

CHARACTERISTICS OF MALICIOUS INSIDERS
AND THEIR RELATIONSHIPS WITH DIFFERENT
TYPES OF MALICIOUS ATTACKS

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Submitted to the Faculty of the
Graduate College of the
Oklahoma State University
in partial fulfillment of
the requirements for
the Degree of
DOCTOR OF PHILOSOPHY
July, 2017

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OF MALICIOUS ATTACKS

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ACKNOWLEDGEMENTS

Five years of Ph.D program is a long journey, I definitely cannot make it without all the helps I received from people around me. There are so many times that I was tired, stressed, or even frustrated. I evened cried one time at 3:00 am in the morning, while writing summaries for the seminar course the next day. But at every hard time, I always feel so lucky to have my family, friends, and colleagues with me. All the good people around me is the proof that God loves me.

I want to thank my Mom and Dad, without whom I could not get into this wonderful world at the first place. Mom, her name is Wanyu Guo, teaches me to be patient, to appreciate the world, and to love people. Dad, his name is Zhongfu Liang, teaches me to be strong, to be curious, and never be afraid of challenges.

I want to thank my wife, Fei Han. She is awesome, awesome and awesome. She is always patient with me, always loves me and always gets my back. Her smiles lighted me up during a lot of hard times, her jokes make me laugh in a lot of days and her breath calms me down every night.

I want to thank my advisor Dr. David Biro. He is a good friend and a mentor. Now look back at these ideas I had at my second year, the arguments we had in his office. I realize how immature my ideas are. But he never becomes impatient for even a second. I stopped by his office a lot without appointments, he always helps; I sent him emails after work hour, he always helps; I bothered him all the time even when he was on vocation, he always helps.

I also want to thank Dr. Bryan Hammer who is strict to me, that helps a lot. One sentence I said most to him is “Hey Dr. Hammer, would you please share your slides/the literature/your syllabus/your book/your codes/your candies... with me?” He is always willing to help. I still

remember the time when he was helping with a grant, as five kids' Dad, he still stayed up very late to review my applications.

Dr. Andy Luse is smart and nice. He is the one that I will come to whenever I have a question about methodology. I didn't do good at his class, but he never gives up on me. Whenever I have a problem, I know Andy will help if I ask. There are a lot of times, when I need the statistical analysis from him, he did it very quick for me even he was super busy by then. Thank you!!

Every time watching the Oscar, I laughed about their long "Thank you List". But when time comes to my own list, I feel there are too many names for this short acknowledgement. My family, my friend, my colleagues, and even strangers on campus who show me the way, thank you! Thank you all!

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Date of Degree: JULY, 2017

Title of Study: CHARACTERISTICS OF MALICIOUS INSIDERS AND THEIR
RELATIONSHIPS WITH DIFFERENT TYPES OF MALICIOUS
ATTACKS

Major Field: MANAGEMENT SCIENCE AND INFORMATION SYSTEMS

Abstract: Malicious insiders continue to pose a great threat to organizations. With their knowledge and access to organizational resources, malicious insiders could launch attacks more easily that result in more damaging impacts compared to outsiders. However, empirical research about malicious insiders is rare due to the unavailability of data. With few exceptions, many studies focus on a small number of cases. In order to identify common characteristics of a large number of malicious insiders, these studies employ text mining to analyze 133 real-world cases of offenders from military units, intelligence agencies, and business organizations with data available to public. I first compare malicious insiders sample with the general public then to the sample of benign insiders. The results show that the prevalence of antisocial personality disorder, avoidant personality disorder, disruptive mood dysregulation disorder and disgruntlement among malicious insider are higher than the general public and the sample of benign insiders. Also, the prevalence of interactions of disgruntlement and personality disorders among malicious insiders are higher than the benign insiders. The final study found that the emotional characteristics of malicious insiders are more associated with expressive attacks, on the other side, cognitive characteristics are more associated with instrumental attacks. Contributions of this study reside in two aspects: first, I utilize public data from documented malicious insider cases, implying a potentially valuable data source for future studies in this domain; second, I validate malicious insider characteristics identified in previous research, thereby establishing a foundation for more comprehensive research in the future.

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CHAPTER I: INTRODUCTION

The threat of malicious insiders has been a long lasting problem for organizations. In 480 BC, Ephialtes betrayed his own people, the Spartans, and helped Persia to invade his homeland, leading to the falling of Spartacus as well as his king, Leonidas (Herodotus, about 450 BC). Most recently, a former engineer of Google was alleged to steal thousands of files regarding the driverless car project “Waymo” before he resigned from google without prior notice. He then started his own company and sold it to Uber for \$700 million (Isaac, 2017).

The problem of malicious insiders has raised concerns of both practitioners and academia (Chen et al., 2012). For practitioners, the US Secret Service and Carnegie Mellon University conducted a series of studies in this area (CPNI, 2013). For researchers, a broad body of research has been conducted with respect to the deterrence of insiders’ harmful behaviors (Bulgurcu et al., 2010; Herath & Rao, 2009; Johnson, 2014).

These reports and studies established an insightful foundation for the study of malicious insiders. However, the current studies of malicious insiders are subject to some problems. Many studies focus on a single case as the unit of analysis and derive their findings in the form of technical reports that lack peer review (Band et al., 2006; Nurse et al., 2014). Academic research endeavors often lack empirical testing with sufficient numbers of real world malicious insider cases (Kamoun & Nicho, 2014; Nurse et al., 2014). Also, malicious insiders have been seen as a homogeneous group. However, malicious insiders, as a group of human beings, are heterogeneous in nature with respect to their personal characteristics. These differences influence insiders’ responses to organizational security measures and deterrence methods (Johnston et al., 2016; Willison & Warkentin, 2013). Thus the deterrence methods need to take these differences

into consideration.

This study is to investigate the aforementioned problems by analyzing a large number of real world malicious insider cases. These malicious insiders conduct various types of malicious attacks, including economic espionage, leaking and sabotage.

In the first study, I start with comparing malicious insiders with the general public, in order to validate the characteristics proposed by previous research. Results of the first study show that the prevalence of several personality disorders and disgruntlement among malicious insiders is higher than the general public.

Furthermore, I argue that, in order to fully support the findings and to utilize this result in information security practice, malicious insiders need to be compared with the benign insiders, because there is a chance that the malicious insiders share the same characteristics with the star employees. Also, to fully understand the characteristics of the malicious insiders, the level of analysis should extend from single characteristic level to include the interactions between characteristics. Thus in the second paper, I compare the malicious insiders with the CEOs from Fortune 500 with respect to both the individual characteristic level and the interactions level, finding that results found in the first paper are still valid when the sample of malicious insiders are compared with the benign insiders.

Finally, I analyzed the relationships between the characteristics of malicious insiders with the different types of attacks they conducted in the third study. This investigation is inspired by the fact that the characteristic that are not salient among all the malicious insider cases could label a certain type of malicious attacks. For example, narcissistic personality disorder is not a distinct characteristic of malicious insiders compared to neither the general public nor the benign insiders, however, malicious insiders with the manipulative nature of narcissistic personality tend to conduct attacks to benefit themselves.

CHAPTER II: AN EMPIRICAL VALIDATION OF MALICIOUS INSIDER CHARACTERISTICS¹

Insider attack is nothing new. In the famous book *The Art of War*, about 2500 years ago Sun Tzu described 5 different kinds of spies. A more recent case, the notorious spy Aldrich Ames was first evaluated as an “enthusiastic employee” at the beginning of his CIA career. As recognition for his outstanding performance, he eventually gained top-level clearances and access to countless classified intelligence documents. However, trust in him finally turned out to be a CIA nightmare (Weiner et al., 2014).

Unlike outsiders, insiders like Ames are legitimately empowered to access, and manipulate an organization’s information’s resources (Bishop & Gates, 2008). Insider attacks are not only easier to launch, but also can be more devastating. Damages of insider attack involve financial loss, disruption to the organization, loss of reputation, and a long-term impact on the organizational culture (Hunker & Probst, 2011).

The threat of malicious insiders has drawn attention from both practitioners and academia (Chen et al., 2012). For practitioners, the US Secret Service and Carnegie Mellon University conducted a series of studies in this area (CPNI, 2013), involving the comparison of sabotage and espionage (Band et al., 2006), sabotage in critical infrastructures (Moore et al., 2008) and insider threat in financial sectors (Randazzo et al., 2005). With respect to academic research, this area of study demands more comprehensive and in depth research because the temporal precedents of malicious insiders’ attacks are currently under researched (Willison & Warkentin, 2013).

¹ Chapter 2 is published at Journal of Management Information Systems. Liang, N., Biros, D. P., & Luse, A. (2016). *An Empirical Validation of Malicious Insider Characteristics*. *Journal of Management Information Systems*, 33(2), 361-392.

In order to investigate and aid in the mitigation of the threat posed by potential malicious insiders, it is necessary to shed light on the characteristics of known malicious insider abusers (Crossler et al., 2013). Researchers focusing on known insider incidents have suggested a number of characteristics thought to be prevalent in malicious insiders (Claycomb et al., 2013; Kamoun & Nicho, 2014; Willison, 2006); however, current research has several problems and limitations. Many studies focus on a single case as the unit of analysis and derive their findings in the form of technical reports that lack peer review (Band et al., 2006; Nurse et al., 2014). Academic research endeavors often lack empirical testing with sufficient numbers of real world malicious insider cases (Kamoun & Nicho, 2014; Nurse et al., 2014). While the current body of research posits a number of potential characteristics of insider threat, they come from multiple and distinct perspectives resulting in the lack of a systematic framework to integrate all characteristics for a clear and solid foundation to facilitate future studies (Claycomb et al., 2013; Kamoun & Nicho, 2014; Nurse et al., 2014; M. Siponen & Vance, 2010).

Part of the reason for the aforementioned shortcomings is due to a lack of data (Noy & McGuinness, 2001). Organizations are reluctant to disclose malicious insider data in fear of negative effects on their reputation (Willison & Warkentin, 2009). One potential way to overcome this issue and gain access to a larger number of malicious insider cases is to mine data from non-security related sources (Crossler et al., 2013). Twyman et al. have suggested an autonomous scientifically controlled screening system to detect hidden information, including insider threat intention, via screening interview results (Twyman et al., 2014). However, it might be economically inefficient to interview all employees. In this research I employ text mining techniques (Dumais, 2004) to evaluate a sample of 133 malicious insider threat cases pulled from public data in order to validate malicious insiders' characteristics and answer the research question:

1. Can text mining be employed to validate characteristics of malicious insiders?

Researchers have suggested a number of characteristics of malicious insiders (Crossler et al., 2013; Willison, 2006; Willison & Warkentin, 2013). The prevalence of such characteristics has not been examined in a large sample of malicious insiders. I take the keywords garnered from our text mining and code them according to characteristic identified in previous research (Crossler et al., 2013; Willison, 2006; Willison & Warkentin, 2013). I extrapolate the proportion of individuals with the given characteristics, but question how this compares to the proportion of individuals in the population at large that display these same characteristics? It would be useful to see if there is a significant proportional difference that allows the identification of characteristic areas more prevalent in malicious insiders. By comparing these proportions, I am able to answer the research question:

2. Do malicious insiders exhibit different levels of characteristics than those exhibited by the general public?

In order to answer our research questions, I will start with a comprehensive literature review in Section 2 to extract a pool of characteristics from the literature. This pool of characteristics is used as a “characteristic dictionary” in Section 3, where I will propose the framework and method to search for characteristics from real world malicious insider cases. After that, the results of a test of the proposed method will be presented. Limitations of this study and future research plans will also be discussed.

2.1 Literature Review

As noted, previous research on malicious insiders includes academic research, technical reports, and various other sources. In this section, I suggest theoretical considerations and I will present definitions or descriptions of characteristics from the literature in related domains.

2.1.1 Theoretical Consideration

The extant literature suggests that malicious insiders exhibit certain characteristics; however, malicious insider attacks include other relevant aspects including the attacker, organizational

factors, environment, and systems (Chen et al., 2012; Predd et al., 2008). A recent leadership study review (Northouse, 2015) shows that effective leadership is related to leader skills and traits, leader behavior, influence process, and other situational behaviors. Additionally, in early leadership studies in the 1930's and 1940's, the trait approach was popular and considerable research was conducted to investigate the unique traits an effective leader possesses (Yukl, 2002). Although criticized for its lack of consideration for situational and mitigating factors (Yukl, 2002), traits of leaders are still starting points for recent leadership research (Dinh et al., 2014), such as leaders' charisma traits (Bono & Ilies, 2006), leaders' skills (Lord & Hall, 2005), or leaders' attributes and behaviors (Uhl-Bien, 2006).

Similar to how researchers have investigated leaders, I believe that Trait Theory may help in explaining malicious insider threats. If traits or characteristics can be identified and attributed to malicious insiders, it could prove useful to future research in profiling and catching them.

2.1.2 Terminology and Definitions

One of the challenges insider threat studies face is the lack of a well-accepted definition of insiders (Hunker & Probst, 2011). Different researchers define the term in different ways: Willison and Warkentin (Willison & Warkentin, 2013) define insiders from the perspective of their privilege as employees or others who have access privileges as well as intimate knowledge of organization. Bishop and Gates (Bishop & Gates, 2008) define insiders based on their actions: one who violates organizational security policies. Others define insiders from the aspect of their relations with organization such as a trusted person who has access to internal information (Brackney & Anderson, 2004). Bishop (Bishop & Gates, 2008) argues that the definition of insider is contingent on the definition of perimeter such that the one inside the perimeter is insider. Hunker (Hunker & Probst, 2011) further state that the definition of insider depends on the research questions.

In the current research, our subjects are not confined to information systems. The subject pool includes all kinds of insiders attacked information or information systems. Additionally, the

malicious actions performed by these insiders include a broad range of activities. Therefore, in this research I use the broad definition by Bishop et al. (Bishop & Gates, 2008), which defines insider as:

An insider is a person that has been legitimately empowered with the right to access, represent, or decide about one or more assets of the organization's structure.

Consistent with the definition of insider, I use the Predd et al. (Predd et al., 2008) definition of insider threat as:

Insider threat is an insider's action that puts an organization or its resources at risk.

As indicated by Crossler et al. (Crossler et al., 2013), insiders whose actions cause damage to the organization could be differentiated by their intentions: those who intentionally harm the organization with deviant behaviors and those who unintentionally do something wrong, often labeled as insider threats. Also, any investigation focusing on this field should not mix these two different types of subjects. Other research also supports their arguments by proposing the insider threat continuum (Willison & Warkentin, 2013) from passive, non-volitional noncompliance behavior to volitional but not malicious noncompliance and finally, these intentional, malicious insiders. This continuum is also proposed by other researchers (Guo et al., 2011; Hu et al., 2011). The wording might be different; however, intention is consistently the key to differentiate different types of insiders within this continuum. Therefore, in this study, I modify Predd's definition by integrating intention factors to finally narrow down to our subjects, the malicious insiders:

Malicious insiders are insiders who intentionally put an organization or its resources at risk.

2.1.3 Characteristics of Malicious Insiders

Previous research has identified a number of characteristics that one or more malicious insiders have exhibited. As previously stated, many studies focused on a single case and very few considered larger samples. Therefore, characteristics of malicious insiders across a large number

of cases have yet to be determined. In the following sections, I review some of the potential malicious insider characteristics noted in the literature to date.

2.1.3.1 Personality Problems

Personality disorders include classic Axis II personality disorders (First, 1994), such as antisocial personality disorder (Shechter & Lang, 2011), narcissistic personality disorder (E. D. Shaw & Fischer, 2005; Shechter & Lang, 2011; B. Wood, 2000), and psychopathy (Shechter & Lang, 2011). Research suggests that malicious insiders (CPNI, 2013) may have a sense of entitlement (Band et al., 2006; Nurse et al., 2014; E. D. Shaw & Stock, 2011) and grandiosity (Gelles, 2005) and tend to have an inappropriate sense of self-importance or self-esteem (Gelles, 2005; Turner & Gelles, 2012) such as Machiavellianism (Maasberg et al., 2015; Nurse et al., 2014). Some have engaged in unrealistic fascination about spy work, imaginary activities (CPNI, 2013), power, or reputation (Nurse et al., 2014).

2.1.3.2 Mental Health Disorder

Mental health disorder involves evidence of Axis I Psychiatric Diagnoses derived from the American Psychiatric Association's Diagnostic Manual (First, 1994). Research reports mental health disorders such as alcohol and drug addiction, panic attacks, or seizure disorders being observed in malicious insiders (Band et al., 2006; Moore et al., 2008). Addictive behavior seems to be associated with malicious insider attacks (Johnson, 2014). These mental disorders and addictions often result in an exploitable or vulnerable lifestyle (CPNI, 2013).

2.1.3.3 Ethical Issues

Ethical beliefs are found to be relevant with insiders' rule violation behaviors (Chatterjee et al., 2015; Vance et al., 2013). Ethical issues are described as lack of empathy, conscience (E. D. Shaw & Stock, 2011), lack of personal integrity (Nurse et al., 2014), no remorse for the harm imposed on others, and an unscrupulous manner. Other issues include being superficial instead of truthful and lack of conscientiousness (CPNI, 2013). Malicious insiders' lack of ethics is usually accompanied with reduced loyalty or attachment to the organization (Nurse et al., 2014). Employ

fraud, which is one type of malicious attack, is also to be found related to ethical flexibility (Murphy & Dacin, 2011).

2.1.3.4 Social Isolation

Band (Band et al., 2006) defines social isolation problems as "...chronic problems getting along and working with others". Shaw and Fischer (E. D. Shaw & Stock, 2011) find in their case study that malicious insiders lack social skills which increase their propensity for social isolation. Shaw (E. Shaw et al., 1998) finds malicious insiders are typically introverts, and some are overly dependent on computers. Moore also reports lack of social skills as one characteristic of malicious insiders (Moore et al., 2008).

