Leadership Complexity While Navigating a Complex Conflict:
Linking Individual Attributes with Dynamic Decision-Making Processes

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ABSTRACT

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Research on dynamical systems theory has demonstrated the vital role that higher levels of complexity play in the constructive management of complex conflicts. Requisite complexity theory proposes that there are stable individual complexity attributes that contribute to a dynamic complexity process that allows an individual to more effectively engage with complex and dynamic decision-making scenarios over time. However, to date, no research has empirically tested the relationships between these attributes and patterns of thought, affect and behavior in individuals engaging with complex tasks. This research examined the relationships between five proposed individual complexity attributes – cognitive complexity, perceived emotional complexity, tolerance for ambiguity, consideration for future consequences and behavioral repertoire – and level of integrative complexity, complexity of emotional experience and patterns of decision making while engaging with a complex conflict resolution simulation. Results provide initial support for the requisite complexity model, with cognitive complexity, perceived emotional complexity, tolerance for ambiguity and consideration for future consequences all demonstrating predictive validity for various aspects of the dynamic decision-making process. Implications for theory and practice are discussed, along with proposed avenues for future research.

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CHAPTER 1: INTRODUCTION

Individuals are facing greater complexity across multiple life domains (Kegan, 1995), which increasingly requires developing what Gregory Bateson (1972) referred to as *systemic wisdom* – defined as the ability to identify factors and the interrelations between factors in the system, the leverage points where changes to the system would be most impactful and constructive, and the potential unintended consequences of taking such actions – in order to make sense of, and act appropriately in, these rapidly changing contexts. This observation is especially relevant to leaders, and other interveners tasked with leadership decision-making and facilitating constructive change in complex and turbulent social scenarios such as pervasive intractable conflicts (Coleman, 2011; Hoojberg, Hunt & Dodge, 1997; Jervis, 1997; Lord, Hannah & Jennings, 2011; Marion, 2007; Senge, 2006; Snowden & Boone, 2007; West, 2013).

For example, many organizational environments today are highly turbulent, characterized by rapid change, increasing diversity, and a fragmentation of the workforce – requiring individual tendencies and leadership competencies very different from more traditional command and control orientations (Harris, 1993; Senge, 2006; West, 2013; Uhl-Bien, Marion & McKelvey, 2007). The breadth of contingences to be addressed by these decision makers has expanded to be seemingly boundless (Hoojberg et al., 1997). The same is true in community contexts, requiring policymakers, government decision-makers and civic leaders to be able to observe a broad range of stakeholder concerns across multiple levels of the system (Jervis, 1997).

This reality requires these leaders be able to conceptualize this complexity, and constructively influence social and organizational processes in new ways, drawing on different competencies and approaches to engaging with these systems beyond what has traditionally been considered essential to effective leadership (Hoojberg et al., 1997; Senge, 2006). This is especially true of conflict dynamics, which are an inevitable part of any social-organizational system (DeDreu & Gelfand, 2008; Pruitt & Kim, 2004). As the complexity of the social world increases, whether or not conflicts take a more or less constructive course increasingly depends on the ability of leaders to foster cultures, structures and processes that are conducive to constructive relations (Coleman, 2011). As described by Uhl-Bien and colleagues (2007), “much of leadership thinking has failed to recognize that leadership is not merely the influential act of an individual or individuals but rather is embedded in a complex interplay of numerous interacting forces.” (p. 302). In the case of protracted conflicts, leaders are often faced with a system characterized by overly simplistic “us versus them” thinking between actors within the system. This means that social relationships are plagued by a narrowing view of possibilities for constructive relations, making it increasingly difficult for leaders to navigate the system out of a pervasively destructive dynamic (Coleman, 2011).

In what follows, three theoretical frameworks will be reviewed and proposed as critical for understanding leadership in complex social conflict contexts. First, recent theoretical developments applying dynamical systems theory to intractable conflicts will be described as a foundation for understanding constructive social change in complex contexts. Next, dynamical decision-making will be introduced as a framework for guiding complex decision-making processes in these contexts. This will be followed by introducing the theory of requisite complexity, which proposes a set of leader competencies for constructively influencing these contexts. Finally, after relating each of these theories, a research study will be described, which tested a new model of leadership and decision making in a simulated complex conflict context.

CHAPTER II: LITERATURE REVIEW

Dynamical Systems Theory and Conflict

Recently, a growing literature has emerged to address the limitations of traditional approaches to leadership and decision making in social systems by framing social environments in terms of complex dynamical systems (Axelrod & Cohen, 1999; Coleman, 2011; Pascale, Millemann & Gioja, 2000; Ricigliano, 2012; Svyantek & Brown, 2001). Rather than viewing social processes in linear, cause and effect relations, dynamical systems theory (DST) proposes that it is the pattern of interactions among individuals within a social system evolving over time that is critical for understanding complex social processes (Coleman, 2011; Nowak & Vallacher, 1998; Vallacher, Coleman, Nowak, & Bui-Wrzosinska, 2010; Vallacher et al., 2013). Overall, the contribution of this theoretical framework is the recognition that patterns of social processes, such as organizational or conflict cultures, form and evolve through the interactions of the individual elements in the system over time, acting and reacting in response to changes in other elements in the system. As the behavior of each individual element changes, other elements in the system must adapt to the changing context, meaning that the system can stabilize, but the impact of changes to the system over time will never be completely predictable (Axelrod & Cohen, 1999).

This perspective offers new insights into social conflict processes by framing their more stable patterns as self-organizing elements, governed by dynamic interaction processes that evolve over time (Coleman, 2011; Vallacher et al., 2010). While many conflicts at the interpersonal and group level can be resolved through more traditional conflict resolution methods, addressing large-scale conflict processes at the systemic-level requires moving past viewing systems in terms of the traditional unidirectional cause and effect relationships between factors at particular points in time, consequently overly simplifying (or overly complicating) the overall patterns (Vallacher et al., 2013). Instead, as Coleman (2011) and others suggest, conflict dynamics in complex systems, such as organizations and communities, should be understood in more fluid, non-linear and dynamical ways.

At this point, it is important to distinguish systems that are *complex* from those that are *complicated* (Cabrera & Cabrera, 2015; Sargut & McGrath, 2011; Snowden & Boone, 2007; Weaver, 1948). In everyday language, these terms are often used interchangeably, but in the complex systems literature their meanings are quite different. This distinction is illustrated perhaps most succinctly by Snowden and Boone (2007), who have differentiated four potential contexts of leadership decision-making: simple, complicated, complex and chaotic. *Simple* systems contexts are characterized by clear cause and effect relationships between variables, with decision making typically requiring only the following of established procedures or best practices. At the other end of the spectrum are *chaotic* systems, which lack coherence across variables and have no underlying pattern or structure driving the system's behavior.

The distinction between complicated and complex systems requires a little more explanation. Both systems are characterized by multiple elements interacting within the system over time resulting in certain patterns of behavior leading to certain outcomes. However, the complicated system is much more like the simple system in that it is describable in terms of cause and effect relationships, only between a larger number of variables. However, it is still possible to get a sense of all of the relevant variables in the system, as well as the relationships between them, such that prediction is possible, but this requires a high level of knowledge and expertise in order to make appropriate decisions.

A complex system is different in that, while the system is stable and has an underlying order, this structure cannot be completely and accurately assessed by the decision maker. In this type of system, it is not possible to see all of the relevant variables, nor can the nature of the relationships between the variables be explicated. Without a full picture of the system, the decision maker is left with an incomplete framework regarding the underlying structure of the system, and is therefore unable to predict with certainty the consequences of interventions (Snowden & Boone, 2007; also see Axlerod & Cohen, 1999; Coleman, 2011; Johnson, 1988; Weaver, 1948).

An example of a complicated system is a commercial airliner. Clearly, this is a highly intricate system with multiple interacting elements that work together to allow it to deliver passengers safely and consistently for decades. For the majority, how this system works is not understood and therefore the ability to make decisions with regards to the operations and maintenance of the system is not possible. However, for the engineers and technicians who design and maintain the aircraft, and for the pilots that operate it, the elements that compose the system and the relationships between those elements is understood. When pilots fly the aircraft, they know exactly how it will behave through all phases of flight. And, on the rare occasions when a component in the system fails, it is clear what impact this will have on other parts of the system and how this will affect the ability to operate the aircraft going forward.

To continue this illustration, pilots are faced with another system during the course of aircraft operations that is characterized as complex: weather. Weather patterns are the result of countless interacting variables from elements in the atmosphere, on the earth's surface, and even from outside of the planet including the sun, the moon and the planet's orientation to these (Gleick, 2008; Procaccia, 1988). Weather systems continue to challenge experts, who struggle to accurately predict weather outcomes even a few hours in advance. There are just too many variables interacting differentially over time for more accurate predictions to be possible. One estimate suggests that for weather prediction to be accurate even just a few days in advance would require measurement of atmospheric conditions at every square meter from the ground to the upper atmosphere across the entire earth's surface (Gleick, 2008). This challenge is very similar to the circumstances faced by those attempting to ameliorate social systems in conflict. The Nobel laureate and physicist Murray Gell-Mann has been credited with the comment "Imagine how hard physics would be if electrons could think" (Page, 1999, p. 36) to describe the difficulties faced by those working to understand these systems.

The challenge for decision-makers and leaders in these contexts, according to Coleman (2011), is to gain an understanding of the complex dynamics within and outside of the system, and to be able to take actions to constructively influence processes within the system over time. However, what becomes clear from this approach to framing social conflict is that the ability to constructively change these systems is an extremely difficult proposition – requiring leaders to enact more effective approaches to gaining an understanding of the system, making decisions, and taking action. As scholars within the social and organizational sciences continue to adapt these concepts to increasingly complex and dynamic social realities, leadership scholars are also recognizing that decision-makers often struggle to make sense of, and adapt to, this increasing complexity (Burke, 2014; Marion, 2008). In support of this, Dinh et al. (2014), in their comprehensive review of emerging trends in leadership theory and research, have identified systems and complexity as rapidly growing areas of inquiry.

Conceptualizing leadership and decision making from the complexity perspective brings new challenges to conducting research in this area. First, there is difficulty in assessing individual decision making in complex social conflict contexts. Access to individual decision makers in real-world environments is limited, and research that is conducted within these environments is problematic to generalize across actors and contexts (Highhouse, 2009). Second, while there is a growing body of theory and research examining the more fundamental competencies that relate to individuals being able to effectively engage with complex systems more generally (e.g. Coleman, 2011; Hoojberg et al., 1997; Lord et al., 2011; Marion, 2007; Suedfeld, 2010), this work is piecemeal and lacks a broader structural framework. Much more research is needed to establish approaches for identifying and developing more effective leader decision makers, by exploring the fundamental relationships between individual-level attributes and internal information processing, emotional reactions, and behavioral strategies and outcomes among individuals attempting to make change in complex environments.

In order to address this limitation, the current study explored leadership decision-making in complex social conflicts through a DST lens by drawing from two theoretical frameworks to inform the identification of the mechanisms that relate to an individual's capacity to effectively navigate complex and large-scale social conflicts effectively.

Dynamic decision making will be explored as a framework for describing decision-making processes that are more or less effective in complex turbulent environments. This will then be paired with a nascent theory of individual leadership processes in these environments, *requisite complexity*, which provides a framework for exploring the internal attributes that influence an individual's ability to conceptualize, and take action in, these environments. These two theories are then applied in the current research study, which tested the extent to which a battery of existing survey instruments, selected to represent the requisite complexity construct, relate to dynamic decision-making processes in a computer simulation of a complex conflict scenario.

Dynamic Decision Making in Social Contexts

A great deal of literature has focused on general individual decision making and heuristics tasks (for a review see Gigerenzer & Gaissmaier, 2011). Additionally, a good amount of research has been conducted around complex decision making in highly complex turbulent environments (Busemeyer & Townsend, 1993; Osman, 2010). For example, a recent review by Osman (2010) of dynamic decision-making research describes multiple platforms that have been employed simulating complex, dynamic process such as an ecosystem in Sub-Sahara Africa, automated piloting systems, a waste incineration plant, stock trading, a sugar factory, and water purification system. Another popular complex decision-making scenario, often employed in business schools and management training is the "Beer Distribution Game" which simulates the complexity of a supply chain (Sterman, 1989).

However, what has received less attention in the literature is decision-making in the context of highly complex social contexts. More recent advances in computerized social simulation platforms – alternately referred to as complex problem-solving tasks, simulated task environments, microworlds, dynamic decision-making tasks, naturalistic decision-making tasks, etc. (Osman, 2010) – offer new tools for investigating individual problem solving in complex environments within a more controlled laboratory setting (Brehmer & Dörner, 1993; Dörner, 1996; Rigas, Carling & Brehmer, 2002). These simulations have been found to have utility both in research and in training and development for leadership (Gray, 2002; Hunsaker, 2007; Lopes, Fialho, Cunha & Niveiros, 2013; Rigas, Carling & Brehmer, 2002).

Research in this area is nascent, primarily due to the difficulties in gaining access to decision makers in complex social contexts. The reasons for this stem primarily from the difficulties of both measuring individual problem solving in real-world environments, and recreating experimental decision-making scenarios that are sufficiently complex to model social environments (Brehmer & Dörner, 1993; Marcy & Mumford, 2010). The types of decision-making that are required of individuals faced with complex processes characterized by change and unpredictability, are very different from the simple and complicated processes that decision makers are often faced with, where identifying direct causal links between actions and outcomes is possible and appropriate (Busemeyer & Townsend, 1993; Edwards, 1962; Snowden & Boone, 2007). Brehmer (1992) suggests that the primary purpose of decision making in these larger social contexts is to initiate an ongoing process of obtaining control in order to move a system to a more desired state. Put more simply, Brehmer and Allard (1991; as cited in Brehmer 1992) state that dynamic decision making is "the problem of finding a way to use one process [i.e. leadership decision-making] to control another process" (p. 213).

The concept of *dynamic decision making* was first articulated by Edwards (1962) who identified three requisite characteristics of these types of tasks:

1) Multiple decisions, made in the context of other decisions, are required to address the systemic issue.
2) Decisions made are not independent – but instead are constrained or expanded by previous actions and also act to constrain or expand subsequent options.
3) The nature of the problem being addressed changes as the decision maker interacts with the system.

Building on the conceptualization of Edwards, Brehmer (1992) added a fourth characteristic – decisions in these systems are made in real time, which means that the timing of decisions is also a critical factor of dynamic decision making. Decisions may have very different influences on the system depending on when they are enacted. For the decision maker, this means not only identifying effective decisions, but also anticipating the appropriate time to enact a decision.

Perhaps most prolific in applying dynamic decision making to complex social environments is the work of Dietrich Dörner, a German social psychologist who employed microworlds of highly complex social scenarios in order to investigate individual decision-making in the context of change. In his book The Logic of Failure: Recognizing And Avoiding Error In Complex Situations, Dörner (1996) summarizes multiple research studies employing microworld simulations to uncover the decision-making patterns employed by individuals more successful in engaging in problem solving and facilitating change in dynamic decision-making scenarios.[1] Example microworld scenarios employed by Dörner include *Moro*, where an individual is tasked with advising a rural African community facing health and environment challenges, and *Lohhausen*, which requires an individual to play the role of mayor of a small German town faced with social and economic challenges (Dörner, 1996; Brehmer & Dörner, 1993).

Overall, Dörner's research has demonstrated that individuals more successful in improving microworld scenarios tend to spend more time making decisions early in the scenario, make decisions more frequently as time goes on, employ less consequential decisions early in the simulation before making more impactful decisions later on, act in ways that reflect an understanding that there are multiple systemic contributions to the problem, generate and test hypotheses more, and stay focused on appropriate long-term goals without fixating prematurely on specific solutions to those goals (Brehmer, 1992; Coleman, 2011; Dörner, 1996). For the last point regarding long-term goals, Dörner provides an example of participants interacting with the *Lohhausen* simulation. While many participants identified an important long-term goal as being the "well-being of citizens" (p 59), many then went about trying to identify problems effecting well-being that they could solve. This, in turn, led to fixating on a specific problem or randomly switching goal strategies as new problems emerged.

While the work of Dörner (1996) and more recent work (e.g. Gebauer & Mackintosh, 2007; Gonzalez, Thomas & Vanyukov, 2005; Gebauer & Mackintosh, 2007; Güss & Dörner, 2011; Rigas, Carling, & Brehmer, 2002) has provided much insight into the processes employed by individuals who are more effective in implementing

[1] Much of Dörner's work is published exclusively in German, necessitating a reliance on this summary review.

constructive change in large-scale dynamic decision-making scenarios, much less is known about the relatively stable attributes and competencies that relate to the ability of an individual to engage in more effective engagement processes. There is some research linking increased intelligence to performance in microworlds (Gonzalez et al., 2005; Rigas et al., 2002), but other studies have found no such link (Gebauer & Mackintosh, 2007; Kanfer & Ackerman, 1989; Rigas & Brehmer, 2014; also see Sternberg, Wagner, Williams & Horvath, 1995). Additionally, one study, using the PeaceMaker microworld simulation of the Israeli-Palestinian conflict, found that individuals higher in the thinking/judging Myers-Briggs Type Indicator subtype showed significant improvement in performance as compared to individuals with other combinations of the feeling-thinking, and judging-perceiving dimensions (Gonzalez & Czlonka, 2010). However, other studies have found no links between standard personality measures and performance in complex simulations (Rouwette, Größler & Vennix, 2004).

Additionally, it seems reasonable that expertise would be a critical individual difference variable predicting performance in dynamic decision-making tasks. However, as Johnson (1988) found in a review of research on expertise in decision-making, results from multiple research studies suggest that under conditions of complexity and uncertainty, where relationships between inputs and outputs are unclear, experts are no more effective than novices (Johnson, 1988). This finding was more recently supported by Tetlock (2005) who found, in research involving 284 expert political and economic forecasters from media, academia, the US government, and prominent international organizations such as the World Bank Group, that "…the average forecaster was roughly as accurate as a dart throwing chimpanzee" (Tetlock & Gardner, 2015). Specifically, he found that even the most successful experts were only able to predict 20 percent of the variability in the probabilities of outcomes across a range of domestic (U.S.) and world affairs, which was less than the variance explained by a simple algorithm designed to assign equal probabilities to each outcome.

This is also born out by research on decision making in complex contexts. For example, among top management teams in organizations, cognitive biases around applying strategies from past successes to new challenges is a common source of serious strategic errors (Shimizu & Hitt, 2011). Dörner (1996) also found this when demonstrating his microsimulation to two domain experts in physics and economics, who focused on a narrow range of solutions rather than grasping the complexity of the larger social challenge they were seeking to address. As Dörner describes, "…they solved some immediate problems but did not think about the new problems that solving the old ones would create… The economist and the physicist were by no means worse planners than other people. Their actions were no different from those of 'experts' in real situations" (pp. 4-5).

However, beyond these domains, no research, to this author's knowledge, has been identified that explores other attributes that may be of importance to existing populations of decision-makers operating in complex social contexts. Overall, as computing technology continues to advance, microworld simulations represent new opportunities for exploring the individual factors and processes related to individual decision-making in dynamic, real-world environments (Gonazlez, Vanyukov & Martin, 2005). Of specific interest in this proposed study is the identification of individual attributes that predict an individual's ability to both gain a more complex understanding of the system they are attempting to ameliorate, and to engage in more effective engagement processes that lead to more beneficial outcomes.

It has been suggested that leaders demonstrating greater complexity generally are more effective in dynamic decision-making contexts (Hannah, Lord & Pearce, 2011), but thus far there is little empirical basis for this. Gaining empirical support for the relationships between these processes would be a crucial step in addressing existing limitations in the leadership and decision-making literature. However, what has been missing thus far from existing leadership theories is a more detailed model of the internal attributes of decision makers that facilitate the ability to effectively make decisions and act appropriately in complex environments. *Requisite complexity* has recently emerged as such a model with implications for understanding individual decision-making processes in complex scenarios.

Requisite Complexity

The *law of requisite complexity*, a term first advanced by McKelvey and Boisot (2003; cf. Uhl-Bien et al., 2007) and further conceptualized by Lord et al. (2011), proposes that influencing complexity requires complexity – in order for a decision maker to be effective in changing a complex social system, their level of understanding of the situation, as well as the actions taken to influence the situation, must match the complexity of the system they are attempting to change. From a DST perspective, this has been conceptualized as a fit between the intrinsic dynamics of the individual and the extrinsic dynamics of the situational context (Nowak & Vallacher, 1998). According to

Lord et al. (2011), the theoretical perspective of individual requisite complexity suggests that a change leader is a complex adaptive system operating within a complexity context:

> *Requisite complexity refers to the ability of the individual to perceive and react to the internal and external organization environment from multiple and sufficiently complex perspectives so that the complexity of individual understanding achieves congruence with the complexity of the situation.* (p. 109)

In other words, in order for an individual to be able to constructively influence a complex system, they must be able to observe and act in response to internal and external stimuli in such a way as to align their internal complexity of understanding with the external complexity of the system they aim to change. Building off of this work, Hannah, Balthazard, Waldman, Jennings and Thatcher (2013) suggest that this is essential to leader adaptability, which depends, in large part, on "the capacity of leaders to adjust their thoughts and behaviors to enact appropriate responses to novel, ill-defined, changing, and evolving decision-making situations" (p. 393). This happens through a continuous process of differentiation and integration of the various components within the system, such that the complexity of understanding of the system, and the ability to make more effective decisions, is enhanced.

Lord et al. (2011) propose that this adaptability is a function of both relatively stable individual complexity attributes and dynamic individual complexity processes. Each of these will be described in more detail in the following paragraphs. First, based on their review of prior research in complexity, leadership and decision making, they identified four stable attributes that leaders rely on when engaging with a complex system: *general cognitive complexity* – the ability to differentiate multiple sources of information, *emotional complexity* – the ability to experience and tolerate a range of positive and negative emotions, *social complexity* – the ability to identify, integrate and enact multiple social roles and relations appropriate to the context, and *self complexity* – the level of complexity of the leader's self-concept within their role.

They further propose that each of theses complexity characteristics acts to influence, over time, the leader's dynamic self-regulation processes as they interact with, and enact decisions in, the system they are attempting to change. Lord et al. (2011) propose that these stable attributes influence a dynamic aggregation process informing momentary brain structures composed of perceptions and lower-level cognitive processes, which then influence higher level complexity processes of goal emergence, emotional reactions and self concept within the system. What the theory essentially proposes is that these relatively stable complexity attributes contribute to a process of facilitating an increasing complexity of mental representation of the system within the decision maker, which then allows the leader to gain a more dynamic understanding of, emotional reactance to, and pattern of decision-making within the system.

In short, theoretically, requisite complexity suggests that the presence of certain complexity attributes (i.e. cognitive, emotional, social and self complexity) should predict more constructive engagement processes in terms of information processing, complexity of emotional reactions, and behaviors, which, in turn, predict more effective leader performance and enhanced systemic outcomes in complex environments. This research sought to test hypotheses borne out by this theoretical model. Specifically, a computer simulation game of a complex conflict scenario is employed in order to test the extent to which the four complexity attributes proposed by Lord et al. (2011) relate to patterns of decision making in this context. Each of these attributes is described in more detail below.

