1		4	1	1		9
90	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	2		11

91	EM 649 Manufacturing Process Planning	1	2		5	1	1		13
92	TS 505 Intro to Technology & Society	1	2		5	1	1		12
93	EM 649 Manufacturing Process Planning	1	2		4	3	1		12
94	MGMT 490 Business Policy	1	2		4	2	1		10
95	TS 505 Intro to Technology & Society	1	2		5	1	1		12
96	MGMT 490 Business Policy	1	2		5	1	1		10
97	MGMT 490 Business Policy	1	2		5	1	2		11
98	PDD 157 Product Design and Development	1	2		3	3	1		10
99	MGMT 490 Business Policy	1	2		2	4	1		12
100	PDD 157 Product Design and Development	1	2		3	1	1		11
101	PDD 157 Product Design and Development	1	2		4	2	1		11
102	PDD 157 Product Design and Development	1	2		5	1	1		11
103	TS 505 Intro to Technology & Society	1	2		5	1	1		13
104	TS 505 Intro to Technology & Society	1	2		5	1	1		12
105	TS 505 Intro to Technology & Society	1	2		5	1	2		12
106	PDD 157 Product Design and Development	1	2		2	1	1		12
107	TS 505 Intro to Technology & Society	1	2		5	1	2		12
108	MGMT 490 Buisness Policy	1	2		5	1	1		11
109	EM 649 Manufacturing Process Planning	1	2		5	1	1		12
110	EM 649 Manufacturing Process Planning	1	0	Only 1 team in this class	5	1	1		12
111	EM 649 Manufacturing Process Planning	1	1		5	1	1		12
112	TS 505 Intro to Technology & Society	1	2		5	1	1		12
113	PDD 157 Product Design and Development	1	2		4	1	1		11
114	TS 505 Intro to Technology & Society	1	2		5	1	2		12
115	EM 556 Lean teams	1	1		2	1	2		9
116	EM 649 Manufacturing Process Planning	1	0	Only 1 team in this class	5	1	2		12
117	EM 649 Manufacturing Process Planning	1	2		4	4	1		12
118	MGMT 490 Business Policy	1	2		4	1	1		11
119	EM 649 Manufacturing Process Planning	1	2		5	1	1		13
120	MGMT 490 Business Policy	1	2		5	1	1		10

121	PDD 157 Product Design and Development	1	0	First day seating	5	1	2		13
122	MGMT 490 Business Policy	1	1		4	1	1		10
123	EM 556 Lean teams	1	2		5	5	1		11
124	TS 505 Intro to Technology & Society	1	2		5	1	1		12
125	MGMT 490 Business Policy	1	2		4	3	1		12
126	MGMT 490 Business Policy	1	0	Randomly choose to be in our group	5	1	1		10
127	TS 505 Intro to Technology & Society	1	0	Volunteer and assignment	5	1	2		4
128	EM 649 Manufacturing Process Planning	1	1		4	2	2		12
129	MGMT 490 Business Policy	1	2		5	1	1		12
130	EM 556 Lean teams	1	1		3	3	1		12
131	TS 505 Intro to Technology & Society	1	2		5	1	1		12
132	PDD 157 Product Design and Development	1	2		4	2	1		12
133	TS 505 Intro to Technology & Society	1	2		5	1	1		12
134	EM 649 Manufacturing Process Planning	1	2		5	1	1		12
135	MGMT 490 Business Policy	1	2		5	1	1		10
136	EM 649 Manufacturing Process Planning	1	2		3	3	1		12
137	MGMT 490 Business Policy	1	2		5	1	1		12
138	TS 505 Intro to Technology & Society	1	2		5	1	1		12
139	MGMT 490 Business Policy	1	2		5	1	1		12
140	PDD 157 Product Design and Development	1	1		5	1	1		12
141	EM 649 Manufacturing Process Planning	1	1		3	3	1		12
142	EM 649 Manufacturing Process Planning	1	1		4	2	2		12
143	EM 649 Manufacturing Process Planning	1	2		5	1	1		13
144	PDD 157 Product Design and Development	1	2		5	5	1		11

original run order	OCE	AVO	EEP	CE	FTR	IC	LR	TL	CS	CUS	QR	PUM	ASTN	FT	MOWTL	ALTV
1	5	8.5	5	5	4	5	4	5	5		4	6	4.78	5	4	4.5
2	6	9	6	5	3	5	5	6	6	5	4	5	5	6	6	6
3	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
4	4	8	5	5	4	4	5	4	3	4	4	4	4.2	5	5	5
5	3	8	3	4	3	2	4	2	4	5	4	4	3.5	2	2	2
6	2	6.5	2	2	2	2	2	2	2	5	2	3	2.4	2	2	2
7	6	9	6	6	6	6	6	6	6		6	6	6	6	6	6
8	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
9	5	8.5	5	5	2		3	4	4		3	4	3.75	4	4	4
10	6	9	6	5	6	6	5	6	6	2	5	6	5.3	6	6	6
11	6	9	6	5	6	6	6	6	6		5	6	5.78	6	6	6
12	2	7.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2
13	6	8	5	6	3	3	3	3	5	2	3	5	3.8	4	4	4
14	5	8.5	5	6	5	5	4	3	5	5	4	6	4.8	5	6	5.5
15	3	7.5	4	3	3	5	3	3	3	4	3	5	3.6	4	5	4.5
16	2	7	2	2	2	2	2	2	2	6	2	2	2.4	2	2	2
17	5	8.5	5	5	4	4	5	4	5	2	4	5	4.3	5	5	5
18	4	8	4	4	3	2	4	2	4	2	3	4	3.2	3	3	3
19	6	9	6	6	6	6	5	6	6	2	5	6	5.4	6	6	6
20	6	9	6	6	6	6	6	5	6	6	6	6	5.9	6	6	6
21	5	8	5	6	5	5	5	6	5	2	4	5	4.8	6	5	5.5
22	5	8.5	4	5	3	3	4	4	5	2	3	5	3.8	4	4	4
23	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
24	6	8.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
25	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
26	6	9	6	6	6	6	6	6	6		6	6	6	6	6	6
27	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
28	5	8.5	6	6	6	4	6	4	5	3	3	5	4.8	5	5	5
29	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
30	6	9	6	5	3	4	3	4	5	2	3	6	4.1	5	5	5
31	5	9	6	6	5	6	6	6	6	5	6	5	5.7	5	5	5
32	2	6	2	2	2	3	5	2	2	4	5	4	3.1	2	4	3
33	5	8.5	6	5	5	5	5	6	5	5	6	6	5.4	5	5	5
34	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
35	6	9	6	6	6	6	5	5	6	2	5	6	5.3	6	6	6
36	6	8	6	6	6	5	5	6	6	6	6	6	5.8	6	6	6
37	6	8.5	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
38	4	8	3	4	3	4	4	4	3		3	5	3.67	4	4	4
39	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
40	5	8	5	5	4	5	5	4	5	2	4	5	4.4	5	5	5
41	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
42	6	9	6	5	6	6	6	6	6	5	6	6	5.8	6	6	6
43	2	7.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2
44	3	4.5	3	3	3	3	3	3	4	4	3	4	3.3	4	4	4
45	2	4	3	2	2	2	3		4	4	5	5	3.33	2	2	2
46	5	6	5	4	4	5	5	4	5	3	4	4	4.3	3	3	3
47	6	9	5	4	3	5	3	4	5	2	3	5	3.9	5	5	5