2.1.3.5 Personal or Work-Related Event

Band et al. (Band et al., 2006) defines personal or work-related event as "events that cause concerning behaviors in individuals predisposed to malicious acts." Moore (Moore et al., 2008) also confirms that malicious insiders typically experience stressful work-related events such as sanctions or internal audit. Also, the stressful experience of employees might result in higher probability of security breach (D'Arcy et al., 2014). Additionally, personal issues such as loss of family member, relationship break up or significant personal injury could also indicate a potential malicious insider (CPNI, 2013).

2.1.3.6 Emotional Characteristics

Malicious insiders are suggested to be emotionally unstable (CPNI, 2013) and might react to work-related issues negatively instead of constructively. These include feelings of being betrayed or isolated (Band et al., 2006) and fear of being excluded (Nurse et al., 2014). As a result of their inappropriate feelings, they might exhibit anger (Band et al., 2006), poor work attitude, or being stressed. However, some research states that instead of feeling negatively, malicious insiders might seek sensation as emotional response (Nurse et al., 2014).

2.1.3.7 Disgruntlement

Many studies (Greitzer et al., 2008; Nurse et al., 2014; Warkentin et al., 2011; Willison & Warkentin, 2009) argue that malicious insiders are also disgruntled employees. A study examining the Department of Agriculture and IT sabotage in the US critical infrastructure program proposes disgruntlement as a potential characteristic of malicious insiders. The disgruntlement might be a result of unmet expectations (Moore et al., 2008), lack of appreciation, and feelings of injustice or inequality (Nurse et al., 2014).

2.1.3.8 Social and Cultural Conflict

Shaw and Fischer (E. D. Shaw & Fischer, 2005) define social and cultural conflict as “differences between social, racial, or technical groups leading to tensions and conflict between the subject and others.” For example, one malicious insider made a racial comment about his African-American supervisor (E. D. Shaw & Fischer, 2005). Shaw (E. Shaw et al., 1998) finds that malicious insiders are frustrated with their personal or social relations.

2.1.3.9 Behavior Precursor

Behavioral characteristics preceding malicious attack include suspicious verbal behavior (Schultz, 2002), confrontation with peers or supervisors (Band et al., 2006), sexual harassment, hygiene problems (Moore et al., 2008), problems of accepting feedback and criticism, and anger management issues (Greitzer et al., 2013). Being defensive of criticism also appears to be a behavior precursor (Turner & Gelles, 2012).

2.1.3.10 Negative Experience

Lastly, Shaw & Fischer (Band et al., 2006) found malicious insiders experience disappointment with family or friends. As such, they might have negative history such as history of rule violation (Moore et al., 2008) and/or criminal and mental disorder (Nurse et al., 2014).

2.1.4 Other Factors

While the previous section presented characteristics of malicious insiders found in the extant literature, insider attacks could also be enabled by other factors. Additionally, before the attack is launched, other characteristics might exist beyond the psychology of the perpetrator. These might

be conditions or precursors that promote or support the malicious act. In this section, I will review and present other factors that could enable malicious insider attack.

2.1.4.1 Overdependence

By definition, insiders have access and knowledge of the organization which could facilitate the attack if they turn to malicious acts (B. Wood, 2000). Further, malicious insiders are often recruited by organizations as they may be domain experts or they are familiar with the work they are responsible for in the organization (B. Wood, 2000). In short, the organization needs them. Once malicious insiders have managerial control or access out of proportion to their technical or managerial duties, they could be a threat unless sufficiently supervised (Band et al., 2006).

2.1.4.2 Preparatory Behavior

Schultz (Schultz, 2002) argues that malicious insiders might leave deliberate marks to make a statement, make mistakes during preparation, and exhibit observable behaviors as part of preparation for the malicious action. These behaviors include information collection behaviors, information transmittal behaviors, and recruitment behaviors (S. Wood et al., 2005). Specifically, insiders might perform technical precursors such as downloading hacking software (Moore et al., 2008), establishing backdoor entry to information systems (Band et al., 2006), violating security policy, or undertaking unauthorized handling of classified materials (CPNI, 2013).

2.1.4.3 Financial Status

Some malicious insiders are motivated by profit (Shropshire, 2009; B. Wood, 2000) because of debt (Band et al., 2006; Cressey, 1953); and as a result, they might exhibit characteristics of illegal income such as a sudden change of lifestyle or excess spending. For example, when interviewed about his spying activities, Robert Hansen told investigators his motive was profit (Wise, 2002).

2.1.4.4 Rationalization

Research finds that malicious insiders might rationalize their behavior (Warkentin et al., 2011) by self-deception (Turner & Gelles, 2012), blaming others, or arguing what they compromise is

not important (Gelles, 2005; Kamoun & Nicho, 2014). Individuals who conduct Internet fraud, which is a subtype of malicious attack, tend to rationalize their behaviors (Cohen et al., 2012; Cressey, 1953; Murphy & Dacin, 2011; Wm. Dennis Huber et al., 2015). A summary of all the aforementioned characteristics is presented in Table 1.

Table 1: Summary of characteristics in previous research

Characteristic	Sub-Characteristic Examples	Citation
Personality Disorder	1. Sense of entitlement 2. Grandiosity 3. Sense of self-importance	1. Band et al., 2006; Nurse et al., 2014; Shaw & Stock, 2011; 2. Gelles, 2005 3. Gelles, 2005; Turner & Gelles, 2012
Mental Health Disorder	1. Addictive Behavior 2. Exploitable Behavior 3. Panic Attack	1. Johnson, 2014 2. Shaw & Stock, 2011 3. Band et. al., 2006; Moore, et al., 2008
Ethical Issues	1. Lack of empathy 2. Lack of Conscience 3. Superficial	1. Nurse et al., 2014 2. Shaw & Stock, 2011 3. Shaw & Stock, 2011
Social Isolation	1. Lack of Social Skills 2. Dependent on Computer 3. Introverted	1. Shaw & Fischer, 2011 2. Shaw et al., 1998 3. Shaw et al., 1998
Related Event	1. Demotion 2. Change in Supervisor 3. Personal Conflict;	1. Band et al., 2006 2. Nurse et al., 2014; Moore, et. al. 2008 3. Nurse et al., 2014
Emotional Characteristics	1. Feeling being Betrayed; 2. Fear of being Excluded; 3. Anger;	1. Shaw & Fischer, 2011 2. Nurse et al., 2014 3. Band et al., 2006
Disgruntlement	1. Unmet Expectation; 2. Lack of Appreciation; 3. Feeling of Injustice;	1. Moore, et al., 2008 2. Nurse et al., 2014 3. Nurse et al., 2014
Social and Cultural Conflict	1. Racial Comment; 2. Frustrated with Relations;	1. Shaw & Stock, 2011 2. Shaw et al., 1998
Behavior Precursor	1. Verbal Behavior; 2. Sexual Harassment; 3. Defensive upon Criticism;	1. Schultz, 2002 2. Moore, et al., 2008 3. Turner & Gelles, 2012
Negative Experience	1. Disappointment with Friends; 2. History of Arrest; 3. History of Mental Disorder;	1. Shaw & Fischer, 2011 2. Moore, et al., 2008 3. Nurse et al., 2014
Overdependence	1. Managerial control; 2. Root administrator; 3. Without supervision;	1. Shaw & Stock, 2011 2. Shaw & Stock, 2011 3. Shaw & Stock, 2011
Preparatory Behavior	1. Download Hack Software; 2. Creating Backdoor Account; 3. Information Collection;	1. Moore, et al., 2008 2. Band et al., 2006 3. Wood et al., 2005

Financial Status	1. Debt; 2. Illegal Income; 3. Change of Lifestyle;	1,2. Band et al., 2006; 3. Wood, 2000
Rationalization	1. Self-Deception; 2. Blaming others; 3. Bragging or Joking about Classified Information	1. Turner & Gelles, 2012 2. Kamoun & Nicho, 2014; Gelles, 2005 3. Kamoun & Nicho, 2014; Gelles, 2005

As implied by previous research, malicious insiders might exhibit some personality cues, be in a certain status, or exhibit suspicious behaviors. However, most research lacks sufficient data, resulting in a lack of strong empirical analysis. In the following section, I propose a method designed to verify the aforementioned characteristics as well as extract characteristics that emerge in cases but are not mentioned by previous research.

2.1.5 States and Traits

The current research investigates the characteristic commonality among known malicious insiders; as identified by the previous research, characteristics should be considered as two types: traits or states (Chaplin et al., 1988). Although not explicitly defined, Allport and Odbert (Allport & Odbert, 1936) describes trait as “consistent and stable modes of an individual’s adjustment to his environment” and states as “present activity, temporary states of mind and mood”.

For the purpose of validation, in the current study I will shed light on the commonality of traits or characteristics, including trait-like conditions, among malicious insiders. Contrarily, by the definition of states, they should be very sensitive to the uniqueness of each individual case, such that I do not expect certain behaviors or events presented in one case to be commonly observed in other cases.

2.1.6 Propositions

As noted, previous research has identified a number of potential characteristics believed to be common of malicious insiders. The potential characteristics have yet to be validated across a

large sample of malicious insiders. The question then becomes, do malicious insiders exhibit these characteristics different than the rest of the general population?

Narcissistic personality disorder is characterized by grandiosity and sense of entitlement (First, 1994). One with the sense of grandiose and superiority typically believes that they possess unparalleled skills or talent (Gelles, 2005); and with their self-perceived abilities, they are prone to fantasize about power, success, and attractiveness (Shechter & Lang, 2011), and perceive themselves as deserving special, or preferential, treatment (E. D. Shaw & Fischer, 2005). Once their craving for admiration and special attention cannot be met, they might seek validation and affirmation of their self-importance from other sources such as competitors or opponents (Gelles, 2005). Even if they don't seek ego fulfillment themselves, their eagerness for recognition subjects them to showboating and manipulation (Shechter & Lang, 2011).

On the other hand, if individuals have antisocial personal disorders which is defined as a "pervasive disregard for the law and the rights of others" (American Psychiatric Association, 2000), they tend to aim at whatever they want, no matter whether it is illegal or others might be hurt. Since these insiders know more about the organization (Bishop & Gates, 2008) and it is hard for them to form attachment and loyalty to the organization (Gelles, 2005), they are prone to attack the organization from inside.

Avoidant personality disorder is characterized by social inhibition and unwillingness to get involved with people (First, 1994). However, teamwork is essential in organizations and social skills are essential in team settings (Morgeson et al., 2005). The inability to work and communicate effectively with others decreases the odds of confronting colleagues with legitimate work-related complaints (Band et al., 2006). When the employee experiences stressful personal or work-related events such as demotion or death of significant others (Band et al., 2006; Nurse et al., 2014), isolation resulting from avoidant personality disorder jeopardizes the possibility that they could solve problems constructively (Shechter & Lang, 2011). Instead, they might engage in more destructive behavior and launch an insider attack. Given this, I propose the following:

Proposition 1-1: Prevalence of narcissistic personality disorder in malicious insiders is higher compared to general population.

Proposition 1-2: Prevalence of antisocial disorder in malicious insider is higher compared to general population.

Proposition 1-3: Prevalence of avoidant personality disorder in malicious insider is higher compared to general population.

Disruptive mood dysregulation disorder (DMDD) is one type of mental health disorder which is featured by persistently outburst of temper or often irritable mood (DSM-5 American Psychiatric Association, 2013). DMDD (American Psychiatric Association, 2000) is structurally linked to emotion regulation and is highly associated with negative emotional response such as emotional instability or bursts of anger (Etkin & Wager, 2007). Studies about malicious insiders report high correlation between the presence of emotional dysregulation and malicious intent (Greitzer et al., 2013).

Therefore, I propose:

Proposition 2: Prevalence of disruptive mood dysregulation disorder in malicious insiders is higher compared to the general population.

Comorbidities of substance abuse and anxiety disorder as well as personality disorder are observed in a national-wide survey (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004; Grant, Stinson, Dawson, Chou, Ruan, et al., 2004). Coupled with the fact that the addiction behaviors could impair professional abilities (Band et al., 2006), employees who have a substance addiction probably fail to work effectively and productively, making mistakes which might result in poor performance reviews, disciplinary action (Greitzer & Frincke, 2010), or sanctions (Moore et al., 2008). These events might cause the individual stress leading to a malicious attack from inside (Shechter & Lang, 2011). Given this, I propose:

Proposition 3-1: Prevalence of alcohol abuse in malicious insiders is higher compared to the general population.

Proposition 3-2: Prevalence of substance abuse in malicious insiders is higher compared to the general population.

Work place disgruntlement is associated with perceived organizational injustice (Warkentin et al., 2011; Willison & Warkentin, 2009). Adams claims that individuals that feel a sense of inequality may attempt to mitigate this feeling by behavioral means such as acting out in some manner (Adams, 1965). In extreme cases, these behavioral means might include malicious attacks such as computer crime (Warkentin et al., 2011; Willison & Warkentin, 2009). Further, the devalued or dissatisfied feelings of disgruntled employees (Greitzer et al., 2008) might affect their emotional state (Nurse et al., 2014) resulting in negative feelings toward the employer or colleagues. Once such negative feelings turn severe or even destructive, disgruntled employees tend to launch attacks (CPNI, 2013). I therefore propose:

Proposition 4: Prevalence of disgruntlement in malicious insiders is higher compared to the general population.

Considering these propositions I now focus on a method for evaluating them. The following section describes our process for validating characteristics of malicious insiders compared to that of the general population. I believe malicious insiders exhibit the characteristics noted above in greater levels than found in the general US population. At this point, our validation efforts focus on individual characteristics only. While consideration of interactions of characteristics is necessary at some point, it is beyond the scope of our current study.

2.2 Method

In this study, I will compare the percentage of malicious insiders with certain characteristics with the percentage of the same characteristics in general public. With respect to malicious insiders, the methods employed in the current study include three steps: in the first step I use the name of malicious insiders (n=133) to collect relevant documents about him/her. Next, in the second step I use a random subset of samples (n=30) to construct and update our dictionary. Finally, I use this dictionary to search and extract characteristics in malicious insider portfolios. As for the general public, I use the reported percentages from previous studies and surveys. In this section, I will first describe the procedure employed to collect data and construct the dictionary, then the extraction process will be introduced. Finally, I will introduce sources of data about general public as well as how will I compare the malicious insiders in our sample and the general population.

Figure 1 shows the process flow diagram of the first and second step. The dictionary creation includes four parts: data collection, dictionary construction, characteristic retrieval, and dictionary update. Note that the process starts from the one at the up left and bottom middle and then ends in up right.

2.2.1 Sampling Criteria and Data Collection

The malicious insiders to be analyzed in this study are drawn from malicious insider's population who were convicted by US courts from 2000 to 2015. Malicious attacks of these convicted include spying, espionage, economic espionage, illegal exports and other security related acts.

Due to the infrequency of malicious insider cases, previous research suggests that it is impractical to draw a random sample (Band et al., 2006). In the current study, I utilize the eminence criterion proposed by Simonton (Dean Keith Simonton, 1999) to select the sample. This criterion has been applied in studies to investigate personality or social psychology when direct analysis of the subjects is far more difficult and even practically or ethically impossible (Dean Keith Simonton, 1999). For example, it is almost impossible to ask Edward Snowden to

fill out some personality assessment questionnaire². This type of research includes the investigation of the relationship between creativity and leadership (Vessey et al., 2014), the mad-genius controversy (Dean Keith Simonton, 2014b), relation between mental health and achievement (Dean Keith Simonton & Song, 2009) and other phenomenon (Post, 1994; Suedfeld & Bluck, 1993).

² Thanks to one of the reviewers to prompt this example.

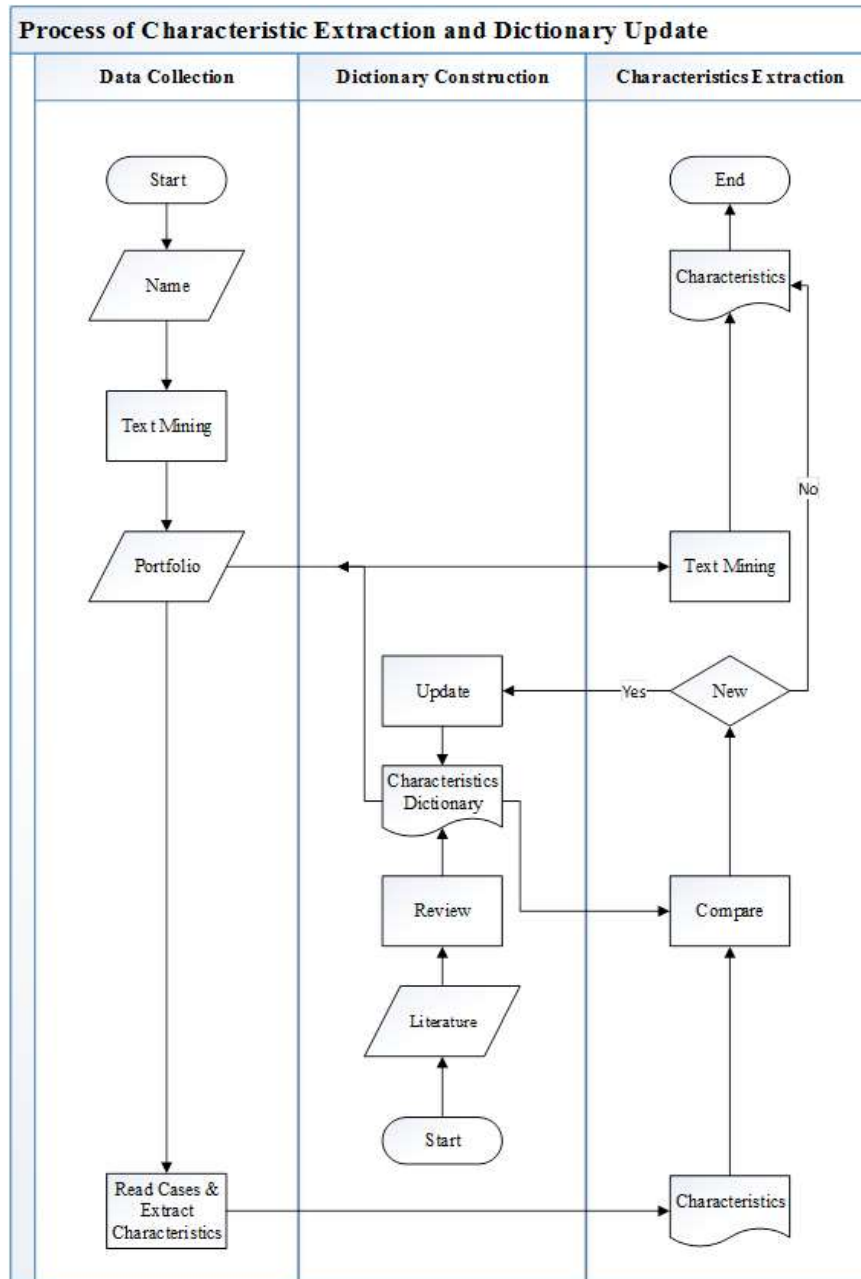


Figure 1: Method process flow

Under this criterion, eminence of an individual or prominence of the event associated with the individual could be used as sampling criterion (Dean Keith Simonton, 2009), and in practice, the eminence of this person or the prominence of the event could be evaluated by the comprehensiveness of representation in archival sources (Dean Keith Simonton, 1999). Eminence could be good or bad (Dean Keith Simonton, 2009), which means eminent people could be

famous or notorious. In the current study, since I am using the press media releases as data sources, I use the extent of media coverage as index of eminence and it is operationalized as the number of reports for an individual.