Stable Complexity Attributes

For this research, stable complexity attributes are conceptualized as the more enduring individual difference variables that are theorized to be predictive of more dynamic processes within a decision-maker as they engage with a complex system over time. The four stable attributes proposed by Lord et al. (2011) will now be described in greater detail. Additionally, social and self complexity – concepts which lack direct measurement approaches amenable to the current research – will be described in terms of existing relevant constructs that have broad support in the literature.

Cognitive Complexity. The concept of cognitive complexity originates with Kelley's (1955) "personal construct theory," which proposed that there are individual differences in the complexity with which individuals observe and conceptualize others and events, and Bieri (1955) who proposed that individuals who are more highly differentiated in their perceptions are able to engage with others more constructively. In short, the cognitive complexity construct refers to the number of social dimensions employed by individuals describing events, experiences or other individuals, such that individuals applying more dimensions in describing a social phenomenon are considered more cognitively complex than those applying fewer dimensions (Spengler & Strohmer, 1994; Tripodi & Bieri, 1966; Woehr, Miller & Lane, 1998). This is conceptualized in this literature as a general cognitive tendency.

More recently, the term *integrative complexity* has been employed, which is described as the extent to which an individual is able to 1) *differentiate* the multiple perspectives that are present in a social situation, and 2) to *integrate* those perspectives into a coherent whole that represents the interactions of the multiple perspectives as well as the influence of the over-arching context (Schroder, Driver, & Streufert, 1967; Suedfeld, Tetlock & Streufert, 1992). This builds from the construct of cognitive complexity, which assesses an individual's tendency to differentiate, by adding the extent to which the individual is able describe the ways in which the differentiated dimensions relate, and the mutual influence of this within the broader systemic context. While cognitive complexity is proposed as a general cognitive tendency, integrative complexity is the expression of complexity while working with information in a specific context (Suedfeld & Coren, 1992; Suedfeld et al., 1992).

For example, previous research on integrative complexity and leadership decision-making suggests that leaders higher in integrative complexity tend to be more effective in managing turbulent situations (e.g. Hooijberg & Quinn, 1992; Hunsaker, 2007; McGill, Johnson & Bantel, 1994; Suedfeld, 2010). For example, an archival analysis of the personal writings of world leaders during international crises found that those who demonstrated higher levels of integrative complexity were better able to resolve the crisis and avoid war (Wallace & Suedfeld, 1988). Additionally, revolutionary leaders higher in integrative complexity tend to be more successful after attaining public office (Suedfeld & Rank, 1976). A multitude of similar findings suggest that higher integrative complexity is related to more successful diplomacy and reaching mutual beneficial agreements (see Suedfeld, 2010 for a review).

Organization scholarship has identified multiple links between integrative complexity among executive decision-makers and organization outcomes (Zaccaro, 2001). For example, Wong, Ormsten and Tetlock (2011) measured integrative complexity in the top management teams within a sample of Fortune 500 organizations and found that those firms led by individuals higher in integrative complexity exercised greater social responsibility and improved relations with societal stakeholders. Additionally, Hunsaker (2007) found that leaders with higher levels of complexity are more likely to be successful in organizations operating within highly turbulent environments as compared to leaders with lower levels of cognitive complexity, who are more effective in stable, structured situations. Finally, looking closely at a particular industry, one study focusing on adaptive performance among banking executives (a particularly turbulent environment) found a positive correlation between multiple measures of cognitive complexity and firm performance as rated by superiors (McGill et al., 1994).

To summarize, cognitive complexity maps onto the differentiation component of integrative complexity. For an individual to exhibit higher levels of integration in decision-making scenario, they must be able to differentiate the multiple components or perspectives operating in the system. Cognitive complexity then, consistent with the Lord et al. (2011) framework, is expressed and can be measured as a more general individual attribute, whereas integrative complexity, is expressed and measured as an individual's conceptualizations applied to a specific scenario. Therefore, in order to test the model proposed by Lord et al., this research has employed an established measure of cognitive complexity (described below), which will then be related to integrative complexity expressed with regards to a specific scenario.

Emotional Complexity. Kang and Shaver (2004) define emotional complexity as both the extent to which an individual experiences a broad range of emotions, as well as their capacity to differentiate subtle distinctions within specific categories of emotion. Their research has demonstrated that emotional complexity in individuals is related to cognitive complexity, as well as personality and life experience (Kang & Shaver, 2004). In some frameworks, emotional complexity is considered a distinct sub-construct of emotional intelligence, focusing on the ability of the individual to be aware and make use of emotional information (Kang & Shaver, 2004; Mayer et al., 2004). Under the conceptualization of requisite complexity put forward by Lord et al. (2011), emotional complexity is the extent to which the leader can experience a wide range of positive and negative emotions both internally and observe them within others, which facilitates enhanced requisite complexity in thought processes and behaviors.

Very little research has examined emotional complexity and leadership. Lord et al. (2011) cite the work of Bledow, Schmidt, Frese and Kühnel (2011) who found that among software developers, a complex interplay of positive and negative emotional experiences throughout a workday contributed to more engagement in project tasks. They propose that this relates to leadership by suggesting that successful leaders must be emotionally complex in order to translate negative events into more positive understandings that facilitate action. Additionally, George and Zhou (2007) found that individuals who received strong supervisory support and held a generally positive mood were able to translate negative mood experience into creative outcomes (i.e. creativity was optimal in the presence of both positive and negative moods). Finally, a field study found that middle managers who were able to balance positive emotional commitment to an organization change project with empathy for employee emotions (generally less positive) were able to better attend to conflict emotions which facilitated more constructive outcomes (Huy, 2002).

Social Complexity. Lord et al. (2011) conceptualize social complexity as "the ability to perceive and integrate multiple aspects of social roles or relations" (p 108). For this concept, the authors draw specifically from the work of Zaccaro (1999; 2001), who suggests that complexity decision making requires assimilating a vast amount of information, balancing a multitude of social demands, and considering the consequences of actions on multiple time scales. It is proposed here that two general individual difference constructs are most relevant to this dimension.

First, it is proposed here that *tolerance for ambiguity* is an individual-level attribute relevant to predicting constructive engagement while engaging with a dynamic decision-making task. Tolerance for ambiguity has been defined at the most basic level as an individual "tendency to perceive ambiguous situations as desirable" (Budner, 1962; p. 29). More broadly, this has been conceptualized as "a range, from rejection to attraction, of reactions to stimuli perceived as unfamiliar, complex, dynamically uncertain, or subject to multiple conflicting interpretations'' (McLain, 1993; p. 184). Both definitions capture the relevance of this construct for individual decision makers: complex dynamic decision-making scenarios are by nature ambiguous in terms of the information available to the decision maker, and individuals attempting to engage with these systems must be able to tolerate this ambiguity in order facilitate constructive change. Complex systems, are by nature unpredictable in most contexts, such that it is not possible for a decision-maker to hold a complete understanding of the underlying dynamics (Axelrod & Cohen, 1999; Pascale, Millemann & Gioja, 2000; Svyantek & Brown, 2001; Vallacher et al., 2013). By extension, this suggests that decision makers engaging with these types of systems would benefit from being able to tolerate the ambiguity and uncertainty inherent to the role.

There is a considerable amount of research to support this proposition. Tolerance for ambiguity has been related to decreased stress from role ambiguity, entrepreneurship, and overall managerial effectiveness (Endres, Chowdhury & Milner, 2009; Furnham & Ribchester, 1995; Judge, Thoresen, Pucik, & Welbourne, 1999). Related to conflict processes, higher levels of tolerance for ambiguity have been found to be related to employing more solution-focused conflict management styles (Nicotera, Smilowitz, & Pearson, 1990). In negotiations, individuals higher in tolerance for ambiguity tend to achieve more profitable outcomes (Yurtsever, 2001; 2008). Finally, there is some evidence to suggest that those lower in tolerance for ambiguity may be more suggestible, more readily drawing more firm conclusions from limited and biased information than those higher in tolerance for ambiguity (Van Hook & Steele, 2002).

Other research has explored the impact of tolerance for ambiguity in more complex scenarios. Judge, et al. (1999) surveyed middle and upper-level managers in organizations experiencing significant change, to assess the extent to which, among other variables, tolerance for ambiguity was related to self-assessments of coping with change. They found that leaders scoring higher in tolerance for ambiguity reported more productive coping with change, higher levels of organization commitment, and greater job satisfaction. In another study, Endres et al. (2009), examining the role of tolerance for ambiguity in decision accuracy, manipulated complexity in a laboratory task and found that the level of tolerance for ambiguity did not matter when the scenario was moderately complex. However, in the high complexity scenario, those with the highest tolerance for ambiguity demonstrated the highest accuracy, while those with the lowest tolerance for ambiguity demonstrated the worst.

Second, consideration for future consequences is proposed as a second relevant construct within the social complexity dimension. Consideration for future consequences (CFC) is defined as “the extent to which individuals consider the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes” (Stratham, Gleicher, Boninger & Edwards, 1994; p. 743). In the case of decision making, this involves the need to reconcile tendencies to act in the present to react to immediate concerns without considerations for the long-term implications of those actions. Higher levels of CFC have been associated with decreased aggression, more prosocial behaviors in organizations, increased academic achievement, and increased behaviors related to concern for the environment (for a review, see: Joireman, Strathman & Balliet, 2006).

Past research suggests that CFC does play a role in more effective decision making in complex social scenarios. CFC has been associated with tendencies toward transformational leadership such as providing vision, setting high expectations, and adaptively providing support (Zhang, Wang & Pierce, 2014), scanning the environment more frequently to identify factors relevant to future outcomes (Parker & Collins, 2010), and developing more creative solutions to abstract problems (Förster, Friedman &

Liberman, 2004). Additionally, in intergroup settings, findings suggest that individuals who are more self-focused yet remain aware of the longer-term nature of a relationship (i.e. anticipate repeated interactions over time) choose more cooperative intergroup engagement strategies (Van Lange, Klapwijk & Van Munster, 2011; Wolf, et al., 2009).

Self-Complexity. While social complexity involves the capacity to integrate the role of decision maker within the larger system of social actors and relations, self complexity refers to holding a complex self concept around the roles required for complex decision making. Although the literature on self complexity lacks consensus (Koch & Sheppard, 2004), this research will apply the definition provided by Lord et al. (2011) in the domain of complex decision making as "the extent to which an individual holds separate self-aspects or social roles (e.g., team leader, mentor, account manager), as well as the breadth of the attributes contained within the leader's self-concept" (p. 119). Hannah et al. (2011) further suggest that the more this is demonstrated within the decision maker, the more likely they are to be adaptable in dynamic decision-making scenarios.

This conceptualization of the construct is most closely related to the concept of *behavioral repertoire* within the broader theoretical framework of *behavioral complexity*. Behavioral complexity in leadership has been most succinctly defined by Denison, Hoojberg and Quinn (1995) as "the ability to perform the multiple roles and behaviors that circumscribe the requisite variety implied by an organizational or environmental context" (p. 526). Denison et al.'s (1995) theory is organized around the *competing values framework* (CVF), which orients multiple leadership roles along two dimensions: internal vs. external, and flexibility vs. stability considerations (Hart & Quinn, 1993;

Hoojberg, 1996; Lawrence, Lenk & Quinn, 2009). Roles are then defined based on their placement along these dimensions. Example roles include innovator (external, flexible), mentor (internal flexible), coordinator (internal, stable) and director (external, stable; Denison et al., 1995). Within this broader conceptual framework *behavioral repertoire* refers to the extent to which an adaptive decision maker is able to conceive of the multiple roles required to engage with the system, while *behavioral differentiation* refers to the extent to which the individual is able to enact behaviors appropriate for engaging with the complexity of the system (Hoojberg, 1996; Hoojberg et al., 1997).

Findings from a broad range of research studies suggest that when leader-decision makers demonstrate behavioral (self) complexity (either through self-report projective questionnaires, or ratings from others along the CVF dimensions), they are rated as more effective in multi-rater feedback assessments (i.e. from subordinates, peers, supervisors, and customers) and tend to show increased performance in organizations based on profits, growth and innovation (Denison et al., 1995; Hart & Quinn, 1993; Hoojberg, 1996; Lawrence et al., 2009). Additionally, there is some evidence to suggest that those higher in this trait tend to respond more adaptively and constructively to failure than those expressing lower self-complexity (Dixon & Baumeister, 1991).

Dynamic Decision-Making Processes

As described above, requisite complexity theory proposes that relatively stable individual complexity attributes and competencies influence the extent to which an individual engages in more dynamic decision-making processes as they work within a complex system. This research will test the relationships between the five proposed static complexity attributes described above (i.e. cognitive complexity, perceived emotional complexity, tolerance for ambiguity, consideration for future consequences, behavioral repertoire) and three proposed dynamic complexity processes: level of integrative complexity, complexity of emotional engagement, and behavioral differentiation while engaged in a complex task. This proposed model is summarized in Table 1.

A key proposition of requisite complexity, as put forward by Lord et al. (2011), is that individual stable complexity traits should influence individual dynamic decision-making process such that higher levels of complexity of understanding of the system will be achieved as the individual engages with the system over time. Consistent with requisite complexity theorizing, this research will specifically examine the extent to which cognitive complexity, emotional complexity, tolerance for ambiguity, consideration for future consequences and behavioral repertoire predict more complex patterns of thinking, feeling and behavior resulting from engagement with a dynamic decision making scenario.

First, the concept of cognitive complexity described above suggests that individuals can be described by both a trait-based global level of cognitive complexity, and a state-based level of integrative complexity within a specific context that can change over time (Suedfeld, Guttieri & Tetlock, 2003; Suedfeld et al., 1992). A measure of general cognitive complexity provides an assessment of the way in which an individual tends to structure complex information, while a measure of integrative complexity measures both the structure and content of an individual's understanding of the complexity of a specific subject (Young & Herman, 2014).

Research has demonstrated that individual integrative complexity can be influenced by numerous internal and external factors, including significant negative life events, uncertainty, fatigue, time pressures, perceived threats and feelings of losing control (Suedfeld & Bluck, 1993; Suedfeld et al., 2003; Tetlock, Peterson & Lerner, 1996), suggesting that engaging with a dynamic decision-making scenario may influence integrative complexity scores over time. Additionally, research suggests a relationship between trait cognitive complexity and openness to experience (McAdams et al., 2004), with openness to experience being a trait conducive to increasing integrative complexity (Tadmor, Galinsky & Maddux, 2012). Another study focusing specifically on communications from U.S. presidents found that, during crises, those who were more open to receiving input from advisors, and willing to entertain more options were less likely to demonstrate decreasing integrative complexity (Kowert, 1996). However, to date, no research to this author's knowledge has measured the extent to which general cognitive complexity relates to higher levels of integrative complexity after engaging with a dynamic decision-making task.

Second, in terms of emotional complexity, previous research suggests that cognitive complexity is positively correlated with complexity of emotional experience (Davis, Zautra & Smith, 2004; Lindquist & Barrett, 2008; Reich, Zautra, & Potter, 2001), but this research did not examine the reverse (i.e. the extent to which increased emotional complexity influenced integrative complexity). Kang and Shaver (2004) found significant correlations between perceived emotional complexity and integrative complexity, but this study did not examine the extent to which perceived emotional complexity relates to higher levels of integrative complexity

With regards to tolerance for ambiguity, there is some data to suggest that individuals higher in cognitive complexity have more complex personality structures (Bowler, Bowler & Cope, 2012; Bowler, Bowler & Phillips, 2009), and both cognitive and emotional complexity have been linked to openness to experience, which is strongly associated with tolerance for ambiguity (McCrae & Costa, 1997). Additional studies have demonstrated links between openness to experience and tolerance for ambiguity (Caligiuri & Traique, 2012; Bardi, Guerra & Ramdeny, 2009), providing support for including tolerance for ambiguity as a potential predictor of increased integrative complexity.

Next, there is scant evidence linking consideration of future consequences (CFC) with integrative complexity. However, conceptually, achieving higher levels of integrative complexity should require some consideration for the influence of time, as this is necessary to gain a sense of the relationships between elements as well as the greater systemic context. Among individuals holding political office, there is evidence that integrative complexity increases with tenure (Wallace & Suedfeld, 1988), suggesting that those in roles requiring considerations for both short and long-term outcomes build integrative complexity of understanding over time. Individuals failing to draw connections between immediate actions and delayed outcomes are likely to struggle to gain a sense of the relationships between elements in the system, and may be become increasingly likely to focus on immediate outcomes (Joireman et al., 2006). For example, Parker and Collins (2010) found that individuals endorsing higher levels of CFC report spending more time scanning the environment to identify factors that may have positive or negative influences on future outcomes. In other words, this suggests that these individuals may more readily identify additional relevant factors in the environment and draw inferences about the nature of these relationships over time, which is essential to gaining a broader understanding of the system.

Finally, in terms of the influence of behavioral repertoire on integrative complexity, this author was not able to find any previous studies exploring this link. However, based on prior theorizing, it is expected that those who endorse more roles, and a balance of roles around the competing values framework, would expend more cognitive effort in terms of differentiating and integrating the different elements of the system. For example Wong et al. (2011) found that top management teams of corporations with higher levels of social performance – in terms of programs, policies, etc. around social responsibility, which requires engagement with stakeholders across a multitude of social roles – demonstrated higher levels of integrative complexity.

While existing research suggests relationships among these variables, this current proposed research is the first, to this author's knowledge, to test them as a constellation of attributes that relate to increasing integrative complexity while engaging with a complex dynamic decision-making scenario. It is proposed that the above-described stable complexity attributes will predict higher levels of integrative complexity after engaging with a dynamic decision-making scenario.

Hypothesis 1a: Cognitive complexity is positively related to integrative complexity at the conclusion of the complex decision-making task.

Hypothesis 1b: Perceived emotional complexity is positively related to integrative complexity at the conclusion of the complex decision-making task.

Hypothesis 1c: Tolerance for ambiguity is positively related to integrative complexity at the conclusion of the complex decision-making task.

Hypothesis 1d: Consideration for future consequences is positively related to integrative complexity at the conclusion of the complex decision-making task.

Hypothesis 1e: Behavioral repertoire is positively related to integrative complexity at the conclusion of the complex decision-making task.

Next, the requisite complexity model proposes that general perceived emotional complexity should predict increased emotional complexity while engaging with a complex task. As described above, emotional complexity represents the extent to which an individual is able to differentiate and integrate a broad range of emotional experiences (Kang & Shaver, 2004; Lindquist & Barrett, 2008).

First, based on the definition of cognitive complexity described above, it is reasonable to expect that those self-reporting higher levels of this dimension should experience a broader range of emotional experiences based on their ability to differentiate experiences across multiple relationships. Sommers and Scioli (1986) provide some evidence that greater emotional range is related to endorsing more cognitively complex social value orientations. Additionally, Kang and Shaver (2004) found a positive relationship between cognitive complexity and self-reported emotional complexity, which predicted greater mood variability. The current research will test whether there is further support for this relationship within a dynamic decision making task.

Next, what seems especially relevant here is the extent to which complexity of emotional engagement is predicted by perceived emotional complexity – in other words, do individuals who endorse self-perceptions of being emotionally complex actually experience this? Surprisingly, beyond that of Kang and Shaver (2004) described above, no research was identified that explores this link, nor was any research identified exploring the role of complexity of emotional experience in dynamic decision-making tasks. Based on the limited research examining this construct, it is proposed here that general perceived emotional complexity will be positively related to the complexity of emotional experience during a complex decision-making task.

No research was identified directly linking tolerance for ambiguity with complexity of emotional engagement. However, given that low tolerance for ambiguity has been linked with increased stress from role ambiguity and less proclivity toward entrepreneurship (Furnham & Ribchester, 1995), there is some basis for exploring this relationship further. It is proposed here that individuals with a lower tolerance for ambiguity are likely to experience decreased complexity of emotional engagement due to the discomfort involved in engaging with an inherently ambiguous (i.e. complex) decision-making scenario.

Similarly, no literature directly exploring connections between CFC and complexity of emotional engagement was identified. However, Lowenstein and Learner (2003) in their review on emotions and decision making, suggest that the emotional experience of the decision maker is influenced by considerations for future outcomes. They propose that there is a relationship between CFC and the more varied emotional experiences that would be expected from a decision maker weighing both positive and negative outcomes. These emotional experiences, in turn, serve to enhance CFC by providing more information to inform the decision-making process (Lowenstein & Lerner, 2003).

Finally, empirical findings linking behavioral repertoire to experiencing a broader and more differentiated range of emotion did not emerge in the literature. However, theoretically, effectively engaging in a broader range of roles should relate to a subsequently expanded range of emotional experience (Kang & Shaver, 2004). However, findings linking self-complexity with emotional experience have been inconsistent, and tend to focus more emotional reactivity and coping behaviors (Koch & Sheppard, 2004), so further research assessing a potential link between these factors is warranted.

Hypothesis 2a: Cognitive complexity is positively related to complexity of emotional engagement during the complex decision-making task.

Hypothesis 2b: Perceived emotional complexity is positively related to complexity of emotional engagement during the complex decision-making task.

Hypothesis 2c: Tolerance for ambiguity is positively related to complexity of emotional engagement during the complex decision-making task.

Hypothesis 2d: Consideration for future consequences is positively related to complexity of emotional engagement during the complex decision-making task.

Hypothesis 2e: Behavioral repertoire is positively related to complexity of emotional engagement during the complex decision-making task.

Next, it is proposed that individuals higher in the stable complexity attributes will be more dynamic regarding the actions they take while engaging with a complex scenario. However, to date, there has been insufficient research linking these attributes to behavioral differentiation, and no research was identified linking the construct to leadership within dynamic decision-making contexts. For the purposes of this study, three proxies of behavioral differentiation, informed by Dörner's (1996) findings from his microworld research, will be measured in order to investigate these relationships.

Complex social systems are often characterized by the need to address multiple ambiguous problems rather than focusing on one well-defined problem (Brehmer & Dörner, 1993). More effective decision makers, in these contexts, take more time to formulate systemic goals, seeking to learn about the system as they take actions and receive feedback from their actions, while attempting to move the system toward those goals (Brehmer & Dörner, 1993). Prior research supports this proposition: individuals more experienced in making decisions in complex social contexts tend to make less decisions early in a complex scenario, and tend to collect more information before making decisions (Brehmer & Dörner, 1993; Dörner, 1996).

As described above, theoretically, behavioral complexity suggests that increased behavioral repertoire should lead to higher *behavioral differentiation* component, which refers to the extent to which the individual is able to enact behaviors appropriate for engaging with the complexity of the system (Hoojberg, 1996; Hoojberg et al., 1997). Additionally, previous theorizing suggests that behavioral differentiation flows from cognitive complexity (Denison et al., 1995; Hoojberg et al., 1997; Hoojberg & Quinn, 1992; Satish, 1997), and may be related to emotional complexity (Clark, Pataki & Carver, 1996; Denison et al., 1995; Kang & Shaver, 2004), consideration for future consequences (Parker & Collins, 2010; Zhang et al., 2014) and tolerance for ambiguity (Zahra &

O'Neill, 1998). This research proposes to explore, in addition to the cognitive processes of integrative complexity and the complexity of emotional experiences, the extent to which the five stable complexity attributes relate to the patterns of actions taken while engaging with a complex scenario.