48	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
49	5	8.5	5	4	5	3	3	3	5	2	3	6	3.9	5	5	5
50	3	7	6	6	6	6	6	6	6	3	6	6	5.7	6	6	6
51	6	9.5	6	6	6	5	5	4	5	6	5	5	5.3	5	5	5
52	6	9	6	6	6	5	5	6	5	6	5	6	5.6	6	6	6
53	6	8	6	6	5	6	4	5	6	3	4	6	5.1	4	5	4.5
54	5	7.5	5	5	4	4	4	4	5	3	5	4	4.3	5	4	4.5
55	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
56	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
57	5	8	6	6	5	5	3	4	5	2	4	5	4.5	6	5	5.5
58	6	8	5	5	5	5	4	6	5	2	5	5	4.7	5	5	5
59	5	8.5	6	6	3	3	2	3	4	4	4	5	4	4	3	3.5
60	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
61	6	9	6	6	5	5	5	4	6	2	5	6	5	6	4	5
62	5	7	3	5	4	4	2	2	4	3	3	4	3.4	5	4	4.5
63	3	8	2	2	3	4	5	4	4	4	5	5	3.8	2	2	2
64	6	8	6	6	6	6	5	5	6		6	5	5.67	6	6	6
65	5	8	6	5	5	4	4	4	5	2	5	5	4.5	5	5	5
66	4	7	5	3	3	3	3	3	5	5	3	5	3.8	4	5	4.5
67	6	9	6	6	5	5	5	4	6	2	5	6	5	6	5	5.5
68	4	8	4	5	2	5	2	2	4	6	2	5	3.7	2	4	3
69	6	8.5	6	6	6	6	6	6	6		6	6	6	6	6	6
70	3	6	4	4	5	4	5	4	4	4	5	4	4.3	4	4	4
71	4	8	4	5	3	3	4	2	4	3	2	5	3.5	4	4	4
72	4	8	6	6	6	6	6	3	3	5	5	3	4.9	3	3	3
73	6	7.5	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
74	5	8.5	5	5	5	5	5	5	3	4	4	6	4.7	3	5	4
75	5	8.5	5	5	5	6	5	6	6		5	6	5.44	6	6	6
76	3	7.5	5	4	4	3	4	4	4	5	4	5	4.2	4	4	4
77	6	9	5	6	5	6	5	6	6		5	6	5.56	6	6	6
78	2	6	2	2	2	3	2	2	2	4	2	4	2.5	2	3	2.5
79	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
80	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
81	6	8.5	6	4	4	5	5	6	6		5	6	5.22	6	6	6
82	3	7	3	3	2	2	3	2	2	5	2	4	2.8	2	4	3
83	5	8.5	5	5	4	4	4	4	4	4	4	5	4.3	4	4	4
84	4	8	2	3	2	3		4	4		2	4	3	2		2
85	5	8.5	6	6	5	6	5	6	6		5	6	5.67	6	6	6
86	6	9	6	6	5	5	4	4	6	2	5	6	4.9	4	5	4.5
87	6	9.5	6	6	6	6	6	6	6	6	6	6	6	6	6	6
88	3	6	2	2	4	2	5	2	2	4	4	4	3.1	2	2	2
89	5	7	3	3	2	2	4	2	4	4	2	5	3.1	2	4	3
90	5	8	5	5	4	4	6	4	4	2	5	4	4.3	5	4	4.5
91	6	9.5	5	5	4	4	5	6	5	5	5	3	4.7	6	5	5.5
92	6	9	6	6	5	5	5	6	5	2	6	6	5.2	6	6	6
93	4	8	5	5	4	5	5	5	5	3	5	5	4.7	5	5	5
94	2	6	2	2	2	2	2	2	2	6	2	2	2.4	2	2	2
95	6	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6
96	6	8	6	6	5	5	5	5	6	5	5	6	5.4	6	6	6