We start with the names of malicious insiders such as “Aldrich Ames,” “Robert Hanssen,” and other known malicious insiders as keywords. Next, I retrieve documents from the Internet containing these name keywords utilizing information retrieval techniques (Chakraborty et al., 2014). The documents retrieved may be news articles, court transcripts, or other accounts of insider incidents associated with the named keywords. All cases have multiple articles reporting on the incident, hereafter referred to as a “portfolio.”

2.2.2 Dictionary Construction and Update

A random subset ($n=30$) of eminent malicious insiders in the datasets is used in the dictionary construction. The documents retrieved are separated by paragraph for analysis with each record in the database consisting of a paragraph from an article. Additionally, when each paragraph is stored, a name tag is added indicating which malicious insider this paragraph is describing.

2.2.2.1. Dictionary Construction

Construction of the dictionary is a dynamic process with the dictionary updated after each portfolio of a malicious insider is analyzed. The basis of this dictionary is derived from the attributes in the extant literature (see Table 1). The characteristic dictionary has two attributes, keyword and characteristic. “Keyword” contains target words or phrases I am searching for in documents; the “characteristic” implies what the corresponding target words or phrases indicate. For example, the keyword “being caught” implies the characteristic of “rule violation”.

2.2.2.2 Extracting Keywords from Portfolio

In this step, I first prepare documents via parsing and stemming. Then I employ computer aided information extraction techniques used in previous research (Nahm & Mooney, 2002) to retrieve keywords from prepared documents that are listed in the characteristics dictionary.

2.2.2.3 Dictionary update

After keywords were extracted with text mining software, I read through cases and manually extracted keywords or phrases present in the documents but missed by computer-aided extraction in an effort to refine the dictionary. For example, there may be synonyms to the dictionary words and phrases not picked-up by the automated process. These missed characteristics are then added to the dictionary.

After these four steps, I start over again using a new insider's name, but with an updated version of the dictionary. Finally, these iterations will cease once the number of updates drops and the returns become marginal.

2.2.3 Characteristics Extraction

The 14 characteristics proposed by aforementioned literature have been classified into two groups with different extracting strategies. Group I includes behavioral precursor, predatory behavior, financial status, personal or work related event, negative experience, ethical issues, disgruntlement, overdependence, social and cultural conflict and rationalization. For this group, all characteristics will either be present or not. Therefore once at least one keyword has been found in the portfolio, this characteristic will be considered present in this malicious insider case. Characteristics in Group II consists of clinical disorders, including personality disorder (narcissistic personality disorder, antisocial personality disorder and avoidant personality disorder) and mental health disorder (Disruptive mood dysregulation disorder, substance use disorder and alcohol use disorder). The presence of a keyword only indicates the presence of one symptom for certain disorder. I used the procedure recommended by Diagnostic and Statistical Manual of Mental Disorders (DSM-V) (DSM-5 American Psychiatric Association, 2013) to assess the exhibition of these characteristics. In DSM-V (DSM-5 American Psychiatric Association, 2013), clinical disorders are diagnosed by diagnose standardized criteria. Typically, several symptoms are described for a certain disorder and then the disorder is confirmed if the number of symptoms exhibited exceeds certain threshold. The thresholds vary by disorder. For example, 7 symptoms are described for antisocial personality disorder such as impulsivity or lack

of remorse. If 3 or more symptoms are exhibited, then the diagnose criteria is met. Therefore, for characteristics in Group II, keywords belonging to each characteristic are first coded into symptoms of the characteristic described by DSM-V by two raters. Then when using the dictionary to scan a malicious insider' portfolio, presence of a keyword represents the existence of one symptom into which the keyword has been coded. Finally, if the number of symptoms identified exceed the threshold defined by DSM-V diagnose criteria, the disorder is considered being exhibited for this malicious insider.

2.2.4 Validity of Data Collected from Press Media and “Distant” Assessment Method

News media data has been used in malicious insider studies to identify clinical disorders in previous research (Band et al., 2006). The U.S. Department of Defense's Personnel Security Research Center (PERSEREC) has created an espionage database from publically available data such as news media (Band et al., 2006; S. Wood & Wiskoff, 1992). Media data has been used to analyze the characteristics of employees who conducted internal fraud (Wm. Dennis Huber et al., 2015) and managers' behavior in corporate fraud (Cohen et al., 2012). I argue that the secondary data, specifically, media data I used in this research offers a valid foundation for analyzing malicious insider characteristics.

Secondary data is data collected by someone other than the current researcher (Pienta et al., 2011). When conducting “distant” measures of subjects who are not accessible for direct assessment or direct measurements are physically or ethically impossible (Dean Keith Simonton, 2009), various materials could be used to analyze the individual differences of subjects, such as biographies, speeches, academic literature or newspapers (Spangler et al., 2012). Materials collected from these sources might provide unobtrusive observations of subjects being investigated reducing the interface of researcher or measurement instruments with the subjects (Trochim et al., 2015). Various academic endeavors have validated that results from the “distant” measures using archival or historical data are comparable with findings resulted from traditional direct assessment methods, such as Simonton's research about mental health of eminent people

(Dean Keith Simonton & Song, 2009), personality of US presidents (Dean K Simonton, 1986), geniuses (Dean Keith Simonton, 2014a), Mumford's findings about leadership violence (Mumford et al., 2007), and Ligon's study about famous leaders' life styles (Ligon et al., 2012).

Distant measures can all be quite useful when direct inquiry methods such as questionnaire or interviewing involves asking question that might be sensitive, embarrassing, or even incriminating (Dalton & Metzger, 1992). Social desirability might severely bias the response (Thomas & Kilmann, 1975). For example, Robertson argues that managers are reluctant to report their true ethical preferences, because they don't want their ethics to be observed (Robertson, 1993).

Newspaper reports generated at the same time as the investigation of an event or an individual (Harris, 2001) could overcome the social desirability bias brought by direct assessment.

Newspaper or press articles as a data source have been used in numerous academic endeavors about individual differences, such as DeChurch et al. (DeChurch et al., 2011) research about leadership styles, Harris' (Harris, 2001) research about business ethics, and Bardi et al (Bardi et al., 2008) research about value and value-behaviors. While some might claim such data may be incomplete or incorrect, research shows that the findings from newspaper data could be comparable with results derived from traditional direct assessments (Bardi et al., 2008). With these advantages noted, the current study utilizes news articles along with court documents and biographies as a data source to analyze individual differences of malicious insiders.

Admittedly, newspaper does have bias in its contents; however, I argue that bias in news articles won't be a serious issue as discussed below. Criticism and concerns about newspaper report mainly focus two aspects: news articles selectively report events associated with an individual (selection bias) and for the event they report, and information of the event is manipulatively reported (description bias) (McCarthy et al., 1999).

With regard to selection bias, critics maintain that many factors will affect the "newsworthiness" of an event, and that coverage of events associated with an individual will be

selectively biased (Barranco & Wisler, 1999). Specifically, factors affecting selection bias include event characteristics, publisher characteristics and issue characteristics (Oliver & Myers, 1999).

However, in the current study I use google search engine to inquiry news articles entries, and our data sources are not limited to a specific newspaper or a specific time frame. Articles entering into analysis include ones from both local, national, and, in some cases international newspapers. Samples in this research contain only malicious insider attacks that draw a national media attention. The three factors affecting selection bias won't significantly reduce the media coverage of events.

For description bias, research has identified three sources for inaccurate or even erroneous description: omission, misrepresentation and framing (McCarthy & McPhail, 1998). These factors are mitigated by our research methods; since I employ google search engine, multiple sources are combined as data source. Therefore, omitted information in a specific newspaper is less likely to be omitted by all other newspapers, especially considering I only use eminent malicious insider cases. Additionally, the misrepresentation and framing problem would also be mitigated by multiple sources; various sources reporting on the same event could help to account for differences in reporting.

To be noted, as I argue for the validity of news articles, that doesn't imply distortion won't happen in these materials. Our intention is to show that I can overcome some bias in newspaper articles. I could also argue that data collected from the malicious insider himself (or herself) or authorities could also be biased as all actors have a stake how the events are portrayed (Earl et al., 2004).

2.2.5 Data about General Population

Since I are comparing the malicious insiders with general public in the current study, in this section, I will describe where the data of general population, with respect to each characteristic I

plan to compare, with came from. A summary of the prevalent data about general public is presented in table 2.

Table 2: Summary of general population data source

Characteristics	Sources
Narcissistic Personality Disorder	Stinson, et. al. 2008
Antisocial Personality Disorder	Grant et. al., 2004
Avoidant Personality Disorder	Grant et. al., 2004
Disruptive Mood Dysregulation Disorder	Copeland, et. al., 2013
Alcohol Use Disorder	Grant et. al., 2015
Substance Use Disorder	Grant et. al, 2004
Disgruntlement	Conference Board Mail Survey, 2014

The percentage of narcissistic personality disorder in the general public was derived from the Wave 2 national epidemiological survey on alcohol and related conditions (Stinson et al., 2008). This survey was face-to-face interview with 34,653 subjects nation-wide. This survey used the fully structured diagnostic interview proposed by DSM. As reported by Stinson et al (Stinson et al., 2008), narcissistic personality disorder has a prevalence of 6.2 percent in the subjects being interviewed.

The antisocial personality disorder, avoidant personality disorder, and substance use disorder data for the general public is from National Epidemiologic Survey conducted during 2001-2002 (Grant, Hasin, et al., 2004; Grant, Stinson, Dawson, Chou, Dufour, et al., 2004). In this survey, all regions in the U.S. were sampled, including District of Columbia, Alaska and Hawaii. The minority was oversampled to produce enough respondents. With an 81percent of response rate (n=43,093), 3.63 percent of the general public have antisocial personality disorder and 2.63 percent have avoidant personality disorder. The respondents were interviewed with Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV version (First, 1994). Using

the same data, Grant et al. reported that 9.35 percent of the general public have a prevalence for substance use disorder (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004).

Prevalence data for disruptive mood dysregulation disorder (DMDD) was estimated using samples from three community studies. With 7,881 observations covering 3,258 subjects, the prevalence of disruptive mood dysregulation disorder ranged from .8 percent to 3.3 percent in these three communities (Copeland et al., 2013). With respect to choosing general public statistics, I intentionally choose the highest prevalence from previous research. Copeland et al. (Copeland et al., 2013) found DMDD as high as 3.3 percent in segments of the general population. I used that higher proportion to represent the general public prevalence.

Prevalence of alcohol use disorder was estimated using 36,309 subjects of US noninstitutionalized civilian adults (Grant et al., 2015). Data was collected from 2012 through 2013 with face-to-face interviews. The results show that 29.1% of the subjects could be diagnosed as alcohol use disorder at least one time during lifetime.

For disgruntlement, data was derived from a mail survey about job dissatisfaction conducted by Conference Board to 5,000 households and the response rate of 33.5 percent (Conference Board). Conference Board is an independent and international research institution which has conducted job satisfaction surveys since 1987 (Conference Board). The characteristic of disgruntlement is operationalized as job dissatisfaction in both dictionary construction and keyword search. Therefore, the results from malicious insiders and from the general public are comparable.

2.2.6 Methodological and Statistical Control in Comparing Malicious Insiders Group with General Population

We compare the different levels of prevalence for certain characteristics of malicious insiders with the general public. In the research studies of the general population structured interviews or surveys were utilized to diagnose disorders. However, in our research, text-mining is used to

extract the corresponding characteristics of malicious insiders. While the data comes from different sources, I took precautions for both the methodological and statistical aspects.

With respect to diagnosis method, I use the similar process as the one in clinical settings. In structured interview and in our method, symptoms exhibited by the subject are first grouped into diagnosis criteria, and then the number of diagnosis criteria presented is used to make the final diagnosis decision. In our research, keywords describing the malicious insiders are first coded into each diagnosis criteria, then the presence of single or multiple keywords themselves will not be considered as the existence of clinical disorder. The presence of a certain disorder will only be confirmed if the number of diagnosis criteria meets the required limit by DSM-V.

Statistically, I employ the Fisher's exact test (Fisher, 1970) to check for difference in proportions within two independent samples. The Fischer exact test has been argued to be too conservative a test and sometimes won't find results when they are really there (Berkson, 1978; D'agostino et al., 1988; Liddell, 1976). Combined with the fact that I intentionally choose the highest percentage among reported results about general public, these precautions effectively bridge the gap between different data sources for general public and for malicious insiders.

2.3. Analysis and Results

In this section, I first report on the data collection and dictionary refinement results. Then I present the characteristic extraction process and conclude by presenting newly identified characteristics that I did not see in the literature.

2.3.1 Data Collection

We randomly choose 133 malicious insider threat cases for the current study. All of the malicious insiders were found guilty and convicted by U.S. court. I see this as a check to ensure all our cases were indeed malicious insider incidents.

2.3.2 Dictionary Construction

We extracted 380 keywords from malicious insiders' attributes proposed by extant literature and 345 characteristics are refined from these keywords using the characteristic dictionary. Using two example statements below, I provide an example of the process. The first statement is an example of characteristics in Group I and the second statement is an illustration of characteristics in Group II.

Example Statement:

1. Disgruntlement: Employee observed to be dissatisfied in current position; chronic indications of discontent, such as strong negative feelings about being passed over for a promotion or being underpaid, undervalued; may have a poor fit with current job (Greitzer et al., 2013).

2. Antisocial Personality Disorder: The employee engages in persistent lying or stealing, disregard the safety of self or others, and possess a superficial charm or wit (Shechter & Lang, 2011).

In the first example statement, three keywords are extracted: “dissatisfied”, “discontent”, and “pass over for a promotion”, and they belong to the characteristic of disgruntlement. After these three records are added into the dictionary, they are used to extract these same keywords for cases examined later. If the keyword is found, I consider it as a “hit” for the corresponding characteristic.

In the second example statement, two keywords are extracted: “lying” and “disregard”. These keywords are coded into the second and fifth diagnosis criteria of antisocial personality disorder (ASPD) in DMS-V (DSM-5 American Psychiatric Association, 2013). The second criteria is “deceitfulness, as indicated by repeated lying, use of aliases, or conning others for personal profit or pleasure” and the fifth criteria is “reckless disregard for safety of self or others.” When used scanning the malicious insider portfolios, if the keyword is found, I consider it as a “hit” for the corresponding diagnosis criteria. The extraction result for these two statements is shown in Table 3.

Table 3: Part of characteristic dictionary

Characteristic ID	Keywords	Characteristic/Diagnosis Criteria	Origins
1	Dissatisfied	Disgruntlement	Example Statement 1
2	Discontent	Disgruntlement	Example Statement 1
2	Pass over for a promotion	Disgruntlement	Example Statement 1
3	Lie	ASPD2	Example Statement 2
4	Disregard the safety	ASPD5	Example Statement 2

2.3.3. Final coding

Using the final dictionary, thematic analysis was used to code all the keywords. Given the existence of a predefined set of characteristics, a deductive approach was used to code the keywords (Crabtree & Miller, 1999). The coding started with two separate coders separately coding 10 percent of the keywords for the identified overarching characteristics of antisocial personality disorder, narcissistic personality disorder, avoidant personality disorder, alcohol use disorder, and disruptive mood dysregulation disorder and then comparing results. The Cohen's Kappa metric for inter-rater reliability between the raters was 0.84, indicating excellent (Fleiss et al., 2013) to almost perfect (Landis & Koch, 1977) agreement between the raters. Afterwards, the two coders categorized each keyword within its respective higher category into the individual characteristic codes within each category. The Cohen's Kappa metric was 0.97, indicating excellent to almost perfect alignment. At this point, one of the two raters coded the rest of the keywords.

2.3.4. Characteristic Extraction Results

The proportion of malicious insiders identified with substance use disorder is significantly greater than in the overall population, ($p < 0.001$) with the proportion confidence interval from 0.27 to 0.45 greater for malicious insiders, supporting proposition 3-2. The proportion of malicious insiders with antisocial disorder is significantly greater than in the overall population, ($p < 0.001$), supporting proposition 1-2, the proportion confidence interval is only 0.01 to 0.13 greater for malicious insiders. The proportion of malicious insiders being dissatisfied is

significantly greater than in the overall population, ($p < 0.001$) with the proportion confidence interval from 0.37 to 0.47 greater for malicious insiders, supporting proposition 4.