First, consistent with research on dynamic decision making and specifically the findings summarized in Dörner (1996) it is anticipated that individuals scoring higher on the complexity attributes will take fewer actions earlier in the scenario which will be demonstrated by taking more time *on average* to make decisions throughout the time engaged with the scenario.

Hypothesis 3a: Cognitive complexity is positively related to average decision-making time during the complex decision-making task.

Hypothesis 3b: Perceived emotional complexity is positively related to average decision-making time during the complex decision-making task.

Hypothesis 3c: Tolerance for ambiguity is positively related to average decision-making time during the complex decision-making task.

Hypothesis 3d: Consideration for future consequences is positively related to average decision-making time during the complex decision-making task.

Hypothesis 3e: Behavioral repertoire is positively related to average decision-making time during the complex decision-making task.

Second, as suggested above, when first entering a complex social system as a decision-maker, while it is difficult to anticipate the consequences of decisions made

(Tetlock, 2005), it is often useful to make decisions and observe their consequences in order to learn more about the system. For example, research suggests that a common error among less successful decision makers is to focus more on the direct rather than longer-term impact of decisions, especially during crisis situations (Brehmer, 1992; Kahneman, 2011; Mumford, Friedrich, Caughron & Byrne, 2007). As such, it is expected that more behaviorally complex individuals will tend to make decisions in the scenario that are less negatively impactful. In other words, consistent with prior research, those individuals demonstrating higher levels of requisite complexity as demonstrated through the five complexity attributes are expected to employ decisions that would have less significant and long-term negative consequences on the system.

Hypothesis 4a: Cognitive complexity is inversely related to the proportion of decisions made that are negatively impactful during the complex decision-making task.

Hypothesis 4b: Perceived emotional complexity is inversely related to the proportion of decisions made that are negatively impactful during the complex decision-making task.

Hypothesis 4c: Tolerance for ambiguity is inversely related to the proportion of decisions made that are negatively impactful during the complex decision-making task.

Hypothesis 4d: Consideration for future consequences is inversely related to the proportion decisions made that are negatively impactful during the complex decision-making task.

Hypothesis 4e: Behavioral repertoire is inversely related to the proportion of decisions made that are negatively impactful during the complex decision-making task.

Third, based on prior research (Brehmer, 1992; Brehmer & Dörner, 1993), it is proposed that behavioral complexity in a dynamic decision-making task is demonstrated by employing a greater variety of actions and switching between action domains more frequently. Research suggests that individuals more successful in dynamic decision-making environments tend to collect more information through experimentation by taking a broader range of action decisions and observing the effects of those actions. (Brehmer, 1992; Brehmer & Dörner, 1993). For example, Dörner (1996) found that less successful participants focused more exclusively on one approach to addressing a systemic problem, while successful participants made use of a broader range options. This is not to be confused with random switching, which Dörner found among less successful participants. Random switching was observed when participants focused on one strategy for a number of turns only to switch abruptly to a different category of decisions without an apparent strategy. In other words, these participants switched decision categories less frequently from turn to turn, and relied on a fewer number of decisions throughout their engagement with the simulation. For the current research, it is proposed that employing a wider variety of decisions and switching decision focus areas more often demonstrates both increased hypothesis testing (testing and learning more about the system), and an understanding that effective interventions in the system require addressing systemic contributions to the problem across a broader range of decision categories.

Hypothesis 5a: Cognitive complexity is positively related to the number of different types of decisions made and the frequency of switches between decision categories during the complex decision-making task.

Hypothesis 5b: Perceived emotional complexity is positively related to the number of different types of decisions made and the frequency of switches between decision categories during the complex decision-making task.

Hypothesis 5c: Tolerance for ambiguity is positively related to the number of different types of decisions made and the frequency of switches between decision categories during the complex decision-making task.

Hypothesis 5d: Consideration for future consequences is positively related to the number of different types of decisions made and the frequency of switches between decision categories during the complex decision-making task.

Hypothesis 5e: Behavioral repertoire is positively related to the number of different types of decisions made and the frequency of switches between decision categories during the complex decision-making task.

Exploratory Analyses: Complexity of Network Conceptualization, Constructive Conflict Processes and Systemic Outcomes

Finally, for the requisite complexity model to demonstrate predictive validity, the proposed stable complexity attributes should relate to performance in the dynamic decision making task such that individuals demonstrating higher levels of the complexity attributes will demonstrate better performance than individuals demonstrating lower levels of dynamic complexity. Based on the literature reviewed above, this research explored three types of individual performance indicators while engaging with a dynamic decision-making scenario: complexity of social network identification, constructive conflict resolution processes and overall performance in improving outcomes in the system.

Complexity of Network Conceptualization. First, while measures of integrative complexity provide information regarding the extent to which individuals are differentiating the different elements and perspectives in the system, and integrating those perspectives into a broader systemic understanding, this does not provide information regarding individual conceptualizations of the complexity of the social network of actors relevant to the scenario. In addition to the network of actors contributing to a conflict, as a decision maker in a complex social system it is important to understand the extent to which the participant integrates the understanding of the social network in terms of the specific roles that each actor plays in supporting or attempting to resolve the conflict.

One new theory for understanding complex networks of social actors and their relationships to overall goals in a social system is dynamic network theory (DNT; Westaby, 2012; Westaby, Pfaff and Redding, 2014). DNT, building on earlier approaches to social network analysis, provides a framework for assessing complex social network dynamics in a system and the relative influence of actors in the system on the pursuit of an identified goal. In other words, according to DNT, an entity (individual or group) in a social system is described in terms of their demonstrated patterns of behavior and efforts to support or thwart directly or indirectly the pursuit of a goal. For the purposes of this research, DNT will be employed to explore the extent to which decision makers are able to identify the complex network of actors in the system they are attempting to improve, and the role that each of these actors plays in pursuit of that change goal.

In order to differentiate the influence of actors on goal pursuit in a system, DNT describes eight roles that actors can play in the system. At the first level there are *goal strivers* and *goal preventers*, which are directly working to pursue or block the pursuit of a certain systemic goal. At the next level are the supporters of these efforts in the system. *System supporters* are those engaged in activities that support those that are directly pursuing the goal, while *supportive resistors are* supporting those who are directly acting to prevent the goal from advancing. At the next level, DNT proposes there are actors in the system that are neither directly or indirectly working to further or prevent a systemic goal, but they are reacting to the progress of the goal in ways that may have a broad influence on the system. *System reactors* respond positively when activities advance the goal, while *system negators* respond negatively when progress is made toward a goal. Finally, DNT purposes two last roles for individuals who are involved in the system but whose actions are not directly or indirectly related to the goal pursuit. *Observers* in the system are witnessing the activities in the system but are not reacting or interfering in any way, while *interactants* are involved in the system and consequently have the potential to support or inhibit goal pursuit unintentionally (for a full overview of the eight actor roles proposed by DNT, see Westaby, 2012 and Westaby, Pfaff and Redding, 2014).

For this research, DNT was employed to assess the extent to which individual levels of the stable complexity attributes relate to the complexity of understanding of the social network of actors relevant to the scenario, based on the eight actor roles described above. It was expected that those demonstrating higher levels of the complexity attributes would describe a more complex network of social actors.

Constructive Conflict Behaviors. Next, given that the purpose of the dynamic-decision making task in the current research is to constructively navigate a conflict within a complex social system, it is proposed that an outcome of more effective individual dynamic decision-making processes will be an increase in constructive conflict resolution actions from the leader-decision maker. Deutsch (1973; 2014), in his theory of cooperation and competition, offers a solid foundation for conceptualizing the essential components of conflict dynamics, and the distinctions between constructive and destructive conflict processes. At the core of Deutsch's theory is the recognition of interdependence as the core dynamic process for parties working toward a common goal, with parties in conflict taking on more or less cooperative orientations in response to that dynamic. In essence, individuals engaging from cooperative orientations toward interdependent goals (success for one means success for the other, while failure for one means failure for other) will show more constructive conflict processes including more effective communications, less obstructive behaviors, efforts to mutually share and enhance each others' power, and integration of effort as compared to more competitive orientations toward interdependent goals (success for one means less success for the other), which are marked by impaired communication, obstructive and less helpful behaviors, and uncoordinated (i.e. ineffective) processes.

While multiple studies have examined leadership performance in computerized negotiation simulations based on personality, negotiation style preferences, information use, experience, and other attributes (see Gist, Hopper & Daniels, 1998; Siewiorek, Saarinen, Lainema & Lehtinen, 2012), to date no research to this author's knowledge has specifically explored effects of the proposed complexity competencies on leadership in dynamic decision-making tasks based on a complex systemic conflict. As the above review demonstrates, each of the five proposed complexity attributes has shown some relation to more constructive conflict behaviors. Employing Deutsch's (1973; 2014) framework, it is proposed that individuals engaging in higher levels of requisite complexity processes should employ more constructive conflict actions while attempting to improve the system, defined by enhancing communications, sharing power, and taking more actions that improve the status of both parties. Given the dearth of research in this area, proposing specific hypotheses was deemed inappropriate. For the purposes of this research, exploratory analyses were preferred in order to gain a better initial understanding of the relationship between the stable complexity attributes and constructive conflict leader behaviors, which could then inform hypotheses that could be tested through further research.

Systemic Outcomes. Finally, it is suggested that engaging in more dynamic decision-making processes will lead to improvements in the overall state of well-being of the social system. Specifically, based on Deutsch's (1973; 2014) cooperative interdependence theorizing, systemic improvement will be demonstrated by feedback indicating gains in decision-making outcomes, based on the levels of satisfaction by the parties involved. As will be described below, this is also the most appropriate metric of systemic performance for the simulated scenario employed in the current study. Again, given the lack of literature to inform more specific hypotheses the relationship between the complexity variables and these systemic outcomes were explored in post-hoc analyses.

CHAPTER III: METHODOLOGY

This research employed the microworld simulation game *PeaceMaker* to investigate the extent to which the proposed model regarding the influences of the stable individual complexity attributes of cognitive complexity, perceived emotional complexity, tolerance for ambiguity, consideration for future consequences, and behavioral repertoire on dynamic complexity processes, effective decision-making performance and positive systemic outcomes in a dynamic conflict decision-making scenario. The nature of this research was correlational: all participants were assessed using the same materials and procedures.

Participant Sample

To test the proposed hypotheses, 107 participants were recruited from Teachers College, Columbia University and other schools within the Columbia University system using a combination of existing email lists (participants who had previously asked to be notified of new opportunities to be involved in research) and online bulletin boards and social media platforms. Since the research hypotheses did not focus on any specific populations of individuals (e.g. organization leaders), a volunteer sampling approach was deemed sufficient. Among those that participated, three failed to properly follow instructions and changed the settings of the PeaceMaker game such that the data was no longer comparable to the rest of the sample, and one participant did not complete the pre-survey data that assessed the independent variables for this study, leaving data for 103 participants available for analyses.

As for the demographic composition of the sample, 74 (73.3%) identified as female, and ages ranged from 18 to 60 with the average age being 25.05 (SD=6.39). Regarding level of education, 32 (31.1%) had completed high school or an associates degree, 34 (33.0%) participants reported having a bachelors degree, and 31 (30.1%) had completed a masters degree. Number of years of management experience was also assessed, with 47 (46.5%) reporting one year or less, 28 (27.7%) reporting between one and three years, and 26 (25.8%) reporting three or more years. Lastly, relevant to the PeaceMaker scenario used in this study, five individuals self-identified as Palestinian and three individuals self-identified as Israeli. The full listing of demographic questions presented to participants is provided as Appendix G.

Procedures and Materials

Participation was solicited through the use of email lists, a university virtual bulletin board service and university social media groups, where individuals were invited to email the study coordinator to express interest and arrange a specific time to visit the lab.

Before coming to the lab, participants were required to complete the online survey, which contained the stable complexity measures and basic demographic variables. Upon arriving at the lab, after completing informed consent procedures[2], participants were first asked to complete the first complexity of emotional experience measure before being presented with a brief outline of the Israel-Palestinian conflict (see

[2] Participants were also provided with preliminary informed consent documentation during the online survey, before being allowed to continue with the survey. However, per institutional review board guidelines, a full informed consent procedure was also conducted before the participant began the lab portion of the study.

Appendix A). They were then asked to spend five minutes completing the first integrative complexity writing task (described below). Next, the participant completed a brief (approximately 8 minutes) tutorial designed to familiarize them with the simulation game interface, before playing the game for a total of 45 minutes. After finishing the simulation, participants completed the second integrative complexity writing task, followed by a second complexity of emotional experience measure. The study concluded with the measure of DNT social network conceptualization, questions assessing potential covariates related to affiliation and familiarity with the Israel-Palestine region and general familiarity with playing computer games. Participants were then debriefed and compensated $25. The total duration of participation was two hours (30 minutes for the online survey, and 90 minutes in the lab). Each of the measurement instruments and tasks are described in more detail below.

Complex Decision-Making Scenario. This research built off the work of Dörner (1996) and others (see Brehmer & Dörner, 1993; Gonzalez, Kampf & Martin, 2012) employing microworld research to directly assess participant decision-making patterns and outcomes in complex social scenarios by using the PeaceMaker simulation game (Impact Games; http://www.peacemakergame.com/) as the dynamic decision-making task environment. This simulation was originally designed primarily as an education tool (Burak, Keylor & Sweeney, 2005) but has also been used by researchers (e.g. Gonzalez et al., 2012; Gonzalez, Saner & Eisenberg, 2013; Gonzalez & Czlonka, 2010). In fact, there is a version of the game designed to support research, which produces, at the conclusion of each game session, a detailed output file listing each decision made by the participant, each city information or poll view initiated by the participant, feedback provided to the participant regarding the consequences of the decisions and new events that have occurred, overall Israel and Palestine approval scores during each round, and a time stamp for each participant response in the game.

PeaceMaker presents players with a simulated task environment where the goal is to reach a two-state solution by playing the role of Prime Minister of Israel or the President of the Palestinian Territories. For this research, all participants played the role of the Prime Minister of Israel under the lowest difficulty setting. Players of the game receive feedback in the form of “approval scores” for both the Israeli public and the Palestinian public, and the task is to raise both scores simultaneously in order to stabilize the region. Extreme deviations between the two approval ratings results in the game ending.

The game begins with a crisis event (a suicide bombing; see Figure 1), and then the participant must choose an action to take. The game is sufficiently complex in that the participant must choose from 76 possible decisions, which fall under broad categories of security, political, and infrastructure/aid (see Figure 2), with no direct indication of what decision is most appropriate. The game is turn-based: each decision point is a round were the participant is provided with updates about the system and feedback regarding specific events that have occurred. Feedback regarding the results of previous decisions may or may not be provided depending upon the decision and at what stage of the game it was made. Some decisions may not result in any feedback, and often the effects of decisions are delayed by a number of turns. Participants must make decisions without having full knowledge of the situation, or a clear understanding of how to improve the situation. Instead, the game requires that participants attempt to improve the system, learning what is more or less effective over time. After the initial few decisions, each round is characterized by influences from the approval scores, previous decisions made that have delayed effects, and random variations built into the game mechanics.

Brehmer (1992) suggests four preconditions for an individual to be able to engage in effective dynamic decision making in a system: 1) they must have a goal, 2) they must be able to observe the state of the system, 3) it must be possible to influence the state of the system, and 4) they must have some model or framework for manipulating the system. The first three of these characteristics are present in the PeaceMaker simulation, while the fourth emerges within the understanding of the player over time (as demonstrated through participants' integrative complexity statements).

Additionally, Brehmer (1992) provides three characteristics of *real world* systems that must be present in a simulation in order for it to serve as a sufficient representation of a complex system: complexity, dynamics and opaqueness. *Complexity* refers to the fact that the system must be composed of multiple interacting elements, while *dynamics* adds the need for the nature of these interactions to change over time. *Opaqueness* refers to the fact that the system is not completely transparent – the decision maker must learn about the system through continuous hypothesis testing. Again, each of these considerations is present in the PeaceMaker simulation. The game design includes multiple interacting elements (complexity), requires consideration of time effects (i.e. decisions made have different effects at different points in time), and does not make all information about the system available to the participant (opaqueness).

Measurement

Cognitive Complexity. Cognitive complexity was measured as a general trait using the Role Construct Repertory Test (Rep Test) developed originally by Kelly (1995), modified by Bieri et al. (1966), and adapted most recently by Woehr et al. (1998) for computer-based administration. The Rep Test asks participants to identify up to 10 individuals who correspond to 10 provided role types (e.g. person you dislike, friend of same sex, father, etc.), with each individual then being rated on a 6-point scale across 10 bipolar criteria (e.g. outgoing-shy, decisive-indecisive, interesting-dull, etc.). The advantage of this approach is that the response content (personal relationships) is removed from the complexity of understanding of the phenomena of interest (in this case the complex decision-making scenario). A potential downside is that this measure focuses on the complexity with which an individual organizes information about personal relationships, rather than other social contexts (e.g. community, organizational, geo-political, etc.). However, given the nature of the construct, few alternative measures exist for measuring individual cognitive complexity, with the primary alternative being coding written or verbalized statements for integrative complexity (see below). However, as described above, measurement of integrative complexity is by necessity context specific, with the level of complexity being influenced both by individual predispositions and contextual factors.

Using the Rep Test approach, cognitive complexity scores are derived by examining each role and adding two points to the participant's score for each matching numerical rating within that role, and one point for each rating of the ratings that are within one point of each other. For example, if under the role of 'friend of same sex' the participant provided ratings of 4, 5, 1, 2, 2, 5, 6, 3, 4, and 1 across the 10 criteria they would receive the minimum score of 28, whereas if their ratings were, 3, 3, 4, 3, 4, 5, 3, 4, 3, and 3 they would receive a score of 56. For each role, the participant will have a minimum score of 28 (there are 10 bipolar criteria, but only 6 points on the rating scale) and a maximum of 110 (the participant rated all 10 criteria exactly the same). This is calculated across each of the 10 roles, with raw composite scores ranging from 280 to 1100. Scores are then adjusted using the formula: 820 – (Raw CC Score – 280), so that higher scores represent higher levels of cognitive complexity.

Previous research has provided support for the validity of this approach as a measure of the complexity of an individual's perceptions of a social scenario (Feixas, Moliner, Montes, Mari & Neimeyer, 1992; Menasco & Curry, 1975; Schneier, 1979), and the measure has shown one-week test-retest reliabilities between .71 and .86 (Tripodi & Bieri, 1966; 1964; Woehr et al., 1998). With regards to criterion validity, the measure has been found to predict diagnostic oversimplification in counselors (Spengler & Strohmer, 1994), increased social conservatism (Hinze et al., 1997), decreased dimensionality of impression formation of others (Petronko & Perin, 1970), and the number of dimensions used to determine pay satisfaction (Carraher & Buckley, 1996). The Cognitive Complexity Role Construct Repertory Test is provided in Appendix B.

Perceived Emotional Complexity. Perceived general emotional complexity was measured using the Range and Differentiation of Emotional Experience Scale (RDEES; Kang & Shaver, 2004). The scale contains 14 items, with responses provided on a five-point scale from 1 = *does not describe me very well* to 5 = *describes me very well*. Example questions include "I experience a wide range of emotions" and "Each emotion has a very distinct and unique meaning to me." The measure is composed of two subscales: range and differentiation. The authors report an internal consistency of α = .85, and alphas of .82 and .79 for the range and differentiation subscale respectively. The full RDEES scale is provided in Appendix C.

Tolerance for Ambiguity. Tolerance for ambiguity was assessed using the Tolerance for Ambiguity Scale (TAS; Herman, Stevens, Bird, Mendenhall, & Oddou, 2010). The TAS is a modified version of an earlier scale developed by Budner (1962) developed to address issues of low internal consistency with the original measure (Herman et al., 2010). The measure consists of 12 items with responses provided on a five-point scale from 1 – Strongly disagree to 5 – Strongly agree. This scale has demonstrated internal consistency values of α = .73 (Herman et al., 2010) and α = .76 (Bardeen, Fergus & Orcutt, 2013). Example questions include “I can enjoy being with people whose values are very different from mine” and “A good teacher is one who makes you wonder about your way of looking at things.” The TAS is provided in Appendix D.

Consideration for Future Consequences. Consideration for Future Consequences was measured using the Consideration for Future Consequences Scale (CFCS; Joireman, Shaffer, Balliet & Strathman, 2012; Strathman et al., 1994), a 14-item survey measure assessing the extent to which an individual considers future outcomes when making day-to-day decisions. Responses are provided on five point scale from 1 = extremely uncharacteristic to 5 = extremely characteristic. Example items include “I consider how things might be in the future, and try to influence those things with my day-to-day behavior” and “I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time” (reversed scored). The authors report an internal consistency of α = .80 - .86 (Joireman et al., 2012; Strathman et al., 1994). The CFCS scale is provided in Appendix E.

Behavioral Repertoire. Behavioral repertoire was assessed using a slightly modified version of the measure of behavioral repertoire provided by Hoojberg (1996). This scale is composed of 16 items measuring the extent to which an individual endorses various leadership roles. Items in the measure are organized based on the competing values framework (Quinn, 1988), along flexible-stable and internal-external dimensions creating four role quadrants: people leadership (flexible, internal; α = .81), adaptive leadership (flexible, external; α = .82), stability leadership (control, internal; α = .72) and task leadership (control, external; α = .88), with people-task and adaptive-stable leadership being role categories considered to be in tension.

The instructions for the scale provided by Hoojberg (1996) were modified to be more relevant to the current sample and to the simulated complex decision-making task. The measure was introduced with the following statement: "As the leader of a social unit working to improve a large social system, such as an organization, community or political system, I would see myself as one who..." followed by the statements reflecting the four leadership role categories. Only one item in the measure was altered: "Exerts upward influence in the organization" was changed to "Exerts upward influence in the system" to reflect the scenario employed in the current research. Other example items include "Encourages participative decision-making in the unit" (people leadership), "Comes up with inventive ideas" (adaptive leadership), "Brings a sense of order into the unit" (stability leadership), and "Makes the unit's role very clear" (task leadership). Items are rated on a five-point scale from 1 – Strongly disagree to 5 – Strongly agree. The full scale is provided in Appendix F.