97	5	8	5	5	4	5	4	4	5	2	4	5	4.3	4	3	3.5
98	6	8	5	6	5	6	4	4	6		4	6	5.11	5	5	5
99	6	9	5	6	5	6	4	4	5		5	6	5.11	6	6	6
100	2	6.5	3	3	2	2	2	2	2	5	2	3	2.6	2	2	2
101	6	8.5	6	5	6	6		6	4	2	6	6	5.22	6	5	5.5
102	6	8.5	6	5	5	6	4	5	6	2	5	6	5	6	6	6
103	4	8.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
104	6	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6
105	4	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4
106	6	9	6	6	5	5	4	4	6	2	5	6	4.9	6	6	6
107	4	8	5	5	4	5	5	5	4	4	3	4	4.4	4	4	4
108	6	8.5	6	6	5	5	4	5	6	5	5	5	5.2	6	6	6
109	6	9	5	6	6	6	6	6	5	2	6	6	5.4	6	6	6
110	5	8.5	6	5	4	4	6	5	5	4	5	5	4.9	5	5	5
111	6	9	6	6	5	5	5	6	6	2	5	6	5.2	6	5	5.5
112	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
113	6	8.5	6	6	6	5	4	5	6	2	5	4	4.9	6	5	5.5
114	4	8	4	4	4	4	4	4	4	4	4	4	4	4	4	4
115	4	6.5	4	4	4	4	4	4	4	4	4	4	4	4	4	4
116	4	8	5	4	5	4	3	4	4	2	5	4	4	4	4	4
117	5	8.5	5	6	4	4	6	6	5	2	5	5	4.8	5	5	5
118	6	8.5	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
119	6	9.5	6	6	6	4	5	5	5	5	6	5	5.3	6	6	6
120	5	7.5	5	5	3	5	3	4	5	3	3	5	4.1	5	5	5
121	2	7.5	2	3	2	2	2	2	3	5	4	4	2.9	2	2	2
122		10	5	5	4	2	2	3	2	3	2	4	3.2	2	3	2.5
123	3	7	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
124	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
125	6	9	4	3	5	4	3	3	5	3	3	5	3.8	3	4	3.5
126		10	6	6	6	6	5	4	5	2	6	4	5	5	5	5
127	2	3	3	2	3	3	2	2	2	4	3	3	2.7	2	3	2.5
128	4	8	4	4	4	5	4	3	3	4	4	5	4	3	4	3.5
129	5	8.5	6	5	5	5	5	5	6	2	5	6	5	6	6	6
130	6	9	6	5	3	5	5	6	5	4	3	5	4.7	6	6	6
131	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
132	6	9	6	6	6	6	5	4	6	2	6	6	5.3	6	6	6
133	5	8.5	6	6	6	6	6	4	6	2	6	6	5.4	6	6	6
134	6	9	5	5	5	6	5	6	5	2	5	5	4.9	6	6	6
135	6	8	6	6	6	6	4	6	5	5	4	6	5.4	6	5	5.5
136	4	8	5	5	5	4	4	3	3	5	4	5	4.3	3	4	3.5
137	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
138	6	9	6	6	6	6	6	6	6	2	5	6	5.5	6	6	6
139	6	9	6	6	6	6	6	6	6	2	6	6	5.6	6	6	6
140	6	9	6	6	5	6	6	6	6	5	5	6	5.7	6	6	6
141	5	8.5	5	5	4	5	4	4	4	5	4	5	4.5	5	5	5
142	4	8	4	5	5	5	4	4	4	5	4	5	4.5	4	5	4.5
143	6	9.5	6	6	5	6	5	6	5	5	5	5	5.4	6	6	6
144	6	8.5	6	6	6	6	5	5	6	6	6	6	5.8	5	6	5.5

	FTG_BC	FTG_BC_z	OCE_BC		EEP_BC		CE_BC		FTR_BC		IC_BC	
original run order	c39	FTG_BC_z	c40	OCE_BC_z	c41	EEP_BC_z	c42	CE_BC_z	c43	FTR_BC_z	c44	IC_BC_z
1	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	16	-0.595	25	0.090
2	8685.544	0.319	216	0.943	216	0.898	125	-0.249	9	-1.209	25	0.090
3	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
4	8685.544	0.319	64	-1.014	125	-0.300	125	-0.249	16	-0.595	16	-0.712
5	11632.466	1.466	27	-1.490	27	-1.590	64	-1.057	9	-1.209	4	-1.781
6	6322.317	-0.600	8	-1.735	8	-1.840	8	-1.799	4	-1.647	4	-1.781
7	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
8	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
9	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	4	-1.647		-2.137
10	8685.544	0.319	216	0.943	216	0.898	125	-0.249	36	1.157	36	1.069
11	8685.544	0.319	216	0.943	216	0.898	125	-0.249	36	1.157	36	1.069
12	11632.466	1.466	8	-1.735	8	-1.840	8	-1.799	4	-1.647	4	-1.781
13	4464.792	-1.323	216	0.943	125	-0.300	216	0.956	9	-1.209	9	-1.335
14	8685.544	0.319	125	-0.228	125	-0.300	216	0.956	25	0.194	25	0.090
15	8685.544	0.319	27	-1.490	64	-1.103	27	-1.547	9	-1.209	25	0.090
16	8685.544	0.319	8	-1.735	8	-1.840	8	-1.799	4	-1.647	4	-1.781
17	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	16	-0.595	16	-0.712
18	8685.544	0.319	64	-1.014	64	-1.103	64	-1.057	9	-1.209	4	-1.781
19	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
20	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
21	6322.317	-0.600	125	-0.228	125	-0.300	216	0.956	25	0.194	25	0.090
22	8685.544	0.319	125	-0.228	64	-1.103	125	-0.249	9	-1.209	9	-1.335
23	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
24	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
25	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
26	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
27	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
28	8685.544	0.319	125	-0.228	216	0.898	216	0.956	36	1.157	16	-0.712
29	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
30	8685.544	0.319	216	0.943	216	0.898	125	-0.249	9	-1.209	16	-0.712
31	11632.466	1.466	125	-0.228	216	0.898	216	0.956	25	0.194	36	1.069
32	4464.792	-1.323	8	-1.735	8	-1.840	8	-1.799	4	-1.647	9	-1.335
33	8685.544	0.319	125	-0.228	216	0.898	125	-0.249	25	0.194	25	0.090
34	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
35	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
36	4464.792	-1.323	216	0.943	216	0.898	216	0.956	36	1.157	25	0.090
37	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
38	8685.544	0.319	64	-1.014	27	-1.590	64	-1.057	9	-1.209	16	-0.712
39	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
40	6322.317	-0.600	125	-0.228	125	-0.300	125	-0.249	16	-0.595	25	0.090
41	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
42	8685.544	0.319	216	0.943	216	0.898	125	-0.249	36	1.157	36	1.069
43	11632.466	1.466	8	-1.735	8	-1.840	8	-1.799	4	-1.647	4	-1.781
44	691.986	-2.792	27	-1.490	27	-1.590	27	-1.547	9	-1.209	9	-1.335
45	691.986	-2.792	8	-1.735	27	-1.590	8	-1.799	4	-1.647	4	-1.781