Table 4: Propositions comparison between malicious insiders sample and the general population

Prop	Characteristics	Study		Population		Difference Test			Support
		Proportion	Sample	Proportion	Sample	p-value	Confidence Interval		
P1-1	Narcissistic Personality Disorder	.023	133	.062 (Stinson et al., 2008)	34653	0.09	-0.01	-0.07	NO
P1-2	Antisocial Personality Disorder	.105		.036 (Grant, Hasin, et al., 2004)	43093	< 0.001	0.01	0.13	YES
P1-3	Avoidant Personality Disorder	.023		.024 (Grant, Hasin, et al., 2004)	43093	1	-0.03	0.03	NO
P2	Disruptive Mood Dysregulation Disorder	.015		.033 (Copeland et al., 2013)	918	0.40	-0.05	0.01	NO
P3-1	Alcohol Use Disorder	.010		.291 (Grant et al., 2015)	36,309	<0.001	-0.26	-0.30	NO
P3-2	Substance Use Disorder	.451		.094 (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004)	43093	< 0.001	0.27	0.45	YES
P4	Disgruntlement	.940		.523 (Conference Board)	1673	< 0.001	0.37	0.47	YES

Conversely, the proportion of malicious insiders with narcissistic personality disorder, avoidant personality disorder and disruptive mood dysregulation disorder is not significantly greater than in the overall population, ($p = 0.09$, 1 and 0.40 respectively), which does not support proposition 1-1, 1-3 nor 2. While significant, the proportion of alcohol use disorder among malicious insiders is significantly less than in the overall population, ($p < 0.001$) with the

proportion confidence interval from 0.26 to 0.30 less for malicious insiders, contrary to proposition 4.

If I lower the number of diagnosis criteria down by 1, I have the propositions 1-3 and 2 supported with regard to avoidant personality disorder and dysregulation disorder, as seen in table 5.

Table 5: Propositions comparison between malicious insiders sample and the general population (lowering diagnosis criteria by 1)

Prop	Characteristics	Study		Population		Difference Test			Support
		Proportion	Sample	Proportion	Sample	p-value	Confidence Interval		
P1-1	Narcissistic Personality Disorder	.075	133	.062 (Stinson et al., 2008)	34653	0.65	-0.04	0.06	NO
P1-2	Antisocial Personality Disorder	.421		.036 (Grant, Hasin, et al., 2004)	43093	< 0.001	0.30	0.47	YES
P1-3	Avoidant Personality Disorder	.098		.024 (Grant, Hasin, et al., 2004)	43093	< 0.001	0.02	0.13	YES
P2	Disruptive Mood Dysregulation Disorder	.090		.033 (Copeland et al., 2013)	918	0.003	0.003	0.11	YES
P3-1	Alcohol Use Disorder	.135		.291 (Grant et al., 2015)	36,309	<0.001	-0.09	-0.22	NO
P3-2	Substance Use Disorder	.451		.094 (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004)	43093	< 0.001	0.27	0.45	YES
P4	Disgruntlement	.940		.523 (Conference Board)	1673	< 0.001	0.37	0.47	YES

Note: Statistics are from the same sources of table 4

Under the revised criteria, the proportion of malicious insiders with avoidant personality disorder is significantly higher than in general public ($p < 0.001$) with the proportion confidence interval from 0.02 to 0.13, supporting proposition 1-3. The proportion of malicious insiders with disruptive mood dysregulation disorder is significantly greater than the overall population, ($p = 0.003$), supporting proposition 2, the proportion confidence interval is 0.003 to 0.11 greater for malicious insiders.

On the contrary, the proportion of malicious insiders with narcissistic personality disorder is still not significantly different from proportion in general public ($p = 0.65$). Also, the proportion of malicious insiders with alcohol use disorder is still significantly less than the proportion in general public ($p < 0.001$) with the proportion confidence interval of 0.09 to 0.22 less than in general public.

Several issues should be noted from our analysis results. First, when applying DSM diagnosis criteria required number of symptoms strictly, most of the propositions about personality or mental health disorders are not supported. However, if I just lower the required number by one, all of them except narcissistic and alcohol use disorders are significant. This might be due to the fact that the diagnosis criteria are applied more strictly in our analysis than in a clinical diagnosis in that that one symptom is only labeled as one diagnosis criterion. In clinical practice, one symptom might infer multiple diagnosis criteria. For example, if a subject is described as “always drunk”, then this might indicate both (1) the subject is taking large amount of alcohol, (2) the subject spend a lot of time consuming alcohol and recovering from its effects. However, in our research, if the keyword “always drunk” is found in the portfolio, it is only classified into one criterion.

In Grant et al.’s research (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004), substance use disorder includes alcohol use disorder. However, in our research, alcohol use disorder is excluded from substance use disorder. However, the proportion of malicious insiders having substance use

disorder is still higher than the proportions in Grant et al.'s research, indicating an additional support for our proposition P3-2.

2.4. Discussions and Limitations

We learned that text-mining can be used in a malicious insider study; specifically, the information extraction techniques could extract characteristics based on our dictionary. More importantly, it enabled us to validate, and in some cases question, characteristics of malicious insiders found in previous research.

When compared to the general population, malicious insiders exhibited greater proportions of most of the characteristics posited, thus confirming the characteristics found in previous research. Malicious insiders have more personality problems, mental health disorders, and substance abuse problems. Interestingly, one trait or characteristic that seem to come up often in the previous literature is narcissistic personality disorder. However, our findings suggest that malicious insiders actually exhibit less narcissism than those in the general population. This may be due to a number of reasons. First, narcissism suggests that individuals want positive attention and recognition. Carrying out a malicious act would be contrary to their objectives. Second, as Deluga (Deluga, 1997) notes, narcissism is not necessarily a destructive trait. In an extensive study of their biographies, many US Presidents were found to be narcissistic.

Table 6: Frequency of characteristics in previous research

Characteristics	Number of Cases	Percentage in Total Cases
Predatory Behavior	133	100%
Personal or Work Related Event	133	100%
Negative Experience	133	100%
Financial Status	133	100%
Behavioral Precursor	133	100%
Emotional Issues	132	99%
Ethical Issues	130	98%
Mental Health Symptoms	128	96%
Disgruntlement	125	94%
Personality Disorder Symptoms	125	94%
Social Isolation	118	89%
Overdependence	118	89%
Rationalization	88	66%
Social and Cultural Conflict	40	30%

As shown in Table 6, all characteristics proposed by previous research are identified in our cases, however, with different commonalities. For this study I only offer propositions about characteristics in which I could find data on the greater population. Nonetheless, our text mining techniques enable us to identify the most prevalent characteristics from a large sample. Among these characteristics, behavioral precursors, predatory behavior, personal or work related events and financial status were found in all cases. It remains to be seen how these events influence the perpetration of incidents by malicious insiders.

More than 90 percent of the malicious insiders in our study have experienced mental health disorder symptoms such as paranoia and gender confusion. Other prominent traits include emotional instability (i.e., outburst of temper), ethical issues like lying, lack of empathy or disregarding others' need, disgruntlement such as dissatisfaction with current job, and personality disorders symptoms such as arrogance, fantasizing behavior or manipulative behaviors. Also, almost 90 percent of malicious insiders exhibit social isolation or the organization they attacked is overly dependent on them. Of the other characteristics noted in the previous literature, rationalization and social isolation score relatively low.

Additionally, I identified other characteristics not found in previous research. Interestingly, some positive characteristics were revealed in our study such as: dedication to family or work (92%) and once being described as agreeable (91%). Since these were not reported in previous studies, they require further investigation. A summary of the new found characteristics is located in Table 7.

2.4.1. Limitations of Current Study

The current study employs a keyword-based method to extract characteristics from text; however, some keywords represent different meanings with different contexts. For example, the keyword "bully" is defined as a characteristic with respect to the relations with coworkers. However, the appearance of "bully" might indicate the subject bullies others, the subject is

bullied, or the subject was bullied in his/her childhood. As I continue to refine the dictionary, these issues should wane.

The primary focus of this study is to empirically validate characteristics or traits of malicious insiders. Although states such as events, activities, and emotions could not be validated for commonalities in this study, they could be useful in future research. An abnormal-based detection approach in which a set of normal events, activities or emotions are defined might aid in the usefulness of examining states. Anything outside the defined parameters could trigger an alarm.

Further, I recognize that data (text) in our sample is based on news reports, court documents and other third party documents. It is possible that some characteristics were left out in the interview and reporting process. However, I believe our sample size of 133 eminent cases is more than enough to mitigate problems due to omitted information. Additionally, due to the challenge of finding relevant data, I compared our text-mined data on malicious insiders to survey based data on the general population. However, as noted, I took precautions in order to bridge the gap of the two data sets.

Table 7: Frequency of newly found characteristics

Characteristics	Number of Cases	Percentage of Total Cases
Dedication to Family or Work	122	92%
Agreeable	121	91%
Professional	119	89%
High Academic Performance	118	89%
Successful Career	92	69%
Intellectual	88	66%
Non-Impulsive	86	65%
Love-Affairs	85	64%
Well-Trained	83	62%
Reputation Problem	66	50%

We stress that this research nowhere to a point where prediction of malicious insiders is possible. No single characteristic can be used to predict a malicious insider. Rather, I much

continue to refine our methods and determine if some set of the characteristics can be used for prediction.

2.4.2 Implications for Research and Practitioners.

This study sought to validate a number of characteristics of malicious insiders suggested in previous research. Much of the previous research was based on either single cases studies or worked with rather small sample sizes. With our large sample size of 133 cases I believe scholars can have increased confidence in the validity of the characteristics in which I found support.

As for practitioners, malicious insiders are a significant threat to organizations because of the large potential impact they may have. While I stress that I am nowhere near capable of predicting if a person is a malicious insider, the validation these characteristics may one day lead to better tools and techniques for screening employees. Additional research on the state-based characteristics may also prove useful.

2.4.3. Future Orientations

Future research will focus on improving the characteristic extraction algorithm. One possible approach is to employ a rule-based method instead of extracting characteristics using keywords. Specifically, I propose to build rules that could represent a set of context. An example of the “bully” rule proposed would be “{set1} bully {set2}”, in which set1 contains words such as insider’s last name, full name and personal pronouns. Set 2 contains words such as peer, coworker and colleague. Then if combination “{set1} bully {set2}” appears in document, it is definitely a hit for the subject bullies his/her coworkers.

Another limitation is about the subjects in the current study. While this study investigated the “eminent” malicious insiders who are widely reported, I am also interested in malicious insiders who do not draw such attentions with less severe consequences. In the future studies I would like to work closely with the practitioners who are willing to share the data, in order to fully understand the characteristics of malicious insiders.

We will also examine the impact of states on malicious insiders. While this study focused on traits, I believe that states may have a moderating effect malicious insider intent and action. Future work will consider the interaction between states and traits. Additional future research will seek to identify any interaction effect between traits. Finally, the characteristics I validated have the potential to be used as input to autonomous agents to allow for better screening of those individuals that might try to purposely conceal information and carry out insider attacks.

2.4.4. Conclusion

The study of malicious insiders is extremely important due to the large negative impact on organizations. Previous studies proposed characteristics that might be exhibited by malicious insiders, paving the way for future research on malicious insiders. However, these studies in the field are mostly based on small number of cases or experts' opinions without empirical test on large number of real world cases. In this study I investigated the sample of malicious insiders who were convicted by U.S. courts. Further, I examined and validated a number of characteristics of malicious insiders noted in the extant literature. I also found some new, candidate characteristics that warrant further study. These findings validate some of the proposed characteristics from previous research, offering a solid foundation for future academic endeavors.

The use of text mining to examine a large sample of malicious insider cases proved to be effective and efficient. With refinement, it should become even more so. Mitigating the threat of malicious insiders is of utmost importance and continued research in this domain is essential. In this chapter, I compared the prevalence of characteristics among malicious insiders to the general public. In the next chapter, I will compare malicious insiders with benign insiders to further support the findings. Also, the comparison will be conducted at both single characteristic and interaction between two characteristics level.

In this chapter, the sample of malicious insiders are compared with the general public to validated the common characteristics of malicious insiders proposed by literature. Based on the result,

malicious insiders do exhibit higher level of certain characteristics. This result offers a solid foundation for future research, however, it also raises a question: whether these characteristics are unique to malicious insiders or are also shared by the benign insiders? We observed that some of the malicious insiders used to be good employees, or even star employees at the beginning of their career, for example, Aldrich Ames was awarded by his good work at his early career. In the next chapter, we are going to compare the sample of malicious insiders with the sample of benign insiders to further support the validity of these characteristics.

CHAPTER III: AN EMPIRICAL COMPARISON OF MALICIOUS INSIDERS AND BENIGN INSIDERS

Insider's attack is nothing new. In 480 BC, Ephialtes betrayed his own people, the Spartans, and helped Persia to invade his homeland, leading to the falling of Spartacus as well as his king, Leonidas (Herodotus, about 450 BC).

Nowadays, with the development of information technology, malicious insiders' attacks could exhibit various forms and thus become a major concern for organizational security professionals. In a recent survey by Information Systems Audit and Control Association (Information Systems Audit and Control Association, 2016b), 40% of 2907 international (Information Systems Audit and Control Association, 2016b) and 41% of domestic organizations expressed their concern about insider attack and social engineering, which are ranked as the second and third most concerns about organization's cyber security, respectively.

Both practitioners and academics have responded to the threats caused by insiders, or more specifically, malicious insiders. For practitioners, CPNI (Center for Protection of National Infrastructure) conducted a series of research studies in this area (CPNI, 2013). For researchers, a broad body of research has been conducted with respect to the deterrence of insiders' harmful behaviors (Bulgurcu et al., 2010; Herath & Rao, 2009; Johnson, 2014). Additionally, collaborations have also been held between industry and academics, such as the US Secret Service and Carnegie Mellon University's extensive research, investigating the characteristics of insider attackers and the process of these attacks (Claycomb et al., 2012; Claycomb et al., 2013; Keeney, 2005).

One branch of academic endeavors focuses on the influences of individual differences of insiders. Dispositional factors, such as personality traits, are shown to be related to security

training effectiveness (Kajzer et al., 2014), adoption of security behavior (Shropshire et al., 2015) and security deterrence results (D'Arcy & Hovav, 2009). Further, Willison states that internal factors could possibly trigger deterrence outcomes (Willison & Warkentin, 2013). This argument is also supported by criminology research which found that internalized norms (Sykes & Matza, 1957), and personalities (Dolan et al., 2001) play an influential role when offenders engage in criminal behaviors.

In the insider threat literature, psychological traits and dispositions such as personality characteristics (Nurse et al., 2014), antisocial personality disorder (Shechter & Lang, 2011), narcissistic personality disorder (E. D. Shaw & Fischer, 2005; Shechter & Lang, 2011; B. Wood, 2000), and psychopathy (Shechter & Lang, 2011) are found as common characteristics of malicious insiders. Personality characteristics are the theories of individuals about themselves as well as the world around them, and might affect their motivations and behavioral patterns (Dweck & Leggett, 1988). These, in turn, affect how they think, act and responds to the outside world variables (Nurse et al., 2014), such deterrence factors (Herath & Rao, 2009; Hu et al., 2011). Therefore, personality and personality disorders play an important role in the study of malicious insiders.

Unfortunately, current studies about the dispositional factors of malicious insiders are subject to several problems. First and foremost, many of the studies are based on field experts' opinions (Greitzer & Frincke, 2010; Greitzer et al., 2010; Shechter & Lang, 2011), survey results (Johnston et al., 2016), or limited number of cases (E. D. Shaw & Fischer, 2005). There is a lack of empirical validation with a large number of real world malicious insider cases many due to the fact that it is hard to find data in this domain. The unavailability of data is mainly due to the fact that organizations are reluctant to release data about their insider attack events, concerning about possible damage to their reputations (Willison & Warkentin, 2013).

Second, current research mainly focuses on the characteristics of malicious insiders individually, without consideration of interactions between these dispositional factors (Band et

al., 2006; Moore et al., 2008). Identifying common characteristics of malicious insiders is important, but I should extend the research scope by considering interactions among these characteristics for the reason that single characteristic might not be sufficient to differentiate malicious insiders with their benign counterparts. For example, narcissistic personality has been identified as one common characteristic of malicious insiders (Gelles, 2005; E. D. Shaw & Fischer, 2005), however, narcissistic personality is also prevalent among the Presidents of the United States and even positively related to presidential performance (Deluga, 1997). I argue that it is the combination of several characteristics that make the difference as opposed to a single factor.

Last but not least, current research derives common characteristics of malicious insiders mostly from pure malicious insider cases (Shechter & Lang, 2011; Vessey et al., 2014) or perception of malicious insiders from field experts (Greitzer & Frincke, 2010), without comparing them with the benign insiders. This might weaken the usability of these characteristics in pre-job screening, organizational deterrence actions, and organizational intervention of potential malicious insiders due to a large amount of false positives. For example, as proposed by the literature, narcissism is a characteristic of both malicious insiders (E. D. Shaw & Fischer, 2005) and high performance leaders (Maccoby, 2000). Without comparing malicious insiders with benign insiders, I could not isolate characteristics only salient among malicious insiders.

Thus, I argue that, in order to fully understand the common characteristics of malicious insiders, I should compare them with their benign counterparts at both individual characteristic as well as interactions of characteristics levels, with large amount of real world cases. In the current research, I am asking the following research questions:

- 1. Do malicious insiders exhibit different levels of individual characteristics than those exhibited by the benign insiders?*
- 2. Do malicious insiders exhibit different levels of several characteristics simultaneously than those exhibited by the benign insiders?*

In order to answer our research question, I will start with a comprehensive literature review about malicious insiders' characteristics as well as the comorbidity of these characteristics. Then in the next section, the data and method used in this research are introduced. Next, analysis results are presented and discussed. Finally, I will discuss the contributions and while limitations for the current research as well as direction for future endeavors.