This inventory can be used as a stand alone measure of behavioral repertoire with higher scores representing higher levels of endorsement of more of the roles represented in the measure, thereby indicating higher levels leader/decision maker self-complexity. However, more interesting for the current research is the concept of integrative balance across roles (see Zaccaro, 2001), which accounts not only for the magnitude of endorsement of the various role self-conceptions, but also the balance across contradictory dimensions in the measure (Hoojberg et al., 1997). A formula for calculating complexity using measures of contradictory self-concepts, such as behavioral repertoire, is provided by Bobko & Schwartz (1984) and was used in this study to calculate scores of behavioral repertoire complexity:

$$\text{Behavioral Repertoire Complexity} = \Sigma_{1\text{-}z}\ [(k-1)-(|X - Y|)]*[(X + Y)/2]$$

Where X and Y are the bipolar concepts that have been measured, on a 1 to k scale. For the current measure this was calculated by using the formula to balance across the people-task and adaptive-stable leadership dimensions, which created two balance scores that were then averaged to obtain the final behavioral repertoire complexity score.

Integrative Complexity. As described above, in order to determine change in integrative complexity after engaging with the dynamic decision-making scenario, participants completed an integrative complexity writing exercise immediately before starting the PeaceMaker tutorial and at the conclusion of the 45 minute simulation session. For this exercise, participants were given five minutes to provide a written response to two questions: *"Why does the conflict in Israel and Palestine continue?"* and

"What makes finding a resolution to this conflict so difficult?" The statements where then classified using the coding scheme provided by Baker-Brown et al. (1992). This coding scheme classifies the integrative complexity of a statement on a 7-point scale: 1 – no complexity, one perspective is provided; 3 – some recognition and differentiation of perspectives; 5 – differentiation of perspectives and some integration of the interrelationships between the perspectives; 7 – full differentiation and integration of perspectives along with consideration of larger systemic-level influences on the context. Even numbered ratings (i.e. 2, 4 and 6) represent some indication toward the next highest rating without a fully sufficient response to warrant the higher rating. For example, a statement may be scored as 4 because the participant providing some indication of integration without fully expressing this.

Two independent coders, each having previously achieved reliability greater than .85 with an expert coder, coded each of the integrative complexity statements achieving an inter-rater reliability of ICC = .68. Consistent with previous research (e.g. Conway et al., 2012; Kugler & Brodbeck, 2014; Suedfeld, Wallace & Thachuk, 1993) disagreements of two points or more between the coders (31 out of 214) were resolved by a third coder (the author), and those differing by one point (102) were averaged. All coders were blind to the independent variables, simulation outcome variables, and whether the statement was collected pre- or post-simulation.

Complexity of Emotional Experience. Emotional reactions were measured before and after the simulation activity using the Positive Affect and Negative Affect Scales (PANAS; Watson, Clark & Tellegen, 1983). Multiple studies have successfully used this scale to measure the complexity of emotional experience (e.g. Carstensen, Pasupathi, Mayr & Nesselroade, 2000; Feldman, 1995; Feldman-Barrett & Russell, 1998; Spencer-Rodgers, Peng & Wang, 2010). This measure provides a listing of 20 emotion adjectives, 10 positive and 10 negative, and respondents are asked to indicate to what extent they experienced each emotion in a specific context and within a specified period of time on a five-point scale (1 = Very slightly or not at all to 5 = Extremely). For this study, participants were instructed to "indicate to what extent you felt this way in the past hour." Emotional complexity was assessed as a "mood variability score" similar to that described by Kang and Shaver (2004), which essentially calculates the within-participant variance in scores across the 20 items, with higher levels of variance indicating higher levels of experienced emotional complexity. Given the definitions of the concept provided above (see Kang & Shaver, 2004; Lindquist & Barrett, 2008) for the purposes of this study, using variance across the individual emotions of the PANAS scale is most appropriate. The full PANAS measure is provided as Appendix H.

Behavioral Differentiation. Behavioral differentiation was measured using the output files provided by the PeaceMaker simulation platform for researchers. As described above, participants were given 45 minutes to engage with the simulation. In the event that a participant lost the game, they were instructed to start a new game. Consequently, many participants played more than one game, with a mean number of games played of 2.74 (*SD* = 2.04; range 1 - 15). In order to include behaviors for the entire 45-minute session, output file data for each game played by the participant were combined.

First, for Hypotheses 3a-e regarding the average time taken to make decisions during the simulation, the time stamp for each decision recoded in the output file was used. The average decision making time simply reflects the average of the time elapsed between each decision input recorded in the game. When participants played multiple games, the average decision making time within each game was used, so as to not include the time elapsed between the end of one game and the start of the next.

Hypotheses 4a-e refer to the number of negatively impactful decisions made during the game session. For the purposes of this study, impactful decisions were defined as actions that would likely result in an immediate and long-term negative effect on the system at any point during the game. In the PeaceMaker simulation, there are certain types of actions that the player can make that will have a severe impact on the scenario at any point during the simulation: violent police or military actions, building new or expand existing settlements into the Palestinian Territories, building walls between Israel and Palestinian territories, and arresting Yesha leaders. Based on the assumptions built into the underlying algorithms of the simulation, these actions represent very low behavioral complexity, providing benefit only to Israel, and drastically harming further relations between Israel and Palestine. As a result, these actions lead to a significant drop in Palestinian scores, which consequently changes the trajectory of the scenario (i.e. it is very difficult to move toward a peaceful resolution after taking these types of action).

In order to identify each of the decisions that would be considered negatively impactful, two independent raters used this definition to code each of the 76 possible decisions in the game. Results of the Cohen's Kappa reliability test between the two raters showed strong agreement, $\kappa = .856$, $p < .001$. For the decisions where there was disagreement, the two raters conferred and reached agreement. The full list of possible decisions within PeaceMaker, along with those identified as impactful, is provided in Appendix K.

Lastly, to address Hypotheses 5a-e, the proportion of unique decisions employed by participants was calculated based on a count of the unique decisions employed in the game, divided by the total number of decisions made during the session. Additionally, the number of switches between decision categories (political, security, infrastructure/aid) from one decision to the next decision was counted, and an overall score was calculated based on the category switches that occurred divided by the total number of possible switches (number of decisions minus one) for each game played. These metrics represent good proxies of behavioral differentiation in the PeaceMaker game, because they suggest the extent to which the participant is working to taking actions in multiple domains simultaneously.

Complexity of Network Conceptualization. In order to measure the complexity of participants' conceptualization of the network of social actors involved in the decision-making scenario, this research made use of the "Network Conflict Worksheet" developed by Westaby and Redding (2014). This worksheet, based on DNT theorizing, asks an individual to analyze a particular conflict by identifying actors that are directly related to each side of the conflict, those supporting each side of the conflict, those reacting negatively to the parties in conflict, those attempting to support both sides to resolve the conflict and those that are observing or involved in the system but not in the conflict. Applied to the PeaceMaker scenario, this results in eight categories of actors, based on the two-party nature of the Israel-Palestine conflict. Appendix I provides the questions that participants were asked to respond to with regards to their understanding of the actors involved in the system, and the roles the actors played based on the DNT approach.

Given that questions were opened ended, two individuals were tasked with coding the responses by counting the number of actors provided under each of the eight question categories, as well as the number of unique actors identified. The initial coding was highly reliable, with Cohen's Kappa values above $\kappa = .86$ for each of the eight DNT categories. For the remaining responses where there was disagreement, the two raters conferred and reached agreement.

Constructive Conflict Behaviors. As with the measure of impactful decisions, in order to measure constructive decision-making performance based on Deutsch's (2014) theory of cooperation and competition, each of the 76 decision options in the game was coded independently by two raters based on two criteria: whether or not the decision represented a constructive approach to conflict resolution based on the extent to which 1) the decision enhanced communications, built trust and coordinated effort between the parties, and responded to the needs and enhanced the power of the other party, and 2) the decision was primarily beneficial to the other party. Results of the Cohen's Kappa reliability test between the two raters showed strong agreement for both constructive decisions ($\kappa = .87$, $p < .001$) and decisions beneficial to the other party ($\kappa = .85$, $p < .001$). As with the coding scheme described above, for those items where there was disagreement, the two raters conferred and reached agreement. The final coding scheme used to analyze the PeaceMaker output files is provided in Appendix K.

Systemic Outcomes. Overall systemic performance was based on the final approval scores for both Israel and Palestine. A balance score was be calculated using the following formula provided by Gonzalez, Saner & Eisenberg (2013): Balance = (1 - ((100 - FinalIsrael) + (100 - FinalPalestine)) / Maximum range of scores observed in the sample). This resulted in scores between 0 and 1 with scores closer to 1 indicating higher approval scores and a greater balance between the Israel and Palestine approval scores. Lower balance scores result from lower overall scores, and/or more extreme differences across the two approval scores. Two scores were used for analysis: the balance score for the first game played, and the average balance score across all games played.

Additional Post-Simulation Measures. Since the PeaceMaker game is designed to simulate a current, real-world international conflict, participants were asked to respond to questions regarding their relationship to, and interest in, the region portrayed in the simulation. Additionally, participants were asked to indicate their experience with playing video games generally, in order to test for the differential impacts of prior video game playing experience. Full measures for each of these are provided in Appendix J.

CHAPTER IV: RESULTS

A series of hierarchical multiple regression analyses were conducted in order to test the hypotheses as well as the exploratory analyses. Consistent with the requisite complexity model described above, the series of five complexity competencies was regressed on the hypothesized and exploratory outcome variables. This approach, including all of the complexity variables in one step, tests the extent to which each of the proposed complexity competencies relates to the criterion (outcome) variable relative to the other competencies.

Additionally, for each analysis, the regression model included the demographic variables gender, age and education as a first step in order to control for these general demographic characteristics. As shown in Table 2, each of the three demographic characteristics shows significant correlations both with the five complexity competencies and with the dependent variables used in the hypothesis testing. Additionally, it was important to control for gender effects given both the nature of the sample as containing significantly more women (73.3%) than men, and the fact that previous research has demonstrated differences in videogame playing preferences between men and women (Greenberg, Sherry, Lachlan, Lucas & Holmstrom, 2010; Lucas & Sherry, 2004). Lastly, with regards to age, a review of multiple research studies suggests that the ability to make sense of and navigate real-world practical challenges increases with age (Sternberg et al., 1995).

Finally, before interpreting each regression analysis, tests were conducted to check for linear relationships between the predictors (collectively) and the criterion, homoscedasticity of the criterion variables, multicollinearity between the predictor variables, potential outliers, and normality of standardized residuals across criterion values in order to ensure that the assumptions for the analysis had been met. Any deviations from these assumptions, and actions taken to correct them, are described under each hypothesis test. In what follows, preliminary analyses including means, standard deviations, inter-correlations and scale reliability tests are provided before describing the results of the hypothesis tests and exploratory analyses.

Preliminary Data Analyses

Descriptive statistics, including the means and standard deviations, Cronbach's alpha coefficients for the scales, and inter-correlations are provided in Table 2 for each of the independent and dependent variables in the hypothesis tests. Starting with cognitive complexity, this analysis shows that in this sample this attribute was negatively correlated with age (r = -.23, p = .021), positively correlated with integrative complexity at the conclusion of the decision making scenario (r = .27, p = .007), negatively correlated with average time to make decisions in the task (r = -.20, p = .048), negatively correlated with the proportion of decisions made during the task that were negatively impactful (r = -.26, p = .009), and positively correlated with frequency of switching between decision categories during the scenario (r = .27, p = .007). Cognitive complexity was also marginally negatively related to the number of unique decisions employed (r = -.17, p = .097). Perceived emotional complexity was related to gender (r = -.28, p = .005; negative reflects higher among females), and positively correlated with the complexity of emotional experience prior to the simulation (r = .23, p = .020) as well as during the simulation (r = .24, p = .014). Tolerance for ambiguity was associated with higher levels of switching between decision categories during the scenario ($r = .23$, $p = .018$), and was marginally positively correlated with integrative complexity at the conclusion of the simulation ($r = .19$, $p = .057$) and negatively correlated with impactful decisions ($r = -.17$, $p = .088$). Finally, consideration for future consequences was positively correlated with pre-simulation integrative complexity ($r = .21$, $p = .030$), complexity of emotions experienced before ($r = .20$, $p = .040$) and after the scenario ($r = .20$, $p = .039$) and decision category switches ($r = .20$, $p = .041$), and marginally negatively correlated with impactful decisions ($r = -.19$, $p = .063$). Surprisingly, behavioral repertoire was negatively correlated with integrative complexity at the conclusion of the simulation ($r = -.20$, $p = .040$), and also showed a marginal positive correlation with the complexity of emotional experience during the scenario ($r = .17$, $p = .086$).

Hypothesis Tests

Hypothesis 1. Hypothesis 1 proposed that individuals demonstrating higher levels of the five complexity competencies would demonstrate higher levels of integrative complexity at the conclusion of the simulation task. In order to control for baseline levels of the complexity of understanding of the Israel-Palestine conflict, integrative complexity was measured both before and after the simulation task.

Results of the hierarchical regression analysis with post-task integrative complexity entered as the criterion variable are provided in Table 3. Demographic variables and pre-task integrative complexity were entered as steps one and two respectively in the model, with step three adding the complexity attribute variables. Overall, the full model of gender, age, education, pre-simulation integrative complexity, cognitive complexity, perceived emotional complexity, tolerance for ambiguity, consideration for future consequences and behavioral repertoire was significant in predicting post-scenario integrative complexity (R^2 = 0.21, F(9,91) = 2.755, p = .007; adjusted R^2 = .14). Step two of the model, adding pre-task integrative complexity, led to a significant increase over the control variables (R^2 *change* = 0.06, F(1,96) = 6.61, p = .012). Finally, adding the complexity attributes to the model in step three resulted in a significant increase over step two in predicting post-task integrative complexity (R^2 *change* = 0.12, F(5,91) = 2.86, p = .019). Specifically, individuals scoring higher on the cognitive complexity measure (β = .21, p = .032) and, contrary to expectations, lower on behavioral repertoire (β = -.23, p = .028) showed higher levels of integrative complexity at the conclusion of the scenario. The remaining hypothesized complexity attributes of perceived emotional complexity (β = .13, p = .192), tolerance for ambiguity (β = .12, p = .220) and consideration for future consequences (β = -.021, p = .844) were not significant predictors in the model.

Overall, in partial support of Hypothesis 1, higher levels of individual cognitive complexity predicted higher integrative complexity of understanding of the conflict scenario at the conclusion of engaging with the simulation task.

Hypothesis 2. For Hypothesis 2, it was proposed that individuals higher on the five complexity attributes would demonstrate increased emotional complexity while engaging with the complex decision-making task. In order to test this hypothesis, similar to the previous analysis, emotional complexity was measured both before and after engaging with the simulation task in order to control for baseline levels of participants' complexity of emotional experience.

Results of the hierarchical regression with post-scenario emotional complexity as the outcome variable are provided in Table 4. As with the previous analysis, demographic variables and pre-scenario emotional complexity were entered as steps one and two in the model respectively, with step three adding the complexity attribute variables. While the full regression model for Hypothesis 2 was significant (R^2 = 0.32, $F(9,91) = 4.67$, $p < .001$; adjusted R^2 = .25), the results show that step three of the model, which added the complexity variables, did not result in a significant increase over the pre-task emotional complexity entered in step two (R^2 *change* = 0.04, $F(5,91) = 2.35$, $p = .43$).

To explore the extent to which the complexity attributes predict emotional complexity generally, two additional regression analyses were conducted on emotional complexity experienced before and during the task. First, the model assessing the relationship between the demographic variables and complexity attributes on complexity of emotional experience *before* the simulation was not significant (R^2 = 0.13, $F(8,92)$ = 1.74, $p = .099$; adjusted R^2 = .06). However, regressing the same model on complexity of emotional experience *during* the simulation was significant (R^2 = 0.16, $F(8,92) = 2.25$, $p = .031$; adjusted R^2 = .09), with education ($\beta = .27$, $p = .02$) and perceived emotional complexity ($\beta = .27$, $p = .01$) emerging as significant predictors. Cognitive complexity ($\beta = -.01$, $p = .957$), tolerance for ambiguity ($\beta = -.06$, $p = .539$), consideration for future consequences ($\beta = .12$, $p = .277$), and behavioral repertoire ($\beta = .07$, $p = .537$) were not significant predictors.

Overall, in partial support of Hypothesis 2, the measure of perceived emotional complexity did predict complexity of emotional engagement during the simulation task.

However, after accounting for the complexity of emotional experience reported before the task (i.e. the baseline measurement), this relationship was no longer significant.

Hypothesis 3. For the third hypothesis it was proposed that the five complexity variables would predict increased average decision-making time while engaging with the scenario. Before conducting this analysis, a positive skew in average decision-making time was observed, which is a violation of the assumptions underlying the linear regression test. To address this, a square root transformation was applied, which resulted in a normalized distribution of this variable. As shown in Table 5, the two-step regression model with demographic variables entered as step one and the five complexity competencies entered as step two was not significant in predicting the average time individuals took to make decisions during the complex decision-making task (R^2 = 0.07, $F(8,91)$ = 0.89, p = .53; adjusted R^2 = -.01). In other words, contrary to Hypothesis 3, none of the five complexity competencies predicted the average amount of time individuals spent making decisions in the complex decision-making task.

Given the null finding, additional exploratory regressions were run testing the same model predicting average decision making time in the first quartile of time engaged in the task, the ratio of decisions made in the first quartile as compared to the last quartile of the task, and the amount of time elapsed between the start of the task and the first decision made by the participant. This analysis found no significant result for average decision-making time in the first quartile of time spent engaging with the task (R^2 = 0.05, $F(8,92)$ = 0.64, p = .74; adjusted R^2 = -.03), nor the ratio of decisions made in the first compared to last quartile of time spent engaged with the task (R^2 = 0.05, $F(8,90)$ = 0.55, p = .81; adjusted R^2 = -.04). However, interestingly, the model was significant in predicting the time participants took to make the first decision (R^2 = 0.16, $F(8,91) = 2.22$, $p = .03$; adjusted R^2 = .09). Table 6 shows that education ($\beta = .24$, $p = .046$) and cognitive complexity ($\beta = -.28$, $p = .007$) were significant predictors, while perceived emotional complexity ($\beta = .02$, $p = .837$), tolerance for ambiguity ($\beta = .031$, $p = .757$), consideration for future consequences ($\beta = .09$, $p = .418$), and behavioral repertoire ($\beta = .11$, $p = .320$) were not significant.

While higher levels of education predicted increased time to make the first decision, cognitive complexity, contrary to expectations, actually predicted taking *less* time to make the first decision.

Hypothesis 4. For Hypothesis 4 it was predicted that individuals higher in the five complexity attributes would make fewer negatively impactful decisions during the complex decision-making task. Table 7 provides the results of the regression analysis. As with the previous tests, demographic variables were entered as the first step in the model, with the complexity competencies as step two. The overall model was significant (R^2 = 0.30, $F(8,91) = 4.89$, $p < .001$; adjusted R^2 = .24). At step one, gender ($\beta = -.29$, p = .002), age ($\beta = .49$, $p < .001$) and education ($\beta = -.38$, $p = .001$) were both significant predictors of the proportion of decisions made during the complex decision-making task that were negatively impactful. However, adding the complexity attributes at step two only led to a marginally significant increase in the variance explained by the model (R^2 *change* = 0.09, $F(5,91) = 2.22$, $p = .059$). In this step gender ($\beta = -.31$, $p = .001$), age (β = .43, $p < .001$) and education ($\beta = -.37$, $p = .001$) remained significant predictors, with perceived emotional complexity ($\beta = -.19$, $p = .048$) also emerging as a significant predictor. Cognitive complexity ($\beta = -.13$, $p = .156$), tolerance for ambiguity ($\beta = -.08$, p

= .394), consideration for future consequences (β = -.10, p = .314), and behavioral repertoire (β = .02, p = .870) were not significant predictors.

In this analysis, the demographic variables were all significant predictors. Employing decisions with a strong negative impact was more likely among women, older individuals and those with lower levels of education. However, after controlling for demographic variables, there was not support for Hypothesis 4. While the model demonstrated a marginally significant increase in prediction over the demographic variables, with (perceived) emotional complexity emerging as a predictor, no conclusions can be drawn.

Hypothesis 5. Lastly, the final hypothesis proposed that individuals higher in the five complexity attributes would employ a greater proportion of unique decisions (i.e. would rely less on taking the same actions multiple times) and would switch more often between the broader security, political, and infrastructure/aid categories from turn to turn. As shown in Table 8, the first regression analysis, testing the influence of the complexity variables on unique decisions employed, was not significant (R^2 = 0.06, F(8,91) = 0.71, p = .680). However, the second regression analysis, with category switches entered as the criterion, was significant (R^2 = 0.26, F(8,91) = 3.99, p < .001; adjusted R^2 = .20). This second analysis is provided in Table 9. As shown, step one of the model, regarding the influence of the demographic variables, was significant (R^2 = 0.09, F(3,96) = 3.20, p = .027; adjusted R^2 = .06), with education (β = -.35, p = .003) as a significant predictor in the model. Step two in the regression model, adding the five complexity variables, resulted in a significant increase in prediction (R^2 *change* = 0.17, F(5,91) = 4.15, p = .002). While education (β = -.41, p < .001) remained a significant predictor in the expanded model, cognitive complexity (β = .24, p = .014), tolerance for ambiguity (β = .23, p = .014) and consideration for future consequences (β = .21, p = .036) were all significant predictors, providing support for Hypothesis 5. Perceived emotional complexity (β = -.07, p = .453) and behavioral repertoire (β = -.03, p = .747) did not reach significance as predictors.

Interestingly, the higher the level of education the fewer times participants switched categories between turns. Additionally, as expected, there were positive relationships between the complexity attributes and category switching. Specifically, participants scoring higher on the cognitive complexity measure and endorsing higher levels of tolerance for ambiguity and consideration for future consequences engaged in more category switching.

In order to explore the relationship between the complexity attributes and category switching further, additional analyses were conducted to better understand these findings. First, the same regression model was tested again – this time looking at variance in the number of decisions made across each of the three categories as the criterion. A measure of variance provides a metric of balance in the number decisions made across the three categories, with higher values indicating less balance. This model is significant at step one (R^2 = 0.14, F(3,96) = 5.03, p = .003), with age (β = -.44, p < .001) and education (β = .25, p = .031) being significant predictors. However, step two of the model, adding in the five complexity competencies, did not result in a significant change in the variance explained (R^2 *change* = 0.03, F(5,91) = 0.66, p = .654). These results suggest that older individuals were more likely to balance decision-making across the three categories, while those with more education were less likely to do so.

Additionally, three further models were assessed with regards to predicting the proportion of decisions made in each category relative to the other two. The model was not significant in predicting the proportion of decision in the political category (R^2 = 0.12, $F(8,91) = 1.49$, $p = .173$), nor the security category (R^2 = 0.09, $F(8,91) = 1.08$, p = .382). However, the model was marginally significant in predicting the proportion of decisions made in the infrastructure category (R^2 = 0.14, $F(8,91) = 1.83$, $p = .081$), with cognitive complexity ($\beta = .21$, $p = .040$) and tolerance for ambiguity ($\beta = .24$, $p = .020$) emerging as significant predictors. Perceived emotional complexity ($\beta = -.04$, $p = .742$), consideration for future consequences ($\beta = -.10$, $p = .358$), and behavioral repertoire (β = .05, $p = .665$) were not significant predictors. Overall, this result suggests that those higher in cognitive complexity and tolerance for ambiguity were more likely to employ decisions related to building infrastructure, enhancing education, and providing aid while engaging with the simulation.