46	1214.618	-2.588	125	-0.228	125	-0.300	64	-1.057	16	-0.595	25	0.090
47	8685.544	0.319	216	0.943	125	-0.300	64	-1.057	9	-1.209	25	0.090
48	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
49	8685.544	0.319	125	-0.228	125	-0.300	64	-1.057	25	0.194	9	-1.335
50	6322.317	-0.600	27	-1.490	216	0.898	216	0.956	36	1.157	36	1.069
51	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	25	0.090
52	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	25	0.090
53	4464.792	-1.323	216	0.943	216	0.898	216	0.956	25	0.194	36	1.069
54	4464.792	-1.323	125	-0.228	125	-0.300	125	-0.249	16	-0.595	16	-0.712
55	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
56	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
57	6322.317	-0.600	125	-0.228	216	0.898	216	0.956	25	0.194	25	0.090
58	4464.792	-1.323	216	0.943	125	-0.300	125	-0.249	25	0.194	25	0.090
59	8685.544	0.319	125	-0.228	216	0.898	216	0.956	9	-1.209	9	-1.335
60	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
61	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
62	3039.453	-1.878	125	-0.228	27	-1.590	125	-0.249	16	-0.595	16	-0.712
63	11632.466	1.466	27	-1.490	8	-1.840	8	-1.799	9	-1.209	16	-0.712
64	4464.792	-1.323	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
65	6322.317	-0.600	125	-0.228	216	0.898	125	-0.249	25	0.194	16	-0.712
66	4464.792	-1.323	64	-1.014	125	-0.300	27	-1.547	9	-1.209	9	-1.335
67	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
68	8685.544	0.319	64	-1.014	64	-1.103	125	-0.249	4	-1.647	25	0.090
69	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
70	3039.453	-1.878	27	-1.490	64	-1.103	64	-1.057	25	0.194	16	-0.712
71	8685.544	0.319	64	-1.014	64	-1.103	125	-0.249	9	-1.209	9	-1.335
72	8685.544	0.319	64	-1.014	216	0.898	216	0.956	36	1.157	36	1.069
73	3039.453	-1.878	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
74	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	25	0.194	25	0.090
75	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	25	0.194	36	1.069
76	8685.544	0.319	27	-1.490	125	-0.300	64	-1.057	16	-0.595	9	-1.335
77	8685.544	0.319	216	0.943	125	-0.300	216	0.956	25	0.194	36	1.069
78	4464.792	-1.323	8	-1.735	8	-1.840	8	-1.799	4	-1.647	9	-1.335
79	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
80	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
81	6322.317	-0.600	216	0.943	216	0.898	64	-1.057	16	-0.595	25	0.090
82	6322.317	-0.600	27	-1.490	27	-1.590	27	-1.547	4	-1.647	4	-1.781
83	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	16	-0.595	16	-0.712
84	8685.544	0.319	64	-1.014	8	-1.840	27	-1.547	4	-1.647	9	-1.335
85	8685.544	0.319	125	-0.228	216	0.898	216	0.956	25	0.194	36	1.069
86	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
87	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
88	3039.453	-1.878	27	-1.490	8	-1.840	8	-1.799	16	-0.595	4	-1.781
89	3039.453	-1.878	125	-0.228	27	-1.590	27	-1.547	4	-1.647	4	-1.781
90	6322.317	-0.600	125	-0.228	125	-0.300	125	-0.249	16	-0.595	16	-0.712
91	11632.466	1.466	216	0.943	125	-0.300	125	-0.249	16	-0.595	16	-0.712
92	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
93	8685.544	0.319	64	-1.014	125	-0.300	125	-0.249	16	-0.595	25	0.090

94	4464.792	-1.323	8	-1.735	8	-1.840	8	-1.799	4	-1.647	4	-1.781
95	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
96	4464.792	-1.323	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
97	6322.317	-0.600	125	-0.228	125	-0.300	125	-0.249	16	-0.595	25	0.090
98	4464.792	-1.323	216	0.943	125	-0.300	216	0.956	25	0.194	36	1.069
99	8685.544	0.319	216	0.943	125	-0.300	216	0.956	25	0.194	36	1.069
100	6322.317	-0.600	8	-1.735	27	-1.590	27	-1.547	4	-1.647	4	-1.781
101	6322.317	-0.600	216	0.943	216	0.898	125	-0.249	36	1.157	36	1.069
102	6322.317	-0.600	216	0.943	216	0.898	125	-0.249	25	0.194	36	1.069
103	11632.466	1.466	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
104	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
105	8685.544	0.319	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
106	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
107	8685.544	0.319	64	-1.014	125	-0.300	125	-0.249	16	-0.595	25	0.090
108	6322.317	-0.600	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
109	8685.544	0.319	216	0.943	125	-0.300	216	0.956	36	1.157	36	1.069
110	8685.544	0.319	125	-0.228	216	0.898	125	-0.249	16	-0.595	16	-0.712
111	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	25	0.090
112	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
113	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	25	0.090
114	8685.544	0.319	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
115	3039.453	-1.878	64	-1.014	64	-1.103	64	-1.057	16	-0.595	16	-0.712
116	8685.544	0.319	64	-1.014	125	-0.300	64	-1.057	25	0.194	16	-0.712
117	8685.544	0.319	125	-0.228	125	-0.300	216	0.956	16	-0.595	16	-0.712
118	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
119	11632.466	1.466	216	0.943	216	0.898	216	0.956	36	1.157	16	-0.712
120	4464.792	-1.323	125	-0.228	125	-0.300	125	-0.249	9	-1.209	25	0.090
121	11632.466	1.466	8	-1.735	8	-1.840	27	-1.547	4	-1.647	4	-1.781
122	4464.792	-1.323		-1.838	125	-0.300	125	-0.249	16	-0.595	4	-1.781
123	6322.317	-0.600	27	-1.490	216	0.898	216	0.956	36	1.157	36	1.069
124	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
125	8685.544	0.319	216	0.943	64	-1.103	27	-1.547	25	0.194	16	-0.712
126	4464.792	-1.323		-1.838	216	0.898	216	0.956	36	1.157	36	1.069
127	157.543	-3.000	8	-1.735	27	-1.590	8	-1.799	9	-1.209	9	-1.335
128	8685.544	0.319	64	-1.014	64	-1.103	64	-1.057	16	-0.595	25	0.090
129	8685.544	0.319	125	-0.228	216	0.898	125	-0.249	25	0.194	25	0.090
130	8685.544	0.319	216	0.943	216	0.898	125	-0.249	9	-1.209	25	0.090
131	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
132	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
133	8685.544	0.319	125	-0.228	216	0.898	216	0.956	36	1.157	36	1.069
134	8685.544	0.319	216	0.943	125	-0.300	125	-0.249	25	0.194	36	1.069
135	4464.792	-1.323	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
136	8685.544	0.319	64	-1.014	125	-0.300	125	-0.249	25	0.194	16	-0.712
137	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
138	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
139	8685.544	0.319	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069
140	8685.544	0.319	216	0.943	216	0.898	216	0.956	25	0.194	36	1.069
141	8685.544	0.319	125	-0.228	125	-0.300	125	-0.249	16	-0.595	25	0.090