3.1 Literature Review

In this section, I will first define our research scope by discussing the definition of malicious insider and insider threat. After that, individual characteristics of malicious insiders will be reviewed. Finally, I will discuss the interactions of these characteristics and propose corresponding hypotheses.

3.1.1 Terminology

One ongoing problem for malicious insider studies is the lack of a widely accepted definition of insiders (Hunker & Probst, 2011). Some research focuses on employees inside the organizations (D'Arcy et al., 2009; Willison & Siponen, 2009), some imply that the scope of insiders should be extended to former employee (Moore et al., 2008) or even contractors of the organization (Band et al., 2006), while others do not specify the boundary between outsiders and insiders (S. M. Lee et al., 2004). However, the subjects in all of these studies abuse, or have intention to abuse their access, knowledge or privilege of organizational resources. Additionally, the scope of current research includes a border range of subjects, not limited to current research. Therefore, I utilize the definition of insider from Bishop et al. (Bishop et al., 2008) page 5 :
An insider is a person that has been legitimately empowered with the right to access, represent, or decide about one or more assets of the organization's structure.

Consistent with the definition of insider, Predd's (Predd et al., 2008) page 67 definition of insider threat is employed in this study:

Insider threat is an insider's action that puts an organization or its resources at risk.

As argued by recent security research, insiders who violate the security policy might be due to non-volitional intention or purely accidental, but could also be the action of malicious intentions (Crossler et al., 2013; Willison & Warkentin, 2013). In the current research, our focus is the “bad” insiders who intentionally violate security policy. Thus, subjects of current research, the malicious insider, is defined by modifying Predd’s definition:

Malicious insiders are insiders who are unauthorized but intentionally put an organization or its resources at risk to the detriment of the organization.

Among the classification of organizational insiders, malicious insider is at one end of the continuum who intentionally jeopardize organizational assets. On the other end are benign insiders who are willing to take expansive roles to protect organizational resources against risk (Posey et al., 2013). In the current study, our focus is to verify characteristics of malicious insiders by comparing them with the benign insiders who are in need for all organizations. Thus, in the current study, I modify Posey et al.’s definition of benign insiders as follows (Posey et al., 2013) Page 16:

Benign insiders are “insiders who are willing to take expansive, active roles” in order to protect an organization or its resources against risk or are authorized to risk the organization or its resources in order to improve the situation of the organization.

We argue that although some executives also put organizations or their resources at risk, they are authorized to do so, such as that the top executives are paid to take certain level of risk for the good of the organization. For example, Jeff Bezos, CEO of Amazon may risk organizational assets and reputation by pursuing drone delivery, but the company may benefit from reduced costs and increased customer satisfaction.

3.1.2 Characteristics of Malicious Insiders

In this section, I review individual differences of malicious insiders in literature and propose our hypothesis for each characteristic. Previous research shows that these characteristics could be classified into 14 categories, including personality problems, mental health disorder, ethical

issues, social isolation, stressful event, emotional issues, disgruntlement, social or cultural conflict, behavioral precursor, negative experience, overdependence of the organization on the individual, preparatory behavior, financial problem and tendency to rationalize their behaviors (Liang et al., 2016). However, characteristics of an individual or individual groups could be classified into two basic categories: trait and state (Chaplin et al., 1988). In general, traits are stable and consistent about an individual, on the contrary, state are temporary (Allport & Odbert, 1936), also contingent to specific context of each case. Thus in this study, I focus on traits or traits-like characteristics and do not expect commonality of states across all cases.

3.1.2.1 Narcissistic Personality Disorder

Narcissistic personality disorder is characterized by a pattern of grandiosity and special need for admiration (DSM-5 American Psychiatric Association, 2013). Criminology research found that narcissism is usually associated with offenders, such as sexual offenders (Meloy, 2000) and other types of violent offenders (Blackburn & Coid, 1999). In the field of organizational security, narcissistic personality disorder is also found to be common among malicious insiders (Shechter & Lang, 2011). Narcissistic insiders with the sense of entitlement (Sarkar, 2010; E. D. Shaw et al., 1999) often have a feeling of superiority (Maasberg et al., 2015) such as being above the rules (Band et al., 2006) or deserving special attention and admiration from others (Shechter & Lang, 2011). Once their need for superiority can't be met, they might launch the attack as relief to the stress (Band et al., 2006). Additionally, the fantasy of power and success of narcissistic insiders (Shechter & Lang, 2011) could worsen the situation by motivating them to seek what they want by reaching out to organization's enemy or competitor. For example, Robert Hanssen reached out to a representative of the Soviet Union, offering services and classified information. Part of the reason is that he thought his intelligence superiority was unappreciated inside the FBI (Wikipedia, 2016). Thus, I propose our hypothesis 1 as follows:

H1: The prevalence of narcissistic personality disorder among malicious insiders is higher compared to that of benign insiders.

3.1.2.2 Antisocial Personality Disorder

Individual with antisocial personality shows a consistent pattern of disregarding the rights of others and failing to conform to regulations, characterizing by deceitfulness, impulsivity and irresponsibility (DSM-5 American Psychiatric Association, 2013). Antisocial personality disorder is found to be prevalent among prisoners worldwide (Fazel & Danesh, 2002). Specifically, insider threat studies also propose antisocial personality disorder as one of the major characteristics of malicious insiders (Gelles, 2005; Shechter & Lang, 2011). Antisocial insiders, by definition, constantly reject organizational rules and security policy (Crede et al., 2007). Additionally, research found that antisocial personality is negatively associated with agreeableness (Furnham et al., 2014; Williams et al., 2010) and consciousness (Paulhus & Williams, 2002; Williams et al., 2010), combined with the findings that low levels of agreeableness and consciousness are antecedents of security policy violation (Johnston et al., 2016) or failure to adopt security policy (Shropshire et al., 2015), I propose the following hypothesis:

H2: The prevalence of antisocial personality disorder among malicious insiders is higher compared to that of benign insiders.

3.1.2.3 Avoidant Personality Disorder

Major symptoms of avoidant personality disorder include fear of criticism or rejection in interpersonal situations, refusing to get involved with people in both occupational or interpersonal activities, and lack of confidence in social scenarios (DSM-5 American Psychiatric Association, 2013). Insiders with avoidant personality disorder are typically less socially skilled and more alienated than their colleagues (E. Shaw et al., 1998), resulting in less social support necessary for success, especially when coping with stressful event (E. D. Shaw & Fischer, 2005). This could escalate the frustration resulting from unmet needs, thus the insiders might seek relief in some extreme ways. Therefore, I propose the following hypothesis:

H3: The prevalence of avoidant personality disorder among malicious insiders is higher compared to that of benign insiders.

3.1.2.4 Disruptive Mood Dysregulation Disorder

Disruptive mood dysregulation disorder is typically associated with recurrent and severe outburst of anger (DSM-5 American Psychiatric Association, 2013). Research in insider threat found that malicious insider attack also follows serious emotional issues, such as anger management issue (Greitzer & Frincke, 2010), exaggerated mood swings (CPNI, 2013) or propensity to anger (Gelles, 2005; E. Shaw et al., 1998). I argue that disruptive mood dysregulation disorder might be associated with malicious attack in two ways: first, emotional regulation is a major developmental task (Cole et al., 1994), and the cognitive development is associated with individual's ability to cope with stress (Compas et al., 1991). Therefore, individuals who are incapable of emotion regulation tend to cope with stress in destructive ways. Second, the emotional issues of malicious insiders will also manifest themselves as problems of accepting criticisms at workplace (Band et al., 2006) or being defensive when given constructive feedback (Greitzer & Frincke, 2010). This will likely lead to an unhealthy relationship with colleagues and supervisors. As a result of intense relationships, the fulfillment of interpersonal needs would be jeopardized, which is a major reason that the individual would launch an attack towards the organization from inside (Band et al., 2006). Therefore, I propose the following hypothesis:

H4: The prevalence of disruptive mood dysregulation disorder among malicious insiders is higher compared that of benign insiders.

3.1.2.5 Substance Use Disorder and Alcohol Use Disorder

Alcohol and drug addiction is one aspect of mental health disorder (DSM-5 American Psychiatric Association, 2013). I discuss it separately because findings are contradictory in literature.

While alcohol and drug abuse is labeled as one characteristic of malicious insiders (CPNI, 2013; Moore et al., 2008), findings in the field of workplace counterproductive behaviors disagree. The latter finds that the alcohol or substance abuse is more prevalent among employees

who feels guilty and shamed, and is a form of self-destructive behavior other than retaliatory behavior against the organization (Martinko et al., 2002).

We support the argument that alcohol and drug abuse should be labeled as characteristics of malicious insiders, because comorbidities of substance abuse and anxiety disorder as well as personality disorder are observed in a national-wide survey (Grant, Stinson, Dawson, Chou, Dufour, et al., 2004). Coupled with the fact that the addiction behaviors could impair professional abilities (Band et al., 2006), employees who have a substance addiction probably fail to work effectively and productively, even making mistakes which might result in poor performance reviews, disciplinary action (Greitzer & Frincke, 2010), or sanctions (Moore et al., 2008). These events might cause the individual stress leading to a malicious attack from inside (E. D. Shaw & Fischer, 2005). Given this, I propose:

Hypothesis 5: The prevalence of substance abuse among malicious insiders is higher compared that of benign insiders..

Hypothesis 5-1: The prevalence of alcohol abuse among malicious insiders is higher compared that of benign insiders..

We consider alcohol abuse separately as alcohol is unique in that it is a legal substance and others are often illegal in general or illegal when not used as prescribed.

3.1.2.6 Disgruntlement

Disgruntlement is also a common characteristic identified by literature (Warkentin et al., 2011; Willison & Warkentin, 2013). Disgruntlement is typically associated with perception of organizational injustice (Warkentin et al., 2011; Willison & Warkentin, 2013), therefore, disgruntled insiders tend to behave in certain means to migrate the feeling of inequity (Adams, 1965). Additionally, unmet needs is one of the motivations which might trigger crime, especially when the unmet need is viewed as injustice as in the case of disgruntlement (Agnew, 1992). Therefore, I propose the following hypothesis:

Hypothesis 6: The prevalence of disgruntlement among malicious insiders is higher compared that of benign insiders.

In this section, I briefly reviewed common characteristics of malicious insiders and proposed our hypothesis about each characteristic investigated in the current research. However, single characteristic identification may not sufficient to predict malicious insider and the interactions of these characteristics are worth further investigation (Nurse et al., 2014).

3.1.3 Interaction of Characteristics

Recall, the second research question focuses on the interactions among these characteristics. Thus for the 7 characteristics investigated in this study, there are 21 candidates of interaction terms. However, the inclusion of an interaction term in our analysis should meet at least one of the following two criteria: one, previous research strongly suggest such an interaction; two, empirical evidence about the interaction is observed in previous research and theoretical support is strongly in favor of such an interaction.

3.1.3.1 Interactions of Personality Disorders

Narcissistic alone is not necessarily a bad characteristic for insiders, what's more, it might even be "extraordinarily useful" (Maccoby, 2000) page 1 for leadership. As noted earlier, research shows that the narcissistic personality is positively related to higher performance of U.S. Presidents (Deluga, 1997).

We argue that antisocial personality would dwarf the advantage of narcissistic and foster the negative results because antisocial insiders typically lack of empathy and loyalty to others, including the organization they work for (E. D. Shaw & Fischer, 2005). This makes them hard to form attachments and commitments to colleagues as well as the organization (Gelles, 2005; E. D. Shaw & Fischer, 2005). Low commitment is found to be associated with negative attitude (Van Dyne & Pierce, 2004). Insider threat studies depict that narcissists with negative attitude towards the organization tends to attack or steal organizational resources, since negative attitude always trigger neutralization techniques towards insiders' attack (E. D. Shaw & Stock, 2011).

Additionally, antisocial personality is characterized by a pervasive pattern of rationalizing hurting or stealing behavior (DSM-5 American Psychiatric Association, 2013). Utilization of rationalizations will increase the risk that the individual might launch the attack. Therefore, I propose the following hypothesis:

H 7-1: The comorbidity of narcissistic personality disorder with antisocial personality disorder is higher among malicious insiders than benign insiders.

Narcissistic personality disorder is characterized by fantasizing of ultimate success and requirement for special admiration (DSM-5 American Psychiatric Association, 2013). Neither success nor admiration could be achieved without interaction with others. However, individuals with avoidant personality disorder are typically less socially skilled (Band et al., 2006; Moore et al., 2008; E. Shaw et al., 1998; E. D. Shaw & Fischer, 2005) and lack of the necessary social capital to cope with stressful events (E. D. Shaw & Fischer, 2005) along the way toward success. Also, the need for special admiration is very unlikely to be met because of the unwillingness to get involved with people. Thus, the unmet professional and interpersonal goals might increase the level of strain (Agnew, 2001; Band et al., 2006), leading to possible insider attack. Therefore, I propose the following hypothesis:

H 7-2: Comorbidity of narcissistic personality disorder with avoidant personality disorder is higher among malicious insiders than benign insiders.

3.1.3.2 Interactions of Personality Disorders with Disgruntlement

As aforementioned in the literature, personality disorders serve as personal dispositions of malicious attack (Nurse et al., 2014), however, disgruntlement, as the feeling of organizational injustice (Warkentin et al., 2011), typically serves as the stressor or tipping point of a malicious insider attack (Nurse et al., 2014; E. D. Shaw & Stock, 2011). In this research, I argue that the combination of personal disposition and disgruntlement will significantly increase the odds that an insider turns malicious. Thus, I propose the following:

Hypothesis 8-1: Comorbidity of Narcissistic Personality Disorder with disgruntlement is higher among malicious insiders than benign insiders.

Hypothesis 8-2: Comorbidity of Antisocial Personality Disorder with disgruntlement is higher among malicious insiders than benign insiders.

Hypothesis 8-3: Comorbidity of Avoidant Personality Disorder with disgruntlement is higher among malicious insiders than benign insiders.

Hypothesis 8-4: Comorbidity of Disruptive Mood Dysregulation Disorder with disgruntlement is higher among malicious insiders than benign insiders.

In this section, I overviewed theories about malicious insiders' individual characteristics and proposed our hypotheses in the current research. The next section focuses on our method and data to compare malicious insiders with the benign insiders. Based on the literature, I believe malicious insiders would exhibit higher levels of personality disorders than the benign insiders. Also, the prevalence of interactions for some disorders will also be higher among malicious insiders compared to the benign insiders.

3.2 Data and Method

One major problem in the malicious insider study is the availability of data (Willison & Warkentin, 2013), since it is almost impossible to conduct direct assessment for most of these malicious insiders, , Aldrich Ames is serving life sentence in prison and Edward Snowden is currently in Russia. Obtaining such data would be difficult to say the least. Therefore, I employ historiometry, a method in used psychology that is targeted to conduct distant assessment of historical data (Dean Keith Simonton, 2009), in order to investigate personality issues of our subjects.

Historiometry is a quantitative method of testing psychological hypotheses using historical data in order to conduct indirect assessment on individuals who cannot or are not willing to be subjected to direct psychological evaluation (D. Simonton, 2007; Dean Keith Simonton, 1990). Historiometry methods have been used in plenty of many studies to evaluate CEO's narcissistic

personality (Spangler et al., 2012), creativeness of scientific leaders (Vessey et al., 2014), IQ and mental health of geniuses (Dean Keith Simonton & Song, 2009), relationship between US presidents' narcissism and presidential performance (Deluga, 1997) and son on. In all of these studies, historiometry is applied to deceased individuals or living ones that are not willing to participate in psychological evaluations (D. Simonton, 2007). In the current study, I utilize historiometry method to evaluate individuals who are currently unavailable for assessment.

In this section, I will introduce the sampling criteria, data source and method used in the current study. For each part, I will first present arguments from the historiometry literature, then discuss the operationalization of these arguments in the current study.

3.2.1 Unit of Analysis and Sampling Criteria

The unit of analysis in historiometry research could range from micro level such as a single decision made by a certain individual to macro level such as a whole generation of individuals (Dean Keith Simonton, 2009). In the current research, the unit of analysis is the individual who is a malicious insider or a benign insider, which falls into the feasible range of the historiometry method.

As a compromise between hypotheses to be tested and subjects' data availability (Dean Keith Simonton, 2009), eminent criterion is typically used to sample the subjects in historiometry research instead of random sampling (Dean Keith Simonton, 1999, 2009). Under this criterion, only significant people that have a comprehensive cover in archival data should be selected to represent the population (Dean Keith Simonton, 1999). The historiometry method relies heavily on archival data about subjects such that only subjects with sufficient historical data could promise the reliability of analysis (Dean Keith Simonton, 1999, 2009). Therefore, random sampling is often not feasible due to the possible unavailability of data for the sampled subjects. To be noticed, the eminence of an individual could be small or big, as long as the eminence is reflected by sufficient archival data. The eminent criteria is uniquely appropriate for the current study.

As noted in literature, due to the infrequency of espionage cases, it is impractical to draw a random sample (Band et al., 2006). The malicious insiders included in the current study are drawn from malicious insiders' population who were convicted by US courts from 2000 to 2015 under counterintelligence laws regulations. Attacks launched by these malicious insiders include spying, espionage, sabotage, and other security related issues. Also, only cases that draw national attention, as reflected by national media coverage, were included. I found eminent cases. And for the benign insiders, I use the same number of subjects drawn from the founders of fortune 500 companies. Our assumption is that the founders of a company did not create the company to harm or destroy it, thus they are considered benign insiders in this study.