Exploratory Analyses

In addition to the above hypothesis tests, additional analyses were conducted in order to explore the extent to which the five proposed complexity competencies relate to the complexity of social network conceptualization as proposed by dynamic network theory (DNT), the extent to which more constructive conflict and other-orientated decision making was employed, and how well participants performed in the complex decision-making task overall.

Complexity of Network Conceptualization. Regarding the complexity of the social network conceptualization, regression analyses were conducted to assess the extent to which participants' conceptualizations of the network of actors involved in the conflict were more or less complex. Specifically, this criterion was calculated based on a count of the total number of actors in the system the participant identified across each of the eight DNT categories. Since the DNT data was collected after the complex decision-making task, a third step to the regression analysis was added that included the measures of behavioral differentiation employed above as dependent variables: proportion of decisions that were impactful, average time to make decisions, category switches and proportion of all decisions made that were unique. This was in addition to the step one demographic variables and step two complexity attribute variable models employed in Hypotheses 3-5.

Results of this first analysis were not significant (R^2 = 0.11, F(12,87) = 0.93, p = .522; adjusted R^2 = -.01). However, a second analysis was conducted focusing specifically on the number of *unique* actors identified across the eight DNT roles (rather than a total number of actors identified, including actors referenced in more than one role category). As shown in Table 10, the full model of this analysis was also not significant (R^2 = 0.15, F(12,87) = 1.27, p = .251; adjusted R^2 = .03). However, step two of the model, while only marginally significant (R^2 = 0.14, F(8,91) = 1.88, p = .073; adjusted R^2 = .07), resulted in a significant increase in variance explained over step one (R^2 *change* = 0.11, F(5,91) = 2.37, p = .045). Given the lack of significance at steps one and three, it was decided to conduct a second regression analysis focusing only on the five complexity attributes. This model was significant (R^2 = 0.12, F(5,97) = 2.51, p = .035; adjusted R^2 = .07), with perceived emotional complexity standing out as a significant predictor (β = .23, p = .024). Cognitive complexity (β = .15, p = .132), tolerance for ambiguity (β = .14, p =

.141), consideration for future consequences (β = .02, p = .834), and behavioral repertoire (β = -.01, p = .921) were not significant predictors. Overall, these results suggest that those higher in perceived emotional complexity tended to identify more relevant actors in the scenario.

In addition to these analyses conducted across all eight DNT role categories, eight separate regression analyses were conducted regarding the number of actors identified in each role independently. The results of each of these analyses were not significant.

Constructive Conflict Behaviors. Next, the relationship between the five complexity competencies and constructive conflict decision making was explored. The first regression analysis, provided in Table 11, explored the extent to which the five complexity competencies predicted the proportion of decisions employed that were constructive in nature (based on the coding scheme described above). This model was significant (R^2 = 0.24, F(8,91) = 3.51, p = .001; adjusted R^2 = .17). In addition to gender (β = .23, p = .024), the complexity competencies cognitive complexity (β = .20, p = .041) and tolerance for ambiguity (β = .21, p = .028) were significant predictors in the model, and perceived emotional complexity was a marginally significant predictor (β = .19, p = .055). Consideration for future consequences (β = .10, p = .305) and behavioral repertoire (β = -.17, p = .096) were not significant predictors. Overall, male participants in the sample were more likely to employ constructive decisions during the task than female participants. Additionally, this analysis suggests that those demonstrating higher cognitive complexity, and endorsing higher levels of emotional complexity and tolerance for ambiguity relied more on constructive decision options while engaging with the complex decision-making task.

Additionally, a second similar analysis was conducted to examine the proportion of decisions made that were more beneficial to the other party (i.e. Palestinians) than to self (i.e. Israelis) or a third party (i.e. other actors in the system). As shown in Table 12, this model was also significant (R^2 = 0.20, F(8,91) = 2.79, p = .008; adjusted R^2 = .13), with cognitive complexity (β = .20, p = .047), perceived emotional complexity (β = .23, p = .024), and tolerance for ambiguity (β = .22, p = .028) again being significant predictors in the model. Consideration for future consequences (β = .06, p = .538) and behavioral repertoire (β = -.12, p = .259) were, again, not significant predictors. This time however, gender was not a significant predictor in this model. It should be noted that the similarity in the outcomes of these two models is not surprising given the high correlation between the two criterion variables (r = .55, p < .001).

Systemic Outcomes. Lastly, while not the primary purpose of this research, there was interest in exploring the extent to which higher levels of the five complexity competencies related to systemic outcomes in the complex decision-making task. Two regression analyses were conducted to test this. The first regression analysis looked at average performance across all games played. As described above, performance in the game was calculated using a balance formula of both the magnitude and balance across both Israel and Palestine approval scores at the end of the game. The overall regression, as shown in Table 13, including the demographic variables as step one with the five complexity competencies as step two was significant (R^2 = 0.15, F(8,92) = 2.05, p = .049; adjusted R^2 = .08), but step two of the analysis was not significantly different from step one (R^2 *change* = 0.08, F(5,92) = 1.42, p = .223). Gender was a significant predictor in steps one (β = .25, p = .016) and two (β = .27, p = .034) of the model, while in step two behavioral repertoire emerged as significant predictor (*β* = -.22, *p* = .043) and consideration for future consequences as marginally significant (*β* = .19, *p* = .070). Cognitive complexity (*β* = .10, *p* = .354), perceived emotional complexity (*β* = .07, *p* = .482), and tolerance for ambiguity (*β* = -.09, *p* = .399) were not significant predictors.

While this data trends toward men showing better performance, as well as those higher in consideration for future consequences and lower in behavioral repertoire, the lack of significance in overall change in R^2 means that no conclusions can be drawn. For the second regression analysis, focusing on the outcome of the first game only, a positive skew in score balance scores was observed and a log (base 10) transformation was applied in order to transform the data to fit a normal distribution. This regression analysis was not significant (R^2 = 0.12, $F(8,92)$ = 1.51, p = .17; adjusted R^2 = .04). In other words, no relationship was found between the complexity attributes model and performance during the first simulation game.

Finally, in order to connect the cognitive, emotional and behavioral outcome variables assessed in Hypotheses 1-5 (post-task integrative complexity, complexity of emotional experience, average decision-making time, impactful decisions, unique decisions, and category switches) to systemic outcomes, a final exploratory regression analysis was conducted with the four behavioral variables as predictors on the criterion of average score balance. This model was highly significant (R^2 = 0.21, $F(6,95)$ = 4.07, p = .001; adjusted R^2 = .15). However, only proportion of decisions that were negatively impactful was a significant predictor (*β* = -.38, *p* = .001). Post-task integrative complexity (*β* = -.07, *p* = .511), complexity of emotional experience (*β* = .03, *p* = .907), average decision-making time (*β* = -.01, *p* = .972), unique decisions (*β* = -.16, *p* = .393) and category switches ($\beta = .04$, $p = .652$) did not predict systemic outcomes. The implications of this analysis are explored below.

CHAPTER V: DISCUSSION

The aim of this study was to investigate the extent to which the model of requisite complexity proposed by Lord et al. (2011) predicts cognitions, emotional experience and dynamic decision-making behaviors of individuals engaging with a complex conflict scenario. Of particular interest was investigating the extent to which the stable individual characteristics proposed in the model – cognitive complexity, emotional complexity, self-complexity, and social complexity – predict more adaptive engagement with a complex dynamic decision-making task. To this author's knowledge, this study is the first to empirically investigate the relationship between these relatively stable individual characteristics and patterns of engagement while attempting to positively change a socially complex and dynamic decision-making scenario. This was identified as a critical opportunity to build on the impactful work of Dörner (1996) and others who specifically worked to identify the patterns of engagement employed by more successful decision-makers in these contexts.

Findings Summary

Participants in the current study where assessed on the stable traits proposed in the requisite complexity model using established measures before playing a simulation game portraying the role of the Prime Minister of Israel attempting to navigate the conflict between Israel and Palestine. Before and after engaging with the scenario participants provided written assessments regarding the reasons for the difficulties in the region, and data regarding their emotional experiences during the previous hour. In addition, detailed logs regarding decisions made in the game were collected and prepared in order to measure decision-making patterns and tendencies.

Overall, these results provide initial support for the requisite complexity model in predicting patterns of engagement in a dynamic decision-making task. The results suggest that higher levels of cognitive complexity are predictive of multiple outcomes including increased integrative complexity after engaging with the task, switching across different types of decision category options more frequently, and employing decisions more constructive to conflict resolution and more beneficial to the other party. Perceived emotional complexity predicted higher levels of complexity of emotional experience during the task, decreased tendencies to employ negatively impactful decisions, identification of more relevant actors in the scenario, and making decisions more beneficial to the other party. Tolerance for ambiguity was positively associated with switching between categories more often, and employing more constructive decisions and those more beneficial to the other party. Consideration for future consequences predicted more frequent category switching and was marginally predictive of increase performance in the task. Surprisingly, behavioral repertoire was not predictive of more complex engagement with the scenario, and was actually associated with decreased integrative complexity at the conclusion of the scenario and marginally associated with employing fewer constructive conflict decisions and overall lower performance. Discussion of the implications of each of the hypothesis tests follows.

Hypothesis 1. The first hypothesis asserted that the five complexity competencies would predict higher levels of integrative complexity of understanding regarding the context of the scenario (i.e. the Israeli-Palestinian conflict) after engaging with the dynamic decision-making task. It was found that increased cognitive complexity, as demonstrated in the role construct repertory task accounted for a significant proportion of the variance in the integrative complexity of understanding of the scenario demonstrated by participants at the conclusion of the task, even after accounting for complexity of understanding prior to the task. Interestingly, across the entire sample, levels of integrative complexity showed a small increase from before ($M = 3.83$, $SD = 1.04$) to after the complex decision-making task ($M = 4.38$, $SD = 0.92$; a significant mean increase of 0.55 points ($t(102) = 37.13$, $p < .001$; see Figure 3).

Cognitive complexity was not correlated with pre-task integrative complexity, suggesting that the construct, as measured in the current study, was related specifically to a differentiation process that occurred while participants were engaged in the task. This suggests that those with higher levels of cognitive complexity tended to gain more complex understandings of the Israeli-Palestinian conflict over time while engaging with the simulation as compared to those lower in cognitive complexity. To this author's knowledge, this is the first time an association between cognitive complexity and integrative complexity has been demonstrated.

While these results are encouraging, and suggest new opportunities for research and practice as discussed below, there are some caveats that should be explored. First, given that this study was correlational in nature, with all participants engaging with the same task, it was not possible to determine whether this increase was attributable to engagement with the simulation or another process. For example, it is possible that this link would be demonstrated with participants who spent 45 minutes researching the

Israeli-Palestinian conflict on the internet, discussing the conflict with others, or just sitting quietly thinking about the conflict for that amount of time.

Another possibility is that the measures of cognitive complexity and integrative complexity are linked by a third variable that accounts for the association. One possibility related to the current research is fastidiousness. Due to the fact that the cognitive complexity reparatory task is more time consuming and tedious than the more common Likert-scale based survey instruments, combined with the vulnerabilities in online measurement around increased response errors (Sargis, Skitka & McKeever, 2013), it is possible that those who demonstrated greater cognitive complexity in the task did so because they completed the measure with more care than those with lower scores. This same attention to detail may have also contributed to more careful consideration when responding to the integrative complexity writing tasks.

Finally, the current research found no relationship of cognitive complexity to perceived emotional complexity, tolerance for ambiguity or consideration for future consequences, and a surprising negative association between behavioral repertoire and post-task integrative complexity. Across hypotheses, when behavioral repertoire was found to be a significant predictor, the association was in the opposite direction. This is likely due to an issue around measurement of the construct – a possibility explored in depth in the limitations section below.

Hypothesis 2. For Hypothesis 2, it was proposed that the five complexity competencies would be related to the complexity of emotional experience while engaging with the simulation. The results did show a direct link between perceived emotional complexity, and higher levels of emotional experience during the simulation. However, this association did not hold when controlling for the complexity of emotional experience in the hour prior to engaging with the task. This suggests that the Range and Differentiation of Emotional Experiences Scale (REEDS) has some predictive validity in predicting the actual complexity of emotional experience during a specified period of time – a finding not previously identified in the literature.

Given that there were few findings in the literature linking the five complexity attributes with complexity of emotional experience, it is perhaps not surprising that support for this hypothesis was not more robust. There are multiple possibilities for explaining this. First, given that participants were engaging with a computer simulation, rather than a real-life scenario, the potential for experiencing a wider range of emotional experiences may have been minimized. Second, the measurement approach may be limited because participants were asked to identify and qualify their emotional experiences after they occurred. It is possible that employing more robust methodologies to measure moment-to-moment emotional responses such as through real-time biometric measurement, or through other self-report methodologies such as those utilized by Gottman (2014) and Kugler, Coleman and Fuchs (2009) may have yielded a more positive result. Finally, it is possible that there is not a link between the remaining complexity competencies and emotional complexity, and that emotional complexity stands alone as a unique complexity engagement process. More research is need both on emotional complexity generally, and specifically related to dynamic decision-making tasks.

Hypothesis 3. For Hypothesis 3, it was proposed that those higher in the complexity competencies would take more time to make decisions, given the complex nature of the task. Surprisingly, this assertion was not supported. As described above, Dörner (1996) found that those more effective in improving processes in complex social systems tended to take more time to formulate decisions and incorporate feedback from the system. Based on the metrics isolated in this study, this pattern of behavior was not predicted by the five complexity competencies. Subsequent analyses were conducted to explore possible nuances in this relationship, attempting to discern decision-making time early versus later in the simulation and still found no significance.

Interestingly, the only significant finding was that those with higher levels of cognitive complexity took *less* time to make their first decision in the game, after receiving the first information in the game about a crisis situation. This was also observed in the negative correlation between cognitive complexity and average decision-making time across the time engaged with the simulation. It is possible that those higher in cognitive complexity were able to more quickly differentiate the multiple relevant perspectives in the scenario. Alternatively, seeking more information, participants higher in this attribute may have chosen to make an initial decision more quickly in order to gain feedback and consequently learn more about the variables involved.

It is surprising that the remaining complexity variables, especially tolerance for ambiguity and consideration for future consequences, did not relate to decision-making time. For example, it would be expected that those low in tolerance for ambiguity, quickly inserted into a very complex decision making scenario such as playing the role of the Prime Minister of Israel, would feel compelled to make a quick decision rather than taking the time to explore the scenario more thoroughly. However, the reverse is equally plausible – those low in tolerance for ambiguity, in their discomfort with the scenario, may have been temporarily overwhelmed and took longer to arrive at decisions. In other words participants, while sharing similar levels of tolerance for ambiguity, may have reacted differently when making decisions.

With regards to consideration for future consequences, there are at least two possibilities. One possibility is that the nature of the CFCS, while robust in measuring this trait relative to personally relevant circumstances, such as health-protective behaviors, may not be sensitive to measuring individual consideration for consequences of decisions made in complex social systems – this is borne out in the analysis for Hypothesis 4, where no association was found between CFCS scores and employing negatively impactful decisions that would have long-term repercussions in the system. Additionally, it may be that considering future consequences is not directly related to time spent making a decision. It is possible that those scoring high on the CFCS, while considering future consequences, were highly diverse with regards to the amount of time preferred to reach a decision. Alternatives for further exploring links between consideration for future consequences and dynamic decision making are explored further below.

Hypothesis 4. For Hypotheses 4, it was proposed that those scoring higher in the five complexity attributes would make fewer negatively impactful decisions in the simulation. In the context of the Israeli-Palestinian conflict, negatively impactful referred to decisions that would result in severe long-term relational consequences for the two parties. These decisions would move the simulation more quickly into losing scenario, and involve the use of violent military or police action, expanding settlements or, internally, suppressing the actions of Yesha. Surprisingly, the five complexity attributes were only marginally predictive of employing less of these decisions, after accounting for age, gender and education, and this was accounted for by perceived emotional complexity – with those higher in this attribute employing less impactful decisions overall.

While not providing statistical support for the hypothesized complexity attributes model, the effects of the demographic variables raise interesting questions. First, Participants in the sample with a higher level of attained education were less likely to employ negatively impactful decisions in the simulation. This finding is perhaps less surprising, but the mechanisms behind this are not clear. It may be that individuals with more education were able to more quickly discern the decision options available to them, and more accurately predict the consequences of certain decision responses.

Second, a more surprising finding was the highly significant positive relationship between age and proportion of decisions employed in the scenario that were negatively impactful. Older participants in this sample were much more likely to rely on these decision options than younger participants. In this sample, age was negatively correlated with cognitive complexity as well as the level of integrative complexity of understanding of the Israeli-Palestinian conflict before engaging with the scenario, which may have influenced decision making by restricting the range of perceived viable actions in response to events in the game. Additionally, some research suggests a positive relationship between age and endorsing military responses when evaluating international security threats (Huddy, Feldman, Taber & Lahav, 2005), while other research suggests the opposite (Brewer & Steenbergen, 2002). Further research is needed to more deeply explore the mechanisms behind this finding.

Lastly, the effect of gender is also surprising: women in this sample were significantly more likely than men to employ more negatively impactful decisions in the simulation. This gender effect will be explored in more detail below.

Hypothesis 5. Finally, Hypothesis 5 proposed that participants with higher levels of the complexity attributes would demonstrate increased behavioral complexity based on the patterns of decision making in the scenario. This was operationalized, based on the data provided by the PeaceMaker simulation, as both the range of decision-making options employed by the participant throughout the simulation, and the extent to which the participant made use of multiple strategies simultaneously while engaging with the conflict. The former was chosen because it was anticipated that individuals lower in the complexity attributes would choose from a narrower range of decision options as a way to cope with the complexity and uncertainty of being presented with 76 decision options without clear guidance as to which to employ.

For the latter, which was described as category switching, this operationalization reflected a limiting parameter of the game interface: participants could only make one decision at a time. As such, in order to enact more complex decision making, participants needed to switch between decision categories between turns. For example, one effective (and complex) strategy early in PeaceMaker is to employ light security actions such as police enforcement and increased checkpoints, while simultaneously engaging in discussions with Palestinian leadership and offering basic development aid to Palestinians. Over three turns, this would represent switching from the security category, to the political category and then to the infrastructure/aid category.

Regression analyses did not find support for the complexity attributes predicting employment of more unique decisions, but there was support for increased category switching with the results showing that those higher in cognitive complexity, tolerance for ambiguity and consideration for future consequences switched between decision-making categories more frequently than those lower in these attributes. This is perhaps one of the more compelling findings of the current research on behavioral outcomes, showing relationships between three of the complexity attributes and dynamic decision-making behavior. Participants demonstrating a tendency to differentiate more, who are more tolerant of ambiguous and uncertain situations, and tend to think in terms of long-term consequences employed patterns of decision making that research suggests are more adaptive for engaging with complex social scenarios.

A follow-up exploratory analysis found that participants higher in cognitive complexity and tolerance for ambiguity also made more use of the infrastructure/aid category. This category houses decisions that would have more *indirect* effects on the conflict, as opposed to the political and security categories, which offer more opportunities to directly respond to events that unfold in the scenario. Decisions in the infrastructure/aid category include options to offer aid in the form of education, medical or security (Palestinian led), increase social programs, provide economic stimulus packages, etc. which can bolster the conditions for more peaceful relations between Israel and Palestine, but do not directly respond to threats or other negative events.

Complexity of Network Conceptualization. Further, exploratory analyses revealed interesting relationships that warrant further research. For example, this research employed, at the conclusion of the simulation task, a measure of participants' conceptualizations of the network of actors relevant to the Israeli-Palestinian conflict. Results of the simplified model including only the five complexity attributes (i.e. omitting the demographic variables), found that those higher in perceived emotional complexity identified more unique actors in the conflict system. This is an interesting finding suggesting that emotional complexity may have some utility for decision makers in identifying those individuals and groups that are relevant to the situation, facilitating engagement with a broader range of actors. However, given the exploratory nature of this analysis and the lack of significance when including the demographic variables, more research is need to further explore the relationship between the complexity attributes and social network actor awareness when engaging with socially complex scenarios.

Constructive Conflict Behaviors. The next exploratory analysis, examining the extent to which the complexity attributes model predicted employing more conflict constructive decisions during the scenario was significant both in terms of overall constructiveness, and in predicting decisions made that were more beneficial to the other party (i.e. Palestine.). These results were very encouraging, demonstrating links between three of the complexity attributes – cognitive complexity, tolerance for ambiguity and perceived emotional complexity (marginal) – and more constructive conflict decision making, building support for the role of the individual requisite complexity processes in fostering more constructive conflict resolution practices in complex contexts.

Systemic Outcomes. Lastly, the relationship between the complexity attributes model and outcomes in the PeaceMaker simulation was explored. As the results demonstrated, there were no significant effects of the complexity attributes on the ability to balance and grow approval scores for Israel and Palestine either for the first game or across all games played. Follow-up analyses revealed that of each of the dependent variables explored in the hypothesis tests, only employing less negatively impactful decisions was a significant predictor of better systemic outcomes.

However, as described above, it was not the intention in the current study to explore the relationship between the complexity attributes and systemic outcomes, as the PeaceMaker simulation was deemed inappropriate for that purpose. While seemingly complex to the participant, the underlying engine of the simulation is deterministic, meaning that the game follows a narrative, which is bound and structured such that the effects of decisions in the game are pre-determined rather than emergent. This is in contrast to agent-based simulations, such as the popular SimCity and Civilization video game franchises, which have no underlying story or pre-determined outcomes, but instead rely on the participant to make decisions to influence how the system organically changes and evolves over time.

In order to advance research in this area by gaining a better understanding of the extent to which the complexity attributes predict systemic outcomes, future studies – such as those conducted by Dörner (1996) and others – will need to identify and employ a simulation that models a complex scenario based on an agent-based modeling approach.

Limitations

While the results from this study are encouraging, there are several limitations that require further exploration. First, this study relied primarily on established self-report survey scale measures (with the exception of cognitive complexity), assessed online, to measure the stable complexity attributes. While each of the scales was previously demonstrated to be a reliable and valid measure of each construct, these types of measures are prone to limitations such as participants misinterpreting or misunderstanding questions, and biases to respond in socially desirable ways (Krosnick, 1999). Additionally, reliance on online administration is especially vulnerable to satisficing (i.e. expending minimal effort in responding) and lack of control over the administration environment (e.g. at the library versus a noisy cafe; Sargis et al., 2013).

Additionally, in some cases, the self-report instrument may not have been sensitive enough to measure general tendencies relevant to the current research. While multiple interesting relationships between the complexity variables and dependent variables were observed, surprisingly, consideration for future consequences and behavioral repertoire did not stand out as predicting outcomes during engagement with the simulation, which may have been due, in part, to the nature of these measures and reliance on self-report data collection.