142	8685.544	0.319	64	-1.014	64	-1.103	125	-0.249	25	0.194	25	0.090
143	11632.466	1.466	216	0.943	216	0.898	216	0.956	25	0.194	36	1.069
144	6322.317	-0.600	216	0.943	216	0.898	216	0.956	36	1.157	36	1.069

	LR_BC		TL_BC		CS_BC		CUS_BC		QR_BC		PUM_BC	
original run order	c45	LR_BC_z	c46	TL_BC_z	c47	CS_BC_z	c48	CUS_BC_z	c49	QR_BC_z	c50	PUM_BC_z
1	16	-0.592	5	0.336	25	0.008		-2.732	16	-0.569	216	1.001
2	25	0.251	6	1.054	36	1.023	1.609	0.991	16	-0.569	125	-0.314
3	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
4	25	0.251	4	-0.381	9	-1.469	1.386	0.475	16	-0.569	64	-1.195
5	16	-0.592	2	-1.817	16	-0.823	1.609	0.991	16	-0.569	64	-1.195
6	4	-1.717	2	-1.817	4	-1.931	1.609	0.991	4	-1.675	27	-1.730
7	36	1.282	6	1.054	36	1.023		-2.732	36	1.275	216	1.001
8	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
9	9	-1.248	4	-0.381	16	-0.823		-2.732	9	-1.215	64	-1.195
10	25	0.251	6	1.054	36	1.023	0.693	-1.129	25	0.261	216	1.001
11	36	1.282	6	1.054	36	1.023		-2.732	25	0.261	216	1.001
12	4	-1.717	2	-1.817	4	-1.931	0.693	-1.129	4	-1.675	8	-2.005
13	9	-1.248	3	-1.099	25	0.008	0.693	-1.129	9	-1.215	125	-0.314
14	16	-0.592	3	-1.099	25	0.008	1.609	0.991	16	-0.569	216	1.001
15	9	-1.248	3	-1.099	9	-1.469	1.386	0.475	9	-1.215	125	-0.314
16	4	-1.717	2	-1.817	4	-1.931	1.792	1.413	4	-1.675	8	-2.005
17	25	0.251	4	-0.381	25	0.008	0.693	-1.129	16	-0.569	125	-0.314
18	16	-0.592	2	-1.817	16	-0.823	0.693	-1.129	9	-1.215	64	-1.195
19	25	0.251	6	1.054	36	1.023	0.693	-1.129	25	0.261	216	1.001
20	36	1.282	5	0.336	36	1.023	1.792	1.413	36	1.275	216	1.001
21	25	0.251	6	1.054	25	0.008	0.693	-1.129	16	-0.569	125	-0.314
22	16	-0.592	4	-0.381	25	0.008	0.693	-1.129	9	-1.215	125	-0.314
23	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
24	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
25	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
26	36	1.282	6	1.054	36	1.023		-2.732	36	1.275	216	1.001
27	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
28	36	1.282	4	-0.381	25	0.008	1.099	-0.190	9	-1.215	125	-0.314
29	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
30	9	-1.248	4	-0.381	25	0.008	0.693	-1.129	9	-1.215	216	1.001
31	36	1.282	6	1.054	36	1.023	1.609	0.991	36	1.275	125	-0.314
32	25	0.251	2	-1.817	4	-1.931	1.386	0.475	25	0.261	64	-1.195
33	25	0.251	6	1.054	25	0.008	1.609	0.991	36	1.275	216	1.001
34	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
35	25	0.251	5	0.336	36	1.023	0.693	-1.129	25	0.261	216	1.001
36	25	0.251	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
37	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
38	16	-0.592	4	-0.381	9	-1.469		-2.732	9	-1.215	125	-0.314
39	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195

40	25	0.251	4	-0.381	25	0.008	0.693	-1.129	16	-0.569	125	-0.314
41	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
42	36	1.282	6	1.054	36	1.023	1.609	0.991	36	1.275	216	1.001
43	4	-1.717	2	-1.817	4	-1.931	0.693	-1.129	4	-1.675	8	-2.005
44	9	-1.248	3	-1.099	16	-0.823	1.386	0.475	9	-1.215	64	-1.195
45	9	-1.248		-3.253	16	-0.823	1.386	0.475	25	0.261	125	-0.314
46	25	0.251	4	-0.381	25	0.008	1.099	-0.190	16	-0.569	64	-1.195
47	9	-1.248	4	-0.381	25	0.008	0.693	-1.129	9	-1.215	125	-0.314
48	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
49	9	-1.248	3	-1.099	25	0.008	0.693	-1.129	9	-1.215	216	1.001
50	36	1.282	6	1.054	36	1.023	1.099	-0.190	36	1.275	216	1.001
51	25	0.251	4	-0.381	25	0.008	1.792	1.413	25	0.261	125	-0.314
52	25	0.251	6	1.054	25	0.008	1.792	1.413	25	0.261	216	1.001
53	16	-0.592	5	0.336	36	1.023	1.099	-0.190	16	-0.569	216	1.001
54	16	-0.592	4	-0.381	25	0.008	1.099	-0.190	25	0.261	64	-1.195
55	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
56	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
57	9	-1.248	4	-0.381	25	0.008	0.693	-1.129	16	-0.569	125	-0.314
58	16	-0.592	6	1.054	25	0.008	0.693	-1.129	25	0.261	125	-0.314
59	4	-1.717	3	-1.099	16	-0.823	1.386	0.475	16	-0.569	125	-0.314
60	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
61	25	0.251	4	-0.381	36	1.023	0.693	-1.129	25	0.261	216	1.001
62	4	-1.717	2	-1.817	16	-0.823	1.099	-0.190	9	-1.215	64	-1.195
63	25	0.251	4	-0.381	16	-0.823	1.386	0.475	25	0.261	125	-0.314
64	25	0.251	5	0.336	36	1.023		-2.732	36	1.275	125	-0.314
65	16	-0.592	4	-0.381	25	0.008	0.693	-1.129	25	0.261	125	-0.314
66	9	-1.248	3	-1.099	25	0.008	1.609	0.991	9	-1.215	125	-0.314
67	25	0.251	4	-0.381	36	1.023	0.693	-1.129	25	0.261	216	1.001
68	4	-1.717	2	-1.817	16	-0.823	1.792	1.413	4	-1.675	125	-0.314
69	36	1.282	6	1.054	36	1.023		-2.732	36	1.275	216	1.001
70	25	0.251	4	-0.381	16	-0.823	1.386	0.475	25	0.261	64	-1.195
71	16	-0.592	2	-1.817	16	-0.823	1.099	-0.190	4	-1.675	125	-0.314
72	36	1.282	3	-1.099	9	-1.469	1.609	0.991	25	0.261	27	-1.730
73	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
74	25	0.251	5	0.336	9	-1.469	1.386	0.475	16	-0.569	216	1.001
75	25	0.251	6	1.054	36	1.023		-2.732	25	0.261	216	1.001
76	16	-0.592	4	-0.381	16	-0.823	1.609	0.991	16	-0.569	125	-0.314
77	25	0.251	6	1.054	36	1.023		-2.732	25	0.261	216	1.001
78	4	-1.717	2	-1.817	4	-1.931	1.386	0.475	4	-1.675	64	-1.195
79	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
80	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
81	25	0.251	6	1.054	36	1.023		-2.732	25	0.261	216	1.001
82	9	-1.248	2	-1.817	4	-1.931	1.609	0.991	4	-1.675	64	-1.195
83	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	125	-0.314
84		-2.092	4	-0.381	16	-0.823		-2.732	4	-1.675	64	-1.195
85	25	0.251	6	1.054	36	1.023		-2.732	25	0.261	216	1.001
86	16	-0.592	4	-0.381	36	1.023	0.693	-1.129	25	0.261	216	1.001
87	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001