3.2.2 Data Source and Validation

The data sources for historiometry analysis include both primary and secondary data (Dean Keith Simonton, 2003). Primary data are materials generated by subjects themselves, such as speeches, interviews and correspondence. On the other hand, secondary data is compiled by others, such as biographies and encyclopedias (Dean Keith Simonton, 2003). In past historiometry research, various data sources have been used to conduct psychological inquiries: biographical materials, newspaper reports and business press stories are often used to analyze CEO's narcissism personality (Spangler et al., 2012); biographies are used to study the relation between leadership and creativity (Vessey et al., 2014), US Presidents' personalities (Dean K Simonton, 1986) and mental health for historical figures (Miles & Wolfe, 1936).

In the field of malicious insider studies, news media data has been used to diagnose clinical personality and mental disorders in various research (Band et al., 2006; Cohen et al., 2012; Wm. Dennis Huber et al., 2015; S. Wood & Wiskoff, 1992). In the current study, I also use secondary data to conduct the psychological inquiries, including biographies, court documents and newspaper report. I argue that the usage of secondary data could reduce the impacts of researcher and measurements on the subjects (Trochim et al., 2015). Also, the usage of secondary data will mitigate the effects of social desirability on subjects' responses (Thomas & Kilmann, 1975),

especially when the research focus is sensitive, embarrassing, or even incriminating (Dalton & Metzger, 1992). A detailed discussion of the validity of data collected from news media is presented by Liang and his colleagues (Liang et al., 2016).

3.2.3 Research Design

One advantage of historiometry method is that it could utilize well-established psychometric measures when evaluating psychological variables (Dean Keith Simonton, 2009). In the current study, I utilize the diagnostic instruments and criteria suggested by American Psychiatric Association (DSM-5 American Psychiatric Association, 2013) to make diagnostic decisions on both malicious and benign insiders. However, two departures from traditional behavioral measures should be noted: First, the biographical data could not be used directly to measure psychological variables. A content analysis method is needed to prepare the data (Dean Keith Simonton, 2009; Spangler et al., 2012). Second, instead of measuring the subjects with various methods, independent raters could score the psychometric instruments based on the materials in order to ensure measurement reliability. In the current study, I use the same method as previous research (Liang et al., 2016). This method starts with data collection, followed by descriptive keywords extraction and a coding procedure by two independent raters, and finally, diagnostic decisions are made based on characteristics extracted from materials based on this dictionary.

3.2.3.1 Data Collection

The data collection starts with using Google search engine to query all relevant data about a certain subject. Then the search results are filtered to eliminate irrelevant information. For the malicious insider subjects, irrelevant information typically included information about people with the same name. For the benign insider subjects, this kind of information typically is newspaper report about an event associated with a certain CEO with a focus on reporting the event but not the person. Then the relevant information is combined as a portfolio for each subject. Google represents the largest search engine on the Internet and it searches all to which it

has access (Bardi et al., 2008). Therefore, I use Google search results as sources for all public available data.

3.2.3.2 Descriptive Keyword Extraction

In this process, I first extract keywords used in the literature about malicious insiders' characteristics. Then the pool of keywords is updated by manually adding in keywords emerged in the malicious insiders' portfolio until the updates become trivial. An example below shows the extraction process (Liang et al., 2016):

Example Statement:

1. Disgruntlement: Employee observed to be dissatisfied in current position; chronic indications of discontent, such as strong negative feelings about being passed over for a promotion or being underpaid, undervalued; may have a poor fit with current job (Greitzer et al., 2013).

2. Antisocial Personality Disorder: The employee engages in persistent lying or stealing, disregard the safety of self or others, and possess a superficial charm or wit (Shechter & Lang, 2011).

In the first example statement, three keywords extracted are: “dissatisfied”, “discontent”, and “pass over for a promotion”. In the second example statement, two keywords are extracted: “lying” and “disregard”. In the first step, I extracted 380 keywords from literature about malicious insiders' possible attributes. Then I take a subset of malicious insider cases (n=30) to update the pool of keywords. In this step, one of the authors manually reads through all materials collected, adding in keywords used in these materials to describe the malicious insiders. An example below shows the updating process:

Example Material:

1. Hanssen craved the rush he received from leading the perilous double life of the double agent, and his Soviet and Russian handlers took pains to stroke his inflated ego, according to the FBI affidavit supporting his arrest (Sisk, 2001).

2. From the beginning of his suspected career as a counterspy, Hanssen showed contempt for the U.S. and his FBI colleagues, and boasted of his ability to outsmart them (Sisk, 2001).

The keyword or phrase extracted from the first example materials is “inflated ego”. For the second example statement, “contempt”, “boast” and “outsmart” are extracted and added into the keywords pool. After extracting keywords in one case portfolio, the keywords pool is then used to scan the next case portfolio to see the number of keywords found by the keywords pool. Then, the new case portfolio is read through in order to manually extract and add new keywords that are not included in the pool. This process continues until the number of updates becomes trivial.

3.2.3.3 Coding Procedure

Coding procedures include training, pre-coding and intercoder reliability check processes suggested by Neuendorf (Neuendorf, 2002). Targeted categories of coding are symptoms of narcissistic personality disorder, antisocial personality disorder, avoidant personality disorder and disruptive mood dysregulation disorder. Also, disgruntlement by itself is a single category.

The coding started with two separate coders discussing the meaning and distinctions of each category, then separately coding 10 percent of the keywords. Since the target categories of coding are predefined, I employ a deductive approach to code the keywords (Crabtree & Miller, 1999) including two steps. In the first step, keywords are coded into each overarching characteristics of antisocial personality disorder, narcissistic personality disorder, avoidant personality disorder, and disruptive mood dysregulation disorder and then comparing results. In the second step, the two coders classified each keyword within its respective higher category of characteristic into symptoms under each characteristic. The Cohen’s Kappa metric for inter-rater reliability between the raters were 0.84 for the first step, indicating excellent (Fleiss et al., 2013) to almost perfect (Landis & Koch, 1977) agreement between the raters, and 0.97 for the second step, near perfect alignment. At this point, one of the two raters coded the rest of the keywords.

3.2.3.4 Characteristic Extraction and Statistical Analysis (Stopped Here)

The portfolio of subjects in this study consists of data from various sources, therefore I take precautions while making diagnostic decisions about subjects and comparing subjects. First, I employ similar process as the clinical setting to make diagnostic decision about subjects. Second,

I utilize a conservative statistical procedure to minimize the chance of Type I error when comparing prevalence of these characteristics between two groups.

With respect to diagnostic method, I use comparable process as would be implemented in clinical setting. In clinical settings, diagnostic decisions of personality disorder are made based on the number of diagnostic criteria exhibited by the subject. Each diagnostic criteria represents a set of symptoms (DSM-5 American Psychiatric Association, 2013). Correspondingly, in the current research, keywords are grouped exclusively into the symptoms associated with each personality disorder. Once a keyword is found in the portfolio, I consider it as a “hit” for the corresponding symptom. After the entire portfolio is scanned, if the number of diagnostic criteria presented in the portfolio meets the requirement for each personality disorder suggested by clinical standards (DSM-5 American Psychiatric Association, 2013), I consider the subject as having such a disorder. Case in point, while scanning the portfolio of Robert Hanssen, who spied for the Soviet Union then Russia, I found keywords associated with the second (deceitfulness), third (impulsivity) and fourth (irritability) diagnostic criteria of antisocial personality disorder. According to the DSM-5 (DSM-5 American Psychiatric Association, 2013), if a subject exhibits more than two diagnostic criteria, they should be diagnosed as having antisocial personality disorder. Thus I make the decision that Robert Hanssen exhibit this disorder.

After I extract the characteristics from each portfolio and make diagnostic decisions about each subject, I apply the Fisher’s exact test (Fisher, 1970) to compare the prevalence of these characteristics among the samples of malicious insiders and of benign insiders. Fisher’s exact test is used to check the differences of proportions for categorical variables (Fisher, 1970) and is a suitable for the current study, as the existence of a characteristic of a subject is coded dichotomous in this study. Also, Fisher’s exact test is criticized to be too conservative in nature as it often fails to detect relationships that actually exists (Berkson, 1978; D’agostino et al., 1988; Liddell, 1976). This conservativeness offers statistical control in order to ensure that the differences discovered by the test actually exist. Fisher’s test has been shown to be an appropriate

test to compare the prevalence of psychological characteristics between two different groups (Carey et al., 2017; Collier & Friedman, 2016; Garcia-Ruiz et al., 2014). Fisher's test has been used to compare the different percentages of anxiety, depression and stress between rural and urban persons (Carey et al., 2017), different percentages of mental health disorders between female intimates who attend the psychiatry service and who don't (Collier & Friedman, 2016), and the prevalence of mental health disorders between patients with and without Parkinson's disease (Garcia-Ruiz et al., 2014).

In this section, I discussed the research design with respect to data collection, dictionary construction, characteristic extraction and statistical analysis. In the next part, I are going to present the hypothesis test result.

3.3 Data Analysis

In this section, I are going to present the hypothesis test results. As I discussed before, Fisher's exact test is utilized to check the differences in proportions. For each hypothesis, p-value and confidence interval are reported.

Hypothesis testing results are shown below in table 8. The proportion of malicious insiders in the study sample was higher than in the benign sample for antisocial personality disorder ($p < 0.001$, 95% CI [0.44, 0.25]), avoidant personality disorder ($p = 0.04$, 95% CI [0.12, 0.0002]), disruptive mood dysregulation disorder ($p = 0.03$, 95% CI [0.12, 0.004]), and disgruntlement ($p < 0.001$, 95% CI [0.52, 0.33]), supporting hypothesis 2, 3, 4, and 6. The test results of these three hypothesis indicate that the prevalence of antisocial personality disorder, disruptive mood dysregulation disorder and disgruntled feelings among malicious insiders is higher compared to the group of benign insiders. Furthermore, the proportion of malicious insiders presenting with multiple concurrent characteristics was higher than in the benign sample for the combinations of disgruntlement and antisocial personality disorder ($p < 0.001$, 95% CI [0.44, 0.24]), disgruntlement and avoidant personality disorder ($p = 0.02$, 95% CI [0.13, 0.009]), and disgruntlement and disruptive mood dysregulation disorder ($p = 0.005$, 95% CI [0.13, 0.02]),

supporting propositions 8-2, 8-3, and 8-4. This result indicates that for insiders with disgruntled feelings, if they also have the antisocial personality disorder, avoidant personality disorder or disruptive mood dysregulation disorder, they tend to attack the organization from inside.

Conversely, the proportion of malicious insiders in the study sample was not significantly higher than in the benign sample for narcissistic personality disorder ($p = 0.86$), alcohol use disorder ($p = 0.08$), or for the multiple concurrent characteristics of narcissistic personality disorder and antisocial personality disorder ($p = 0.11$), narcissistic personality disorder and avoidant personality disorder ($p = 0.25$), or disgruntlement and narcissistic personality disorder ($p = 0.59$), not supporting propositions 1, 5-1, 7-1, 7-2, and 7-3. This result shows that the prevalence of narcissistic personality disorder and alcohol use disorder is not higher among the malicious insider group compared to the benign insider group. Also, neither does the interaction between narcissistic personality disorder and antisocial disorder, nor the interaction between narcissistic personality disorder and avoidant personality disorder.

3.4. Discussion and Limitations

The current research utilizes text mining to collect and analyze data about both malicious and benign insiders. I learn that malicious insiders do exhibit a higher level of prevalence of several personality disorders compared to the benign insiders. Also, the co-occurrences of certain characteristics among these two groups are also compared, revealing a higher prevalence of occurrences among malicious insiders. Next, the differences between these two groups are discussed in details.

Several characteristics are shown to be more prevalent among malicious insiders, as well as the co-occurrences of these characteristics. Malicious insiders have more antisocial personality disorder, avoidant personality disorder, disruptive mood dysregulation disorder and disgruntled feelings, indicating that malicious insiders are more prone to disregard the security rules, are less likely to fit in the social setting, are easier to get angry and are more likely to be dissatisfied about their job. For the interactions among individual characteristics, interaction between

disgruntlement and antisocial personality disorder has a higher percentage among malicious insiders than among the benign insiders, indicating that the antisocial malicious insiders are more prone to attack the organization if they have unmet needs. Also, interaction between disgruntlement and avoidant personality disorder is more prevalent among malicious insiders compared to the group of benign insiders, implying the fact that insiders who could not fit into the social environment tend to take destructive action toward the organization when they feel being treated with injustice. Finally, prevalence of interaction between disgruntlement and disruptive mood dysregulation disorder is higher among malicious insiders, supporting our argument that insiders who easily become angry and has unmet needs are prone to attack the organization from inside. Although the tests for each individual characteristic is already significant, I observe a decrease of p-values of interaction effects test compared to individual effect test, indicating that the malicious insiders are more different with the benign insiders with respect to these interaction effects. For instances, p-value for avoidant personality disorder test is .04 but the p-value for the interaction term between disgruntlement and avoidant personality disorder is only .005, indicating that the insiders that are both disgruntled and avoidant are more like to conduct malicious attacks compared to the insiders that are only avoidant.

However, two characteristic proposed by previous literature, the narcissistic personality disorder and alcohol use disorder, are found not significantly more prevalent among malicious insiders, neither does any co-occurrences between narcissistic with other characteristics. For narcissistic personality disorder, this might be due to the fact that narcissistic is not necessarily negative as the narcissistic leaders might have incredible achievement driven by certain narcissistic urges (Maccoby, 2000). Also, for alcohol use disorder, this might be due to the fact that excessive alcohol usage is an indicator of self-destruction behavior, implying that the subject feels guilty or shamed, in which case, the subject is less likely to blame the organization, neither would they launch an attack (Martinko et al., 2002).

Table 8: Hypothesis test result between malicious insiders sample and benign insiders sample

Prop	Characteristics	Malicious		Benign		Difference Test			Support
		Proportion	Sample	Proportion	Sample	p-value	Confidence Interval		
P1	Narcissistic Personality Disorder	10	133	14	133	0.86	0.04	-0.10	no
P2	Antisocial Personality Disorder	56		10		< 0.001	0.44	0.25	yes
P3	Avoidant Personality Disorder	13		5		0.04	0.12	0.0002	yes
P4	Disruptive Mood Dysregulation Disorder	12		4		0.03	0.12	0.004	yes
P5-1	Alcohol Use Disorder	18		10		0.08	0.13	-0.01	no
P6	Disgruntlement	125		68		< 0.001	0.52	0.33	yes
P7-1	Narcissistic*Antisocial	8		3		0.11	0.09	-0.01	no
P7-2	Narcissistic*Avoidant	2		0		0.25	0.04	-0.006	no
P8-1	Disgruntlement* Narcissistic	10		10		0.59	0.06	-0.06	no
P8-2	Disgruntlement* Antisocial	54		8		< 0.001	0.44	0.25	yes
P8-3	Disgruntlement* Avoidant	13		4		0.02	0.13	0.009	yes
P8-4	Disgruntlement* Disruptive Mood Dysregulation	12		2		0.005	0.13	0.02	yes

3.4.1 Limitations and future research

The primary focus of the current study is to explore the prevalence of certain individual characteristics as well as their interactions among malicious insiders compared to the benign insiders. However, due to the infrequencies of personality disorder as well as other disorders, I have very low numbers of occurrences in both groups. This makes the comparison difficult, especially for the interaction terms. In the future, I will use measures with finer granularity, such as measures of criteria of each disorder instead of the overall disorder. For example, prevalence

of narcissistic personality disorder is found not higher among malicious insiders compared to the benign insiders in the current research. However, I believe that this is partly due to the fact that narcissistic personality disorder is a multi-facets concept which has several diagnosis criteria focusing on different aspects such as the superiority feeling and manipulative nature of an individual. In the future research, instead of looking at the narcissistic personality disorder as a single concept, I are going to analyze how individuals with different diagnostic criteria will behave.

Another limitation of current study is that the malicious insiders are considered as a homogeneous group in the current study. However, I observe that some of the malicious insiders launch the attack to express their disgruntlement but others do so to benefit from the attack. Previous research also indicates the heterogeneity among malicious attacks, arguing that the expressive attack and instrumental attack are developed with different mechanisms (Willison & Warkentin, 2013). In the future, I will study the heterogeneity of malicious insiders based on their personality characteristics and investigate the relationships between personality characteristics and the malicious attack behaviors.

3.4.2 Implications for Research and Practitioners

The current study validates a set of characteristics of malicious insiders by comparing them with the benign insiders. These characteristics are proposed by previous research, however, without empirical testing on large scale of samples. The findings of this research set a solid foundation for future research to investigate the mechanism of malicious insider attack and pave the way for studying why individuals with these characteristics are more likely to launch the malicious attack.

For practitioners, findings from the current research should not be applied without caution. To be noted, the pattern of human behavior is so complex that even insiders with all characteristics validated in the current study will not necessarily sabotage the organization. The purpose of the current study is to provide a framework to red flag potential malicious insiders to facilitate

organizational intervention. Specifically, in the organizational security practice, I should pay special attention to antisocial employee as they typically disregard rules and policies. For people with avoidant personality and with disgruntled feelings, constructing legitimate and effective communication channel will be the best way to mitigate the risk. For instance, Bradley Manning was reported to have this avoidant personality and was disgruntled during his service. If this have raised attention from the authority and have his problem solved, the leaking incident could have possibly been avoided. On the other hand, narcissistic employees would be a double-edged sword as they might be either the super star or malicious attacker.

3.4.3 Conclusion

The ultimate goal of malicious insider study is to mitigate the risk of malicious insiders. This paper investigate the individual dispositions of malicious insiders by comparing them with the benign insiders, in order to answer the question that what are the characteristics unique to malicious insiders. I found that malicious insiders do exhibit some characteristics that are different from the benign insiders, such as antisocial personality, avoidant personality, disruptive mood and disgruntled feelings. However, some characteristics proposed by previous research, such as narcissistic personality and excessive alcohol usage, are not supported by the current research, neither does the interaction between narcissism with other characteristics.