For example, while the consideration for future consequences scale has demonstrated predictive validity in a variety of future-oriented behaviors such as participation in health screenings (Orbell & Hagger, 2006), practicing better sleep habits (Peters, Joireman & Ridgway, 2005), and acting safely in the work environment (Probst, Graso, Estrada & Greer, 2013), it is oriented primarily around a general concept of tendencies for future thinking. A more nuanced behavioral measure of individual planning tendencies at various time scales may be more appropriate for assessing decision-making tendencies in complex environments, where consideration must be given to multiple time scales depending upon the situation. Perhaps more appropriate, in the domain of executive leadership, is a measure of *time span* developed by Jaques (1964), which assesses an individual's ability to anticipate future outcomes across multiple time scales while engaged in executive decision making (see Zaccaro, 2001). Unfortunately, however, this measure is time consuming, requiring the participant to spend several hours completing tasks with a trained administrator, which was not possible for the current study.

Additionally, there are several limitations with regards to the measure of behavioral repertoire employed in this study to assess the self-complexity dimension proposed by Lord et al. (2011). First, the original measure was designed specifically for use in the context of organizational leadership, and therefore may not have been appropriate to extend to decision making in the context of leading a nation, conducting negotiations, or navigating diplomatic relations. While the measure was modified slightly for this study (i.e. changing the instructions to apply to a broader social context, and modifying items to refer to a broader range of constituents), this may not have been sufficient for measuring endorsement of leadership roles relevant to the current simulated context. Second, behavioral repertoire measures are typically employed in a multi-rater format, drawing not only from leader self-ratings but also ratings from supervisors, subordinates, peers and customers/clients (Denison et al., 1995; Hart & Quinn, 1993; Hoojberg, 1996; Lawrence et al., 2009). For the current study this was not possible, and it may be that generally this is a difficult trait for individuals to self-assess.

Additionally, in this study it was not possible to perfectly map each of the four competencies proposed by Lord et al. (2011) on to a pre-assessment. Even in the cases where there are more established measures closer to the individual attributes proposed in the requisite complexity model, such as the time span measure described above, it was not possible to integrate these methods into the current study. Assessing behavioral repertoire was decided to be the most straightforward approach for approximating the construct of self-complexity described by requisite complexity theory. Another measure that may have been helpful in teasing out this construct further is *social identity complexity*, which would have provided information regarding the ways in which the participant decision makers conceptualized their group memberships within the system they were attempting to change.

There are existing measures of social identity complexity (e.g. Brewer & Pierce, 2005; Miller, Brewer & Arbuckle, 2009; Roccas & Brewer 2002; Schmid, Hewstone, Tausch, Cairns & Hughes, 2009) but these measures are designed specifically for measuring this in a specific context. These measures rely on context because the nature of the task is for the participant to describe the various group memberships they identify with. For the current study, participants could have been assessed with regards to their assumptions of the group memberships relevant to the role of the Israeli Prime Minister. Low social identity complexity in this context would be demonstrated when participants stuck closely to groups directly relevant to the role, such as Israeli citizen, participant in the Likud political party, member of the Jewish faith, etc. Increased social identity complexity would be demonstrated, for example, if the participant also identified broader group memberships in the region such as resident of the Middle East and North Africa (MENA) or even more broadly as global citizen. What is revealing in assessing social identity complexity is the extent to which there is overlap in groups that are typically perceived as very different. When a leader holds specific and relatively similar in-group identities, their conceptualization of the interrelationships between possible identities tends to be relatively simple (Roccas & Brewer, 2002). In the current study, it is possible that participants who were able to identify both as Israeli citizen and resident of MENA, for example, would have held more complex ideas about the interrelationships between these memberships, and therefore would have brought an increased awareness of the social complexity of the region and the opportunities as an influential figure to influence positive change. Unfortunately, assessing this variable was not possible for the current study because of concerns regarding the impact of prematurely revealing to the participant the nature of the simulation task they would be engaging in during the lab session.

A second limitation to this study involves using the PeaceMaker simulation as the complex conflict scenario. Based on the needs for the current research question, and existing simulation platforms, PeaceMaker provided an appropriate task environment. However, there are some limitations to relying on this platform that should be explored.

The first limitation of the platform relates to the nature of scenario: the Israeli-Palestinian conflict. Because this is a current conflict, many participants likely engaged with the task holding pre-existing ideas regarding the nature of the conflict, what perpetuates it, and what potential solutions to the conflict are. With the Israeli-Palestinian conflict so prevalent in the news media, even individuals demonstrating higher levels of the complexity attributes may have found themselves struggling with pre-conceived notions and biases about the region. Interestingly, post-hoc correlation analyses revealed the self-reported knowledge about the Israeli-Palestinian conflict was correlated with integrative complexity measured before engaging with the simulation ($r = .25$, $p = .004$) but not after ($r = .17$, $p = .089$), suggesting that pre-knowledge may have influenced initial conceptualizations of the conflict more than the complexity of understanding following engagement with the conflict.

Further post-hoc correlational analyses revealed that self-reported knowledge was also correlated with making more constructive decisions ($r = .41, p < .001$) and overall higher performance in the simulation ($r = .32, p = .001$), suggesting that pre-knowledge of the conflict may have influenced some aspect of participants behavior during the simulation. Participants were also asked to indicate their *interest* in the region, and this was found to be related to making less impactful decisions ($r = -.27, p = .005$), switching between decision categories less ($r = -.25, p = .011$), making more constructive decisions ($r = .26, p = .010$) and higher performance ($r = .27, p = .007$). This suggests that personal interest in the conflict may also have influenced participant behavior. However, because these variables were necessarily assessed *after* participants engaged with the PeaceMaker simulation (to avoid priming participants regarding the nature of the simulation before coming to the lab), these findings must be interpreted with caution. However, this is consistent with prior scholarship suggesting that simulations that are based on real scenarios that are salient to the participants inhibit learning (Cuhadar & Kampf, 2014; Ebner & Efron, 2005). In short, employing a simulation of a hypothetical scenario would reduce concerns around bias that were present in the current study.

Another limitation of the PeaceMaker platform concerns the information that is generated by the output files. First and foremost the game was created and designed to be an educational tool, walking players through the intricacies of the Israeli-Palestinian conflict and providing an experiential space to learn what sustains the intractability of the conflict, and what effects various intervention approaches have. The ability to collect participant behavioral data was added later, and was limited to data already collected by the program or generated in response to various actions. This data was sufficient for investigating the hypotheses proposed in the current study, but was limited in testing other hypotheses.

For example, the output file provides very little data regarding participants' information-gathering behaviors. The only data provided in this regard is a tally of the number of times the participant clicks to view information about a city or the results of polls, and even these metrics lack important specifics such as which cities or polls (for, example, there are five internal polls on topics of Israel security, militant activity suppression, Israeli leadership, Israeli sympathy, and Palestinian cooperation) that the participant is viewing, nor how much of the information the participant is reading.

There are multiple other sources of information provided while playing PeaceMaker that are critical for making decisions, the most important of which are the overall Israel and Palestine approval scores. Information regarding the approval scores of the multiple subgroups that compose these overall scores – such as the Israeli public, Yesha, the Palestinian public, the Palestinian President, and militant groups as well as external including the United Nations and "The Arab World" – is also provided on the screen during game play. Since this information is available just by looking at the screen (i.e. the participant does not have to click), there is no way to know whether participants accessed this information, what information they relied on, and to what extent.

Lastly, there are also opportunities for participants to gain advisement around each of the 76 decisions available to them from the "Hawks" (i.e. conservative, security-focused) and "Doves" (i.e. liberal, peace-focused), but the game does not record these information requests. Not having access to this level of information gathering limited the ability to test hypotheses around how participants made use of the information they had available to them.

A final limitation of this study to consider is the nature of the sample employed for this study, especially with regards to the imbalance of gender. First, nearly three-quarters of participants in the current study were women, which although consistent with the population where the data was collected, presents some concerns with regards to interpreting the results. Primarily, as described above, there were some surprising gender-related findings, with the data suggesting that women tended to rely more on harsh, negatively impactful decisions, and less on constructive decisions while engaged with the simulation than men. Exploratory t-tests provide marginal support for a difference in the reliance on harsher decisions, with women, on average, making more negatively impactful decisions ($M = 0.047$, $SD = 0.037$) than men ($M = 0.032$, $SD = 0.032$), which was a marginally significant difference ($t(98) = 1.917$, $p = .058$). This was also the case for constructive decisions more broadly, with women employing these marginally less ($M = 0.58$, $SD = 0.10$) than men ($M = 0.62$, $SD = 0.08$); $t(98) = 1.786$, $p = .077$). This trend is unexpected given multiple research findings that would propose the opposite trend (e.g. Brahnam, Margavio, Hignite, Barrier & Chin, 2005; Chusmir & Mills, 1989; Holt & DeVore, 2005; Thomas, Thomas & Schaubhut, 1990; Walters, Stuhlmacher & Meyer, 1998).

Finally, there were gender differences in performance in the PeaceMaker task. However, this difference was less surprising when looking more closely at the data. While, overall, men produced higher mean scores ($M = 0.55$, $SD = 0.26$) than women (*M*

= 0.42, *SD* = 0.23), a significant difference ($t(98) = 2.374$, $p = .020$), men also reported spending much more time during the week playing video games (*M* = 3.37, *SD* = 5.76) than women (*M* = 0.59, *SD* = 1.98), which is consistent with previous studies examining gender differences in video game playing among college-age students (Greenberg et al., 2010; Lucas & Sherry, 2004). This research also found that males tend to prefer action and strategy games (i.e. similar to the PeaceMaker format), while women are more likely to prefer board game and puzzle formats (Greenberg et al., 2010).

While gender was controlled across analyses, a limitation of the current study is inability to better understand the extent to which gender may have interacted with other variables in the context of a video game task. One possibility is that women participating in this study may have experienced a form of stereotype threat related to expectations of performance while playing a video game. In short, research on stereotype threat suggests that even subtle reminders of broader perceptions of expected lower performance in a task, such as a standardized test, or a complicated math problem, can lead to lower performance (see Spencer, Steele & Quinn, 1999; Steele, 1997).

In this study, demographic variables were assessed at the end of the online pre-survey. Although subtle, asking participants to identify gender before visiting the lab to participate in a video game task may have activated subtle perceptions of lower expectations for performance in this task. Similar to findings regarding women seeking to advance careers in the science, technology, engineering and mathematics (STEM) fields (Weber, 2012), research suggests that women are perceived as less skilled in the domain of video games, and are often subjected to increased hostility in online gaming settings (Kuzenkoff & Rose, 2013; Lucas & Sherry, 2004). For female participants in the current study, the simulation task may have activated a concern that their performance in the task would confirm negative stereotypes of their gender group (Steele & Aronson, 1995), which may have had the effect of reducing motivations to improve performance (Fogliati & Bussey, 2013). Additionally, this may have introduced compensatory behaviors such as relying more on hostile and negatively impactful decision-making, and invoking overall less constructive conflict resolution approaches.

Implications for Theory, Practice and Future Research

Theoretical Implications. The results from this study have several theoretical implications. First, these findings provide initial support for the requisite complexity model proposed by Lord et al. (2011). To this author's knowledge this study was the first to specifically attempt to map a competencies framework onto the patterns of behaviors while attempting to change a complex social system, providing initial validation of the requisite complexity competency model among a population of novice decision makers. Lord et al. (2011) have asserted that the complexity attributes contribute to a self-regulation process that allows the individual to become more attuned with the environment they are attempting to change, drawing from each of the attributes differentially as the situation requires. Consistent with this, each of the five complexity attributes explored in the current study showed different levels of prediction of dynamic decision-making behaviors. Among all of the attributes studied, cognitive complexity was especially predictive of complex thought and action during the PeaceMaker simulation, while perceived emotional complexity, tolerance for ambiguity and consideration for future consequences each played a role in certain processes.

Further, the current research represents a new vein of research complementing the seminal work of Dörner (1996) and others researching leadership decision-making behavior in simulated scenarios, providing initial links to the underlying characteristics of individuals who engage in the patterns of decision-making more effective in ameliorating complex social challenges. This represents an important contribution to theoretical work on leadership and complexity, providing initial evidence for certain leadership competencies that can be integrated into existing theories of leadership and incorporated into future research of leadership competencies.

Much of the existing theoretical work on leadership falls within the study of organizations, where decision makers are faced with an ever increasing range of systemic considerations as companies expand globally, and market forces shift much more rapidly (Hoojberg et al., 1997; Senge, 2006; West, 2012; Uhl-Bien et al., 2007). Trends in leadership scholarship relevant to an examination of the phenomena more in line with the complexity science perspective began during the middle 1980s, when concepts such as transformational, charismatic, and values-based leadership began to take hold (Hunt, 1999), fundamentally proposing that leadership requires creating the right conditions to foster desirable outcomes (Gardner, 1995; O'Toole, 1995). These approaches to leadership, fall within the broad category of *transformational leadership*, which describes leadership as influencing the fundamental social structure of an organization such that the very nature of the interactions between individuals, groups and units is impacted (Burke, 2011). Unfortunately, the current research, due to the nature of the simulated task environment, was not able to incorporate transformational considerations.

However, transformational leadership offers only one side of the dual-considerations facing today's leaders. In addition to rallying followers around a shared goal, leaders today must also work to enact structures and processes which foster change from the bottom up and middle out, not simply top down (Coleman, 2011; Lord, 2008). The transformational approach, while significant in shifting leadership theory away from a more hierarchical command and control process, still remains focused on leadership as influencing the behavior of organizational members for the purposes of achieving outcomes that are predictable (Plowman & Duchon, 2008), at the expense of allowing self-organization and constructive conflict among members to contribute to the emergence of new and adaptive outcomes (Uhl-Bien et al., 2007).

Recent leadership theorizing from the complex systems perspective (see Plowman & Duchon, 2008) suggests that complexity-aware leaders work to disrupt the status quo while simultaneously building the conditions for desired outcomes to emerge, rather than focusing on specific end goals and working to enact desired futures through command and control processes. Part of this is on the transformational side – with leaders working to develop the internal capacities of the system to respond appropriately to emerging challenges – but also involves the ability to understand the larger system of influence adapt this understanding as new experiences are acquired (Senge, Hamilton & Kania, 2015). These leaders seek to better understand the system by making small changes and observing the pattern of responses in the system over time, rather than directly prescribing and initiating a change agenda.

This is achieved through what has been referred to as *adaptive leadership*, or a leadership style that reflects an understanding of social change as a *generative dynamic*

(Uhl-Bien et al., 2007). This adapted approach was observed in the current study, with participants who demonstrated certain complexity traits proposed as conducive to requisite complexity processes showing increased complexity of understanding of the context over time, more awareness of the nuances of their emotional experience while engaging with the scenario, and patterns of adaptive behavior that worked across the system and suggested considerations for the short and long term similar to those patterns observed by Dörner (1996) and others. What remains to be explored are the interactions between these patterns of engagement, and the social aspects of leadership critical to large-scale social change such as those explored in discussions of transformational processes.

Finally, this research provided empirical support for the theoretical link between the relatively stable trait of cognitive complexity and changes in integrative complexity. To this author's knowledge, no previous research has explored the link between these two complimentary constructs. Theoretically, individuals demonstrating higher levels of cognitive complexity generally tend to structure systemic information with greater complexity by differentiating more dimensions when working to conceptualize a social phenomena (Spengler & Strohmer, 1994). This, then, contributes to enhanced *integrative complexity* where individuals are able to both *differentiate* the elements relevant to the social phenomena, and describe how those elements are *integrated* into a coherent whole that describes the overall structural dynamic of the system (Suedfeld et al., 1992; Young & Herman, 2014). In other words, cognitive complexity represents a tendency that individuals should exercise across social phenomena, while integrative complexity can be higher or lower depending upon the context.

First, these results are encouraging for researchers interested in linking integrative complexity to a more general, relatively stable trait. Essentially, cognitive complexity is a necessary but not sufficient condition for increasing integrative complexity. Absent the tendencies to identify the multiple relevant elements, there is insufficient information to cognitively structure a more integrated understanding of the system. Theoretically, the current findings represent an important empirical link between these two concepts. Individuals who demonstrated lower levels of cognitive complexity tended not to increase the integrative complexity of the understanding of the conflict while engaging with it, as compared to those higher in cognitive complexity.

However, additional research is needed to provide further support for this finding, and to explore the extent to which other factors may increase or decrease the link between these two constructs. As described above, integrative complexity has been found to be sensitive to numerous contextual factors, including significant negative life events, uncertainty, fatigue, time pressures, perceived threats and feelings of losing control (Suedfeld & Bluck, 1993; Suedfeld et al., 2003; Tetlock et al., 1996). In the current study, general cognitive complexity was related to increased integrative complexity in a scenario not directly or immediately relevant to most participants – in other words participants were not directly involved in the conflict. What is less clear is the extent to which this finding would be demonstrated when participants are directly involved in the scenario they are asked to describe. Further research is needed to explore this link for topics of direct personal significance to the participant, such as a recent family conflict or a conflict in their work setting.

Second, there have recently been calls for the development of new approaches to measuring integrative complexity, primarily due to the time-consuming nature of eliciting statements from participants that then have to be coded by two or more trained raters coding the statements independently (see Tetlock, Metz, Scott & Suedfeld, 2014) – the approach employed in the current study. Results from the current study suggest that the much less laborious measure of cognitive complexity has some predictive validity when it comes to the integrative complexity with which the participant describes a particular system.

Others, while not explicitly exploring this link, have experimented with alternative approaches to measuring the complexity with which individuals structure information in order to predict outcomes that are theoretically consistent with the cognitive and integrative complexity frameworks. For example, in one study assessing the effectiveness of a learning module among junior high school students, the reparatory grid (RG) technique was employed to assess comprehension of a complex ecological system. Similar to the approach used in the current study to assess cognitive complexity, the RG approach is composed of elements, constructs, and ratings. What is different in this approach is that participants first identified the elements of the system themselves and then went through a process to describe the relationships between different combinations of the elements in a way that used the grid approach to measure integrative complexity. Essentially, this approach employs first the cognitive complexity approach, by asking participants to differentiate the multiple elements in the system but then takes further steps to measure integrative complexity through subsequent tasks. In the study that employed this approach, participants completed the RG task before and after the learning module, and the researchers were able to identify changes in integrative complexity.

Similarly, Carroll and Bright (2010) measured integrative complexity of beliefs about wildfire management by asking participants to first differentiate their understanding of the issue by listing as many arguments for and against the practice, before demonstrating integration of these arguments by rating the strength of each of the arguments they generated – the researchers scored integration based on the balance of ratings across the ‘for’ and ‘against’ categories. In both of these studies, participants engaged in similar differentiation tasks before further indicating the extent to which they were able to integrate the elements identified. The current research demonstrates support for this approach, and suggests further research to explore 1) the effects of separating the differentiation task from the integration task, 2) the relationship between the general differentiation task (used in the current study) and the context-specific differentiation task, and 3) relationships between combinations of these tasks and integrative complexity as elicited through coding written statements.

Implications for Practice. In addition to the theoretical contributions to existing conceptual frameworks of complexity and adaptive leadership, the current findings have implications for leadership practice as well. First, the shifting challenges faced by leaders today require new approaches to the advisement and support offered by consultants, coaches and others working with leaders faced with socially complex challenges. For practitioners, taking stock of leaders’ tendencies regarding these complexity competencies may help in fully exploring both the ways in which the leader cognitively structures complex information, and their action tendencies when faced with demands to make decisions to navigate complex scenarios.

In organization environments, executive coaching has been defined as a process for "helping leaders to get unstuck from their dilemmas and assisting them to transfer their learning into results" (O'Neill, 2000). For leaders challenged by systems that are essentially "stuck" in undesirable processes, the role of a coach or advisor from the requisite complexity perspective would be to help the leader to better understand their own cognitive processes, the dynamics demonstrated by the system, and the extent to which the leader is more or less aligned with the system they are attempting to change. As suggested by Tsoukas and Hatch (2001), while not using the exact term, requisite complexity represents *second-order complexity* – the complexity with which an individual understands complexity – with the implication that this thinking about complexity represents a narrative, or an interpretation of complexity.

Coaching leaders in the context of complexity and conflict would be different from existing models of *conflict coaching* (e.g. Jones & Brinkert 2007; Noble, 2012), which do not offer a broader framework for facilitating leaders' ability to see the complexity of the broader system that serves to perpetuate conflicts, nor do they offer guidance in helping leaders to make decisions informed by this perspective. Findings from the current study could be used to advance these existing models by integrating the requisite complexity model with recent theoretical work on applications of DST to negotiations in complex conflict situations (e.g. Coleman, Redding & Fisher, in press).

Second, while preliminary, these results may be used to inform the criteria by which emerging leaders are identified. Scholarship has previously established that traditional assessment approaches, such as intelligence testing, are less effective in predicting real-world performance, especially with regards to identifying solutions to novel, complex problems (Sternberg et al., 1995). Additionally, Marcy and Mumford (2010), in a micro-simulation study similar to the current research, found that none of the subscales of the commonly used Multifactor Leadership Questionnaire (MLQ 5x-short) nor analytical reasoning as commonly measured with the Employee Aptitude Survey (EAS), related to performance in the complex simulation they employed. Results of the current research provide initial support for exploring new avenues for identifying individuals who may be more successful in navigating complex social scenarios such as those presented in executive leadership roles, individuals tasked with responding to large-scale social crises, and others coordinating large-scale change efforts in military, governmental and non-profit roles.

Finally, expanding on the prospect of enhanced selection processes, these findings suggest that the training and development of leaders might benefit from complementing existing programs to integrate the complexity perspective along with the competencies explored in the current study. A recent American Management Association (2012) survey of employers found increasing pace of change and global competition are the top considerations regarding the competencies that are needed for employee development. Currently, training programs lack integration of the multiple competencies required for navigating complex social environments (Grossman, Thayer, Shuffler, Burke & Salas, 2015). Yorkes and Nicolaides (2013), speaking from the perspective of adult learning and leadership, suggest:

> "The implications of complexity for both theory and practice have become a recurring topic in the literatures of a wide range of scholarly and professional fields… Receiving less attention has been the implications for designing learning settings that prepare adults to function effectively under conditions of complexity as they strive to translate the insights from this literature into practice." (p. 3)

It is proposed that the results from the current research are useful for this purpose. This current study measured participants using multiple methodologies – a cognitive complexity task, survey instruments of complexity competencies, written statements demonstrating mental model development, and behavioral data regarding the decisions made while interacting with a complex scenario simulation– and explored the extent to which these are related. For those working to design training programs or courses incorporating the complexity leadership perspective, these results provide initial validation for measuring cognitive and emotional complexity, tolerance for ambiguity and consideration for future consequences as an initial assessment of these as competencies, which can then be fed back to participants to explore how these may impact their role as leader. This addresses previous calls in the literature for the identification of meta-cognitive tendencies that relate to learning about complex systems (Hmelo-Silver & Azevedo, 2006).