88	25	0.251	2	-1.817	4	-1.931	1.386	0.475	16	-0.569	64	-1.195
89	16	-0.592	2	-1.817	16	-0.823	1.386	0.475	4	-1.675	125	-0.314
90	36	1.282	4	-0.381	16	-0.823	0.693	-1.129	25	0.261	64	-1.195
91	25	0.251	6	1.054	25	0.008	1.609	0.991	25	0.261	27	-1.730
92	25	0.251	6	1.054	25	0.008	0.693	-1.129	36	1.275	216	1.001
93	25	0.251	5	0.336	25	0.008	1.099	-0.190	25	0.261	125	-0.314
94	4	-1.717	2	-1.817	4	-1.931	1.792	1.413	4	-1.675	8	-2.005
95	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
96	25	0.251	5	0.336	36	1.023	1.609	0.991	25	0.261	216	1.001
97	16	-0.592	4	-0.381	25	0.008	0.693	-1.129	16	-0.569	125	-0.314
98	16	-0.592	4	-0.381	36	1.023		-2.732	16	-0.569	216	1.001
99	16	-0.592	4	-0.381	25	0.008		-2.732	25	0.261	216	1.001
100	4	-1.717	2	-1.817	4	-1.931	1.609	0.991	4	-1.675	27	-1.730
101		-2.092	6	1.054	16	-0.823	0.693	-1.129	36	1.275	216	1.001
102	16	-0.592	5	0.336	36	1.023	0.693	-1.129	25	0.261	216	1.001
103	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
104	36	1.282	6	1.054	36	1.023	1.792	1.413	36	1.275	216	1.001
105	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
106	16	-0.592	4	-0.381	36	1.023	0.693	-1.129	25	0.261	216	1.001
107	25	0.251	5	0.336	16	-0.823	1.386	0.475	9	-1.215	64	-1.195
108	16	-0.592	5	0.336	36	1.023	1.609	0.991	25	0.261	125	-0.314
109	36	1.282	6	1.054	25	0.008	0.693	-1.129	36	1.275	216	1.001
110	36	1.282	5	0.336	25	0.008	1.386	0.475	25	0.261	125	-0.314
111	25	0.251	6	1.054	36	1.023	0.693	-1.129	25	0.261	216	1.001
112	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
113	16	-0.592	5	0.336	36	1.023	0.693	-1.129	25	0.261	64	-1.195
114	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
115	16	-0.592	4	-0.381	16	-0.823	1.386	0.475	16	-0.569	64	-1.195
116	9	-1.248	4	-0.381	16	-0.823	0.693	-1.129	25	0.261	64	-1.195
117	36	1.282	6	1.054	25	0.008	0.693	-1.129	25	0.261	125	-0.314
118	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
119	25	0.251	5	0.336	25	0.008	1.609	0.991	36	1.275	125	-0.314
120	9	-1.248	4	-0.381	25	0.008	1.099	-0.190	9	-1.215	125	-0.314
121	4	-1.717	2	-1.817	9	-1.469	1.609	0.991	16	-0.569	64	-1.195
122	4	-1.717	3	-1.099	4	-1.931	1.099	-0.190	4	-1.675	64	-1.195
123	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
124	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
125	9	-1.248	3	-1.099	25	0.008	1.099	-0.190	9	-1.215	125	-0.314
126	25	0.251	4	-0.381	25	0.008	0.693	-1.129	36	1.275	64	-1.195
127	4	-1.717	2	-1.817	4	-1.931	1.386	0.475	9	-1.215	27	-1.730
128	16	-0.592	3	-1.099	9	-1.469	1.386	0.475	16	-0.569	125	-0.314
129	25	0.251	5	0.336	36	1.023	0.693	-1.129	25	0.261	216	1.001
130	25	0.251	6	1.054	25	0.008	1.386	0.475	9	-1.215	125	-0.314
131	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
132	25	0.251	4	-0.381	36	1.023	0.693	-1.129	36	1.275	216	1.001
133	36	1.282	4	-0.381	36	1.023	0.693	-1.129	36	1.275	216	1.001
134	25	0.251	6	1.054	25	0.008	0.693	-1.129	25	0.261	125	-0.314
135	16	-0.592	6	1.054	25	0.008	1.609	0.991	16	-0.569	216	1.001

136	16	-0.592	3	-1.099	9	-1.469	1.609	0.991	16	-0.569	125	-0.314
137	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
138	36	1.282	6	1.054	36	1.023	0.693	-1.129	25	0.261	216	1.001
139	36	1.282	6	1.054	36	1.023	0.693	-1.129	36	1.275	216	1.001
140	36	1.282	6	1.054	36	1.023	1.609	0.991	25	0.261	216	1.001
141	16	-0.592	4	-0.381	16	-0.823	1.609	0.991	16	-0.569	125	-0.314
142	16	-0.592	4	-0.381	16	-0.823	1.609	0.991	16	-0.569	125	-0.314
143	25	0.251	6	1.054	25	0.008	1.609	0.991	25	0.261	125	-0.314
144	25	0.251	5	0.336	36	1.023	1.792	1.413	36	1.275	216	1.001