These findings shed light on both the academic research and security practices with regard to malicious insiders. For academic endeavors, the validation of these characteristics offers a solid foundation for future research about the behavior pattern of malicious insiders, since the personal dispositions are the starting point of behavior (Ajzen, 2005). For information security practice, findings in this paper offer a framework for organizational intervention to prevent the malicious attacks. With future research into the mechanism of malicious insider attack, this field of study will offer more insights to mitigate the malicious insider risks.

In this chapter, I compare the sample of malicious insiders with the sample of benign insiders, finding that malicious insiders differ from benign insiders not only at single characteristic level

but also at interaction level. I also noticed that although some characteristics are not common among all the sample of malicious insiders, the malicious insiders with these characteristics conducted the similar type of attack. For example, narcissistic is not a common characteristic of malicious insiders based on the result of this chapter, however, we found that malicious insiders with narcissistic tend to attack the organization to express their disgruntled feelings. Therefore, in the next chapter, I will take a deeper look at the characteristics of malicious insiders at a finer granularity. Also, I will investigate the relationship between malicious insiders' characteristics and their different types of malicious attacks.

CHAPTER IV: Classification of Malicious Insiders and the Association of the Forms of Attacks

In October 2011, President Obama issued Executive Order 13578 establishing the National Insider Threat Task Force, in order to better predict, prevent, and mitigate the malicious insider threats to national security (National Insider Threat Task Force, 2011). Even with this national endeavor, trusted insiders still betrayed and caused harm to the nation. Case in point, NSA contractor Harold Martin III stole and leaked classified documents as well as computer source code which jeopardized the national security and sensitive government assets (Cox, 2016).

Malicious insiders are not a concern for government but also for civil organizations. In a recent survey, insider threat is the third highest concern for domestic organizations and the second highest of international companies (Information Systems Audit and Control Association, 2016a, 2016b). Insiders include but are not limited to employees and contractors. Anyone that has legitimate access and knowledge about organizational resources is an insider (Bishop et al., 2008).

Consequences of malicious insiders' attacks could be devastating (Willison & Warkentin, 2013) including financial loss, damage to reputation, and even long term effects on the organizational culture (Hunker & Probst, 2011). Insiders have skills from organizational training, knowledge from working, and access granted that enables them to harm the organization at potentially greater levels than external threats (Willison & Warkentin, 2013). Insiders, once turned rogue, could bypass security countermeasures and exploit the organizations trust (Bellovin, 2008).

Problems in practice have raised academic attention. Many studies have been conducted to investigate various issues associated from malicious insiders, including common characteristics (Claycomb et al., 2013; CPNI, 2013; Greitzer et al., 2010; Liang & Biros, 2016), attack process (Band et al., 2006; Nurse et al., 2014), motivations (Shropshire, 2009), intentions (J. Lee & Lee, 2002; Warkentin et al., 2011), prevention (Willison & Backhouse, 2006; Willison & Siponen, 2009), and deterrence of malicious insiders (D'Arcy et al., 2009; Hu et al., 2011; S. M. Lee et al., 2004). I believe that not enough attention has been given to the heterogeneous nature of malicious insiders and their motivations.

Malicious insiders have been seen as a homogeneous group. However, malicious insiders, as a group of human beings, are heterogeneous in nature with respect to their personal dispositions. I argue that the ignorance of this heterogeneity will cause several problems. First, uncommon characteristics of malicious insiders in a whole possibly mask certain subtypes of malicious insiders. For example, narcissistic personality has been found as a characteristic of malicious insiders in several studies (E. D. Shaw & Fischer, 2005; Shechter & Lang, 2011). However, Liang et al. (Liang et al., 2016) found that prevalence of narcissistic personality disorder among malicious insiders is not higher than the general public. This should not be seen as a denial of narcissism as a characteristic as found in previous research, instead, it provides evidence that other types of malicious insiders exist. Second, individuals with different personalities might have different thinking processes or different patterns of response to the environment (Dweck & Leggett, 1988). These differences influence insiders' responses to organizational security measures and deterrence methods (Johnston et al., 2016; Willison & Warkentin, 2013). Thus the deterrence methods need to take these differences into consideration.

Motivation research of malicious insiders is coarse grained and does not distinguish between instrumental and expressive motivations. Instrumental violations are means to achieve goals other than the violation itself. In expressive violations, the commission of the action itself is the end goal (Burek, 2006; Willison & Warkentin, 2013). For example, a typical robbery is an

instrumental crime because robbery is the mean to illegally take others' property to a goal of obtaining resources. Aggravated assaults are expressive in most cases, since the action of hurting others itself is the end goal (Willison & Warkentin, 2013). I argue that effective deterrence, prevention, and organizational intervention of malicious insiders' attacks could not be achieved without distinguishing between these two types of motivations.

Expressive and instrumental attacks are not equally deterrable (Willison & Warkentin, 2013). Research shows that the legal sanctions applied to instrumental crimes are not equally effective towards expressive crimes (Chambliss, 1967). Deterrence means, such as punishment, might motivate additional violations because offenders violate rules to make a statement (Leroch, 2014). However, malicious insider studies that are based on rational choice theory (Paternoster & Simpson, 1996) or similar theories (J. Lee & Lee, 2002; Loch & Conger, 1996; M. T. Siponen, 2000) overlook the expressive/instrumental distinction and weaken the usability of the research on deterrence practice.

Expressive and instrumental attacks should be treated differently when the organization is intervening and attempting to prevent the malicious insider attack. Psychology research shows that the expressive and instrumental aggressions are different processes, involving frustration-reaction process and social learning process respectively (Antonius et al., 2013). Literature on the psychological indicators used to predict malicious insiders (Greitzer et al., 2013) as well as prevention methods (Willison & Siponen, 2009) mix the two types of attacks. I argue that the clarification of these two types of violation will help to further specify indicators for each type of attack, better predict malicious insider attacks, and build more effective prevention systems.

The expressive/instrumental classification of malicious attack is a reflection of reactive/instrumental aggression in psychology (Cornell et al., 1996). Personalities are shown to be related with different types of aggressions (Antonius et al., 2013; Blair, 2001; Daffern & Howells, 2007; Lobbestael et al., 2013; Nouvion et al., 2007). The expressive attack is emotion driven as a reaction to threat, but the instrumental attack is more of a cognitive process (Antonius

et al., 2013). It is reasonable to argue that the personality disorders affecting emotions would be more associated with expressive attacks than instrumental attacks. Instrumental attacks among malicious insiders with disorders that affect the cognitive process would be higher than expressive attacks. In the current study, I investigate the following research questions:

1. Are malicious insiders with emotional characteristics more prone to conduct expressive attacks?

2. Are malicious insiders with cognitive characteristics more prone to conduct instrumental attacks?

In the next section, I will review the literature about expressive/instrumental aggression, and the relations between aggression types and personality to build the theoretical foundations of this paper. Then, I discuss the data and methods used, analysis results are presented, and finally limitations and future research are discussed.

4.1. Literature Review

The ultimate goal of malicious insider studies is to mitigate the malicious insider threat. However, are all threats posed by malicious insiders the same? If not, the seeking of a universal method to mitigate these threats might be impractical or even misleading. In this section, I will first discuss the differences between expressive and instrumental violations and their implications for malicious insider study. Then I focus on one of the differences between the two with regard to the individual dispositions of malicious insiders and propose our hypotheses.

4.1.1 Differences between expressive and instrumental violation

Expressive violation focuses on the action itself, but instrumental violation is a means to the end (Burek, 2006). In the field of Counterproductive Work Behavior (CWB), several researchers have called for more in depth investigations into the expressive/instrumental dimension (Bowling & Gruys, 2010; Spector et al., 2006) in order to better mitigate the negative effects of CWB. As a sub stream of CWB research, malicious insiders' studies have started to pay more attention into this distinction calling for research about its effect on deterrence practice (Willison & Warkentin,

2013). However, security research has not made this distinction. I argue that combining expressive/instrumental violations could have negative effects in both theoretical and practical endeavors. Theoretically, they are different processes involving different constructs. Mixing these two might lead to misleading research in the field of malicious insiders.

Expressive aggression is partly explained by frustration-aggression hypothesis, which states that frustration will increase the instigation of aggression, and emotion moderates the possibility of actual occurrence of aggression (Antonius et al., 2013; Dollard et al., 1939). Instrumental aggression is argued (Antonius et al., 2013) to be partly based on social learning process, in which the self-efficacy, commitment, and positive/negative stimuli will play an important role (Bandura, 1973). This distinction should be taken into account in malicious insider studies. For example, in malicious insiders as well as broader cybersecurity research areas, practical and academic endeavors investigated the effect of emotions on deterrence (Loewenstein, 1996; Willison & Warkentin, 2013). However, effects of emotion should be treated differently under the two violation scenarios, because of a different nomological network in which emotion construct is embedded.

We are not stating that emotion won't play a role in instrumental violations nor that sanctions do not effect on expressive violations. What I argue is that these two types of violations are systemically different, therefore they should be treated differently with respect to academic research.

Practically, the significance of this distinction is that offenders with different motivations are not equally sensitive to deterrence (Willison & Warkentin, 2013). Criminology research already shows that legal sanctions that are effective against instrumental offenders might not readily apply to expressive crime (Chambliss, 1967), or even motivate individuals to commit crimes to make a statement (Leroch, 2014). This distinction has not received enough attention in security research community.

Expressive and instrumental violations differ across cognitive processing, neurobiological, and psychological factors (Antonius et al., 2013). Cognitively, expressive aggression is found to be associated with lower information processing ability (Barratt, 1991) as well as lower intelligence level (Vitiello et al., 1990). Neurobiological research confirmed the differences. Blair (Blair, 2001) discovered that expressive aggression is associated with a somatic marker mechanism that would activate the linkage between factual knowledge and bioregulatory state. Thus in the case of expressive aggression, the individual behaves as an “as-if body loop” (Blair, 2001 P728). However, instrumental aggression is regulated by the violence inhibition mechanism, which states that human beings would control aggression because of cues of distress from others. In the next section, I will focus on one aspect among these: the individual differences of malicious insiders who launch the attacks.

4.1.2 Personality Disorders of Malicious Insiders

Personality is an individual’s theory about themselves as well as the environment. It is internalized behavioral patterns and motivation preferences (Dweck & Leggett, 1988). Personality characteristics are found to be associated with cybersecurity concerns such as policy violations (Johnston et al., 2016), adoption of security behavior (Shropshire et al., 2015) and malicious insider attacks (Shechter & Lang, 2011).

In malicious insiders cases, various personality disorders were observed (Maasberg et al., 2015; Shechter & Lang, 2011). Disorders (e.g., antisocial personality disorder, avoidant personality disorder, alcohol abuse disorder) are more prevalent among malicious insiders compared to the general public (Liang et al., 2016). Although previous research investigated a bunch of personality disorders or other characteristics (Liang et al., 2016), the current study will only focus on narcissistic personality disorder, antisocial personality disorder and dysfunctional mood dysregulation disorder because in the literature, these three disorders are most relevant with the difference between expressive attacks and instrumental ones (Bettencourt et al., 2006; Bobadilla et al., 2012; Lobbestael et al., 2013; Ostrov & Houston, 2008).

Personality disorders are also found to be associated with different types of aggressions; subjects with certain types of personality disorders are found to be more inclined to commit expressive or instrumental aggressions (Lobbestael et al., 2014; Lobbestael et al., 2013; Ostrov & Houston, 2008). However, findings from aggression research are not consistent. Bobbadilla et al. (Bobadilla et al., 2012) found that narcissistic personality disorder is more associated with expressive aggression, but Lobbestael’s study shows that narcissistic personality disorders (Lobbestael et al., 2015) are more prevalent in instrumental offenders .

We argue that the inconsistency resides in the different facets of a certain disorder. In clinical settings, a personality disorder is diagnosed by a criteria exhibited by the subject. However, these criteria describe different facets of a disorder. In other words, a certain disorder is not reflective but formative on these diagnostic criteria. This argument is supported by psychology studies showing that the different dimensions of antisocial personality disorder and narcissistic disorders are associated with different types of aggressions (Baron et al., 1999; Lobbestael et al., 2014). In this research, I focus on the association between the expressive/instrumental violations and the diagnostic criteria, instead of the overarching disorders. Table 1 shows the personality disorders of interest as well as their diagnostic criteria (DSM-5 American Psychiatric Association, 2013). Diagnostic criteria is shown in table 9.

In the following sections, I will discuss the diagnostic criteria under each personality disorder and its relationship with expressive/instrumental motivations.

Table 9: Diagnostic criteria of personality disorders

Disorder	Diagnose Criteria	Description
Antisocial	AS1	Failure to conform to social norms with respect to lawful behaviors.
	AS2	Deceitfulness, as indicated by repeated lying, use of aliases, or conning others for personal profit or pleasure
	AS3	Impulsivity or failure to plan ahead

	AS4	Irritability and aggressive, as indicated by repeated physical fights or assaults
	AS5	Reckless disregard for safety of self or others
	AS6	Consistent irresponsibility, as indicated by repeated failure to sustain consistent work behavior or honor financial obligations
	AS7	Lack of remorse, as indicated by being indifferent to or rationalizing having hurt, mistreated, or stolen from others
Narcissistic	NPD1	Has a grandiose sense of self-importance (e.g., Exaggerates achievements and talents, expects to be recognized as superior without commensurate achievements)
	NPD2	Is preoccupied with fantasies of unlimited success, power, brilliance, beauty or ideal love
	NPD3	Believes he or she is special and unique and can only be understood by, or should associate with, other special or high status people(or institution)
	NPD4	Requires excessive admiration
	NPD5	Has a sense of entitlement (i.e., Unreasonable expectations of especially favorable treatment or automatic compliance with his or her expectations)
	NPD6	Is interpersonally exploitative (i.e., Takes advantage of others to achieve his or her own ends)
	NPD7	Lacks empathy: is unwilling to recognize or identify with the feelings and needs of others
	NPD8	Is often envious of others or believes that others are envious of him or her
	NPD9	Shows arrogant, haughty behaviors or attitude
Dysfunctional Mood Dysregulation Disorder	DMDD1	Severe recurrent temper outbursts manifested verbally and/or behaviorally (e.g., physical aggression toward people or property) that are grossly out of proportion in intensity or duration to the situation or provocation
	DMDD2	The temper outburst are inconsistent with developmental level
	DMDD3	The temper outbursts occur, on average, three or more times per week
	DMDD4	the mood between temper outbursts is persistently irritable or angry most of the day, nearly every day, and is observable by others
	DMDD5	Criteria are present in at least two of three settings (i.e., at home, at school with peers) and are severe in at least one of these

4.1.2.1 Narcissistic Personality Disorder

Narcissistic personality disorder is characterized by sense of entitlement and superiority (First, 1994). Although labeled as one single personality disorder (DSM-5 American Psychiatric Association, 2013), narcissism is argued to be a multifaceted concept (Cain et al., 2008; Vazire et al., 2008). Factor analysis of narcissistic personality inventory shows four factors under the overarching narcissistic construct: Exploitativeness/Entitlement, Leadership/Authority, Superiority/Arrogance and Self-absorption/Self-Admiration (Emmons, 1984). In the aggression studies, certain aspects of narcissistic personality are found to be associated with different types of aggressions (Fossati et al., 2010; Lobbestael et al., 2014; Washburn et al., 2004). Self-admiration and entitlement are found to be uniquely associated with expressive aggression (Bobadilla et al., 2012; Reidy et al., 2008). Because individuals with narcissistic personality tend to utilize aggression as a defensive strategy, in order to cope with external rejection of their superior ego (Twenge & Campbell, 2003). On the other side, exploitativeness is uniquely associated with instrumental aggression (Fossati et al., 2010; Seah & Ang, 2008; Washburn et al., 2004), as exploitativeness is individual's tendency to manipulate others in order to achieve personal goals.

Referring to narcissistic personality disorder in table 1, criterion 1 is specific for grandiose sense and superiority; criteria 2 and 3 imply the sense of self important and self-admiration. Criteria 4 and 5 focus on the feeling of entitlement that requires special treatment or deserve excessive admiration from others. Criteria 7 and 8 show the egocentric nature of narcissism. Also, criteria 9 implies the individual has a strong feeling of self-importance and superiority. As mentioned before, self-admiration and entitlement are uniquely associated with expressive attacks (Bobadilla et al., 2012; Reidy et al., 2008). Thus the individual meets these criteria tend to conduct expressive attacks. However, criterion 6 focuses on the exploitative aspect of narcissism. Therefore, I argue that except criterion 6, all other criteria fall into the cluster of personality traits that is more prone to commit expressive violations. To be noticed, not every criteria of

narcissistic personality disorder is investigated in this study, but only the criteria that is argued to be relevant with expressive or instrumental attack in the literature is tested for the difference.

Hypothesis 1-1: Malicious insiders with NPD6 are more prone to conduct instrumental attacks compared with malicious insiders without NPD6.

Hypothesis 1-2a: Malicious insiders with NPD5 are more prone to conduct expressive attacks compared with malicious insiders without NPD5.

Hypothesis 1-2b: Malicious insiders with NPD_9 are more prone to conduct expressive attacks compared with malicious insiders without NPD9.

4.1.2.2 Antisocial Personality Disorder

Although antisocial personality disorder is defined as a pervasively behavioral pattern of rule violations and disregarding the interests of others (First, 1994), subscales of antisocial personality have been confirmed (i.e., impulsivity, stimulus seeking,) (Lilienfeld & Andrews, 1996; Werner & Crick, 1999). Generally, antisocial personality is positively associated with both expressive and instrumental aggressions (Lobbestael et al., 2013; Walters, 2007). On the level of different subscales, certain facets of antisocial personality traits are only associated with one type of aggression. Carefree, lack of planning, impulsivity, and nonconformity are found to tend to associate with expressive aggressions (Antonius et al., 2013; Bobadilla et al., 2012; Ostrov & Houston, 2008), because expressive aggression represents an impulsive, non-planning, and carefree coping action to deal with stress (Lobbestael et al., 2015). Lack of empathy, shallow affect, and low sensitivity to punishment are common antecedents of instrumental aggressions (Antonius et al., 2013; Bobadilla et al., 2012; Ostrov & Houston, 2008). This might be due to the fact that lack of empathy and shallow effect would reduce the commitment to others, increasing the likelihood of hurting others.