Additionally, this research adds to a growing body of research supporting the benefits of employing computer simulations for training purposes across a variety of complex phenomena (e.g. Marcy & Mumford, 2010; Qudrat-Ullah, 2010; Satish et al., 2001; Shute, Masduki & Donmez, 2010; Sterman, 2006). Johnson (2008) suggests that one of the greatest opportunities for transformative leadership development is to develop programs that challenge leaders' mental models as they are increasingly faced with environmental complexities – traditional learning formats, such as conferences and workshops, have limited utility in this regard. Marcy and Mumford (2010) found that by first providing basic causal analysis training before engaging with a complex scenario, participants demonstrated more adaptive learning in the simulated leadership role. Additionally, Dörner (1996) found that those trained with basic systems thinking skills were more successful in his simulations than those not trained in this way. This suggests that employing simulations in concert with more traditional training materials and approaches may result in enhanced learning, with participants being able to immediately apply the concepts learned while gaining experiential feedback regarding the outcomes associated with utilizing these approaches.

In the current study, it was demonstrated that, overall, participants' integrative complexity of understanding of the scenario increased after interacting with the simulation for just 45 minutes. While data from this study does not provide conclusive evidence that this was attributable to the simulation (i.e. exposure to the simulation was not experimentally manipulated, failing to rule out alternative explanations), these initial findings are encouraging. However, when employing complex computer simulations for training purposes, it is recommended that facilitators make use of simulations that either offer a gradually increasing complexity over time, or the ability to change the level of complexity of the scenario to be appropriate for the training audience (Yascaran, 2009). There is also some evidence to suggest that context-specific simulations may be more appropriate for more advanced trainings and courses, rather than introductory trainings (Qudrat-Ullah, 2010).

Additionally, trainings should be based both on established effective training practices of providing feedback after experiential activities (Salas, Tannenbaum, Kraiger & Smith-Jentsch, 2012), and, in order to incorporate individualized feedback obtained through competency assessments, participants should be encouraged to reflect on the patterns of decision-making they employed in the simulation and how these broader individual tendencies may have contributed to this. In a training setting, in addition to being provided with progressively more guidance on practices for navigating complex scenarios, participants should have multiple opportunities to receive individualized feedback and space to reflect, engaging with the simulation multiple times after receiving feedback. Dörner (1996) found that those asked to reflect on their thought processes at each turn in the simulation performed better than those not receiving this guidance. Activities such as these could be easily incorporated into trainings emphasizing experiential learning.

Directions for Future Research. Given the compelling results from the current study, providing initial support for links between requisite complexity competencies and patterns of dynamic decision making in a complex scenario, further research is warranted to better understand how these competencies are linked to changes in the complexity of the mental models held by decision makers, the extent to which these competencies interact with the environmental context and complexity of the scenario, and the patterns involved in the dynamic decision-making process as it unfolds dynamically over time.

First, due to time constraints, the measurement of participant mental models of the simulated decision-making scenario was limited to the written integrative complexity statements, as well as the post-simulation questions regarding the network of actors involved in the conflict. Since these outcome variables showed relationships with the complexity competencies, it would be important to learn more about how specifically these competencies relate to changes in mental models. While these measures provided important information regarding the extent to which the proposed competencies related to the complexity of understanding of the scenario, further research is needed to understand in more specific detail how these competencies relate to the ways in which participants formulate and modify mental models while working within a scenario.

In short, mental models are abstract representations of the problem, system, or scenario. These mental models develop as the individual gains more information, and receives feedback about the system. With regards to conflict in social systems, eliciting mental models can provide a sense of the underlying assumptions that impact the sense-making that individuals employ to construct their mental maps of the conflict process, which consequently impacts the ability to constructively influence the conflict (Siira, 2012; Sword, 2008). These mental maps, of which individuals are often unaware, influence the analysis of the conflict dynamics, which, in turn, guide decision-making (Sword, 2008). In other words, the quality of the mental model influences how the individual understands the system, what options they recognize as available to them, and the outcomes they forecast. Improving mental models over time while engaging with a system is a critical component of leadership and decision making in complex social contexts (Johnson, 2008).

There are multiple approaches for eliciting mental models (Doyle, 1997; Doyle, Radzicki & Trees, 2008; Hall, Aitchison & Kocay, 1994; Hodgkinson, Maule & Brown, 2004). One approach asks participants to draw their mental model. For example, Marcy & Mumford (2010) provided participants with a list of core and non-core variables in the system, with participants choosing the variables they thought to be relevant for their model and then indicating connections and directions of influence between these variables. Independent judges or raters applied a coding scheme to the mental model depictions provided by the participants to rate them on pre-specified dimensions: the number of relevant variables included, the number of appropriate causal connections between variables, and the number of appropriate directional connections between variables. Kunc (2008) describes a similar approach, coding for the complexity of participant models by evaluating their self-generated causal-loop diagrams (CLD) in terms of the number of concepts, feedback loops, time delays, and other factors deemed relevant to the scenario by the researcher.

These approaches to assessing mental models could be employed as an alternative to the integrative complexity coding employed in the current study, or as an additional measure. The advantage of this approach is that participants are able to describe their conceptualization of a complex system in much more detail, which can be more readily interpreted by researchers than through narrative formats (Hodgkinson et al., 2004). Additionally, more information can be gleaned from the information participants provide in these models. As compared to the integrative complexity coding, content coding of CLDs could yield information regarding the extent to which the participant differentiated the number of factors in the system, and conceptualized the integration of the factors simply by counting the number of elements and connections provided in the model. The primary challenge of this approach centers on training participants to properly generate CLDs, which is addressed by providing instruction and allowing the participant to generate an initial practice map (Marcy & Mumford 2010; Kunc, 2008). This process can be much more time consuming than asking participants to provide a written or verbalized statement.

An alternative approach, similar to that employed by Dörner (1996), is to engage participants in a think-aloud procedure. This is similar to the mental models elicitation, but instead of (or in addition to) drawing their model of the system, participants are asked to verbalize their thoughts while engaging with a scenario – by either being asked to describe what they observe about the system or to respond to a problem that has been described and presented to them. These are recorded and transcribed during the study session to be coded later along pre-defined criteria. For the current study, this approach was not employed because of the time required to train participants to verbalize their thought processes, and the potential distraction of needing to provide this verbalization while engaging with the simulation. However, future research making use of this approach is an essential next step to further building off of the findings of Dörner (1996) and others.

Additionally, future research should begin to explore causal relations between the complexity competencies explored in the current study and requisite complexity processes. The current study relied on correlational data for the hypothesis tests. However, a basic tenet of social research is that correlations between variables do not imply causation (Hoyle, Harris & Judd, 2002). It is therefore not possible to determine whether or not these variables contribute to more complex engagement, or if the observed relationships are due to other, as yet not identified variables. Additionally, this research did not vary the level of complexity of the scenario, nor the context in which the scenario is based. As such, there are opportunities to learn more about the role of these complexity competencies across contexts and levels of complexity.

As an example, in a different study employing a microworld simulation to explore leadership complexity, Marcy and Mumford (2010) employed the micro-world simulation Virtual U, which simulates the role of the president of a university system tasked with improving the quality of education on campus. These researchers incorporated three experimental manipulations into their study in order to identify factors that lead to higher or lower leadership performance in improving complex systems: participants received training/no training prior to engaging with the simulation, participants provided with case studies demonstrating effective/ineffective university change prior to engaging with the simulation, and high/low level of complexity of the simulation based on the size of the student body, the percentage of part-time students, and the number of students in university housing (higher levels of each make the simulation more complex).

The researchers found interesting effects of these manipulations in terms of leadership performance, sense making and adaptive learning. While summarizing their findings is beyond the scope of this discussion, Mumford and Mumford (2010) illustrate that much can be learned by manipulating certain aspects of the participant experience of engaging with the dynamic decision-making scenario. Future research would benefit from building off of the current findings by introducing experimental manipulations regarding scenario context and complexity, as well as different levels pre-simulation training and preparation, to learn more about how these may impact leadership performance. For example, in the current study, participants were provided with a brief neutral description of the conflict provided primarily to orient participants with little background knowledge of the Israeli-Palestinian conflict. It would be interesting to determine the extent to which varying the amount of information provided about the conflict, or providing information about cases where conflicts like this were resolved, would influence patterns of decision-making. Additionally, modifying the parameters of the game to provide participants with more or less decision possibilities could be a way to identify, more specifically, the impact of the complexity of the scenario on performance.

Further, introducing context manipulations could provide more information about the relationships between the complexity competencies and patterns of decision making. It could be, for example, that higher levels of consideration for future consequences relates to more complex patterns of decision making only when participants are provided with more information about the scenario, clearer goals about expectations for future outcomes in the system, or with relevant case analyses of past constructively resolved conflicts. As another example, individual tolerance for ambiguity may be differentially relevant based on the complexity of the scenario. High levels of tolerance for ambiguity may be advantageous when complexity is high, due to the number of variables and relationships to consider, but less advantageous when the scenario has fewer factors to consider. Future research should be conducted to further explore these nuances of the fit between individual competencies and tendencies, and the decision-making context.

Another avenue for future research in this area would be to make use of more dynamic approaches to measuring engagement with the simulation task over time. For example, in the current study, complexity of emotional experience during the scenario was measured at the conclusion of the scenario. An interesting next step, similar to the research of Gottman, Swanson and Swanson (2002) or Kugler et al. (2011) would be to measure participants' moment-to-moment emotional experience while engaging with the scenario rather than a once-off post-hoc recall of emotional experience summarized across a period of time, as in the current study. The methods used by these researchers involve video-recording a participant's engagement in a task, and then at the conclusion of the task, asking the participant to view the recording and adjust either a slider or move a mouse on a screen to indicate the extent to which they were feeling positive or negative.

For example, with the Kugler et al. (2009) "mouse paradigm" approach (see Nowak & Vallacher, 1998), participants listened to an audio recording of an interaction they had previously engaged in with another participant over a contentious issue, and while doing so, were instructed to move the mouse to the left side of the screen when they recall feeling more negative feelings, and to the right when they were feeling positive. The extent to which the participant moved the mouse to the edges of the screen provided a measure of the magnitude of the feeling, and the center of the screen represented neutral or unsure. This approach provided novel insights regarding the moment-to-moment emotional experiences of individuals engaged in conflict.

This same approach could be employed for future iterations of the current study. For example, after engaging with the simulation, participants could view a video recording of their engagement with the simulation, using the mouse paradigm to provide their moment-to-moment emotional experience. This approach could also be used to measure numerous other constructs beyond emotional experience. For example, in the current study, the extent to which the participant (in the role of Prime Minister of Israel) was concerned with the well-being of Israel (self) versus Palestine (other) could be assessed throughout the time engaged with the simulation, to explore how these concerns change over time in terms of the ratio of concern for self/other and the magnitude of these concerns. Further, this approach could be used to expand upon the findings demonstrating increased integrative complexity. Participants, at the conclusion of the simulation session, could be instructed to indicate moment-to-moment the extent to which they were seeking a broader understanding of the system, versus focusing on one particular aspect of the system. Given that the current research findings, as well as previous studies (i.e. Suedfeld & Bluck, 1993; Suedfeld et al., 2003; Tetlock et al., 1996), suggest that integrative complexity changes over time, exploring the extent to which this process is influenced by moment-to-moment changes in the conceptual focus of the participant would be have great utility for expanding current theorizing of integrative complexity in the context of dynamic decision making.

CONCLUSION

This study was inspired by the work of the Morton Deutsch International Center for Cooperation and Conflict Resolution at Columbia University's Teachers College, which strives to conduct research, build models of practice and advance pedagogy in ways that have the potential to transform the field of conflict resolution – and especially the resolution of the most protracted and intractable conflicts. The current study was in the spirit of these ambitions, with an intentionally broad aim of linking three relevant but as yet unconnected theories – dynamical systems theory, requisite complexity theory and dynamic decision making – to provide support for this comprehensive model and offer a foundation for further research and translation to training and practice. This aim was fulfilled with multiple compelling findings and insights for expanding this work further. It is hoped that the field will continue to work to identify those individual tendencies and patterns of behavior shared by individuals with a true capacity to transform humanity's deepest social challenges, perhaps fundamentally shifting understandings of 21st century leadership in the process.

Table 1
Conceptual model of individual attributes proposed to influence individual dynamic complexity processes

Stable Complexity Attributes	**Dynamic Complexity Processes**

• Cognitive complexity
• Perceived emotional complexity
• Tolerance for ambiguity
• Consideration for future consequences
• Behavioral repertoire
	• Increased integrative complexity
	• Complex emotional engagement
	• Behavioral differentiation
	    o Taking more time to make decisions
	    o Employing less impactful decisions
	    o Drawing from a broader range of decision options and moving between broader decisions categories more frequently

Table 2

Means, standard deviations and correlations of variables used in hypothesis tests

		M.	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Gender	0.27	0.45															
2	Age	25.04	6.39	0.13														
3	Education	2.63	1.22	-0.09	0.53													
4	Cognitive Comp.	700.14	61.93	0.07	-0.23	-0.09												
5	Per. Emotional Comp.	3.76	0.65	-0.28	-0.06	-0.02	0.08	(0.88)										
6	Tolerance for Ambiguity	3.39	0.49	0.07	0.05	0.13	0.15	0.09	(0.72)									
7	Con. for Future Consequences	3.63	0.57	-0.05	-0.09	0.02	0.08	0.23	0.10	(0.87)								
8	Behavioral Repertoire	13.96	2.14	0.01	0.13	0.17	0.04	0.16	0.03	0.35	(0.86)							
9	Pre-task Int. Comp.	3.83	1.05	-0.07	-0.28	-0.20	0.13	0.11	0.15	0.21	0.02							
10	Post-task Int. Comp.	4.38	0.92	0.05	-0.14	-0.14	0.27	0.12	0.19	0.00	-0.20	0.28						
11	Pre-task Emotional Comp.	1.20	0.63	0.07	0.04	0.13	-0.05	0.23	0.05	0.20	0.16	-0.10	-0.06					
12	Post-task Emotional Comp.	1.53	0.77	0.09	-0.03	0.15	0.05	0.24	0.02	0.20	0.17	-0.05	-0.09	0.50				
13	Average Decision Time	6.38	1.25	-0.07	0.04	0.01	-0.20	0.05	0.08	-0.05	0.08	0.01	-0.08	0.09	0.07			
14	Impactful Decisions	0.04	0.04	-0.19	0.25	-0.09	-0.26	-0.16	-0.17	-0.19	-0.06	-0.16	-0.20	-0.07	-0.18	0.11		
15	Unique Decisions	0.58	0.15	-0.12	0.08	-0.02	-0.17	-0.01	0.02	-0.04	0.04	-0.07	-0.11	0.03	-0.03	0.82	0.36	
16	Decision Category Switches	0.56	0.10	0.02	-0.09	-0.29	0.27	0.03	0.23	0.20	0.00	0.18	0.26	-0.11	-0.14	-0.12	0.11	-0.06

Note. Numbers in parentheses are internal reliability of scales (Cronbach's α). For correlations above .16, $p < .10$; above .20, $p < .05$; above .26, $p < .01$; above .32, $p < .001$.

Table 3
Results of hierarchical regression analysis on post-task integrative complexity (Hypothesis 1)

	Model 1			Model 2			Model 3		
Variable	*SE B*	*β*		*SE B*	*β*		*SE B*	*β*	
Gender	0.21	0.05		0.21	0.07		0.21	0.07	
Age	0.02	-0.11		0.02	-0.05		0.02	0.02	
Education	0.09	-0.08		0.09	-0.06		0.09	-0.05	
Pre-Task Int. Comp.				0.09	0.26	*	0.09	0.23	*
Cognitive Comp.							0.00	0.21	*
Perceived Emot. Comp.							0.14	0.13	
Tolerance for Ambiguity							0.19	0.12	
Con. for Future Conseq.							0.17	-0.02	
Behavioral Repertoire							0.04	-0.23	*
R^2		0.03			0.09			0.21	
F		0.93			2.39	†		2.76	**
ΔR^2					0.06			0.12	**

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 4
Results of hierarchical regression analysis on post-task emotional complexity (Hypothesis 2)

	Model 1			Model 2			Model 3		
Variable	*SE B*	*β*		*SE B*	*β*		*SE B*	*β*	
Gender	0.18	0.14		0.15	0.09		0.17	0.14	
Age	0.01	-0.19		0.01	-0.16		0.01	-0.15	
Education	0.08	0.27	*	0.07	0.18	†	0.07	0.19	†
Pre-Task Emot. Comp.				0.11	0.48	***	0.11	0.42	***
Cognitive Comp.							0.00	0.04	
Perceived Emot. Comp.							0.11	0.16	†
Tolerance for Ambiguity							0.14	-0.06	
Con. for Future Conseq.							0.13	0.06	
Behavioral Repertoire							0.03	0.04	
R^2		0.06			0.28			0.32	
F		1.98			9.26	***		4.67	***
ΔR^2					0.22	***		0.04	

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 5

Results of hierarchical regression analysis on average decision-making time during the complex decision-making task (Hypothesis 3)

	Model 1		Model 2		
Variable	*SE B*	*β*	*SE B*	*β*	
Gender	0.29	-0.09	0.31	-0.07	
Age	0.02	0.07	0.03	-0.01	
Education	0.13	-0.04	0.13	-0.05	
Cognitive Comp.			0.00	-0.22	*
Perceived Emot. Comp.			0.21	0.03	
Tolerance for Ambiguity			0.27	0.12	
Con. for Future Conseq.			0.25	-0.10	
Behavioral Repertoire			0.07	0.13	
R^2		0.01		0.07	
F		0.27		0.89	
ΔR^2				0.06	

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 6

Results of hierarchical regression analysis on time to make first decision in the complex decision-making task

	Model 1			Model 2		
Variable	*SE B*	*β*		*SE B*	*β*	
Gender	8.07	0.01		8.33	0.05	
Age	0.66	0.04		0.67	-0.03	
Education	3.44	0.24	*	3.43	0.24	*
Cognitive Comp.				0.06	-0.28	**
Perceived Emot. Comp.				5.68	0.02	
Tolerance for Ambiguity				7.24	0.03	
Con. for Future Conseq.				6.62	0.09	
Behavioral Repertoire				1.75	0.11	
R^2		0.07			0.16	
F		2.51	†		2.22	*
ΔR^2					0.09	†

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 7
Results of hierarchical regression analysis on proportion of negatively impactful decisions employed during the complex decision-making task (Hypothesis 4)

	Model 1			Model 2		
Variable	*SE B*	*β*		*SE B*	*β*	
Gender	0.01	-0.29	**	0.01	-0.32	**
Age	0.00	0.49	***	0.00	0.44	***
Education	0.00	-0.38	**	0.00	-0.36	**
Cognitive Comp.				0.00	-0.13	
Perceived Emot. Comp.				0.01	-0.19	*
Tolerance for Ambiguity				0.01	-0.08	
Con. for Future Conseq.				0.01	-0.10	
Behavioral Repertoire				0.00	0.02	
R^2		0.22			0.30	
F		8.78	***		4.89	***
ΔR^2					0.09	†

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 8

Results of hierarchical regression analysis on proportion of unique decisions employed during the complex decision-making task (Hypothesis 5)

	Model 1		Model 2	
Variable	*SE B*	*β*	*SE B*	*β*
Gender	0.03	-0.15	0.04	-0.15
Age	0.00	0.16	0.00	0.11
Education	0.01	-0.12	0.02	-0.12
Cognitive Comp.			0.00	-0.14
Perceived Emot. Comp.			0.02	-0.05
Tolerance for Ambiguity			0.03	0.07
Con. for Future Conseq.			0.03	-0.05
Behavioral Repertoire			0.01	0.07
R^2		0.03		0.06
F		1.04		0.71
ΔR^2				0.03

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 9

Results of hierarchical regression analysis on proportion of category switches between turns in the complex decision-making task (Hypothesis 5)

	Model 1			Model 2		
Variable	*SE B*	*β*		*SE B*	*β*	
Gender	0.02	-0.03		0.02	-0.09	
Age	0.00	0.10		0.00	0.21	†
Education	0.01	-0.35	**	0.01	-0.42	***
Cognitive Comp.				0.00	0.24	*
Perceived Emot. Comp.				0.01	-0.07	
Tolerance for Ambiguity				0.02	0.23	*
Con. for Future Conseq.				0.02	0.21	*
Behavioral Repertoire				0.00	-0.03	
R^2		0.09			0.26	
F		3.20	*		3.99	***
ΔR^2					0.17	**

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 10

Results of hierarchical regression analysis on number of unique actors identified

	Model 1		Model 2			Model 3		
Variable	*SE B*	*β*	*SE B*	*β*		*SE B*	*β*	
Gender	0.87	-0.09	0.89	-0.06		0.96	-0.07	
Age	0.07	-0.01	0.07	0.06		0.08	0.06	
Education	0.37	0.14	0.37	0.12		0.42	0.14	
Cognitive Comp.			0.01	0.18	†	0.01	0.16	
Perceived Emot. Comp.			0.61	0.22	*	0.63	0.21	†
Tolerance for Ambiguity			0.77	0.13		0.83	0.10	
Con. for Future Conseq.			0.71	0.03		0.75	0.01	
Behavioral Repertoire			0.19	-0.04		0.19	-0.04	
Impactful Decisions						0.58	0.06	
Avg. Dec.-Making Time						14.01	-0.04	
Category Switches						4.58	0.09	
Unique Decisions						5.32	-0.04	
R^2		0.03		0.14			0.15	
F		0.98		1.88	†		1.27	
ΔR^2				0.11	*		0.01	

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 11
Results of hierarchical regression analysis on proportion of constructive conflict-resolution decisions employed

	Model 1			Model 2		
Variable	*SE B*	*β*		*SE B*	*β*	
Gender	0.02	0.21	*	0.02	0.23	*
Age	0.00	-0.22	†	0.00	-0.13	
Education	0.01	0.07		0.01	0.04	
Cognitive Comp.				0.00	0.20	*
Perceived Emot. Comp.				0.02	0.19	†
Tolerance for Ambiguity				0.02	0.21	*
Con. for Future Conseq.				0.02	0.10	
Behavioral Repertoire				0.01	-0.17	†
R^2		0.07			0.24	
F		2.28	†		3.51	**
ΔR^2					0.17	**

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 12

Results of hierarchical regression analysis on proportion of decisions employed beneficial to the other party

	Model 1		Model 2		
Variable	*SE B*	*β*	*SE B*	*β*	
Gender	0.02	0.01	0.02	0.04	
Age	0.00	-0.04	0.00	0.04	
Education	0.01	-0.12	0.01	-0.15	
Cognitive Comp.			0.00	0.20	*
Perceived Emot. Comp.			0.01	0.23	*
Tolerance for Ambiguity			0.02	0.22	*
Con. for Future Conseq.			0.02	0.06	
Behavioral Repertoire			0.00	-0.12	
R^2		0.02		0.20	
F		0.70		2.79	**
ΔR^2				0.18	**

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 13
Results of hierarchical regression analysis on score balance average across all games played

	Model 1			Model 2		
Variable	*SE B*	*β*		*SE B*	*β*	
Gender	0.05	0.24	*	0.06	0.27	*
Age	0.00	-0.12		0.01	-0.06	
Education	0.02	-0.07		0.02	-0.05	
Cognitive Comp.				0.00	0.10	
Perceived Emot. Comp.				0.04	0.07	
Tolerance for Ambiguity				0.05	-0.09	
Con. for Future Conseq.				0.05	0.20	†
Behavioral Repertoire				0.01	-0.21	*
R^2		0.09			0.15	
F		3.02	*		2.05	†
ΔR^2					0.07	

Note. ΔR^2 is the change from previous step. †p < .10; * p < .05; ** p < .01; *** p < .001.