	FT_BC		MOWTL_BC		AVO_BC	ASTN_BC	ALTV_BC			
original run order	c51	FT_BC_z	c52	MOWTL_BC_z	c53	c54	c55	AV_OO_z	AV_TN_z	AV_LTV_z
1	25	0.016	16	-0.833	2276.64	22.85	20.25	0.046	-0.360	-0.408
2	36	0.939	36	1.015	2798.75	25.00	36	0.631	0.197	0.977
3	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
4	25	0.016	25	-0.001	1828.89	17.64	25	-0.347	-0.474	0.008
5	4	-1.745	4	-1.942	1828.89	12.25	4	-0.012	-0.964	-1.843
6	4	-1.745	4	-1.942	863.87	5.76	4	-1.167	-1.494	-1.843
7	36	0.939	36	1.015	2798.75	36.00	36	0.631	0.698	0.977
8	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
9	16	-0.738	16	-0.833	2276.64	14.06	16	0.046	-1.193	-0.786
10	36	0.939	36	1.015	2798.75	28.09	36	0.631	0.534	0.977
11	36	0.939	36	1.015	2798.75	33.41	36	0.631	0.476	0.977
12	4	-1.745	4	-1.942	1448.58	4.00	4	-0.134	-1.734	-1.843
13	16	-0.738	16	-0.833	1828.89	14.44	16	-0.190	-0.688	-0.786
14	25	0.016	36	1.015	2276.64	23.04	30.25	0.046	0.068	0.516
15	16	-0.738	25	-0.001	1448.58	12.96	20.25	-0.585	-0.864	-0.370
16	4	-1.745	4	-1.942	1129.03	5.76	4	-0.708	-1.480	-1.843
17	25	0.016	25	-0.001	2276.64	18.49	25	0.046	-0.399	0.008
18	9	-1.325	9	-1.480	1828.89	10.24	9	-0.347	-1.192	-1.403
19	36	0.939	36	1.015	2798.75	29.16	36	0.631	0.654	0.977
20	36	0.939	36	1.015	2798.75	34.81	36	0.631	1.041	0.977
21	36	0.939	25	-0.001	1828.89	23.04	30.25	-0.414	0.024	0.469
22	16	-0.738	16	-0.833	2276.64	14.44	16	0.046	-0.752	-0.786
23	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
24	36	0.939	36	1.015	2276.64	36.00	36	0.171	1.113	0.977
25	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
26	36	0.939	36	1.015	2798.75	36.00	36	0.631	0.698	0.977
27	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
28	25	0.016	25	-0.001	2276.64	23.04	25	0.046	0.149	0.008
29	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
30	25	0.016	25	-0.001	2798.75	16.81	25	0.631	-0.424	0.008
31	25	0.016	25	-0.001	2798.75	32.49	25	0.619	0.843	0.008

32	4	-1.745	16	-0.833	646.96	9.61	9	-1.529	-1.058	-1.289
33	25	0.016	25	-0.001	2276.64	29.16	25	0.046	0.551	0.008
34	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
35	36	0.939	36	1.015	2798.75	28.09	36	0.631	0.582	0.977
36	36	0.939	36	1.015	1828.89	33.64	36	-0.190	0.912	0.977
37	36	0.939	36	1.015	2276.64	31.36	36	0.171	0.859	0.977
38	16	-0.738	16	-0.833	1828.89	13.47	16	-0.347	-1.127	-0.786
39	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
40	25	0.016	25	-0.001	1828.89	19.36	25	-0.414	-0.319	0.008
41	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
42	36	0.939	36	1.015	2798.75	33.64	36	0.631	0.950	0.977
43	4	-1.745	4	-1.942	1448.58	4.00	4	-0.134	-1.734	-1.843
44	16	-0.738	16	-0.833	228.86	10.89	16	-2.141	-1.079	-0.786
45	4	-1.745	4	-1.942	149.55	11.09	4	-2.263	-1.172	-1.843
46	9	-1.325	9	-1.480	646.96	18.49	9	-1.408	-0.394	-1.403
47	25	0.016	25	-0.001	2798.75	15.21	25	0.631	-0.675	0.008
48	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
49	25	0.016	25	-0.001	2276.64	15.21	25	0.046	-0.618	0.008
50	36	0.939	36	1.015	1129.03	32.49	36	-1.045	0.953	0.977
51	25	0.016	25	-0.001	3402.38	28.09	25	1.205	0.434	0.008
52	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.709	0.977
53	16	-0.738	25	-0.001	1828.89	26.01	20.25	-0.190	0.413	-0.370
54	25	0.016	16	-0.833	1448.58	18.49	20.25	-0.776	-0.395	-0.408
55	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
56	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
57	36	0.939	25	-0.001	1828.89	20.25	30.25	-0.414	-0.150	0.469
58	25	0.016	25	-0.001	1828.89	22.09	25	-0.190	-0.098	0.008
59	16	-0.738	9	-1.480	2276.64	16.00	12.25	0.046	-0.474	-1.109
60	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
61	36	0.939	16	-0.833	2798.75	25.00	25	0.631	0.316	0.053
62	25	0.016	16	-0.833	1129.03	11.56	20.25	-1.053	-1.010	-0.408
63	4	-1.745	4	-1.942	1828.89	14.44	4	-0.012	-0.609	-1.843
64	36	0.939	36	1.015	1828.89	32.15	36	-0.190	0.392	0.977
65	25	0.016	25	-0.001	1828.89	20.25	25	-0.414	-0.202	0.008
66	16	-0.738	25	-0.001	1129.03	14.44	20.25	-1.168	-0.727	-0.370
67	36	0.939	25	-0.001	2798.75	25.00	30.25	0.631	0.316	0.469
68	4	-1.745	16	-0.833	1828.89	13.69	9	-0.347	-0.784	-1.289
69	36	0.939	36	1.015	2276.64	36.00	36	0.171	0.698	0.977
70	16	-0.738	16	-0.833	646.96	18.49	16	-1.684	-0.409	-0.786
71	16	-0.738	16	-0.833	1828.89	12.25	16	-0.347	-0.931	-0.786
72	9	-1.325	9	-1.480	1828.89	24.01	9	-0.347	0.232	-1.403
73	36	0.939	36	1.015	1448.58	31.36	36	-0.467	0.859	0.977
74	9	-1.325	25	-0.001	2276.64	22.09	16	0.046	-0.024	-0.663
75	36	0.939	36	1.015	2276.64	29.59	36	0.046	0.157	0.977
76	16	-0.738	16	-0.833	1448.58	17.64	16	-0.585	-0.498	-0.786
77	36	0.939	36	1.015	2798.75	30.91	36	0.631	0.278	0.977
78	4	-1.745	9	-1.480	646.96	6.25	6.25	-1.529	-1.448	-1.612
79	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977