Referring to the diagnostic criteria of antisocial personality disorder, criterion 3 describes the impulsivity of antisocial personality; criterion 4 focuses on the violent coping pattern; criterion 6 reflects the non-planning attribute of antisocial personality. Thus I argue that these criteria above

fall into the cluster that tends to engage in expressive violation. Criterion 2 describes the manipulative nature, and criterion 7 focuses on the lack of empathy aspect. Therefore, I argue that these two criteria fall into the profile of malicious insiders who are prone to commit instrumental violations. Similar to the hypothesis for narcissistic personality disorder, only criteria of antisocial personality disorder that are proposed in previous research to be relevant with the differences between instrumental and expressive attacks are tested in the current research.

Hypothesis 2-1a: Malicious insiders with AS2 are more prone to do expressive attacks compared with malicious insiders without AS2.

Hypothesis 2-1b: Malicious insiders with AS6 are more prone to do expressive attacks compared with malicious insiders without AS6.

Hypothesis 2-2: Malicious insiders with AS4 are more prone to do instrumental attacks compared with malicious insiders without AS4.

4.1.2.3 Disruptive Mood Dysregulation Disorder

Disruptive Mood Dysregulation Disorder is characterized by persistent irritability and outbursts of anger (DSM-5 American Psychiatric Association, 2013). Anger, or negative affect, is found to be strongly related to expressive aggression as outbursts of temper is a hostile response to stress or provocations (Dodge & Coie, 1987). Also, anger would interact with provoking conditions to promote aggression (Bettencourt et al., 2006). In a meta analytic review, Bettencourt (Bettencourt et al., 2006) found that the anger is uniquely associated with expressive aggression under provoking conditions. Therefore, I propose that individuals with disruptive mood dysregulation disorder would tend to engage in expressive violation.

Hypothesis 3: Malicious insiders with any of the DMDD criteria are more prone to do expressive attacks compared with malicious insiders without any of the DMDD criteria.

In this section, I reviewed the literature of expressive/instrumental aggression and proposed our hypotheses. The following section discusses our data and methods.

4.2. Data and Method

4.2.1 Data

In the study of malicious insiders, secondary data has been used in the literature. Practically, organizations are reluctant to release data about malicious insider attacks because of concerns about reputation. Theoretically, secondary data provides unobtrusive data observation of the research subject, which avoids the social desirability issue.

The sampling frame in this study is malicious insiders who were convicted by the U.S court from 2000 to 2015. Malicious attacks conducted by these subjects include espionage, leaking information, sabotage, and economic espionage. Employing eminent criteria, the current study samples a total number of 133 cases. I only use IT related attack cases, which lowers the number of cases to 84.

4.2.2 Method

The current study investigates the relationship between personality characteristics and different types of malicious attacks. For the personality characteristics, I use the same method as Liang et al. (Liang et al., 2016), which extracted these characteristics based on a “keyword-characteristic” dictionary. For different types of malicious attack, two raters rated each case based on criteria modified from criminology research to determine the degree of expressiveness and instrumentality. In this section, I will briefly introduce these two processes.

For personality characteristic extraction, I first collect public available data for each subject, including newspaper reports, court documents, Wikipedia, biographies, and blogs. These materials are combined together as a portfolio for each malicious insider. Then for each characteristic mentioned in the literature, I use the descriptive word from the literature to construct the original version of the dictionary. Then the dictionary is updated by adding in new descriptive words found in the portfolio until the update becomes trivial. After this process, I end up with a dictionary of descriptive words about malicious insiders. Then, two different coders

code these descriptive words in to each characteristic as the keywords for that characteristic. Finally I use this dictionary to scan through the portfolio of malicious insiders: if a descriptive word is found, then I see it as a hit for that characteristic.

For evaluation of the expressiveness and instrumentality, I modified the criteria used in criminology research. Also, two different raters first study this criteria, then code 5 cases independently. After that, two raters discuss the coding process as well as the results, reaching an agreement of coding criteria. At this point, one rater does the rest of the coding. Modified criteria are listed below. After coding these cases, categories 1 and 2 are classified as expressive attacks. categories 4 and 5 are classified as instrumental attacks.

1). Purely expressive: In order for malicious attack to be rated as purely expressive, there must be absolutely no sign of external goal other than the action itself. Expressive attack is coded if there are evidences that the attack is a result of purely ideology, revenge, disgruntlement or a belief to right the wrong, in which cases the action itself if the end goal. A typical example of expressive attack is Terry Childs, who erased all router settings and shut down the entire city network; because his new supervisor asked him to share the password of the city network, which made him angry.

2). Expressive/Instrumental: to qualify for this rating, the malicious attack should show evidence for both expressive and instrumental motivations. However, the primary goal of the attack should be internal such as disgruntlement or revenge. For example, one malicious insider was fired by the company, and he got really angry. As a result, he planted a logic bomb in the company's system that disabled the company's network. Also, he made a trade in the stock market to benefit from this event.

3). Balanced expressive and instrumental. To qualify for this rating, the malicious attack should show evidence for both expressive and instrumental motivation. Also, the internal and external motivation should contribute equally to the attack, making it difficult to differentiate which motivation is primary. An example of this category is a former employee from the PPG

company, who used the commercial secrets of PPG to create his own company, claiming that he has been under paid for years and should “correct the wrong”.

4). Instrumental/expressive: to qualify for this rating, the malicious attack should show evidence for both expressive and instrumental motivations. However, the primary goal of the attack should be external such as financial gains. For example, Aldrich Ames’s primary reason to commit espionage to get rewarded by KGB and to pay his debts. However, his disgruntlement of being passed over by a promotion also plays a role in his motivation.

5). Purely instrumental: to qualify for purely instrumental rating, the malicious attack case should have clear evidence of external gains. A typical example will be stealing company’s information for sale or illegal export of information technology devices.

In this section, I introduced the method I used to analyze the data. In the following section, I present our analysis results.

4.3. Data Analysis

In this section I will present the hypothesis test results about characteristics that are more associated with instrumental violations. Then the hypothesis test results about characteristics that tend to associate with expressive violations will be presented.

In the current study, I employ Fisher’s exact test (Fisher, 1970) to compare the different proportions of malicious insiders who conducted instrumental/expressive attacks between two independent groups of malicious insiders with/without certain characteristics. Fisher’s exact test is utilized to test the difference of proportions for categorical variables (Fisher, 1970). In the current study, I coded the malicious insiders’ action as either instrumental or expressive thus the Fisher’s exact test is applicable to test the differences in proportions. Also, Fisher’s exact test is criticized to be too conservative to find relationships that actually exist (Berkson, 1978; Liddell, 1976). I argue that the conservativeness of Fisher’s exact test is suitable for the current study because as the starting point of investigating the relationships between malicious insiders’

characteristics and attack types, I prefer the results to be conservative and solid, in order to set a solid foundation for future studies.

The first group of hypothesis argues that malicious insiders with the following characteristics conduct more Instrumental attack compared with malicious insiders without these characteristics.

The statistical results are shown in Table 10:

Table 10 Hypothesis about Instrumental Attacks

Prop	Characteristics	With Characteristic		Without Characteristic		Difference Test			Support
		Frequency	Sample	Frequency	Sample	p-value	Confidence Interval		
1_1	NPD_6	38	54	13	30	0.01	0.09	0.45	YES
2_1a	AS_6	16	20	35	64	0.04	0.07	0.43	YES
2_1b	AS_2	32	57	19	27	0.93	-0.32	0.04	NO

Note:

NPD_6: interpersonally exploitative

AS_6: consistent irresponsibility

AS_2: deceitfulness

The proportion of instrumental attacks conducted by malicious insiders with NPD_6 ($p=.01$, 95% CI[.009,.045]) and AS_6($P=.04$, 95%CI[.07,.043]) is significant higher than malicious insiders without these two characteristics. Thus H1_1 and H2_1a are supported. However, malicious insiders with AS_2 ($p=.93$ 95%CI[-.32, .04]) do not conduct significantly more instrumental attacks, thus H2_1b is not supported.

The second group of hypothesis argues that malicious insiders with the following characteristics conduct more expressive attack compared with malicious insiders without these characteristics. The statistical results are shown in table 11:

Subjects with NPD_9 ($p=.047$, 95%CI [.04,.039]) conducted significant higher proportion of expressive attacks, supporting hypothesis 1_2a. Conversely, malicious insiders with NPD_5 ($p=.58$, 95%[-.17,.18]), AS_4 ($p=.51$, 95%CI[-.16,.20]) and DMDD ($p=.27$, 95%[-.09, .30]) do

not conduct significantly higher proportion of expressive attack compared to malicious insiders without these characteristics.

Table 11 Hypothesis about Expressive Attacks

Prop	Characteristics	With Characteristic		Without Characteristic		Difference Test			Support
		Frequency	Sample	Frequency	Sample	p-value	Confidence Interval		
1_2a	NPD_9	26	56	7	28	0.047	0.04	0.39	YES
1_2b	NPD_5	13	33	20	51	0.58	-0.17	0.18	NO
2_2	AS_4	13	32	20	52	0.51	-0.16	0.20	NO
3	DMDD	25	57	8	24	0.27	-0.09	0.30	NO

Note:

NPD_9: arrogant

NPD_5: sense of entitlement

AS_4: irritability and aggressive

DMDD: disruptive mood dysregulation disorder

4.4. Discussion and Conclusion

The results shows that malicious insiders with emotional characteristics will conduct more expressive attacks, and that malicious insiders with cognitive indicators tend to do more instrumental attacks. Previous research proposed that malicious insiders are actually a heterogeneous group with respect to the attack types (Willison & Warkentin, 2013). Findings in the current research extend the knowledge by discovering relationships between the personality characteristics and the attack types of the malicious insiders.

Specifically, 70 percent of malicious insiders with NPD_6 launch an instrumental attack, compared to only 43 percent of malicious insiders without NPD_6 conduct an instrumental attack. Also, 80 percent of malicious insiders with AS_6 conduct an instrumental attack, compared to only 55 percent of malicious insiders without AS_6. The findings show that malicious insiders that fail to sustain job or financial responsibility (AS_6) and that are

manipulative in nature (NPD_6) tend to exploit rules or others to achieve personal goals such as monetary gain. Therefore, their primary motivation to launch an attack would be instrumental. However, another indicator (AS_2) that I proposed to be associated with the instrumental attacks is not supported by the data. AS_2 described a deceitful personality and the repeated lying behavior. I proposed that malicious insiders who are deceitful might con others for personal benefit. However, the high p-value (.93) indicates that malicious insiders with AS_2 actually conduct less instrumental attacks compared to these without this indicator. This might be due to the fact that malicious insiders conduct instrumental attacks tend to play honest in daily work to take advantage of others' trust.

For indicators I proposed to be associated with expressive attacks, malicious insiders with NPD9 tend to do more expressive attacks. This implies that the arrogant insiders are likely to be disgruntled, thus launching attacks is their choice to express their negative feelings. However, malicious insiders with NPD5, which describes the sense of entitlement and superiority, do not conduct more expressive attacks as I proposed. This might due to the fact that sense of entitlement or superiority is actually not an indicator of malicious insiders as indicated by previous research, people with the sense of entitlement or superiority probably will perform very well in their job (Deluga, 1997). Also, AS_4 which describe the aggressive personality and DMDD which portrays the tendency to get angry are not associated with expressive attacks. I believe this result is due to the lack of data, since the proportion of expressive attacks among malicious insiders with these two characteristics are higher than malicious insiders without these characteristics (40% vs. 38% and 44% vs. 33% for AS_4 and DMDD respectively). Theoretically, insiders who are easy to get angry tend to expressive their negative feelings in destructive and emotional way. Therefore I believe that the relationship is there and I need to collect more data to support the statistical testing.

On the other side, malicious insiders that are arrogant and believe themselves to be superior conduct more expressive attack, in which case, the attack itself fulfills their superior feelings.

4.4.1 Limitations and future orientations

Although having a significantly larger sample size compared to previous research, the current study is also subject to the problem of data availability. I started with more than 700 malicious insider cases but only 133 of them are suitable for analysis with abundant data available. What's worse, after I focus on IT related cases, the number of cases shrinks to 84. Also, I am very cautious in identifying characteristics, which might result in Type II error. Both of these would result in a lower percentage of characteristics exhibited by malicious insiders than really exists. Thus I suspect that some of the hypotheses are not supported not because certain characteristics are not prevalent, but because of the smaller sample size to fully exhibit statistical significance. In the future research, I will attempt to enlarge the sample size by adding new cases reported by the news media.

The data for current paper is secondary data, collected from public available source. Thus it is interesting and necessary to conduct experiment research to compare with findings in the current research, in which case measurement and situations are more controllable. This is also the next step of the current research stream.

Also, this paper investigates the relations between personality characteristics and malicious attack types. However, I have not integrated all findings under an overarching theory. It is necessary to validate these relationships before I go any further. In future work I will focus more on the mechanism and overarching theories to explain the behavioral patterns of malicious insiders.

4.4.2 Implications for research and practitioners

The result has a profound implication for both academic research as well as practice. Previous academic research shows that prevalence of narcissistic personality disorder among malicious insiders is not significantly higher than the general public (Liang et al., 2016), however, I found that certain aspect of narcissistic is prevalent among malicious insiders who conducted instrumental attacks, as indicated by our findings that 70% of malicious insiders with NPD6

conducted the instrumental attack. This result implies that certain aspects of narcissistic labels a subtype of malicious insiders and calls for a deeper research into the heterogeneity. On the other side, even the hypotheses that are not supported also shine lights on some interesting facts. For example, malicious insiders with AS_2 who are deceitful and tend to con others for personal gain actually conducted more expressive attack than malicious insiders without this characteristic. If this hypothesis is tested oppositely, it is almost significant ($p=.20$). This definitely calls for future research into the opposite side evidence.

Also for practitioners, the result indicates that not all “red flags” of a malicious attack are equal and insiders showing different characteristics should be treated differently in order to deter or prevent the attack. Specifically, if an insider shows irresponsibility or exploitativeness, it is best to deter the potential insider attack by enforcing award and punishment mechanism. However, for malicious insiders with precedents of expressive attacks, it is best to focus on the inner feelings of them to prevent the disgruntlement to escalate to the possibility of launching a malicious attack.

4.4.3 Conclusion

Although many studies investigated the characteristics of malicious insiders, few of them considered malicious insiders as heterogeneous group. Previous research did not analyze the relationships between characteristics of malicious insiders and the attack types they launched. In the current research, I found that emotional characteristics are associated with expressive attacks, which is used to express the negative feeling of the attackers. Cognitive characteristics of malicious insiders are more prone to launch instrumental attacks where the primary goal is personal benefit. Malicious insiders, who fail to sustain financial or job responsibility and who are manipulative in nature, tend to launch instrumental attacks; malicious insiders that are arrogant tend to launch instrumental attacks.

The findings of this paper show that malicious insiders are different with respect to their personality characteristics as well as types of malicious attacks. Therefore, in both academic

endeavors as well as security practice, I should differentiate them. In the field of malicious insider study, I should realize that expressive and instrumental attacks have different motivations and process. Thus the differences of antecedence and precedence of these two types of attacks should draw our attention. In the security practice, I should notice that different characteristics exhibited by insiders might indicate potential attacks of different types. I must deal with these two different types of insiders with different strategies because instrumental attacks are easier to deter with reward or punishment than expressive attacks. Otherwise, the methods used to deter instrumental attacks might motivate expressive attacks as the attackers use this attack to make a statement (Leroch, 2014).

CHAPTER V: CONCLUSION

In this study I investigate the common characteristics of malicious insiders by comparing them with the general public as well as the group of benign insiders. I found that malicious insiders do exhibit some characteristics at higher level than both the general public and the benign insiders. Specifically, the prevalence of antisocial personality disorder, avoidant personality disorder, disruptive mood dysregulation disorder and disgruntled feelings among malicious insiders are higher than both the general public and the benign insiders. Also, the prevalence of substance use disorder among malicious insiders is higher than the general public.

Also, I found that the malicious insiders differ from the benign insiders not only at single characteristics level, but also at the bi-characteristics interaction level. Specifically, the malicious insiders group exhibit more interactions of disgruntlement and antisocial personality disorder, disgruntlement and avoidant personality disorder, as well as disgruntlement and disruptive mood dysregulation disorder. These interactions differ malicious insiders with the benign insiders at a higher level, and if used to predict malicious insiders, less false positive prediction will be achieved.

Finally, I investigate the relationships between malicious insiders' characteristics with the different types of malicious attacks they conducted. I found that malicious insiders with emotional characteristics tend to conduct more expressive attacks to express their disgruntlement. On the other side, malicious insiders with cognitive characteristics tend to conduct more instrumental attacks as a mean to achieve other goals such as financial gain.

The findings in this study are interesting and valuable to both practitioners as well as academia.

Results for the current research pave the way of future investigation of the behavior of malicious insiders as well as the mechanism behind malicious insider attacks. As this research validated the characteristics proposed by previous research, it offers a solid foundation for future research to investigate the behavioral pattern of malicious insiders as well as the theory behind these characteristics.

For practitioners, findings in this paper offer a framework to identify potential malicious insiders in order to mitigate the insider threat. Also, results of chapter four suggest that different strategies should be applied to deter different types of malicious insiders, because the expressive attacks and instrumental attacks have totally different motivation. Ignoring this difference would possibly lead to ineffective prevention of malicious insider attacks, or even worsen the situation. To be noticed, findings in this paper should not be abused in information security practice as even an insider has all characteristics confirmed in this study, he or she would not necessarily launch the malicious attacks. The purpose of this study is to red flag potential malicious insiders and provide a framework for organizational intervention, in order to help the insiders and to prevent the attack.

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