Table 14

Results of regression analysis of hypothesis test criterion variables on score balance average across all games played

	Model		
Variable	*SE B*	*β*	
Post-task Int. Comp.	0.03	-0.07	
Post-task Emot. Comp	0.03	-0.01	
Avg. Dec.-Making Time	0.03	-0.01	
Impactful Decisions	0.72	-0.38	**
Category Switches	0.31	-0.16	
Unique Decisions	0.24	0.04	
R^2		0.21	
F		4.07	**

Note. †p < .10; * p < .05; ** p < .01; *** p < .001.

Figure 1

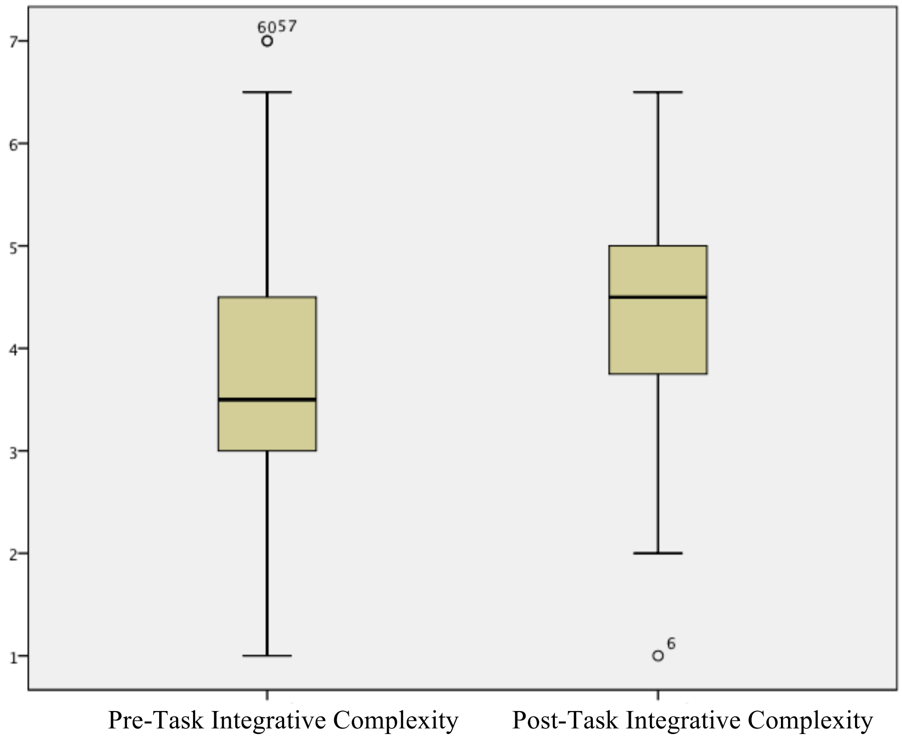
Initial crisis event presented in PeaceMaker

Figure 2

PeaceMaker decision menus (descriptions added)

Figure 3

Box plot comparing pre-task integrative complexity scores to post-task integrative complexity scores across all participants



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Appendix A

Background information on Israel-Palestine conflict provided to participants

The Israeli–Palestinian conflict is the ongoing struggle between Israelis and Palestinians that began in the mid 20th century. The Israeli–Palestinian conflict has formed the core part of the wider Arab–Israeli conflict. Despite the long going peace process and the general reconciliation of Israel with Egypt and Jordan, Israelis and Palestinians have failed to reach a final peace agreement. The remaining key issues are: mutual recognition, borders, security, water rights, control of Jerusalem, Israeli settlements, Palestinian freedom of movement and finding a resolution to the refugee question. The violence resulting from the conflict has prompted international actions, as well as other security and human rights concerns, both within and between both sides, and internationally. In addition, the violence has curbed expansion of tourism in the region, which is full of historic and religious sites that are of interest to many people around the world.

Many attempts have been made to broker a two-state solution, involving the creation of an independent Palestinian state alongside an independent Jewish state. The two parties engaged in direct negotiation are the Israeli government, and the Palestine Liberation Organization (PLO) representing both the West Bank and Gaza. On the Israeli side, the Yesha Council is the umbrella organization of the various municipal councils (local, regional, and cities), which oversees the settlement of Jewish people in the West Bank and Gaza. Since 2006, the Palestinian side has been fractured by conflict between the two major factions: Fatah, the traditionally dominant party, and its later electoral challenger, Hamas. The division of governance between the parties has effectively resulted in the collapse of bipartisan governance of the Palestinian National Authority (PA). Direct negotiations between the Israeli government and Palestinian leadership began in September 2010 aimed at reaching an official final status settlement. The official negotiations are mediated by an international contingent that consists of the United States, Russia, the European Union, and the United Nations. The Arab League is another important actor.

Appendix B

Role Construct Repertory Test (Woehr, Miller & Lane, 1998)

On the following pages, you will be asked to record your perceptions of yourself and several other people you encounter in everyday life. These "roles" are listed below. You will be asked to rate each of these individuals on 10 criteria using the 6-point scale provided. You will do this for each of the 10 roles listed below.

The following list contains all the roles you will be asked to rate. This list is provided to let you know what the different roles are before you begin. Please take a second glance over the list and familiarize yourself with the items. After you have looked over the entire list, think of a specific individual for each of the roles. Type the initials of the individual next to each of the roles. Keep these specific individuals in mind when you rate each of the roles on the various scales.

		Initials
1	Yourself	
2	Person you dislike	
3	Mother	
4	Person you'd like to help	
5	Father	
6	Friend of same sex	
7	Friend of opposite sex	
8	Person with whom you feel most uncomfortable	
9	Person in a position of authority	
10	Person difficult to understand	

[page break]

Now, please rate [initials] the following qualities:

		1	2	3	4	5	6	
1	outgoing	1	2	3	4	5	6	shy
2	maladjusted	1	2	3	4	5	6	adjusted
3	decisive	1	2	3	4	5	6	indecisive
4	excitable	1	2	3	4	5	6	calm
5	interested in others	1	2	3	4	5	6	self-absorbed
6	ill-humored	1	2	3	4	5	6	cheerful
7	irresponsible	1	2	3	4	5	6	responsible
8	considerate	1	2	3	4	5	6	inconsiderate
9	dependent	1	2	3	4	5	6	independent
10	interesting	1	2	3	4	5	6	dull

(Repeated for each of the 10 roles identified)

Appendix C

Range and Differentiation of Emotional Experience Scale (RDEES; Kang & Shaver, 2004)

Please answer each of the following questions according to the following scale:

		Does not describe me well				Describes me very well
1	I don't experience many different feelings in everyday life.	1	2	3	4	5
2	I am aware of the different nuances or subtleties of a given emotion.	1	2	3	4	5
3	I have experienced a wide range of emotions throughout my life.	1	2	3	4	5
4	Each emotion has a very distinct and unique meaning to me.	1	2	3	4	5
5	I usually experience a limited range of emotions.	1	2	3	4	5
6	I tend to draw fine distinctions between similar feelings (e.g., depressed and blue; annoyed and irritated).	1	2	3	4	5
7	I experience a wide range of emotions.	1	2	3	4	5
8	I am aware that each emotion has a completely different meaning.	1	2	3	4	5
9	I don't experience a variety of feelings on an everyday basis.	1	2	3	4	5
10	If emotions are viewed as colors, I can notice even small variations within one kind of color (emotion).	1	2	3	4	5
11	Feeling good or bad — those terms are sufficient to describe most of my feelings in everyday life.	1	2	3	4	5
12	I am aware of the subtle differences between feelings I have.	1	2	3	4	5
13	I tend to experience a broad range of different feelings.	1	2	3	4	5
14	I am good at distinguishing subtle differences in the meaning of closely related emotion words.	1	2	3	4	5

Appendix D

Tolerance for Ambiguity Scale (TAS; Herman, Stevens, Bird, Mendenhall, & Oddou, 2010)

To what extent do you agree with the following statements?

		Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	I avoid settings where people don't share my values.	1	2	3	4	5
2	I can enjoy being with people whose values are very different from mine.	1	2	3	4	5
3	I would like to live in a foreign country for a while.	1	2	3	4	5
4	I like to surround myself with things that are familiar to me.	1	2	3	4	5
5	The sooner we all acquire similar values and ideals the better.	1	2	3	4	5
6	I can be comfortable with nearly all kinds of people.	1	2	3	4	5
7	If given a choice, I will usually visit a foreign country rather than vacation at home.	1	2	3	4	5
8	A good teacher is one who makes you wonder about your way of looking at things.	1	2	3	4	5
9	A good job is one where what is to be done and how it is to be done are always clear.	1	2	3	4	5

10	A person who leads an even, regular life in which few surprises or unexpected happenings arise really has a lot to be grateful for.	1	2	3	4	5
11	What we are used to is always preferable to what is unfamiliar.	1	2	3	4	5
12	I like parties where I know most of the people more than ones where all or most of the people are complete strangers.	1	2	3	4	5

Appendix E

Consideration for Future Consequences Scale (CFCS; Joireman et al., 2012)

For each of the statements below, please indicate to what extent the statement is characteristic of you.

		Extremely Unchar-acteristic	Unchar-acteristic	Uncertain	Character-istic	Extremely Character-istic
1	I consider how things might be in the future, and try to influence those things with my day-to-day behavior.	1	2	3	4	5
2	Often I engage in a particular behavior in order to achieve outcomes that may not result for many years.	1	2	3	4	5
3	I only act to satisfy immediate concerns, figuring the future will take care of itself.	1	2	3	4	5
4	My behavior is only influenced by the immediate (i.e. a matter of days or weeks) outcomes of my actions.	1	2	3	4	5
5	My convenience is a big factor in the decisions I make or the actions I take.	1	2	3	4	5
6	I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes.	1	2	3	4	5

7	I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.	1	2	3	4	5
8	I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences.	1	2	3	4	5
9	I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.	1	2	3	4	5
10	I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time.	1	2	3	4	5
11	I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.	1	2	3	4	5
12	Since my day-to-day work has specific outcomes, it is more important to me than behavior that has distant	1	2	3	4	5

	outcomes.					
13	When I make a decision, I think about how it might affect me in the future.	1	2	3	4	5
14	My behavior is generally influenced by future consequences.	1	2	3	4	5

Appendix F
Behavioral repertoire measure (Hoojberg, 1996)

As the leader of a social unit working to improve a large social system, such as an organization, community or political system, I would see myself as one who...

		Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)
1	Surfaces key differences among unit members, then works participatively to resolve them.	1	2	3	4	5
2	Encourages participative decision-making in the unit.	1	2	3	4	5
3	Shows empathy and concern in dealing with subordinates.	1	2	3	4	5
4	Treats each individual in a sensitive, caring way.	1	2	3	4	5
5	Comes up with inventive ideas.	1	2	3	4	5
6	Experiments with new concepts and ideas.	1	2	3	4	5
7	Exerts upward influence in the system	1	2	3	4	5
8	Influences decisions made at higher levels.	1	2	3	4	5
9	Anticipates workflow problems, avoids crisis.	1	2	3	4	5
10	Brings a sense of order into the unit.	1	2	3	4	5
11	Maintains tight logistical control	1	2	3	4	5
12	Compares records, reports, and so on, to detect discrepancies.	1	2	3	4	5
13	Sees that the unit delivers on stated goals.	1	2	3	4	5
14	Gets the unit to meet expected goals.	1	2	3	4	5
15	Makes the unit's role very clear.	1	2	3	4	5
16	Clarifies the unit's priorities and directions.	1	2	3	4	5

Appendix G

Demographic questions

What is your gender?

1. Female
2. Male

What is your current age? _____

What ethnicity do you identify with?

1. American Indian / Alaska Native
2. Asian / Pacific Islander
3. Black / African American
4. Hispanic / Latin American
5. White
6. Other ____________________

In what country/countries did you mainly grow up?

What, if any, is your religious preference?

1. Atheist
2. Buddhist
3. Evangelical Christian
4. Hindu
5. Jewish
6. LDS/Mormon
7. Muslim
8. Protestant Christian
9. Roman Catholic
10. Other
11. None
12. Prefer not to answer

What is your political affiliation?

1. Democrat
2. Independent
3. Republican
4. Other __________________________

What is your last completed degree?

1. High School Diploma / GED
2. Associate's Degree
3. Bachelor's Degree
4. Master's Degree

5. Doctorate
6. Other ___________________________

For how long have you held a management/leadership position or held these responsibilities?

1. 0-1 years
2. 1-3 years
3. 3-5 years
4. 5-7 years
5. 7-10 years
6. More than 10 years

Appendix H

Positive and Negative Affectivity Scale (PANAS; Watson et al., 1988)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then indicate the appropriate answer to the right of that word. Indicate to what extent you have felt this way during the past hour:

		Very slightly or not at all (1)	A little (2)	Moder-ately (3)	Quite a bit (4)	Extreme-ly (5)
1	Interested	1	2	3	4	5
2	Irritable	1	2	3	4	5
3	Distressed	1	2	3	4	5
4	Alert	1	2	3	4	5
5	Excited	1	2	3	4	5
6	Ashamed	1	2	3	4	5
7	Upset	1	2	3	4	5
8	Inspired	1	2	3	4	5
9	Strong	1	2	3	4	5
10	Nervous	1	2	3	4	5
11	Guilty	1	2	3	4	5
12	Determined	1	2	3	4	5
13	Scared	1	2	3	4	5
14	Attentive	1	2	3	4	5
15	Hostile	1	2	3	4	5
16	Jittery	1	2	3	4	5
17	Enthusiastic	1	2	3	4	5
18	Active	1	2	3	4	5
19	Proud	1	2	3	4	5
20	Afraid	1	2	3	4	5

Appendix I
Dynamic Network Theory (DNT) questions

You have just played a game that is based on the current conflict between Israel and the Palestinian territories. We would now like you to take a few moments to respond to the following questions related to the various actors or groups involved in this conflict.

For each question, please only type the name of the actor/group (or brief description if you forgot the name) – no further explanation is needed.

1. Who is directly promoting or defending mostly the interests of *Israel*?
2. Who is directly promoting or defending mostly the interest of *Palestine*?
3. Who is indirectly supporting mostly *Israel*?
4. Who is indirectly supporting mostly *Palestine*?
5. Who seems to be equally upset with both sides of the conflict?
6. Who seems to be supporting both sides to resolve the conflict?
7. Who is just observing the conflict (or neutral in the system), but not involved?
8. Who is NOT sufficiently aware of (or noticing) this conflict, yet could be important in the system if they got involved?

Now, please carefully review each actor/group that you mentioned in all of the different boxes above and please insert or add the following symbols next to their relevant names, when it makes sense to those people:

a. Place an exclamation mark (!) next to those actors that seem upset about this conflict.
b. Place a question mark (?) next to actors if you were not entirely sure about where you chose to list them or if you felt like you were kind of guessing when writing down their names.

Finally, in your opinion, who may be more influential in this conflict? Choose one option in this multiple choice question.

1. Israel
2. Palestine
3. Both
4. Neither

Appendix J
Final questionnaire

How knowledgeable would you consider yourself with regards to the Israeli/Palestinian conflict?

1. No knowledge
2. Very little knowledge
3. Somewhat knowledgeable
4. Moderately knowledgeable
5. Very knowledgeable

How interested are you in this conflict?

1. No interest
2. Very little interest
3. Somewhat interested
4. Moderately interested
5. Very interested

I identify as:

1. Israeli
2. Palestinian
3. Both
4. Neither

Have you played the PeaceMaker game before today?

1. Yes
2. No

During a typical week, how many hours do you spend playing video games? Please enter your best guess in hours. If you do not play video games at all, please enter 0: ______

Please provide us with your most recent SAT or GRE score (if you do not recall, or are uncomfortable providing this, please leave it blank).

SAT:

Critical Reading: ____
Mathematics: ____
Writing: ____

GRE:

Verbal Reasoning: ____
Quantitative Reasoning: ____
Analytical Writing: ____

Appendix K

PeaceMaker decisions coded as impactful, constructive to conflict resolution and more beneficial to the other party

	PeaceMaker Decision	**Coded as Impact-ful**	**Coded as Constructive to Conflict Resolution**	**Coded as More Beneficial to Other Party**
1	Construction >> ISRAEL ALLOW SOME PALESTINIAN IMMIGRANTS		X	X
2	Construction >> ISRAEL AUTHORIZE PAYMENTS TO REFUGEES		X	X
3	Construction >> ISRAEL BUILD NEW SETTLEMENT	X		
4	Construction >> ISRAEL BUILD WALL ON GREEN LINE	X		
5	Construction >> ISRAEL BUILD WALL ON PALESTINIAN LAND	X		
6	Construction >> ISRAEL CIVILIAN AID		X	X
7	Construction >> ISRAEL DISMANTLE SETTLEMENT		X	X
8	Construction >> ISRAEL ECONOMIC STIMULUS PACKAGE			
9	Construction >> ISRAEL EDUCATION AID DIRECT		X	X
10	Construction >> ISRAEL EDUCATION AID WITH RESTRICTION		X	
11	Construction >> ISRAEL EDUCATIONAL GRANTS			
12	Construction >> ISRAEL EXPAND SETTLEMENTS	X		
13	Construction >> ISRAEL HALT SETTLEMENT EXPANSION		X	X
14	Construction >> ISRAEL INFRASTRUCTURE AID		X	X
15	Construction >> ISRAEL MEDICAL AID DIRECT		X	X
16	Construction >> ISRAEL MEDICAL AID THROUGH UN		X	X
17	Construction >> ISRAEL REMOVE SECURITY WALL		X	X

18	Construction >> ISRAEL SECURITY AID		X	
19	Construction >> ISRAEL SOCIAL PROGRAM INITIATIVE			
20	Political >> ISRAEL CROSS-CULTURAL PROJECT		X	
21	Political >> ISRAEL DECREASE TRADE RESTRICTIONS		X	
22	Political >> ISRAEL DECREASE WORKER PERMITS			
23	Political >> ISRAEL EDUCATIONAL INITIATIVE		X	
24	Political >> ISRAEL EU ASK FOR MEDIATION SUPPORT		X	
25	Political >> ISRAEL EU ASK FOR POLITICAL PRESSURE ON PALESTINE			
26	Political >> ISRAEL GOVERNMENT ASK FOR LESS CRITICISM			
27	Political >> ISRAEL GOVERNMENT ASK FOR WITHDRAWAL SUPPORT		X	
28	Political >> ISRAEL GOVERNMENT ASK TO UNITE FOR PEACE		X	
29	Political >> ISRAEL GOVERNMENT LISTEN TO CONCERNS			
30	Political >> ISRAEL GOVERNMENT PROMISE MORE SECURITY			
31	Political >> ISRAEL INCREASE TRADE RESTRICTIONS			
32	Political >> ISRAEL INCREASE WORKER PERMITS		X	
33	Political >> ISRAEL PALESTINIAN PRESIDENT ASK FOR ANTI-MILITANT SUPPORT		X	
34	Political >> ISRAEL PALESTINIAN PRESIDENT INSIST ON ANTI-MILITANT ACTIONS			
35	Political >> ISRAEL PALESTINIAN PRESIDENT LISTEN TO CONCERNS		X	X
36	Political >> ISRAEL PALESTINIAN PRESIDENT PROMISE RECONSTRUCTION ASSISTANCE		X	X
37	Political >> ISRAEL PALESTINIAN PRESIDENT PROMISE SECURITY		X	X

	CONCESSIONS			
38	Political >> ISRAEL PEOPLE ANTI-MILITANCY			
39	Political >> ISRAEL PEOPLE LISTEN TO CONCERNS			
40	Political >> ISRAEL PEOPLE PRO-PALESTINIAN COOPERATION		X	X
41	Political >> ISRAEL PEOPLE PRO-PEACE PROCESS		X	
42	Political >> ISRAEL PEOPLE PRO-SECURITY			
43	Political >> ISRAEL STRUCTURED DIALOG		X	
44	Political >> ISRAEL TRADE INITIATIVE		X	
45	Political >> ISRAEL UN ASK FOR MEDIATION SUPPORT		X	
46	Political >> ISRAEL UN ASK FOR POLITICAL PRESSURE ON PALESTINE			
47	Political >> ISRAEL USA ASK FOR MEDIATION SUPPORT		X	
48	Political >> ISRAEL USA ASK FOR POLITICAL PRESSURE ON PALESTINE			
49	Political >> ISRAEL WORLD ANTI-MILITANCY			
50	Political >> ISRAEL WORLD PRO-PALESTINIAN COOPERATION		X	X
51	Political >> ISRAEL WORLD PRO-PEACE PROCESS		X	
52	Political >> ISRAEL WORLD PRO-SECURITY			
53	Political >> ISRAEL YESHA ARREST LEADERS	X	X	X
54	Political >> ISRAEL YESHA ASK FOR RESTRAINT		X	X
55	Political >> ISRAEL YESHA PROMISE CONCESSIONS			
56	Political >> ISRAEL YESHA SUPPRESS VIOLENCE		X	X
57	Security >> ISRAEL ASSASSINATE APACHE STRIKE	X		

58	Security >> ISRAEL ASSASSINATE COVERT OPERATION	X		
59	Security >> ISRAEL BULLDOZE CLEAR ROADBLOCKS	X		
60	Security >> ISRAEL BULLDOZE PUNISH MILITANTS	X		
61	Security >> ISRAEL DECREASE CHECKPOINTS		X	X
62	Security >> ISRAEL IDF ARREST MILITANTS			
63	Security >> ISRAEL IDF DESTROY MILITANT INFRASTRUCTURE			
64	Security >> ISRAEL IDF SECURE AREA			
65	Security >> ISRAEL IMPOSE CURFEW			
66	Security >> ISRAEL INCREASE CHECKPOINTS			
67	Security >> ISRAEL MISSILE MILITANT HQ	X		
68	Security >> ISRAEL MISSILE PA INFRASTRUCTURE	X		
69	Security >> ISRAEL MISSILE PA POLICE	X		
70	Security >> ISRAEL POLICE PATROL			
71	Security >> ISRAEL POLICE SECURE			
72	Security >> ISRAEL RAISE CURFEW		X	X
73	Security >> ISRAEL RELEASE NON-VIOLENT PRISONERS		X	X
74	Security >> ISRAEL RELEASE VIOLENT PRISONERS		X	X
75	Security >> ISRAEL REMOVE IDF		X	X
76	Security >> ISRAEL REMOVE POLICE		X	X