80	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
81	36	0.939	36	1.015	2276.64	27.25	36	0.171	0.019	0.977
82	4	-1.745	16	-0.833	1129.03	7.84	9	-1.045	-1.344	-1.289
83	16	-0.738	16	-0.833	2276.64	18.49	16	0.046	-0.406	-0.786
84	4	-1.745		-2.311	1828.89	9.00	4	-0.347	-1.527	-2.028
85	36	0.939	36	1.015	2276.64	32.15	36	0.046	0.397	0.977
86	16	-0.738	25	-0.001	2798.75	24.01	20.25	0.631	0.232	-0.370
87	36	0.939	36	1.015	3402.38	36.00	36	1.205	1.113	0.977
88	4	-1.745	4	-1.942	646.96	9.61	4	-1.684	-1.080	-1.843
89	4	-1.745	16	-0.833	1129.03	9.61	9	-1.053	-1.131	-1.289
90	25	0.016	16	-0.833	1828.89	18.49	20.25	-0.414	-0.384	-0.408
91	36	0.939	25	-0.001	3402.38	22.09	30.25	1.205	-0.102	0.469
92	36	0.939	36	1.015	2798.75	27.04	36	0.631	0.460	0.977
93	25	0.016	25	-0.001	1828.89	22.09	25	-0.347	-0.070	0.008
94	4	-1.745	4	-1.942	646.96	5.76	4	-1.529	-1.480	-1.843
95	36	0.939	36	1.015	2798.75	36.00	36	0.631	1.113	0.977
96	36	0.939	36	1.015	1828.89	29.16	36	-0.190	0.600	0.977
97	16	-0.738	9	-1.480	1828.89	18.49	12.25	-0.414	-0.403	-1.109
98	25	0.016	25	-0.001	1828.89	26.11	25	-0.190	-0.033	0.008
99	36	0.939	36	1.015	2798.75	26.11	36	0.631	-0.052	0.977
100	4	-1.745	4	-1.942	863.87	6.76	4	-1.167	-1.444	-1.843
101	36	0.939	25	-0.001	2276.64	27.25	30.25	0.171	0.216	0.469
102	36	0.939	36	1.015	2276.64	25.00	36	0.171	0.281	0.977
103	16	-0.738	16	-0.833	2276.64	16.00	16	0.226	-0.655	-0.786
104	36	0.939	36	1.015	2798.75	36.00	36	0.631	1.113	0.977
105	16	-0.738	16	-0.833	1828.89	16.00	16	-0.347	-0.655	-0.786
106	36	0.939	36	1.015	2798.75	24.01	36	0.631	0.232	0.977
107	16	-0.738	16	-0.833	1828.89	19.36	16	-0.347	-0.322	-0.786
108	36	0.939	36	1.015	2276.64	27.04	36	0.171	0.384	0.977
109	36	0.939	36	1.015	2798.75	29.16	36	0.631	0.637	0.977
110	25	0.016	25	-0.001	2276.64	24.01	25	0.046	0.139	0.008
111	36	0.939	25	-0.001	2798.75	27.04	30.25	0.631	0.460	0.469
112	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
113	36	0.939	25	-0.001	2276.64	24.01	30.25	0.171	0.180	0.469
114	16	-0.738	16	-0.833	1828.89	16.00	16	-0.347	-0.655	-0.786
115	16	-0.738	16	-0.833	863.87	16.00	16	-1.446	-0.655	-0.786
116	16	-0.738	16	-0.833	1828.89	16.00	16	-0.347	-0.639	-0.786
117	25	0.016	25	-0.001	2276.64	23.04	25	0.046	0.051	0.008
118	36	0.939	36	1.015	2276.64	31.36	36	0.171	0.859	0.977
119	36	0.939	36	1.015	3402.38	28.09	36	1.205	0.485	0.977
120	25	0.016	25	-0.001	1448.58	16.81	25	-0.776	-0.501	0.008
121	4	-1.745	4	-1.942	1448.58	8.41	4	-0.134	-1.259	-1.843
122	4	-1.745	9	-1.480	4094.97	10.24	6.25	-1.580	-1.073	-1.612
123	36	0.939	36	1.015	1129.03	31.36	36	-1.045	0.859	0.977
124	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
125	9	-1.325	16	-0.833	2798.75	14.44	12.25	0.631	-0.723	-1.079
126	25	0.016	25	-0.001	4094.97	25.00	25	-1.580	0.291	0.008
127	4	-1.745	9	-1.480	52.90	7.29	6.25	-2.367	-1.387	-1.612

128	9	-1.325	16	-0.833	1828.89	16.00	12.25	-0.347	-0.623	-1.079
129	36	0.939	36	1.015	2276.64	25.00	36	0.046	0.268	0.977
130	36	0.939	36	1.015	2798.75	22.09	36	0.631	-0.021	0.977
131	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
132	36	0.939	36	1.015	2798.75	28.09	36	0.631	0.612	0.977
133	36	0.939	36	1.015	2276.64	29.16	36	0.046	0.715	0.977
134	36	0.939	36	1.015	2798.75	24.01	36	0.631	0.084	0.977
135	36	0.939	25	-0.001	1828.89	29.16	30.25	-0.190	0.597	0.469
136	9	-1.325	16	-0.833	1828.89	18.49	12.25	-0.347	-0.412	-1.079
137	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
138	36	0.939	36	1.015	2798.75	30.25	36	0.631	0.757	0.977
139	36	0.939	36	1.015	2798.75	31.36	36	0.631	0.859	0.977
140	36	0.939	36	1.015	2798.75	32.49	36	0.631	0.873	0.977
141	25	0.016	25	-0.001	2276.64	20.25	25	0.046	-0.274	0.008
142	16	-0.738	25	-0.001	1828.89	20.25	20.25	-0.347	-0.276	-0.370
143	36	0.939	36	1.015	3402.38	29.16	36	1.205	0.537	0.977
144	25	0.016	36	1.015	2276.64	33.64	30.25	0.171	0.938	0.516